RSA6 - Greening the Economy in the Alpine Region

Final Draft

5 October 2016

Confidential! Do not cite, quote, copy or distribute!

This report was approved by the Alpine Conference at its XIVth meeting in Grassau, held on 13 October 2016.

The preparation of this report was coordinated by the German Presidency of the Ad-hoc expert group for the preparation of the sixth Report on the State of the Alps in coordination with the Permanent Secretariat.

The text has been drafted by the German Presidency of the Ad-hoc expert group, with the collaboration of its members, the Permanent Secretariat and the contracted consultancy.

The maps were prepared by the European Topic Center on Urban, Land and Soil Systems of the European Environment Agency and the Permanent Secretariat, in coordination with the German Presidency of the ad-hoc expert group and the contracted consultancy.

Coordination of Ad-hoc expert group

Presidency
Hans-Joachim Hermann, Richard Landgraf (German Environment Agency)

Permanent Secretariat of the Alpine Convention
Marianna Elmi, Aureliano Piva Simona Vrevc

Members of the Ad-hoc expert group

Austria
Josef Behofsics (Federal Ministry of Agriculture, Forestry, Environment and Water Management)

France
Richard Rouquet (Federal Ministry for Ecology, Energy, Sustainable Development and Sea)

Germany
Andreas Burger (German Environment Agency)

Italy
Luca Cetara (Italian Delegation to the Alpine Convention, EURAC research, European School of Economics)

Liechtenstein
Heike Summer (Office of Environment)

Slovenia
Urška Kušar (Slovenian Water Agency)
Tatjana Orhini Valjavec (Ministry of Environment and Spatial Planning)

Switzerland
Silvia Jost (Federal Office for Spatial Development)

Observers of the Ad-hoc expert group

Andreas Pichler, Anita Conrad (CIPRA International)
Veronika Schulz, Liliane Dagostin (Club Arc Alpin)
Peter Winkler (FIANET)
Thomas Scheurer (ISCAR)

Consultants of Ad-hoc expert group

Stefan Marzelli, Claudia Schwarz, Linda Szücs (ifuplan)
Vivien Führ (agado)
Paschen von Flotow (Sustainable Business Institute)

Focal Points of the Alpine Convention

Austria
Ewald Galle (Federal Ministry of Agriculture, Forestry, Environment and Water Management)

France
Isabelle Paillet (Ministry of the Environment, Energy and the Sea)

Germany
Silvia Reppe (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety)

Italy
Paolo Angelini (Ministry of the Environment and Protection of Land and Sea)

Liechtenstein
Helmut Kindle (Office of Environment)

Monaco
Céline Van Klaveren-Impagliazzo (Government of the Principality of Monaco)

Slovenia
Blanka Bartol (Ministry of Environment and Spatial Planning)

Switzerland
Silvia Jost (Federal Office for Spatial Development)

European Union
Giacomo Luciani (European Commission DG Environment)

Further institutions and persons that contributed to the report

Bavarian State Ministry of the Environment and Consumer Protection
Peter Eggensberger

Berchtesgaden National Park
Michael Vogel

Club Arc Alpin
Liliane Dagostin

Ecological Networks Platform of Alpine Convention
Bettina Hedden-Dunkhorst (German Federal Agency for Nature Conservation)
Marie Odile Guth (French Ministry of Ecology, Sustainable Development and Energy)
Aurelia Ullrich (CIPRA International)
Marianne Badura (Bavarian State Ministry of the Environment and Consumer Protection)
Yann Kohler (ALPARC)

European Topic Center on Urban, Land and Soil Systems of the European Environment Agency
Silvia Giulietti (European Environment Agency)
Andreas Bartel, Andreas Littkopf (Austrian Environment Agency)
Emanuele Mancosu (University of Malaga)

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
Anastasia Guretskaya

German Environment Agency
Björn Bünger

Italian Ministry for the Environment Land and Sea
Benedetta Dell'Anno

Italian National Institute for Environmental Protection and Research, ISPRA
Claudio Curcuruto, Riccardo De Lauretis

Mountain Farming Platform of the Alpine Convention
Ewald Galle, Ignaz Knöbl (Austrian Federal Ministry of Agriculture and Forestry, Environment and Water Management)

Swiss Federal Office for Spatial Development
Martyna Derszniak-Noirjean, Maria Hopf

Working Group Mountain Forests of the Alpine Convention
Francesco Dellagiacoma (Autonomous Province of Trento)

Working Group Sustainable Tourism of the Alpine Convention
Thomas Bausch, Stephan Meier (Munich University of Applied Sciences)
Marcella Morandini (Foundation Dolomitis UNESCO)

Working Group Transport of the Alpine Convention
Thierry Louis, François Lamoise (French Ministry of Sustainable Development)

Foreword of the President of the Ad-hoc Expert Group

The Ad-hoc expert group for the preparation of the sixth Report on the State of the Alps "Greening the Economy of the Alpine Region" has been set up at the XIIIth Alpine Conference in Torino. It consisted of nominated members from the Alpine countries and has been strongly assisted by its observers, the Permanent Secretariat and a contracted consultant.

As the President of the Ad-hoc expert group, I would like to extend my sincere thanks to everyone who contributed to the elaboration of this report. The meetings of the Ad-hoc expert group were characterised by very fruitful discussions, a highly professional exchange, and trustworthy cooperation. The final report benefited from all the different inputs.

The report analyses the status of the development towards a Green Economy in the Alpine region with a range of indicators and good practice examples. Furthermore, a workshop with the Alpine Towns of the Year and expert interviews with relevant stakeholders from the Alpine region generated additional input for the drafting of this report.

The results of this report are encouraging! They show that existing local initiatives and good practice examples could be blueprints for the needed transformation process towards a Green Economy in the whole Alpine region. This would provide valuable benefits for the environment and the economy. Despite these positive initial developments, there is a strong need to strengthen the efforts at all political levels and in the business community to transform the Alpine economy into an Alpine Green Economy in the long-run.

Hans-Joachim Hermann
German Environment Agency
Presidency of the Ad-hoc expert group

Content

Figures

Tables

Abbreviations

AC: Alpine Convention

ASP: Alpine Space Programme

BES: Benessere Equo Sostenibile - equitable and sustainable well-being

CHP: Combined Heat and Power

CICES: Common International Classification of Ecosystem Services

CIPRA: Commission Internationale pour la Protection des Alpes – International Commission for the Protection of the Alps

CLC: CORINE Land CoverCOP: Conference of the Parties

CORINE: Coordination of Information on the Environment

DMC: Domestic Material Consumption

EAP: Environmental Action Plan

EC: European Comission

EEA: European Environmental AgencyEGSS: Environmental Goods and Service Sector

EMAS: Eco Management and Audit Scheme

EM-DAT: Emergency Events Database

EMS: Environmental Managament System

ENEA: Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico – National agency for new technologies, energy and economicdevelopment

ESD: Effort Sharing Decision

ESS: Ecosystem Services

ETS: Emissions Trading Scheme

EU: European Union

EUROSTAT: Statistical Office of the European Union

EUSALP: EU Strategy for the Alpine Regions

FOEN: Swiss Federal Office for the Environment

FSC: Forest Stewardship Council

GDP: Gross Domestic Product

GE: Green Economy

GEC: Green Economy Coalition

GGKP: Green Growth Knowledge PlatformGHG: Greenhouse Gases

GJ: Gigajoule

HNV: High Nature Value

IMAD: Institute for Macroeconomic Analysis and Development of the Reupublic of Slovenia

INBS: Italian National Biodiversity Strategy

INFC: Inventario Nazionale delle Foreste e dei Serbatoi Forestali di Carbonio - Italian national forest inventory

ISO: International Organisation for Standardisation

ISPRA: Istituto Superiore per la Protezione e la Ricerca Ambientale - Institute for Environmental Protection and Research

IT: Information Technology

JRC: Joint Research Center of the European Commission

JTS: Joint Technical Secretariat of the Alpine Space Programme

kWp: kilo Watt peak

LAU: Local Administrative Unit

LEADER: Liaisons entre actions de developpement de l'économie rurale – rural development programm of the European Union

LED:

LEED: Leadership in Energy and Environmental Design

LIFE:

LIFE+: L'Instrument Financier pour l'Environnement - funding instrument for the environment and climate action of the European Union

LUCLUCF: Land Use, Land-Use Change and Forestry

MEA: Millennium Ecosystem Assessment

MAES: Mapping and Assessment of Ecosystems and their Services

MSW: Municipal solid waste

MWI: Municipal Waste Intensity

NC: Natural Capital

NGO: Non-Governmental Organisation

NREAP: National Renewable Energy Action Plan

NUTS: Nomenclature des unités territoriales statistiques

OECD: Organisation for Economic Cooperation and Development

PA: protected Areas

PES: Payment for Ecosystem Services

PJ: Petajoule

PM: Particulate Matters

PPP: Purchasing Power Parity

PPS: Purchasing Power Standard

PSA : Permanent Settlement Area

PSAC : Permanent Secretariat of the Alpine Convention

PV: Photovoltaics

R&D: Research and Development

RE: Renewable Energies

RES : Renerwable Energy Sources

RK: Reduction Capacity

RMC: Raw Material Consumption

SDG: Sustainable Development Goals

SEEA: System of Environmental-Economic Accounting

SME: Small and Medium Enterprise

SOIA: System for the Observation and Information on the Alps

UAA: Utilized Agricultural Area

UN: United Nations

UNEP: United Nations Environmental Programme

UNESCO: United Nations Educational, Scientific and Cultural Organization

VDI: Verein Deutscher Ingenieure - Association of German Engineers

VOC: Volatile Organic Compound(s)

WEI: Water Exploitation Index

WG: Working Group

WHO: World Health Organisation

Wp: Watt peak

WWTP: Wastewater Treatment Plant

1 Introduction

1.1 Opportunities and challenges for greening the economy in the Alps

Benefits and challenges for Green Economy in the Alpine Convention area

The economy in the Alps is influenced and framed by the environmental, economic and social conditions of the Alpine area. For developing towards a Green Economy, the economic activities in the Alps need to respect the specific topography, the natural resources, climate and the sensitive Alpine environment. The Alpine topography poses special challenges, such as urging transport to cross valleys and ridges and the limitation of land with small slope gradients. On the other hand, it forms the basis for a unique landscape, Alpine natural assets and the appropriate land cultivation, which are the crucial requisites for Alpine tourism. The specific Alpine environment creates special conditions such as differences of climate and habitat conditions at different altitudes, differences of water retreat and discharge, and appearance of natural hazards. Therefore, also reactions of the Alpine environment on climate change are specific.

Besides these natural conditions, structural limitations for the economy exist in some areas of the Alps i.a. due to limited accessibility from the Alpine area to centers and to small settlements, market barriers for small or new companies, limited disposability of knowledge or a limited supply for consumers. The above mentioned conditions require integrative approaches for sustainable development and form a framework which predestines the Alps as a pilot area for a Green Economy approach.

Green Economy may offer also sound benefits for an area with a sensitive environment: an adapted economy may save costs for environmental damages, trigger innovation and generate jobs in the green sector but also in a green restructuring of the whole economy. This might boost the competitiveness of the regional economic system.

Common understanding of a Green Economy in the Alpine Region

One main challenge of economy is to provide economic opportunities in a world with limited resources. The concept of “planetary boundaries” (Rockström et al. 2009) expresses very clearly, that our planet can be considered like a spaceship limited in its resources. Experts baptized an economy recognising these limitations “spaceship economy”. In sustainable development the economic, ecologic and social dimensions are interlinked. A long-term stable economy will need stable social conditions. Therefore, under a normative point of view, in a Green Economy framework, emphasis should be given to equity, fairness and social justice that an economic concept should consider and possibly achieve. This implies that a Green Economy has to respect social requirements, ecological limits and to be compatible with nature and the environment.

Conventionally, economy is measured by using Gross Domestic Product (GDP) or similar indicators for national income. These are a measure of productivity based on the overall output of produced goods and services within a certain time period and spatial entity. To put it short, national GDP is a measurement of a nations’s overall economic activity. This is one of the main reasons why economy is focused on economic growth.

There is a variety of criticisms against GDP as a measure of economic and social well-being and its shortcomings have been debated for decades. One of the key concerns from a sustainability perspective is that it does not take into account the state of natural resources and the social aspects necessary for human well-being.

The recent economic and environmental crises have further contributed to creating a climate for change in the economic paradigm, which underlines the necessity and benefits of the transformation to a Green Economy.

Even though the term 'Green Economy' is still not consistently defined, most organisations now have a shared understanding of the concept. As a common basis, the Ad-hoc Working Group for the Elaboration of the Sixth Report on the State of the Alps agreed to use for the purpose of this report the

UNEP-definition of Green Economy as the most widely used and authoritative one. UNEP 2011b defines Green Economy

"[…] as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive. Practically speaking, a green economy is one whose growth in income and employment is driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services."

This implies four key topics of Green Economy, which are used to structure the report:

- low carbon and energy efficient economy,
- resource efficient economy,
- ecosystem services and natural capital based economy, as well as
- economy supporting quality of life and well-being.

Policy objectives

A Green Economy is an instrument to achieve sustainable development. It is explicitely addressed in the UN Sustainable Development Goal 8 ("Promote inclusive and sustainable economic growth, employment and decent work for all") and Goal 12 ("Ensure sustainable consumption and production patterns") but also most other SDGs have strong linkages to Green Economy (cf. chapter1.2.1).

The European Commission sets in its Europe 2020 strategy priorities for a smart, sustainable and inclusive growth. Sustainable growth shall achieve a resource efficient, green and more competitive low-carbon economy and shall fulfil the so-called 20-20-20 goals[1]. The flagship initiative of a resource efficient Europe is to support the shift towards a resource-efficient, low-carbon economy. In this EU policy, the concept of economic growth is still considered as a competitive factor but it also introduces the issue of properly assessing well-being.

Numerous initiatives to assess well-being other than through GDP have seen the light of day in recent years, such as the OECD Better Life Index, Happy Planet Index or Gallup-Healthways Well-Being Index[2]. There is a debate about the need for a great transformation process, encompassing all kinds of economic activities from production to consumption, trade and services including the financial sector. As the global finance system has supported and invested in the "brown economy", remarkable resistance against such a transformation is expected. Nonetheless, it is all the more important to implement a successful transformation towards a Green Economy and realizing all the potential synergies.

The concept of a Green Economy needs to be based on a holistic approach: it is essentially about greening the entire economy, not about fostering a particular "green" sector. This will not be feasible by technological and social innovations alone, but also "[…] includes a re-allocation of capital and investment between sectors, a change in the demand for certain goods and services, and, accordingly, a change in prices and thus the profitability of existing investments" (UBA Germany 2015a).

The concept of Green Economy also raises controversial questions[3] regarding the role of market mechanisms and public regulations of the economy, the balance between technological innovation and changing consumption patterns, the economic valuation of natural resources, the trade-off between

[1] 20-20-20 Goals are: 1) Reducing greenhouse gas emission by 20% compared to 1990; 2) increasing the share of renewables in final energy consumption to 20%; 3) moving towards a 20% increase in energy efficiency.

[2] Further information: http://www.oecdbetterlifeindex.org , http://www.happyplanetindex.org/, http://www.well-beingindex.com/.

[3] Further information: http://whygreeneconomy.org/which-green-economy/

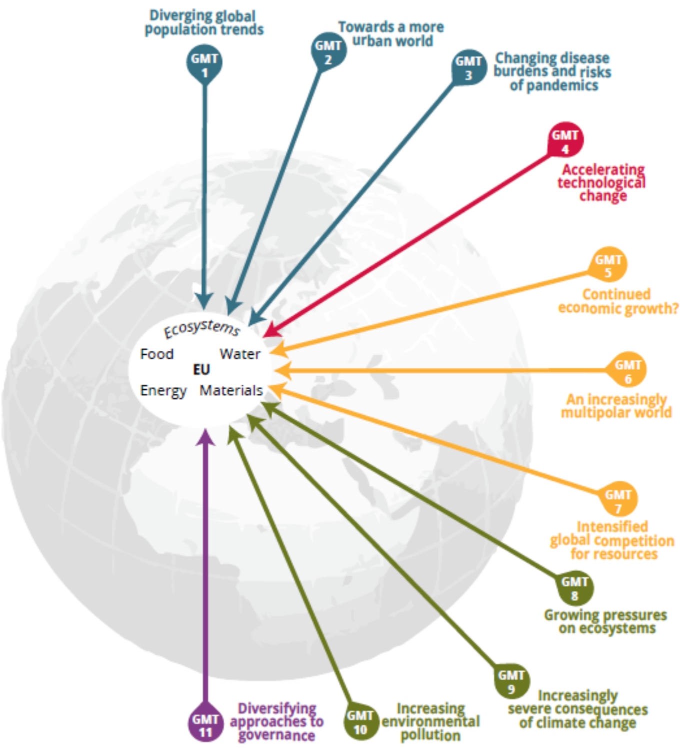
economic growth and environmental protection, and the way of producing energy from renewable sources (centralised or decentralised).

1.1.1 Global and European megatrends

The Alpine Convention area is strongly intertwined with the rest of Europe and the world by exchange of material, energy, financial resources, people as well as innovation and ideas. Therefore, the Alpine area is also exposed to most global and European megatrends[4]. These are directly or indirectly relevant for the Alpine area and a greening of its economy as the Alpine population contributes through its consumption of globally produced goods and services and related effects of the production, transport and removal to these global challenges. Most common megatrends[5] are globalisation, female shift, connectivity, urbanisation, neo-ecology, health, new learning, mobility, new work, individualisation and silver society. The megatrend neo-ecology comprises about 30 subtrends of high relevance for Green Economy such as green jobs, social business, corporate responsibility, green technology, energy grids, fair trade, reuse-reduce-recycle, mixed mobility or smart buildings.

The European Environment Agency identifies 11 global megatrends (cf. Figure 1.1.1-1) of relevance for Europe from which particularly 6 trends seem to be relevant for the Alpine area:

- GMT 1 Population trends
- GMT 2 Towards a more urban world
- GMT 5 Continued economic growth
- GMT 8 Growing pressures on ecosystems
- GMT 9 Increasingly severe consequences of climate change
- GMT 11 Diversifying approaches to governance



[4] Megatrends influence civilisations, technologies, economies and value systems, often consist of different single, sometimes overlapping trends and last for at least 50 years. This makes them different from short-term trends of products, fashion, or consumption.

[5] Further information: http://de.megatrends.wikia.com/wiki/Megatrend.

Figure 1.1.1-1 Impacts of global megatrends on EU resource systems (Source: EEA 2015j).

Responses to global megatrends may follow two options according to the European Environmental Agency (EEA 2015j). The first option is to influence changes in a way that mitigate and manage risks caused by them, such as environmental pressures. The second option is to adapt to these global trends through restoration of damaged ecosystems, correction of social impacts and to identify the opportunities that may be connected with these challenges.

The study on strategy development of the Alpine Space Programme (JTS 2013) identified important main trends with relevance for the Alps (cf. Figure 1.1.1-2), which is outlined below.

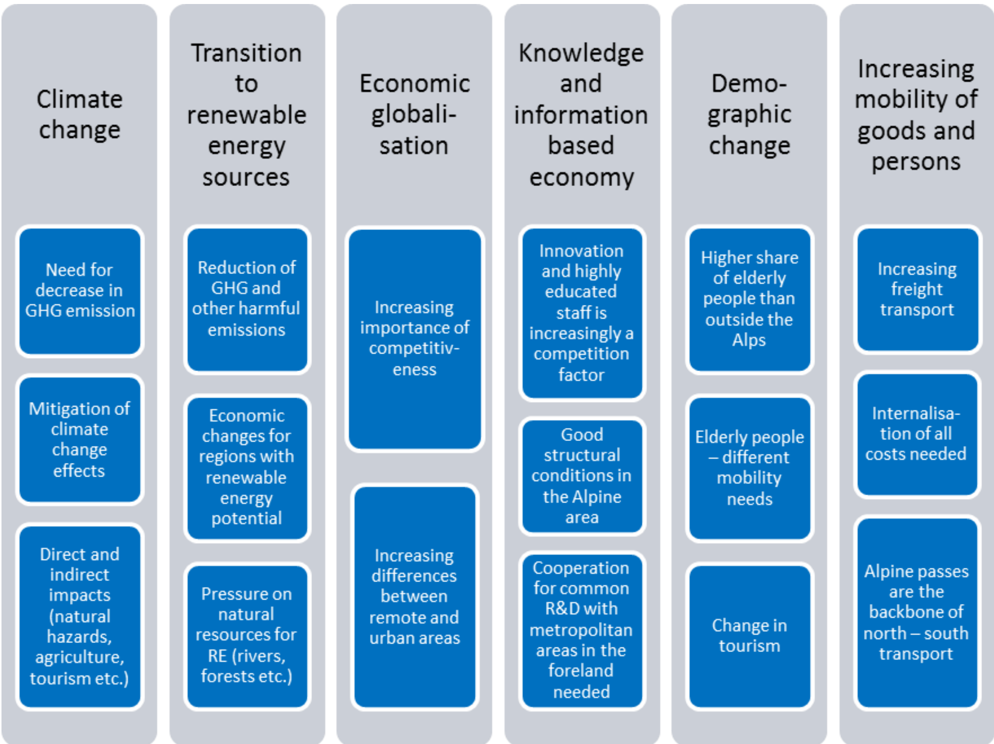


Figure 1.1.1-2 Driving forces in the Alpine area according to JTS extended (Source: JTS 2013, graph: ifuplan 2016).

Climate change

The Alpine climate has changed significantly during the past century, with temperatures increasing more than twice as much as the global average. This has very strong effects on the alpine hydrology: run-off systems will be altered by changes in precipitation, higher frequency of extreme weather conditions occur, snow-cover patterns and glacier storage are changing (EEA 2009).

Climate change will lead to economically relevant effects such as increasing losses due to natural hazards or expenses for prevention of such losses, effect on yields in agriculture, vinery and horticulture, decreased (respectively unsteady) hydropower generation. This requires adaptation measures to avoid damages by these effects or to mitigate the effects. Examples are flood prevention measures, irrigation or adaptation of agricultural practices, increasing expenses for adaptation of housing (such as insulation, cooling) or in winter tourism through changes due to decreasing or irregular snow cover.

Transition to renewable energy sources

Climate protection strategies require a substantial decrease of GHG emissions from fossil energy sources as one major source of GHG emissions. These cause economic costs through environmental damages and often release harmful emissions. Declining stocks of fossil energies on global level might lead to increases of energy prices that pose economic pressure on high consumption sectors. Therefore, energy strategies encompass energy efficiency targets and usually include a shift towards renewable energy sources. This is often linked with decentralised energy generation, use of small power plants and options for energy storage. Regions with high potential of renewable energy might prosper from this development if efficient and sustainable solutions for production, storage and transportation of the generated energy are developed or if energy intensive production is replaced in these regions.

The transition towards renewable energy sources can, however, sometimes lead to pressures on natural resources such as rivers for hydropower generation, high altitude valleys for water storage, forests for biomass, short term plantations and bioenergy crops for biogas, and suitable plots of landscape for wind power.

Economic globalisation

Economic globalisation poses pressures on the traditional Alpine economies, leading to an intensification of economic activities in some valleys and highlands but also to a decline of land uses in high altitudes and slopes. Both trends cause environmental and socio-cultural problems (Bätzing 1998). Another effect of economic globalisation is a standardisation of production, particularly in agriculture (ESPON 2013a, p. 95) – where environmental costs of intensified production, harmful subsidies and missing payments for ecological services are frequently not considered in agricultural economy. The resulting homogeneous production methods can successively lead to standardised landscapes. On the other hand, as a consequence of globalisation, less productive sites which are not competitive on the global market are abandoned. Next to environmental problems, the loss of distinctive cultural landscapes may also induce the decline of one of the most important basis for Alpine tourism. The trend towards a further intensification of farmland is aggravated by the increasing demand for land for renewable energy production particularly for biomass. However, renewable energy production can also support farm incomes and support them in maintaining cultural landscapes.

Knowledge and information based economy

Due to information technology, knowledge, inventions and innovation is easily accessible and fast distributing around the world. Innovation is a key for fueling qualitative economic development through adoption of improvements in the standard production processes. Even more, as Alpine countries often cannot compete on a global scale in terms of mass production. This is why future economic development should focus on research, innovation and the link to traditional regional and local knowledge and employees.

Research and development (R&D) activities in the Alpine area are high compared to European averages. Additionally, most peripheral areas of the Alps are relatively close to urban centers, which often have R&D institutions and universities, often with worldwide reputation. The linkage between rural areas and urban centers could yield in further innovation advantages and positive economic effects in the peripheral areas.

Demographic change

Demographic change occurs in all Alpine countries. In the Alpine area, this has different effects such as an increase of life expectancy, decrease of birth rates, abandonment of rural areas, and exodus of young people from remote areas. It will lead – among others - to a shift in the relation of different age groups in the Alpine population.

This shift will also have economic effects: A declining demand in peripheral regions will lead to smaller markets and limited provision of public services. The higher percentage of elderly people and diverging life styles of the younger generation may cause a lack of successors for agricultural businesses and reduces the workforce potential for all branches.

Increasing mobility of goods, persons and information

Demographic change and economic conditions are reflected in changing mobility needs. It is expected that passenger as well as freight transport will further increase. Specific mobility demands will arise in peripheral areas with low public service supplies, due to an increasing population share with no private cars.

Economic pressure will also trigger further increases in freight transport crossing the Alps as well as inside the Alps. Due to recognised environmental, health and infrastructural impacts of transport parameters for the internalisation of external costs are discussed and effects of different toll models for freight and passenger transport are compared at EU, Alpine-wide and national level. At the same time, access to digital infrastructure becomes an important issue for business but also private life. It is an indispensable precondition for business activities and can also save physical mobility through online services, such as entertainment, medical services, shopping and further more.

These main trends in the Alpine Convention area pose challenges but offer also opportunities for further development. They are reflected in the topics of the Alpine Space Programme and the projects, which are elaborated within this programme.

1.1.2 Alpine specificities

What are Alpine specificities to be particularly considered when dealing with a Green Economy for the Alpine Convention area? The most relevant specificities are explained below.

Population distribution

The population density within the Alpine Convention area is in average lower than in the surrounding lowlands. Figure 1.1.2-1 shows the allocation of population within the perimeter of the Alpine Space Programme. While the population within the Alpine Convention area is about 14,000,000 people, there are about 61,000,000 people living within the Alpine Space Programme area, many of them – especially in Italy – very close to the Alpine Convention area (cf. Figure 1.1.3-9).

The population, seen as an important resource (workforce) and demand (market) for economy, is thus relatively small within the Alpine Convention area compared to the majority of the national population of the Member States outside the Alpine Convention area and in direct neighbourhood to the Alps. The influence of the adjacent population and metropolises, representing main economic centers in Europe, upon the Alps is fairly strong. They offer on the one hand chances and opportunities for the Alpine population, such as job markets and innovation hubs. On the other hand, the metropolises put a certain risk on Alps to be used as source for natural resources such as water, food, wood, recreation landscapes, etc. and to be dominated from external interests. Therefore, a strong and fair cooperation between the Alps and their forelands is needed.

However, within the Alpine area population densities may be as high as in some of the European capitals due to the concentration of people in limited valley bottoms. In these limited areas (the so-called Permanent Settlement Area PSA, cf. Figure 2.2.2-1), the average population density reaches 414 people/km², which is comparable to densely populated areas outside the Alps. Favourable areas may have even much higher densities such as the regions around Grenoble 6,282 people/km², Lugano 2,097 people/km², or Innsbruck 1,444 people/km². This is comparable to European capitals such as Berlin (3,812 people/km²) or Vienna (4,025 people/km²).

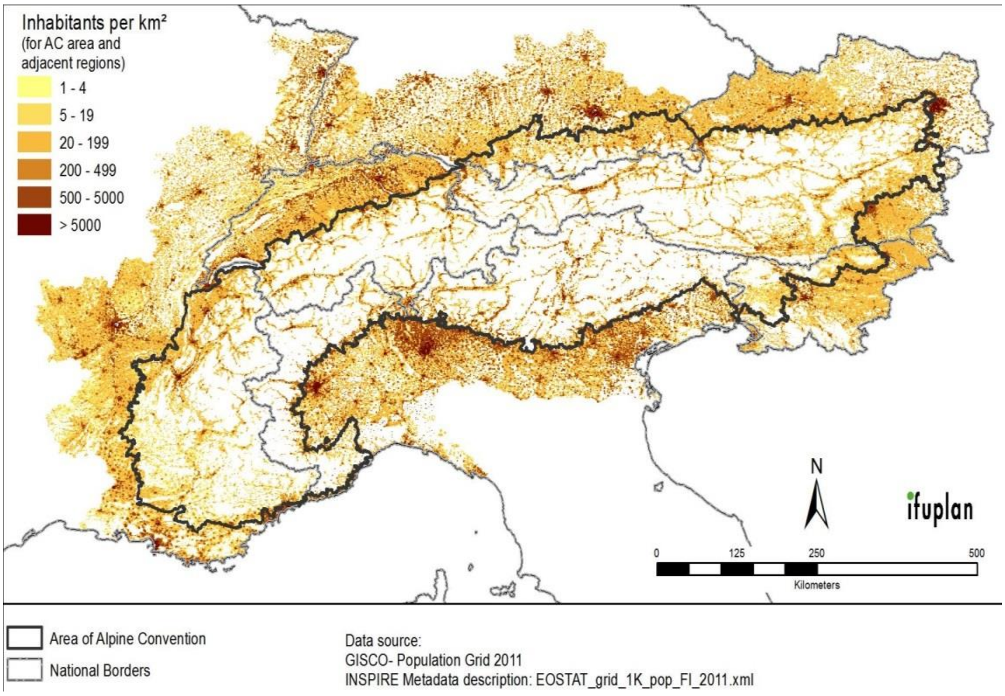


Figure 1.1.2-1 Population density inside and outside the Alpine Convention area (Source: EUROSTAT 2011).

Alpine Convention – an area with many different entities

The Alps are an area with multiple entities – not only of countries but also of languages and cultures. On the one hand, this is a strength as it fosters creativity and innovation through the traditional exchange between different countries (Bätzing 1998). On the other hand, it is a challenge as there are differences in administration systems and governance, which have to be overcome for common goals and actions.

Landscape amenities

The picturesque mountain landscapes and the rich natural and cultural heritage are attractive for short and long-term visitors (day tourists, holiday tourists but also as home for retired people) and are the economic basis for tourism. Since tourism is an important economic sector for the Alpine area, landscape preservation is of greatest importance to the Alpine economy. Rural areas and small cities between European metropolises offer destinations for many of the metropolises' citizens, however, public goods such as landscapes, nature experiences and cultural heritages of the rural areas and little towns are often used without generating any economic revenues.

Figure 1.1.2-2 Alpine landscapes represent the natural and cultural heritage.
Zermatt with the famous peak of the Matterhorn attracts about 1.1 million overnight stays per year.

Traditional skills

The specific living conditions in the Alps have also generated the development of skills people needed to live and work in this area, using the regional available resources. Some examples for these kinds of skills are high pasture farming and cheese production, use of chestnuts, mushrooms or berries for food or timber handcrafts. A Green Economy may open up new markets for these skills and use the know-how and abilities for innovation such as wood construction for buildings, use of renewable material for insulation.

Alpine vulnerabilities

Special Alpine vulnerabilities are caused by the topographic conditions. Different altitudes are the reason for specific climate conditions which in higher altitudes often limit agricultural and forest yields. Slopes limit the area available for infrastructures and urban settlement. Therefore, the average area which can permanently be used for settlements is only about 17.3% of the total territory (cf.Figure 2.2.2-1) (Tappeiner et al. 2008).

Due to the harsh climate and thin soil layers, vegetation and ecosystems are often at the limits of their living conditions. Accordingly, land uses have been adapted to these specific natural circumstances and – in its sustainable manner – have produced cultural landscapes such as high altitude pastures, mountain forests, bush lands and others, which are one major reason for the attractiveness for tourism.

Figure 1.1.2-3 The Aletsch glacier is the largest glacier in the Alps.
Glaciers and their surrounding vegetation are one of the very specific characteristics of high alpine areas but are endangered by effects of climate change. The Aletsch glacier has lost since 1860 about 300 m of thickness and about 3000 m in length (Pronatura Zentrum Aletsch 2015).

1.1.3 Alpine economy characteristics

There is no documentation of the economy in the Alpine Convention area as an entity. Most statistics refer to the national level only, which is inappropriate for the Alpine Convention area. For the purpose of this report, a first rough picture is outlined, based on European data and information provided by member states of the Alpine Convention.

Employment and unemployment

Employment in the Alpine area is generally at a high level compared to European employment rates of 2012 (cf. ESPON & BBSR 2014). A detailed look at the Alpine Convention area (cf. Figure 1.1.3-1) reveals that in some areas such as the South-Eastern French and South-Western Italian Alps, as well as the Italian-Slovenian border, lower employment rates are reported. The unemployment rate ranges from 2.5% in Liechtenstein to 11.2% in the Slovenian Alpine area. Except for Slovenia, the average unemployment rate is lower in the Alps than in the country as a whole. In some small inner alpine areas, unemployment rates exceed 20%. The youth unemployment rate is higher in the southern fringe of the Alpine Convention area.

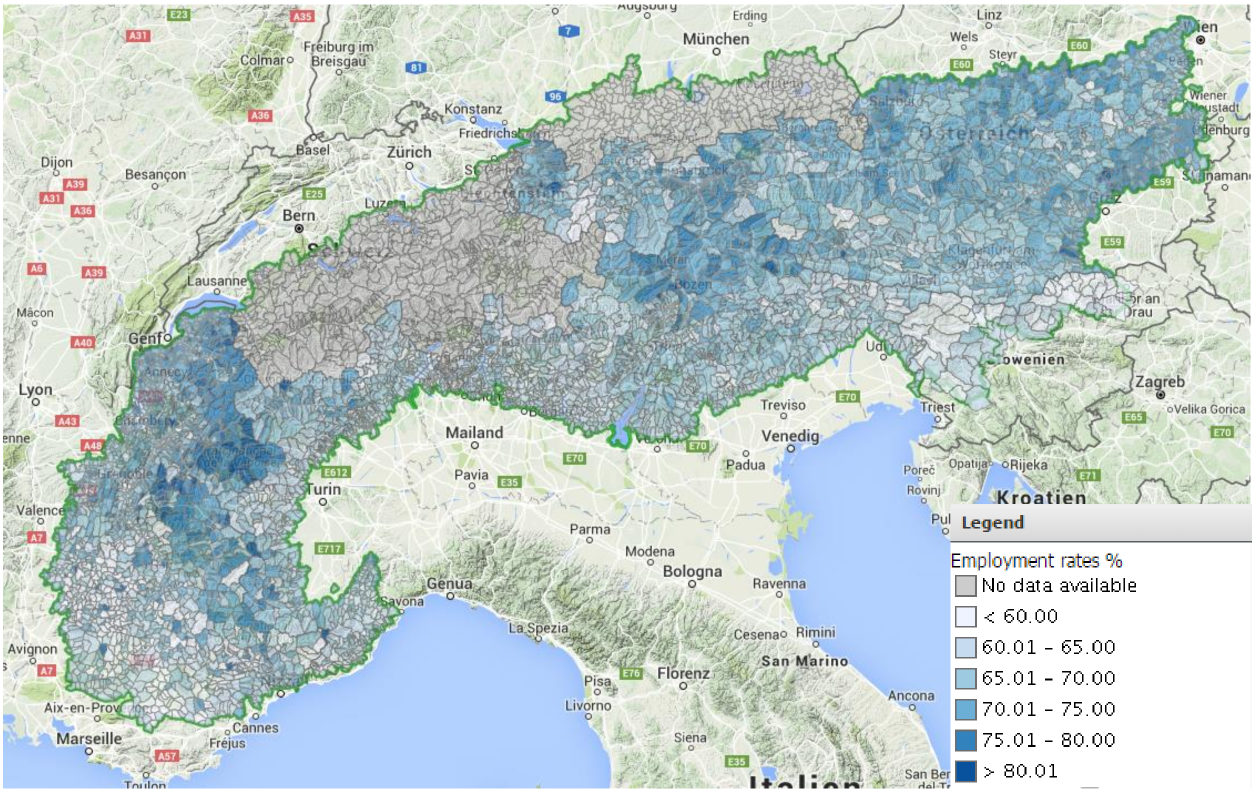


Figure 1.1.3-1 Employment in the Alpine convention area[6] (Data source: SOIA 2016).

Main economic branches

The economic branches have undergone changes in the recent years caused by the economic crisis. It is therefore interesting to see what kind of economic branches can be found in the Alpine countries compared to the EU averages. Following results of the ESPON atlas, parts of the German, Italian and Slovenian Alpine areas have a high share in manufacturing and agricultural economy whereas in Austria construction and retail are dominating. France and Switzerland are close to the EU average with an overrepresentation of public services (cf. Figure 1.1.3-2).

[6] Data from Austria, Italy, Liechtenstein and Slovenia refer to 2012 or 2013; Data from France refer to 2010 Census Data.

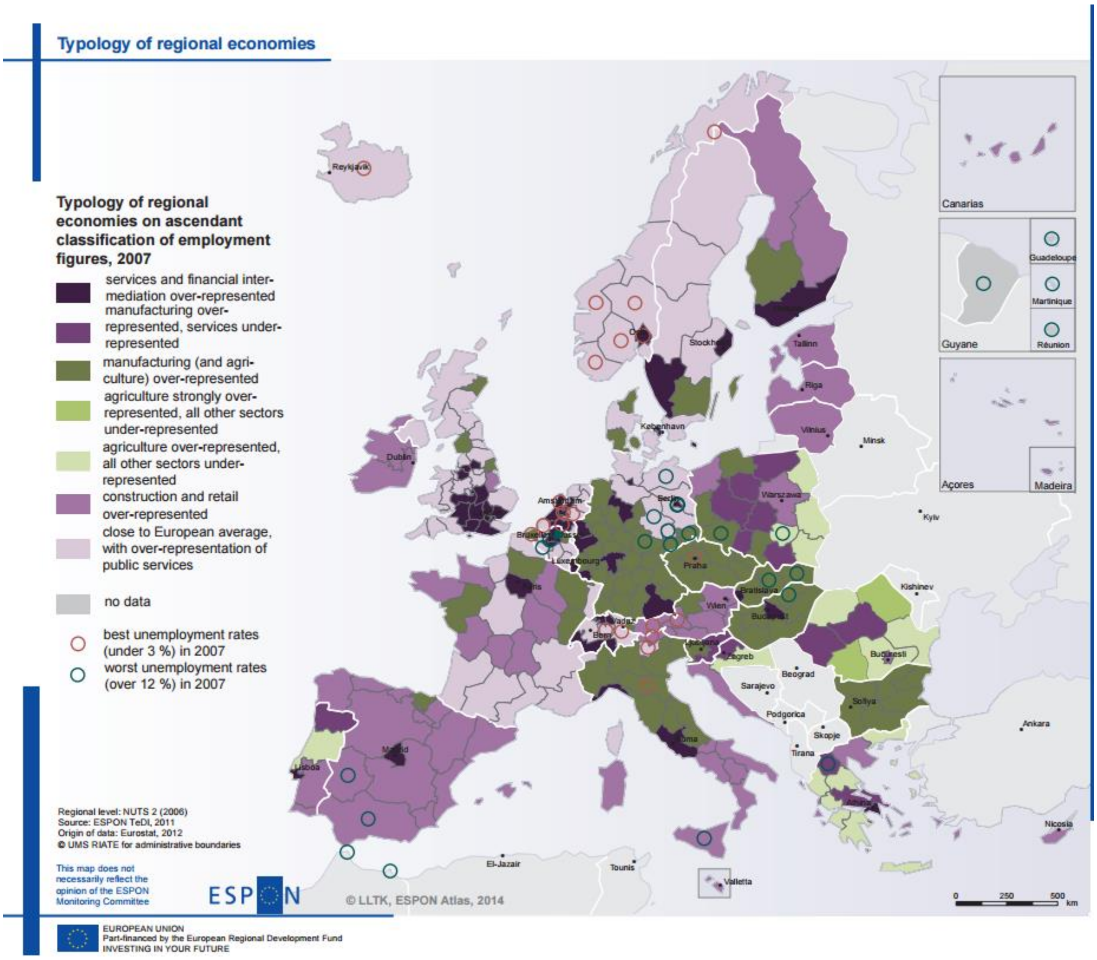


Figure 1.1.3-2 Regional types of economy (Source: ESPON & BBSR 2014, p.39).

The regional distribution of jobs in the different sectors can be observed in data provided by the Alpine data observatory SOIA (cf. Figure 1.1.3-3). In this map, primary sector jobs make up more than 32% of the job market in the southeastern Italian and French Alps, in the Austrian central Alps in the eastern Alps. However, in the Alpine parts of Germany, some parts of Austria and Slovenia, primary sector jobs make up less than 8.8%.

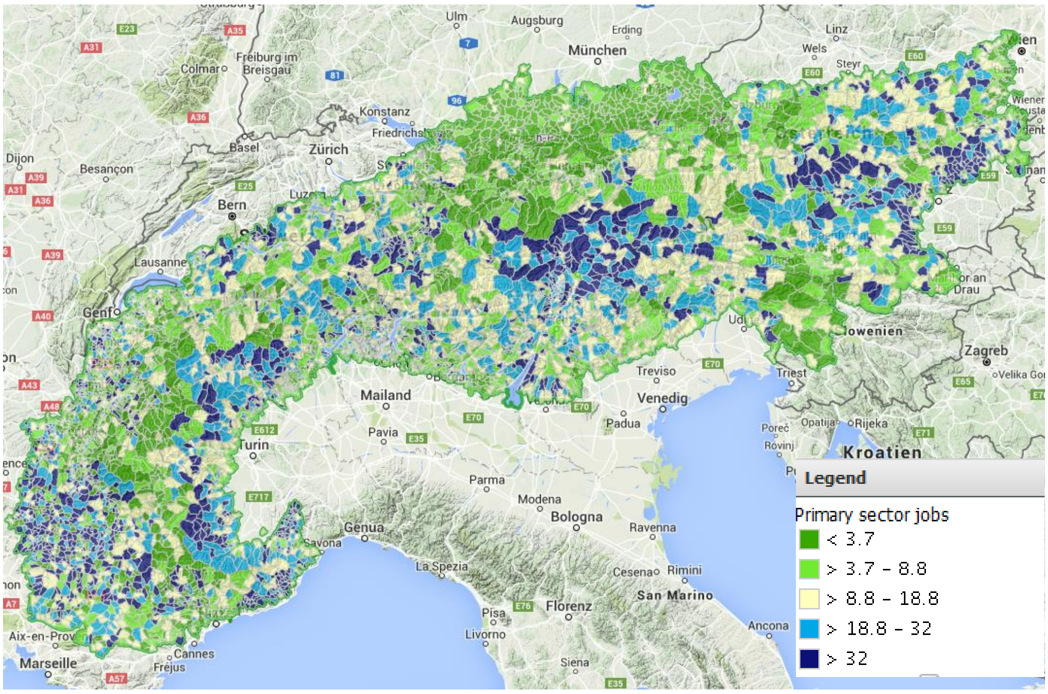


Figure 1.1.3-3 Percentage of primary sector jobs of total jobs in the Alpine Convention area[7] (Source: SOIA 2016).

Regional economic development

The economic development in the Alpine countries has also been influenced by the economic crisis and the long-term GDP growth rate has declined in some regions of Italy. In most Alpine regions, the GDP growth rate has slightly increased between 1 – 4 % in real terms as annual average for the period 2001-2011 (ESPON & BBSR 2014, p. 40). A further advanced picture is delivered by a composite benchmark index of the ESPON programme, taking into account 7 of the 14 so-called Lisbon indicators. These consider the areas of employment, innovation and research, economic reform, social cohesion and the environment. GDP per capita has dropped particularly in the French and Italian parts of the Alps. However, Lisbon performance is above or high above the average in most Alpine regions (cf. Figure 1.1.3-4).

The GDP distribution per capita in the Alpine Convention area is available at NUTS 3 level and shows disparities particularly between the central parts of the Alps and the eastern and western parts, even within a country. The southern parts of the Italian Alps, central parts of the Austrian and the Swiss Alps perform a relatively high GDP per capita (cf. Figure 1.1.3-5).

[7] Data sources: AT Statistik Austria (2001): Volkszählung (data provided via GALPIS). CH Bundesamt für Statistik (2000): Eidgenössische Volkszählung. DE no data available, FR INSEE (1999): Recensement de la population. IT ISTAT (2001): 14° Censimento generale della popolazione e delle abitazioni. LI Amt für Volkswirtschaft (2000): Beschäftigungs- und Arbeitsplätzestatistik. SI Statistični urad Republike Slovenije (2002): Popis prebivalstva.

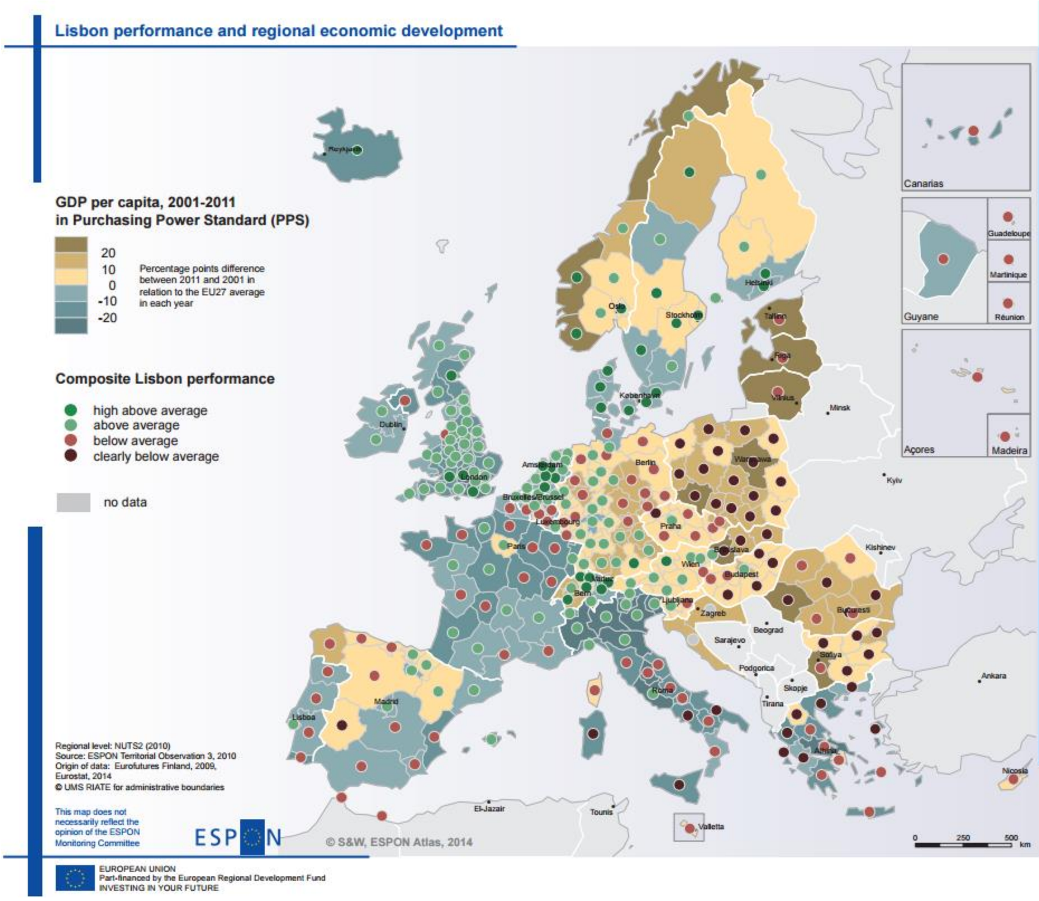


Figure 1.1.3-4 Lisbon performance and regional economic development (Source: ESPON & BBSR 2014, p.41).

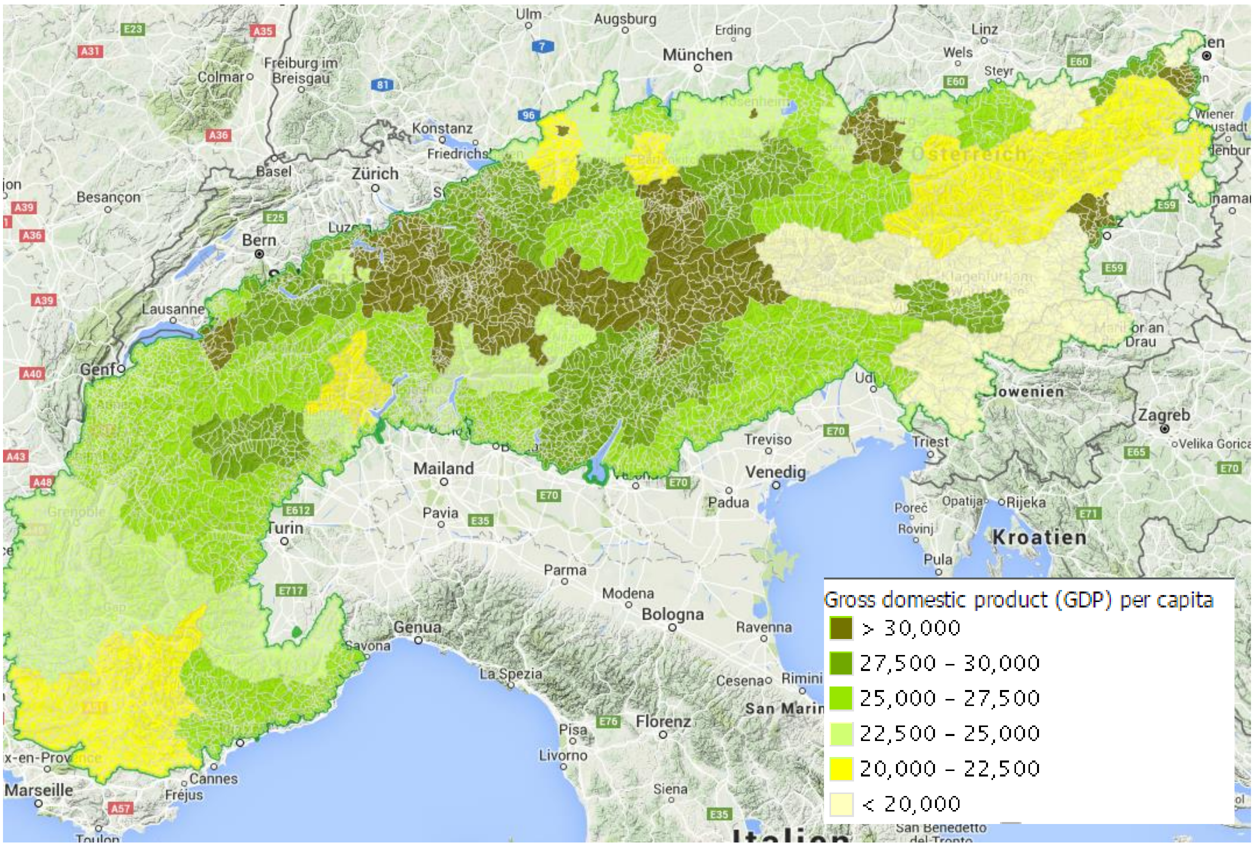


Figure 1.1.3-5 GDP per capita 2002/2003 (Source: SOIA 2016).

Innovation and knowledge

Innovation can be interpreted in its spatial patterns through the total research and development expenditures within a statistical unit, independent of the source of funds in relation to the GDP ("total intramural expenditures"). Results from the ESPON data (cf. Figure 1.1.3-6) show for large parts of the Alpine Space area and for the Alpine Convention area EU average values, in some areas even clearly over average (> 3 % of GDP).

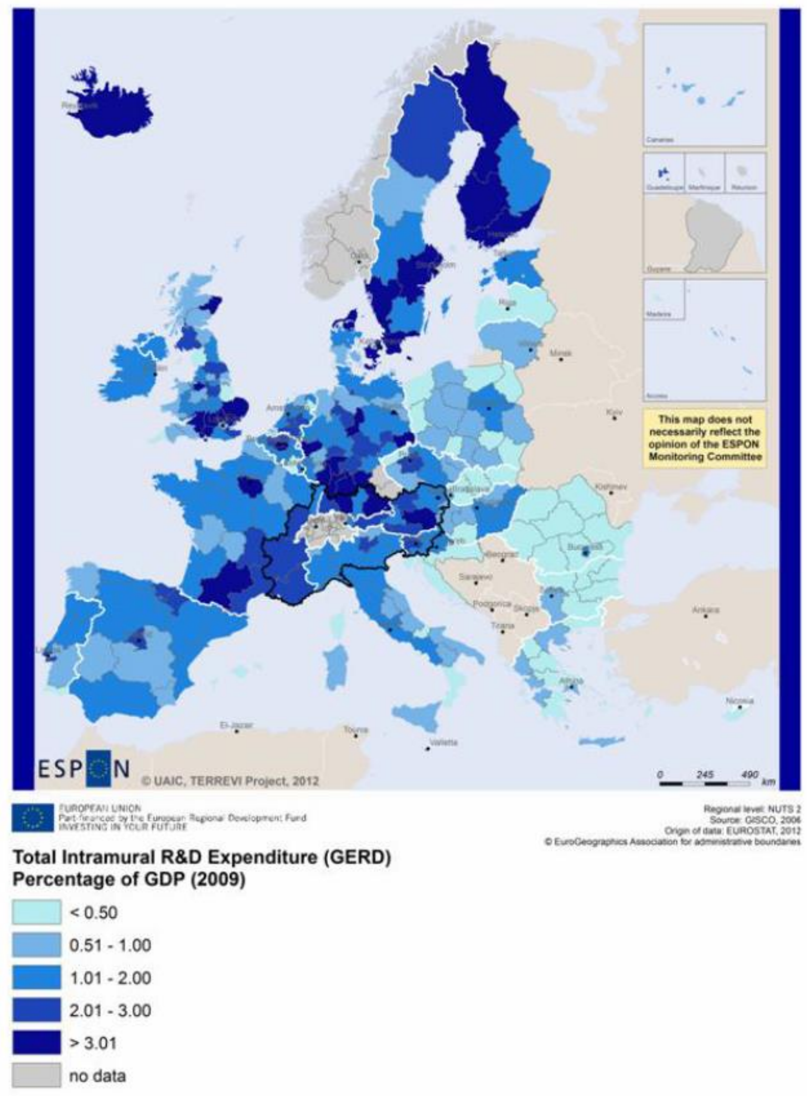


Figure 1.1.3-6 Total intramural R&D Expenditures (Source: ESPON 2013a, p.20).

The employment rate in knowledge-intensive services (cf. Figure 1.1.3-7) in the southern part of the Alpine Convention area is lower than in the north and northwestern part.

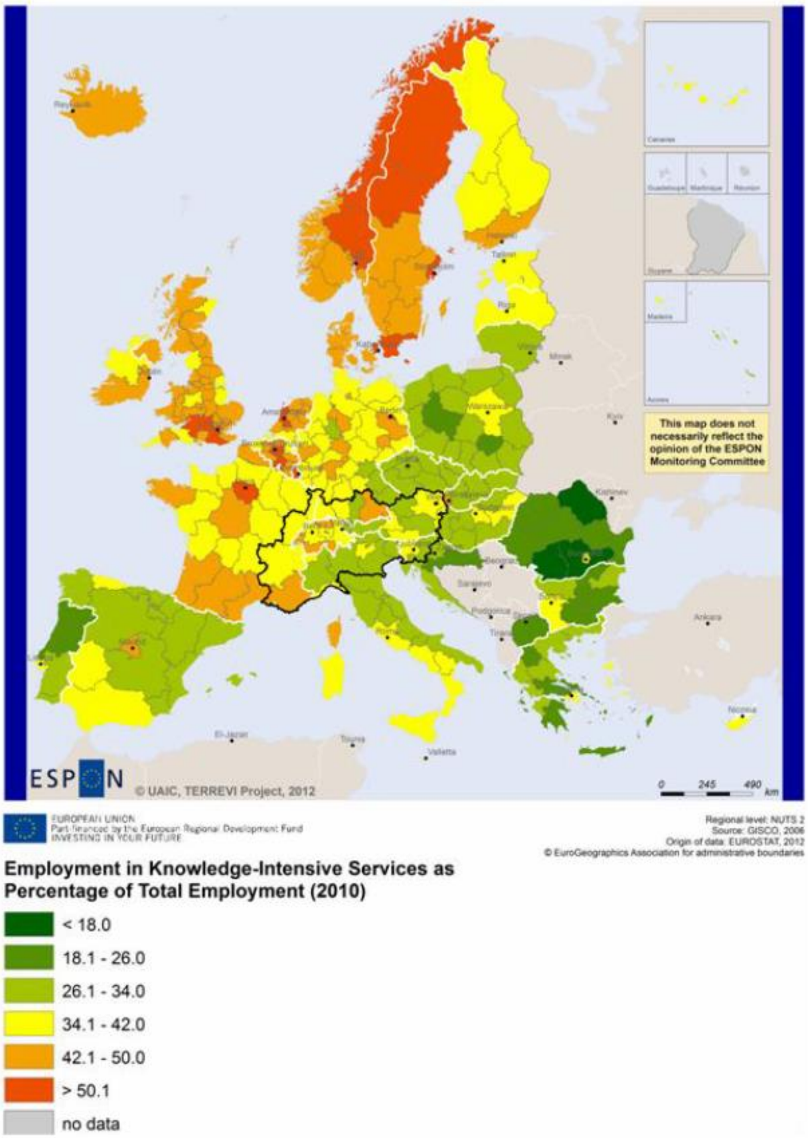


Figure 1.1.3-7 Employment in knowledge-intensive services (Source: ESPON 2013a, p.23).

Greening the economy

The greening of the economy was measured in the ESPON programme in five spheres of Green Economy: the environmental, the social, the territorial, the economic sphere and the econosphere[8]. According to this approach, the Alpine regions have very high to average Green Economic Performance with a medium potential for Green Economy in France, Switzerland, Slovenia, parts of Austria and Italy, a high potential in Italy where the Green Economy performance is average and low potential in parts of Austria and Germany.

[8] The econosphere links the environment with the economy and is measured by environmental and resource productivity indicators (ESPON & BBSR 2014).

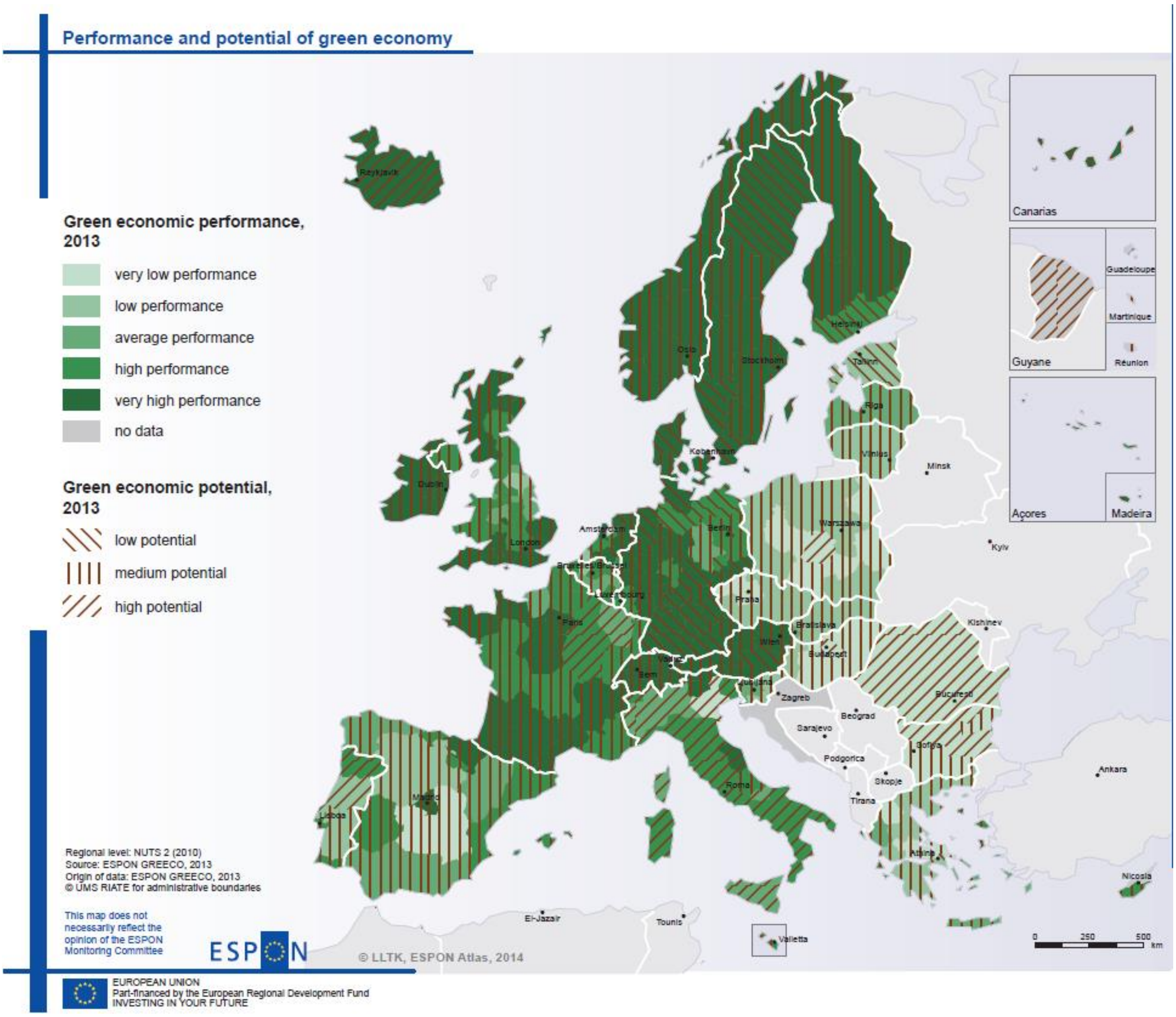


Figure 1.1.3-8 Green Economic Performance (Source: ESPON & BBSR 2014, p.91).

Different territories for cooperation and economic activities

The Alpine Countries cooperate in different organisations with different territorial extents (cf. Figure 1.1.3-9). The delineation of the Alpine Convention most adequately reflects the geomorphological Alps. The Alpine Space Programme comprises a larger territory and includes lowlands including the neighbouring metropolitan areas. The territory for the macro regional strategy EUSALP is almost identic with the Alpine Space Programme's territory, except in the North, where the whole German Länder Bavaria and Baden-Württemberg are included and the French area of Alsace is excluded.

Within the Alpine Convention area many economic activites are ongoing but there are also strong relationships to the surrounding areas particularly to the big agglomerations in the area of the Alpine Space Programme. The influence of the EUSALP territory on the Alpine economy is not yet identifiable.

Figure 1.1.3-9 Overview of Alpine areas: Alpine Convention area, Alpine Space Programme area and EUSALP area (EUSALP 2015).

Even within the Alpine Convention's area different spatial types exist due to the natural conditions, population density, infrastructures and accessibility. For example, Switzerland has developed a spatial typology of five categories for which different kinds of economic development can be observed. (cf. Figure 1.1.3-10)

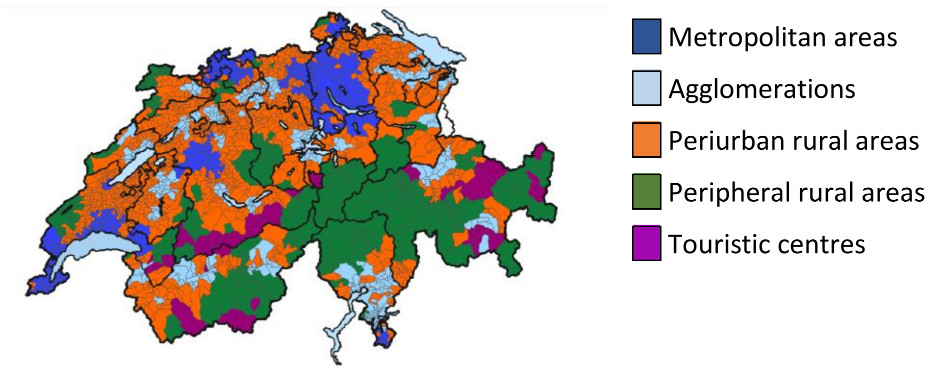


Figure 1.1.3-10 The metropolitan areas (blue), the agglomerations (light blue), the peri-urban areas (orange), the peripheral areas (green) and the touristic centres (pink) (Source: Regiosuisse 2011, p.7).

The Alpine part of Switzerland comprises every territorial category except the metropolitan areas. The most dominant categories are the peripheral rural areas, the touristic centres and some agglomerations.

Economic situation in Alpine countries

The following information on economic sectors, activities and employment provided by Alpine countries may give some further characteristics of the economy in the Alpine countries.

<u>Germany:</u>

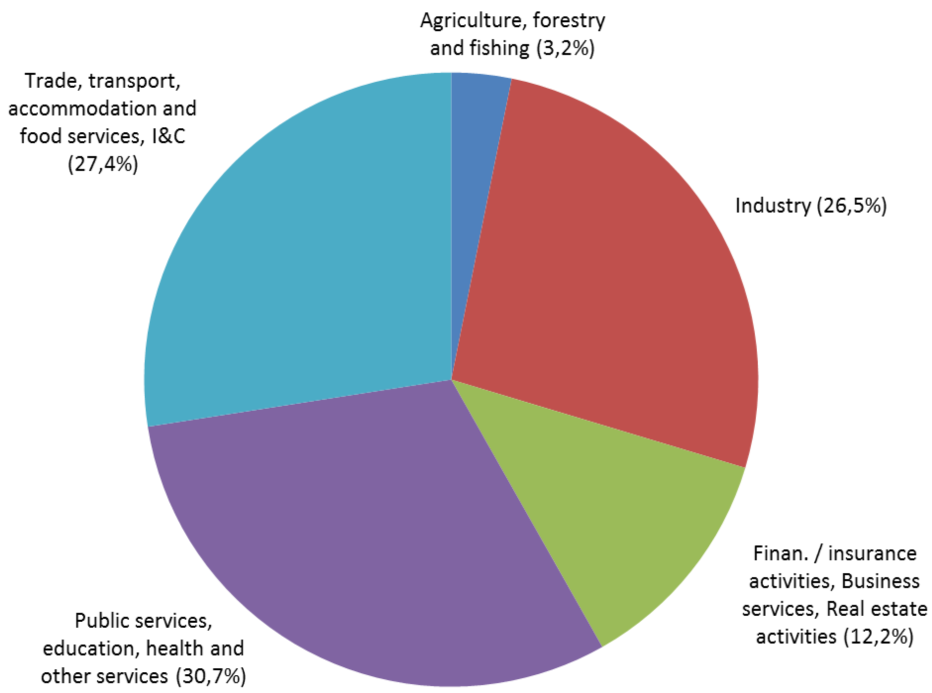


Figure 1.1.3-11 Share of economic active people per sector in the German Alpine Convention area 2013.

Economic sectors expressed by the economically active people (2013, data compared on NUTS3 level[9]) are presented in Figure 1.1.3-11. Comparing the situation within the Alpine convention area and the rest of Bavaria one can observe:

- A higher share of persons is engaged in the primary sector (agriculture, forestry, fishing and mining) within the German Alpine Convention area (AC) (3.2 %) than outside the German Alpine Convention area (2.6%);
- A lower share of persons is engaged in industry (26.5%) within AC compared to outside (29.9%);
- A lower share of persons is engaged in financial, insurance, business services and real estate activities within the AC;
- There is a higher share of the public services, health and other services within AC;
- Almost no differences are observed in trade, transport, accommodation, food services and information and communication sector.

Unemployment rate: The unemployment rate is a bit higher within the AC area (3.6% compared to 3.0% average of the respective NUTS3 outside), but still lower than the Bavarian average (3.8%).

[9] Data by Bavarian State Agency for Statistics.

Job density: The job density measured as people in economic activity per 1,000 inhabitants from 15 to 65 years, data for NUTS3 level: The mean value of 841 (outside AC: 806) is higher within the AC area, especially in Rosenheim (1,150) and Kempten (1,217), which are important labour markets.

Agriculture: The share of ecologically used agricultural land is higher within the Alps than in the foreland. The density of livestock units (expressed in count of livestock units per 100 ha of agricultural area) is rather high (more than 200 livestock units / 100 ha) in some parts of the AC area (counties of Rosenheim, Traunstein and Bad Reichenhall).

The GDP per capita is comparable with the rest of Bavaria, but shows a wide range: it is highest in the county-free town of Kempten (54,739 € in 2013) and lowest in the county of Garmisch-Partenkirchen (24,180 € in 2013).

Italy

In terms of GDP per capita (2013) Italian Alpine Regions rank well enough - with some significant differences - at the national level. Notwithstanding the still visible effects of the financial downturn which lowered GDP per capita since 2011 in the entire country, a few Alpine regions and autonomous provinces show the highest values of GDP p.c.. In Italy: the Autonomous Province of Bolzano and Valle d'Aosta (32,284 and 30,843 € p.c. respectively), are followed by Lombardia (29.434 €) and the Autonomous Province of Trento (26,547 €). The Valle d'Aosta suffered the highest loss of GDP p.c. between 2011 and 2013 (-3.8 %).

Labour productivity is particularly high across the Italian Alps in comparison with the rest of the country: out of the ten top-ranked regions for GDP (PPP) per hour worked, seven are in the Alpine area: Autonomous Province of Bolzano, Valle d'Aosta, Liguria, Autonomous Province of Trento, Friuli Venezia-Giulia, Piemonte and Veneto. Lombardia confirms to be one of the most productive areas in Italy: labour productivity has been growing between 2000 and 2012 by 2.4%.

Inflation has not been a major issue over the last few years due to the contraction of consumption following the economic crisis. However, some Alpine regions appear as being less sensitive than the national average to price increase with the slowest growth registered in Lombardia (0.1%) and unaltered prices in Veneto and Friuli Venezia-Giulia over the 1st 10 months in 2014.

Liechtenstein:

- Liechtenstein's economy is extremely diverse with a large number of small and medium-sized enterprises. The high value-added generated can mainly be attributed to a strong industrial sector and to financial service providers. At the same time, the contribution of the public sector to the national economy is comparatively small.
- A distinctive feature of Liechtenstein's national economy is the large number of inward cross-border commuters. In 2013, 53% of Liechtenstein's work force consisted of this group. Since GDP is generated by the entire work force, country comparison of GDP per capita may in the case of Liechtenstein lead to misleading conclusions. Hence, GDP per person employed may be considered a more appropriate figure to compare Liechtenstein across countries.
- The value added by agriculture and households mainly corresponds to the rental activities of real estates and the imputed rental of owner occupied dwellings.

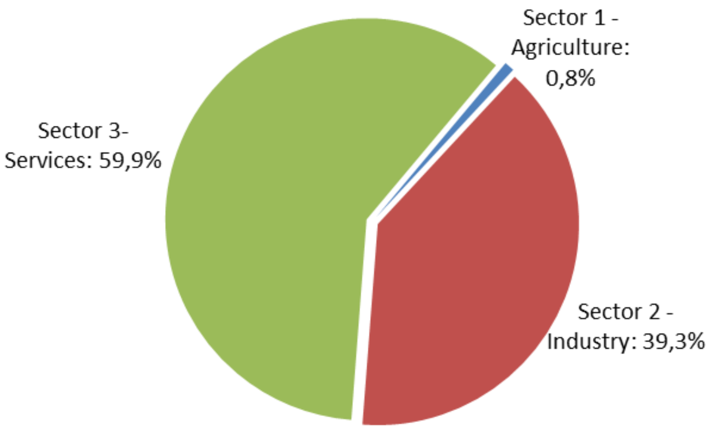


Figure 1.1.3-12 Employment of different sectors in Liechtenstein (31/12/2013)

Slovenia

- The economic sectors in the Alpine part show a significantly higher proportion of industrial production, mainly metallurgical industry (machinery and electrical equipment production), but also in other industries the value added slightly lags behind the Slovenian average. This economic structure has also an effect on the distribution of employed people.
- In Slovenia, 29% of the total employed population lives in the Alpine part[10] of the country. In comparison with the national level, the value added in the Alpine part is somewhat lower - around 27%.

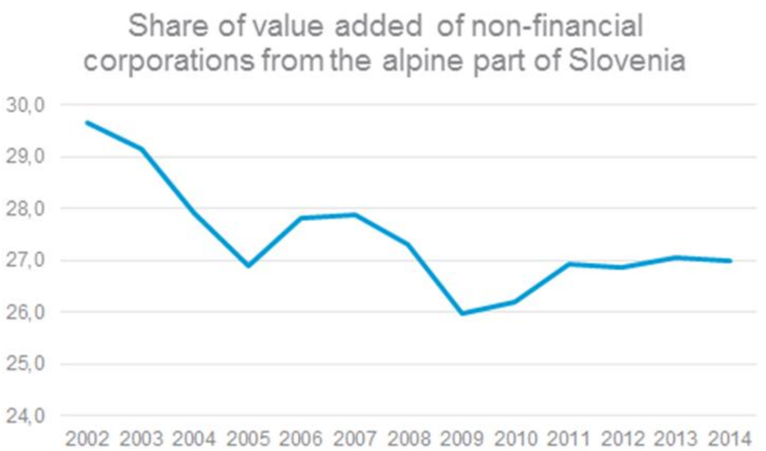


Figure 1.1.3-13 Development of value added in the Slovenian Alpine Convention area (Source: Slovenian delegation).

Switzerland:

- The different sectors, expressed as the mix of trades and industry, is reported for the different territorial categories in Switzerland measured in number of workplaces in 2008 (cf. Figure

[10] For this analysis, Alpine part was defined as postal areas which are completely of partially within Alpine Convention.

1.1.3-14). It shows that the most relevant industry in terms of employment within the Alpine area is the hotel and restaurant industry. A striking difference between the Alpine and the non-Alpine area can be found in the financing sector, which is a lot stronger in the metropol areas. However, the constructing sector is stronger in the Alpine area than the Swiss average.

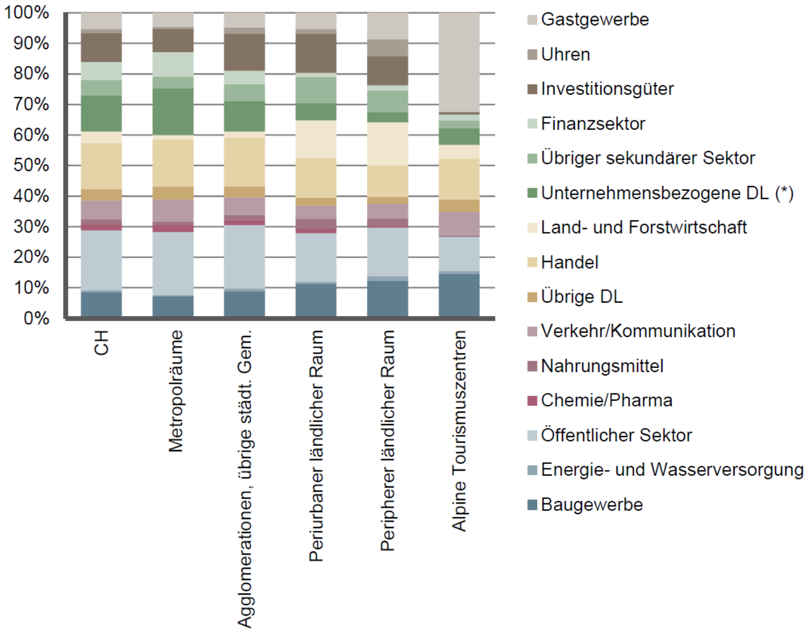


Figure 1.1.3-14 Mix of economic sectors in Switzerland measured as number of work places 2008 (Regiosuisse 2011).

1.2 Green Economy – the political and structural framework

1.2.1 Green Economy strategies and policies

Despite a growing international interest in Green Economy, a common definition of the concept, agreed general principles and clarity about policy measures did not exist over many years. Recent initiatives and publications by international and national organisations have addressed these challenges and fostered the development of the concept of a Green Economy. The most important initiatives and instruments are presented in the following.

International level

The United Nations Environmental Programme (UNEP) launched a Green Economy Initiative in 2008 that provides scientific and policy support for investing in green sectors and in greening traditional economic sectors. In collaboration with international experts, it compiled the Green Economy Report, which outlines the chances and implications of a Green Economy and aims at motivating policy makers to create framework conditions for increased investments in Green Economy. Furthermore, the Green Economy Initiative provides advisory services in specific countries and engages a wide range of research, non-governmental organisations, businesses and UN partners in implementing their activities.

The Organisation for Economic Co-operation and Development's (OECD) Green Growth Strategy, delivered in 2011, was the starting point for OECDs work on Green Economy. Activities focus above all on tools, indicators and policies for green growth and provide recommendations for governments in a wide range of topics, including employment, taxes, green technologies and social aspects. The OECD also has a green growth and sustainable development forum, an interactive platform bringing together stakeholders from different policy fields and disciplines working on Green Economy issues.

The Green Growth Knowledge Platform (GGKP) is a network of international institutions and experts established in 2012 with the aim to close major knowledge gaps in Green Economy theory and practice. It provides policy guidance, good practices, tools, and data necessary to support the transition to a Green Economy. Founding members include the Global Green Growth Institute, the OECD, UNEP and the World Bank, which since then were joined by leading institutions and organisations active in areas related to green growth and Green Economy.

In the context of a new sustainable development agenda, the United Nations adopted the so-called Sustainable Development Goals (SDGs) at the Sustainable Development Summit in 2015. The 17 new Sustainable Development Goals and its associated 169 targets shall safeguard a sustainable development from an economic, social and environmental point of view. More precisely, they aim to end poverty, hunger and inequality, take action on climate change and the environment, improve access to health and education, and build strong institutions and partnerships. Unlike their predecessor, the Millennium Development Goals that focused on developing countries, the SDGs are addressed to all states. Governments at all levels are now called upon to integrate the SDGs into their existing national, regional and local strategies and plans to ensure their practical implementation and achievement. The great majority of the 17 SDGs have a direct link to Green Economy, in particular the SDG 8.

EU - level

In 2010, the European Commission launched the Europe 2020 strategy, a ten-year strategy for the advancement of the economy of the European Union. Europe 2020 follows the Lisbon Strategy and shall create the conditions for smart, sustainable and inclusive growth. Within the strategy, five targets have been set, covering employment, research and development, climate change and energy sustainability, education, and social inclusion and poverty reduction, to be achieved by the end of 2020. Member States have adopted their own national targets and a wide range of actions at EU and national level underpin the strategy. To achieve progress on the targets, the Commission is putting forward a number of flagship initiatives. These include the initiative for a resource-efficient Europe supporting the shift towards a resource-efficient, low-carbon economy as well as the agenda for new skills and jobs just to mention two of them.

The 7th Environment Action Programme (EAP) of the European Union ('Living well, within the limit of our planet') was adopted at the end of 2013 and sets the framework for environment policy and actions by the EU institutions and the Member States until 2020. The programme has set three thematic priorities: (1) To protect, conserve and enhance the Union's natural capital; (2) To turn the Union into a resource-efficient, green and competitive low-carbon economy; (3) To safeguard the Union's citizens from environment-related pressures and risks to health and well-being.

The European Environmental Agency (EEA) publishes reports and provides data, developing the knowledge base on Green Economy to support informed decision making by policymakers, businesses and citizens.

The European Commission provides guidance and adopts legislation, policies and measures on various Green Economy topics. These include resource efficiency, waste and water management, sustainable production and consumption and innovation. In July 2015, the Commission launched the EU Strategy for the Alpine Region (EUSALP), focusing on policy areas with a high relevance to Green Economy, such as economic growth and innovation, connectivity and mobility, and environment and energy.

Situation in Alpine countries

Most of the Alpine countries do not have a specific Green Economy strategy, but adopted policies and measures that are relevant to particular aspects of a Green Economy. These include for example climate protection programmes and energy strategies.

Austria

For Austria Green Economy stands for a resource- and energy-efficient form of the production of goods and service, which is based on the three pillars of sustainable development. The Green Economy consists of environmental strategies, which have been mainstreamed in various policy fields.

Although Austria does not have a specific Green Economy strategy, important Green Economy measures are implemented by the Ministry for Agriculture, Forestry, Environment and Water Protection. One example is klima:aktiv, a very effective programme of the national climate protection strategy, focusing on energy and transport issues. Furthermore, Austria is strengthening sustainable investment and sustainable public procurement, the protection of the water system, organic agriculture, and innovative environmental and energy technologies.

An enormous potential for economic recovery and for green jobs rests with the increase in energy efficiency, energy saving, the consistent further development of renewable energy technologies and with investments in innovative environmental technologies.

The Austrian Ministry for Environment carries out numerous activities to reduce the energy demand, to encourage the use of renewable energy sources and the promotion of energy efficiency. Those activities include awareness-raising initiatives, support schemes and setting the appropriate legislative framework. The Ministry cooperates with companies, regions and local authorities and sensitizes children to environmental and climate issues through the programme "climate schools".

Austria's environmental technology industry is continuously growing with a turnover amounting to 8.2 billion Euro in 2011, mostly achieved in the export sector. To reinforce and sustain this positive development, a "Master Plan Environmental Technologies" and, subsequently, a "Master Plan Green Jobs" were established. Austria's vision according to the strategy documents is: "Austria takes the leadership in development, implementation and export of environmental technologies within the European Union".

Germany

Germany has no specific national strategy on Green Economy. However, the national sustainable development strategy “Perspectives for Germany – Our Strategy for Sustainable Development”, submitted in 2002, includes elements of a Green Economy. The strategy has been updated regularly, most recently with the last progress report 2012. Current priority fields of action are sustainable economic activity, climate and energy, and sustainable water resource policy.

Further to that, other national strategies support and facilitate the transition towards a Green Economy. The energy transition (Energiewende) is Germany’s “avenue to a secure, environmentally friendly, and economically successful future” and includes a number of policies and measures to achieve these objectives. Its 10-point Energy Agenda contains key projects of the energy transition, including i.a. the Renewable Energy Sources Act, the European Climate and Energy Framework 2030, and the National Energy Efficiency Action Plan.

In 2012, the German Resource Efficiency Programme (ProgRess) was adopted which aims at a more sustainable use of natural resources as well as a reduction of associated environmental pollution. Economic growth shall be decoupled from resource use as far as possible. For 2016, the start of ProgRess II is planned. Germany is among the first European countries having adopted a strategy for resource efficiency.

Italy

In Italy, a significant structural reform is taking place in the environmental sector at large.

The first component of it is a legal act (“Collegato ambientale”) introducing measures and investment on the most relevant sectors of a Green Economy as well as a few economic instruments, aimed at increasing transparency and equity in income and labour taxation. This is expected to strengthen an environmental fiscal reform focussed on achieving a gradual shift of tax base to the use of natural resources. The measures include financial support for sustainable mobility (car-pooling, car-sharing, bike pooling, bike sharing, “walking bus” for students). Basic environmental standards are required for companies willing to engage in green public procurement with public administrations. The administrative burden is reduced for companies being EMAS validated or ISO 14001 certified and whose products are certified with the EU Ecolabel. There are reduced tax rates for municipalities reaching garbage collection targets as set by the law. Furthermore, funds for hydrogeological hazards and water infrastructure were set up and so-called “oil free zones” were created across the national territory. The act also introduces a new voluntary scheme for environmental footprinting of Italian products (“Made in Green Italy”) to support Italian excellence in environmental sustainability.

The second component, known as the “Green Act”, is a wide public spending plan envisaging measures and incentives that aim to ensure the provision of energy, resources and food, to sustain a development path not impacting on climate variables, and to address global problems such as equity and poverty extinction. The measures aim at leveraging a huge economic impact across the country towards the implementation of a green and circular economy. The measures are consistent with the outcomes of major global and regional processes (e.g. SDGs, UNFCCC COP21, and the expected EU legislation on circular economy). They incentivise emissions’ cuts in the most impacting sectors, support a resource-efficient and circular economy in the municipal waste sector across the whole country (where significant differences still exist), provide efficient alternatives to individual transport and address hydro-geological risks especially in the most fragile regions, in particular mountain municipalities exposed to landslides, floods and rockfalls.

The specific measures are the result of a participatory, multi-stakeholder consultation process through which information, data and suggestions have been collected from the private sector, the citizens and the sub-national administrations involved, including mountain municipalities

Liechtenstein

Liechtenstein has no national strategy on Green Economy but numerous policies touch on subjects that are relevant to a Green Economy, such as energy efficiency, renewable energy, sustainable transport, waste management and biodiversity.

In 2012 the Government adopted ”The Energy Strategy 2020”. The strategy provides future-oriented impulses for the national energy policy. The focus areas of the concept are the promotion of efficient energy use, the use of renewable energies, and energy conservation. These goals correspond to the aims of the EU’s 20-20-20 climate package from 2008. Liechtenstein also has developed a climate change adaptation framework with the Alpine Space project C3Alps.

Slovenia

Slovenia has adopted a Framework Programme for Transition to a Green Economy in October 2015, which builds on the coalition agreement as well as strategic documents of the European Union. It sets the framework for measures Slovenia is planning and up taking to react to global challenges like population growth, environmental degradation and resource scarcity. One main objective of the Framework Programme is to promote green economy as an opportunity to enhance competitiveness and thus an impetus for the development of new green technologies and new jobs. Furthermore, the Programme aims to promote the development of knowledge and cooperation of stakeholders to make the transition to Green Economy feasible and efficient. A set of indicators will help to monitor the progress towards Green Economy in Slovenia.
The focus lies on the following areas: sustainable resource management, promotion and support to green business, support for green jobs, demand for green services and products, green public procurement, green fiscal reform, sustainable urban development, education and skills for green growth and green agriculture and forestry. An Action Plan for 2015-2016 accompanies the programme.

Support to green economy and especially to circular economy is also one of the objectives of the Smart Specialization Strategy 2015.

Switzerland

The Swiss government aims to protect natural resources and at the same time strengthening the economy. In order to achieve the goal of an environmentally sustainable economy, the Federal Government created a framework that contributes to both the interests of environmental and economic policies. The Federal Office for the Environment (FOEN) has the lead and other ministries are pursuing this goal as part of the Federal Council's mandates for a Green Economy.

In 2013, the Swiss Government adopted the Green Economy Action Plan. In doing so, it intended to conserve natural resources, make consumption more environmentally friendly and strengthen the circular economy. The action plan includes 27 existing and new measures in four priority areas of action: consumption and production; waste and raw materials; horizontal instruments; objectives, follow-up, information, reporting.

The "Green Economy- Federal measures for a resource-conserving, future proof Switzerland"[11] report from April 2016 assesses the implementation of the 2013 Green Economy Action Plan and sketches further developments in Green Economy based on the existing legislative basis. The measures are are based on UN`s Sustainable Development Goals as well as on Federal Council`s Sustainable Development Strategy. The discussed measures fall under three categories: 1. consumption and production, 2. waste and raw materials, 3. crosscutting instruments. More specifically, the report assesses past actions and

[11] Available here: http://www.bafu.admin.ch/wirtschaft/15556/15557/15562/index.html?lang=en; indicators’ report available here:
http://www.bafu.admin.ch/wirtschaft/15556/15610/index.html?lang=en&download=NHzLpZeg7t,lnp6I0NTU042l2Z6ln1ad1IZn4Z2qZpnO2Yuq2Z6gpJCHeoF3fWym162epYbg2c_JjKbNoKSn6A--

future goals concerning: consument behaviour, transparency of standards by ecologically important resources and products, product and process optimisation, waste avoidance, closing life-cycles of materials, sector-specific approaches for increasing efficiency, international involvement, incentives and strengthening of knowledge-basis, aims, dialog and reporting.

Moreover, the FOEN participates in various international initiatives for promotion of the Green Economy and shares its experience with other national ministries and agencies. Furthermore, Switzerland is a member of - or is in close contact with - various international organizations (UNEP, OECD, European Union, etc.) that promote the transition to a Green Economy. The action is motivated, in particular, by global environmental problems and the increasing scarcity of resources.

1.2.2 Green Economy and the Alpine Convention

The concept of Green Economy is not explicitly mentioned in the Alpine Convention or in the Protocols. The main reason for this is that, at the time of the drafting of the Convention, sustainability was the main concept used for highlighting the need of balancing ecological, economic and social aspects, while the concept of Green Economy was not yet fully developed and widespread. Nevertheless, the Protocols of the Convention show several provisions and concepts relevant for greening the economy in the Alps, especially in light of the topics tackled in the current Report on the State of the Alps.

References to issues related to Green Economy are available in the Protocols on Energy, Transport, Spatial Planning and Sustainable Development, Soil Conservation, Mountain Farming, Forestry and Tourism. While the first four mentioned Protocols mostly tackle resource efficiency and low-carbon aspects of Green Economy, the last ones refer more to aspects related to well-being, quality of life and ecosystem services. Moreover, the Declarations on Climate Change and Population and Culture set a specific context for greening the economy by highlighting both, the need of the Alpine area to contribute to mitigation and adaptation of climate change and the need to promote high quality of living standards in the Alps.

The Declaration on Climate Change sets a context for greening the economy by highlighting the need of striving towards a low-carbon economy to contribute to mitigation to climate change. Some proposed measures are the improvement of energy efficiency and the use of the existing energy saving potential, also in the use of renewable materials and in the construction of building. The Protocol on Energy plays a key role, since it recognises the key contribution of the Alpine area - where renewables will play an increasingly strong role - to meeting European long–term energy needs and fighting climate change. The Protocol encourages the Contracting Parties to make use of renewable energy sources, also in combination with existing conventional supplies, by promoting, *e.g.* the use of decentralised plants for hydropower, solar and biomass energy, while at the same time avoiding impacts on the environment and the landscape. Additionally, the Protocol on Energy highlights the need to promote the reduction of energy needs through measures aimed at enhancing efficiency. Transport (regulated by the Transport protocol) has a specific role when tackling energy consumption and emissions in the Alps and is therefore one of the main sectors to address.

The XIII Alpine Conference has envisaged several activities concerning sustainable energy in the Alps and has confirmed the willingness to become a model region in this respect, thus striving for a "Renewable Alps" vision. Based on the decision by the Ministers and in view of the XIV Alpine Conference, several follow-up activities have been carried out, such as a progress report on the Renewable Alps vision and the collection of good practices concerning the solving of conflicts between renewable energy use and spatial planning.

Soil and land are particularly scarce resources, which are important for an Alpine wide resource–efficient approach. The Protocol on Spatial Planning and sustainable development specifically tackles this issue, by envisaging an efficient and prudent use of land in the Alps. Additionally, the Protocol on Soil conservation focuses on soil quality and highlights how the impacts on soil of economic activities such as agriculture and forestry should be minimised; the Protocol thus establishes a link to the Green Economy principle of quality of life.

Relevant Alpine economic sectors, such as farming, forestry and tourism can play a key role in the reduction of greenhouse gas emissions. The Protocol on mountain farming highlights the economic relevance of this sector in the Alps, which traditionally has been rooted in a balance with the environment. Moreover, it takes into account the well-being of consumers by fostering the provision of quality products. The Protocol on Mountain Forests emphasizes how wood is a renewable resource, whose use should be encouraged in a sustainable fashion, such as, for example, through reforestation in a natural way, through the use of indigenous forest material and adequate tree species. The Protocol recognizes the role of forests in Green Economy, by highlighting their economic as well as their protective, recreational and social function, and their provision of substantial ecosystem services. Finally, greening strategies in the Alps need to effectively address tourism and its environmental, social and economic balance. The Protocol on Tourism highlights the specific environmental conditions in which alpine tourism takes place and the subsequent need to take in account “ecological data, natural resources and limitations to the ability of ecosystems to adapt”. The greening of specific parts of the service tourism chain – such as accommodation – can also give an important contribution to a low-carbon economy and has been a focus of the conference “Climate protection and energy efficiency in hotel and gastronomy” organized in 2016 in the framework of the German Presidency of the Alpine Convention.

1.2.3 Main players of Green Economy

The transition process towards a Green Economy will consist of the activities of different players, such as industry, public administration, municipalities, research and development institutions, small and medium enterprises (SME), Non-Governmental Organisations (NGOs) and citizens. Primarily "greening the economy" is a political vision and strategy, which is perceived as a dynamic process building on interactions between civil society, markets and political institutions. There is a broad consensus regarding the need for further development of institutional frameworks creating purposeful incentives and standards. At the same time, knowledge, creativity and intrinsic motivation of private actors are crucial preconditions for greening the economy. The role of alpine NGOs such as CIPRA, the Alpine Town of the Year, Alliance in the Alps or Alparc is crucial for dissemination and implementation of a Green Economy. The specific setting of the Alpine region might particularly motivate public and private actors to create innovative solutions, which lead the way beyond current practices.

At the international as well as at the national level, different organisations and sectors from NGOs, research institutes, UN organisations, business, trade unions, and experts can be identified. The Green Growth Knowledge Platform (GGKP[12]) and the Green Economy Coalition (GEC[13]) are two important platforms for such players of Green Economy. Based on this general information the role of players may be identified as in Table 1.2.3 1:

Table 1.2.3-1 Potential role of main players

Type of player	Potential role for greening of the economy
Policy makers	Setting green economy on the policy agenda, raising awareness of other players for needs and benefits of a green economy, taking decisions fostering a greening of the economy.

[12] Further information: http://www.greengrowthknowledge.org.

[13] Further information: http://www.greeneconomycoalition.org/.

International Organisations	Development of strategies and overarching concepts; linking approaches in different countries; exchange of information.
Public administrations	Implementation of greening instruments such as regulations, financial incentives according to the level of organisation. Consideration of greening instruments lying in the responsibility of the administration such as sustainable public procurement.
Towns and municipalities	Coordination and implementation of instruments for greening the economy in their area, raising awareness amongst business and citizen, promoting and offering business opportunities to green business, sustainable public procurement. Important fields of action are energy efficiency, renewable energies, sustainable mobility.
Science and R&D institutions	Development, feasibility tests and analysis of effects of new economic concepts, technical solutions, governance approaches.
Associations	Dissemination of knowledge and new approaches within their membership, promotion of benefits of greening effects; raising awareness and responsibility of companies.
Industry and enterprises	Implementation of measures such as energy savings, efficiency increase in their production; good practice examples.
Consumers	Reflecting the power of consumers, taking conscious decisions when purchasing services and products and steering the demand.

2 Status and trends of Green Economy

The Alps can be a pioneering CO_2 neutral region being also independent from fossil energy sources. Not only its natural circumstances, but also the motivation of different stakeholders in the Alpine region offer a good basis to reach this ambitious goal on the way to a greener economy. Within this context, energy efficiency, potentials for using renewable energy sources, and resource efficiency play an essential role. Energy and climate are pivotal issues in the Alps for both physical and policy reasons. Stakeholders have shown some willingness to start the transformative path to a greener economy.

However, a Green Economy cannot be restricted only to introducing innovative technologies. A primary challenge is to change the prevailing mindset and alter production and consumption patterns. Only by establishing a greener society, a Green Economy framework can succeed in delivering sustainable development in the long run. Providing the right incentives to a consistent individual behavior can significantly help achieve major environmental targets such as greenhouse gases' and other emissions' reduction from industrial activities, households and transport. Another goal of a Green Economy is to minimise environmental impairments due to technological advancement on the alpine environment and human well-being.

The issues raised above are discussed in the following subchapters focusing on the topics of

1) Energy efficient and low carbon economy;

2) Resource efficient economy;

3) Ecosystem services and natural capital based economy;

4) Economy supporting quality of life and well-being.

The four topics are examined within the framework of Green Economy, giving a picture on status, potentials and trends of the Alpine countries.

2.1 Energy efficient and low carbon economy

A low carbon economy is generally understood to be an economy based on low-carbon energy sources that produces minimal greenhouse gas emissions (GHG), in particular carbon-dioxide (CO_2). Typically, a low-carbon economy makes limited use of fossil fuels.

Characteristic goals of such an economy include achieving high energy efficiency, using clean and renewable energy, and pursuing the greening of GDP via technological innovation, while maintaining the same levels of energy security, electricity supply and economic growth (Regions for Sustainable Change, 2011).

The Alpine region is characterised by a fully industrialised energy system with all its typical environmental problems such as large GHG emissions and a heavy dependence on exhaustible fossil energy. Demand for industrial energy is growing, thus presenting challenges to meet the stated policy goals such as CO_2 reduction and a higher share of renewable energy.

The European Union recognizes the importance of a low carbon Alpine space by including the objective as priority axis to the (Alpine Space Programme 2014). The topic is also subject of the Macroregional Strategy for the Alps, EUSALP. There, the objective of "Building further on the position of the Alpine Region as world-class in terms of energy efficiency and sustainable production of renewable energy" is clearly underlined and supported by an own action group.[14]

[14] Further information: http://www.alpine-region.eu/the-pillars.html.

In this chapter, the focus is on three main topics concerning energy efficient and low carbon economy in the Alps:

(1) Carbon emissions focusing on status and trends of GHG emissions (especially CO_2 and CH_4) and their consequences, policy background and main targets towards low carbon economy in the Alpine countries, as well as potentials for reducing CO_2 in the Alpine area.
(2) Renewable energy sources, highlighting the situation on installed renewable energy (RE) capacity of the Alpine countries as well as the potential use of RE within the Alpine area.
(3) Efficient use of energy in particular primary and final energy consumption in different Alpine countries as well as their status and goals towards energy efficiency;

Instruments and measures related to the named topics are described in chapter 3.1.

2.1.1 Carbon emissions

The combustion of fossil raw materials generating CO_2 has several consequences on the natural and human environment: global warming is causing among others extreme weather conditions, melting of glaciers, rise of sea level, loss of biodiversity (IPCC 2007, 2013) and the depletion of fossil resources (PSAC 2011). These trends are likely to have serious consequences on the economy of the Alpine area, which calls for further collective efforts towards a low carbon economy on a supranational level aimed at avoiding such extremes. Due to these consequences, the last Conference of the Parties of the United Nations Framework Convention on Climate Change (COP21) (UNFCCC 2015) in Paris aimed to achieve, for the first time in over 20 years of UN negotiations, a binding and universal agreement on climate worldwide.

In the context of carbon emissions we will use the two terms “mitigation” and “adaptation” according to the definition of the Alpine Convention´s Action Plan on Climate Change (AC 2009).

Background about carbon emissions

In the last decades, the amount and distribution of precipitation in the Alps has changed significantly: In the north-western part of the Alps (France, North Switzerland, South Germany and West Austria), the average annual precipitation has grown, whereas in the south-eastern part of the Alps (Slovenia, East-Austria) a decreasing precipitation was measured (Auer et al. 2005). The temperature in the Alps has been risen by just under 2°C over the past 120 years and about 1.2 °C in the last 25 years (Auer et al. 2007 & EEA 2009). This amount is almost twice as much as the global average (PSAC 2009). The Alpine permafrost itself has been warmed by 0.5-0.8 °C (PSAC 2011). Researchers are predicting a further 2°C increase over the next forty years. According to the OECD report on Climate Change in the European Alps (2007), the effects of climate change in the Alps are three times higher than the world average: For every degree celsius of warming, the snowline will rise by about 150 m (Beniston 2003) and the duration of snow cover will decrease by a few weeks (IPCC 2007).

Their fragile ecosystems make the Alps sensitive to the natural consequences of climate change (e.g. migration of species, habitats and treelines due to shift of climate zones). More information on this can be found in chapter 2.3.2.

The consequences of climate change make the Alpine area also economically vulnerable. On the one hand, costs arise from climate change-induced events such as natural hazards. These include floods and hydrometeorological processes (e.g. heavy rain events), landslides and geological mass movements (e.g. rockfalls, rock slides) as well as avalanches (e.g. snow avalanches). According to the International Disaster Database (EM-DAT), 150 catastrophic events caused approximately € 45 billion direct losses and more than 4,000 fatalities in the last 60 years in Austria, Germany, France, Italy, Slovenia and Switzerland (UIBK 2011).

On the other hand, economic costs are connected to risk mitigation measures. Just to mention some examples, Switzerland spends about 0.6 % of GDP (€ 2.2 billion) in total for mitigation of natural hazards per year (Wegmann et al. 2007). Compared with Switzerland, the yearly expenses for public safety are significantly lower in Austria with an estimated 0.07% (in total € 154 million) of GDP incl. the costs of risk mitigation of floods, torrent processes and avalanches (BMLFUW 2010).

Situation of CO_2 and CH_4 emissions at the EU level

CO_2 emissions are a major contributor to global warming and account for around 80% of all greenhouse gas emissions in the EU (EUROSTAT 2016a). Several factors influence the diverse picture of CO_2 emissions in the Alpine countries. It is important to mention that the economic background such as the recession in 2008 as well as natural circumstances such as cold winter resulting in higher heating rates particularly affect CO_2 emissions. According to the JRC report (2014c) on trends in global CO_2 emissions the economic recession after 2008 influenced the emission trend explaining less than 50% of the greenhouse gas emission reductions in the EU countries. Another important driver of specific fossil fuel consumption is the fuel price. Moreover, energy policies can have a strong impact on CO_2 emissions.

Figure 2.1.1-1 shows the CO_2-emissions of fossil fuel use and industrial processes in the Alpine countries AT, FR, DE, CH, IT, SI at the national level from 1990 to 2013 (including cement production, carbonate use of limestone and dolomite, non-energy use of fuels and other combustion). Excluded are: short-cycle biomass burning (such as agricultural waste burning) and large-scale biomass burning (such as forest fires).

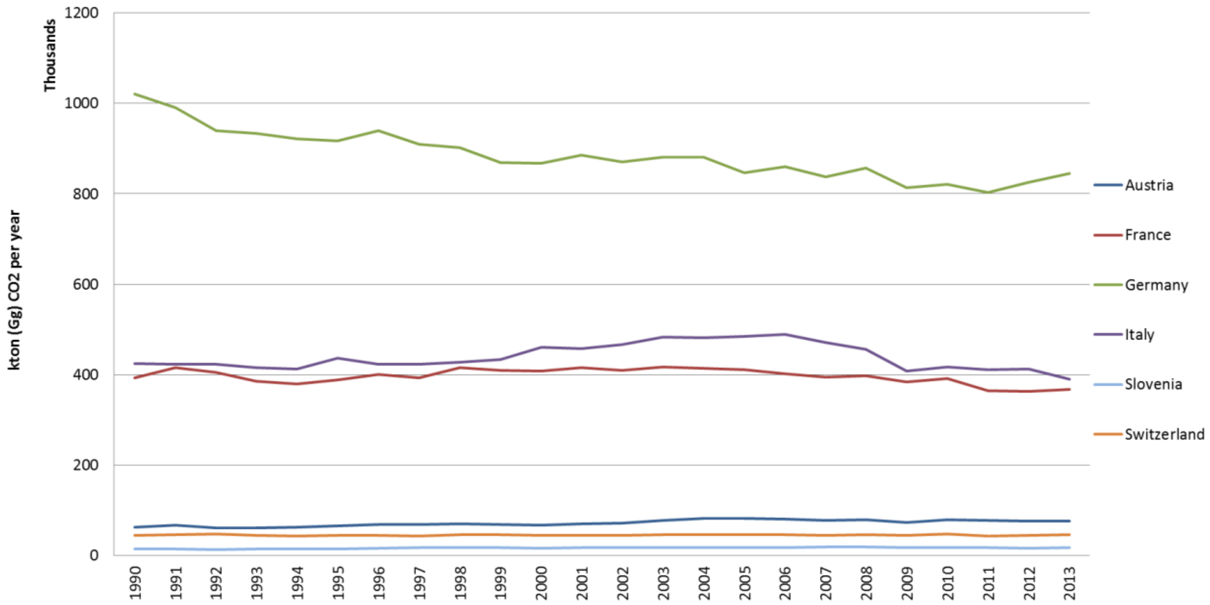


Figure 2.1.1-1 At national levels: CO_2 emissions in Alpine countries from fossil fuel use and industrial processes (1990-2013, in kton (Gg) CO2 per year) (data source: JRC 2014b, graph: ifuplan 2016). Data of Liechtenstein has been included in the data of Switzerland[15].

The diagram illustrates that until 2013 three Alpine countries have reduced their CO_2 emissions in comparison to the base year of 1990. Decreasing tendencies can be found in Germany (-17 %), Italy (-8 %) as well as France (-6 %). In other Alpine countries - compared to 1990 - increasing CO_2 tendencies have been reported such as Austria (+22 %), Slovenia (+13 %) and Switzerland (+4%).

[15] According to the methodology of the EDGAR calculations (http://edgar.jrc.ec.europa.eu/methodology.php) depending on country definition and availability of activity statistics, some small countries are presented together with other countries (e.g. Liechtenstein with Switzerland).

Methane emissions are often underrepresented in the discussion on GHGs. Farming is a particularly relevant sector for CH_4 emissions in the Alpine region, whose national trends from 1990 to 2012 are reported below for the Alpine countries (Figure 2.1.1-2). Since there are no statistics on CH_4 emissions for the Alpine space, national tendencies are displayed here. This data includes also biofuel and biomass burning (such as agricultural waste burning, forest fires, post-burn decay, peat fires and decay of drained peatlands).

Figure 2.1.1-2 shows decreasing tendencies in Austria (-20%), Switzerland (-17%), Germany (-51%), Italy (-25%), Slovenia (-7%) as well an increasing tendency in France (+7%).

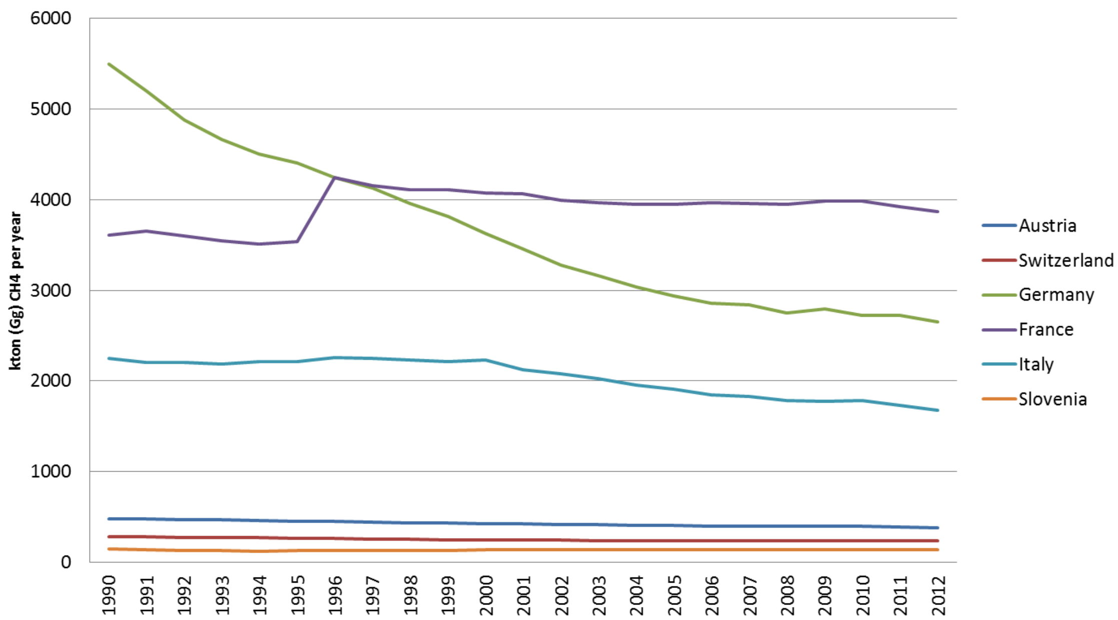


Figure 2.1.1-2 CH_4 emissions in Alpine countries incl. biofuel and biomass burning between 1990 and 2012 (data source: JRC 2014a, graph: ifuplan 2016). Data of Liechtenstein has been included in the database of Switzerland[16].

Detailed information on GHG emission trends and contributing sectors on the national level can be found in the paragraph "Situation in Alpine countries".

<u>Decoupling economic growth from fossil fuels</u>

According to the Eurostat (2015d) news in 2014, the EU has been continuing to decouple its slow-moving economic growth from CO_2 emissions. While the EU-28´s GDP has grown with 1.4% in comparison to 2013, the CO_2 emissions decreased by 5.4%.

In a nutshell, the combustion of fossil fuels that cause a big amount of CO_2 emissions in the Alpine area has not changed very much compared to past years (PSAC 2011, cf. Figure 2.1.1-1). Different sectors contribute to that, such as the transport, energy, heating industry as well as construction sector. Among the consumers, heatings from private households, industrial motorised transport as well as the tourism sector is also responsible for the high emissions. Against this background, these sectors play a key role in establishing a low carbon economy in the AC area.

The fight against the impacts of climate change can only go hand in hand with a tangible and applicable low carbon policy. On the other hand, the transition to a low carbon economy in the Alpine region requires greater CO_2 emission cuts.

[16] Ibid.

EU and international level

On its way towards a highly energy-efficient, low carbon economy, the EU has conceived a roadmap outlining the necessary measures and transformations. For the middle-term, it adopted a package of binding legislation, which aims at ensuring that the EU reaches its objectives for the year 2020, the so-called "20-20-20" climate and energy targets (EEA 2015l):

- 20% reduction in EU GHG emissions compared to 1990 levels;
- 20% share of renewable energy sources in EU's final energy consumption;
- 20% improvement in energy efficiency: absolute energy consumption 20 % below "business as usual scenario" which is equivalent to a 13 % reduction from 2005 levels.

However, the analysis of Höhne et al. (2011) has shown that implementing the renewable energy as well as the energy efficiency targets leads to an emission reduction of 30% rather than 20%. Whereas the EU is well on track to achieve the renewable energy and emissions reduction targets, it lags behind in respect of the energy efficiency target[17].

The Roadmap for building a competitive low-carbon Europe by 2050 (ECF 2010) sets out ways to achieve cuts of GHG emissions by 2050 (compared with 1990 levels) entirely through measures taken within Europe. Intermediate cuts of 25% by 2020 and 60% by 2040 are needed.

Moreover, the EU countries have agreed on a new 2030 Framework for Climate and Energy, including EU-wide targets and policy objectives for the period between 2020 and 2030 in particular three new commitments for climate and energy for the year 2030:

- A binding minimum 40 % domestic reduction of GHG emissions compared to 1990 levels;
- A binding minimum 27 % share of gross final renewable energy consumption;
- An indicative minimum 27 % improvement in energy efficiency[18].

On 12 December 2015, the participating 195 countries to the Paris conference on climate change agreed on the the Paris Agreement. The members agreed to reduce their carbon output "as soon as possible" and to do their best to keep global warming to "well below 2°C" above pre-industrial levels and pursue efforts to limit it to 1.5°C. Before and during the Paris conference countries submitted comprehensive national climate action plans to reduce their emissions (UNFCCC 2015).

In relation to 2020, the EU has signed up to the second commitment period of the Kyoto Protocol. Under the Effort Sharing Decision (ESD), Member States are required to limit their greenhouse gas emissions between 2013 and 2020 by meeting binding annual limits, which are set according to a linear path. The annual targets – known as annual emission allocations (AEAs) - follow a logical line between a defined starting point in 2013 and the target for 2020. The EU or national targets for the Alpine countries for the time period between 2013 and 2020 are listed in Table 2.1.1-1.

[17] Further information: http://climateactiontracker.org/countries/eu.html.

[18] Further information: http://ec.europa.eu/clima/policies/strategies/2030/index_en.htm.

Table 2.1.1-1 EU Climate and Energy Package Effort Sharing targets (2013-2020) as well as pledged targets under the UNFCCC (CH, LI) (Source: EC 2009a).

Alpine Countries	GHG emission reduction targets[19]
Austria	16% below 2005 level
France	14% below 2005 level
Germany	14% below 2005 level
Italy	13% below 2005 level
Liechtenstein	20% below 1990 level
Slovenia	4% above 2005 level
Switzerland	20 % (30 %) below 1990 level[20]

The EEA report on trends and projections towards climate and energy targets (EEA 2015l) shows the progress towards the ESD targets by 2020 with existing as well as with additional measures. According to this, all Alpine countries except Austria are expected to achieve their 2020 goals. Furthermore, between 2013 and 2020 a decrease of GHG emissions of EU-countries is expected. National projections of the Alpine countries show that ESD emissions will remain below the annual ESD targets. However, in Austria emissions could exceed the targets by 2020 if no additional measures are implemented.

In contrast to the ESD targets, the reduction target of 40% until 2030 envisaged by the above mentioned 2030 Framework for Climate and Energy is hardly to be achieved for all Alpine countries. Policy strategies and more strict plans are needed in some Alpine countries to achieve these ambitious goals.

<u>Alpine level</u>

At the Alpine level, the Alpine Convention´s Action Plan on Climate change approved by the Xth Conference of the Alpine Conference (PSAC 2011) considers tackling the two main strategies on the issue of climate change: mitigation and adaptation. It includes 7 mitigation and 24 adaptation objectives within 9 strategic areas such as spatial and land planning, energy (mainly heating energy), transport, tourism, forestry, preservation of biodiversity, water and water resources, mountain farming, as well as applied research and awareness raising. The main issue of the Action Plan is to go beyond the general framework by offering concrete measures on mitigation and adaptation strategies being subject of regional cooperations within the Alpine Convention area. It takes into account actions that are already in place on national, regional and local level.

Some further information on national specific GHG emission targets as well as their estimated way to achieve these goals can be found in the paragraph „Situation in Alpine countries".

[19] EU Climate and Energy Package Effort Sharing targets for 2013-2020 (AT, DE, FR, IT, SI) as well as. Pledged targets under the UNFCCC (CH, LI). The Effort Sharing Decision sets individual binding annual targets for GHG emissions not covered by the EU ETS (Emission Trading System) for all EU Member States for the period 2013-2020.

[20] According to the Doha Amendment: Switzerland would consider a higher reduction target up to 30 per cent by 2020 compared to 1990 levels subject to comparable emission reduction commitments from other developed countries and adequate contribution from developing countries according to their responsibilities and capabilities in line with the 2° C target." (Doha amendment to the Kyoto Protocol, 2015, UNFCCC, p.3, footnote 11) Further information can be found on the UNFCCC website http://unfccc.int/kyoto_protocol/doha_amendment/items/7362.php.

Alpine relevance of carbon emissions

Sectors contributing to GHG emissions in the Alps

The Alps are not only affected by climate change, but activities taking place by different sectors in the Alps are also contributing to global warming. According to facts researched by CIPRA as part of the cc.alps project, the Alps consume around 10% more energy per capita than the European average.

Alpine regions take part in the collective effort to reduce the impacts of the GHG-effect by searching for adapted solutions particularly in terms of the key sectors contributing to CO_2 emissions such as transport, energy and heating industry, construction, tourism and private households.

On the consumers' side, private households' heating account for the highest share of CO2 emissions. Climatic circumstances, in particular extreme weather conditions in wintertime have an important influence on emissions in the Alps.

Tourism and transport are further important contributors to GHG emissions in the Alps. Due to topographic features and limited accessibility of some regions in the Alps, high CO_2 emissions are caused by transport (especially by vans). Motorised road traffic (individual and freight transport) bears the main responsibility for CO_2 emissions caused by traffic (93%). Passenger cars are used for 84% of all holiday trips to the Alps. The first Report on the State of the Alps (PSAC 2007) shows that 84% of all tourists use the car to travel to their destinations. However, the transport-related "well to wheels"[21] CO_2 emissions show a higher growth than passenger transport by car (PSAC 2013).

Workshop on "Climate action and energy efficiency in hotel and restaurant industries in the Alpine region"

Tourism is a significant economic factor in the Alpine region. The use of efficient technology and construction methods can lower operating costs and increase the quality of tourism services on offer. Such measures enable small and medium-sized businesses to improve their competitive position. Many investments in energy efficiency pay off very quickly, but are not widely known.

A two-day international workshop on "Climate action and energy efficiency in hotel and restaurant industries in the Alpine region" was organised by the German Presidency of the Alpine Convention in April 2016. The goal of the workshop was to enable hotel and restaurant associations, tourism and climate experts and interested operators throughout the Alpine region to share experiences related to climate action and energy efficiency measures. Different measures are being implemented by means of various initiatives and networks in the Alpine countries already. One outcome of the workshop was the common need of a joint initiative of Alpine countries to promote climate action and energy efficiency measures in hotel and restaurant businesses.

Another result of the workshop contains the development of an internet app for hotel and restaurant operators that will be available in the four languages of the Alpine countries. The app will inform users about various initiatives for climate action and increasing energy efficiency and about available technologies and support programs. The initial tool was presented at the workshop and at the conference on sustainable Alpine tourism in June 2016 in Sonthofen, Germany.

Further information: https://alpine.adelphi.de/de

[21] "Well to wheel" is the specific life cycle assessment used for transport fuels and vehicles.

Import of energy from fossil fuels increases the carbon footprint of a country, while import of electricity does not directly affect the importer's CO_2 emissions – since they are already accounted for in the exporter's footprint (EUROSTAT 2015d). However, due to the global relevance of GHG emissions a more credible policy should consider the carbon footprint of locally consumed goods and services.

The energy sector quite certainly is one of the most promising areas to investigate its significant potential in terms of energy efficiency and use of local assets for RE production. In this line, the construction industry is a promising sector for achieving energy savings and GHG emissions' cuts in the Alps, where many old buildings need renovation. Energy efficient constructions and examples on refurbishment and retrofitting projects in the Alps are described in chapter 2.3.1.

It would seem sensible to invest in the implementation of energy efficiency measures and low carbon technologies particularly in the Alpine industries responsible for the higher shares of GHGs and to create appropriate policies for achieving cost-effective emissions' cuts across the region.

Climate protection and adaptation in the Alps

Accelerating carbon emissions indicate a mounting threat of climate change, with potentially severe human consequences deriving from economic facts such as a surge in commodities and food prices at the global level, in connection with an estimated increase of energy demand triggered by the recovery from the financial crisis. Among the causes of the environmental and economic crises, there are the concentration of capital in property and fossil fuels (which are responsible for climate change) coupled with relatively little investment in renewable energy, energy efficiency, public transportation, sustainable agriculture, ecosystem and biodiversity protection, and land and water conservation. The resulting depletion and degradation of natural capital brings about detrimental impacts on the well-being of present and future generations. A wide range of climate-induced risks affect food security, water availability, natural disasters, ecosystem stability, and human health (OECD 2008 & UNDP 2007) also in the Alps where primary industries such as winter tourism are at risk (OECD 2007). Addressing climate change with both mitigation and adaptation actions can bring economic benefits that may help to keep or increase the attained level of welfare across the society as well as spur long-term growth through innovation (UNEP 2011a).

Climate friendly innovation could be implemented in the Alps aiming at reducing CO_2 emissions, such as climate-friendly local and regional transport, energy efficient construction and refurbishment, sustainable food and energy production, regional cycles or climate-friendly tourism. Information on the status quo as well as suggestions on mitigation measures can be found in chapter 3.1.2.

Some economic sectors have been openly addressed as holding a great potential for climate change mitigation in the "Appeal to the participants of the UNFCCC COP21 in Paris" drafted by CIPRA International, Alliance in the Alps Network of Municipalities and the Alpine Town of the Year Association. This Appeal shows municipalities and other Alpine stakeholders' willingness to take responsibility for climate mitigation and apply their expertise and resources to this purpose, serving also as an example for other mountain regions worldwide. Among others, the following topics have been mentioned in the Appeal: local and regional transport, tourism (especially winter tourism), natural hazards (heat, avalanches, floods, mudslides, etc.) that should be embedded in urban development, climate friendly public procurement, energy-efficient construction and refurbishment, and sustainable food and energy production and consumption (CIPRA 2015).

In fact, early adaptation means lower costs to society and less residual damage. Economic assessments of the monetary benefits of adaptation vary across sectors and require a case-by-case approach. However, adaptation can provide immediate benefits in the sites where it is applied (which is not the case of mitigation) and that is also the reason why much adaptation is delivered autonomously by individual stakeholders operating in different sectors in response to market or environmental changes (PSAC 2015b). If adaptation measures are not properly taken, the costs of mitigation will be higher and the consequences of the climate change will be more serious, before it can be stabilized by the long-run effects of mitigation policies (Stern-Report 2007).

Technical and infrastructural adaptation measures are usually found in areas such as water and natural hazards management, and tourism, being all particularly affected by climate change in terms of water availability, frequency and quantity of snow during the winter season. Alternative options are often possible and a wide set of possibilities of hard and soft, behavioural measures exist, among which a preferred one has to be singled out. An economic assessment of these measures (cost-effectiveness) might help both public bodies and companies to identify suitable local adaptation options, cut adaptation costs (including planning, preparing for, facilitating, and implementing adaptation measures, and transition costs) and bring about substantial benefits, including economic ones (defined as: avoided damage costs or the accrued benefits following the adoption and implementation of adaptation measures). For instance accurate assessment of public expenditure on new ski facilities in resorts under threat of sharp reductions in snowfalls can help to avoid ineffective and non-profitable investment of public money (CIPRA 2011).

Adaptation affects most economic sectors, but it is also cross sectoral, due to the diversity of the affected sectors. For example, a shift from ski tourism supported by snowmaking facilities, to all-year tourism may affect other sectors (e.g. energy, water and biodiversity conservation) with different goals. Thus also negative effects in some sectors and for some stakeholders can derive from adaptation measures in one sector – that is a situation which can generate conflicts and resistance to adaptation.

A considerable amount of adaptation costs is likely to be covered with public funding, due to the sizeable social benefits of investment in adaptation. However, alternative funding sources may be derived from the private sector. Especially in a Green Economy framework, climate change may represent both a threat to economic activity as well as an opportunity for new businesses and investment.

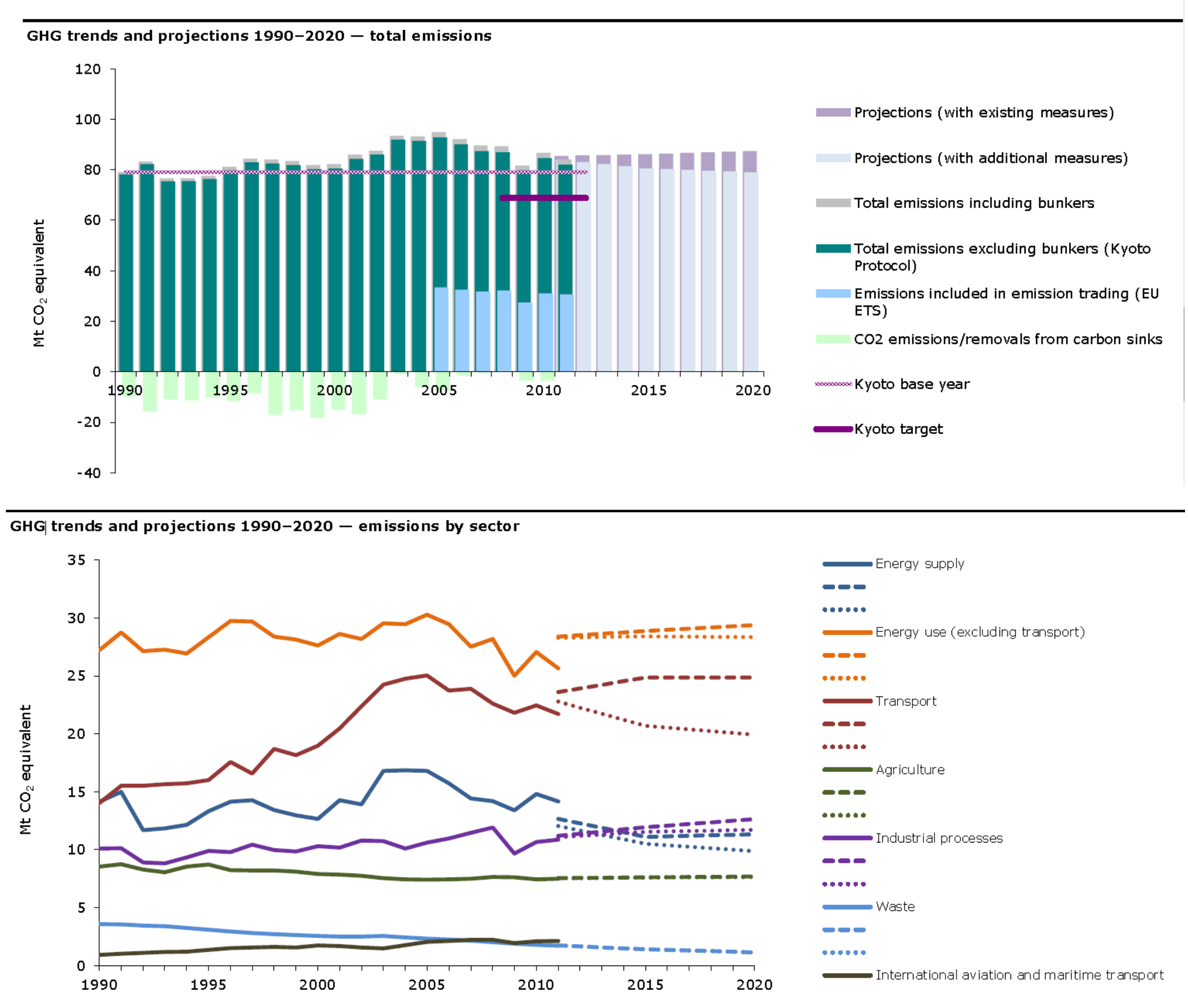
It has been observed how private companies take into account the risks on their assets and portfolios whose incidence is increased by climate change. At the same time, effective adaptive practices and innovative solutions help suppliers, stakeholders, and customers to adapt to a changing climate. Development and provision of adaptation technologies and approaches can also become an important driver of future business and growth, also for the SME sector. Adequate risk-sharing and insurance mechanisms and products could help companies and individuals to cover climate-induced risks and incentivise individual and behavioural adaptation (PSAC 2015b).

Situation in Alpine countries

In the following part, we will present 1) national specific targets concerning GHG emission reduction as well as 2) the main trends concerning emission reductions. The relevant policy background is listed in Annex (chapter 6.2.1). Depending on data availability, emission data of some Alpine countries refer to CO_2 (Austria, Switzerland, Italy) and some of them refer to GHG emission trends (Austria, France, Liechtenstein, Slovenia, Germany).

<u>Austria</u>

For reaching the Kyoto-Target (13% below 1990), Austria has formulated a National Climate Strategy (Klimastrategie 2002;BMLFUW 2002) that was adopted in 2007 (BMLFUW 2007). In 2011, the Climate Protection Law (KSG 2011; BGBl. 2011I Nr. 106/2011) came into effect and was amended in 2013 (BGBl. 2011I Nr. 94/2013). It defines maximum amounts of GHG emissions until 2020 for each sector. By 2020, Austria needs to reduce its emissions not covered by the EU ETS (EU Emissions Trading Scheme) by 16% compared to 2005 in accordance with the Effort Sharing Decision (ESD) (Decision No 406/2009/EC). Figure 2.1.1-3 shows that the average 2008–2011 emissions in Austria were 5.4 % higher than the base-year level (1990). This is significantly above the burden-sharing target (Kyoto target; UN 1998) of -13 % for the period 2008–2012.



Note: GHG emission projections are represent either through dashed lines (with existing measures) or dotted lines (additional measures).

Source: National GHG inventory report, 2012; national proxy estimate of 2011 GHG emissions; national GHG projection data submitted in 2011.

Figure 2.1.1-3 GHG trends and projections 1990–2020 — total emissions as well as emissions by sector in Austria (Source: EEA 2011a, p.2).

In the sectors not covered by the EU ETS, emissions were significantly higher than their respective target, by an amount equivalent to 20.9 % of base-year emissions. According to the EEA report on Austria´s energy and climate situation (EEA 2011a) land use, land-use change and forestry (LULUCF) activities are expected to decrease net emissions by an annual amount equivalent to 0.9 % of base-year level emissions.

Considering all these effects, average emissions in the sectors not covered by the EU ETS in Austria were standing below their target level by a gap representing 0.3 % of the base-year emissions. Austria was, therefore, on track towards its burden-sharing target by the end of 2011 (EEA 2011a).

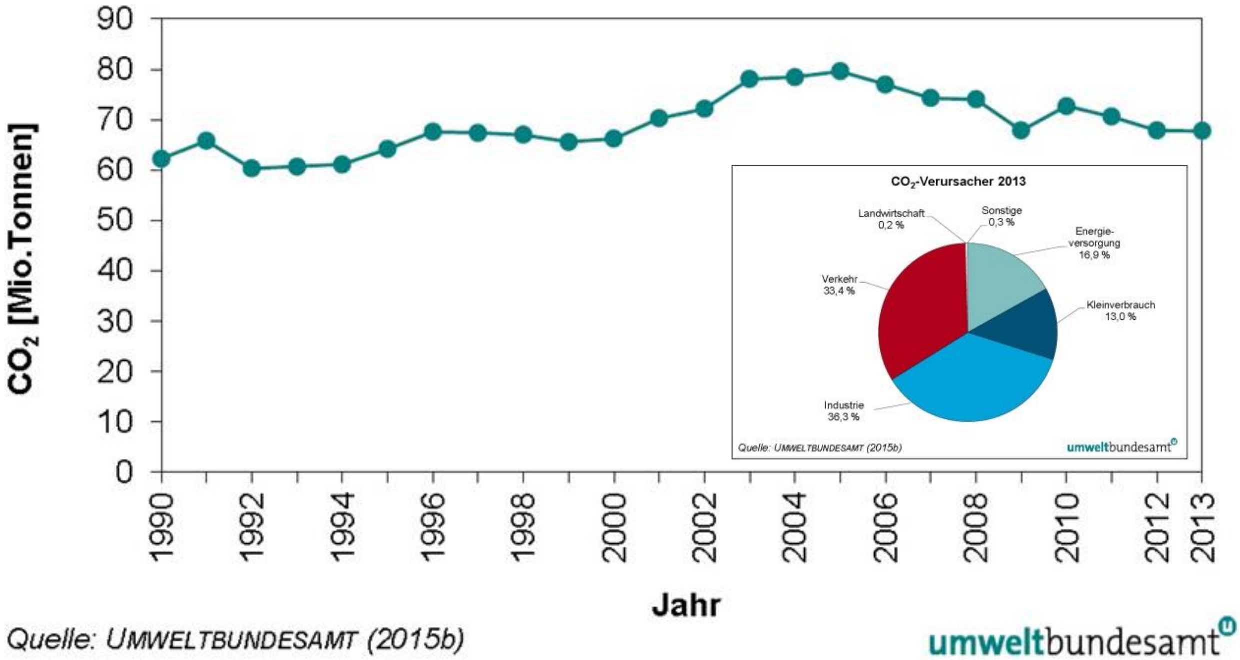


Figure 2.1.1-4 CO_2 emission trends (1990-2013) in Austria (Source: UBA Austria 2015a, p.57).

According to the statistical trends (see Figure 2.1.1-4) summarised by the Federal Environmental Agency of Austria (UBA Austria 2015a) in 2013, CO_2 emissions were 8.9 % above the 1990 level. In this last documented year (2013) 67,8 million tons of CO_2 have been emitted, that is 0.1% less than in the year before (2012). The share of CO_2 pollutants shows that emissions from industry (36.3%) and transportation (33.4%) cause the most emission, however, energy supply (16.9 %) as well as small .consumptions from households (13.0 %) are still relevant. Agriculture (0.2%) and other sectors like waste combustion (0.3 %) produce CO_2 only marginally (UBA Austria 2015a).

Considering all these information, the 2020 GHG emission target seems to be very ambitious for Austria and with the existing measures this target is not going to be achieved. Thus, more ambitious mitigation strategies are needed.

France

Among the large industrialised nations, France has the lowest carbon dioxide production per unit of GDP in the world. This is primarily because 75% of its electricity is produced by nuclear power. France is also the largest exporter of electricity in the world, with net electricity exports of €3 billion (Privacy Policy 2015).

France, with its Energy Transition Act for Green Growth, has committed to reduce its greenhouse gas emissions by 40% between 1990 and 2030. The EU Climate and Energy Package Effort Sharing target for 2013-2020 aims at 14% below 2005 level.

France's greenhouse gas emissions per person are already among the lowest in the developed world, but more needs to be done to achieve the reduction targets. The act introduces tools designed to promote a low-carbon economy, namely 'carbon budgets' and the National Low-Carbon Strategy (SNBC), in order to achieve these new goals. These have been set for the 2015-2018, 2019-2023 and 2024-2028 periods. More information on SNBC targets are listed in Annex (chapter 6.2.1).

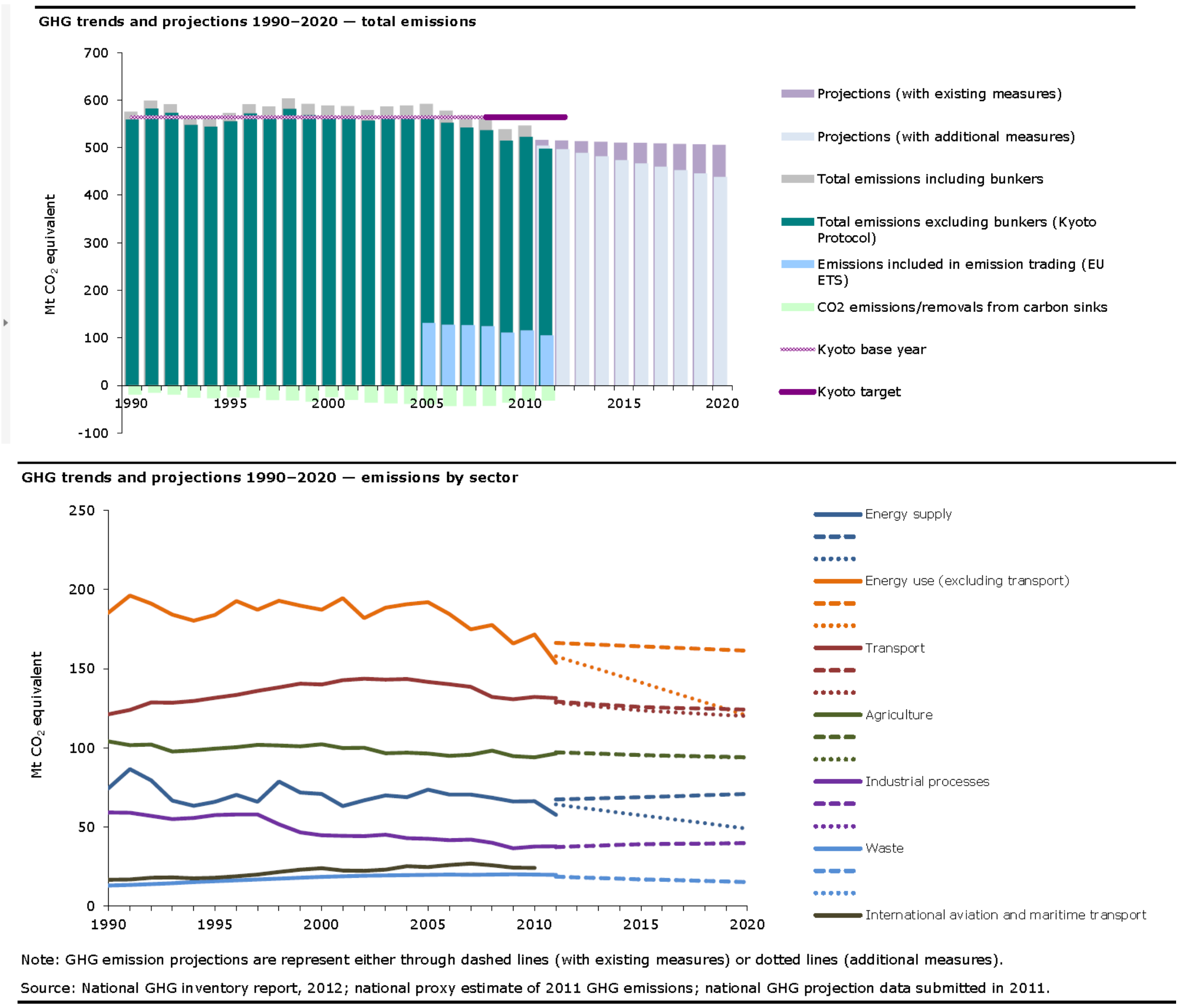


Figure 2.1.1-5 GHG trends and projections 1990-2020 total emissions as well as emissions by sectors in France (Source:EEA 2011b, p.2).

According to the EEA report (2011b) the average 2008–2011 emissions in France were 8.2 % lower than the base-year level, well below the burden-sharing target of 0 % for the period 2008–2012. In the sectors not covered by the EU ETS, emissions were lower than their respective target, by an amount equivalent to 4.2 % of base-year emissions. LULUCF activities are expected to decrease net emissions by an annual amount equivalent to 0.6 % of base-year level emissions.

Considering all these effects, average emissions in the sectors not covered by the EU ETS in France were standing below their target level, representing 4.6 % of the base-year emissions. France was, therefore, on track towards its burden-sharing target by the end of 2011. This means that with the existing measures, France is going to achieve its 2020 target.

Germany

Germany´s GHG emission reduction targets set by the German Energiewende[22] are summarised in

Table 2.1.1-2.

[22] Further information: http://www.bmwi.de/DE/Themen/Energie/energiewende.html.

Table 2.1.1-2 Quantitative targets of the German Energiewende and Status quo in 2014 (Source:BMWi 2015).

GHG emission reductions compared to the base year 1990					
	2014 (Achieved)	2020	2030	2040	2050
Target	-27 %	-40 %	-55 %	-70 %	-80 - -95 %

Until 2014, a reduction of 27% (346 million tonnes CO_2 eq.) CO_2 emissions was achieved, compared to 1990 levels. By 2008, Germany had more than fulfilled its greenhouse gas reduction targets under the Kyoto Protocol. However, the Federal Environment Agency (UBA) who collects Germany's official emissions data, estimated in March 2016 that emissions increased again by 6 million tonnes or 0.7% in 2015, to 908 million tonnes.

Between 1990 and 2015, CO_2 reductions were achieved in most major sources of emissions (Figure 2.1.1-6). In the energy industry sector, which is responsible for the largest share of Germany's greenhouse gas productions (around 40 %) emissions fell by 24 % between 1990 and 2014. Even bigger reductions were achieved by households (32.9 %) and industry (33.8 %), while the transport sector only reduced its emissions by 0.2 % (UBA Germany 2016).

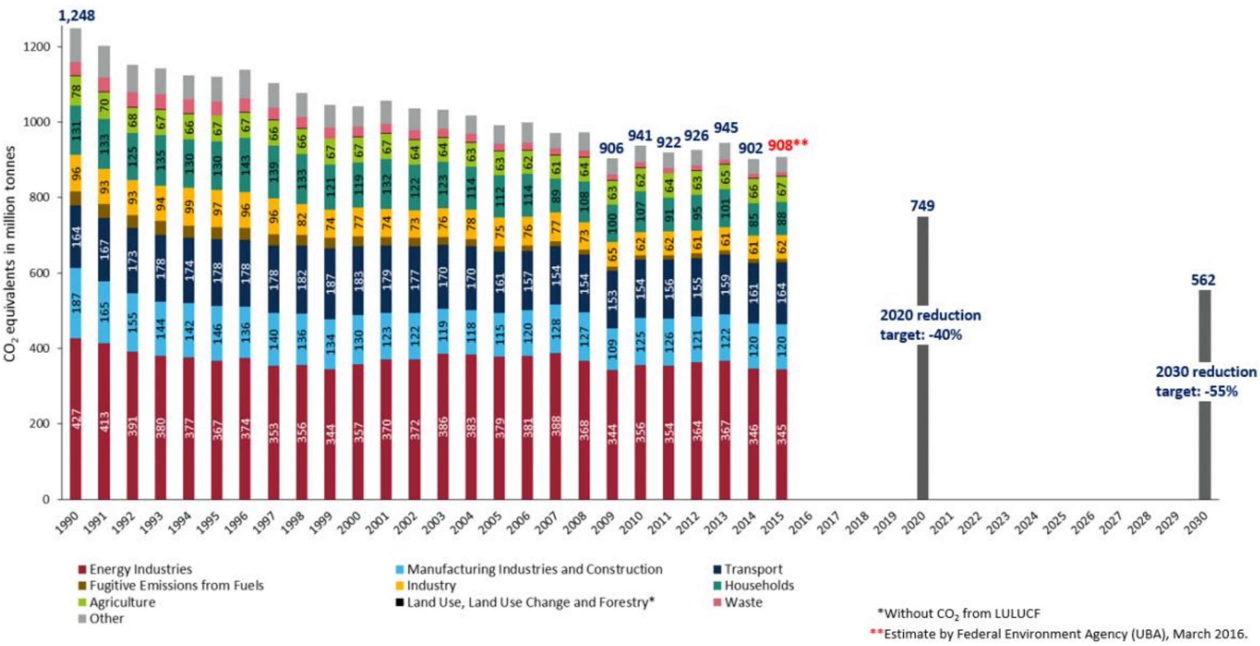


Figure 2.1.1-6 GHG emissions in Germany from 1990-2015 by sources and emission reduction targets to 2020 and 2030 (Source: UBA Germany 2016).

Two consecutive rises in emissions in 2012 and 2013 left Germany with the challenge of curbing emissions by another 20 % over the next six years – or an average of 3.3 - 3.6 % annually. Experts interpreted a drop in emissions in 2014 as a sign that the country was back on track, but critics pointed out that a significant part of 2014 CO_2 saving can be attributed to warm winter weather, so that it only amounts to a 1.7 instead of a 4.3 % drop (BMWi 2015).

Italy

Italy imports 86.4% of the consumed energy from abroad. The residential and public sector account for 36.3% of energy demand, the transportation sector for 32.5% and industry for 23.4%. Total net production at the country level (269,147,9 GWh) is covered by traditional thermoelectric power plants (62%), hydropower (21%) and other sources. Notoriously, nuclear energy is not produced in Italy.

Italy ratified the Kyoto Protocol in 2002 with a commitment to reduce greenhouse gas emissions by 6.5% below base-year (1990) levels from 2008 to 2012. In the framework of the Effort Sharing Decision, its goal was to reduce non-ETS sector GHG emissions by 13 % from the 2005 level by 2020. Italy´s national GHG-Inventory System is managed by Istituto Superiore per la Protezione e la Ricerca Ambientale - Institute for Environmental Protection and Research (ISPRA). It´s guidelines about national policies and measures for reducing emissions are described in the National Action Plan (2003-2010) (PSAC 2011).

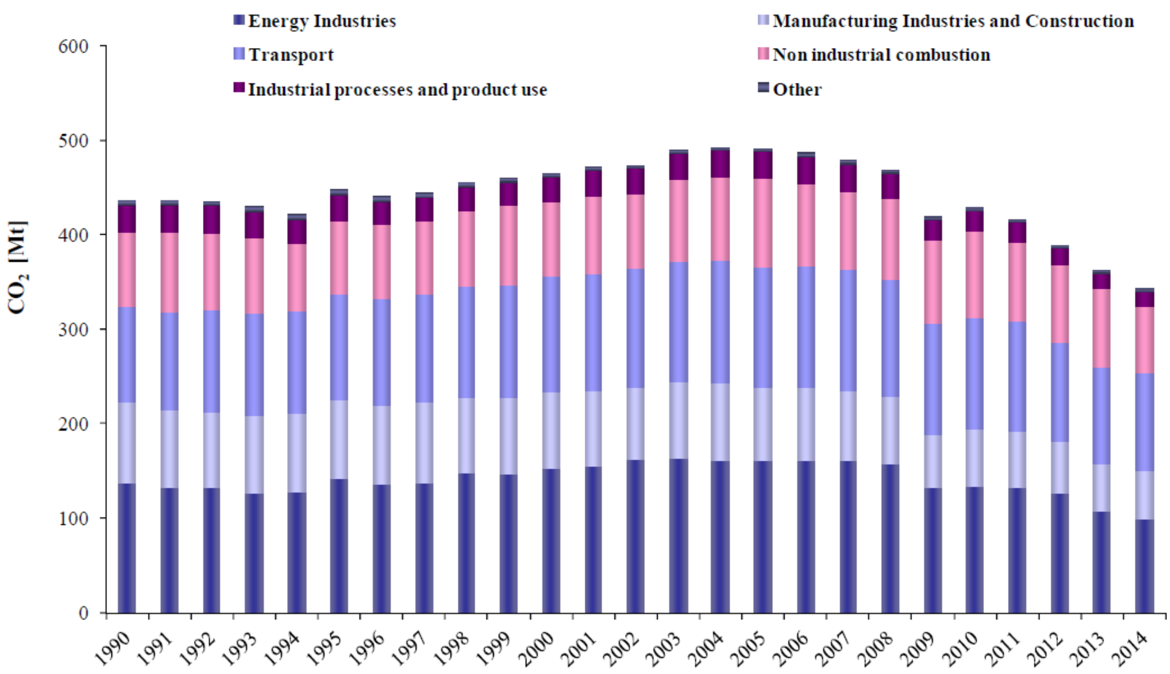


Figure 2.1.1-7 Italian national CO_2 emissions in Italy on the national level by sector from 1990 to 2014 (Mt) (Source: ISPRA 2016, p.51).

In Italy, CO_2 emissions excluding land use, land-use change and forestry have decreased by 27.24% from 1990 to 2014, ranging from 436.2 to 342.8 million tons. The most relevant emissions derive from transportation (30.25%) and energy industry (28.94%). Other sectors (20.34%), manufacturing and construction (14.81%) and industrial processes (4.57%) basically make up the remaining quota of CO_2 emissions. Looking more in depth at the main contributing sectors (see Figure 2.1.1-7), it is worth noticing that over the 1990-2014 period the energy industry's share has been decreasing by 39.22%, manufacturing and construction by 66.44%, industrial processes' by 86.63%. Only the transportation sector has seen a small increase of 2.31% (ISPRA 2016).

The majority of the Italian Alpine regions showed a trend to GHG-reduction compared to the base year 1990. Valle d'Aosta and Liguria have halved emissions, Veneto has reduced to less than a third, and Piemonte and Trentino-Alto Adige of more than a quarter (ISTAT & noi italia 2015).

Some figures for the regional level are available for 2010 where trend in tons of CO_2 per capita are shown (cf. Table 2.1.1-3). At that time, the Eastern Alpine regions showed an average value of 8.1 tons, the Western ones of 8.6: both of them being higher than the national average (7.4).

The Italian administrative units in the Alpine region emit slightly more than the rest of the territory, however, the areas that can be qualified as completely mountainous seem to perform relatively better. The achieved reduction by the Alpine regions in CO_2 emissions over the 1990-2010 period is around 19% (more than the national average of 12.3%), with the best performances in Valle d'Aosta (-49.9%), Liguria (-46.5%) and Veneto (-32.4%).

Table 2.1.1-3 CO_2 emissions per capita in Italian Provinces 2010 (ISTAT 2015).

Provinces	CO_2 tons/capita
Friuli Venezia-Giulia	10.6
Liguria	9.1
Lombardia	8.4
Autonomous Provinces Trentino, Alto-Adige-Trento, Bolzano	5.5
Valle d'Aosta	4.9

CO_2 emissions in the 1990s essentially mirrored energy consumption. A decoupling between the curves is observed only in recent years, mainly because of the substitution of fuels with high carbon contents by methane gas in the production of electric energy and in industry; in the last years, the increase in the use of renewable sources has led to a notable reduction of CO_2 emissions.

Liechtenstein

In the framework of the second commitment period of the Kyoto Protocol, Liechtenstein has introduced a legally binding emission reduction target of at least 20% compared to 1990 until 2020. Due to the 2 degree goal as well as the doubling of its climate goals, Liechtenstein is ready to reduce its emissions by 40 % until 2030 (140 kt CO_2). For 2035, it aims at 3.7 t CO_2 per inhabitant and year, for 2050 at 1.7 t/cap/a. The nationwide emissions of 2012 show an equivalent level with 1990 (225,000 tons CO_2 equ) despite significant economic and population growth (+25 %) (Franke 2015).

According to the GHG-Inventory (2013) in 2011, Liechtenstein emitted 222.0 Gg (kilotonnes) CO_2 equivalent, or 6.1 tonnes CO_2 equivalent per capita (CO_2 only: 5.1 tonnes per capita) into the atmosphere excluding emissions and removals from land use, land-use change and forestry (LULUCF). At the beginning of the Kyoto compliance period in 2006, per capita emissions were as high as 8 tonnes per capita and since then continuously declined by 23%. The largest contributor gas is CO_2, and the most important sources of emissions are fuel combustion activities in the energy sector (see Figure 2.1.1-8).

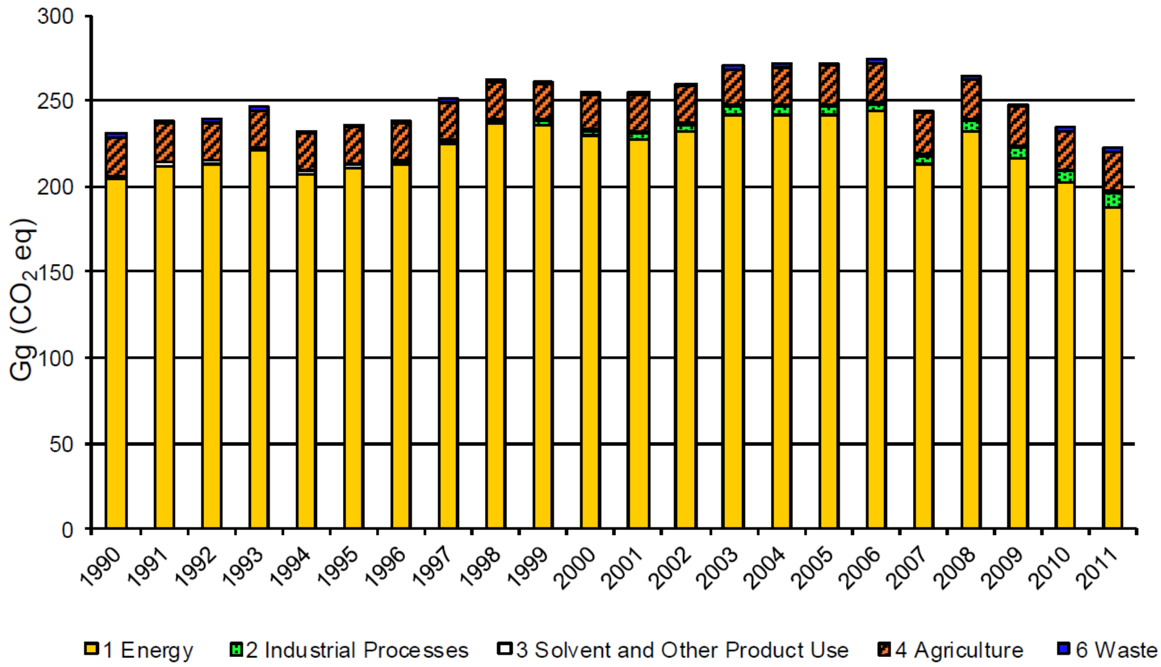


Figure 2.1.1-8 Trend of Liechtenstein's greenhouse gas emissions by main source categories in CO_2 equivalent (Gg), 1990–2011 (excl. net CO_2 from LULUCF) (Source: Office of the Environment 2013, p.56).

Slovenia

Slovenias objective under the Energy and Climate Package of the EU is that greenhouse gas emissions should not increase by more than 4% until 2020 compared to 2005 (refers to emissions sources not included in the EU-ETS scheme, i.e. emissions from sources under Decision 406/2009/EC.

In 2013, the first year of legally binding targets under ESD, emissions were lower than the annual target by as much as 12.6%. First estimates indicate that the trend continued in 2014, emissions have decreased again, the annual target was even exceeded by 13.8%; the first indication of emissions in 2015 shows a reduction in emissions as well. In 2012, the highest contributor wasthe transport sector (51%). Furthermore, GHG emission derives from agricultural soil (6 %), enteric fermentation (6 %), industry and construction (5 %), manure management (5%), solid waste disposal (3%), fugitive emission (3%) as well as from fuel combustion from other sectors (15 %).

The most recent projections demonstrate that the binding national targets under ESD will be achieved and even exceeded throughout the period 2013-2020. The greatest uncertainties in the projection are related to the transport sector. A sensitivity analysis of the impact of transit traffic in projections was made that compared scenarios of the implementation of measures of the transport sector. The range between the highest and lowest projections of GHG emissions in transport amounted to 37%. The worst example analysed shows a stagnation of total GHG emissions in ESD sectors in the period 2012-2020, which is still sufficient to achieve the national targets for 2020 (see Figure 2.1.1-9).

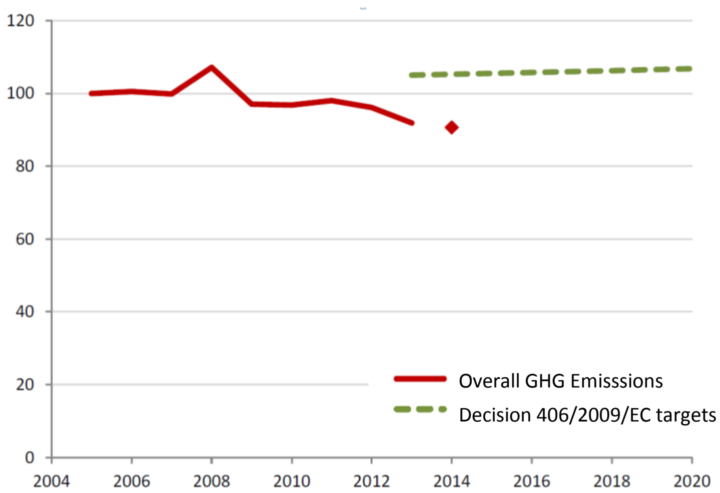


Figure 2.1.1-9 Changes in ESD (Effort Sharing Decision) sectors emissions in the period 2005-2014 compared with developments in emission target trajectory during the period 2013-2020 calculated on emissions in 2005 (2005=100) (Source: MOP 2016).

Regarding GHG emissions in Slovenia Figure 2.1.1-10 shows the last trends from 2000 – 2013. According to the Development Report of the IMAD (2015) total GHG emissions amounted to 18,112 kt of CO_2 equivalent in 2013, which was approximately 4% less than in the preceding year. The trend shows that after declining in 2008 and remaining roughly unchanged for three years, total greenhouse gas emissions fell again in 2013 for the second consecutive year (IMAD 2015).

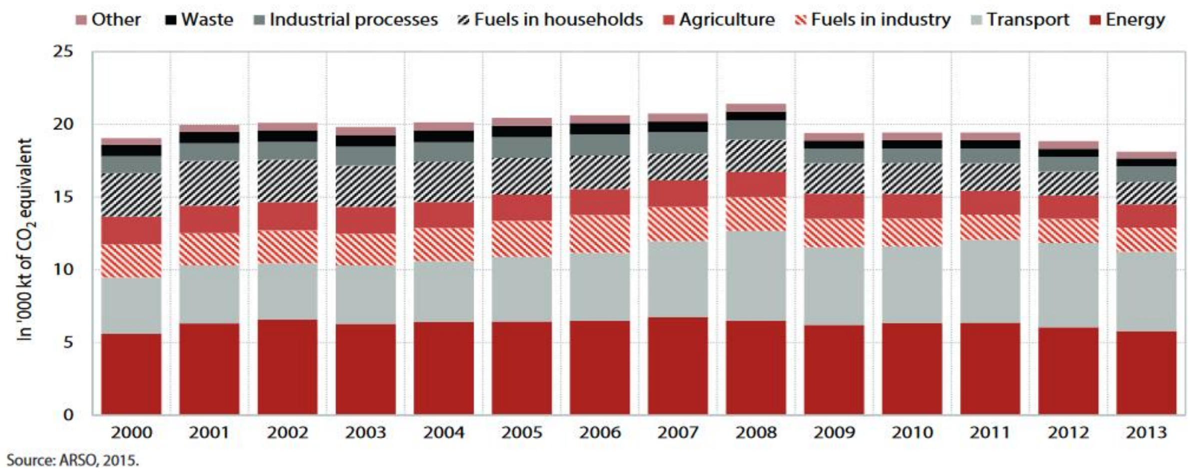


Figure 2.1.1-10 GHG emissions by sectors in Slovenia (Source: IMAD 2015).

Switzerland

By signing the Kyoto Protocol, Switzerland committed itself to reducing its greenhouse gas emissions during the period 2008-2012 to 8% below the level in 1990. In order to achieve the Kyoto target, the Swiss government has accepted a specific CO_2 Act in 1999. Since 2013, a revised CO_2 Act is in force. It foresees that Switzerland reduces its greenhouse gas emissions by 2020 at least by 20% compared to the level in 1990[23]. For the UN climate conference in Paris (COP21), Switzerland has provided its goals concerning GHG emissions until 2030: it wants to achieve a 50% decrease of GHG emissions compared to the value of 1990[24].

[23] Further information: http://www.bfs.admin.ch/bfs/portal/de/index/themen/21/02/ind32.indicator.72205.3211.html.

[24] Further information: https://www.news.admin.ch/message/index.html?lang=en&msg-id=56394.

In Switzerland CO_2 emissions vary from year to year, mainly due to specific winter weather conditions. In 2012, 43.24 million tons of CO_2 were produced (see Figure 2.1.1-11). Compared to the reference year 1990, emissions did not decrease significantly. This means that in Switzerland further efforts are needed to achieve the targets.

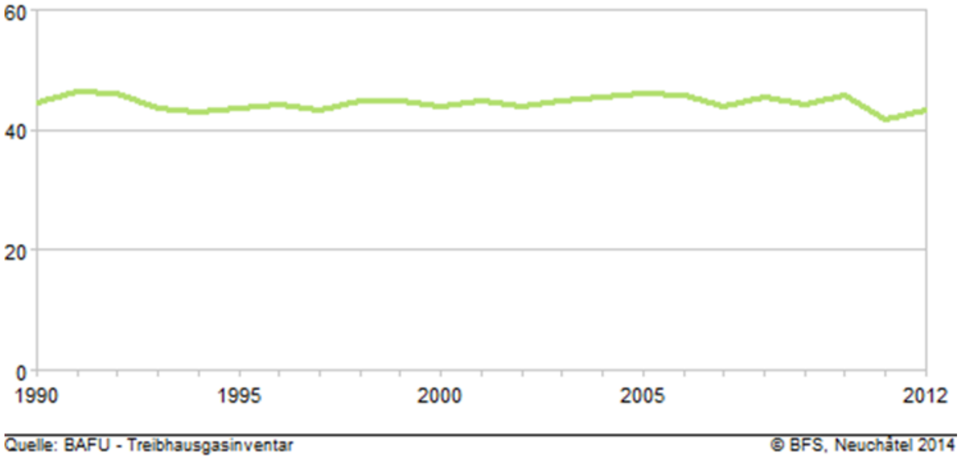


Figure 2.1.1-11 National CO_2 emissions of Switzerland according to the Greenhouse Gas Inventory (million tons, 1990-2012) (Source: Schweizerische Eidgenossenschaft 2014).

In 2013, around 31% of GHG emissions in Switzerland were caused by transport. Transport is the biggest contributor, followed by the industry sector (21%) and households (20%). With 7%, waste emissions have the smallest percentage (see

Figure 2.1.1-12).

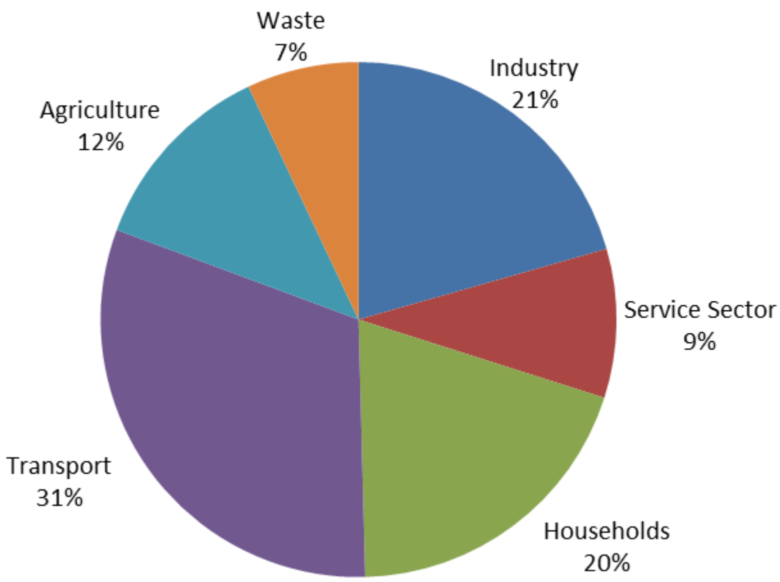


Figure 2.1.1-12 GHG emissions by different polluter sectors (CO2 equiv.) in 2013 in Switzerland (Source: BAFU 2015).

Several good practices show the motivation for reducing carbon emissions in the entire Alpine area. Some of them are presented here:

Good practice – klimaaktiv mobil, Austria

The initiative of the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) – has relevant impacts on climate protection, environment and health, providing an essential impetus for the economy and for securing jobs and is also an important contribution to support the local development in rural areas and Alpine regions.

The cornerstones of klimaaktiv mobil´s portfolio until 2020 are consulting, financial support, education & certification, information & awareness raising as well as awarding of partners committed to CO_2 reduction projects. The program supports businesses, fleet operators and real estate developers, cities, municipalities and regions, actors in tourism, as well as schools and youth initiatives, in developing and implementing mobility projects for reducing carbon dioxide emissions.

The klimaaktiv mobil investment funding program for alternative vehicles and electro mobility, the expansion of the infrastructure for cycling as well as the promotion of mobility management are important contributions to meeting the requirements of the Austrian Climate Protection Act and the Federal Act on Energy Efficiency, and also create important stimuli for the economy. Therefore, klimaaktiv mobil also contributes to job security and to the creation of green jobs. At the same time, new opportunities for industries and businesses, cities and communities emerge.

klimaaktiv mobil achievements 2007-2015:

- *6,600 climate-friendly mobility projects were implemented by 5,000 businesses, 700 towns, municipalities and regions, 650 providers of tourist services and 250 schools*
- *These projects are achieving an annual reduction of 610,000 tons of CO_2 emissions*
- *€ 79.6 million of public funding spent for these environmentally friendly mobility projects led to a total investment volume of more than € 500 million*
- *Approximately 6,000 so-called green jobs have been secured or created*

Further Information: www.klimaaktivmobil.at

Good practice - "100% from the region for the region – sustainable energy supply in Achental", Germany

The main issue of this project was to create a model of sustainable energy supply and utilisation in the whole of the Achental through creation of regional cycles, targeted sourcing, processing and supply of all bio-energy resources in the region, optimised logistics and processing, while minimising resulting CO_2 emissions, efficiently utilising resources through combined heat and power and small-scale district heating networks and reducing demand through savings in heat and power consumption. Through this project, the self-sufficiency in terms of energy supply by 2020 is strived to be reached, with annual savings of 128,000 tons of CO_2 (reference year 2006).

Further Information: http://www.oekomodell.de/

CO_2 reduction capacity of the Alps and mitigation opportunities

The CO_2 reduction capacity of a region provides information on the overall ability of reducing GHG-emissions to hinder or to mitigate climate change effects including different aspects such as know-how, technology and infrastructure including the potential for photovoltaic and wind energy (BBSR 2012).

The Alpine area's CO_2 reduction capacity lies in the potential for installing renewable energy power plants and the carbon sinks of Alpine forests (cf. box on carbon sequestration). The use of renewable energy sources is described in chapter 2.1.2.

Figure 2.1.1-13 shows CO_2 reduction capacity (RK) vs. CO_2 emissions (CO_2) on a regional level calculated by the ESPON climate project (BBSR 2012). The calculation of this is based on different other indicators such as:

- Knowledge and awareness: education expenditures per inhabitant;
- Technology: % expenditures on research and development;
- Infrastructure: photovoltaic and wind energy potential, forests as carbon sinks;
- Institutions: government effectiveness according to the World Bank, number of questions, suggestions and measures on climate change;
- Economic resources: per capita income.

According to this map, the Alpine area shows a heterogeneous picture with

1) high exploitation of reduction capacity and compared to this low CO_2 emissions (AT: West and Middle part of Tyrol, DE: Garmisch-Partenkirchen, Bad-Tölz, Wolfratshausen, Miesbach, SI: Goriska, Gorenjska) as well as

2) high reduction capacity but still high CO_2 emissions (AT: Tyrolean uplands, Upper Austria, IT: Trentino, SI: Osrednjeslovenska).

The more challenging areas (with beige and red colour) are those where CO_2 despite RK is still high.

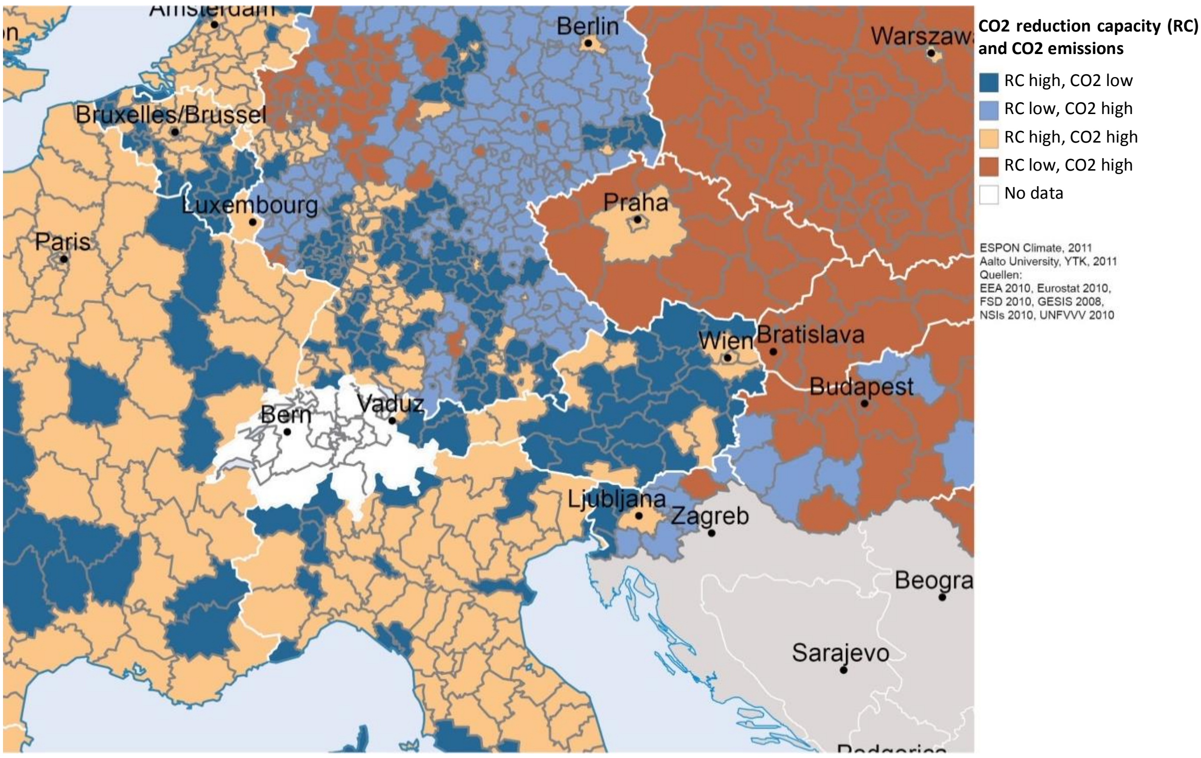


Figure 2.1.1-13 CO_2 reduction capacity (RC) vs. CO_2 emissions of the Alpine countries

(Source: BBSR 2012, p.15).

Different pictures can be drawn on CO_2 reduction capacity of the Alpine countries. Liechtenstein has significant reduction capacities in the buildings sector as well as in the transport sector. With its energy transition (Energiewende), Germany is shifting to a power system based on renewable energies while phasing out nuclear power at the same time. Moreover, there are several reduction capacities within the transport sector (BMWi & IKA 2012). Considering for example its RE potential and good conditions for low carbon and energy efficient technologies, Austria has very good conditions for CO_2 reduction. According to recent research analyses (e.g. Ajanovic & Haas 2014), the CO_2-reduction capacity in Austria is 7 million ton CO_2 equ. by 2050. The potential amount for each sector has been summarised in the report on GHG projections and assessment of policies and measures in Austria by the Federal Ministry (UBA Austria 2013).

Carbon sequestration potential of Alpine forests

Alpine forests stock big amounts of carbon, removing CO_2 from the atmosphere and transforming it into organic matter (mostly wood, which basically consists of carbon). Considering only the carbon in the above ground mass (without roots, litter and soil that represent the most part of it), the total amount is remarkable: 600 million t (i.e. 2,200 t CO_2). Annual sequestration is also very relevant: 50 million t wood growth corresponding to 55 million t CO_2: 42% of it is stocked in the growth of forest stands (representing an accountable sequestration within the Kyoto agreement); the rest (non-accountable sequestration) is felled and used mostly in the building and furniture sectors (thus continuing sequestration for the time staying in the stock) and in part as firewood (returned to atmosphere but replacing fossil fuels). A 'cascade use' of wood (i.e. the use of raw material primarily in long-life products, while bioenergy should be produced preferably using industrial wood waste and end of life-products) extends the carbon sequestration (Working Group Mountain Forests of the Alpine Convention 2016).

Conclusions on opportunities and challenges

Status conclusions:

To sum up the results above, it can be concluded that:

The progress to achieve the climate goals of the Paris agreement as well as the 2020 EU targets shows a heterogeneous picture among the Alpine countries:

- The Paris Agreement with its goal to keep the increase in global average temperature to "well below" 2°C above pre-industrial levels and pursue efforts to limit it to 1.5°C sets ambitious targets for the Alpine countries. Strong political efforts are needed to achieve the 2°C and especially the 1.5°C target.
- EU 2020 climate and energy targets: According to the progress reports on GHG emissions at the national level, with existing measures most of the Alpine countries are on track to achieve their 20 % GHG reduction goals (in comparison with 1990 level) until 2020. However, the binding reduction target of 40% until 2030 seems to be a significant challenge for all Alpine countries. Therefore, further efforts and actions in the field of mitigation as well as adaptation should be considered.

There is a high need for mitigation as the Alpine countries have decreasing but still high CO_2 emissions:

- Due to natural as well as anthropogenic circumstances (e.g. CO_2 emissions in transport sector due to the topography; heating of households in wintertime), there is a responsibility of the Alpine area for climate protection.

- The national trends on GHG emissions show that efforts in GHG reduction are not sufficient in all Alpine countries.
- The continous use of fossil fuels without taking into account externalities in the Alpine region hinders innovation in the energy sector and makes the Alpine area economically and environmentally vulnerable. There is a need for an absolute decoupling of economy from fossil fuels.

However, adaptation in the Alpine region is especially relevant for specific effects of climate change:

- There is a need for adaptation due the economic and ecological vulnerability of the Alps.
- Adaptation to natural hazards, adaptation to changing water discharge (e.g. due to the fact that water is not going to be stored in snow and glaciers), and different production patterns for agriculture (e.g. due to changing harvest yields) are relevant.

The adaptation and mitigation strategies have to address primarily the main sectors contributing to GHG emissions:

- In the Alps, the main sectors contributing to CO_2 emissions derive from the fossil fuel combustion in transport, energy and heat industry, household heating, construction and tourism. These sectors play a key role in establishing a low carbon economy within the Alpine region. Efforts in reducing carbon emissions from the combustion of fossil fuels should not be thwarted by increased economic activities.

<u>Opportunities</u>

- The Alpine region has multiple capacity for CO_2 reduction based on the potential for installing renewable energy power plants, the increase of energy efficiency by applying innovative technologies and CO_2 sequestration in Alpine forests.
- Increasing the use of renewable energies and local energy sources and reducing the dependency on fossil fuels of the Alpine area can be a triggering factor for an innovation towards a low carbon economy that can and will also bring benefits to the Alpine economy, environment and society.
- To support the initiatives by local, regional and non-state actors (e.g. municipalities, regional governments and businesses) to reduce greenhouse gases taking note of the significant potential of their efforts to achieve regional climate targets.

<u>Challenges</u>

- Among the biggest challenges towards low carbon economy are the urgently needed schedule for adaptation as well as the short remaining time for policy action.
- A further challenge will lie in accelerating the implementation of measures as well as in transferring innovative approaches of pilot regions to the whole Alpine area.

2.1.2 Renewable energy sources

Fossil energy resources are limited and the trust in the safety of nuclear power is decreasing in many societies. Prices for energy are variable and, in case of fossil fuels, are likely to increase in the future. In the Alpine area, limited access to energy can expand existing territorial discrepancies. The rich endogenous renewable energy sources (RES) such as hydropower, solar and wind energy, wood and other biomass can offer an opportunity to solve this problem (AlpEnergy 2013), but such power plants have to be planned in accordance with nature conservation and sustainable land use.

Background about renewable energy sources

Energy sources that do not rely on finite resources are defined as renewable energy (RE) sources. The most widely used RE that will be looked at in this report are hydroelectric power, biomass energy, solar energy, wind energy and geothermal energy. RE often displaces conventional fuels in four important areas: electricity generation, hot water/space heating, transportation and rural (off grid) energy. Stated policy goals comprise CO_2 reduction to be reached particularly by increasing energy efficiency and the use of RE sources.

European level

According to the EU objectives defined in the Directive on Renewable Energies (2009/28/EC), the share of RE has to increase to 20% until 2020 in order to reduce GHG emissions while also enhancing energy security and providing opportunities for economic development. The RE Directive recognizes the necessity to adapt the 20% target for individual Member States depending on each state's starting point and potential. To achieve this target, the EU Member States have submitted their National Renewable Energy Action Plans (NREAP).

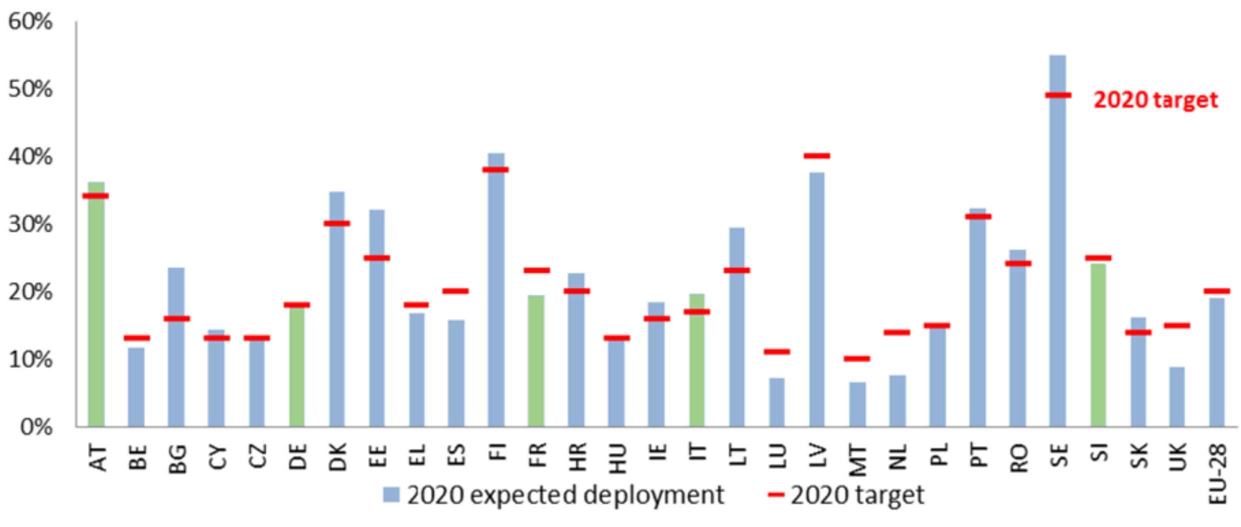


Figure 2.1.2-1 Expected RES development in Member States and 2020 RE targets in %, countries belonging to the Alpine Convention are marked with green colour (Source: EEA 2015h, p.5. Note: Modelling is based on policy measures implemented only until 2013).

Figure 2.1.2-1 projects trajectories with current and planned policies until 2013, that have been described in the NREAPs - as well as the set RE targets until 2020. The target for the share of energy from RE sources in gross final energy consumtion until 2020 is set to 34% in Austria, 23% in France, 18% in Germany, 17% in Italy, and 25 % in Slovenia (Annex I of Directive 2009/28/EC). The goal in Switzerland is to increase the proportion of electricity produced from RE by at least 5400 GWh. In Liechtenstein precise goals until 2020 are missing.

From the projections in Figure 2.1.2-1, it can be concluded that France is not likely to achieve its target. In Slovenia, there is also small gap between the national target and the projected RE value. Germany will reach its goals, Austria and Italy may exceed their RE targets (EEA 2015l).

At the EU level, there are three energy market sectors where renewable energy sources compete with conventional sources: electricity (RES-E), heating and cooling (RE-H/C) and energy used in transport (RES-T). According to the EEA (2015g) in 2013, RES H/C contributed the most towards the gross final consumption of all RE sources (50 %), followed by the RE-E (42 %) and RE-T (8%).

In the transport sector, the target for 2020 is to achieve 10 % share of RE, which is expected to come from biofuels. However, the progress in the last five years (2010-2015) within the transport sector towards this target has been very slow (EEA 2015h).

Alpine level

The Energy Protocol of the Alpine Convention (AC 2005) area aims at a long-term contribution of the Alpine region to Europe's energy needs. Furthermore, it expresses a commitment to increase the use of RE sources in the Alpine region (Svadlenak-Gomez et al. 2013). The Contracting Parties of the Alpine Convention pledge, inter alia, to harmonize their energy planning with spatial planning in the Alps (Article 2 (1a)), to implement measures to reduce energy consumption (Article 1, Article 2 (1c)) as well as to promote environmental friendly deployment of renewable energies (Article 6 Energy Protocol).

Furthermore, the Alpine Convention´s Platform Water Management drafted guidelines for the use of small hydropower. Figure 2.1.2-2 illustrates the shares of RE sources in total energy production per Alpine country in 2011. The biggest share of energy production from RE lies in biomass incl. waste as well as hydropower (Swiss Confederation et al. 2015). It should be noted that since 2011 the composition of renewable energy sources in the Alpine countries has shifted in favour of wind power and solar energy.

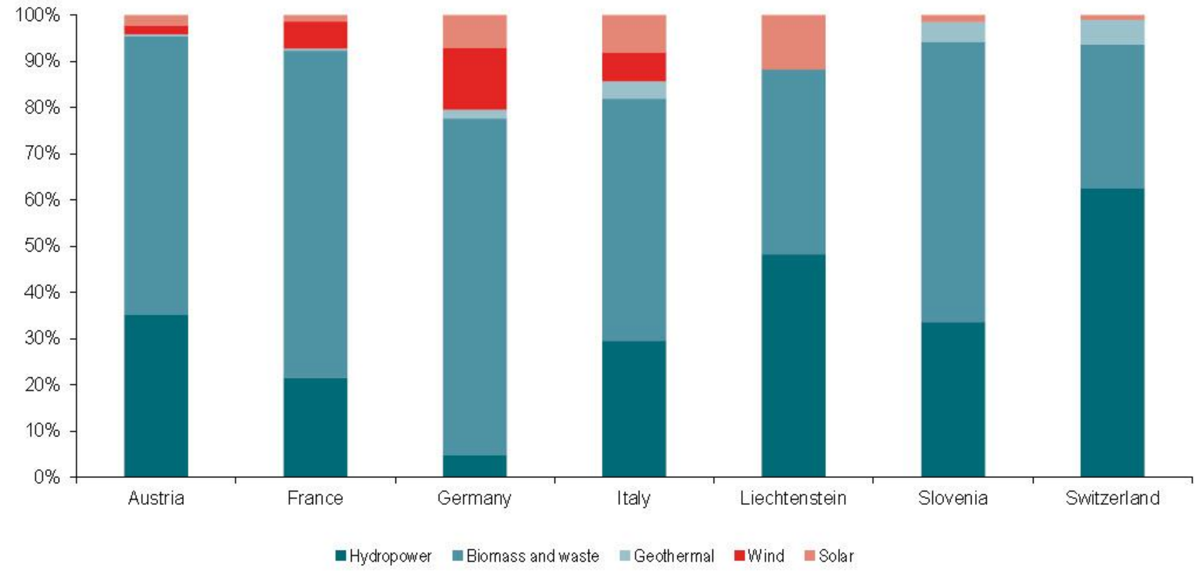


Figure 2.1.2-2 Share of hydropower, biomass incl. renewable waste, geothermal, wind and solar energy in RE production for each Alpine country in 2011 (Source: Swiss Confederation et al. 2015).

Figure 2.1.2-3 shows the projected future development of the share of RE in final energy demand of the Alpine countries for 2020, 2030 and 2050.

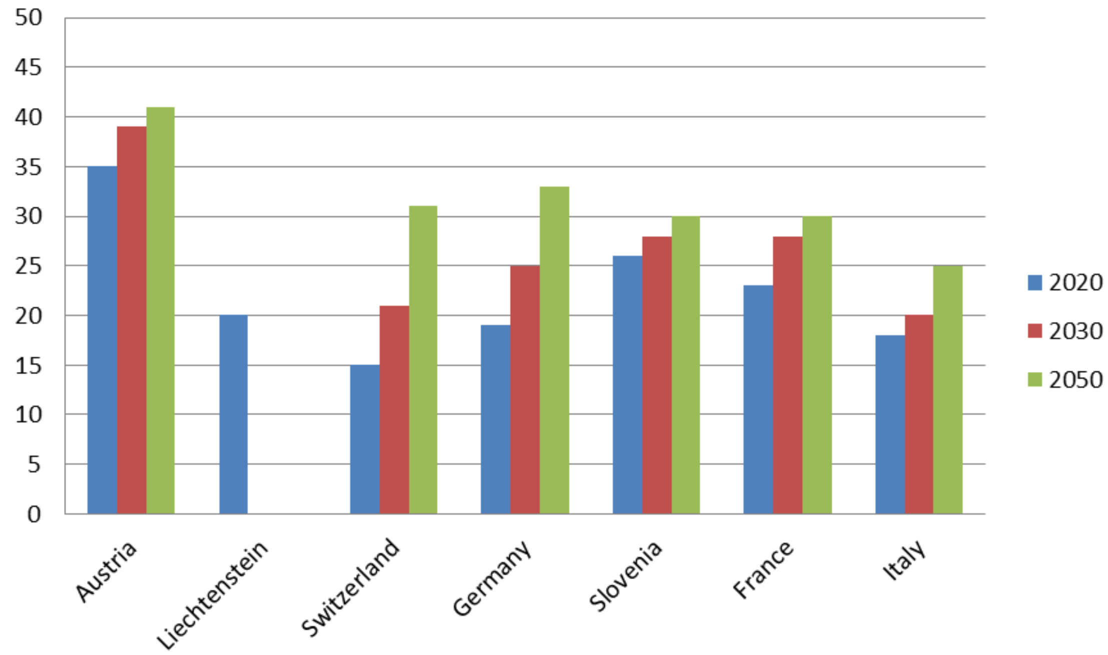


Figure 2.1.2-3 Projected share of RES in final energy demand (%) per year of the Alpine countries in 2020, 2030 and 2050 (data source: Swiss Confederation et al. 2015, p. 26, graph: ifuplan 2016).

Alpine relevance of renewable energy sources

It is generally assumed that the Alps have a significant potential for the use of renewable energy and for making a valuable contribution to reduce CO_2 emissions and thus for mitigating climate change. However, the continuing growth in energy demand of the growing and increasingly wealthy population of the Alpine region is a major problem for any attempt to significantly increase the share of environmentally-friendly, renewable energies, to reduce the heavy reliance on exhaustible fossil fuels and to achieve long-term reductions of greenhouse gas emissions. Behind the energy demand, the increasing transport volumes are the strongest driver, followed by the growth in economic output and household consumption. Population growth in the Alps also contributes to that trend. There are only few fossil fuel deposits within the Alpine area. Since the energy demand is high, fossil fuels have to be imported (CIPRA International 2002).

In order to create an efficient and resilient system with a high share of renewable energies within the Alpine area, concrete measures are needed to promote an increased supply of RE taking into account their social, ecological and economic implications. For future plans and constructions on RE as well as aiming at the vision on the "Renewable Alps" (Schweizerische Eidgenossenschaft 2015), the carrying capacity of the Alpine area concerning their ecosystems has to be taken more into consideration.

The Alpine area is predestined for multifaceted decentralised generation of power from renewable energy sources. Many of those are intermittent and power usage needs to better adapt to power generation. While demand side management offers potential, intelligent storage technologies can provide for cost effective buffering in metropolitan areas as well as scattered habitats. The development of the so-called "smart grids" - infrastructure based on modern information and communication technologies - seems to be relevant for the Alpine area. Smart energy management and sustainable mobility solutions can be found in the context of the AlpStore[25] project.

[25] Further information: http://www.alpstore.info/.

The sustainable potential for RE production in the Alps is determined by the big amount of protected areas as around 40% of the Alpine area is under protection. In some of the protected areas, RE production from wind and solar constructions as well as forest biomass extraction is allowed to a confined extent, while in other areas any energy production is prohibited. Against this background, it is important to take into consideration the so called RE “carrying capacity”, that shows how sustainable and ecologically sound the planned RE power plants are. The EU Alpine Space recharge.green project develops tools to evaluate the RE carrying capacity of the biodiversity-rich Alpine ecosystems. The tool will aid in the analysis of siting decisions and in weighing costs and benefits to enable rational energy implementation decisions. It has been tested in five pilot regions in Austria, Germany, Italy, and Slovenia (Recharge Green 2015).

Report on how to balance nature conservation and avoid land use conflicts during the development and operation of energy projects

How to balance nature conservation and avoid land use conflicts during the development and operation of energy projects was the central question of a report commissioned by Germany following the XIIIth Alpine Conference. There, it was agreed that Germany would collect best practice examples of energy projects, which demonstrate how the above mentioned question can be best dealt with. For this best practice report, forward-looking, economically viable projects and especially efficient technological solutions that demonstrate effective solutions for nature conservation aspects and land use conflicts were collected. Moreover, procedural aspects of the projects, e.g. participation of stakeholders, information exchange and planning methods have been evaluated. The focus is on successfully implemented energy projects that produce, transmit or store energy rather than research projects. The final report will be presented during the Alpweek in October 2016.

Initial results, known at the time of the preparation of the RSA6, show that the considerable RE potential of the Alpine region can be used in a manner that observes nature conservation and avoids land use conflicts by mitigating the physical impact of energy projects on nature and by including the relevant stakeholders during planning, construction and operation of the project. Although there are clearly RE technologies with a greater impact on nature and a greater potential for land use conflicts – e.g. hydropower compared to roof-top PV – there are sensible solutions to mitigate risks and, therefore, successfully develop the RE potential of the Alpine region.

Situation in Alpine countries

In the following, the status of realised power plants and RE installed capacity is presented as far as data were available.

<u>Status on RE and installed capacity of the Alpine countries (Alpine and national level)</u>

“Installed capacity for renewable electricity generation” expresses the power capacity of already installed RE power plants, especially relevant for GE in the Alpine area. In most of the Alpine countries, data on hydropower (installed capacity and energy production) is available. In Switzerland, comprehensive data is available on NUTS3 level (1990-2014), in Liechtenstein only data on hydroelectric power production could be collected (1990 – 2014), in Slovenia data on small and large hydropower plants is available (1950-2014).

Within the framework of the recharge.green project, data about RE production at different units was collected. According to this project (Figure 2.1.2-4), hydropower as well as biomass considering thermal and electrical energy productions are the most exploited RES in Alpine countries. Biomass and hydropower are predominant at both NUTS1 and NUTS3 level.

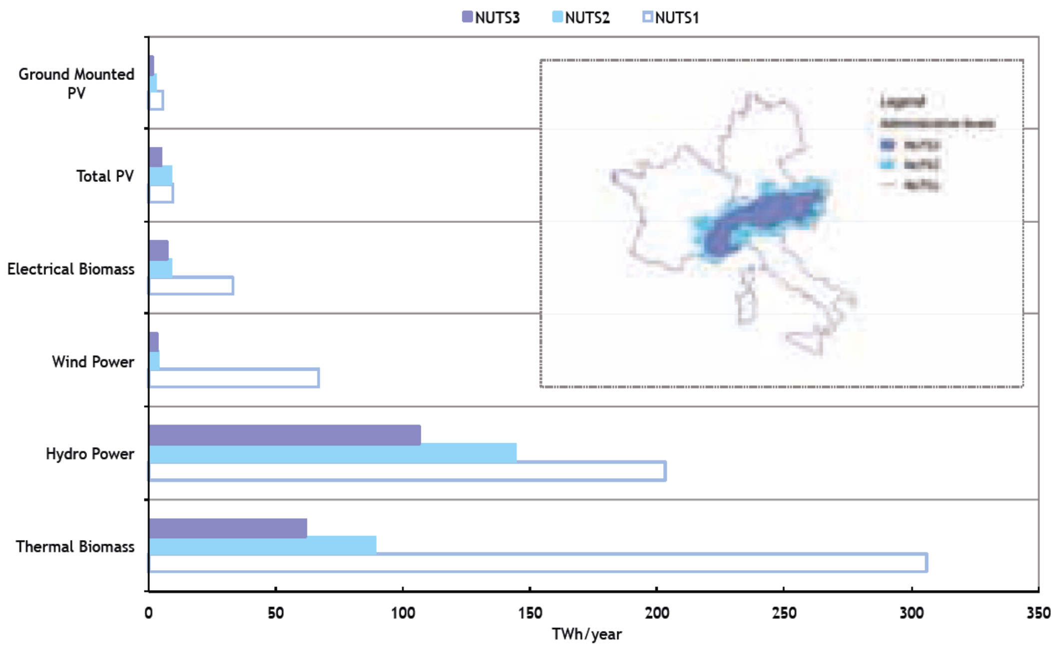


Figure 2.1.2-4 RE production in the Alpine countries (NUTS1) and in the total NUTS2 and NUTS3 unit (Source: Recharge Green 2015).

Austria

In Austria until 2020, the Eco-Electricity Act 2012 (BGBl.I Nr. 75/2011) has established goals for an increase of the RE installed capacities between 2010 and 2020 of:

- Hydropower (1,000 MW);
- Wind power (2,000 MW);
- Biomass and biogas (200 MW);
- Photovoltaics (1,200 MW).

According to the statistics of E-Control Austria[26] on RE installed capacity trends, the installation of wind power as well as biomass power plants stalled between 2006 and 2010 due to unfavorable conditions in the previous Green Electricity Act. Since 2010 for both RE power plants, there are significant increases every year, which are expected to continue in the future.

Installations of photovoltaics have taken off in 2011 and are expected to continue to increase sharply. Geothermal electricity plants do not play a significant role in Austria.

Figure 2.1.2-5 shows the installed capacity of RE power plants in the time interval of 2005-2013.

[26] Further information: https://www.e-control.at/statistik/strom/bestandsstatistik.

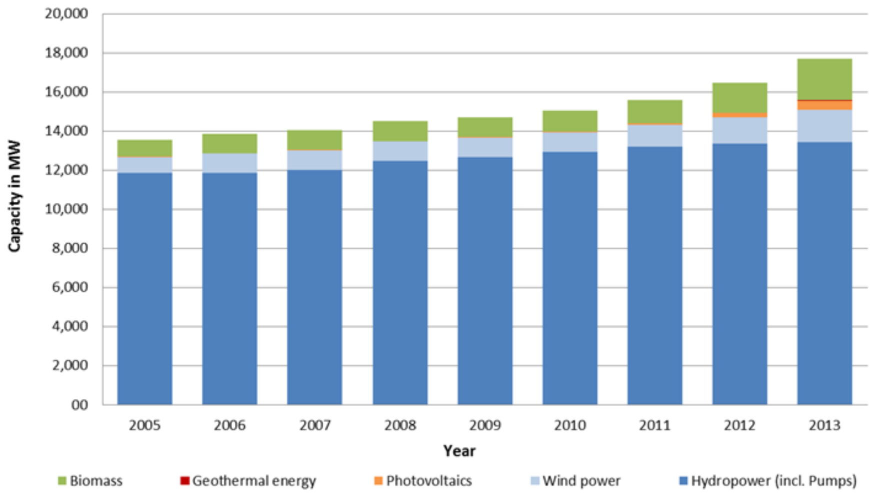


Figure 2.1.2-5 Installed capacity of RE sources in Austria from 2005-2013 (data source: Umweltbundesamt Austria 2015, graph: ifuplan 2016).

According to the current figures of the green-electricity report (Ökostrombericht) (E-control Austria 2014) there were in total 18,482 small-scale hydropower stations and other eco-electricity plants which were subsidized via the Green-Electricity Act in Austria in 2013. Apart from photovoltaics and small-scaled hydropower stations, almost all plants are subsidised via the Green Electricity Act. The installed power of these plants amounted to 2,648 MW with a feed-in volume of 7,140.5 GWh (cf. Table 2.1.2-1).

However, the spatial distribution of the individual sources of energy shows quite different patterns in this context. Whereas, for example, the utilisation of hydropower primarily takes place in the Alpine area (cf. Figure 2.1.2-6), wind energy plants can rather be found in the North and in the East of the country.Forest locations in mid-mountain resorts are getting increasingly in the focus of interest. Other sources of energy, such as biomass or biogas, show an almost homogeneous distribution, the major part of photovoltaics plants is located outside the Alpine area.

The share of eco-electricity (domestic production) in the consumption amounted according to the green-electricity report 2014 to 70 % in 2013, after having already amounted to 73 % in 2012. The decline was due to a moderate increase in consumption and a reduction in the field of hydropower. Figure 2.1.2-7 shows the development of consumption in the public network including pumped storage, as well as the share of electricity from renewable sources of energy (subsidized eco-electricity and hydropower).

Table 2.1.2-1 Eco-electricity - feed-in volume and fees in Austria in 2013 (Source: E-control Austria 2014).

Source of energy	Installed capacity in MW	Feed-in volume in GWh	Number of plants	Fees in million €	Subsidised share of feed-in Eco-electricity in % of the total supplied quantity	Average fees in cent/kWh
Small-scaled hydropower station (subsidized)	**342**	**1,371.3**	**1,801**	**66.6**	**2.40%**	**4.86**
Other eco-electricity plants	**2,306**	**5,769.2**	**16,681**	**680.4**	**10.10%**	**11.79**
Wind power	1,555	2,970.0	295	247.6	5.20%	8.34
Biomass solid[27]	322	2,013.0	129	272.8	3.50%	13.55
Biomass gaseous *)	83	544.3	293	96.8	1.00%	17.79
Biomass liquid	5.0	0.19	32	0.02	0.0003%	11.83
Photovoltaics	324	215.2	15,886	61.7	0.38%	28.67
Landfill gas and sewage treatment plant gas	15.8	26.0	44	1.4	0.05%	5.42
Geothermal energy	0.9	0.306	2	0.012	0.0005%	3.85
Total small-scaled hydropower plants and other eco-electricity plants	2,648	7,140.5	18,482	747.1	12.50%	10.46

*) including operating costs surcharges (for 2013 and second half-year 2012) / raw material costs surcharges (for first half-year 2012).

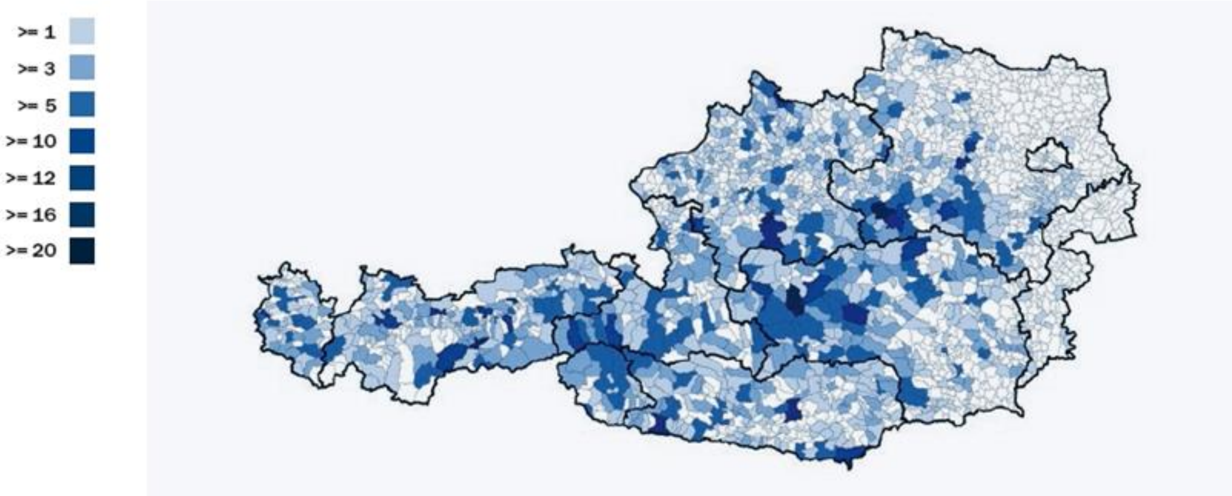


Figure 2.1.2-6 Regional distribution of small-scale hydropower, by number of plants, from the green-electricity report (Ökostrombericht) 2014 (Source: E-control Austria 2014 (Electricity Guarantee of Origin Database))[28].

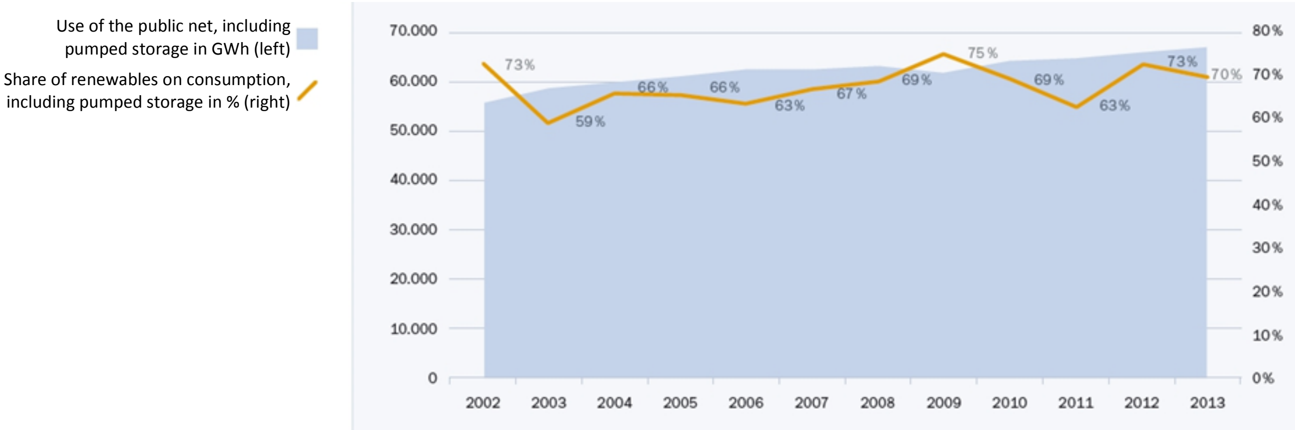


Figure 2.1.2-7 Share of electricity from renewables from domestic production (in GWh) in the final consumption in Austria (Source: E-control Austria 2014).

<u>Germany</u>

Germany aims to increase the share of gross electricity consumption to 80% by 2050, up from 27.4% in 2014. The renewables share in heating and cooling was 12.2%, and in transport 5.6%, in 2014. The target for RE in total final energy consumption (TFEC) is 60% by 2050, compared to 13.5% in 2014. According to the Renewable Energy Roadmap 2030 (IRENA 2015), Germany is on track to meet its 2020 target of an 18% renewables share in TFEC. Further RE targets of the country are summarised in Table 2.1.2-2.

[28] Further information: http://www.e-control.at/marktteilnehmer/strom/e-diskurs/e-diskurs-archiv/stromnachweisdatenbank

Table 2.1.2-2 Renewable energy targets of the German Energiewende (Source: IRENA 2015; BMWi 2016).

	Increase in share of renewable energy in final energy consumption			
	Share in gross electricity consumption	Share in gross final energy consumption	Share in heat consumption	Share in transport sector
2014 (Achieved)	27.4 %	13.5 %	12.5 %	5.6 %
2020	35 %	18 %	14 %	
2030	50 %	30 %		
2040	65 %	45 %		
2050	80 %	60 %		

In Germany, the share of RE sources in primary and final energy consumption has been continuously increasing. In 2014, 11.5 % of the primary energy consumption has been covered by renewables. In the same year the share of RE in gross final energy consumption has been 13.8 % (see Figure 2.1.2-8). The government aims to follow the increasing tendencies of this last value by reaching 30 % until 2030.

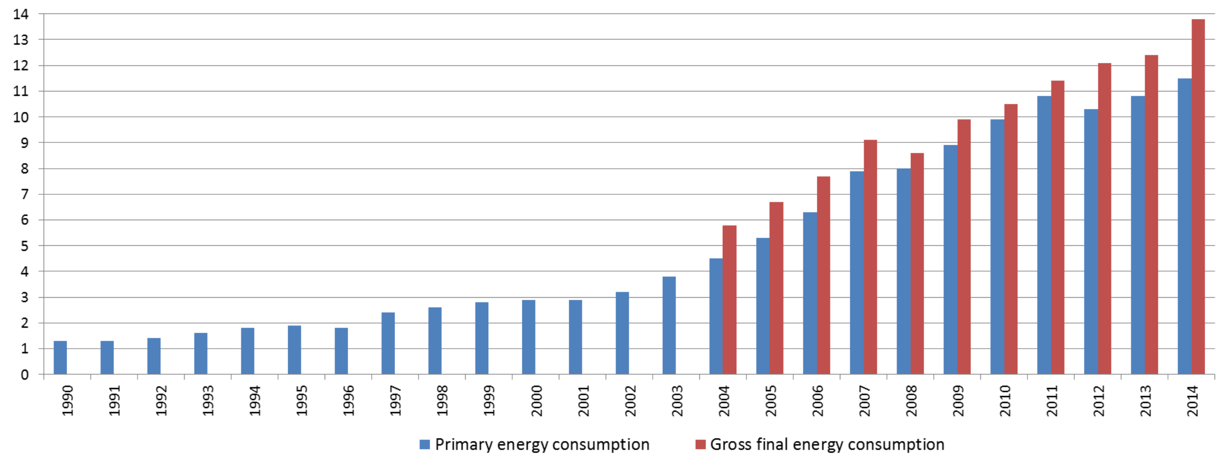


Figure 2.1.2-8 Share of RE on primary energy consumption (red) and on total final energy consumption (blue) in Germany, 1990-2014 (data source: BMWi 2016, graph: ifuplan 2016).

In 2013, the total gross electricity generation in Germany has been 634 TWh. This is a result of a continuous increase from 1993; however, the economic crisis in 2008 caused a relevant decline. From 2003 onwards, the total gross energy consumption is constantly lower as the gross electricity production.[29]

The German government projects that the contribution from renewables will increase substantially by 2030. For wind and solar power, a significant growth rate is predicted, while hydro and geothermal-power are expected to grow more slowly. The largest increase in renewable electricity production is expected to come from wind power (Swiss Confederation et al. 2015).

[29] Further information: https://www.umweltbundesamt.de/daten/energiebereitstellung-verbrauch/stromerzeugung.

The installed capacity of renewable power plants has increased very fast during the last years in Germany (see

Figure 2.1.2-9). Since 2000, wind power has the highest installed power capacity among renewables. Power from photovoltaic came on the first place in 2012 and 2013. In 2014, wind power got the leading position back due to changing promotional measures for photovoltaic systems. The installed power of biomass and hydropower systems is on the national level much lower than photovoltaics and onshore wind power capacity.

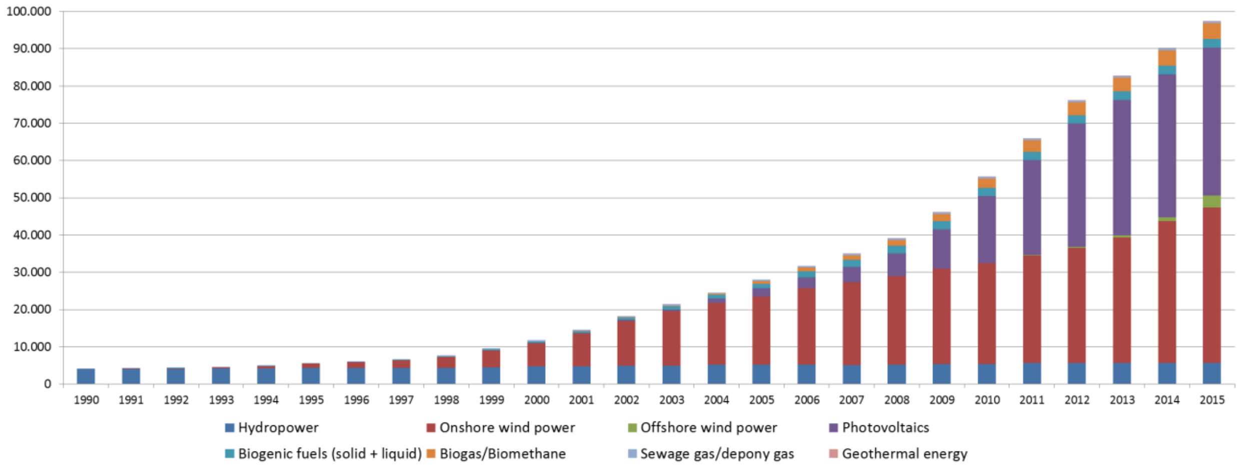


Figure 2.1.2-9 Renewable electricity installed capacity (MW) in Germany,1990-2015 (Data source: BMWi 2016, p.63, graph: ifuplan 2016).

The high installation figures for renewable power have caused the increasing total installed power capacity in Germany. About half of the installed power in Germany is already renewable. Nuclear power stations will be decommissioned due to the nuclear phase out within the next years. Moreover, Germany will gradually take lignite-fired power plants generating 2.7 GW off the market and close them down after four years.

German Alpine municipalities

Bavaria has a leading position in hydropower, solar and geothermal power in Germany and holds a second place on electricity generation from bioenergy. At approximately 16.2%, the share of renewable energies in 2014 in Bavaria's primary energy consumption is significantly higher than Germany's national average.

The goal of the Bavarian energy policy is to increase the share of RE in gross electricity production until 2025 to 70%. For the share of RE in overall energy consumption, the target value of 20% until 2025 has been defined. According to the Bavarian Energy Programme (StmWi 2016) the share of RE in gross electricity production has been increased from 25.9 % (2010) to 36.2 %. (2014). It means a significant increase of around 40 % within 4 years (Figure 2.1.2-10).

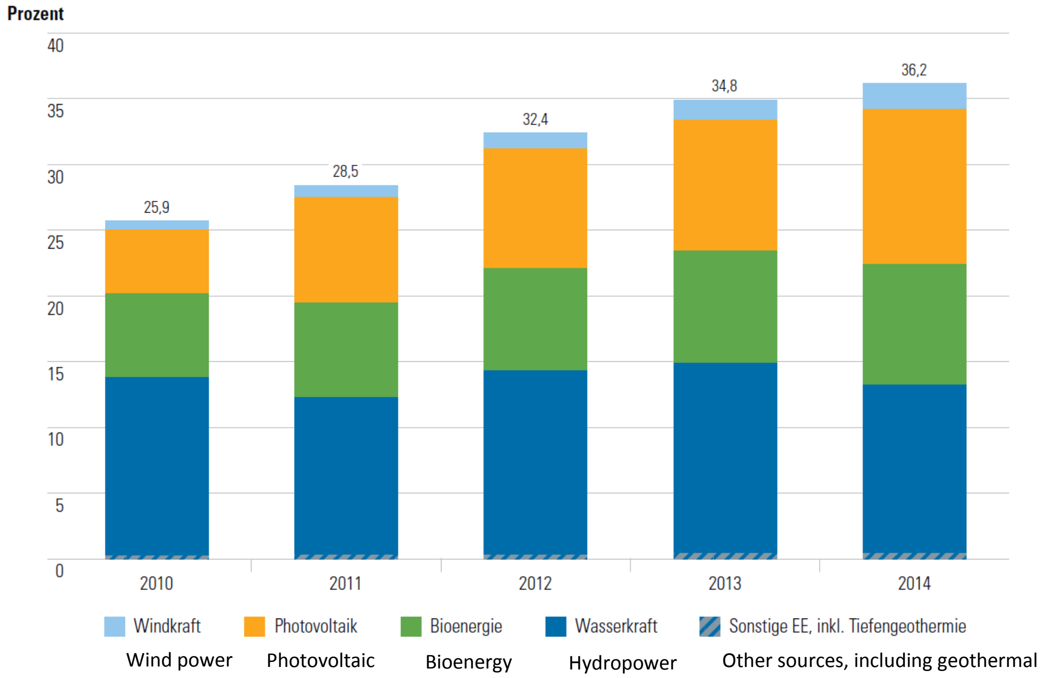


Figure 2.1.2-10 Share of RE on gross electricity generation in Bavaria (Source: StmWi 2015, p.7).

The success of RE installations is going to be measured in the future with a view to the development of the system and the market integration. With the reform of the Renewable Energy Law in 2014, the first steps in this direction have been undertaken[30].

Figure 2.1.2-11 presents the installed RE capacity within the Alpine area for Germany derived from the Energy Atlas of Bavaria (Energieatlas 2016). It shows a status of 2013 of RE with feed-in remuneration. The share of installed photovoltaic capacity is the highest in the municipalities of Ostallgäu, Rosenheim, Traunstein, Oberallgäu and Weilheim-Schongau. Hydropower plants have been mainly installed in the municipalities of Rosenheim, Bad-Tölz Wolfratshausen as well as in Weilheim-Schongau. Installed capacity from biomass is quite low, mainly found in Rosenheim, Traunstein, Weilheim-Schongau and Ostallgäu. Wind power has still the lowest share among the German municipalities in the Alpine area.

[30] Further information: http://www.stmwi.bayern.de/energie-rohstoffe/erneuerbare-energien/.

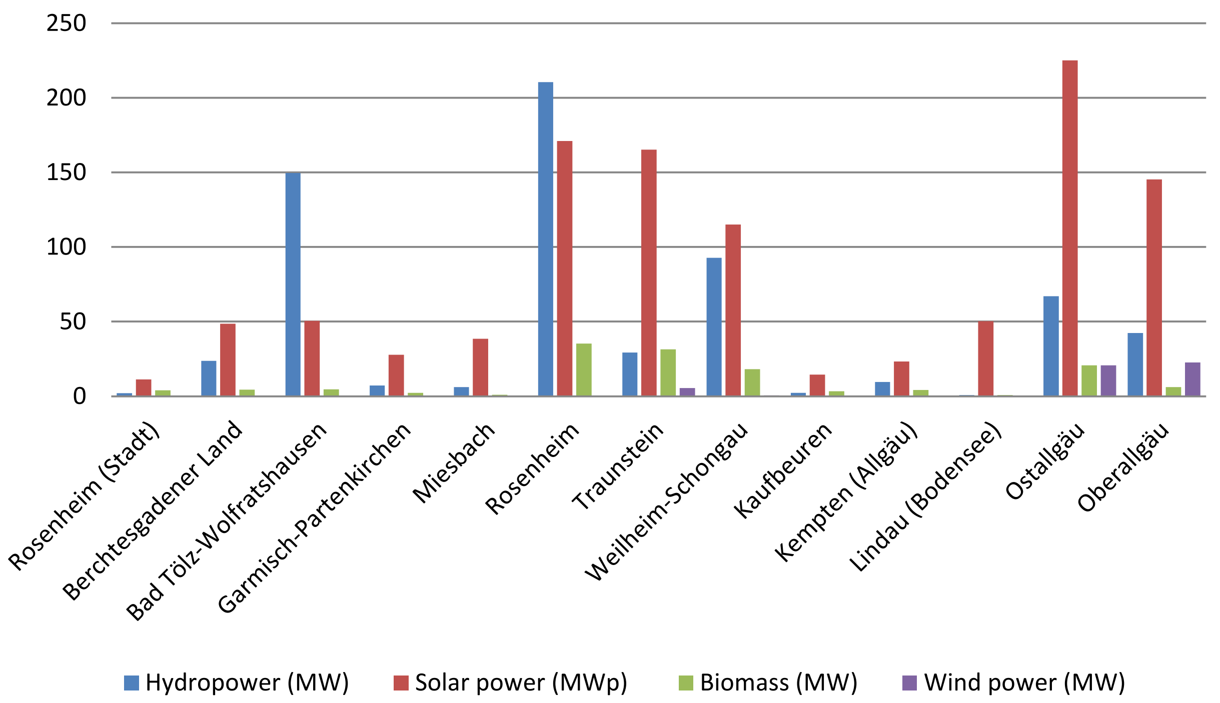


Figure 2.1.2-11 Installed RE capacity within the Alpine area of Germany, 2013 (Data source: Energieatlas 2016. Diagram made by ifuplan. Note: Data only include RE power plants that receive feed-in remunerations according to the German Renewable Energy Law).

To sum up, Germany – including the Alpine municipalities - is on its way to realistically achieve the targets set for RE until 2020.

Italy

The Italian National Renewable Energy Action Plan was published by the Ministry of Economic Development on the 10th of June, 2010. The document was drawn up in collaboration with the Ministry for the Environment, Land and Sea (IMELS) and the Ministry of Agricultural, Food and Forestry Policies.

Following the EU Directive 2009/28/EC, the plan sets up strategies and action lines in order to reach the national target of 17% of energy produced by renewable sources by 2020. In particular, renewable energy shares in transport, electricity, and heating and cooling should reach 6.38%, 28.97% and 15.83%, respectively. That would lead to an increase in the use of hydro, wind, solar and geothermal power as well as biomass, and changes in the current incentive mechanisms.

In Italy, renewable energy sources (RES) have been contributing to 43.1% of total gross production in 2014 with a positive trend that is appreciable also over the 2013-2014 period (+4.5%). At the national level, an increase was registered for all RES between 2013 and 2014 especially concerning hydropower (+10.9%) and bioenergy (+9.6%) (GSE 2015).

Focusing on the Italian Alps, a composite situation with the regional energy balance sheets can be observed. In general, energy demand and production is quite in balance across the Italian Alpine regions with a small deficit – that would seem to be higher than elsewhere in the country (national average is around 13%, Alpine average is 20%). As a share of total production, hydropower is the most relevant source of energy available in the Italian Alps – where the highest shares for this source have been registered in Valle d'Aosta (99%) and Trentino Alto Adige (88%). It significantly contributes to the positive energy balance of two emblematic mountain regions such as Valle d'Aosta and Trentino-Alto Adige. Moreover the Italian Alpine regions provide some 79.5% of hydropower, 36% of thermoelectric, 1% of wind and 29.3% of photovoltaic power of the national level (Terna 2014). These numbers echo both the economic history of some of these regions (Piemonte, Liguria and Lombardia having been major sites for industrial production, which needed a relatively huge quantity of power supply) and the local endowment with natural assets in mountain zones – particularly water that has been used for electricity production since the second half of the 19th century.

Figures on number and power of RES power plants in the Italian Alps confirm Lombardia as the Italian region where the highest concentration of installed RES capacity can be found (36.7% of the capacity installed in the Italian Alpine regions and 15.9% of Italy as a whole in 2014). At the Provinces' level, Brescia qualifies as the area with the highest installed capacity in Italy (5.5%), but a high share can also be found in other provinces like Lombardia, Sondrio (4.6%). Very well ranked for installed capacity at the national level are also the Alpine provinces of Bolzano/Bozen (3.9%), Trento (3.5%), Torino (3.2%) and Cuneo (2.4%). Lombardia, Piemonte and Trentino are the main producers (in MW) of renewable energy in the Italian Alps, ranking well also at the national level, being respectively 1st , 3rd and 4th absolute providers of electricity from RES (GSE 2015).

Liechtenstein

The energy supply from domestic energy resources is limited to the energy sources firewood, solar panels and biogas from the wastewater treatment plant (WWTP).

The energy supply from domestic energy resources decreased in 2014 from 133,600 MWh to 93,257 MWh. The electricity production from domestic energy resources decreased because of the construction of the hydropower plant Samina in 2014 by 54.3% (37,864 MWh).

The electricity production in natural gas-fired cogeneration plants in MWh is also mentioned, because natural gas is not a domestic energy resource. The heat production from local wood and biogas from the 1,794 solar thermal collector installations totalled 55,393 MWh. The two wood-fired power stations in Malbun and Balzers use mostly domestic wood for heat production. Compared to the previous year (2013), the self-sufficiency ratio fell from 9.8% to 7.6%. The self-sufficiency rate is the ratio of energy from indigenous sources of energy to total energy consumption or import. The supply of domestic electricity to the national grid was carried out in 2014 by:

- Hydropower plants Samina, Lawena, Schlosswald, Mühleholz sources, Letzana, Steia, Schaan sources, Stieg, Maree, Wasserkopf sources, Wissa, Stae and Meierhof.
- Natural gas-powered cogeneration plants in the municipalities of Triesen, Balzers, Schaan, Eschen, Mauren and Schellenberg.
- Biogas-powered combined heat and power (CHP) cogeneration plant of wastewater treatment plant (WWTP) Bendern.
- Solar power plants (photovoltaics): 1,343 plants with an installed capacity of 965 kWp fed their energy production into the national grid. In the previous year, there had been 1,224 plants with an installed capacity of 333 kWp.

In the field of photovoltaics, the cumulative photovoltaic capacity per inhabitant resulted in 2015 in 481 Wp (peak power). Liechtenstein is the number one in the category Solar of the SolarSuperState Ranking 2015 with a cumulative installed photovoltaic power of 481 Watt per capita and received the SolarSuperState Prize. With the promised investments, Liechtenstein can supply 3,000 households with solar electricity. Nevertheless, it remains a challenge: only if the technically and economically feasible potential is tapped, the objectives of the energy strategy can be achieved in 2020.

Slovenia

The total production of electricity in 2014 amounted to 17,437 GWh. The biggest share was produced from renewable energy sources (38%), followed by nuclear energy (37%), the share of the production from fossil fuels was 22%.

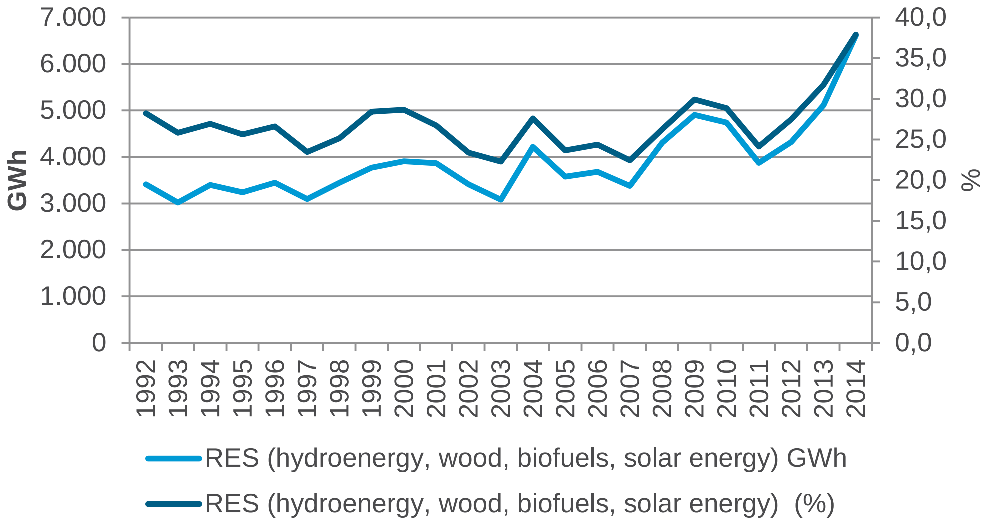


Figure 2.1.2-12 RE electricity production in Slovenia in GWh and % (Source:MOP et al. 2016).

In 2013, the share of renewable energy sources in primary energy consumption amounted to 16.6% (or 1,129 ktoe), an increase of 9.2% compared to the year before.

The most important source was wood and other solid biomass (50.6%), the second most important source was hydropower (35.1%). Other sources were liquid biofuels (5.3%), geothermal energy (3.4%), biogas (3.1%) and solar energy (2.5%).

Wood is an important source of energy, as more than 60 % of the Slovenian territory is covered by forests. Most of solid biomass is consumed by private households (in 2013 472 ktoe), followed by industry with 48 ktoe. The use of biomass for district heating and electricity production is increasing as well.

The second most important renewable energy source in Slovenia is hydropower. The production of electricity from hydropower in 2013 amounted to 4,613 GWh (excluding pumped storage power plant). The production capacity in the period 2000-2013 increased by 30% on account of renewals of large hydroelectric power plants and the construction of new ones (Boštanj, Blanca, Krško HPP) as well as the construction and renovation of small hydroelectric power plants.

Further renewable sources are used in Slovenia such as biogas (landfill gas, sewage gas and other biogases - biogas plants in agriculture), geothermal energy, solar energy and liquid biofuels. In Slovenia, higher solar radiation occurs mainly in the Primorska region and areas with higher altitudes. Figure 2.1.2-13 shows installed RE power plants in Slovenia.

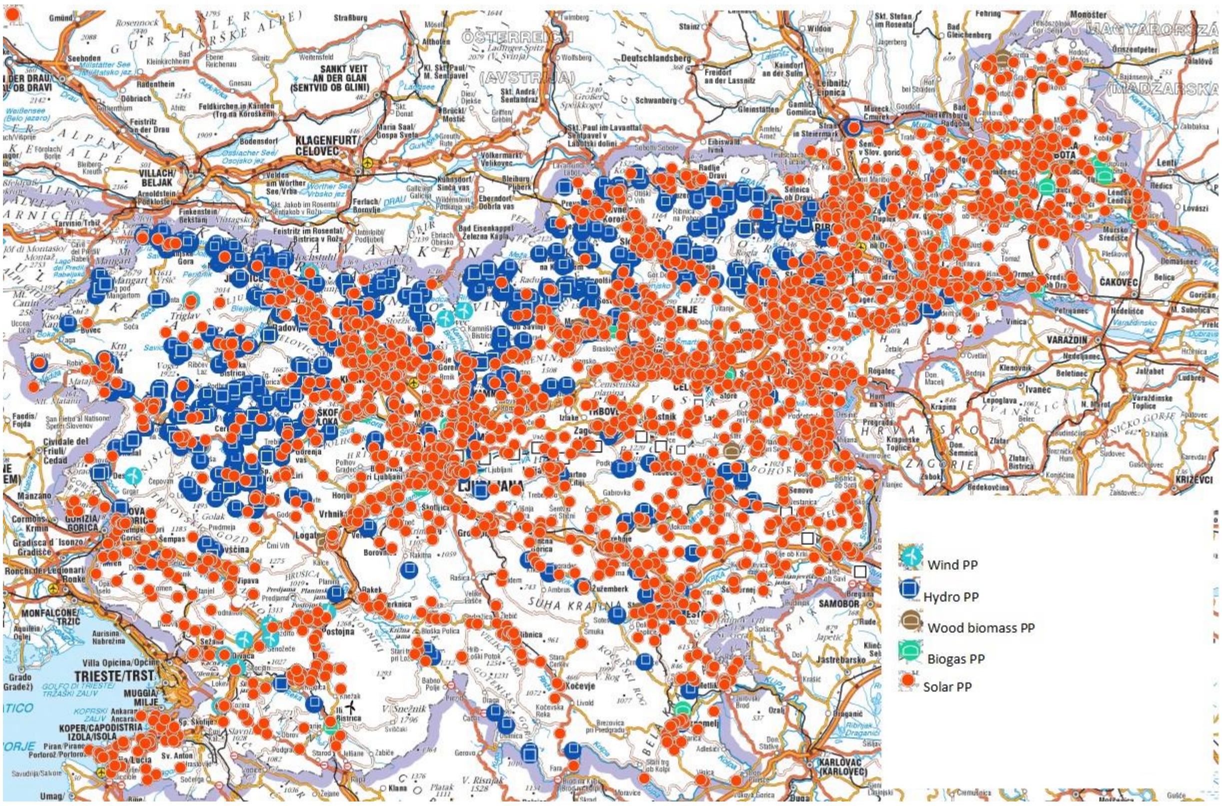


Figure 2.1.2-13 Installed RE power plants in Slovenia (Source: ENGIS 2016).

Switzerland

In Switzerland, the electricity production from renewable energy sources has developed differently since 1990 depending on the energy source. The partially high fluctuations in the production of hydroelectric power are explained by the differing hydrological conditions. However, the energy from renewable resources comes largely from hydropower (60.3% in 2013). 22.7% comes from renewable biomass (wood and agricultural biogas), 7.2% from geothermal heat and 6% from renewable waste fractions. Also other energy technologies (solar energy, wind energy, biofuels and residues in wastewater treatement plants) produce some share of renewable energy in Switzerland.

Figure 2.1.2-14 shows the trends of energy production from 1990 to 2010.

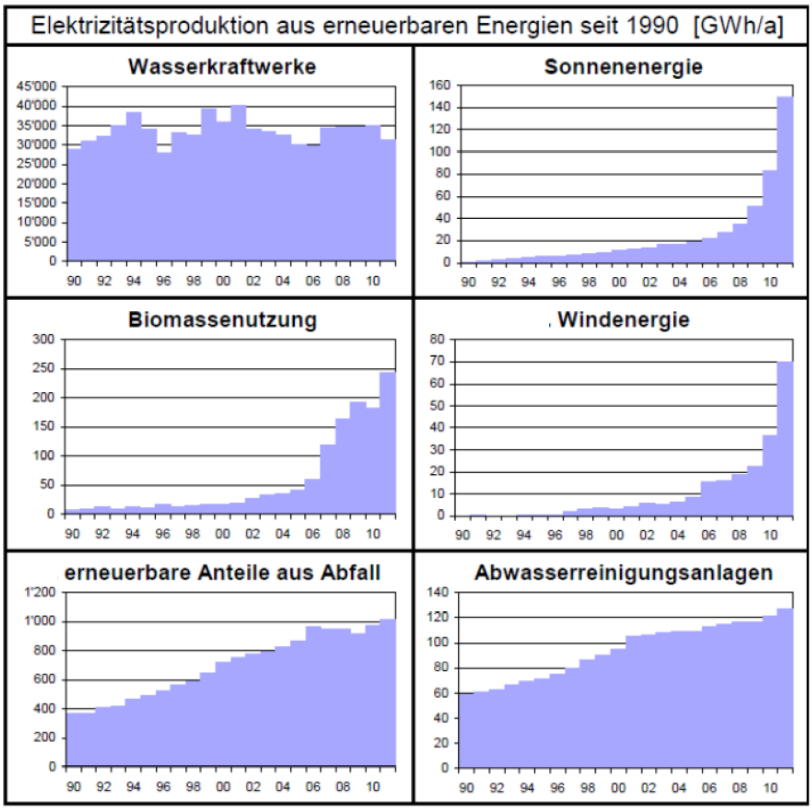


Figure 2.1.2-14 Development of the energy production since 1990 according to technologies (Source: BFE 2012).

In Switzerland around 20% of consumed energy comes from renewable sources. This proportion is continuously increasing since 1990 (

Figure 2.1.2-15).

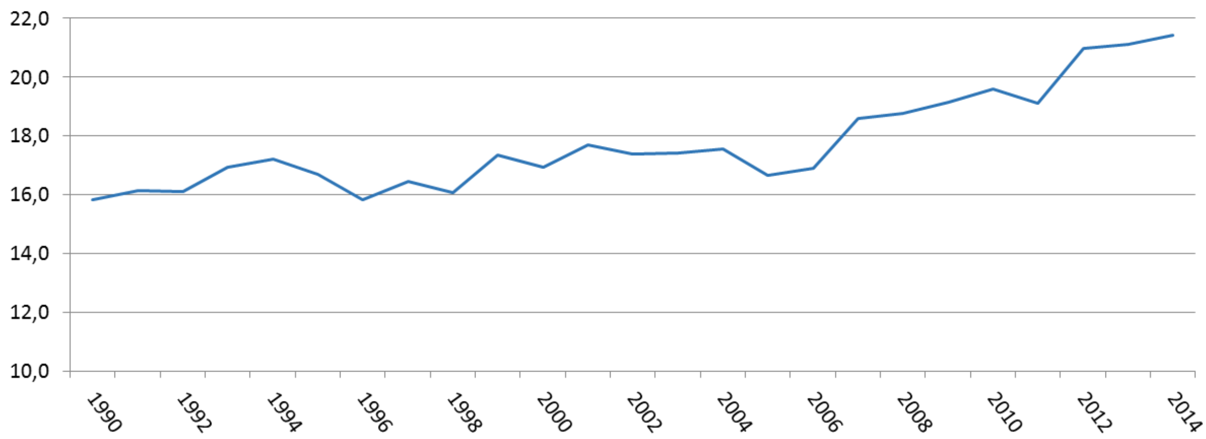


Figure 2.1.2-15 Share of RE in % in Switzerland on the national level, 1990-2014 (Source: BFS 2016e).

As Figure 2.1.2-16 shows, the total installed hydropower capacity has continuously risen from 1990 to 2014. A sharp increase of the installed hydropower capacity of the turbines was registered in the year 2000. In 2014, it reached more than 14,500 MW.

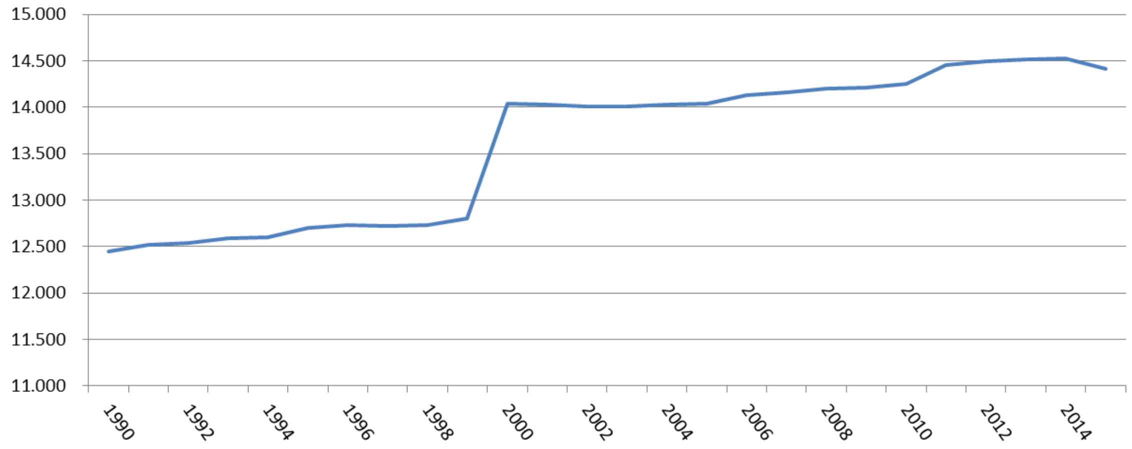


Figure 2.1.2-16 Installed hydropower calculated in capacity of turbines in megawatts, 1990-2014 (Source: BFS 2016f).

A result worth noting is that the proportion of fossil energy carriers in total energy consumption was reduced from 70.9% in 2000 to 65.3% in 2014, while the consumption of fossil fuels reduced by 10.3% in 2014 compared to 2000. The use of different fossil energies showed various patterns: the consumption of heating oil in 2014 decreased by 37.6% compared to 2000. For the same period, the use of other oils decreased by 57.6%, while the use of gas increased by 14.9%. Energy consumption from renewable energy sources increased substantially between 2000 and 2014 by 175.7%.

Figure 2.1.2-17 presents the percentage change in the final energy consumption between 2000 and 2014:

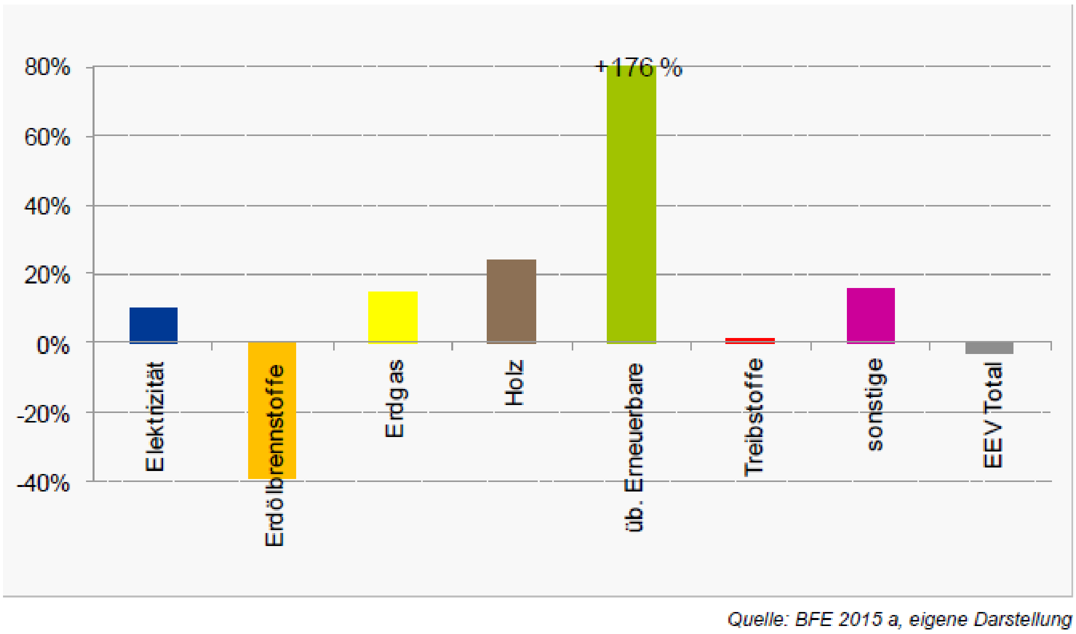


Figure 2.1.2-17 Percentage change in final energy consumption in Switzerland between 2000 and 2014 (Source: BFE 2015).

RE potentials in the Alpine area as well as in some Alpine countries

In the following, the RE potentials at the Alpine level as well as exemplary for some Alpine countries sorted by RE sources will be described.

Hydropower

Within the framework of the 2nd Report on State of the Alps on Water and Water Management issues (PSAC 2009), an overview of over one hundred large hydroelectric dams (producing installed capacity of > 28 GW) has been collected. Most of these power plants are storage plants that deliver valuable peak-load power. Because hydropower plants deliver less electricity in winter, the combination with wind power could be a complementary solution that is still in discussion within the Alpine area.

Taking into account the technical and economic potential of hydropower stations, the power generated from hydropower would have the capacity to increase by 10% (Kraxner et al. 2015) .

Following other opinions, however, in most Alpine countries the hydropower potential is almost exploited (Platform Water Management in the Alps 2011). Hydropower plants can have negative effects on river ecosystems and neighboring areas such as floodplains or alluvial forests. They may affect water run-off, water quality, habitats and aquatic species, sediment transport and many other important ecosystem functions and services. Therefore, a further use of undisturbed Alpine rivers for hydropower is very critical and requires careful environmental assessment. The refurbishment of existing older hydropower plants may offer solutions with less environmental impacts but also these effects need to be controlled and verified.

Wind power

According to the main findings of ESPON (2013b), the wind energy potential of the Alpine area is much lower than the potential of the EU - especially in the northern part of Europe - and shows a high level of diversity. The wind power potential maps used in this report (ESPON 2013b) highlight the Alpine regions with the greatest wind power potential, with high wind speeds and large area size. In the northern Alps, the potential for wind power is higher than in the southern Alps.

Lower accessibility of mountainous areas and the limited roads and grid connections result in less favorable conditions for wind farms. Thus, only a limited number of wind farms are installed in mountainous areas. In mid-2004, for instance, 1.5 % of turbine capacity was installed in mountainous areas in Austria, France, Italy, Slovenia and Switzerland. There are however wind turbines at high altitudes. For instance, the highest large-scale wind park was situated at 2330 m in Switzerland in 2004. Only one EU research project has been identified that considered the impact of wind farms in Alpine area: Alpine Windharvest (Winkelmeier H. & Geistlinger, B. 2004).

Many parts of the Alpine area are characterised by their historical cultural landscapes that are often a further barrier to wind park developments. Evaluating visual impacts caused by wind power stations is thus regarded as a key task for Alpine regions (CIPRA International 2002).

Biomass

The potential to produce bio-energy on cropland is limited due to the overweight of mountainous landscape. However, biomass as a resource provides a big potential for RE in the Alps thanks to growing forest and an increasing volume of standing timber. Alpine forests provide a vital basis for ecosystem services such as water retention, air quality and climate regulation, carbon sequestration, soil conservation and protection against natural risks. Thus, the increasing bio-energy production of the Alpine forests must be carefully and sustainably planned to maintain these essential services.

According to the Recharge Green (2015) report on RE and ESS, the theoretical potential of bioenergy in the Alps is about 60 TWh. This is considerably less than the current use by the existing wood-based industries, which require more than 50% of available wood resources.

Geothermal energy

Best conditions for geothermal energy production can be found in the Molasse basin, a foreland basin north of the Alps. Geothermal projects in the central part of the Alps are very rare because of the heterogeneity and complexity of geological structures which do not provide large geothermal fields being easily detectable and accessible. In contrast with this the Alpine foreland is hosting several large geothermal heat generation sites and electricity power plants. The rocks here are karstified so that hot water flow through the cleats is allowed.

In Germany especially in the northern part of the Alpine Molasse Basin called Bavarian Molasse several deep and hundreds of near surface geothermal power plants are operating mostly for heat but also for electricity production. In Switzerland, the biggest geothermal potential is in the very north of the country in the Molasse basin as well as the Upper Rhine Graben. However, several deep geothermal production projects had to be stopped in Switzerland according to earthquakes triggered by drilling. Another popular way of geothermal heat production in Switzerland is using the heat from Switzerland’s 700 road - and railway tunnels(Philipp 2013).

To sum up, there are mostly near surface geothermal projects in the Alpine area. However, alone in the Molasse basin, 20 deep geothermal projects are under construction.

Austria

An evaluation of the potential of renewable sources of energy can be found in the final report of the project “Future-proof energy supply for Austria” (BMVIT 2011). Table 2.1.2-3 shows the potentials of RE sources of energy in PJ (Petajoule) for the year 2020 and 2050 and it summarises the growth potentials between 2020 and 2050. According to this it can be concluded that the highest RE potential growth between 2020 and 2050 lies in photovoltaics (+950%), in the biomass from agricultural sources (+156 %) and solar thermal energy (+133 %). The potentials of hydropower plants however are predicted not to expand significantly (+5 %). Thus, in total the RE potential of 510.3 PJ by 2020 and even of 932.8 PJ by 2050 would be possible.

Table 2.1.2-3 Potentials [PJ] of renewable sources of energy in Austria in the years 2020 and 2050 (Source: BMVIT 2011).

Sources of energy	2020	2050	Growth potential (2020-2050)
Hydropower	144.2	152.3	8.1
Biomass agriculture	80	205	125
Biomass forestry	193.5	215.6	22.1
Wind energy	26	61	35
Photovoltaics	9	94.5	85.5
Solar thermal energy	27	90	63
Heat pump	26.5	95	68.5
Geothermal energy	0	7.4	7.4

Industrial waste heat	4.1	12	7.9
Total	510.3	932.8	422.5

However, the table contains rather optimistic ceilings of potentials of renewable sources of energy. “In the field of agricultural biomass the question arises, whether in fact a conversion to integrated systems, namely at 100 %, will take place. Also regarding forest biomass it is insecure whether the share of material use will rise or not. However, even if it should rise, this doesn’t mean that the effects on the potential of forest biomass are unequivocally clarified” (BMVIT 2011).

In the field of solar energy the potentials are only limited by the area available for installations.

In a current study of the Federal Environment Agency various scenarios are compared to each other with respect to their shares of renewable sources of energy (UBA Austria 2015b). In the year 2030 the highest share of renewable sources of energy will be reached with 46.9 %, according to another scenario with 34.3 %. In the year 2050 the value will fluctuate, depending on the scenario, between 32.3 % and 66.6 %.

Germany

The ReMap 2030[31] report of Germany (IRENA 2015) aims to determine the potential of renewable energy deployment. According to the REmap analysis in the reference case, Germany reaches a 27% renewable energy share in the total energy mix by 2030.

The end-use sectors offer significant additional renewable potential. The largest potential for additional deployment of renewables beyond the reference case of the REmap analysis is in the heating and transport sector. Figure 2.1.2-18 represents the trends of RE share of Germany´s final energy consumption in the three most relevant sectors: electricity, heating and transport and their targets until 2020.

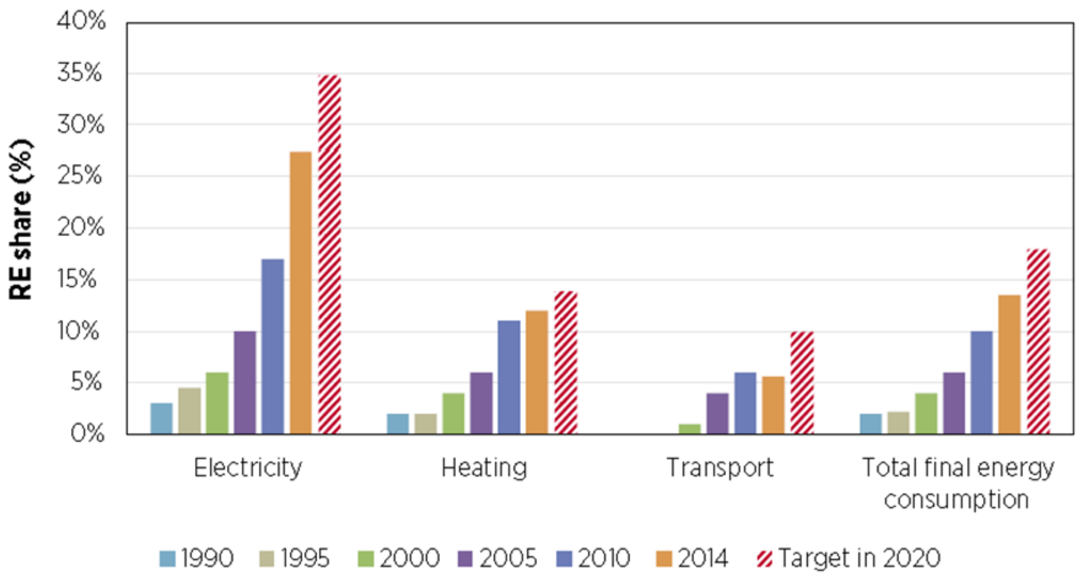


Figure 2.1.2-18 Renewable energy share of Germany’s final energy consumption, 1990-2014 and targets for 2020 (Source: IRENA 2015, p.26).

[31] Renewable Energy Roadmap 2030

CIPRA Germany has published a position paper on nature compatible implementations of the "Energiewende" in the Bavarian Alps (CIPRA Deutschland 2013). This document describes that big potentials are seen in retrofitting or repowering of RE power plants.

Within the German part of the Alpine Convention area, there are in a sum 380 hydropower plants in operation. Concerning repowering of small hydropower plants, the most actual interpellation of the Bavarian Parliament (Bayerischer Landtag 2015) shows the number of granted new and follow-up permissions within the German part of the Alpine area. From an ecological point of view, it is important to look at the installed fish ladders of hydropower plants. In the German part of the Alpine area, 82 (21.6 %) power plants are equipped with fish ladders. In the time interval from 2005 to 2014, 49 fish ladders have been installed altogether (see Table 2.1.2-4).

Table 2.1.2-4 Granted new and repowering permissions of small hydropower plants (< 1,000 kW) with numbers of installed fish ladders in Bavaria within the time interval of 2005-2014
(Data selected from interpellation of the Bavarian Parliament 17/6592, Bayerischer Landtag 2015, p.51).

	New permissions		Follow-up permissions		Fish ladders
Admin. district	**Number of power plants**	**Capacity (kW)**	**Number of power plants**	**Capacity (kW)**	**Number of power plants**
Bad Tölz-Wolfratshausen	4	22	5	159	n.a.
Berchtesgadener Land	7	1,007	15	1,315	7
Garmisch-Patenkirchen	4	1,098	5	1,058	4
Kempten (municipality)	1	150	1	460	n.a.
Lindau			1	195	n.a.
Miesbach			5	1,006	7
Oberallgäu	6	1,272	17	2,608	19
Ostallgäu	2	491	13	1,805	4
Rosenheim	1	30	21	840	2
Traunstein	8	1,762	20	1,637	6
Weilheim-Schongau	1	2	2	9	n.a.

Concerning wind energy, the Bavarian Wind Atlas includes maps that show the wind velocity and potential energy output of wind power plants in the elevation of 100 meters, 130 meters and 160 meters. The wind maps give an impression about interrelations of wind velocity in typical hub heights of wind power plants. Furthermore, it gives information on wind power reference yields[32]. Figure 2.1.2-19 shows the full load hours (left) and the reference yields (right) in 100 m height.

[32] Further information: https://www.energieatlas.bayern.de/thema_wind.html.

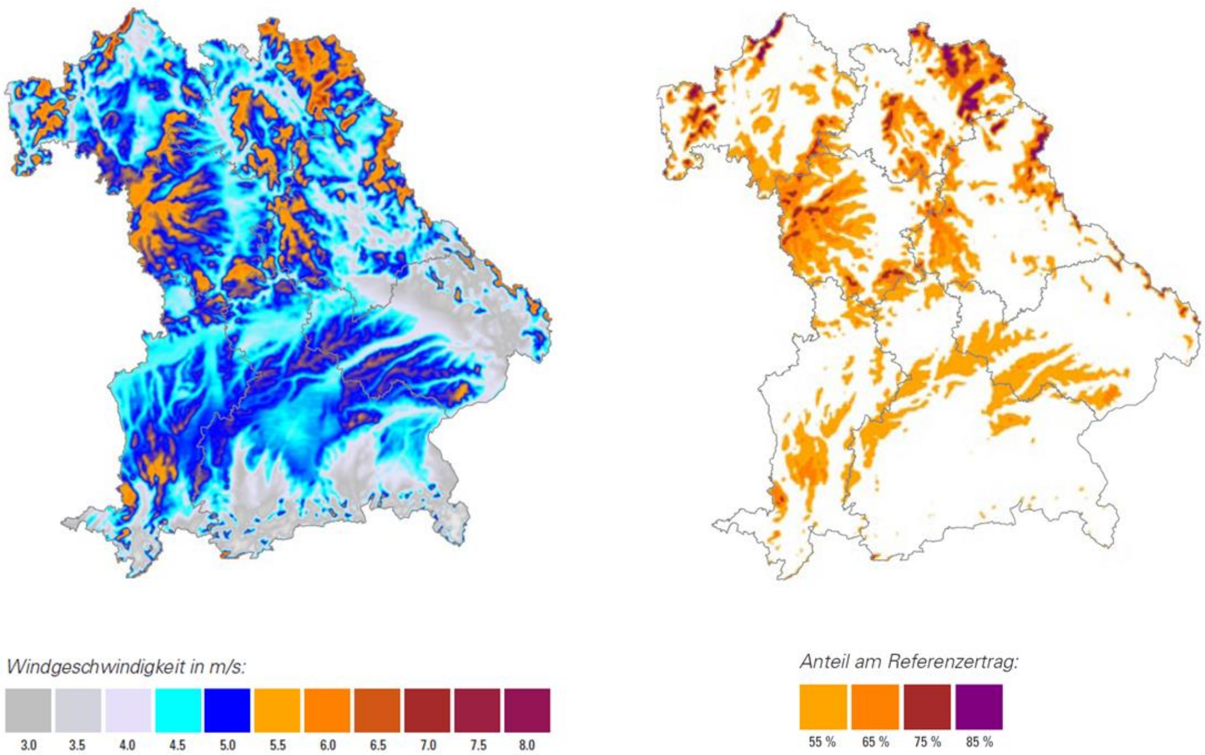


Figure 2.1.2-19 Wind conditions (left, m/s) and reference yields of windpower (right, %) in 100 m above ground level in Bavaria (Source: StmWi 2014).

Liechtenstein

Liechtenstein analysed the renewable energy potential in the Energy Strategy 2020. PV panels have a theoretical potential of 104 GWh/a. Solar collectors have a theoretical potential of 36 GWh/a, hydropower has a theoretical potential of about 200 GWh/a.

Slovenia

The main potential for further exploitation of renewable energy sources can be seen in the field of hydropower plants (rehabilitation and extension of existing and construction of new ones- complete the Sava chain), modern biomass utilization and in the construction of wind and solar power plants.

Another two hydropower plants in the chain of six on the lower Sava River are in the planning phase until 2019. In preparation are also other projects for the exploitation of the hydro potential: hydropower plants on the middle Sava River, on the Mura et al. An important factor in the production of hydropower plants is the hydrologic condition, which shows a negative trend on average in the last years, possibly related to climate change.

Swi Wind speed Share on reference day

The Swiss Federal Office of Energy (SFOE) is the country's competence center for energy supply and energy use at the Federal Department of the Environment, Transport, Energy and Communications (DETEC). In order to estimate the future development potential of renewable energy, the SFOE undertook data calculations with other experts. The expected development potential for the year 2050 looks as follows:

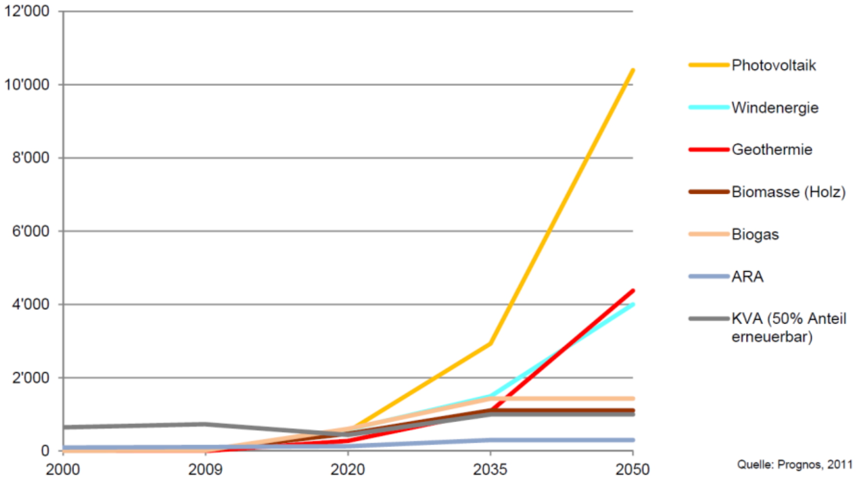


Figure 2.1.2-20 Development potential of RE for electricity production in Switzerland (in GWh/el/a) (Source: BFE 2012).

The expected development potential of renewable energy production is significant, but also limited by economic, environmental, social and spatial barriers. The installation of RE production plants is still cost intensive. Thus, there is a need for further studies on RE capacities in the Alpine region, to support the Alpine countries in their efforts to increase the share of renewable energies in final energy demand.Good practice -Energyvalley Toggenburg, Switzerland

All twelve municipalities within the region of Toggenburg work together to achieve regional energy self-sufficiency: Until 2034, the valley wants to self-sustain itself by producing energy from local and renewable resources. A further goal is to realise the environmental vision of a 2000-watt society until 2059. The canton, municipalities, companies and private citizensall support and work towards fulfilling these goals. Energy Valley Toggenburg (Energietal Toggenburg) is a regional nonprofit organization, which brings different stakeholders together to develop new ideas and coordinates projects in the fields of energy efficiency and renewable energies. Furthermore, the nonprofit organization plans different public events, develops educational projects for schools, communities and practitioners, supports plant construction, and offers consultations in the field of energy efficiency. In 2011, Energy Valley Toggenburg won the Zürich Climate Prize and the solar Prize in Lucerne in 2014.

Further Information: www.energietal-toggenburg.ch

Good practice - Tropical House Frutingen, Switzerland

The Tropical House in Frutigen, Switzerland, is a commercial project using geothermal energy from hot water flowing out of the Lötschberg base tunnel for the production of exotic fruit, sturgeon meat and caviar in a tropical greenhouse in the Swiss Alps.

The idea for the greenhouse was born in 2002 when it became apparent that the water continuously flowing out of the Lötschberg Base Tunnel could not be diverted to the local river, the Kander, as its temperature of 20 °C would disrupt the biological rhythm of the endangered trout there. Rather than cooling the water artificially, wasting its thermal energy, tunnel engineers founded a start-up company to use the warm water to heat a greenhouse. The Tropical House in the Alps takes a leading role in the use of renewable energies. The largest proportion of the required energy is taken from the warm mountain water from the base tunnel of the Lötschberg Mountain. The remaining energy required is covered by additional, equally sustainable sources, namely the sun, water and biomass. It is a fish breed and exotic fruits growing center and a model company for experiencing a special athmosphere within the Alps.

Further information: www.tropenhaus-frutigen.ch

Good practice -Ecological hydropower Au an der Iller, Germany

The special issue of the first in Germany installed ecological hydropower is the "Very Low Head"-Turbine (VLH) based on a combination of variable water level control with a water filled rubber dam. Low head hydropower applications use tidal flows or rivers with a head of 20 metres (66 ft) or less to produce energy. These applications may not need to dam or retain water to create hydraulic head. Fishes have to swim through the extremely slowly moving turbines down the river.

Using the drop in a river or tidal flows to create electricity may provide a renewable energy source that will have a minimal impact on the environment with high fish-tolerance. This way, the "win-win situation" between hydropower utilization and water ecology is enabled.

Furher information: http://www.illerkraftwerk-au.de/content/technologie/

Conclusions, opportunities and challenges

Status conclusions:

To sum up the results listed above, it can be concluded that:

- The Alps have a significant potential for the use of RE, making a valuable contribution to reduce CO_2 emissions and so to mitigating climate change;
- The biggest share of RE production lies in all Alpine countries in biomass as well as hydropower.
- Concerning RE potential in the Alps: Although there is a significant potential for hydroelectricity with pump-storage development, the potential is conditioned by requirements of nature protection, impacts on the landscape and other forms of land use. Solar and wind energy are recognized as high potential RES by the Alpine countries. Wind power potential might have to consider landscape effects e.g. visual, acoustic interventions as well as a lack of space; the utility of biomass for RE needs to respect sustainable management. Winning electricity from geothermal power is still in the development phase, initial projects have already started in Germany, Switzerland as well as in Austria. All renewable energy plants have to consider the impact on flora and fauna;
- Most of the Alpine countries are on the way to achieve their ambitious 2020 targets set by the EU Renewable Energy Directive with existing as well as with planned measures;
- Cooperation between the Alpine countries might support the sustainable use of renewable energies as cross-border synergies in terms of energy generation and consumption could be established and knowledge on renewable energies could be exchanged. Furthermore, it is important to establish joint policy frameworks, programmes, measures and guidelines as well as implementing joint projects in practice.

Opportunities:

- Fostering sustainable installations for RE in the Alps offers great opportunities towards energy independent, CO_2 neutral Alps;
- Existing infrastructure for RE power plants (e.g. existing hydropower plants) can be used to feed in energy – from other RE sources in the electricity grid system. Also retrofitting of older, longer existing hydropower plants can be an option for a more sustainable energy generation;
- There are economic chances for the local and regional level including jobs & income using the indogeneus energy potential of the Alps.

Challenges:

- Storage of power from RES still needs technical innovations; connected energy grid systems are needed for an effective transfer within the Alps that particularly call for transborder cooperation;
- Preservation of environment: The RE power plants have to be planned in accordance with nature conservation and sustainable land use. A more holistic assessment is needed to plan new RE power plants in accordance with environmental regulations (e.g. EU Water Framework Directive).

2.1.3 Efficient use of energy

Energy efficiency describes the ratio of output of performance, service, goods or energy to the input of energy (EC 2012b, UBA Germany 2012).Energy efficiency has the potential to, but does not necessarily reduce energy consumption. A higher level of energy efficiency means to either consume less energy while maintaining the benefits, which we are used to (e.g. availability of lighting, heating, electric motors), or to achieve higher levels of services with comparably fewer energy input. Under certain circumstances so-called rebound effects can limit the saving effects of efficiency measures (financial savings due to reduced energy intensity leading to higher demand).

Background about efficient use of energy

Relation between energy efficiency and Green Economy

In the face of an increasing dependence on energy imports, scarce energy resources and the need to combat climate change, the EU has idenified energy efficiency to be an important approach to address these challenges (EC 2012b). Energy efficiency can contribute to a reduction of primary energy consumption, of energy imports and of GHG emissions (see chapter 2.1.1), thereby mitigating climate change cost-effectively. An energy-efficient economy is expected to accelerate the spread of innovative technological solutions and improve industrial competitiveness through innovation and cost-savings, boost economic growth and create high quality jobs in sectors related to energy efficiency.

On a macroeconomic level, energy efficiency can reduce final energy consumption costs, which for Germany range at 13.5% related to the GDP (BMWi 2014, p.5), and simultanously reduce the dependency on energy imports. At the level of individual enterprises, the return on investments in energy efficiency can be as high as 20-25% for small and medium sized companies (BMWi 2014, p.5), making these investments significantly more profitable than capital market investments. Additionally, energy efficiency can also be a viable marketing and image tool for enterprises.

Being the most energy intensive branches among the Alpine countries, industry, transport and the residential sector (UVEK & ARE 2015) will be specific targets of efforts to increase energy efficiency.

Benefits of energy efficiency

Several studies show the economic advantages of increasing energy efficiency. Figure 2.1.3-1 illustrates the multiple benefits of energy efficiency (IEA 2014a) that can be grouped in five key areas such as 1) macroeconomic development 2) public budgets; 3) health and well-being 4) industrial productivity and 5) energy delivery.

There is a particularly strong connection between energy efficiency and employment rate (see also chapter 2.4.1). According to a report of Cambridge Econometrics (2015) on assessing the **employment and social impact of energy efficiency,** around 900,000 people were employed in jobs related to the supply of energy efficient goods and services in 2010 in the EU. The results showed that the sectors “with the greatest level of energy efficiency jobs were those that produce, or are part of the supply chain for investment goods. This includes jobs in the manufacturing of the machinery and equipment that enables the production of energy efficient goods, as well as the energy efficient goods themselves”. Future scenarios showed that more jobs could be created in the manufacturing and installation of energy efficient products, in particular since it is a relatively labour intensive activity.

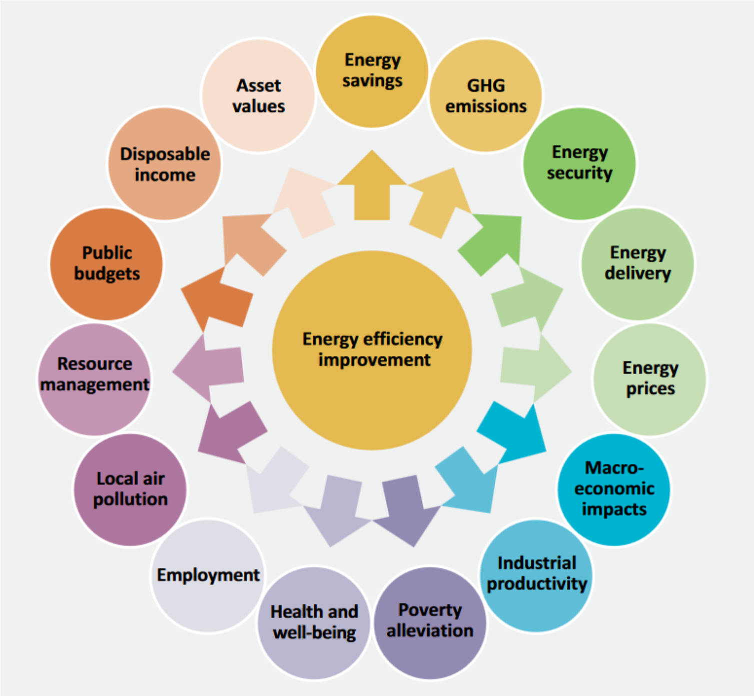


Figure 2.1.3-1 Key benefit areas derived from energy efficiency (Source: IEA 2014a, p.28).

The study also found that opportunities for new jobs are greatest in the buildings and transport sectors. Not at least the financial value of energy performance certificated buildings is 10-16 % higher than other non-certified ones.

Efforts for energy efficiency can potentially be jeopardised through the so-called rebound effect. The term describes the phenomena that efficiency savings are eaten up by increases in consumption. Efficiency gains of products and services make them more affordable, which in turn increases the level of their consumption also among businesses. Studies estimate that the rebound effect reduces technically feasible and projected savings by up to 25%, depending on the sector and specific circumstances (UBA Germany 2015b).

Different sources (e.g. Swiss Confederation et al. 2015) state that the energy consumption per capita is roughly 10% higher in the Alps compared to the European average. Against this background, it is particularly important to 1) reduce energy consumption as well as 2) focus on political strategies for increasing energy efficiency. Besides sufficiency and consistency strategies, energy efficiency policies are among the most effective tools for achieving energy conservation goals.

This chapter highlights the most relevant policies concerning targets for energy efficiency on the EU and Alpine level. The paragraph "Situation in Alpine countries" within this chapter illustrates national targets, while Table 3.1.1-1 in chapter 3.1.1 provides information on political strategies, action plans and directives in the field of energy efficient economy. More detailed policy background information of the Alpine countries is listed in the Annex (chapter 6.2.12).

European level

The EU **Energy Efficiency Directive** (EED) (2012/27/EU) of 4 December 2012 (EC 2012b) repealed both the Energy Service Directive (2006/32/EC) and the Combined Heat and Power (CHP) Directive (2004/8/EC). The EED establishes a common framework of measures for the promotion of energy efficiency within the European Union in order to ensure the achievement of the 2020 20% target on energy efficiency and to pave the way for further energy efficiency improvements beyond that date. In its energy efficiency target stipulating that energy consumption should not exceed 1,474 Mtoe primary energy consumption or 1,078 Mtoe of final energy consumption by 2020, the EU equalises energy efficiency with a reduction of energy consumption.

The Alpine countries have set ambitious targets towards the Europe 2020 strategy in their **National Energy Efficiency Action Plans NEEAP 2014.**

Table 2.1.3-1 illustrates target levels of energy consumption in 2020 (Mtoe) as reported by Member States in 2013, in the NEEAP 2014 or in a separate notification to the European Commission in 2015 as well as the projected energy demand.

Table 2.1.3-1 Topical targets on energy consumption (2020) as well as the predicted energy demand (2030, 2050) of the Alpine countries in Mtoe.

Country	Primary Energy Consumption target (Mtoe)[1]	Final energy consumption target (Mtoe)[1]	Final energy demand projection (Mtoe)[2]	
Year	**2020**	**2020**	**2030**	**2050**
Austria	31.5	25.1	27.0	27.2
Liechtenstein	6,200 Watt per inhabitant	0.11	0.014	no target value defined
Switzerland	*	*	14.4	10.8
Germany	276.6	194.3	187.2	176.9
Slovenia	7.3	5.1	5.6	5.7
France	219.9	131.4	147.9	150.9
Italy	158.0	124.0	122.3	126.4

(Source: [1] NEEAP targets of EC Europa, 2015, [2] EU Trends to 2050 Reference scenario, 2013) *In Switzerland the bill on Energy Strategy 2050 has not yet been passed by the National Council and the Council of the States. Sector specific energy efficiency targets of Switzerland are described in “Situation in Alpine countries”.

Alpine level

The **Energy Protocol of the Alpine Convention** (2005) aims to promote energy efficiency and the use of renewable energy sources in the Alps. Contracting parties pledge to harmonise energy planning, implement measures to reduce energy consumption, and to promote environmentally friendly, decentralised renewable energy provision.

Within the **Alpine Space programme**, several projects concerned with energy efficiency issues mostly with respect to buildings and sustainable architecture have been implemented (e.g AlpHouse, ENERBUILD, AlpBC).

The **EUSALP Action Plan** also addresses energy efficiency as part of Action 9 “To make the territory a model region for energy efficiency and renewable energy”. In the following textbox, some background information on the Alpine Building Conference (2016) is given.

Alpine Building Conference - Garmisch-Partenkirchen | March 16 –17, 2016

In March 2016, the first Alpine Building Conference "Towards Net Zero Energy Buildings (NZEB)"took place in Garmisch-Partenkirchen as part of Germany's presidency of the Alpine Convention. The exchange was organised by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) in cooperation with the Bavarian Chamber of Architects (Bayerische Architektenkammer ByAK) and the Technical University of Munich (TUM).

Topics addressed during the conference included not only new building design but also renovation projects with a special focus on

- *Net Zero Energy Buildings and Building Culture*
- *Strategies for Climate Responsive Neighbourhoods*
- *Sustainable Building Refurbishment*
- *Reinventing Alpine Communities*
- *Holistic Building Design and Certification Systems*

Conference discussions took into account the rich Alpine architectural culture and the environmental assets that have to be considered in the building plans.

There was great interest in continuing the exchange of experience in the field of zero-energy buildings and neighbourhoods, sustainable and energy-efficient construction, building culture and other related design topics.

Alpine relevance of energy efficiency

As outlined above, energy efficiency is generally a crucial approach for resource protection and economic competitiveness irrespective of territorial settings. Yet, there are mountain-specific aspects that make energy-efficiency all the more relevant in the Alpine area. Harsher climatic conditions result in increased heating requirements of Alpine households, tourist accomodations and businesses compared to the lowlands. Consequently, insulation and energy efficient building techniques have historically been particularly relevant in the Alps.

The Alps feature a disproportionately high share of uphill and downhill road sections. Consequently, the transport-related energy demand, but also energy demand for agricultural cultivation and forestry is higher than in the lowlands, making energy-efficient propulsion techniques particularly relevant for Alpine conditions.

Situation in Alpine countries

In the following part, we will present 1) the EU status, 2) the national status / trends of energy efficiency versus national objectives as well as 3) relevant sectors concerning the energy consumption in the Alpine countries.

Energy efficiency trends

Focusing on energy efficiency as a way of moderating energy demand delivers on the objectives of security of supply, competitiveness and sustainability, and results in cost savings for consumers and industry (EC 2015e).

Energy efficiency can be measured through energy intensity, namely the ratio between unit of energy and unit of GDP.

Figure 2.1.3-2 shows trends on the average annual change of energy intensity between 2005 and 2013 in the following five sectors in the EU countries of the Alps:

- Industry: average change of energy intensity in industry (%)
- Households: average annual change of final residential energy consumption per capita (%)
- Service: average annual change of energy intensity in the service sector (%)
- Transport: average annual change of total final energy consumption in the transport sector (%)
- Generation: average annual change of heat generation from CHP (Combined heat and power).

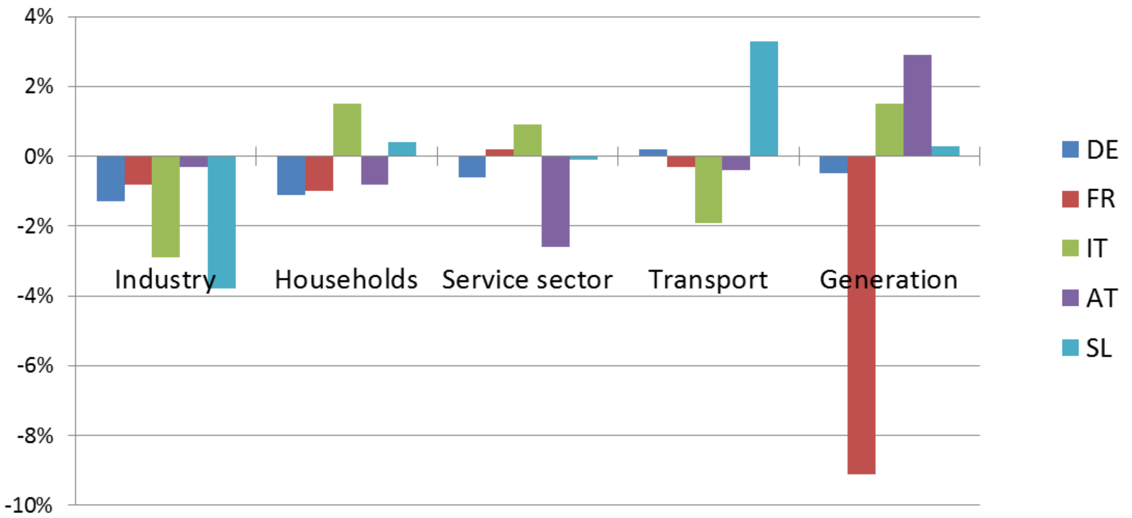


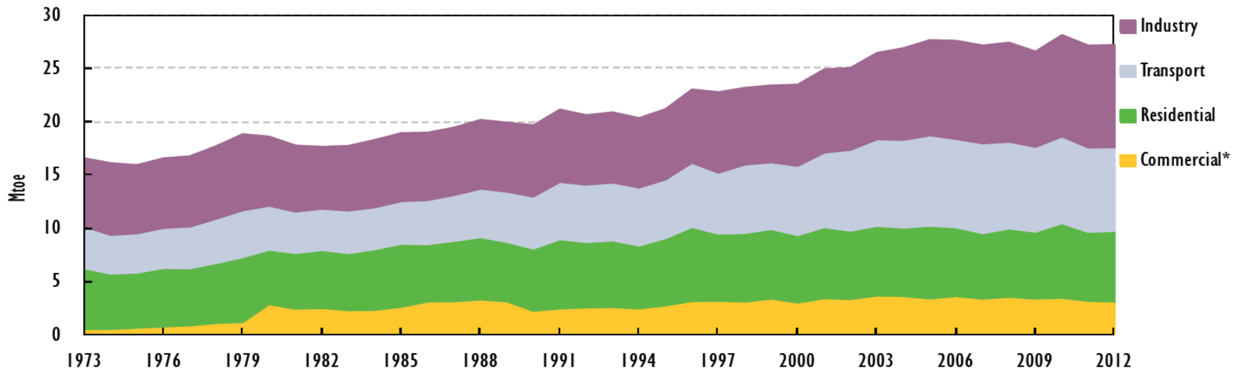
Figure 2.1.3-2 Average annual change of energy intensity indicators from 2005-2013 in different secors of the Alpine countries within the EU (data source:EC 2015e, graph: ifuplan 2016).

In summary, the average annual change of primary energy consumption (%) showed energy intensity is reduced (and therefore energy efficiency increased) in all considered countries from 2005-2013 (Germany -1.9%, Austria -1.6%, France -1.3%, Italy -1.2%, Slovenia -1.1%) (EC 2015e).

To measure national efforts, the EU target value of 20% increase in energy efficiency, measured in reduction of primary energy consumption, is broken down into an annual target path that illustrates annual desirable reductions between 2005 and 2020. In 2015, the EEA has assessed the progress made by member states towards these targets (EC 2015b, p.20). On a national level, the EU Alpine states Austria, Italy and Slovenia are on track by excelling the target values set for 2013, while France and Germany need to accelerate their primary energy reductions.

Austria

The Austrian Energy Strategy for 2020 has the target of stabilizing the yearly energy demand at 26 Mtoe (1,100 PJ). The predicted growth of the energy demand in a business as usual scenario should be prevented by energy efficiency measures.



* *Commercial* includes commercial and other services, agriculture, forestry and fishing.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2013; and country submission.

Figure 2.1.3-3 Final energy consumption trends (1973-2012) in Austria (Source: IEA 2014b).

According to the IEA report (2014b) on Austria´s energy efficiency, the industry sector is the largest consumer of energy, amounting to 9.6 Mtoe in 2012, or 35.4% of total final consumption (TFC). Energy use in this sector has increased by 24.6% since 2002, more than in any other sector of the economy. Transport is the second-highest consumer at 7.8 Mtoe or 28.7 % of the total. Energy consumption by the sector has increased by 3.6 % since 2002. Residential energy use accounts for 24.3 % of TFC, with the level of consumption increasing by 3.2% over the past decade. Commercial and public services represent 11.6 % of TFC, and consumption has decreased by 6.9 % since 2002 (IEA 2014b).

The purpose of the Austrian energy efficiency law is the implementation of the Energy Efficiency Regulation 2012/27/EU (EC) and the meeting of the 20-20-20 objectives from other EU regulations.

Germany

With the Energy Concept 2010, Germany sets its goal to obtain the greater part of the energy supply from renewables by the year 2050. The concept is a long-term strategy for renewable energy sources and reducing GHG emissions expanding the necessary transformation of the energy system by increasing energy-efficiency. The Energy Concept provides a comprehensive package containing policies for electricity, heating and the transportation sector. The aim of the Energy Concept 2010 was to make Germany one of the world's most energy efficient economies with affordable energy price levels. The most important targets set by the Energy Concept in Germany are listed in Table 2.1.3-2.

Table 2.1.3-2 Targets set by the Energy Concept in Germany (Source: BMWi 2016, p.88).

Year	Energy consumption and energy efficiency targets					
	Primary energy consumption[33] (vs. 2008)	Final energy productivity (2008-2050)	Gross electricity consumption[34] (vs. 2008)	Primary energy demand buildings (vs. 2008)	Heat demand buildings (vs. 2008)	Final energy consumption transport[35] (vs. 2005)
2014 (Achieved)	- 8.3 %	+ 1.6 % p.a. (2008-2014)	-4,2 %	-14.8 %	-12.4 %	1.1 %
2020	-20 %		-10 %		-20 %	-10 %
2030						
2040						
2050	-50 %	Increase by 2.1 % p.a.	-25 %	Around 80 %		-40 %

The process of reorganising the energy supply system needed to be accelerated by a comprehensive package of legislation, the energy package 2011, the so-called "Energiewende" resolution.

In 2014, the Federal Ministry for Economic Affairs and Energy has assessed energy efficiency and measures in the National Action Plan Energy Efficiency (NAPE)(BMWi 2014). According to the NAPE (BMWi 2014, p.19f), the current national energy efficiency strategy focusses on:

- Energy efficiency in the building sector;
- Energy saving as yield and business model – setting new incentives for energy services and efficiency technologies;
- Individual responsibility for energy efficiency;
- Measures in the transport sector.

According to the IEA report (2013), energy efficiency in Germany increased by 19% since 2000. Since 2012, the federal government constructs only ultra-low energy buildings for the public sector according to a new sustainable construction certification scheme (Bewertungssystem Nachhaltiges Bauen, BNB).

Germany's total final consumption (TFC) of energy was 221 Mtoe in 2011, which is 3.9% lower compared to the previous year and 2.1% higher than in 2009. Final consumption of energy has also been in modest decline over the past three decades, falling by 4.5% since 2000 (IEA 2013).

Figure 2.1.3-4 illutrates that Germany has made progress towards meeting the energy efficieny target 2020, but currently ranges slightly above the primary energy linear target path 2005-2020.

[33]Further information: http://www.ag-energiebilanzen.de/7-0-Bilanzen-1990-2014.html.

[34] Further information: www.ag-energiebilanzen.de/index.php?article_id=29&fileName=20160128_brd_stromerzeugung1990-2015.pdf.

[35] Further information: http://www.ag-energiebilanzen.de/7-0-Bilanzen-1990-2014.html.

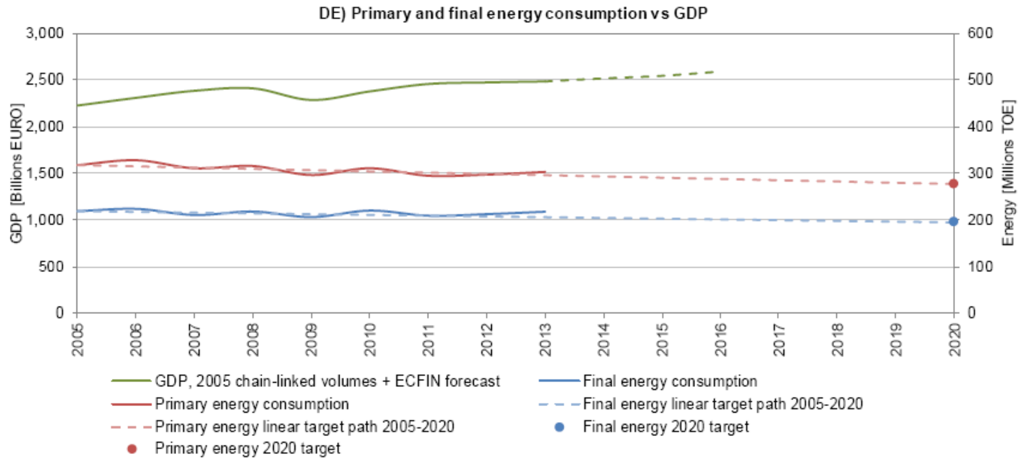


Figure 2.1.3-4 Primary and final energy consumption vs. GDP for Germany (Source: EC 2015b, p.53).

The final energy consumption in Bavaria has increased across all sectors from 1,369 PJ in 2010 to 1,438 PJ in 2014 (Figure 2.1.3-45), with transport, households and industry being the most important sectors. Per resident, the primary energy consumption has more or less been stable , ranging from 163 GJ (Gigajoule) in 2010 to 161 GJ in 2014. The index for primary energy productivity, measuring gross national product in relation to primary energy consumption, has reached 129 in 2014 in regard to the baseline of 100 set for 2000 (StmWi 2016, p.6).

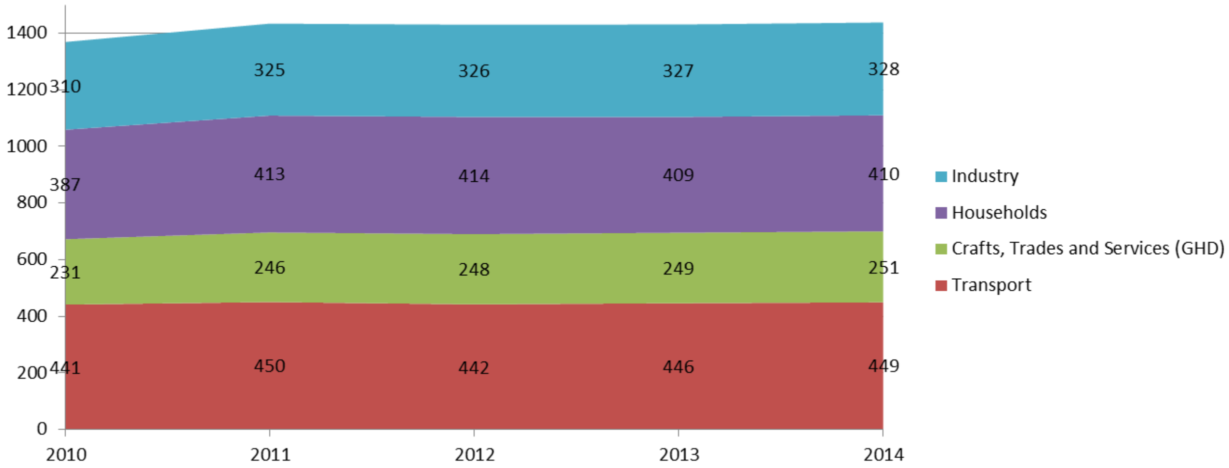


Figure 2.1.3-5 Final energy consumption in Bavaria 2010-2014 in PJ (Data source: StmWi 2016, p.65, graph: ifuplan 2016)

Italy

In its National Energy Efficiency Action Plan (NEEAP 2007), Italy is required to demonstrate to the European Commission how the Government intends to reach its indicative 9.6% energy savings target by 2016. The Plan takes into account measures already adopted under Law no. 296/2006 and other measures already implemented in 2006 and 2007. The plan addresses industrial, residential, tertiary and transport sectors.

Liechtenstein

The EU formula of the Energy Strategy 2020 reads "20-20-20". According to this Liechtenstein wants to achieve by 2020 the following targets:

- 20% increase in energy efficiency for consumption stabilization;

- 20% domestic, renewable energy;
- 20% fewer greenhouse gases compared to 1990 levels.

The Energy Strategy 2020 includes six areas of action, each with a set of measures. The fields of action cover the areas of buildings, mobility, processes and equipment, energy generation and procurement, awareness raising and development of decision-making.

The successes of the Energy Strategy 2020 to date are impressive: through the promotion of renewable energy and energy efficiency measures approximately 6 million liters of fuel oil and 12,000 tonnes of CO_2 are saved annually.

Slovenia

The Action Plan for Energy Efficiency for the period 2014 - 2020 (NEEAP 2020), adopted in May 2015 in accordance with the requirements of the Energy Efficiency Directive (2012/27/EU), raises the national objective of improving the energy efficiency by 20% by 2020. The absolute target is that primary energy consumption in 2020 will not exceed 7,125 Mtoe (82.86 TWh). Slovenia has not yet established a medium to long-term strategy for climate and energy covering the post-2020 period.

Figure 2.1.3-6 presents the primary and final energy consumption trends of Slovenia until 2013, including the targets until 2020 defined by the Operational Programme. When comparing the trend of primary energy consumption with the GDP development over the past decades, it can be seen that decoupling has not taken place. Even if Slovenia's current primary energy consumption (6.7 Mtoe in 2013) is slightly below its 2020 target, additional efforts regarding energy efficiency seem needed to keep the primary energy consumption at this level or to minimise its increase if the GDP increases again during the next five year period (EC 2015c).

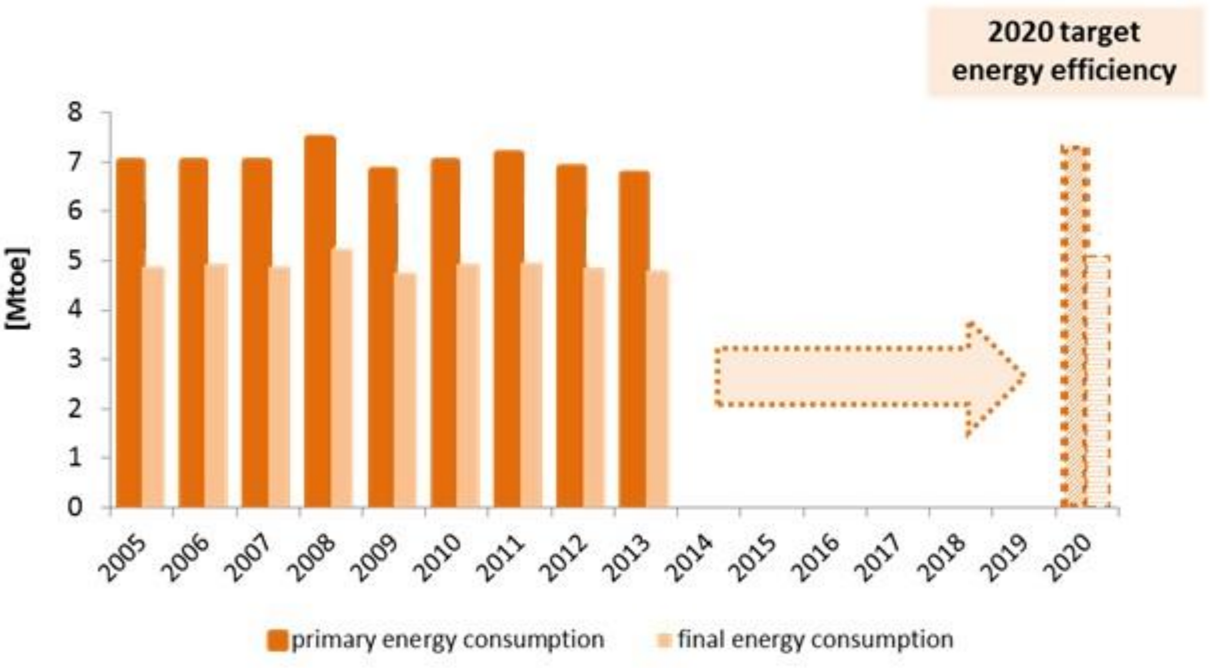


Figure 2.1.3-6 Primary and final energy consumption trends of Slovenia with its target until 2020 (Source: EC 2015c).

Slovenia is allowed to increase primary energy consumption by 4.5% relative to 2005, while in the EU overall primary energy consumption should be reduced by 13.2%. The majority of EU countries are on track to meet the 20% target, partly of the deteriorated economic conditions. To reach the targeted savings, Slovenia should not increase primary energy consumption by more than 9.1% in 2014–2020, while the EU as a whole should reduce it by 5.3%. In the last few years, energy intensity in Slovenia deteriorated significantly compared with the EU average, as it was falling more slowly than in the EU.

Approximately until the middle of the previous decade, energy intensity in Slovenia had converged towards the EU average, exceeding it only by 15%, while in the few years that followed it was moving away from the EU average and was a quarter higher in 2013 (Table 2.1.3-3).

	2005	2007	2008	2009	2010	2011	2012	2013	2020 target*
Slovenia	100.0	100.1	106.5	97.3	100.0	102.0	98.1	95.7	104.2
EU	100.0	98.7	98.7	93.2	96.6	93.3	92.5	91.7	86.6

Source: Eurostat Portal Page – Europe 2020 indicators, 2014; EC Energy Efficiency, Reporting targets; calculations by IMAD.
Note: * One of the three 20-20-20 environmental targets of the EU.

Table 2.1.3-3 Primary energy consumption, fixed base data index 2005=100 (Source: EUROSTAT 2014, p.197).

Regarding final energy consumption, Slovenia stands out particularly in the large share of energy consumption in transport (see Figure 2.1.3-7). In 2005–2013, final energy consumption was falling by 0.3% per year in Slovenia; the decline in the EU overall was much larger (0.9% per year). Energy consumed by industry was falling faster (by 1.7 % points), but this improvement was offset by a concurrent increase in energy used for transport (by 2.8% per year) which is mainly attributable to increasing freight transit through Slovenia.

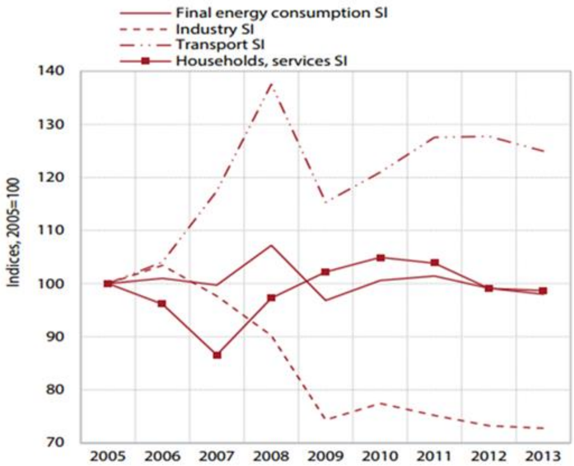


Figure 2.1.3-7 Final energy consumption by consumer sector in Slovenia
(Source: EUROSTAT 2014, p.197; calculations Institute of the Macroeconomic Analysis and Development).

<u>Switzerland</u>

The Swiss Federal Office of Energy SFOE has drafted an Action Plan for Energy Efficiency. The Action Plan sets forth that the use of energy in buildings, by cars and devices, and under the condition of availability of new technologies, can be reduced by 30 to 70% in various areas of use. Until 2020, the following targets are set:

- Reduction of use of fossil fuel energy by 20% between 2010 and 2020;
- Maximum 5% of increase in use of electricity between 2010 and 2020 while aiming at its constant reduction from 2015 onwards;
- Following a "Best Practice Strategy" in cases of buildings, vehicles, devices and industrial processes. Appropriate investors, buyers and operators are to receive incentives to increase energy efficiency.

The total of final energy consumption in Switzerland 2014 decreased by 7.7% in comparison to year 2013. This change is partly connected to warm weather in the 2014 winter season. Compared to the year 2000, the final energy consumption decreased by 2.5%.

In Switzerland, mobility is one of the biggest areas of energy consumption. At present, it accounts for around one-third of end energy consumption with a rising tendency. It also accounts for the largest proportion (48%, including air transport) of CO_2 emissions.

Referring to the construction sector at present, approximately 50% of Switzerland's primary energy consumption is attributable to buildings: 30% for heating, air-conditioning and hot water, 14% for electricity and around 6% for construction and maintenance. Economically speaking, it is essential to continue exploiting the still considerable efficiency potentials in the area of buildings, which is also a major consumer of material resources, generates high levels of waste and makes a significant contribution towards the pollution of the environment.

As for fossil fuel consumption between 2000 and 2014, there has been a decrease in each sector, except for transport. The decrease in households was as high as 7.3%, industry -2.4% and services -4.9%, while the increase in the transport sector was 2.8%. Table 2.1.3-4 below shows the numbers and the percentage changes.

	2000	2008	2009	2010	2011	2012	2013	2014	Δ '00 – '14
Haushalte	236.3	247.8	245.7	264.9	225.7	244.3	259.0	219.0	-7.3%
Industrie	160.7	171.3	161.1	168.5	162.2	163.1	164.5	156.9	-2.4%
Dienstleistungen	137.6	144.6	142.6	151.8	135.4	143.5	149.8	130.8	-4.9%
Verkehr	303.3	312.2	306.4	308.4	309.6	313.0	312.7	311.7	+2.8%
Statistische Differenz inkl. LWT	9.2	9.4	9.3	8.9	9.4	9.3	9.1	7.4	-19.5%
Total Endenergieverbrauch	847.0	885.2	865.0	902.5	842.3	873.2	894.9	825.8	-2.5%

Table 2.1.3-4 Fossil fuel consumption according to different sectors in Switzerland from 2000 – 2014 (Source: BFE 2015).

Additionally, it was calculated how much policy and technological advancement contributed to the changes in energy consumption and to a more rational use of energy. Included in this assessment are various instruments and construction solutions towards improved heat insulation, as well as the use of more efficient electrical appliances, heating systems, production facilities, machines, motors, vehicles and others. Except for the case of diesel oils, applied measures of policy and technology had a decreasing effect, which can be ascribed to improvements in heat insulation and more efficient heating systems. The cause of the increase in consumption of diesel oil is the change of rules in freight transport,which raised the weight limit from 28 to 34 tonnes and contributed to more frequent use of heavy goods vehicles.

Technology and policy strongly influenced the use of petroleum fuels (mainly heating oil), as well as the consumption of electricity, gas and gasoline.

Figure 2.1.3-8 below shows yearly savings between 2000 and 2014 ascribed to technological development and applied policies on the use of different energy sources.

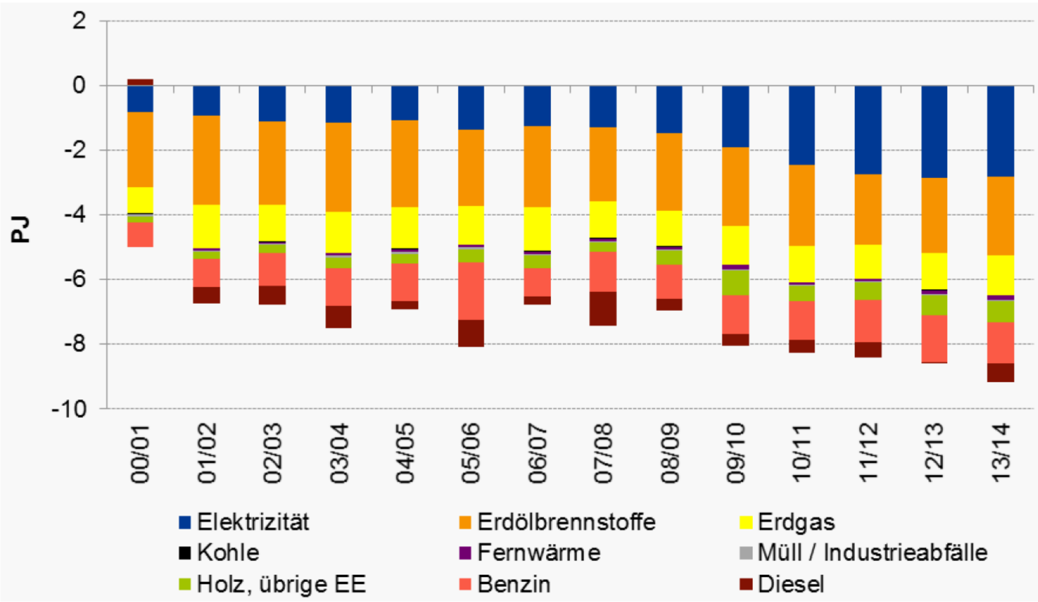


Figure 2.1.3-8 Yearly energy savings in Switzerland between 2000 and 2014 in PJ (Source: BFE 2015).

Good practice – BIOCASA – Zero Consumption Bio Building in Clusone and Desenzano del Garda, Italy

The BIOCASA project started in 2005 aiming at building houses with low energy impacts (efficiency), low carbon emissions and reduced energy costs. As a member of GBCItalia (association introducing new sustainable building standards), the cooperative FILCA (which started BIOCASA) accepted Leadership in Energy and Environmental Design (LEED) certification standards and implemented them in new construction. The main features of a BIOCASA building are as follows 1) Site sustainability 2) Reduction of energy consumption 3) Human well-being and safety 4) Materials and resource management 5) Asssessment of bioclimatic quality of buildings.

The main results of the projects are:

- Reduction of energy consumption of around 70-80% in comparison with older buildings (before 2007-2008);

- An energy class A, BIOCASApiù building with 90 square meters has an annual cost for heating between € 300 and 350, compared to € 1,500/1,800s average cost for current housing sector energy standards;

- Expected real estate value increase of 16-22%;

- Establishment of the labels BIOCASApiùFilca (Energy class A Buildings), BIOCASA Filca (class B) and BIOCASA A+ Filca Consumo Zero – Qualità Certificata e Assicurata.

Further information: http://www.filca.it/BIOCASAFILCA/marchiobiocasa/index.html

Conclusions on opportunities and challenges

Status conclusions

- Targets towards energy efficiency: The target of a 20 %increase in energy efficiency by 2020 set forth in the EU Energy Efficiency Directive is an ambitious goal for the Alpine countries.
- Efforts to boost energy efficiency in the Alpine countries are having a positive effect on reducing primary energy consumption. However, not all countries are meeting the target path and the continuing growth in energy demand and consumption poses big challenges for environmentally friendly, low carbon and more efficient technologies.
- Primary energy consumption is still closely related to economic cycles. Decoupling economic growth from resource consumption remains a challenge among Alpine countries.
- Energy efficiency can result either in an absolute reduction of energy consumption or in a reduction of energy consumption in relation to productivity. In addition, the reduction of CO_2 emissions is strongly connected to energy efficiency.
- Political approaches of the Alpine countries include the setting of targets to promote energy efficiency. The housing and transport sector, but also production processes and the service sector are identified as action fields.

<u>Opportunities:</u>

- The benefits of energy efficiency include e.g. a more sustainable energy system, a support for strategic objectives of economic and social development and the promotion of environmental goals, profitability and cost-savings. Moreover, studies suggest a strong link between energy efficiency and employment rate that brings economic benefits.
- Higher energy efficiency increases competitiveness in various aspect:
    - Economic advantages due to cost savings;
    - Economic opportunities as leader in energy efficiency and innovative solutions.

<u>Challenges:</u>

- Improving energy efficiency may save less energy than expected due to changes of energy use consumption patterns. This so-called rebound effect has to be considered and addressed when talking about energy efficiency within the framework of GE.
- Efforts in reducing carbon emissions from the combustion of fossil fuels may be thwarted by increased economic activities; therefore, carbon emissions targets should be related to the productivity of economic sectors (CO_2 productivity). Furthermore, when replacing old technology with more efficient one, life-cycle issues such as upstream-downstream effects need to be considered (energy efficiency vs. resource efficiency).
- Ecological challenges: From the ecological point of view, there is a risk that the constant or growing energy consumption from renewable energies results in a higher and ecologically not desirable land take for power generation facilities. Consequently, efforts towards energy savings as well as energy efficiency are essential within the framework of an energy transformation in the Alps and, therefore, have important implications for the future of our society.
  Despite successes in decoupling economic growth and energy consumption, additional efforts are needed to reach ambitious primary energy demand reduction goals. Energy efficiency can contribute to sustainable development, particularly if it contributes to a reduction of the total energy demand.

2.2 Resource efficient economy

A resource efficient economy is an essential brick for paving the way for a Green Economy in the Alpine region. Using natural resources – renewable or non-renewable – is the basis for economic activities in all sectors from agriculture and industry to the service sectors and for all branches. The term resource efficient economy means to put society's demands on nature (in terms of resource extraction, pollutant emissions and ecosystem pressures) in relation to the returns generated (such as economic output or improved living standards) (EEA 2015k), or in other words to increase the returns without increasing the input, but it does not automatically mean a decrease of the total resource input. On a global scale, the use of all natural resources from biotic to non-biotic raw material, water, air, soil, land and biosphere increased over the last decades in an unsustainable way, accompanied by severe negative impacts on environment and human well-being. The conventional patterns of resource use are leading toresource scarcity of some non-renewable resources and overuse of some renewable resources. The Alpine economy is dependent on resource imports from other world regions, which shifts the environmental and social impacts of resource exploration and extraction to distant countries – not in each case a fair share of burdens. Increasing resource efficiency and circular economy will help to reduce environmental pressure not only in Europe and will lead to lowering material purchasing costs. It thus enhances competitiveness and offers opportunities to innovate.

From the view of ecological economics it has become increasingly clear, that beyond the idea of efficiency (more with less), it is necessary to see the economy embedded in a world of limited ecological resources.

As described in the EU Factsheet “Resource efficiency – a business imperative” (EC 2011c), resource efficient economy comprises a broad range: “It is an overarching idea that applies to all natural resources from food, timber and biodiversity to metals, soil, water, minerals, the atmosphere and land.” It does not matter whether resources are used as source for production and consumption or as a sink for pollution. As not all aspects can be presented here, this chapter will concentrate on:

(1) Efficient use of non-energy resources,

(2) Land use changes and

(3) Circular economy, recycling and waste management.

Efficient use of energy resources is presented in Chapter 2.1.3 and, therefore, excluded here. The aspects of ecosystem services / natural capital based services which are part of the EU resource efficiency concept are presented in Chapter 2.3 and consumers’ role and human well-being are described in Chapter 2.4.3.

2.2.1 Efficient use of non-energy resources

An increase in resource efficiency is relieving the environment and reducing production costs. The Alpine region is rich in natural resources, such as biodiversity, water, and forests. However, the Alpine countries are importing many resources for their national industries, or in the form of final products. Therefore, the following approach is used to analyse the state of the economy in the Alpine region in terms of resource efficiency. First, we look at material use in the national economies of the Alpine region. Second, we analyse relevant resource efficiency aspects of two Alpine specific natural resources, namely water and forests. Finally, we will present sector specific approaches by using good practice examples on resource efficiency of different Alpine industry sectors.

Background

Resource efficiency is a strategic priority of the Europe 2020 Strategy, which addresses a wide spectrum of important economic and environmental concerns. However, no targets have yet been adopted for resource use or resource efficiency at a European level. The European Commission proposed the adoption of a resource-productivity target, and it is hoped that this would provide an impetus for countries to also adopt targets. At present, only a few individual countries (e.g. Austria and Germany) have concrete and measurable targets accompanied by a deadline (EEA 2015c, 2015j)

One main benefit of resource efficient measures in the private sector is to reduce costs and, therefore, support competitiveness of companies. Schmidt & Schneider (2010) elaborated 569 potential analysis of energy efficiency measures in German companies and identified saving opportunities of 2.1 % of turnover in average. According to this study, the highest saving potentials are located in small companies, amounting to 5 % of annual turnover. More than half of proposed measures considered in this study could be realized with investments less than € 10.000 and with a payback period of less than 6 months. Even though this study only analysed the situation in a selection of German companies, similar results could be expected from other Alpine countries.

The transformation to a resource efficient economy is generally characterised by an increase in resource productivity and an absolute reduction of material input. One of the approaches to measure resource productivity is gross domestic product (GDP) divided by domestic material consumption (DMC). Since these indicators are available on national level only, no statement on the Alpine region itself can be formulated.

DMC per capita in the Alpine countries varies from 8.8 to 21 tonnes in 2014. During 2005 and 2014 the absolute DMC had been decreasing in almost all Alpine countries except for Germany and Switzerland. The largest reduction has been achieved in Italy and Slovenia. For resource productivity the Alpine countries achieved values from 1.7 to 3.7 in the Purchasing Power Standard (PPS) per kg in 2014. In relation to these figures, Switzerland and Italy achieved the highest values for resource productivity among the Alpine countries in 2014. However, a direct comparison is difficult, since the industry structures of the Alpine countries differ a lot. In fact, countries with a large service sector register higher resource productivities. Noteworthy, too, is the change of resource productivity in the last decade (2005-2014). All Alpine countries have increased their resource productivity in this timeframe. Slovenia and Italy actually have increased their resource productivity more than 50%. Therefore, in all Alpine countries material demand has been decoupled from economic growth during the period under consideration. (cf.Table 2.2.1-1)

Table 2.2.1-1 Domestic material consumption in Alpine countries (in tonnes per capita), 2014. (Data source: EUROSTAT 2015f, FSO 2016)

Country	DMC in t per capita 2014	GDP/DMC in PPS per kg 2014	Change of DMC in % 2005-2014	Change of GDP/DMC in % 2005-2014
Austria	21.0	1.7	-8.9	22.1
France	12.0	2.5	-7.5	15.9
Germany	16.2	2.1	1.0	11.6
Italy	8.8	3.0	-38.3	52.7
Liechtenstein	-	-	-	-
Slovenia	12.2	1.8	-31.7	59.1
Switzerland	12	3.7*	2.5*	12.0*

*Latest data 2012.

Since DMC only includes physical imports and exports of materials, it lacks to account for the resources used to produce traded goods. Other approaches to measure resource productivity, such as raw material consumption (RMC), rely on footprint indicators: they work with raw material equivalents, estimating the amount of raw materials needed to produce a traded good. The Swiss Federal Statistical Office has some advanced experiences with this kind of indicators (FSO 2016), whereas for the other mentioned Alpine countries, RMC exist on EU level only. Moreover, the extraction and processing of raw materials has an impact on the environment (e.g. CO2 emissions), too. For an Alpine specific analysis, more research on regional indicators is needed.

Alpine relevance of the efficient use of resources / Situation in the Alps

Water

Water resources are an important topic for the Alpine region. The Alps are the so-called "water towers" of Europe, as they provide continuous runoff to the forelands. Alpine water resources are rivers, lakes, wetlands, groundwater bodies, glaciers and precipitations. Major European rivers, for example the rivers Danube, Rhine, Po and Rhone, have their headwaters in the mountains and their discharge is transported via river systems to lower-lying areas providing essential freshwater resource. Therefore, Alpine water resources are used inside and outside the Alps for different purposes from water supply for all economic sectors and branches (inclusive energy supply and agriculture) to public water supply. The following paragraph from the Report of the European Environment Agency "Regional climate change and adaptation - The Alps facing the challenge of changing water resources" gives a comprehensive explanation of the importance of the resource water in the Alpine region and beyond:

"Since the hydrological cycle of the Alps is influenced by meteorological and climatic processes, by topography and by the anthropogenic use of water, it is closely related to any changes in those parameters. Thus, the Alps as 'water towers' are extremely sensitive and vulnerable to various impacts including climate change. Due to global warming, changes in precipitation regimes, snow cover patterns and glacier storage will alter the water availability. Most relevant conflicts in consequence of water-supply shortages can be expected at a local level in the south‑eastern and south‑western climatic sub‑regions. In the future, lowlands dependent on water resources from the Alps may also face problems in both quantity and quality aspects. Potential conflicts have to be reviewed continuously and critically, and adapted to improved models of prognosis." (EEA 2009, p. 30)

An indicator to describe the efficient use of the resource water is the water exploitation index (WEI). As there are no regional data, the WEI is available on national level and by river basin only. Calculations of the EEA (2009) show for all Alpine countries, that in 2009 less water is used compared to 1990, and the registered WEIs are below warning thresholds (except Italy, where no data are available for 1990). However, as these data are on national level and averaged over one entire year, it does not reflect regional or seasonal water scarcity mainly in summer. Climate change may lead to regional and seasonal water scarcity also within the Alps and in the lowlands depending on water from the Alps.

The second Report on the State of the Alps addressed the challenges, which the Alpine region is facing regarding the efficient use of water resources. "[…] [The sources used for writing the report] clearly reveal the existence of problems occurring at local level in the Alpine Region, leading to conflicts among water users and to negative ecological impacts. The reasons for this may be quite diverse, covering the full range of water abstraction - from irrigation purposes, the production of artificial snow, drinking water supply in times of touristic high seasons paired with natural low water availability in winter or periods of occasional droughts in summer. This is particularly relevant in the Southern part of the Alps, also as a consequence of climate change." (PSAC 2009, p. 49) Some water pollution problems through industries, intensive land use and agriculture are reported for the outskirts of the Alpine region (ibid).

The Alpine Convention (PSAC 2010) itself covers water management in Article 2(2)e: "the objective is to preserve or re-establish healthy water systems, in particular by keeping lakes and rivers free of pollution, by applying natural hydraulic engineering techniques and by using water power, which serves the interests of both the indigenous population and the environment alike". For the continuous improvement and implementation of adequate water management systems in the Alpine region, the Water Management Platform of the Alpine Convention has been established.

Forests[36]

Wood is another relevant resource for the greening of the Alpine region. It is renewable, totally recyclable, produced locally, and the work process consumes less energy in comparison with other materials (metals, concrete). It can be used to substitute fossil fuel, contributing to a transition towards a low carbon emission economy.

The concept of sustainable use of forests has been developed in German forestry (H. C. von Carlowitz 1713) to grant continuous provision of wood to the mining industry. The concept has evolved in the 19th century in the Alpine area to consider also soil protection and flood prevention, linked to forest cover and its quality (C. Thiery in France, A. von Seckendorff in Austria). In the 20th century, clean water provision, biodiversity conservation, and finally carbon storage were integrated in a new broad view of sustainable forest management. Forest management in Alpine countries is further presented in chapter 2.3.1.

Non managed forests, while useful to monitor natural development, at a larger scale and in the medium run not only fail to provide wood (needed in a Green Economy) but also reduce the provision of other ecosystem services: CO_2 sequestration (decomposition of wood releases it), soil protection and recreation; landscape and biodiversity are reduced by a simplified and more homogeneous environment.

To address the important role of mountain forests the Alpine countries have agreed on a protocol of the Alpine Convention aiming at mountain forests and a working group has been established.

Sector specific considerations

Relevant, resource intensive industry sectors in the Alpine region are the agricultural sector (including food processing), the tourism sector and the construction sector. The European Commission states that a "[b]etter construction and use of buildings in the EU would influence 42% of our final energy

[36] Extract from a contribution of the Working Group Mountain Forests of the Alpine Convention (Working Group Mountain Forests of the Alpine Convention 2016). All reported data are taken from the report on the state of the Alpine forests presented to the Permanent Committee by the WG 2014 (PSAC 2014).

consumption, about 35% of our greenhouse gas emissions and more than 50% of all extracted materials; (EC 2011d). The following two good-practice examples provide a glimpse on the potential for resource efficiency in the construction and the food sector. The first shows how non-renewable construction materials can be substituted by wood, and simultaneously achieve a reduction of energy consumption. The second example gives some insights into the Milky Way project, which aims to optimize milk use in the dairy production in Italy.

Good practice– High up with wood – the first 8-storey wooden building in Central Europe in Rosenheim, Germany

Built on a former military brownfield on what has been named "Nullenergiestadt" (Zero-Energy-City), the project is the first 8-storey high-rise building made of wood.

Wood as building material is highly resource-efficient as it is a renewable raw material and at the same time a sink for carbon dioxide during its use as building material. From a life-cycle-assessment perspective, it by far out-competes other building materials such as concrete or steel, due to low energy-intensity during harvesting and processing, high insulation values, and at the end of the life cycle, it can be used for biomass energy production and leaves no waste.

Moreover, the project is based on four guiding principles, which are:

- Sustainable, CO2-free energy, decentralized and self-sufficient supply,

- Innovative, low-energy timber construction,

- Living and working in the same location,

- Varying standards of modernisation as examples of housing industry requirements.

Further information: http://www.detail.de/artikel/vorgefertigtes-bauen-mit-holz-8765/

Good practice - MILKY WAY: eco-innovative real-milk classification technology for optimized milk use, Italy

The project aims at promoting a new environmentally friendly breakthrough solution contributing to the reduction of the environmental impact deriving from dairy production. In areas with a high concentration of milk production, as the Alpine region, there is a larger risk of nitrogen water pollution. The new solution is based on real-time classification of milk (without any type of manipulation). Main results:

- *Reduced amount of milk employed in the dairy production process;*
- *Milk efficiency improvement and high quality cheese with enhanced nutrient properties;*
- *Improvement of dairy production and yields (up to 15%);*
- *Facilitate the milk supply chain, important savings in operational costs for dairy farming, optimization and higher value to milk processors and premium prices to farmers.*

Further information: http://www.milkyway.bio/

Tourism[37]

[37] Contribution from the Working Group Sustainable Tourism of the Alpine Convention: Analysis of the role of sustainable Alpine tourism in green economy.

The tourism sector is a good example for an industry, which depends heavily on resources provided by the Alpine region. In many regions of the Alpine area, especially in the more central and mountainous areas, tourism is a key economic sector. From a global perspective, the Alpine area is one of the few touristic hot spots. Tourism often contributes with more than 20% to the regional domestic product. In some valleys, the share is higher than half of the total economy. Also in the surrounding foothill areas it takes an important role in touristic municipalities even though on the regional level its importance often is not dominant anymore. Due to the importance of the tourism sector for the Alpine region, it can take an important role for the development of a green Alpine economy.

The need of resources in the tourism economy can be analysed based on the touristic process chain (see below). We consider energy as a resource to the production process even if it is obvious that the actual natural resources used in the background (renewable or non-renewable energy sources) can vary. Furthermore, waste shall also get listed, as waste management needs resources itself on the one side. But on the other side, it also can be part of a circular economy. Table 2.2.1-2 shows the most important resources by each step.

Table 2.2.1-2 Touristic process chain.

Step	Needed resources
Information and booking	Energy (IT), paper (e.g. catalogues)
Transport to destination	Energy, land and material (infrastructure)
Accommodation	Land (settlement), energy, water, waste
Food & beverage	Energy (transport), land/soil (in case of regional cultivation/ production), water, waste
Inner destination mobility	Energy, land and material (infrastructure)
Outdoor sports activities	Energy, land and material (infrastructure), waste, water
Health and spa activities	Energy, land and material (infrastructure), water, waste
Culture / events	Energy, land and material (infrastructure), waste, water
Transport from destination	See transport to destination
Remembering	See information and booking

Developing resource efficient tourism concepts therefore mainly has to do with

1. Reduction of printed advertising material, use of high share recycled paper;
2. Energy efficient and renewable energy based transport to and from destination, improve information on travel directions and local mobility offer;
3. Development of new / renewed accommodation by focusing on re-use and improvement of existing structures and redensification of properties;
4. Energy, water and waste management as well as use of regional resources in accommodation, boarding and other large-scale indoor infrastructure;
5. Offering resource efficient public transport within destinations as well as individual mobility concepts based on renewable energy and convincing consumers to use them;

6. Improvement of outdoor facilities within existing infrastructure and already used areas focusing on quality as well as resource efficiency;
7. In general: increasing the share of regional circular economy by the tourism sector.

The most important instruments for an (step-by-step) implementation of a resource efficient Alpine tourism can be structured by stakeholders and by the level they are acting on. First, the stakeholder group of the guests has to be seen. Even if an increasing part of guests is aware of the interdependencies of their behaviour and used resources, only competitive products covering the needs and expectations of the guests are attractive. Therefore, the challenge is to combine a comparative advantage (service, unique experiences) for the guests and resource efficiency (as a basis for that advantage) by innovative products. But innovation and improvement of resource efficiency takes place on the level of the entrepreneurs. The economic benefits out of resource efficiency are the main argument for turning their business into a more resource efficient one. Moreover, the rising demand for sustainable tourism has to be satisfied by increasing certified sustainable tourism supply in the Alpine region. This underlines the role of umbrella associations of destination management organization, hotel and restaurant owners or ropeway company associations. They can offer training, consultancy, labels or awards and take a leadership role for turning their business towards opportunities for Green Economy. Local authorities and regions mainly can contribute by a better guidance in the field of regional and settlement planning, strategic development plans, improving their waste management and public transport system as well as fostering pilot actions supporting a regional circular economy approach in tourism.

A sustainable Alpine tourism integrates the use of local products and of renewable energy in the hotel and catering industry and in leisure facilities. In addition, regional economic cycles can benefit from increased sustainable tourism concepts, e.g. by linking local tourism businesses and local organic farms.

Conclusions on opportunities and challenges

For a comprehensive picture, the data availability for resource efficiency at the regional level needs to be improved. Therefore, this chapter concentrates mainly on two Alpine specific resources, namely water and wood. In general, all Alpine countries increased their resource productivity from 2005-2014. In the same timeframe, absolute domestic material consumption has been decreasing in almost all Alpine countries.

One especially relevant resource in the Alpine region is water. Climate change exacerbates existing water challenges, due to more likely regional and seasonal water scarcity within the Alps and in the lowlands. This increases the need for a sustainable Alpine water management and climate change adaptation measures. Occasional local conflicts among water users and negative ecological may concern the full range of water uses - from irrigation purposes, the production of artificial snow, and drinking water supply in times of touristic high seasons to natural low water availability in winter or periods of occasional droughts in summer. In the southern part of the Alps, this needs special consideration, also because of climate change.

The second resource with special relevance for the Alpine region is wood. A more sustainable forest management can improve the production of wood due to a higher wood mobilisation, and create increasing supply of other ecosystem services, such as CO_2 sequestration, soil protection, natural hazard protection, recreation, landscape and biodiversity. Room for increased wood mobilisation has been identified especially in the southern part of the Alpine region. Moreover, wood can be used as an alternative renewable resource, e.g. in the construction sector.

Businesses can benefit from resource efficiency in at least two ways: a reduction of input costs, which makes them more competitive and by reducing their ecological footprints, thus acknowledging their corporate responsibility. Therefore, a continuous increase in resource efficiency will make specific sectors of Alpine economy not only more green but also more competitive. Business solutions to increase resource efficiency contain technological innovations, the increased use of renewable resources and materials, as well as sustainable management concepts.

2.2.2 Land use changes

Across Europe, artificial surfaces respectively settlement and infrastructure areas are increasing steadily, mainly at the expense of agricultural areas and, to a lesser extent of forests and other (semi-) natural areas. This process is more or less irreversible, developed areas are no longer available for agriculture, forestry and other non-urban land uses. The type of land use has fundamental consequences for the environment, especially on landscape aesthetics, biodiversity, soils, hydrology and local climate. Artificial areas are often causing further environmental impacts, in general additional emission of air pollution from transport, housing and production on these settlement and infrastructure surfaces, an increase of run-off of precipitation and a decline of infiltration to groundwater tables. These effects are economically relevant as they lead to external costs which are often not considered.

Further negative economic effects of land take are the costs needed to build and maintain the settlement, infrastructure and industrial and economic sites. These costs include not only the market price of land, the construction and maintenance costs, e.g. for transport and technical infrastructures as power supply lines, fresh- and wastewater, digital infrastructure but also the social infrastructure, recreation areas and public transport services. The more the urban and suburban fabric extends, the higher are the expenses for all these services and infrastructures. In regions with a population decline, the costs have to be paid by less people in the future, unless underused buildings, infrastructures or even settlements are reduced. The gap between maintainance costs and people obliged to pay for these is widening, even in regions with a stagnating population, if land take continues. However, there are also positive economic effects of land take, such as employment opportunities, generation of income, and provision of expansion opportunities for local companies and others.

In economic modelling, land is one out of three factors of production besides capital and labour. It has to be recognised as limited resource, which is used for many different and partly competing purposes such as settlements and transport, agriculture, forests, mining, energy production, nature protection and biodiversity, flood management and recreation / leisure / sports.

Background information

The main drivers for land take in the Alps are:

- The increase of population (to about 14 million in the Alpine Convention area) and population concentration processes, especially the migration to towns and agglomerations induces the enlargement of settlements and transport infrastructure.
- The increasing per capita demand for living space and the reduction of household size.
- The growing land demand of the tourism and leisure industry in some regions, which is accompanied by new transport infrastructure needs.
- Competition between municipalities and regions for relocation of residents and businesses.
- Local and regional (spatial planning) authorities, allowing the enlarging of housing areas and areas for business and trade. They often practice a supply-oriented instead of a demand-oriented spatial planning.
- The construction branch, which is an important economic stakeholder in many regions.
- Speculation and stockpiling of developed real estate, which excludes these areas from market access and encourages local planning authorities to develop new areas.

At the EU level, the 2011 Road Map to a Resource-Efficient Europe (EC 2011d) as part of the Europe 2020 Strategy has the following aim concerning land as a resource: “By 2020, EU policies take into account their direct and indirect impact on land use in the EU and globally, and the rate of land take is on track with an aim to achieve **no net land take by 2050**".

A possibility to limit land take is to densify existing settlements and to use brownfields instead of greenfields for further development. In the sense of a resource efficient economy, it is desireable to reach "zero land take" by establishing a circular economy of land. This means that not only brownfields, but also unoccupied or underused houses and farms , which can be found in many towns and villages, should be developed or restructured instead of developing greenfields. The SCoT Tarantaise (cf. text box) is an example for such a process as well as the activation of unoccupied or underused houses in Bellinzonese e Valli (cf. text box). However, in many cases, development on greenfields is cheaper – or at least easier to calculate, as spatial planning authorities are willing to designate new development areas at the fringe of urban areas or along the main roads. The task of spatial planning is to promote and implement resource efficient land use and to combat urban sprawl.

Good practice - SCoT[38] Tarentaise - Development of new / renewed tourist accommodation, France

The scheme for territorial coherence (referred to as SCOT) is a strategic planning and urban development document. One of the most important challenges for the Tarentaise Valley is to define the development of Alpine ski tourism as well as the development of the ski resorts (tourism beds, ski resorts, leisure facilities). The Tarentaise SCOT is one of the first studies of this type on the real estate sector in the alpine ski resorts (counting commercial and private tourist beds, unoccupied bed, forecasting). For the Tarentaise Valley representatives, the priority lies in renovating existing buildings rather than encouraging new constructions.

Since 2010, the SCOT has begun to assess the situation before launching a partnership program called Remise En Tourisme de l'Immobilier de Loisir (RETIL) – measures to restore tourist properties. SCoT Tarentaise : Diagnostic immobilier touristique: http://rehabilitation-immobilier-montagne.url.ph/?page_id=54

The municipal and intercommunal representatives are not alone in taking on this project. Ski lift companies have also got involved. For example, in order to combat the unoccupied bed issue, the 3 Valley Company has introduced the Affiniski scheme. This concept supports property owners for their projects: assessment, renovation, finance plan, rentals, etc.

Further information: http://www.affiniski.com/en/

Good practice - Activation of the potential use of second homes in Bellinzonese e Valli, Switzerland

The Leventina (11 municipalities) and the Blenio Valley (3 municipalities) are in a difficult economic situation. Many buildings in this area are empty or only partially used. In a pilot project, the buildings are used as second homes for tourism and an agency for the rental has been tested. Regarding the new railway line through the Gotthard base tunnel, it will be a chance to offer a new form of accommodation.

Further information : http://www.are.admin.ch/themen/raumplanung/modellvorhaben/05205/index.html?lang=de

[38] Schéma de cohérence territoriale.

Austria

The Austrian Sustainability Strategy (ÖSTRAT 2010) intends to reduce land take to a daily maximum of 2.5 ha. A working group between national and federal experts has been established to define steps and measures towards the 2.5 ha goal.

Germany

The German government decided in 2002 in the framework of the National Sustainability Strategy (Die Bundesregierung Deutschland 2002) to reduce the increase of settlement and transport area from 129 ha per day (as moving average over 4 years from 1997 to 2000) to 30 ha per day until the year 2020. To reach the target value of 30 ha per day, the government launched several programmes and projects to enforce inner-urban development (e.g. REFINA, MORO).

In Bavaria, the State Development Programme (BayStMF 2013) expresses several principles as aims for inner-urban development, which should be respected in urban land use plans. One of it is the aim to prefer inner-urban development prior to greenfield development.

Italy

Among the main topics for cooperation between the six Italian Alpine Regions and the two Autonomous Provinces was land use and soil consumption, where the goal is to achieve a "zero consumption" paradigm in the Italian Alpine regions (plus Emilia Romagna) through the concept of territorial regeneration instead of new developments. Economic development is expected to stem from a novel approach based on rational use of land. Underlying considerations include the precautionary principle, landscape quality and biodiversity preservation, urbanisation interventions as responses to a specific demand, urban development based on re-use and quality, and innovation and institutional cooperation at different levels. A document was produced where these principles have been collected and innovative policies have been agreed upon (Agenda di Bologna, Regione Piemonte et al. 2012). It aimed at contrasting dispersion, ensure sustainable use of land and conserve soil, reducing its consumption as well as improving landscape planning and the quality of territorial transformations.

Alpine relevance

Due to the Alpine topography, the share of suitable land for settlement and most economic activities - except for forestry and agriculture - is smaller in the Alps than in the lowlands. It is mostly restricted to the so called Permanent Settlement Area (PSA). Many Alpine regions feature high population densities comparable to urban regions (cf. Figure 1.1.2-1), if the numbers are related to the permanent settlement area. In Austria, the permanent settlement area is about 37% of the surface area, in the German Alps (as delimited in the Bavarian spatial planning document LEP) 34% (Bayerischer Landtag 2015). While spatial planning authorities in the Alpine states define PSA in different ways, Figure 2.2.2-1 shows the share of PSA per municipality calculated for the whole Alpine Convention area in a homogenous way (Tappeiner et al. 2008). On average about 17% of the area can be considered as appropriate for PSA, some municipalities even have less than 1%, others almost 100%, in about 16% of all municipalities PSA has a share of more than 50% of their territory, mostly municipalities in the foothills (EEA 2010a, p. 126). This shows that suitable land for development is a rare resource and why land use conflicts are pronounced especially in the highly populated areas. A strong spatial planning is, therefore, desireable in the whole Alps.

Climate change may possibly put additional pressure on the PSA, as floods, landslides and rock falls may increase, when whether conditions such as extreme rainfall occur more often, and the increase of temperature leads to glacier and permafrost melting, triggering rockfalls and providing new materials for landslides. Spatial planning has to anticipate these changes to reduce possible damages.

Although agriculture and forestry can cultivate steeper land and land in higher altitudes for their purposes, they have to cope with natural land use restrictions and harsher climate conditions. To remain competitive in globalised agricultural and timber markets is a challenging task. Natural hazards as Alpine mass movements (rock falls, landslides, rock slides, mudflows and avalanches) restrict land use possibilities also for agriculture and especially for forestry, as forests play an important protective role for settlements and infrastructures.

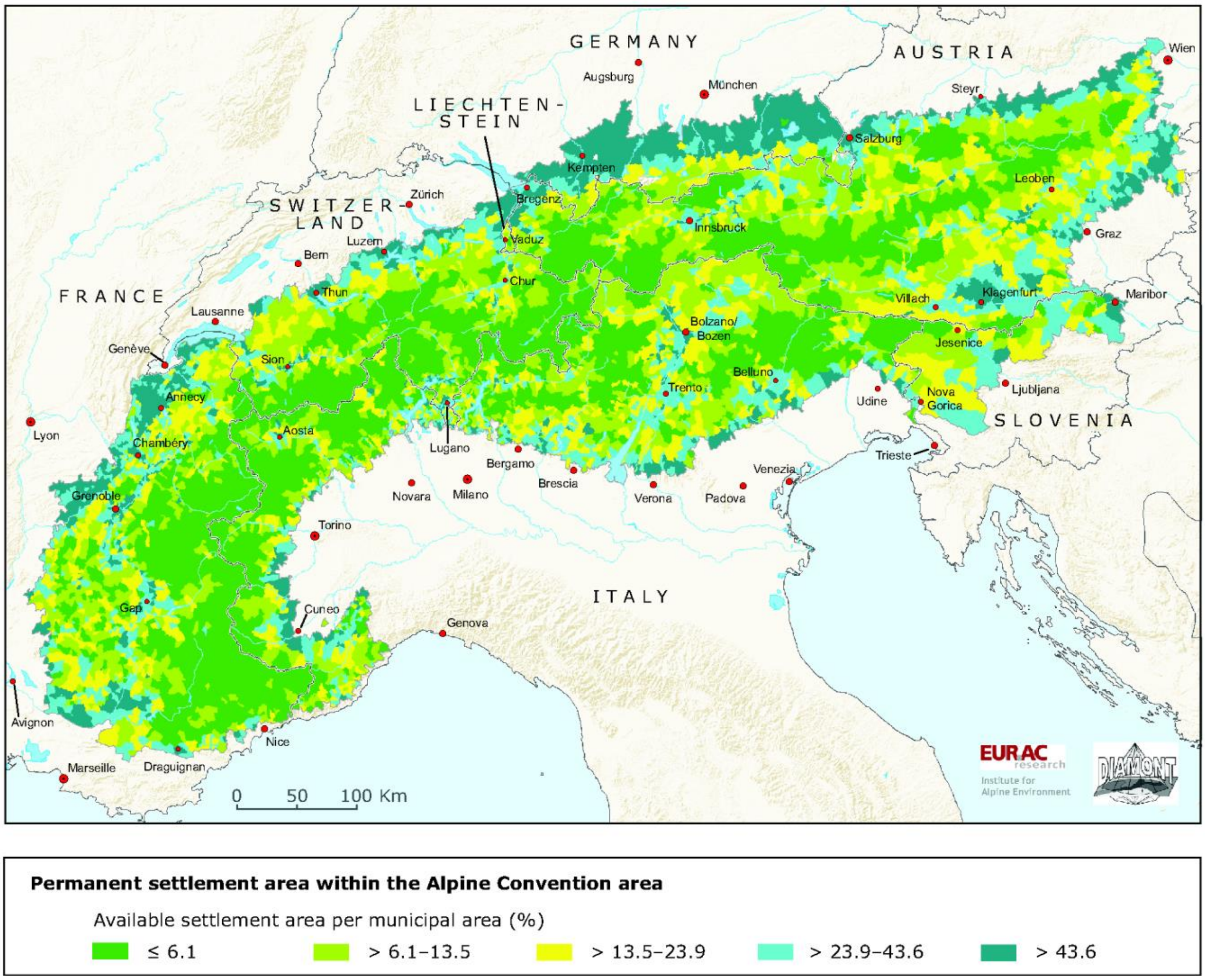


Figure 2.2.2-1 Share of permanent settlement area within the Alpine Convention area per municipal area (Source: EEA 2010c)

To present the status quo of land use, land use change was selected as the main indicator for this report. There are differences from country to country concerning the land use statistics, either in sources, in definitions of categories or in intervals of the assessments. Therefore, the comparability of land use data is very restricted.

The Alps show a differentiated picture concerning land take for settlement and infrastructures: there are some regions with a high demand of land for building, mainly near the urban centres and inner-Alpine main valleys and tourism regions with an increasing demand for new accommodations and infrastructures such as golf courses, adventure parks. However, there are also regions where settlements are abandoned.

Situation in Alpine countries – based on CORINE Data

To present land use changes for the whole Alpine Convention area, the initial idea was to use the "land cover change" datasets, which are derived from the CORINE Datasets and can be retrieved at the European Environmental Agency website. The advantage of these data in contrast to national data would be the availability for the whole Alpine Convention area and the homogeneity over national borders.

During data compilation and mapping it turned out, that these data produce a picture of land use change and especially land take, that is not corresponding with national statistical datasets. This became apparent when the results of the calculations of land use change per NUTS3-unit were compared to the changes, which were calculated with national land use data for the same spatial unit (NUTS3) and period. Especially changes in settlements and transport infrastructures differ significantly from the national data. One reason is the minimum mapping unit (MMU) of 5 ha in CORINE Changes. Due to this MMU, only large changes are mapped, and the slower, but continuous process of land take by e.g. enlargement of settlements, by smaller residential or industrial areas or by the expansion of roads are not well detected.

For these reasons the issue of land use changes in this report relies on national data, even if they are not directly comparable.

Situation in Alpine countries – Analysis of land use changes based on national statistical data[39]

Austria

The average land take is still 22.4 ha per day. At the same time, an alarming amount of brownfields and underused residential buildings can be found as well as many unused buildings in small village centres, which contribute to loss of identity and emigration.

The utilized agricultural area in all LAU2 units of the Alpine Convention in Austria declined by 26% between 1999 and 2010, compared to 15% nationwide (Data of the Farm Structure Surveys 1999 and 2000). This is mainly due to changed entry conditions for recording the areas of Alpine pastures in 2010 (separation of fodder area, forest area and other unproductive area), which led to a serious reduction of Alpine pasture area – solely recording the fodder area in 2010 and excluding stony patches and unproductive areas covered with shrubs or trees.
The settlement and transport area of all LAU2 units within the Alpine Convention perimeter in Austria shows an increase of 9-8% from 2001 to 2012 (regional information data derived from the real estate database of BEV – Bundesamt für Eich- und Vermessungswesen - Austrian Federal Weights and Measures Office).

Germany

In spite of all efforts, land take in Bavaria (18.1 ha per day in 2013 for settlement and transport area) is still significantly exceeding the target path towards the 2020 national goal. In 2014, land take for settlement and transport area decreased to 10.8 ha per day, but this was only due to a change in the data collection and classification method as Figure 2.2.2-2 shows (blue columns: old method, red columns: new method).

[39] National land use data are in most cases more precise than CORINE data, but each country has its own classification scheme and data source. Ragarding changes over longer time series may be difficult even within one country, as data sources and classifications sometimes are changed.

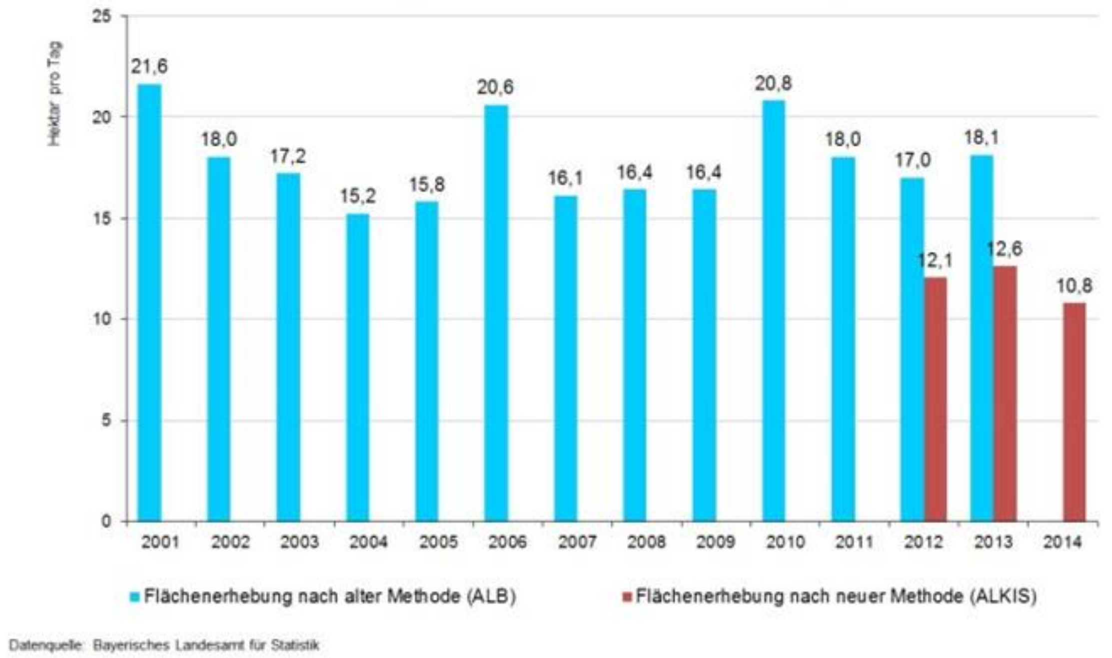


Figure 2.2.2-2 Land take in Bavaria between 2001 and 2014 (Source: LfU 2014)

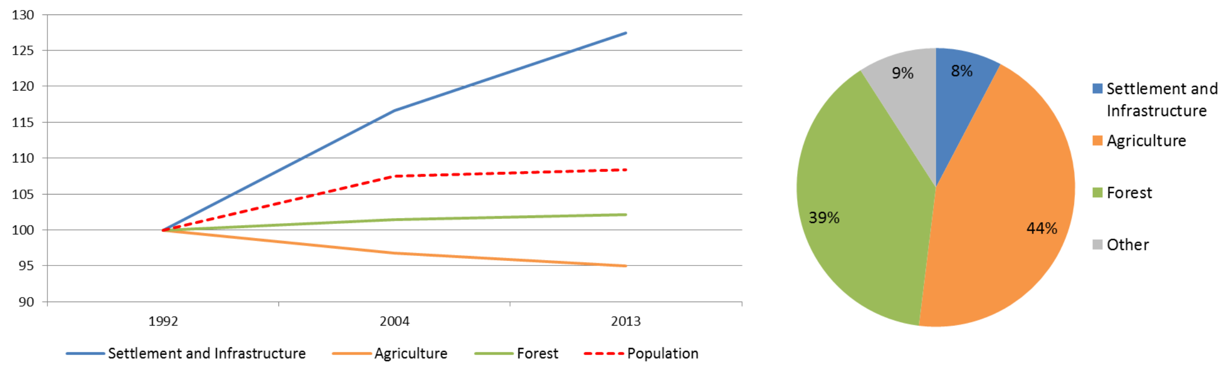


Figure 2.2.2-3 Development (1992-2013) and share (2013) of different land use classes in the German part of the Alpine Convention area between 1992 and 2013[40] (Base year 1992 = 100) (data source: Bayerisches Landesamt für Statistik und Datenverarbeitung 2004, graph: ifuplan 2016).

Italy

In 2012 land take in the Italian Alpine territory (provinces, NUTS3) is still significant even though lower than the national average (weighed average 23,9 ha/day compared with a national average of 55 ha/day), with Piemonte, Lombardia and Veneto showing higher values (ISPRA 2015a). It is to be noticed that the units covered by mountains for a higher share show lower absolute values of land take, but the estimates show an increasing consumption at the regional level across all the Italian Alpine provinces. Mountain and hill areas show very low values of land take all across the country. Most of the land take seems to take place in the lowlands rather than at higher altitudes or where slopes are steeper, however it has been shown how land take influences ecosystem services especially the climatic and hydrogeological regulation (ISPRA 2015a).

[40] Due to changes in the land use statistics, the data from 2014 onwards are not directly comparable with data until 2013.

Liechtenstein

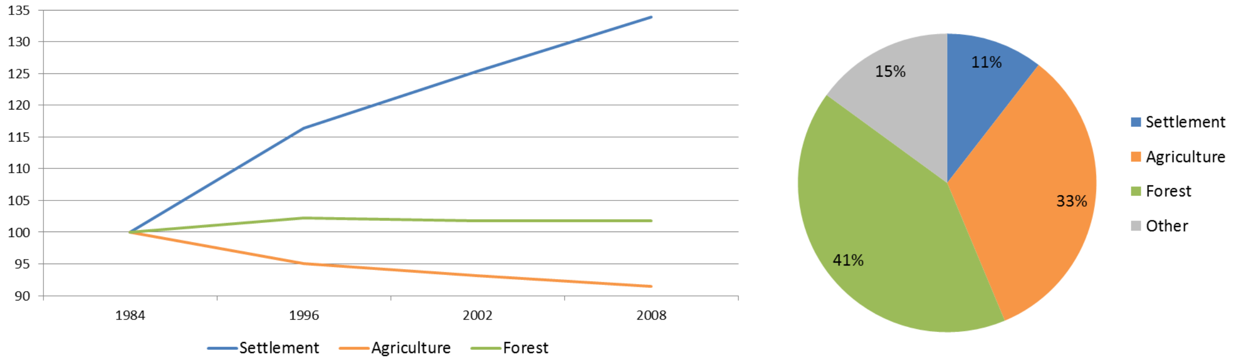


Figure 2.2.2-4 Development (1984-2008) and share (2008)of different land use classes in Liechtenstein (data source: Schweizerische Eidgenossenschaft 2009, graph: ifuplan 2016).

Slovenia

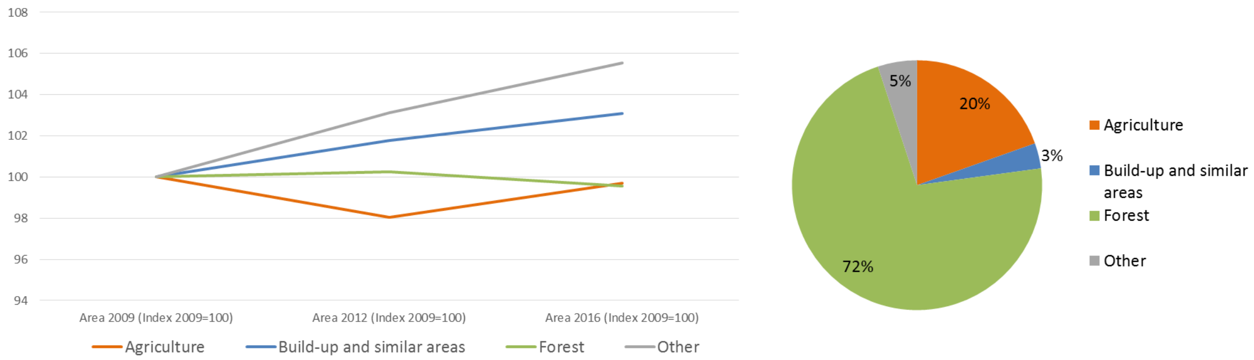
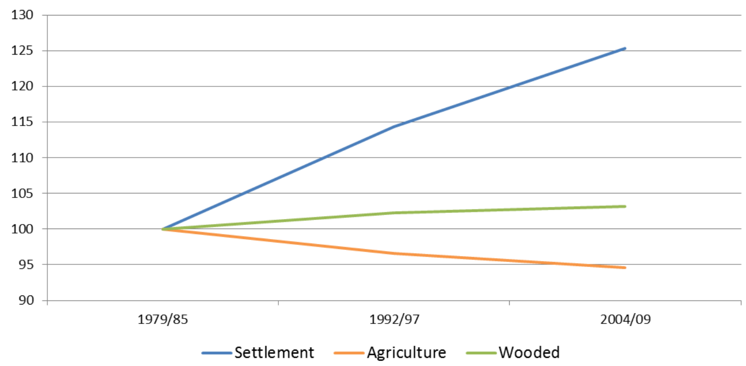


Figure 2.2.2-5 Development (2009-2016) and share (2016) of different land use classes in the Slovenian part of the Alpine Convention area (data source: Ministry of Agriculture, Forestry and Food and Slovenian Environment Agency).

Switzerland



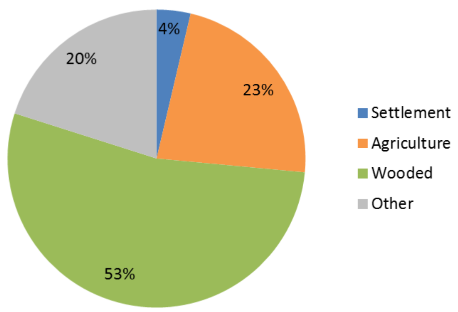


Figure 2.2.2-6 Development (1979-2009) and share (2004-9) of different land use classes in the Swiss part of the Alpine Convention area[41] (data source: BFS 2016b [42], graph: ifuplan 2016).

Germany (cf.Figure 2.2.2-3), Liechtenstein (cf. Figure 2.2.2-4), Slovenia (cf. Figure 2.2.2-5) and Switzerland (Figure 2.2.2-6) show a continuous increase of settlement area over the last decades, with only minor decreases in growth rates during the recent period. The comparability with land use data based on cadastres (as German data) or interpretation of aerial photography (as Slovenian, Swiss and Liechtenstein data) is rather limited. The share of settlement and transport infrastructure area in Germany (8%) and Liechtenstein (10%) seems relatively high compared to other Alpine countries. However as the classifications and sources differ from country to country, a direct comparison of numbers is possibly misleading.

The development of the settlement area has to be considered in connection with the development of population. In the German Alps, data show that the increase of settlement area is much higher than the population increase (cf. Figure 2.2.2-3.

Agricultural area declined in Germany (to 44% in 2013), in Liechtenstein (to 33% in 2008) and in Switzerland (to 23% in 2004/09) as this land use category is most frequently converted. In the Slovenian part of the Alps, the agricultural area stagnated at about 20% of the total area in 2016.

In Slovenia and Switzerland, more than half of the Alpine Convention area is forest or wooded area, in Switzerland these areas increased, in Slovenia they stagnated. Germany and Liechtenstein have a smaller share and a minor increase of forest area.

Conclusion on opportunities and challenges

Due to topographic and climate conditions, land suitable for settlement, transport and agricultural land is more limited within the Alps compared to the lowlands. A probable increase of natural hazards due to climate change may additionally endanger parts of the permanent settlement area. As permanent settlement areas are limited, population densities in some Alpine areas may be comparable to densely populated areas in low land or even big cities. Despite the fact that the transformation from agricultural land to settlement area has slowed down in most regions in the last decade, the current levels are not sustainable in a mid- or long-term perspective. More efforts are needed to reach the target values. Taking into account the demographic changes, such as an ageing population in many Alpine regions,

[41] Data were provided for Cantons. Four Cantons are only partly in the AC area, but included completely in the figures.

[42] The term “settlement” stands as an abbreviation for the land use class “settlement and urban areas”.

there is a need, but also the opportunity to reduce and restructure settlement structures, stop net land take and develop a sustainable circular land use management.

Spatial planning plays a crucial role to decrease land take. Turning the wide spread supply-oriented development policy into a demand-oriented one could be a first step to reduce land take. Preferential use of brownfields, vacant buildings and building plots, densification possibilities and other inner-urban development possibilities to satisfy the demand instead of developing greenfields is another important step. A political commitment and efforts of the competent bodies would support spatial planning authorities. Concerning these policy objectives, cooperation at least on a regional scale instead of competition for more inhabitants, more enterprises and more infrastructures between neighbouring municipalities or regions would additionally help addressing the problem of land take.

Land take affects agricultural areas, which have lost shares as settlement, infrastructures and economic sites have been enlarged. This conversion of agricultural land affects mainly valley bottoms and gentle slopes in lower altitudes were soil productivity is – in most cases - higher than in higher altitudes and at steeper slopes. Therefore, agriculture has lost and still looses more and more land with a relatively high productivity and thereby chances to compete with agriculture in the lowlands. The economic consequences cannot be described here comprehensively, but this process may potentially contribute to a further decline of agriculture in the Alps.

At the same time, reforestation mainly in the central parts of the Alps is controversially discussed, as it can lead to a loss of biodiversity, if forests grow on former extensive pastures. Tourism managers and anthropological scientists fear negative changes in natural scenery. Others appreciate the increase of forests, as they represent the natural vegetation and are a renewable resource, which can be used for different economic purposes.

2.2.3 Circular economy, recycling and waste management

Turning waste into a resource is important for the development towards a circular economy. Our economy followed for a long time the linear approach of "take – make – consume and dispose". Turning this line into a circle means to keep resources within the economy after a product reached the end of its life. This is an essential step towards more resource efficiency. To strive for a circular economy is part of the political strategy to avoid or at least minimise severe conflicts about resources. Secondary raw materials can partly substitute primary raw materials. If products could be reused, recycled or upcycled, several goals of greening the economy are served: the use of resources is more efficientand the generation of waste and its environmental impacts (landfill etc.) are reduced.

The idea of a circular economy goes far beyond the reuse and recycling of waste. It is about a transformation of production and consumption patterns and includes not only technological, but also organisational and social innovations. A change of production patterns means that the ideas of circular economy have to be respected already before and during product development, e.g. by facilitating the possibilities to repair the product or exchange single components instead of replacing the whole product. Already during product development there is a need to consider recycling after the last use of the product to preserve the material or to replace non-recyclable materials by recyclable material (e.g. plastics by regrowing or compostable alternatives or synthetics by natural materials). It also includes strategies like as reducing the quantity of raw material needed for a product (light weighting), increasing the durability of products and the substitution of hazardous materials and materials difficult to recycle. Briefly, waste prevention means to act across the whole life cycle of products and not only at the end of their use.

Circular economy may also offer additional opportunities for innovation, product design, jobs (repairing, reuse, deconstructing etc.) and new business models. In Europe, currently 16 tons of material per person and year are used and 6 tons of it turn to waste. In 2010, only 36% of waste was recycled, the rest was landfilled or burnt (EC 2016c). This means there is still a high loss of potential secondary raw material, although some progress was made in the past.

Background

The generation of waste and wastewater through production processes and consumption may affect human health and the environment through emissions from landfills and waste incineration and means the loss of material resources (metals and other recyclable materials). Efforts are required to reduce and prevent the generation of waste. While in the past, waste was considered disposable, it is now increasingly recognised as a resource and fed back into the economy through recycling and recovery (reuse, re- and even upcycling) or serves as energy source (heat and electricity) in case of waste incineration.

An additional effect is the supply of job opportunities in the recycling industry, as in general recycling creates more job offers than landfilling and incineration. The goal could be a 100% recycling quota and the distance to this target means a potential for green waste management. For some types of waste (e.g. destruction waste, glass, paper, biomass, plastics), a 100% recycling rate may be achievable with high efforts. However, it is an illusion that recycling processes especially of technological products (IT infrastructure) can recover 100% of each single raw material (e.g. metal) used in the end product. To a certain part, reuse and recycling is not possible. There are e.g. technological limits for regaining metals: in some technological products, the concentration of chemical elements can be so low, that recycling is not (yet) possible or lucrative and material loss is irreversible. This applies also for production processes where non-recyclable material losses happen. Additionally, recycling in general and especially of metals needs energy input, which is not yet provided without GHG-emissions. Therefore, the most desirable goal is the prevention of waste, as this has the best benefits in terms of environment and health.

A change of consumption patterns means that consumers buy repairable and recycled products and feed products after the last use back into the economic cycle. More and more consumers are aware of their responsibility and take initiatives to reduce waste as e.g. repair cafés, food sharing and others (cf. Chapters 2.4.3 and 3.2.3).

Besides the concept of circular economy, there is the concept of regional economic cycles. The crucial aspect of regional economic cycles is to keep the transport distances as short as possible, which is somehow controversial to globalisation and the aim of free trade in wide parts of the world. Some clear advantages of regional economic cycles are the use of regional resources and short transports, which come with a decrease of energy demand and consequently the decrease of pollution caused by transport.

The EU Directive 2008/98/EC on Waste) supports the development towards a circular economy by setting basic concepts and definitions related to waste management and lays down the "polluter pays principle" and the "waste hierarchy" as presented in Figure 2.2.3-1.

Figure 2.2.3-1 Waste hierarchy of the EU Waste Directive (Source: EC 2008).

The Waste Framework Directive sets the target to recycle 50% of municipal waste and 70% of construction and demolition waste by 2020. Besides, different other regulations and directives of the EU apply to waste management, such as the Regulation of Waste Shipments, the Packaging Waste Directive, the Waste Incineration Directive, the Landfill Directive, the End-of-Life Vehicles Directive and others.

The EU adopted in 2015 a Circular Economy Package, which includes legislative proposals on waste and an EU Action Plan for the Circular Economy. The Circular Economy package of the EU proposes to amend the waste legislation with the following targets:

- Recycling of 65% of municipal waste by 2030;
- Recycling of 75% packaging waste by 2030;
- Material specific targets for different packaging materials;
- A binding landfill reduction target of 10% by 2030.

Alpine relevance of circular economy, recycling and waste management

Circular economy, recycling and waste management in the Alps are not very different from the lowlands. The EU Member States follow the respective directives. Waste and circular economy regulations and policies are made mainly at national level. Waste management is often organised by regional or local administrations, they are the administrative level for coordination and waste management. However, tourism in some Alpine regions puts additional pressure on waste management, as more food and material may be wasted and waste volumes may fluctuate seasonally. This becomes even more relevant if small municipalities are affected with a high ratio of tourists per resident. Furthermore, the providers of mountain huts (mainly Alpine Clubs) have a special challenge to deal with waste and wastewater, as they are in general not connected to municipal waste collections and sewage lines due to their remote locations.

A special Alpine problem concerning waste collection may occur at border regions: for some municipalities the neighbouring country is closer or easier accessible than the home country and a cross-border solution for waste collection and treatment would be easier.

Good Practice - Eco Kamp Koren, Slovenia

Koren Camp – a sustainably managed campsite - is organised with regard to nature and the protection and care of natural resources. It strives to offer many products from the local ecological cultivation in its store.

Koren Camp was the first Slovene camp that fulfilled the required criteria for the acquirement of the European Eco-label for the environment-friendly camp in 2011. Due to the many years of striving towards nature-friendly tourism and ecological arrangements, it had no problems acquiring this certificate.

The camp ensures to use as many reusable containers as possible. For heating the water, it uses the energy from renewable energy sources (solar cells). It also tries to save water and uses rainwater for watering the plants; instead of environmentally harmful detergents it uses natural, degradable cleaning agents (i.e. vinegar). The camp recycles and expects the same from its guests.

The environmental policy of the campsite is based on several principles: with regard to the legislative framework it relies on preventive action to ensure human health and a healthy environment; the commitment of employees and visitors to protect the environment; and constant improvements of its environmental performance.

Further information: www.kamp-koren.si/en

Situation in Alpine countries

Germany

Figure 2.2.3-2 shows the absolute amount of waste in Germany and the shares of different sources. The blue part shows the municipal waste which is more or less stable over the years, while the green part - waste from waste chapter 01[43] decreased due to the reduction of coal exploitation. Waste from production and manufacturing – the dark red share of the column - fluctuated with business activity. The highest waste volumes originate from the construction and destruction sector including road construction waste (yellow). It is four times higher than municipal waste and more than 50% of the total waste. Finally, waste from waste treatment plants (orange) is almost as much as municipal waste.

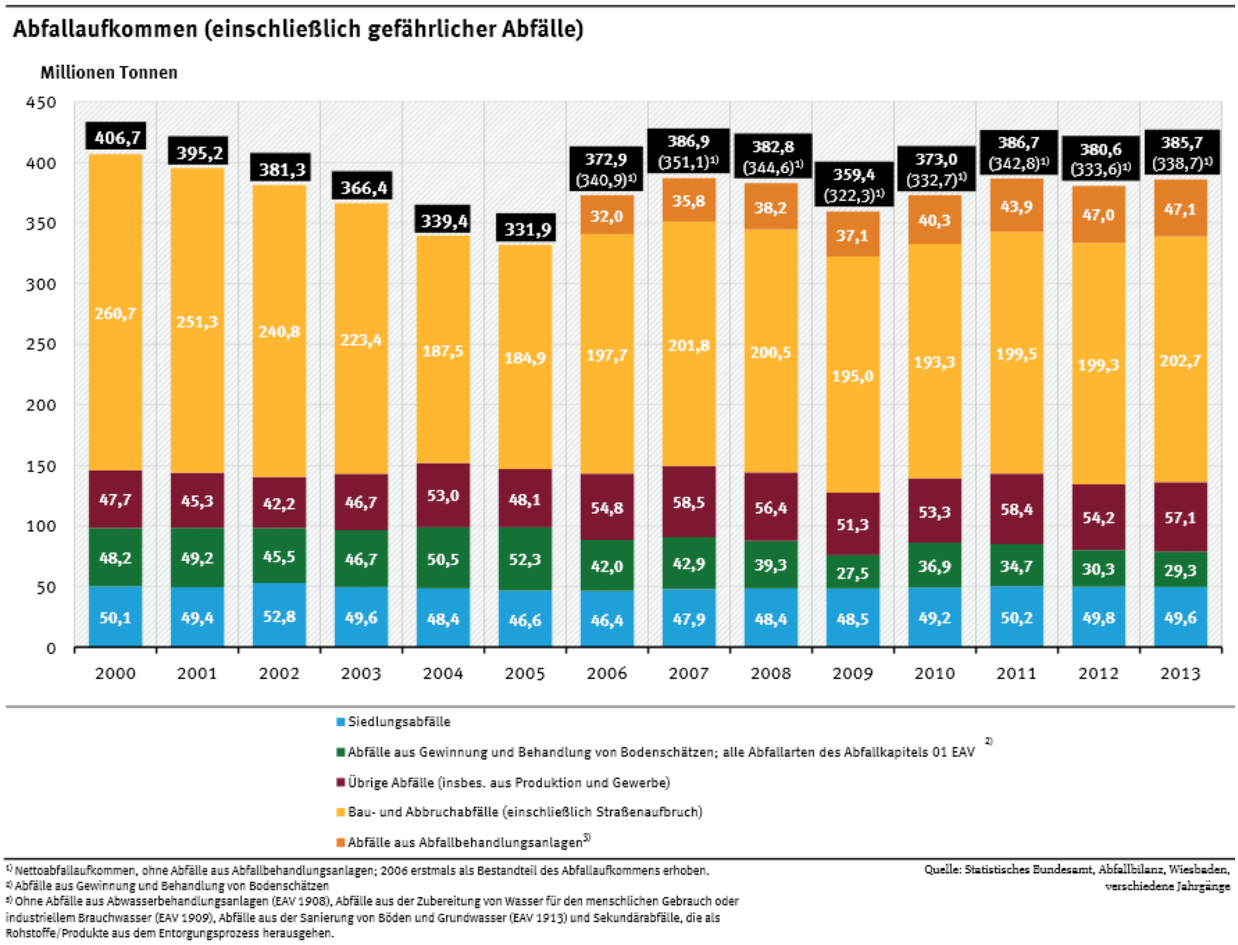


Figure 2.2.3-2 Total waste in Germany (2000 – 2013) in million tons for different types of waste.
Blue: municipal waste; green: mining waste; dark red: other waste (escpecially production and industry; yellow: construction and demolition waste; orange: waste from waste treatment plant (Source: UBA 2015).

Municipal waste in Bavaria is collected and / or has to be brought to collection points: the systems are different in each municipality. While residual waste and in most cases also paper and organic waste is collected, the other recyclable fractions as textiles, glass, metals, packaging waste etc. have to be brought to collection points.

[43] This is waste from exploration, mining, quarrying, physical and chemical treatment of minerals.

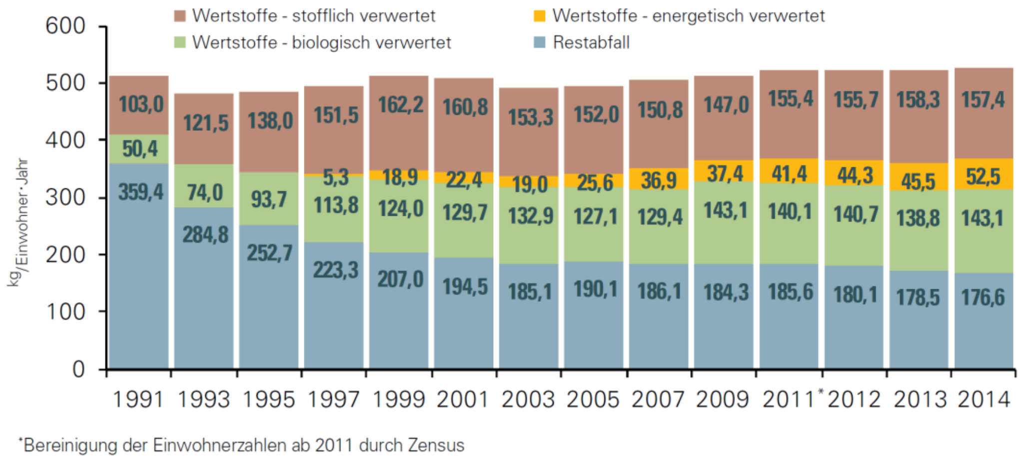


Figure 2.2.3-3 Development and utilisation of municipal waste [kg per inhabitant] in Bavaria between 1991 and 2014. Note: The dark grey share of the columns shows the amount of residual waste, the green is the biological utilised share, the orange is the energetic utilised share and the brown the materially utilised share. (Source: LfU 2015)

Figure 2.2.3-3 shows the development of municipal waste in Bavaria per inhabitant. According to this the biological utilisation shows an increase until 2009 and is since oscillating similar to the material utilisation, which seems to oscillate since 1999 around 155 kg per inhabitant and year. Residual waste is still slightly decreasing and energetic utilisation shows the highest increase and has a share of about 10% of total waste. The total rate of utilisation of primary waste from households is stagnating for years at about 2/3 of total primary waste (LfU 2015).

Italy

Italy seems to be on the right path to reach the EU recycling target of 50 % for Municipal solid waste (MSW) by 2020. Available figures at the regional level show that municipal waste has been decreasing all across the Italian Alps during the period 2010-2014, while waste sorting as a share of the total waste collected at the regional level has increased on average by 16.4% with higher values in Friuli Venezia Giulia (+21.9%) and Liguria (+35%). The highest shares of sorted waste in 2014 refer to Veneto (67.6%), Trentino Alto-Adige (67.0%) and Friuli Venezia-Giulia (60.4%).

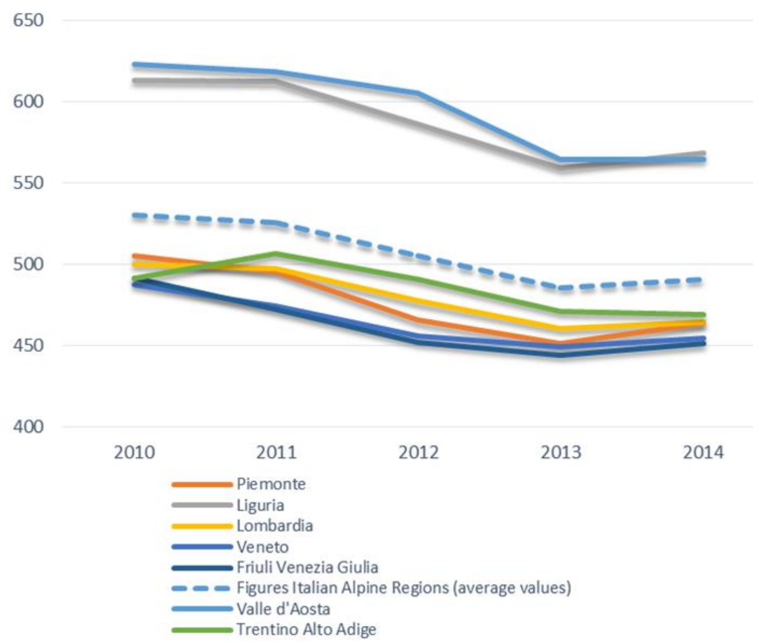


Figure 2.2.3-4 Urban waste p.c. in the Italian Alps, regional data (2010-2014) (Source: ISPRA 2015b).

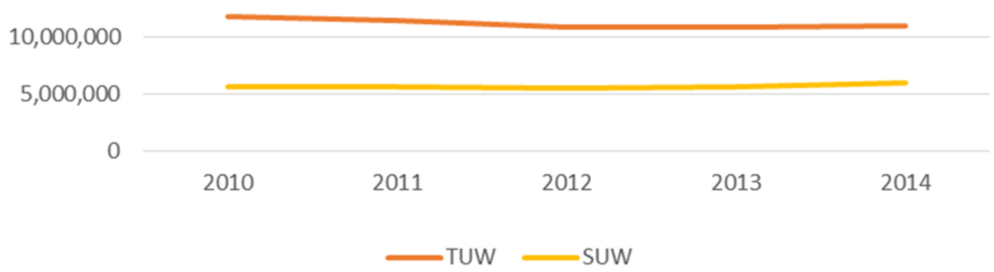


Figure 2.2.3-5 Total and sorted urban waste (TUW and SUW) in the Italian Alps (Source: ISPRA 2015b).

The analysis of municipal waste intensity (MWI) i.e. the physical quantity of municipal waste generated per unit of GDP, is sometimes adopted in international reporting practice for investigating delinking phenomena between economic and environmental variables. Its application in the Italian Alpine regions has shed some light on the ratio between the relative trend of waste generation and the relative development of regional GDP – expressed in physical (tons) over monetary units (Euros) during an economically complex time (cf. Figure 2.2.3-6).

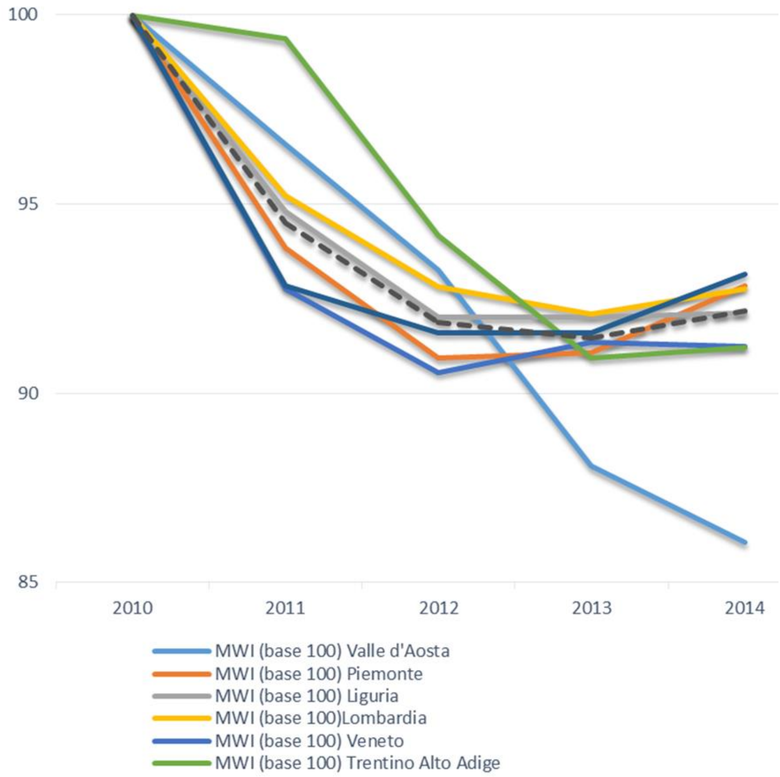


Figure 2.2.3-6 Municipal Waste Index (MWI) in the Italian Alpine Regions (2010-2014) (Source: ISPRA 2015b).

In the Italian Alps, figures at the regional level show at least a "relative decoupling" between the quantity of municipal waste produced (ISPRA 2015b) and the regional GDP (ISTAT 2016) between 2010 and 2014. The trend is particularly significant in some areas (Valle d'Aosta and Trentino-Alto Adige) where a sufficiently strong negative correlation can be found. This trend indicates a certain degree of resource-efficiency in waste management across the region, notwithstanding the slower growth of GDP experienced since the global financial crisis.

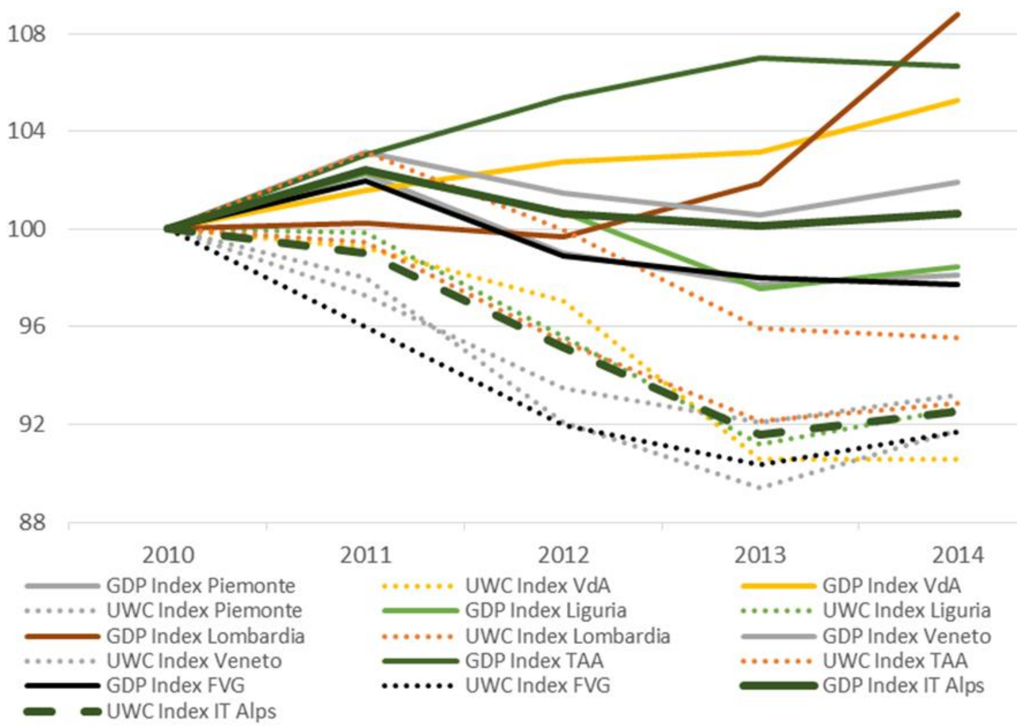


Figure 2.2.3-7 Trends of Urban Waste and GDP p.c. in the Italian Alpine Regions, indices (2010-2014) (Source: ISPRA 2015b).

Concerning the other figures, at the Alpine level in Italy, no significant discontinuity (if not a very modest negative correlation) can be observed between the quantity of collected and sorted municipal waste – whose growth rate has been aligned with the growth of total municipal waste. If looking at the single Italian regions, only Liguria and Friuli Venezia-Giulia show a strong enough trend of total waste reduction and a concurrent increase in sorting of municipal waste over the 2010-2014 period.

Figures are available at the regional level concerning some economic aspects of waste management in the Alpine area. The average costs of waste disposal for unsorted, sorted and total waste collected for inhabitants have been changing over the 2001-2014 period in the Northern area of Italy: the growing rate of sorting and the innovative management techniques have caused an increase in total costs of 37.7% driven by a significnat increase in the cost of sorted waste management (+139%). Some components have nevertheless decreased (unsorted waste management cost has been decreasing by 13.4%).

Alpine regions are rather efficient in comparison to the average national values (with a relative cost advantage of 22.5%) especially for some cost categories (e.g. costs for sweeping and cleaning (Costi di spazzamento e lavaggio – CSL) and costs for collection and transport (Costi di raccolta e trasporto – CTR). Relative inefficiencies are found especially in waste treatment and disposal and in the "other costs" category. Among the analysed regions in Italy, Veneto and Friuli Venezia-Giulia would seem to be the most efficient regions both in costs *p.c.* and per kg of produced waste (ISPRA 2015b).

Concerning the appropriate quantification of fees or taxes paid for waste management and their ability to cover the costs of waste management discussed above, Alpine regions are quite in line with each other and rank slightly better than the national average. The collected revenues from fees or taxes cover on average 98.6% (from 96 in Valle d'Aosta to 104% in Piemonte) of the total p.c. costs of waste management at the regional level. Over the 2001-2014 period the ability of fees and taxes at the regional level in covering costs has been increasing on average by 12.1% and particularly in Valle d'Aosta (+27.5%), Piemonte (+14.3%), Friuli Venezia-Giulia (+13.7%) and Liguria (+10.9%).

Liechtenstein

After the implementation of fees on municipal waste considering the polluter-pays-principle in 1994, the amount of waste has apparently declined. In the following years, the amount has developed in parallel to the population growth. The recycling quote was 60.3% in 2010.

The landfill volume fluctuates strongly depending on building activities and market conditions. There is no landfill for hazardous waste. In Liechtenstein, only excavated material and construction waste are deposited.

Since 2007, the existing landfills were checked nationwide for their suitability as deposition sites. Hydrogeological investigations have shown that only three of the seven landfill sites are suitable as deposit sites not only for unpolluted excavated material but also for other inert material waste (mainly construction waste, etc.). In the near future, there will be at maximum three locations in Liechtenstein available to store unpolluted excavated material and other inert material waste. In all other municipalities, a solution must be found for the disposal of construction waste. In some Liechtenstein communities, a shortage of landfill capacity was predictable. Additionally, the landfill plan in Switzerland changed significantly, which will also affect Liechtenstein.

Slovenia

The largest quantity of waste is generated by production and service activities (3.8 million tonnes in 2014), including the most dangerous waste especially in the manufacturing sector. Since 2002, more than 60% is processed.

Extended producer responsibility started to be introduced in most sectors in 2004 (packaging waste, end of life vehicles, waste medicinal products). The recycling rates of the collected waste in general meet current targets, but the collection rates themselves need to be improved (Republic of Slovenia Statistical Office 2015).

For certain types of waste, the state cannot guarantee proper management, so they are exported.

Consumers are one of the driving forces who through their lifestyles influence the use of natural resources and generation of waste. In 2014, 891,708 tonnes of municipal waste have been generated (414 kg per capita). Due to separate waste collection and other legal measures, the quantity of landfilled municipal waste has declined (from 74% in 2008 to 23% in 2014).

Exploitation of natural resources produced or abstracted in Slovenia after 2007 is decreasing. In 2012, 22 million tons, of which a maximum of mineral raw materials, primarily for construction, have been used. The efficient use of resources can be monitored by resource productivity. This is rising after 2007, but for now, more due to reduced construction activity.

Switzerland

The Federal Office for Environment (FOEN) is responsible for the national coordination. There exist statistical data on recycling (tons and per cents) from 1990 to 2014 (BFS 2016h).

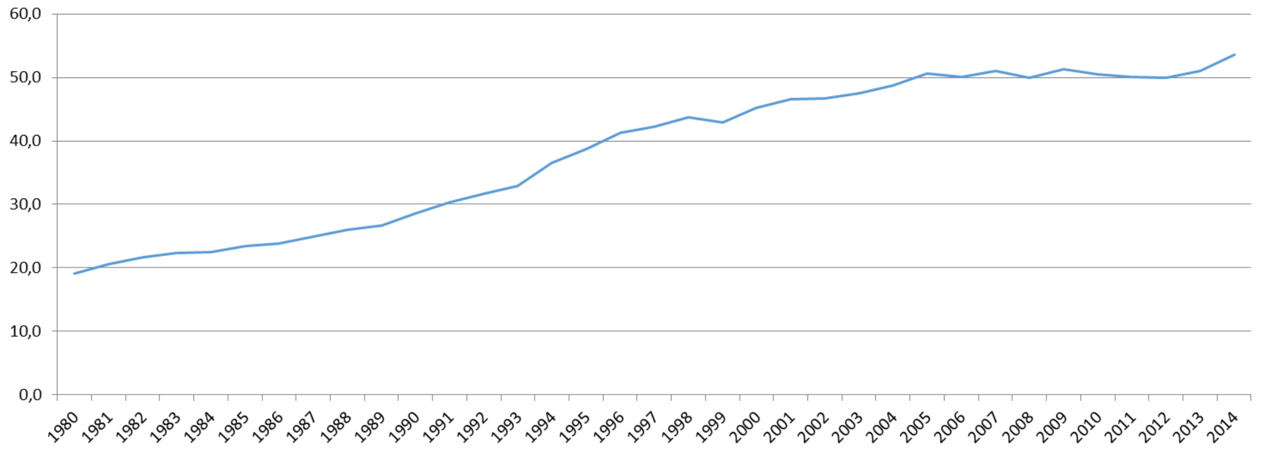


Figure 2.2.3-8 Separately collected waste as percentage of total municipal waste (1980-2014). (Source: BFS 2016h).

Switzerland has good results not only in recycling of electronic equipment. The figure above shows that the recycling rates have steadily risen since 1980. In 2014, the percentage reached 53.5%. In 2013, 51% of the total volume of solid municipal waste was recycled. Also in the same year, the proportion of municipal waste that cannot be recycled has successfully been reduced to 344 kg per person from 433kg per person in 1989. Recycling of the following waste yielded impressive results:

- Glass (collection rate in 2013: 96 %);
- Aluminium cans (collection rate in 2013: 91 %);
- PET beverage bottles (collection rate in 2013: 83 %);
- Waste paper (collection rate in 2013 91 %).

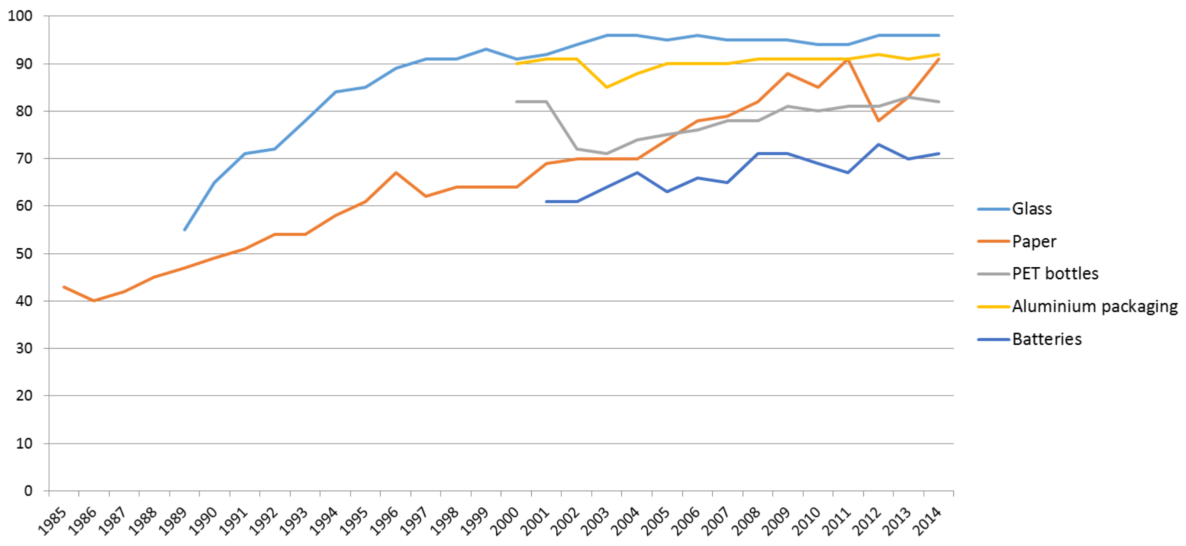


Figure 2.2.3-9 Recycling ratio of various materials (1985-2014) (Source: BFS 2015a).

In Switzerland, also organic waste is recycled. Around 1.3 million tones are composed in 235 organic waste plants and are processed in fermentation plants.

Conclusions on opportunities and challenges

Opportunities and challenges within the AC area in circular economy and waste management are not different from those in the lowlands. The Circular Economy package of the EU contains targets for waste management for 2030, which could be met considering ongoing developments in the countries. A special challenge may be the waste management in remote areas, where expenditures for separated waste collection (organisational structures and transport) are rather high in relation to the lesser quantities of each fraction of waste.

Waste prevention, in general, and regional material cycles are important topics of the circular economy inside and outside the Alpine region. Regional material cycles can have additional positive environmental impacts like a reduction of pollution and CO_2 emissions due to reduced transport needs. The handling of waste and wastewater in huts without connection to municipal sewage and waste collection systems are challenges where solutions have to be found for each single hut.

In some border regions, international cooperation concerning waste management would be desireable.

2.3 Ecosystem services and natural capital based economy

This chapter deals with the economic basis which nature provides to our societies and economies. In agriculture and forestry, it is well known how we depend on the nature to achieve economic success. However, even in manufacturing and industry, we rely on capital and services of nature, which are often taken for granted and not considered and respected in our economic systems. Even if these topics are mostly in a conceptual state, they are very relevant for greening the economy and are introduced in this report:

- Natural capital and ecosystem services introduce the concept that also natural resources represent a capital besides human capital, manufactured capital, and social capital. In addition the services nature provides are a foundation for the human well-being.
- Biodiversity is a relevant factor for the provision of ecosystem services, the building of natural capital and represents a value in itself.
- The valuation of ecosystem services finally introduces limitations and opportunities of valuation, in particular economic valuation of natural capital and ecosystem services.

2.3.1 Natural capital and ecosystem services

Like financial capital, also natural capital and the ecosystem services form the basis for our economic activities and thus for human well-being. They are a key input for a wide range of economic sectors.

Economy, social services and human well-being in the Alps are based directly or indirectly on goods and services provided by nature. This kind of goods and services are called ecosystem services, they build an indispensable foundation for our well-being and have a crucial economic relevance. However, the value of natural capital and ecosystem services is often not taken into account in the wealth accounting systems at the national level.

The degradation, overexploitation and destruction of natural capital and ecosystem services would lead to an ecological "bankruptcy". This would mean tremendous disadvantages for economy, culture and social life. Examples are the costs arising from flood damages which are related to degraded regulation service of riversides. The flood damages in summer 2013 in Germany sum up to about € 11.7 billion (MunichRe 2014).

Therefore, a monitoring of natural capital is one pillar for defining the sustainable use of natural resources, for example by extraction rates, which take into account recharging rates and growth of natural capital.

A mismanagement of natural capital often occurs because the full value of natural capital and ecosystem services is not reflected in policy-trade-offs and in economic choices. This lack in decision-making is relevant from the local to the national level (EEA 2015d). The maintenance of natural capital and provision of ecosystem services is linked to the economy particularly because the economic valuation of ecosystem services can support the identification and internalisation of environmental costs. In addition, the payment for ecosystem services is based on the multitude of ecosystem services. A missing internalisation of environmental costs delivers wrong signals for economic development. Almost all economic sectors have to integrate environmental costs and are, therefore, relevant for the transition to a Green Economy and the conservation, restoration and sustainable use of natural capital (Brink et al. 2012).

Background about the concept of natural capital and ecosystem services

Where do benefits of nature come from? The concept of natural capital and ecosystem services puts biophysical structures, which enable ecological functions and services provided by ecosystems in a context with benefits for humans.

Figure 2.3.1-1 Soil functions allow plants to grow and bloom. Fertilization by bumblebees, bees and other insects are the basis for growing fruits such as apples. These interlinked services of nature are often without monetary values but contribute remarkably to human well-being. (Image rights: Marzelli, S. & Rabe, S.E.).

<u>Interlinkages between natural capital and ecosystem services</u>

According to the EEA (2015e), a nation´s wealth is grounded in four core stocks of capital:

- Manufactured capital (e.g. machines and buildings);
- Human capital (e.g. people, their skills and knowledge);
- Social capital (e.g. trust, norms and institutions) and
- Natural capital.

Natural capital is the most fundamental of the forms of capital, since it provides the basic conditions for the other kinds of capital and enables human existence, delivering food, clean water and air, and essential resources. It sets the ecological limits for our socioeconomic systems, which require continuous flows of material inputs and ecosystem services.

Natural capital comprises two major components

- Abiotic natural capital including subsoil assets (e.g. fossil fuels, minerals, metals) and abiotic flows such as wind and solar energy, as well as
- Biotic natural capital that consists of natural assets delivering a wide range of valuable services being essential for human well-being.

How are natural capital and ecosystem services interlinked? “Natural capital can often be confused with ecosystem services. However, whilst similar concepts, they are fundamentally different. Natural capital refers to the actual stock (living and non-living parts) that provides value whereas ecosystem services refer to the flow of benefits that this stock provides. Essentially, natural capital is about nature’s assets, whilst ecosystem services relate to the goods and services derived from those assets” (British ES 2016).

Common definitions and the measurement of ecosystem services are still under development and a common understanding is on its way. These aspects are a big challenge for an Alpine-wide evaluation of ecosystem services. However, European approaches such as the Common International Classification of Ecosystem Services (CICES) and the Mapping and Assessment of Ecosystems and their Services (MAES) Framework do exist and may be a starting point for an assessment of ecosystem services in the Alps. A first framework may be expected from the Alpine Space project *Alpine ecosystem services – mapping, maintenance and management* (AlpES). The overall objective of the project is to introduce ecosystem services as a regional/transnational environmental governance framework.

<u>Types and structure of ecosystem services</u>

Ecosystem services can be divided in different types of services such as

- provisioning services such as food, raw materials, water,
- regulating services such as purification of air and water, climate and run off control and
- cultural services which provide recreational, aesthetic benefits or inspiration.

They all are based on the supporting services such as the photosynthesis, nutrient cycles, and soil development. The worldwide Millennium Ecosystem Assessment (MEA 2005) highlights the contribution of ecosystem services to human well-being – which is assumed to include basic material for good life, health, good social relations, security and freedom of choice and action – its relations are explained in Figure 2.3.1-2.

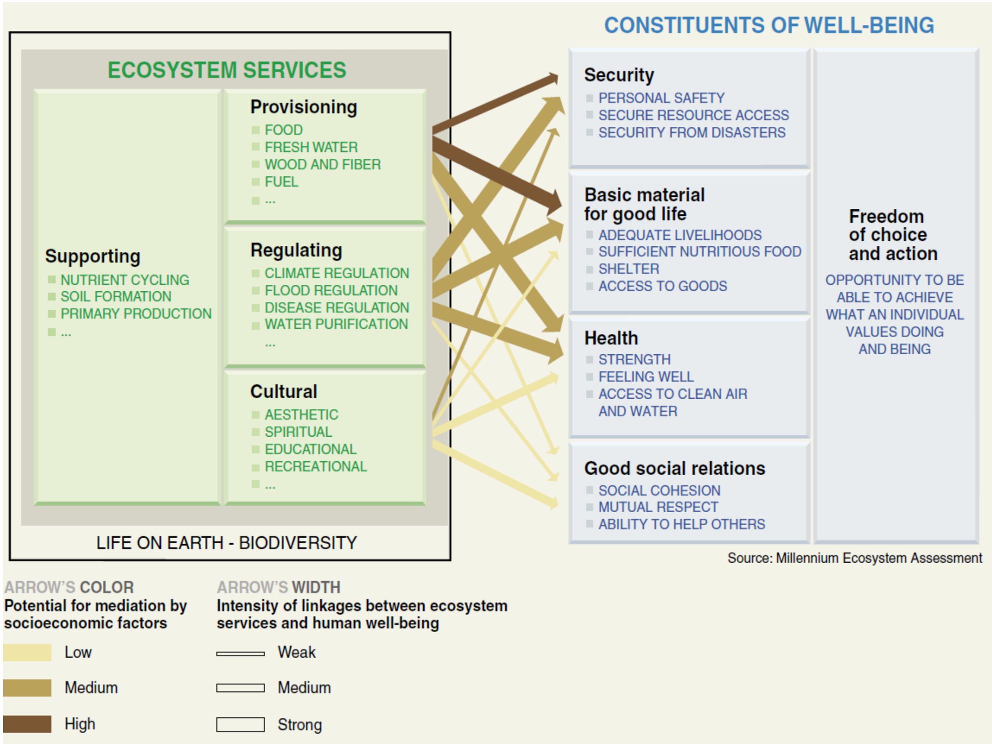


Figure 2.3.1-2 Categories of ecosystem services and their relation to human well-being (Source: MEA 2005).

<u>Trade-offs between ecosystem services and other land uses</u>

The application of the ecosystem service concept does not mean conflicts do not appear. It is more the case that trade-offs between different ecosystem services become more visible and benefits and disadvantages for human well-being will be easier to detect. This might be the case between intensive agricultural production in fruit orchards (provisioning service) versus groundwater protection as a regulating service. Even conflicts between the maintenance of ecosystem services and other land uses, in particular economic activities, are better to grasp as the effect on well-being is in the focus. An example might be the use of hydropower dams for electricity production versus cultural services such as landscape aesthetics.

The project recharge.green identifies recommendations for developing renewable energies in the Alpine area and considers the affected ecosystem services (Hastik et al. 2015):

- Biomass energy needs to consider the small scale of Alpine agriculture and has to adjust the biomass facility size;

- Hydropower should seek to find a balance between energy production and the preservation of particularly small pristine rivers with high ecological values;
- Windenergy should consider requirements of biodiversity protection and the compatibility of wind mills with Alpine landscapes;
- Photovoltaic should be preferably promoted on buildings and other sealed surfaces.

Ambiguity of evaluation

There is a large discussion about the feasibility of monetization of ecosystem services. Some critics argue that the complexity and multitude of ecosystem services can never be fully taken into account in monetary terms. Others hold that there are no established tools available and that, therefore, most policies ignore economic values of nature. Against this background, there is also some skepticism towards the concept of ecosystem services itself. However, this challenge might also turn into an opportunity as it is expressed by the GreenAlps Team: "The principal focus within the EU and its Member States is on economic growth (even within the realm of the green economy). The value of ecosystem services is underappreciated (under-valued or grossly rebated). The view is, however, expanding from requiring compensation for environmental damage to considering the valuation of and payment for ecosystem services" (greenAlps 2014a).

The recharge.green project tried to analyse ecosystem services in the Alpine area, focusing on ecosystem services related to renewable energies. The project worked in five pilot areas in which the ecosystem services have been analysed on a qualitative basis. The trade-offs between use of natural energies and other ecosystem services are identified between long-term productivity, nature protection requirements (depending on the degree of infrastructures needed), hazard protection and cultural services, in particular if the ecosystem services are based on "pristine" mountain landscapes (Hastik et al. 2015).

A challenge for the economic monetization is that a multitude of economic evaluation approaches exist, which deliver different values for ecosystem services. Also the concept of a "total economic value" is difficult to calculate, as economic valuation must always be interpreted in the context of a specific decision, which leads to marginal values (cf. ch. 2.3.3). However, the economic importance of ecosystems is sparsely considered so far. Therefore, in a further step, ecosystem services need to be considered in the economic and management systems. This could be a step forward for the internalisation of external costs but will also be a major challenge. In an ultimate step, costs for the use of ecosystem services would be integrated in a national accounting system, having influence on welfare measurement and by this on the strategic policy level. First international approaches exist within the System of Environmental-Economic Accounting (SEEA) activities.

Another challenge for applying such a concept is the fact that ecosystem services are imported to and used in the Alps (e.g. food, raw material, virtual water) but also exported (such as water, timber, agricultural products) and need to be considered in an Alpine ecosystem service assessment.

Status of ecosystem service analysis at European level

The MAES-Framework is an analytical framework for the assessment of ecosystem services in European Member States which shall ensure consistent national approaches. The main understanding is condensed in the scheme in Figure 2.3.1-3. This approach is structured along types of ecosystems providing a set of ecosystem services. For this purpose, 12 main ecosystem types have been defined from which the terrestrial and freshwater types (urban, cropland, grassland, woodland and forest, heathland and shrub, sparsely vegetated land, wetlands, rivers and lakes) are relevant for the Alps. The ecosystem types correspond to the satellite data in the CORINE land cover (CLC) classes (cf. Figure 2.3.1-4).

Up to now, different countries have carried out ecosystem service assessments in different ways such as the United Kingdom, Spain, Portugal and Belgium (Flanders). For the Alpine countries, further information will be given below in the national subsections.

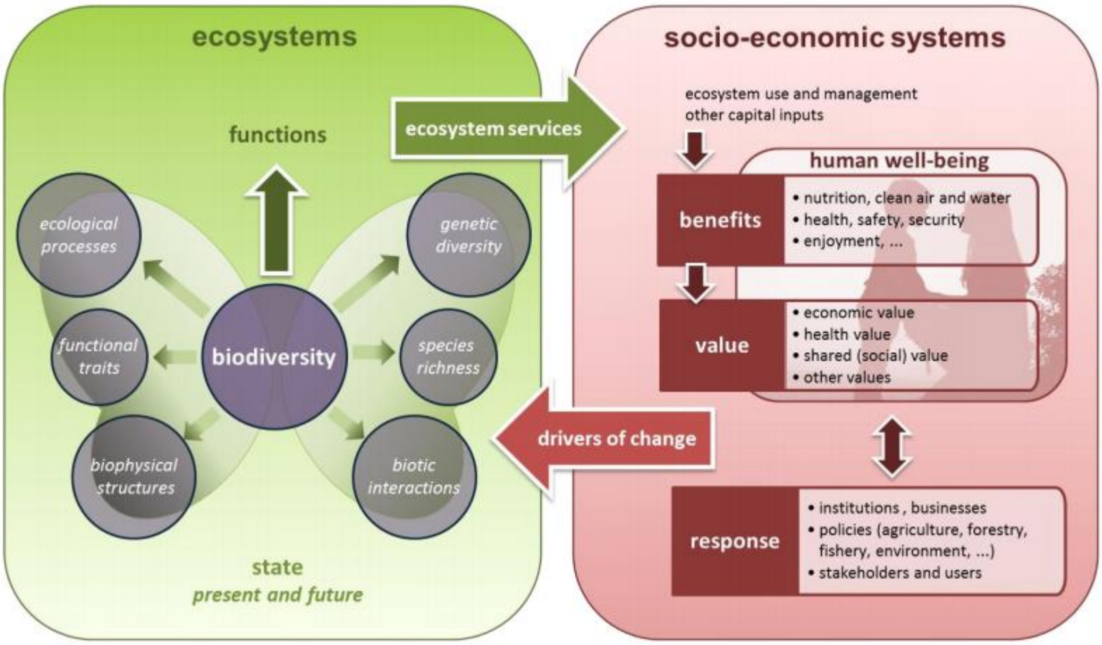


Figure 2.3.1-3 Conceptual framework for EU wide ecosystem assessments (Source: Maes et al. 2016, p.16).

At a European scale, different approaches have been carried out to model ecosystem services based on existing data files. The starting point of the PRESS project (PEER research on Ecosystem Services) is to improve the knowledge about land-use information and mapping and to reflect the existing knowledge about ecosystem services and their social and economic values to better inform policy design and decision making processes. Within this project, several maps at European scale have been developed (Maes et al. 2011).

There remain still many challenges for an Alpine wide assessment of ecosystem services. Based on the conclusions in an EEA report (2015d), key challenges related to ecosystem services are: functional relationships between ecosystem conditions and ecosystem services, mapping multiple pressures and conditions, linking of Europe-wide information with Member State assessments.

The recently started ESMERALDA-project[44] is going to provide an overview of the state of assessments and mapping of ecosystem services in the EU Member States. In this study, different levels (tiers) of ecosystem service assessments will be considered and data for map production and practical recommendations will be provided.

The OpenNESS-project aims to translate the concepts of Natural Capital (NC) and Ecosystem Services (ES) into operational frameworks that provide tested, practical and tailored solutions for integrating ES into land, water and urban management and decision-making. Within the project, case studies have been carried out on application of ecosystem services in practice. For instance in the Gorla water park in the Lombardy region, a new ecosystem has been developed to improve flood prevention and pollution removal and to offer an area for leisure and education and increasing habitat diversity for water birds (OpenNESS 2016). A second case study has been carried out in the Vercors natural regional park in the French Alps. Here, the ecosystem service concept was integrated into forest management planning to analyse trade-offs and synergies in terms of pastoralism and ski tourism.

[44] Enhancing ecoSysteM sERvices mApping for poLicy and Decision mAking. Further information: http://www.esmeralda-project.eu.

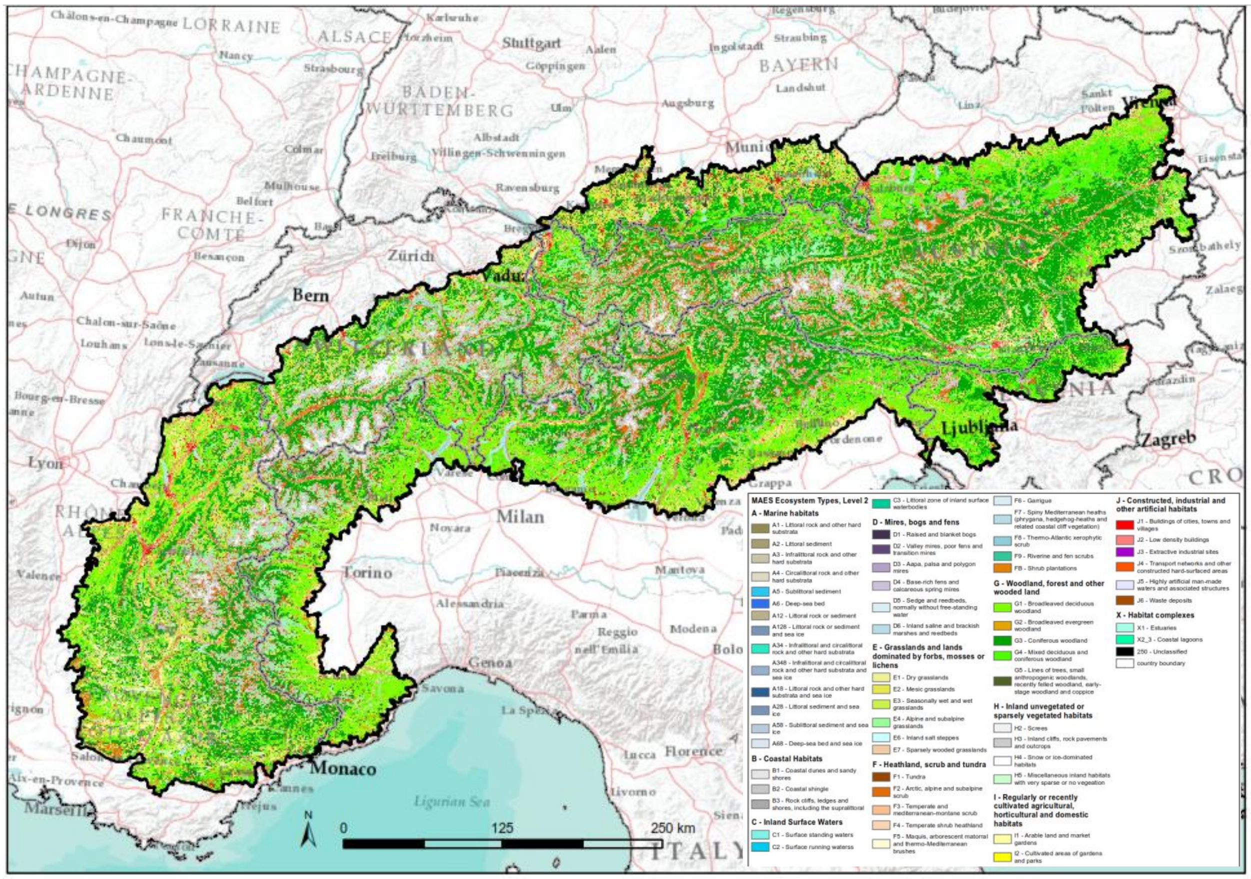


Figure 2.3.1-4 Ecosystem types based on CORINE Land Cover (CLC) data (Source: ETC ULS 2016a).

Policy background for natural capital and ecosystem services

The concept of ecosystem services has been pushed by the initiative on "The Economics of Ecosystems and Biodiversity" (TEEB 2010) which led to the adoption of five strategic goals for the maintenance and use of biodiversity (so called Aichi goals, CBD 2014) and their underlying global Aichy targets, that were adopted at the Conference of Parties (COP) in Nagoya. These goals aim to preserve biodiversity and ecosystem services. Triggered by this international development, also TEEB processes at European and national level have been launched, such as "Naturkapital Deutschland" in Germany.

At the EU level, the European Commission adopted in its EU Biodiversity Strategy "Our life insurance, our natural capital: an EU biodiversity strategy to 2020" (EC 2011a) objectives for the maintenance and enhancement of ecosystem services and also claims to restore degraded ecosystems (target 2). One important step towards this target is the assessment and mapping of ecosystem services in all Member States which is as "action 5" layed down in the EU Biodiversity Strategy. Furthermore, there is a call for ecosystem restoration and development of a Green Infrastructure Strategy in action 6. The EU is committed to halt the loss of biodiversity and the degradation of ecosystem services by 2020. Action 7 shall ensure the no net loss of biodiversity and ecosystem services through compensation or offsetting schemes. This is in line with the initiative of the European Commission on Green Infrastructure (EC 2013a) – a strategically planned network of natural and semi-natural areas with other environmental features. Green Infrastructure will support and safeguard the provision of ecosystem services.

Sustainability and multifunctionality are essential elements of the EU Forest Strategy (EC 2013b) and at the core of forest management policies in the Alpine area aiming at providing wood and other ecosystem services (soil protection, nature conservation, recreation). They are based on a long tradition of local and national regulations, community involvement in the forest management and public or community ownership. All Alpine Convention countries have private certification systems for sustainable forest management in place (40% of the Alpine forests are certified), that are useful tools for independent control and for communication. In the Alpine area, the relevant forest ownerships since several decades are managed following forest plans based on the principle of increasing the stock and stability of the stands, assuring the maximum potential of private and public goods supply (Working Group Mountain Forests of the Alpine Convention 2016).

Alpine relevance of natural capital and ecosystem services

What are specific contributions of the Alps in terms of natural capital and delivering ecosystem services? It is difficult to tell as no cross-country analysis of natural capital and ecosystem services exist. However, from other analysis, one might highlight some first examples of Alpine natural capital and ecosystem services:

- Water in high quantities and qualities is provided not only for the Alpine area but also feeding large European catchment areas such as Rhône, Po, Rhine and Danube;
- A high stock of biomass is provided by Alpine forests which cover 46% of the Alpine Convention area, with higher coverage rates in the eastern, lower area, up to 53% in Austria and 68% in Slovenia (data provided by WG Mountain Forests);
- Large scale semi-natural landscapes host not only a high diversity of plants and animals but are also a biotic resource for cultural services (see below);
- Provisioning services are the basis for tons of fruits and vine grapes cultivated in many of the Alpine regions;
- Regulating services for natural hazards such as floods, avalanches, mud slides are provided by Alpine forests and the maintenance of Alpine pastures;
- Cultural services like health, wellness and wellbeing are what people are seeking in lonely valleys. Millions of tourists and residents experience the Alps as hikers, bikers, mountaineers or skiers or people looking after their health through a stay in clean mountain air and climate. An example for the use of such services is the Swiss tectonic area (cf. Good Practice Sardona active). The Alpine landscapes offer also a vast amount of cultural services which have inspired generations of painters, musicians and poets.

A first systematic collection of ecosystem services has been carried out in the recharge.green project (cf. Figure 2.3.1-5).

	Ecosystem Services	Description
provisioning	Provision of forest and agricultural products	Products obtained directly from ecosystems such as agricultural products, forest products and aquaculture products (includes production function of soils)
provisioning	Provision of fresh or potable water	Provision of fresh or potable water, including water filtering function of soils
supporting & regulating	Carbon sequestration and climate regulation	Carbon dioxide (and other greenhouse gases) sequestrated by the ecosystem for regulating the global atmospheric composition
supporting & regulating	Air quality regulation	Mediation of toxic and other polluting particles in the air (e.g. dust) by the ecosystem -> ecological habitat quality
supporting & regulating	Protection against natural hazards	Mediation/buffering of flows (mass, liquid, gaseous) for avoiding extreme events (floods, soil erosion, landslides, avalanches, storms, rock falls, ...)
supporting & regulating	Ecological habitat quality	Overall habitat quality for wild plant and animal species. Habitat quality is (mutually) dependent on nutrient cycling, seed dispersal and pollination. Long term ecosystem stability (=resilience) and resistance against pests affecting human health and forest or agricultural production are an expression of high ecological habitat quality.
cultural	Aesthetical value	Experiencing the natural world (through different media), landscapes as source of inspiration or cultural values, and a "sense of place" in general, associated with recognised environmental features
cultural	Recreational value	Value for recreational activities (e.g. walking, hiking, skiing, climbing, boating, leisure fishing and leisure hunting), possibility for relaxation, reflection, and general absence of "noise pollution"
cultural	Intrinsic value	Value of ensuring the particular character of an ecosystem for future generations; the value of the ecosystem's existence for its own sake

Source: University of Innsbruck (Clemens Geitner & Richard Hastik), for recharge.green project

Figure 2.3.1-5 Examples of ecosystem services in the Alps (Source:greenAlps 2014a).

Good practice - Sardona active, Switzerland

The project "Sardona-aktiv" aims to stregthen the tourism offer in the UNESCO World Heritage Swiss Tectonic Arena Sardona. The area has high touristic potential due to its spectacular geological phenomena that can be appreciated by many people. These geological features represent a natural capital in the Swiss Alps.

The touristic services are developed in close cooperation with the Swiss Tectonic Arena Sardona and consideration of its needs. The project began in 2014 with a pilot stage which helped to clarify what specific measures in the development of organizational structure, sensitization, product development and marketing should be taken. Currently, the implementation stage is running.

Further Information: http://www.unesco-sardona.ch/

Natural capital - the example of forests in the Alps

From the different types of natural capital for this report, forest has been choosen as an indicator for natural capital. A sustainable management of forests requires that not more wood is extracted from forests than it is compensated by growth of forests.

<u>Ecosystem services – the example of hazard prevention</u>

Mountain forest do not only represent a natural capital, they also offer an important regulating ecosystem service, the protection against avalanches. Avalanches are a type of natural hazards occurring only in middle and high mountain ranges. Regulating the events and frequency of avalanches is thus an Alpine ecosystem service. In Figure 2.3.1-6 the provision of avalanche regulation through mountain forests in the Alpine area is presented.

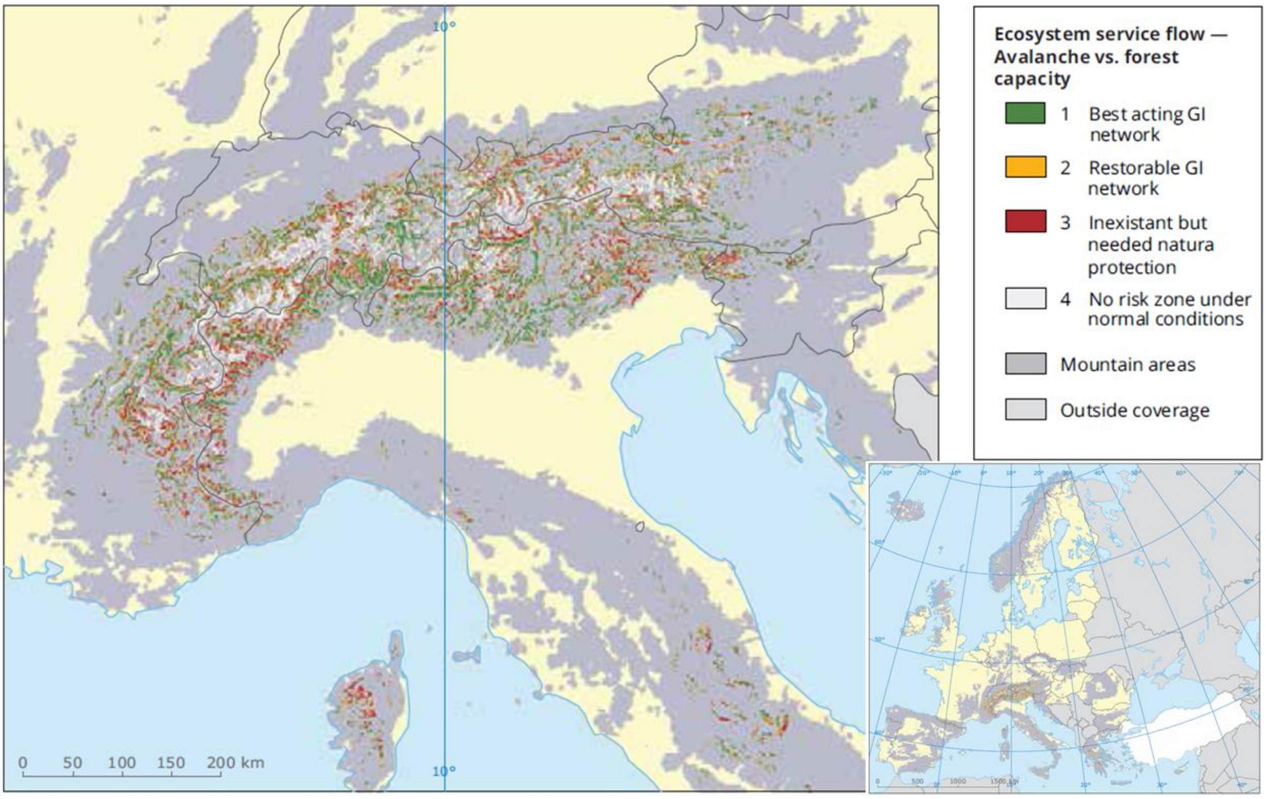


Figure 2.3.1-6 The capacity for avalanche protection is almost unique in the Alps. The hazard potential is presented against the ecosystem service capacity to mitigate avalanches. (Source: EEA 2015e)

Situation in Alpine countries

Natural capital in the Alpine countries - Forest development

Wood is a renewable and climate neutral resource, which serves as a key material for GE. For the purpose of this report, two indicators were selected to describe the subtopic "natural capital" within the Alpine Convention area:

- Net annual increment of forests (m^3/ha);
- Annual fellings (m^3/ha).

Both numbers related to each other express the stress due to exploitation of the natural resource forest in the Alpine area.

The total wood volume of Alpine forests is 2,000 million m^3, with an average of almost 240 m^3/ha, much higher than the EU 28 average (146 m^3/ha). The annual increment is 50 million m^3, equal to 5.7 m^3/ha, which is higher than the EU 28 average of 4.8 m^3/ha. The annual cutting is 28.5 million m^3 (Working Group Mountain Forests of the Alpine Convention 2016). Figure 2.3.1-7 presents trends on the amount of annual growth and fellings in relation to each other

In recent years, there has been a significant expansion of the forest cover, particularly in the southern and western part, due to the abandonment of marginal agricultural areas (meadows and pastures). The forest expansion reported in Europe is concentrated in mountain and other marginal areas.

Alpine forests did not only expand their area significantly over the last decades, but they have also increased their biomass. The significant increase in the annual increment observed in last decades is likely due to the multiple combination of several factors such as a larger growing stock, a reduction of grazing, the fertilization effect caused by atmospheric nitrogen deposition, and the increase in atmospheric CO_2 content concentration and temperatures (Bellassen et al. 2011).

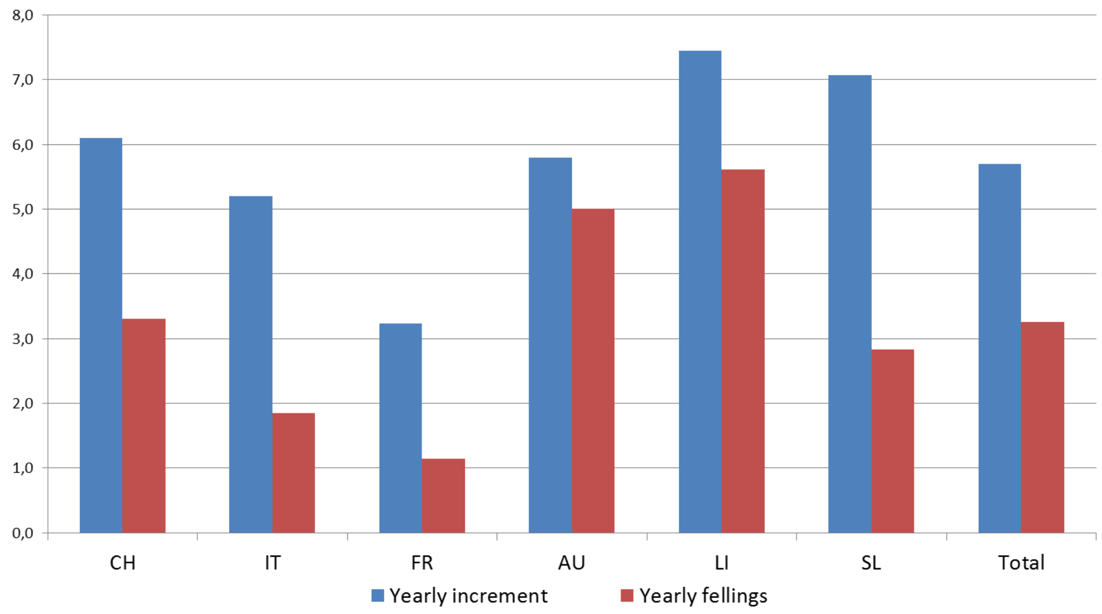


Figure 2.3.1-7 Annual forest increments and fellings in m^3 per ha in the Alpine countries (Data source: Working Group Mountain Forests of the Alpine Convention 2014; In the south – west Alps, fellings achieve a quote of 35% of the forest-increment, while in the north-eastern area they are 75%.

There are significant differences in the management of the forest area: In the northern part of the Alps a considerable wood mobilisation has taken place (particularly in Austria) and the ratio growth/felling is close to 90%. Whereas in the southern part, a considerable accumulation of biomass has taken place and there is room for increased wood mobilisation that has to be sustainable and implies investments in access, machineries and training of owners, contractors and foresters.

Almost all Alpine forest are semi-natural as defined by Forest Europe, with a significant presence of large trees and deadwood, while there are almost no truly primary forests and plantations. Alpine forests are evolving towards mixed and often irregular structures (Working Group Mountain Forests of the Alpine Convention 2016).

<u>Austria</u>

The Austrian forest inventory at the Federal Agency for Forests (Bundesamt für Wald, BfW, Österreichische Waldinventur) monitors the state of Austria’s forests. Areas, wood and biomass assets, species compositions, and many other parameters are monitored in a raster sample design regularly and calculated with statistical methods for the national level. National trends in biomass and condition can be visualized and long-term effects of management, natural drivers or other influences on forest can be demonstrated. The forest inventory also measures a biodiversity index, which has been developed for Austrian forests. The Figure 2.3.1-8 shows, as a regional example, the annual fellings in Tyrol from 1974-2012.

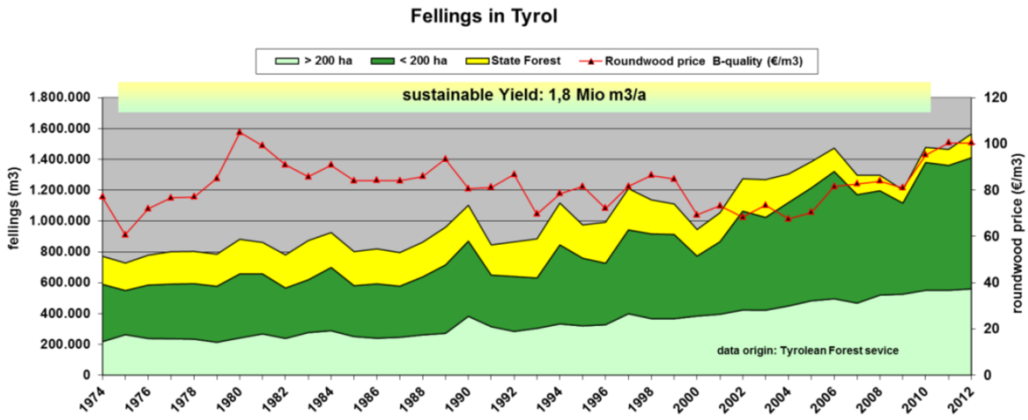


Figure 2.3.1-8 Felling dynamics in Tyrol from 1974-2012 in smaller and larger than 200 ha properties and state forests (Data source: Working Group Mountain Forests of the Alpine Convention 2014).

Germany

Results from the Third National Forest Inventory show that the forested areas in Bavaria have continued to increase. The proportion of deciduous trees is about 36 percent, almost two-thirds more than the first large scale inventory in 1971. In young stands, this proportion is even as high as 54 percent. The average age of the forests in Bavaria is 83 years, has risen by four years since the last inventory and is distinctly higher than the national average. The proportion of dead wood (i.e. coarse woody debris) is also higher than the national average and is approximately 22 m^3 per hectare; in public forests it is even higher at 35 m^3. Additionally, the timber stocks clearly lie above the national average with 396 m^3 per hectare.

According to the Interpellation Report of the Bavarian Parliament (Bayerischer Landtag 2015) within the German part of the Alpine Convention area, a total of 435 hectares forest have been cleared in the time period between 2006 and 2012. The biggest transformations for clearings have been performed by the agricultural sector with almost 190 hectares.

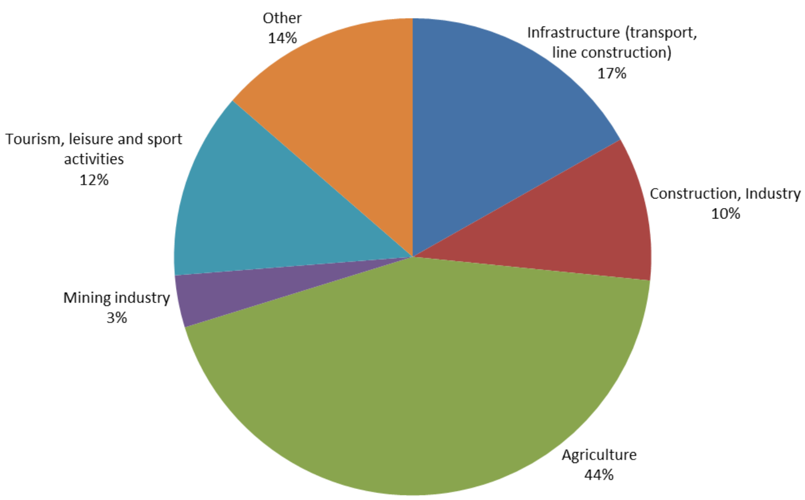


Figure 2.3.1-9 Share of approved clearings of forests by sectors in the German Alpine Convention area from 2006 to 2012 in the districts of Bad Tölz, Berchtesgadener Land, Garmisch-Patenkirchen, Lindau, Miesbach, Oberallgäu, Ostallgäu, Rosenheim, Traunstein and Weilheim (Source: Bayerischer Landtag 2015).

Italy

In physical terms, forested areas have been increasing significantly in Italy almost everywhere since the previous issue of the Italian national forest inventory in 2005 (Corpo Forestale dello Stato & CRA 2005 and 2015).

In particular, Alpine regions show an increase also over the last 10 years (2004-2014) even though with diverse intensities that may be linked also to socio-economic factors and habits in different areas (Corpo Forestale dello Stato & CRA 2015). Figures at the regional level show that three Alpine regions rank among the first ten for forested areas (Piemonte, Lombardia and Veneto). As a whole, the Italian Alps host 34% of the total forested area in the country. Data on forest increment show a diversified situation with a particularly limited increase in the regions where a more significant forest sector exists and forest management is usually performed (Trentino and Alto Adige/Südtirol), while only Liguria region shows a trend that is in line with the national average (around +6.1%). In absolute terms, Valle d'Aosta has the lowest number of trees per hectare (707) but low values are also found in Alto Adige/Südtirol (884).

Figures also show an annual increase of forests of 0.6% in the whole country that is lower in the Alps (+0.4%).

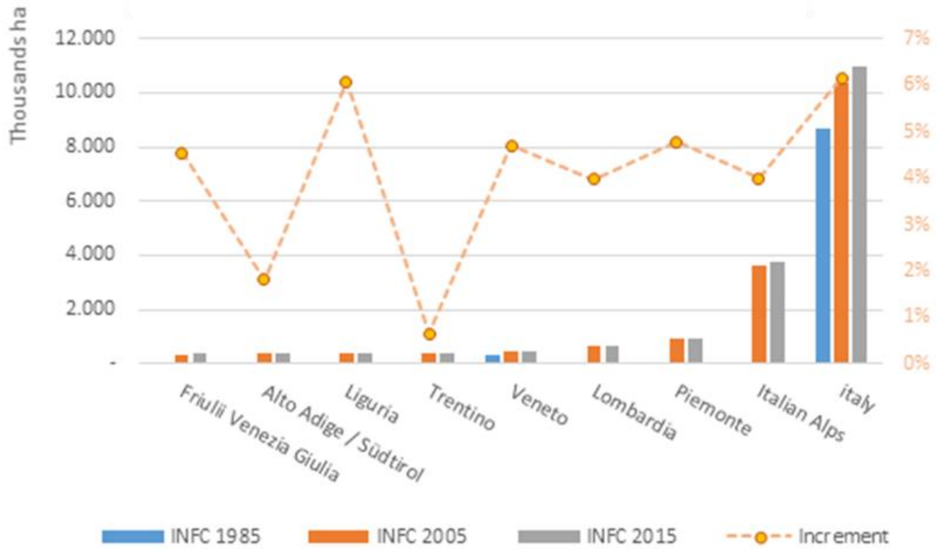


Figure 2.3.1-10 Forest land and increment, Italian Alpine Regions (2004- 2014) (Source: Corpo Forestale dello Stato & CRA 2015).

Liechtenstein

The annual cutting rate in Liechtenstein shows a slight decrease from 25,000 to around 22,000 cubic meters over the last years du to the strengthening of the Swiss Franc against the Euro. Therefore, the actual amount of cuttings lies significantly below the coutrywide growth rate (see AWNL 2012).

Table 2.3.1-1 shows the distribution of logged woods to different usage categories. Around 70% of total fellings in Liechtenstein are used for wood fuel. 33.3% is assigned for construction wood and only 0.5% is used for industrial purposes. Since 2014, energy wood obtained from branches and crowntops is documented separately and shows a share of more the 10% of the whole energy part.

Table 2.3.1-1 Wood utilisation in 2014 in Liechtenstein (Landesverwaltung Fürstentum Liechtenstein, Amt für Statistik 2014).

	Energy wood	Construction wood	Industrial wood	Remaining in forest	Total
Total logged, m^3	14401	7407	109	342	22259
Share	64.7%	33.3%	0.5%	1.5%	100%

Slovenia

Slovenia has a long tradition in sustainable forest management. The most typical feature of the Slovenian landscape is its forests, which cover 58,4% of the national territory. In terms of relative forest cover, Slovenia ranks third in the European Union, after Finland and Sweden.

The forest area in Slovenia is expanding through the natural reforestation of abandoned farmland, meadows and pastures. In many parts of the urban landscape however, forests have to yield to the construction of infrastructure and housing. The forests are a valuable natural resource for Slovenia, containing close to 300 million cubic meters of wood. The proportion between deciduous and coniferous trees is 45,8: 54.2. In the year 2013, the growing stock has increased by 1.4% and has amounted to 342,408,614 m^3 or 289 m^3/ha. The annual increment was 8,491,883 m^3, from this 3.7 million m^3 by coniferous trees and 4.8 million m^3 by deciduous trees.

The Triglav National Park (TNP) participated in the Alpine Space project recharge.green that focused on the question of balancing renewable energy (RE) production and nature conservation. As a project partner and one of the project pilot regions, TNP focused on the use of woody biomass as a renewable energy source and its impacts on nature conservation and other ecosystem services.

Switzerland

According to the Federal Statistic Office of Switzerland (BFS 2016d), there was a slight increase in the forested area between 2005 and 2013. Wood production, as well as Forest Stewardship Council (FSC) certified wood production, increased between 2005 and 2013 (see Table 2.3.1-2).

Table 2.3.1-2 Forest area, Wood production, certified wood production in Switzerland (Source: BFS 2016d).

Switzerland	2013	2012	2010	2009	2008	2007	2006	2005
Forest area (ha)	1 258 210	1 258 658	1 255 274	1 255 141	1 254 144	1 247 856	1 244 681	1 242 510
Wood production (m^3)	4 778 328	4 658 379	5 128 995	4 879 697	5 262 183	5 690 549	5 701 515	5 284 639
FSC certified wood production (m^3)	3 194 409	3 176 516	3 456 408	3 443 713	3 494 644	3 809 913	3 895 054	3 552 518

Good practice - Sustainable forest management in Mezzano, Italy

In the province of Trento, sustainable forest management for the forest of Mezzano has been pushed through in the 1960s, reducing annual cuts, promoting broadleaved species and fir, establishing natural regeneration and composite structures.

The forest has been managed based on management plans and inventories with a period of 10 years. Since 1958, data are comparable. From 1958 to 2008 the forest area has grown from 360,000 to 420,000 cm (+17%). The growing stock per hectar is considerably higher than the average of the province (now 354 cm/ha and 210). Broadleave species (beech) have more than doubled, rising from 4 to 7.4%.

Prescribed cutting was also increased from 3,750 to 5,500 cm/year, from 60% to 70% of the annual increment of the forest, despite the fact that the actual felling was higher due to wind damages (in the 50 years 53,000 cm i.e. +22%). In total 300.000 cm wood have been collected, mostly industrial wood but also firewood for the local population.

After 50 years, the forests have a good accessibility and infrastructure, with a house for the forest warden, a former agricultural building refurbished as a camp for school children, and a forest learning path. Despite some relevant damages caused by windthrow and snowbreaks the forest has a very high growing stock and wood production. Wood is sold at a good price, there is a relevant presence of large fir trees, a rapidly growing beech percentage with positive effect on soil fertility, and part of the forest is within a Natura 2000 area.

Felling is done by local companies while many families still take wood fuel for their needs (which is a recognised right for the inhabitants of the municipality as well as wood when they build their residence house).

Further Information: http://www.comune.mezzano.tn.it/home.html

Status of ecosystem service analysis in the Alpine countries

Role of mountain forests for providing ecosystem services

Overview

Alpine forests stock big amounts of carbon, removing CO_2 from the atmosphere and transforming it in organic matter (mostly wood, which basically consists of carbon). Also considering only the carbon in the above ground mass (without roots, litter and soil that represent 150 to 200% of it), the total amount is remarkable: 600 million t (i.e. 2,200 t CO_2). Annual sequestration is also very relevant: 50 million wood growth corresponding to 55 million t CO_2: 42% of it is stocked in the growth of forest stands (representing an accountable sequestration within the Kyoto agreement); the rest (non accountable sequestration) is felled and used mostly in the building and furniture sectors (thus continuing sequestration for the time staying in the stock) and in part as firewood (returned to atmosphere but replacing fossil fuels). A 'cascade use' of wood (i.e. the use of raw material primarily in long-life products, while bioenergy should be produced preferably using industrial wood waste and end of life-products) extends the carbon sequestration.

In mountain areas, forests play an essential role in providing soil cover and protection against natural hazards like avalanches, rockfalls and erosion; designed as protective forests they are subject to stricter regulations regarding land use change and management. This function is particularly relevant in the Alps, characterised by steep slopes, dense population and infrastructure.

The storage of carbon in Alpine forests is a regulating service which gained higher attention due to the effects of climate change.

Also very important is the impact of forest cover on the water cycle: forests provide for canopy and soil filters and stores rainwater with a positive effect on quality and on flood reduction. The natural risk reduction function is even more important in the context of climate change, the expected rise of extreme events and the very high costs of soil and infrastructures protection (Working Group Mountain Forests of the Alpine Convention 2016).

Austria:

The Austrian Biodiversity Strategy 2020+ published in 2014 refers to ecosystems and their services. The introduction of a green GDP ("Umweltgesamtrechnung") is discussed and approaches for such a green accounting are tested, but methods and applications are still on the research agenda.

The MAES group[45] characterizes activities related to ecosystem services in Austria as focused on the development of biodiversity indicators: "For this, several studies have been conducted by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, also dealing with Ecosystem Services. Aim of a study in 2013 was to assess the condition and importance of biological diversity in Austria, to describe Ecosystem Services in a common language and to depict possible conflicts, e. g. effects of soil sealing on various services.

Other activities so far were undertaken by the Environment Agency Austria, such as a national wide mapping of ecosystems based on the EUNIS classification (105 classes from level 2 to 4) with a spatial resolution of 10 x 10 metres. Mapping and assessing of a set of ecosystem services on a regional level was conducted within the project MUFLAN for two case studies in Römerland Carnuntum and Oststeirisches Kernland. A study published in 2011 presented an inventory of ecosystem services in agricultural context, an inventory of ecosystem services of forests followed in 2015. Also in 2015, a report examined potentials, requirements and risks of the economic valuation of ecosystem services. Furthermore, contributions were made to the project COIN – Cost of Inaction by examining the costs of climate change and its effects on two ecosystem services (pest control and pollination). On European scale activities included the participation in MESEU or contributions, e.g. to the creation of the Map of European ecosystem types based on the EUNIS classification and ecosystem assessment as part of ETC-SIA."

In a case study in the Stubai valley, the ecosystem services of agricultural areas have been analysed in terms of effects of global change from Schirpke et al. (2013). In addition, scenarios have been analysed how future land-use patterns would develop under changing conditions and what this will mean for multiple ecosystem services. Results point out that local economy may generate new markets for agricultural products; however, due to changing climate conditions declining precipitation may limit farming opportunities. Increasing forest cover may increase some ecosystem services but might reduce cultural services for tourism. It is recommended to consider multiple ecosystem services and their trade-offs in agricultural management and in land use policy.

France[46]

According to the MAES group, scientific and technical committees, and steering committee involving stakeholders have been set up in France. There are working groups focusing on different ecosystems (at the stage of 2015, forest, wetlands, urban, agro-ecosystems, and marine ecosystems). A new working group on rocks and mountains should have been launched at the beginning of 2016. There will be a few outputs from the working groups (e.g. map of wetlands, report on what can be done in urban

[45] More information: http://biodiversity.europa.eu/maes/maes_countries

[46] Further information: http://biodiversity.europa.eu/maes/maes_countries.

ecosystems and case-studies, map and assessment of some ecosystem services such as pollination). In terms of the economic assessment of ecosystem services, the use of data was clarified at the Hands On workshop.

A process has been launched to look at values of ecosystem services that are not well considered in current work which tends to focus more on economic assessment. Issues that will be explored concern less tangible cultural services with benefits such as spiritual and mental well-being. Experience has shown that it is difficult to communicate these issues and one priority will be how to use indicators for the decision making process.

Germany

In Germany, ecosystem services are tackled mainly by the Federal Agency for Nature Conservation and the German Environment Agency at the federal level but also other public authorities e.g. from the agricultural sector have joined the discussion and development process. Many activities are carried out in the national TEEB-process (The Economics of Ecosystems and Biodiversity), called “Naturkapital Deutschland” (nature capital Germany). The activities comprise:

- A national overview study on physical accounting for ecosystem services has been carried out including first mapping and assessment approaches on behalf of the Federal Agency for Nature Conservation (Marzelli et al. 2014). It includes the definition of ecosystem services, prioritization of services with special importance for Germany, exploration of available data, presentation/creation/discussion of alternative indicators for each service, reasoned proposal of one indicator for each service, mapping of indicator values based on available data and a scoping study on economic values for ecosystem services (meta-analysis). The study produced several maps of ecosystem services at national level which cover also the German Alpine Convention area (cf. Figure 2.3.1-11).
- Based on the above mentioned overview study, a discussion paper summarised the development of national indicators for ecosystem services - Recommendations for Germany (Albert et al. 2016). In this paper, 23 indicators for ecosystem service supply, demand and use are proposed with some extensions and modifications regarding e.g. groundwater quality, fodder production, ecosystem services of natural and semi natural ecosystems in agricultural landscapes.
- Within the process Natural Capital Germany[47] – TEEB DE (2012 – 2017) - two general and four topic-based reports presenting the economic arguments to support nature conservation are produced. The reports include an Introductory brochure (TEEB Germany 2012) and a brochure for business (TEEB Germany 2013). The topic reports focus on the contribution of nature and nature conservation to climate change mitigation and adaptation (Marzelli et al. 2014), ecosystem services in rural areas (TEEB Germany 2016a), on ecosystem services in cities (TEEB Germany 2016b) and a summary report on the integration of ESS into private and public decision making.
- Job (2015) has analysed the economic effects of tourism in the Nationalpark Berchtesgaden. He documented, that in the year 2014 about 1.58m people visited the park and generated a turnover of € 93.8m. Compared to his former analysis in the year 2002 (Metzler & Job 2003), visitors and turnover have significantly increased.

[47] Further information: www.naturkapital-teeb.de

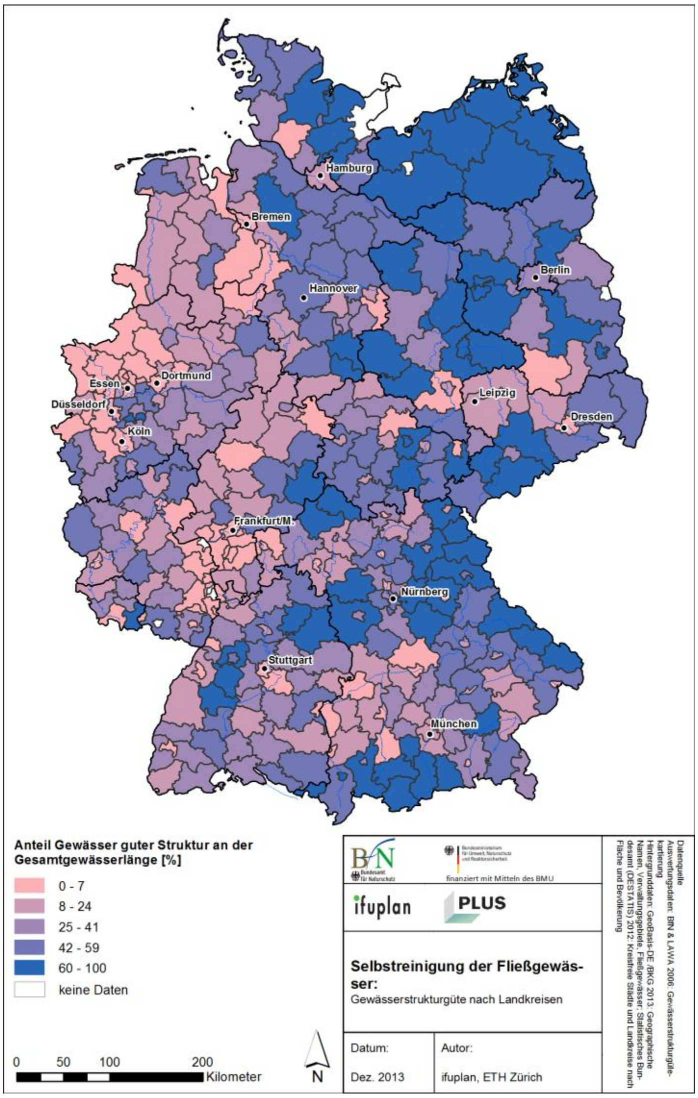


Figure 2.3.1-11 Share of streaming waters with a good water structure in percent of the overall lengths of the streaming water per county in Germany. The streaming water structure in the Alpine counties is better than in most counties north of the Alpine arc. (Source: Marzelli et al. 2014)

Italy

Updated and detailed basic data have been collected at the national level, including ecoregions, land units, bioclimate, biogeography, potential natural vegetation and CORINE land cover at the fourth level. As a result, a map of national ecosystems at 1:100,000 based on CORINE land cover and potential natural vegetation, bioclimatic and biogeographical information has been delivered in which ecosystem types have been defined according to biogeographic and bioclimatic setting, geographical location and vegetation phisionomy. Moreover, the conservation status of ecosystems and landscape has been assessed based on a selected set of parameters. Ecosystem services have been assessed under the biophysical point of view for five pilot case studies focusing in particular on provisioning and regulating services' types. Moreover, some criteria to determine priorities for ecosystem restoration have also been proposed and applied starting from the status of conservation of related habitats of community interest (ESMERALDA 2015).

Under the policy point of view, ecosystem services have been considered as deserving a particular attention in the framework of the Italian National Biodiversity Strategy (MATTM 2010) especially the ones that derive from national, regional and other parks across the whole country (MATTM & Unioncamere 2015).

National parks in Italy are considered responsible for the implementation of CBD Strategic Plan 2020 (Aichi Target 11) to conserve biodiversity and ecosystem services through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes.

The Italian National Biodiversity Strategy (approved in 2010) (MATTM 2010) considers biodiversity as natural capital due to both its intrinsic and tangible value and the ecosystem services that flow from it, which are essential to shape human well-being, but also to sustain durably economic prosperity. Therefore, it starts from an investigation concerning natural capital (defined as “natural heritage”) that aims at accounting in physical terms the size of vegetal, wildlife and water heritage by providing a homogenous metrics for all the national parks across the country.

Forest ecosystems received particular attention due to their significant presence in national parks. The identified forest ecosystem services include the following ones, where the role played by forests in stabilizing GHGs concentrations in the atmosphere has increased the importance of the ecological role and the socio-economic function of forests as carbon sinks and stocks, in line with climate change mitigation as a priority-action:

- Water regulation and surface run-off reduction;
- Prevention of hydrogeological instability and limitation of natural hazards;
- Influence on global atmospheric circulation and its components (in particular through “carbon sinks”).

In line with the role of forests as carbon sinks which contribute to CO2 regulation, a national registry has been set up showing that their contribution to meet Kyoto Protocol’s targets is significant. The estimated biomass of Alpine forests in Italy (data for above-ground phytomass have been reported for 2005 and 2015) has been increasing, which resulted in an augmented CO2 storage capacity on average by some 12% (own calculation) over the 2005-2015 period. The highest increase took place in Liguria and Valle d’Aosta, as shown in the Figure below.

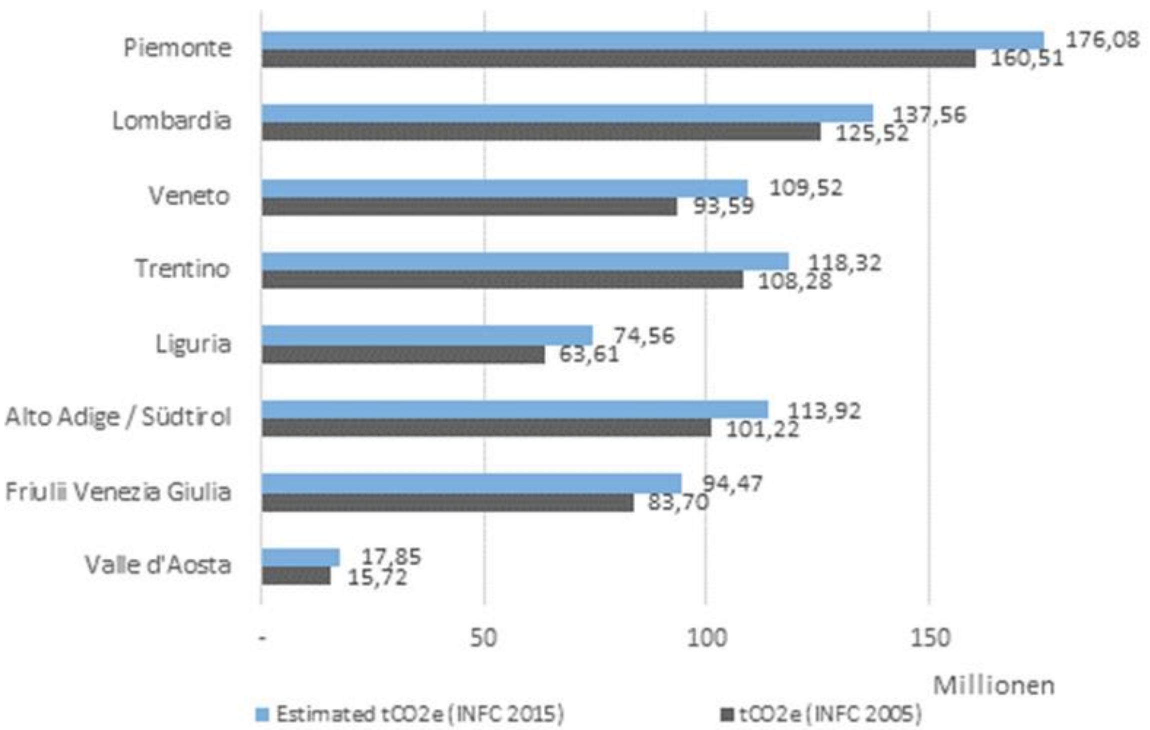


Figure 2.3.1-12 Forest carbon sinks in the Itailan Alpine Regions, 2005 – 2015 (tCO2e, figures for epigeous phytomass, INFC- Italian national forest inventory 2005-2015) (Source: Corpo Forestale dello Stato & CRA 2015).

The resulting ecosystem service of carbon sequestration provided by Alpine forests in Italy could be valued in monetary terms, at the average market price for CO_2 EU ETS allowances of 6.65 €/ton (over the period 2012-2016), at from € 5,002 to € 5,601 m (for 2005 and 2015 values respectively) (Corpo Forestale dello Stato & CRA 2015).

Increasing attention has been paid to the effect of alternative development paths and policies on natural and semi-natural ecosystems and the services they deliver. Concerning the latter, it is recognized that many ESS are supported by biodiversity, however only a share can be assessed qualitatively, an even smaller one quantitatively and a very small share can be valued in monetary terms (MATTM 2013).

Companies located in protected areas appear to receive significant benefits from ESS whose provision they seem to care for, including drinking water provision and climate regulation services (MATTM & Unioncamere 2015). Some industries have been considered in a recent report as "core-economic sectors" in national parks, being particularly linked to the natural capital stored in those protected areas. They are:

- Food & agriculture (farming and food industry);
- Forestry and wood-value chain from raw timber (silviculture, wood industry, pulp, paper and cardboard);
- Agro-food and wood trade;
- Tourism;
- Culture and recreation.

Liechtenstein

A national biodiversity strategy is available, but no practice examples or studies on benefits have been reported. Liechtenstein participates together with partners from Austria, Germany, France, Italy and Slovenia in the Alpine Space project AlpES, which addresses ecosystem services. In Liechtenstein, one or two pilot areas will be analysed.

Slovenia

Ecosystem services in Slovenia have not yet been systematically mapped and economically evaluated, but several studies dealing with particular areas have been carried out. Slovenia has participated in the TRAIN project and several ecosystem services have been analysed and drafted on a national level.

The most important ecosystem services in the Triglav National Park (TNP) have been identified within the Alpine space project greenAlps in which the TNP took part as a project pilot region. TNP provides a variety of ecosystem services such as nature conservation, environmental and cultural heritage protection, recreation and tourism. In addition, agriculture and forestry can be recognized as important economic activities for local people. Within that project, the balancing of renewable energy (RE) production and nature conservation has been analysed.

Several studies also took place where ecosystem services were evaluated in small protected areas such as the evaluation of ecosystem services as perquisite for sustainable development in "The cases of Lovrenško barje meres and Škocjan caves" (Danez et al. 2014). The Institute of the Republic of Slovenia for Nature Conservation is partner in the project AlpES[48]. In the sequence of this project, mapping and assessment of ecosystem services will be carried out not only for the Alpine Space but for the entire country.

Switzerland

In 2012 Switzerland has adopted a biodiversity strategy in which the assessment of ecosystem services is one out of ten strategic objectives. The main objective is the long-term maintenance of ecosystem services. The Federal Office for Environment states in the strategy that one of the ways to achieve it is to develop indicators that help assess all ecosystem services. To this end, the Confederation has developed a catalogue with 23 ecosystem services, from which the society can benefit most (Staub et al. 2011). The work on development of indicators that could measure these ecosystem services is already in progress. The results of this qualitative observation of the ecosystem services should be the basis for consideration of conflicts in application of the strategy.

There has also been an attempt for national assessment of ecosystem services and a first screening of data for a mapping of ecosystem services in Switzerland. This recommended to apply the tier-approach, assessing ecosystem services at different levels and with different intensity (Gret-Regamey et al. 2014).

The recognition of ecosystem services is at the heart of the Swiss Biodiversity Strategy and also a pillar of the Office’s strategy for the rural area and of the Swiss forest policy. In 2009 and 2011 the Swiss FOEN has published methodological studies for establishing (non-monetary) indicators for ecosystem services. A part of the studies’ recommendations have been implemented, others (e.g. indicators on pollination) need further research. A feasibility study on mapping ecosystem services and a practical assessment of data availability for ESS (Gret-Regamey et al. 2014) was conducted.

Conclusions on opportunities and challenges

Natural capital and ecosystem services are new concepts, which bear a high potential for greening the economy in the Alpine Convention area: They measure and analyse stocks and flows of natural resources and make them accessible for consideration in economic terms.

The natural capital of forests is an important resource in a Green Economy due to its characteristics of being renewable, low-energy intensive and no-waste producing. From national data on forest increment and fellings, it is evident that wood biomass is managed sustainably; even the forest area has increased. However, regional data for the Alpine Convention area have not been available for this report.

Opportunities of this local and regional natural capital in the Alps are the use of sustainably produced raw material as construction wood in an innovative building sector and furniture industry and energy wood as a renewable energy source. The consolidation and further development of sustainable forest management practices can support the efficient performance and supply of ecosystem services of forests to the local and regional communities.

For the assessment of ecosystem services, a variety of national approaches exists or is in preparation in the Alpine countries and first case studies are available. In the future, the concept of ecosystem services could serve as a tool and basis for the identification of trade-offs between different ecosystem services and other land uses. Based on these trade-offs and their costs, environmental costs and benefits could be better considered in a Green Economy. Furthermore, the spatial disparities of ecosystem services and the above mentioned analysis of trade-offs might also be a starting point for the development of compensation schemes for the provision and benefitting of ESS within and outside the Alps.

Until now, a common classification or identification of ecosystem services for the Alps is missing and data for an assessment or a mapping of ecosystem services are not ready for use.

[48] Further information: http://www.alpine-space.eu/projects/alpes/en/home.

2.3.2 Biodiversity

Biodiversity is part of our natural capital and contributes to all ecosystem services, which are used by our society. However, biodiversity is also a category in itself, as biodiversity is not only the vast amount of biological functionalities of and between habitats, species and genes. Biodiversity is influencing our cultural habits such as cuisine (regional recipies) or clothing assesoires for traditional costumes and enriches our personal nature experiences. More than this, biodiversity is also an important economic factor such as a marketing and image asset in tourism (e.g. eagle or alpine ibex), input for pharmaceutical products, biochemical products or cosmetics, or as a master for bionic developments. The uncountable variations and million years of development time for biological solutions are also an important knowledge source for innovation. Often, this crucial role of biodiversity for society and economy is underestimated.

Background about biodiversity

Biological diversity is understood as (1) the diversity of ecosystems and habitats, (2) the diversity of species and (3) the genetic diversity. Frequently, the protection of this diversity by nature conservation is perceived as a counterpart of economic prosperity, hindering the development of business and infrastructure. However, this viewpoint disregards the high importance of biodiversity for economy, particularly for a Green Economy.

The last decades have seen a dramatic decline of species worldwide. The Alpine biogeographic region exhibits an extreme fauna and flora and a high level of endemism. This builds essential and unique ecosystems with an extraordinary biological diversity that is particularly vulnerable. Anthropogenic impacts through transport, fragmentation of biotopes, land use-change, and air pollution strongly affects mountain areas with negative effects on biodiversity. As an indirect impact, climate change continues to alter the distribution of species affecting the species composition in mountain ecosystems. Lowland species are expected to move upwards in altitude. Highland species may become extinct, as no high grounds will be available for escape (EEA 2002). Therefore, the EU Habitats Directive (EC 1992) lists some tens of species in the Alpine biogeographic region, which are under specific protection according to Annex II of this directive.

From an economic point of view, biodiversity loss causes significant costs for society (Svadlenak-Gomez et al. 2013): According to the study of the Nature Conservancy and the Corporate EcoForum (Corporate Eco Forum & The Nature Conservancy 2012), each year our planet's complex land and water systems — a "natural living infrastructure"— produce an estimated $72 trillion worth of "free" goods and services essential to a well-functioning global economy. According to the UNEP report (2011c) the use of these natural resources is generating environmental and social costs to the tune of $6.6tn a year – costs that could climb to $28tn a year by 2050 if we fail to take action. Therefore, while we reap the benefits of nature, we are undermining its valuable inputs (Andersen 2015).

At the EU-level, several policy instruments address the maintenance and conservation of biodiversity. The overarching EU Biodiversity Strategy to 2020 (EC 2011a) is a comprehensive strategic document with six operational targets and 20 associated actions, which are closely modelled on the Aichi targets (CBD 2014) of the Convention on Biological Diversity (UN 1992).

Areas protected for the preservation of biodiversity at EU level are proposed by the EU Member States under the Habitats Directive. Some 788 thousand km² of the EU-28's terrestrial area were proposed for protection under the Habitats Directive as of 2013, around 18 % of the total land area (EUROSTAT 2015c).

The Green Infrastructure Strategy outlines that "Green Infrastructure is specifically identified as one of the investment priorities. Green Infrastructure is recognised as contributing to regional policy and sustainable growth in Europe and facilitating smart and sustainable growth through smart specialisation" (EC 2013a).

Several projects in the Alpine Space Programme address the topic of biodiversity: e.g. the DynAlp-nature programme, developed by the Alliance in the Alps, is designed to promote innovative model ideas targeted at habitat networking and at the creation and preservation of biodiversity. Relevant measures include the near-natural management of municipal green areas and open landscape management (Project duration 2013-2016).

Alpine relevance of biodiversity

There is only scattered information on the Alpine wide situation of biodiversity and its role for economy. Therefore, the Alpine wide status of biodiversity is described by the following points: the contribution of biodiversity to Green Economy products, the status and role of protected areas, which represent important areas for biodiversity conservation, and the occurrence of high-nature farmland, where even outside of protected areas a high level of biodiversity is likely.

Biodiversity and Green Economy products

It is important to mention the role of biodiversity for human well-being, which is one major reason for a greening of the economy. In the Alpine area, biodiversity is one main reason for nature experience as a basis for ecotourism or close to ecotourism.

There is a growing offer of such products and ecotourism is developing as a diversified branch of Alpine tourism. So called herbal excursions, herb walks, herb cooking courses or haybaths offer special, biodiversity based opportunities for the tourism sector in the Alps. The symbol of *Leontopodium alpinum* is often used in naming markets/products. Excursions, bird watching events, golden eagle shows (see good practice) are also attractive touristic spectaculars. Several hotels in the Alpine area spread their services through nature and biodiversity experience.

Moreover, biodiversity serves also as an essential resource for natural substances. For example, some special plant products come from or grow also in the Alpine region (DAV 2015) such as *Angelica sylvestris, Peucedanum ostruthium, Arctostaphylos uva ursi, Vaccinium vitis idea, Gentiana lutea*, healing herbs such as *Arnica montana, Pimpinella anisum, Alchemilla officinalis, Pinus mugo, Pinus cembra, Rhododendron ferrugineum, Cetraria islandica, Taxus bacatta.* In addition, the Alpine fauna offers special products concerning pharmaceutical purposes e.g. marmot fat.

Good practice - Protection of golden eagles in the Alps, Germany

The main objective of the Golden Eagle Project in the National Park Berchtesgaden was to identify areas most important to the Golden Eagle (Aquila chrysaetos) in the Alps for hunting. Recommendations incl. 11 guidelines were made concerning the protection of these habitats as well as the areas around occupied nests. Recommendations were communicated to the public through specific environmental education programs, more general public relations exercises and through cooperation with groups that utilize Golden Eagle areas (e.g. hunters, hikers, and paragliders).

Further information: http://www.dhv.de/web/en/sites-nature/nature-conservation/protection-of-golden-eagles/

Status and role of protected areas in the Alpine Convention area

Kind, number and extension of protected areas

Biodiversity cannot be maintained while restricting it to protected areas only. The goal for biodiversity maintenance is to offer habitats, niches and green infrastructure also in landscapes with agricultural and forestry use, even in settlement areas. Yet, protected areas, allowing natural dynamics, are an important backbone for a transnational green infrastructure in the Alpine area. According to the latest Alpine

Protected Areas database (ALPARC 2016), the coverage of protected areas including nature reserves, national parks, regional parks, areas under particular protection, biosphere reserves, world heritage sites (> 100 ha) is 53,820 km^2. This means that 28.3 %, a total number of 893 regions of the whole Alpine Convention area, are under protection. Table 2.3.2-1 shows the detailed number of protected areas in the Alpine Convention (see also Figure 2.3.2-1). These protected areas already today generate significant added value. Although this number of areas might be impressive, one has to consider that protection rules and limitations of harmful land uses differ significantly due to the type of protected area.

Table 2.3.2-1 Number of Alpine Protected areas > 100 ha.

Number of Alpine Protected Areas* > 100 ha								
	Country							
Type	AT	CH	DE	FR	IT	LI	SI	Total
Nature reserve	78	53	37	25	55	1	11	260
National Park	3	1	1	3	4		1	13
Regional Park	30	9	1	9	45		2	96
Particular protection	52	298	76	53	8		20	507
Biosphere Reserve (UNESCO)	5	2	1	3	1		1	13
World Heritage Site (UNESCO)		3			1			4
Total	**168**	**366**	**116**	**93**	**114**	**1**	**35**	**893**

*Protected areas in the perimeter of the Alpine Convention or outside but member of ALPARC. (Source:ALPARC 2016. ALPARC makes no claim of exhaustivity)

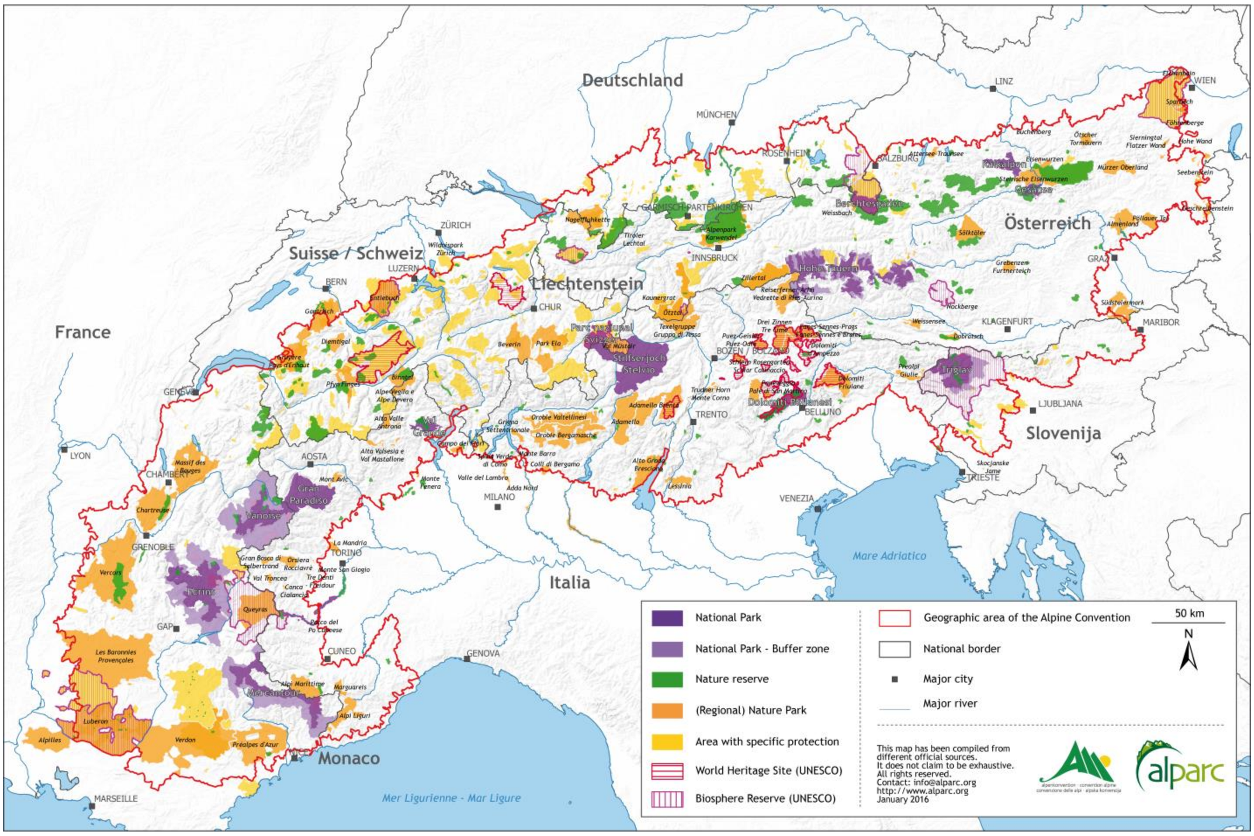


Figure 2.3.2-1 Large protected areas (> 100 ha) in the Alpine Convention area (Source: ALPARC 2016).

Economic relevance of protected areas

Alpine nature protected areas make a relevant contribution to the greening of the Alpine economy. Their best-known missions are nature protection and biodiversity conservation. In the last two decades, they have also become important players in the economy and in governance processes in many Alpine regions. A contemporary mission - especially for inhabited protected areas such as (regional) nature parks, biosphere reserves or national park buffer zones - is to promote an integrated economic development that uses natural resources sustainably and accounts for social needs in their regions. In order to accomplish this mission, stakeholders in nature parks and other label regions work together and develop strategies and projects that build upon their unique natural and cultural capital.

Already today, the 13 national parks, the 96 (regional) nature parks and the 13 biosphere reserves in the perimeter of the Alpine Convention generate significant value added. As examples, annual regional economic impacts for the following protected areas have been estimated:

- € 17.9 million for the Swiss National Parks (overall impact, 2013);
- € 2.9 million for the National Park Hohe Tauern (only direct impact, 2004), and
- CHF 2.7 to 4.5 million for nature parks or biosphere reserves such as Entlebuch (overall, 2004), Val Mustair (overall, 2013), and Rieserfehrner-Ahrn (direct, 2004);
- € 93.8 million (overall impact, 2014) and € 47.5 million (direct impact, 2014) for the National Park Berchtesgaden (Job 2015, 2008).

For economic development, protected areas greatly depend on an effective valuation of their natural capital, such as biodiversity, specific natural and geological features, cultural landscapes, and traditional local knowledge. They value these resources primarily through the development of brands and labels for products and services, and through the promotion of sustainable tourism. The labels, often attributed by the national level, enable protected area regions and local producers to increase their visibility and recognition value, improve their marketing and strengthen regional identity. In addition, protected areas focus especially on naturetourism and related activities as different local economic sectors can benefit at the same time (e.g. accommodation, catering and food, agriculture, crafts, transport). Ecotourism-related projects and development measures are relatively easy to implement financially and politically. In the last years, ecotourism has been booming as it meets current and future societal trends, i.e. a continued rise in demand for nature-based tourism, outdoor activities, adventure, learning and innovative travel experiences. The development of such tourism forms is furthermore in line with sustainable development aims: it promotes responsible behaviour for the environment, considers local needs, involves local inhabitants and generates local income.

Protected areas as model regions

Beyond the direct and indirect effects of labelling policies and ecotourism, governments see and support inhabited protected areas as model regions of sustainable development. The term model region refers on the one hand to the exploration of new pathways of sustainable regional development, i.e. the generation of new ideas, the use of new technologies and the experimentation with new approaches in different sectors. Current efforts of protected areas focus e.g. on the commercialization of regional products and tourism offers, local production and consumption, the redevelopment of local value chains, and co-working in remote regions and renewable energy. On the other hand, the term model region refers also to new forms of governance, collaboration, regional management and participation. In many protected areas, a multidisciplinary management team ensures networking, regional management and project coordination tasks. It concentrates knowledge on the region, on funding possibilities and on key players, and therefore, acts as a facilitator for regional development. Protected area regions such as the Entlebuch Biosphere Reserve or the Nature Park Tiroler Lech are good practices that show how local stakeholders reorganize around a common development vision and integrate horizontally (cross-sectoral approach). The protected area is often a unifying element that strengthens a common regional identity among local stakeholders in these processes.

Within the wider context of spatial development, governments see inhabited protected areas also as a means to attenuate the negative effects of metropolisation, notably depopulation and increasing spatial disparities. Research and policy-makers state that protected areas contribute to retaining the local population, especially the young, increase local incomes, create employment opportunities and attract new residents and potentially firms due to their high quality of life.

<u>High nature value farmland</u>

Also outside nature protected areas, biodiversity has to be maintained all over the territory. Therefore, appropriate habitats and less intensive used areas are important structures for flora and fauna in agricultural areas. High nature value farmland is used as an agri-environmental indicator in the EUROSTAT system and is defined as “the percentage of utilized agricultural area (UAA) farmed to generate high nature value (HNV)” (EUROSTAT 2015a). Typical HNV areas are extensively grazed uplands, Alpine meadows as well as pasture lands with particular interests for nature conservation because of their high biodiversity (Paracchini et al. 2008). Based on the main characteristics of HNV, these authors categorised three types of HNV farmlands: Type 1: Farmland with a high proportion of semi-natural vegetation; Type 2: Farmland with a mosaic of low-intensity agriculture and natural and structural elements; Type 3: Farmland hosting rare species, or supporting a high proportion of European or world populations (Desjeux et al. 2015). All the three types can be found in the Alpine area.

In 2008, the JRC and the EEA have prepared the first EU27 map of High Nature Value farmland (Paracchini et al. 2008), on the basis of land cover data from 2006, refined and regionally differentiated selection criteria, and additional biodiversity datasets such as PBAS: Prime Butterfly Areas; IBAS: Important Bird Areas and NATURA 2000 areas. Based on this methodology, Figure 2.3.2-2 presents the likelihood of HNV farmland presence in Europe indicating that in the most part of the Alpine area the likelihood of HNV is high.

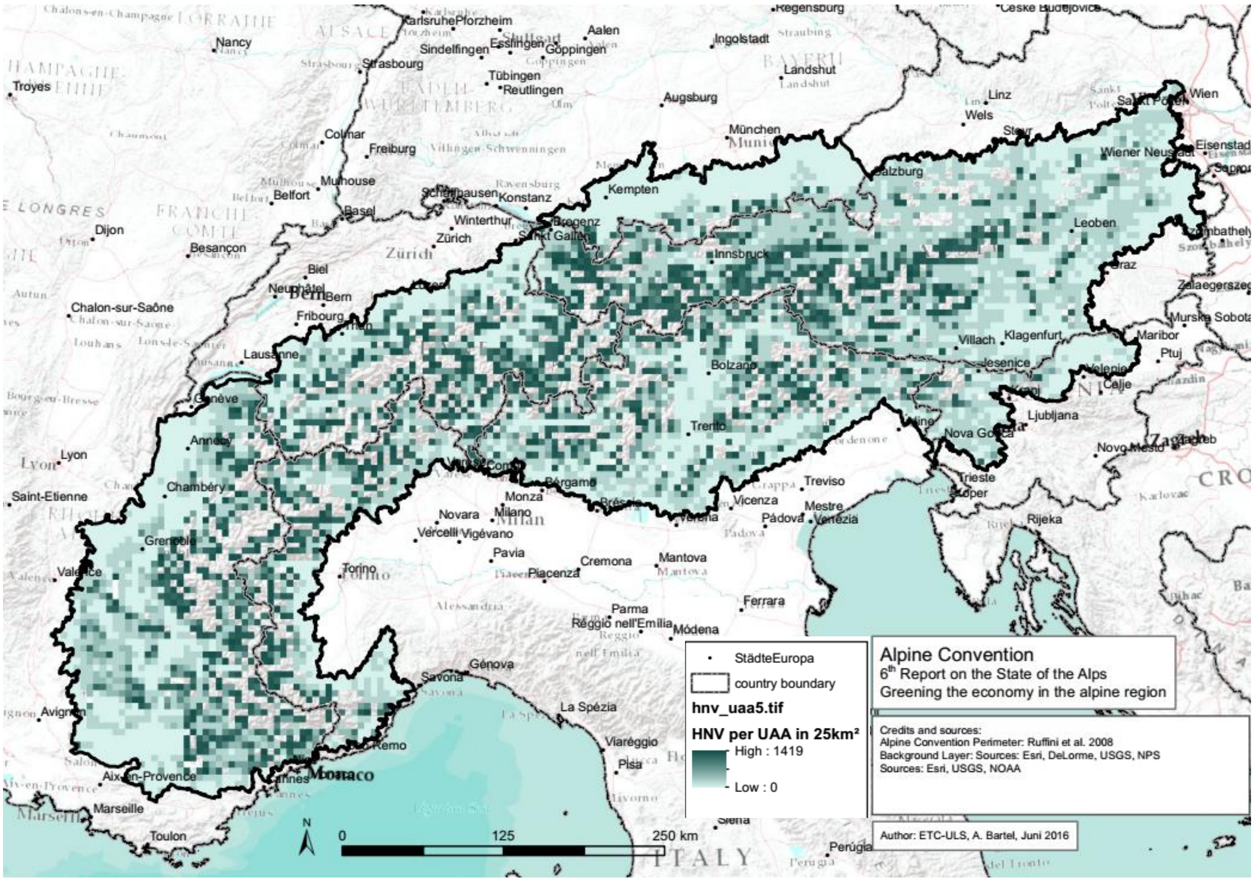


Figure 2.3.2-2 Share of HNV Farmland presence per 25 km² based on CORINE land cover data (Source: ETC ULS 2016b).

Figure 2.3.2-3 presents the share of the estimated HNV farmland according to Parachini (2008) in relation to utilized agricultural areas (UAA) according to CORINE Land Cover data (EEA 2006). It shows that the biggest percentual proportion of HNV farmlands in relation to the utilized agricultural area is in Slovenia (78.4%), as well as in Austria (68.4%). The volume of HNV farmlands however is the biggest in France and Italy. In Germany, the share of 14.6% has been estimated for HNV. The analysis has not been conducted for Switzerland and Liechtenstein.

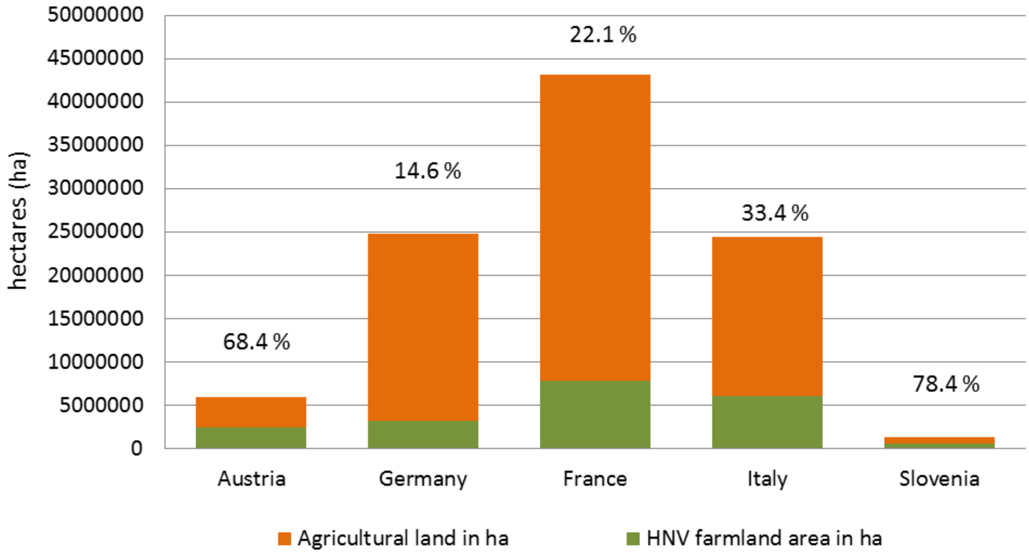


Figure 2.3.2-3 High nature value farmland areas and their percentage in relation to utilized agricultural area in the Alpine countries (data source: Paracchini et al. 2008; graph: ifuplan 2016).

Situation in Alpine countries

Austria

In Austria, the national biodiversity strategy has been approved by the national government in 2014. The strategy comprises five action fields: recognition, sustainable use, reduction of impacts, maintenance and development and global preservation of biodiversity.

The strategy has 12 objectives and more than 140 measures, which should i.a. contribute to an integration of biodiversity issues in all relevant sectors such as agriculture, forestry, tourism and transport. For these objectives, also quantitative and qualitative sub goals are defined which address the responsible actors and criteria for evaluation. The strategy's objectives are to be implemented until 2020.

Biodiversity is considered the main resource for a high share of the tourism industry in the Austrian Alps, at least in the summer season. Many activities support projects in agriculture for an economical and ecological sustainable way of production. They are focused on management and production (e.g. sheep herding on the winter skiing area Hauser Kaibling), product development and marketing (e.g. the brand "Tauernlamm") and on traditional use of natural products (e.g. the "Narzissenfest" in Bad Aussee). Supporting environmental friendly agriculture means keeping a traditional way of using the ecosystems, finding modern ways for the placement of its products in the market and thus to valorize their uniqueness. Lively farming in the Alps means living of the cultural landscape and this is the precondition for the rich and characteristical biodiversity in the Alps. This in turn is a basic need for the tourism economy.

Support of such projects often comes from the rural development programme (LEADER, Investment support, diversification, etc.). Moreover, the agri-environmental programme in Austria is a major source of funding for sustainable agriculture, ranging from conservation measures over management of extensive meadows to organic farming.

Money, which is directly spent for the improvement of ecosystems also has effects for the local economy: Jobs are created, at least for some time during the planning and construction phase. The LIFE+

Natur programme has spent or will spend about € 170 Million in Austria for 49 specific conservation projects from 1996 to 2020. It has become an important instrument for the implementation of the Natura 2000 directives. The majority (34) of the projects is for renaturation of rivers. About half of the projects are in the Alpine Convention area.

Biodiversity maintenance itself generates economical effects: The management of protected areas in Austrian national parks and Natura 2000 sites offers a number of skilled jobs, mostly based in remote areas. A lot of research, mapping and monitoring activities, communication needs (from leaflets up to visitor centers) and technical maintenance requires staff or contracted people. Educational programmes are an economical factor, too: The University of Klagenfurt offers an international training programme especially for those who are interested in the management of protected areas.

Germany

Germany has adoptedthe Federal Nature Conservation Act (later amended in 2013, see Bundestag, Deutschland 2009), and biodiversity is a key focus in it. This is a uniform nationwide legal statutory basis for nature conservation, which is a major advance that facilitates the translation of EU directives into national laws, vis-à-vis other Alpine countries with decentralised nature conservation law systems. A biodiversity handbook for the private sector has also been published (EC 2012c).

The German National Strategy on Biological Diversity (BMU 2007a) includes 330 goals and 430 stakeholder-related instruments towards biodiversity aiming at the protection, sustainable use and social aspects of biodiversity preservation. The Strategy also requires that forests with natural forest development have to reach 5 % of the wooded area by 2020. This corresponds to about 1.6 % of the country´s total area. The other essential goal of the Strategy is connected to the vision of wilderness: 2% of Germany´s territory has to develop as an undisturbed ecosystem, to evolve as awilderness areas by 2020. By this year, also a well-functioning management system for all large protected areas and Natura 2000 areas has to be established.

The OECD policy recommendations for Germany include, inter alia, a suggestion to build upon the assessment of the economics of ecosystems and biodiversity (TEEB) to guide implementation of the National Strategy on Biological Diversity and to strengthen inter-institutional cooperation in this area (OECD 2012a).

With focus on Bavaria, the following policy programmes are the most relevant concerning Green Economy:

- The Biodiversity Programme of Bavaria 2030 (Bayerische Staatsregierung & StMUV 2014)
- Strategy for Maintaining of Biodiversity in Bavaria (BayStMUG 2009)
- Bavarian Compensation Regulation (BayKompV 2013)

Italy

The Italian National Biodiversity Strategy (INBS) is the Italian national policy instrument aimed at the conservation of biodiversity and its integration with the development goals of the whole country (MATTM 2010).

Implementing INBS requires a strong cooperation among political and administrative bodies at all levels (particularly: central and regional) as well as the participation of stakeholder groups. INBS recognises the intrinsic value of biodiversity and its impact on human well-being. It aims at integrating the need for conservation and sustainable use of natural resources across national sectoral policies. It builds around three strategic goals to be achieved by 2020, the third of which is particularly relevant in a Green Economy perspective:

1. Ensuring the conservation of biodiversity and the safeguarding and restoration of ecosystem services aiming at guaranteeing their key role for the life on earth and human well-being.

2. Substantially reducing the impact of climate change on biodiversity on the national territory, by defining adaptation and mitigation measures and increasing resilience of natural and semi-natural ecosystems.

3. Integrating biodiversity conservation in economic and sectoral policies, also as an opportunity for new jobs and social development, by strengthening the understanding of the economic and societal benefits of ecosystem services and the awareness of the cost of their loss.

In order to achieve a satisfactory implementation of the strategy, improvements are needed for assuring a better coordination among national and regional bodies. These are jointly responsible for the strategy's implementation; defining common criteria and methods for the identification, quantification and assessment of ecosystem services in natural areas and sites. The objectives are to improve the data collection and transferability; to ease the systematic implementation of common indicators on the national territory; to contribute actively to the definition of sound shared criteria for natural capital accounting (NCA) at the regional and national level.

Protected areas are recognised as a fundamental and unavoidable tool to implement biodiversity conservation strategies. However, progress is still needed in the collection of natural, economic and social data as well as in the perception and awareness of the potential for human and economic development provided by natural capital.

Shared methodologies for assessing and evaluating natural resources and capital aimed at ensuring their better management are required and adequate financial and legal instruments for nature conservation should be developed and made available at all levels for promoting consistent and efficient spending patterns.

Significant sources of income to be at least partly invested in nature conservation actions might derive from a better integration of tourism and cultural heritage in natural sites with significant potential for sustainable growth.

Furthermore, a larger and deeper understanding of the different values (ecological, economic, social, cultural and ethical) of biodiversity by a large share of the population would be welcome and a wider participation of stakeholders in development policies based on natural resources' potential for value creation.

An interesting field of inquiry and action is the connection between biodiversity conservation and management and other sectorial policies. The INBS, in its section dedicated to “strategic objectives”, dedicates a specific work area to tourism.

The INBS recognises tourism as a sector, which can strongly contribute to the achievements of goals of sustainable development. For this to happen, there is a need to create conditions for protecting the territory. Furthermore, awareness of the value of the biodiversity on the territory is necessary.

The main challenge in the sector is to manage properly tourist activities coherently with the need to ensure a sustainable use of limited natural resources, consistent with their capacity to regenerate and generate income and profits for the industry. This objective especially requires monitoring of tourism impacts on biodiversity through a set of specific indicators that may support territorial planning and public and private decisions. Furthermore, the promotion of a protected areas network for sharing experiences and enhancing cooperation is necessary.

With the aim to achieve these objectives by 2020, INBS identifies the adoption of the “European Charter for Sustainable and Responsible Tourism” as one of the priority measures, and the need to carry out actions aimed at promoting new business in the area for biodiversity enhancement is explicitly mentioned.

Liechtenstein

Liechtenstein is a Contracting Party to the Convention on Biological Diversity and has set itself the goal of stopping the loss of biodiversity by 2010. Liechtenstein has also signed other conventions relating to biodiversity such as the Ramsar Convention, the Bonn Convention and the Bern Convention. The process of developing a biodiversity strategy has begun, with the Fourth National Report on Implementation of the Convention on Biological Diversity serving as the basis.

Slovenia

The adoption of the Nature Conservation Act in Slovenia provided a basis for the overall conservation of biodiversity and protection of valuable natural features as part of Slovenia's natural heritage. Around 10% of Slovenia's territory today falls within protected areas, 37.16% of the territory is protected under Natura 2000, and 14,901 elements of nature have been given the status of valuable natural feature.

Slovenia fulfilled the obligation to draw up a Biodiversity Conservation Strategy by adopting the first Strategy for the 2002–2012 period. This document determined a set of specific objectives and directions for the coordinated implementation of measures facilitating the achievement of the three main CBD goals. The updated national biodiversity strategy and action plan are currently being drawn up. Compared with the previous strategy, the targets proposed for the new strategy are focused more on the achievement of global (Aichi) goals. In Slovenia, biodiversity is included in basic national and various sectoral strategies, plans and programmes. The integration of environmental requirements in all policies and activities is essential for the enforcement and promotion of sustainable development.

Nature conservation planning in Slovenia is carried out through the National Nature Protection Programme. The National Nature Protection Programme defines operational programmes that contribute to the achievement of biodiversity conservation objectives, i.e. the Operational Programme for Biodiversity Conservation with the Natura 2000 Site Management Programme, the Strategy for the Management of Populations of Large Carnivores, and the Strategy for the Management of Non-native Invasive Species.

The Natura 2000 Site Management Programme is another key document for biodiversity conservation, owing to the large share of Natura 2000 sites (37.16% of Slovenia's territory). Slovenia's Development Strategy 2014–2020 is a fundamental national strategic document which states that all changes in the economy and society will be directed towards increasing the well-being of generations, taking into account environmental restrictions and human health considerations.

Switzerland

In Switzerland there exists a national Biodiversity Strategy to safeguard the natural capital. An Action Plan to implement the strategy is currently developed. The Biodiversity Strategy for Switzerland was adopted by the Federal Council on April 25th 2012. Ten strategic objectives describe the priorities and involve all actors in order to develop sufficient effects and to achieve clear results. The Federal Office of Environment is taking the lead for the development of the Action Plan.

The following topics are part of the strategic objectives (BFS 2016g):

- Sustainable use of biodiversity
- Creating an ecological infrastructure
- Improving the state of national priority species
- Preservation and promotion of genetic diversity
- Verification of financial incentives
- Detection of ecosystem services
- Generation and distribution of knowledge

- Promoting biodiversity in urban areas
- Reinforcement of international engagement
- Monitoring of changes in biodiversity

The objectives are harmonised and influence each other in their implementation.

In Switzerland, two major monitoring systems exist for biodiversity: the Swiss Biodiversity Monitoring Programme (BDM) and the Swiss Landscape Monitoring Programme (LABES). Both aim at identifying the key biodiversity trends so that effective measures can be taken to conserve and promote biodiversity.

In addition, action plans for priority species and the federal inventories for protection of certain habitat types are the main pillars of the Swiss biodiversity policy, accompanied by conservation schemes such as the national agricultural subsidies programme, compensation measures for construction projects, regulation of the use of exotic organisms, etc.

Conclusions on opportunities and challenges

The Alpine Convention area has a remarkable share of different types of protected areas. However, considering the high abundance of rare, threatened and endemic species and specific Alpine habitats – efforts are necessary to maintain and develop this natural heritage and to stop a further loss of habitats and species.

It should be recognised and communicated that biodiversity generates economic benefits. These benefits originate directly in goods (such as plant based pharmaceuticals) or services (such as wildlife experience) or in costs which are avoided through biodiversity (such as erosion prevention through native trees and grassland species). This happens indirectly while biodiversity contributes to the provision of ecosystem services supporting human well-being.

Therefore, an opportunity to improve biodiversity protection but also an economic opportunity lies in the development of markets for goods and services based on Alpine biodiversity[49]. In these terms, nature conservation should be viewed as an area of economic opportunity for Green Economy and not as a constraint.

In particular, protected areas can contribute to a greening of the Alpine economy by

- facilitating the development of activities and projects that reconcile economic development with nature conservation and social inclusion,
- supporting social innovation in rural areas and
- offering good practices and inspirations for biodiversity management and economic benefits also to other regions.

Besides protected areas, biodiversity can also be maintained by preserving high nature value farmland while providing sufficient and long-term financial compensation for the management of this low intensive farmland.

[49] Further information: https://www.iucn.org/news_homepage/events/iucn___rio___20/iucn_position/green_economy/.

2.3.3 Valuation of ecosystem services

Natural capital, ecosystem services and biodiversity are – alongside ethical and cultural values - also valuable in economic terms. People and society in the Alps benefit economically from nature – and suffer from losses of natural goods.

Some examples may give an impression of such monetary values: Globally about 400,000 tons of pharmaceutical plants with a value of 54 to 72 billion Euro are put on the market each year (Jessel et al. 2009). Global losses by natural hazards (Figure 2.3.3-1) sum up to an average of 164 billion Euro per year in the last ten years. The summer floods in southern and eastern Germany 2013 alone caused losses of about Euro 13.6 billion (MunichRe 2014). Tourism is an important economic sector in the Alps and is very often based on the natural assets and unspoiled landscapes. The GDP of tourism in Germany accounts to almost Euro 100 billon and employs about 2.9 million people in the year 2010 (BMWi 2012). Therefore, economic values are additional arguments for the preservation of natural goods.

Figure 2.3.3-1 Damages caused by floods impressively display the economic value of missing flood retention by ecosystems (Image rights: Marzelli).

Background about the valuation of ecosystem services

Is it necessary to valorise ecosystem services and biodiversity? In principle, economics is about making choices and decisions while weighing the values of different alternatives. However, often economists equate “values” with “prices” (cf. paragraph on valorisation below). Therefore, the markets in place do not and cannot fully reflect all values of ecosystem services. Markets are structurally limited in their abilities to provide a comprehensive evaluation of all ecosystem services and to act as a decision support (TEEB 2010, ch.5: 8). Moreover, it will be very difficult to quantify ecosystem services which embrace also services from human-made assets, such as inputs as labour and technology.

GDP measures the total value of all goods and services produced within the national territory within a specified period . However, GDP normally does not regard damages to the environment and to nature: paradoxically it considers the impacts on the environment as a positive contribution to welfare. It does not take the loss of natural capital in account (e.g. clear cutting of a forest for a motorway), as at present there is no methodology implemented to measure it. On the contrary, the GDP counts the replacement of natural capital (e.g. motorway instead of forest) as production and a contribution to welfare. Even more, technical substitutes for natural services (e.g. noise protection embankments) are also counted as production and additional contribution to welfare. “Ultimately, not recording the cost of reinvestments to sustain healthy ecosystems creates and conceals ecological liabilities. This distorts our perception of the future when restoring ecosystem services will demand that we repay the debts” (EEA 2013c).

One needs to be aware that the term “value” bears different meanings: value may mean to regard something being of importance or worth. Value also is sometimes used as a synonym for price or monetary value. The valuation of ecosystem services means first to recognize the importance and the value ecosystem services provide for our daily life. Furthermore, the value may also be expressed as an economic value of ecosystem services: which are the preferences people attribute to ecosystem goods and services in monetary terms. For this, a variety of different qualitative and quantitative methodologies exists. On the one hand, economic values are often very difficult to assign to ecosystem services, particularly for regulating and cultural services. On the other hand, economic values play a major role in decision making at all levels from strategic policy decisions up to private customer’s decisions and are – whether consciously or not - applied to many public and private decisions. Thus, economic values are a very important link between the environmental and economic sphere. The TEEB foundation lists six main reasons for conducting a valuation of natural capital and ecosystem services (TEEB 2010, ch.5.9):

- “Missing markets
- Imperfect markets and market failures
- For some biodiversity goods and services it is essential to understand and appreciate its alternatives and alternative uses
- Uncertainty involving demand and supply of natural resources, especially in the future
- Government may like to use the valuation against the restricted, administered or operating market prices for designing biodiversity / ecosystem conservation programmes
- In order to arrive at natural resource accounting for methods such as Net Present Value methods, valuation is a must.”

It has to be underlined that the economic valuation is never foreseen as a stand-alone solution, but needs to and will be embedded in legal, administrative and planning solutions.

What does valuation mean?

The valuation of ecosystem services and biodiversity needs several succeeding steps which include the identification of ecosystem services, the physical measurement with help of indicators, data and analysis of data and finally the assessment of functions, services and use. The assessment may be in a qualitative manner or in an advanced state in a quantitative manner. Based on this, a monetary valuation of ecosystem services can be carried out. Figure 2.3.3-2 shows the different levels of valuation of ecosystem services presented by ten Brink (2008).

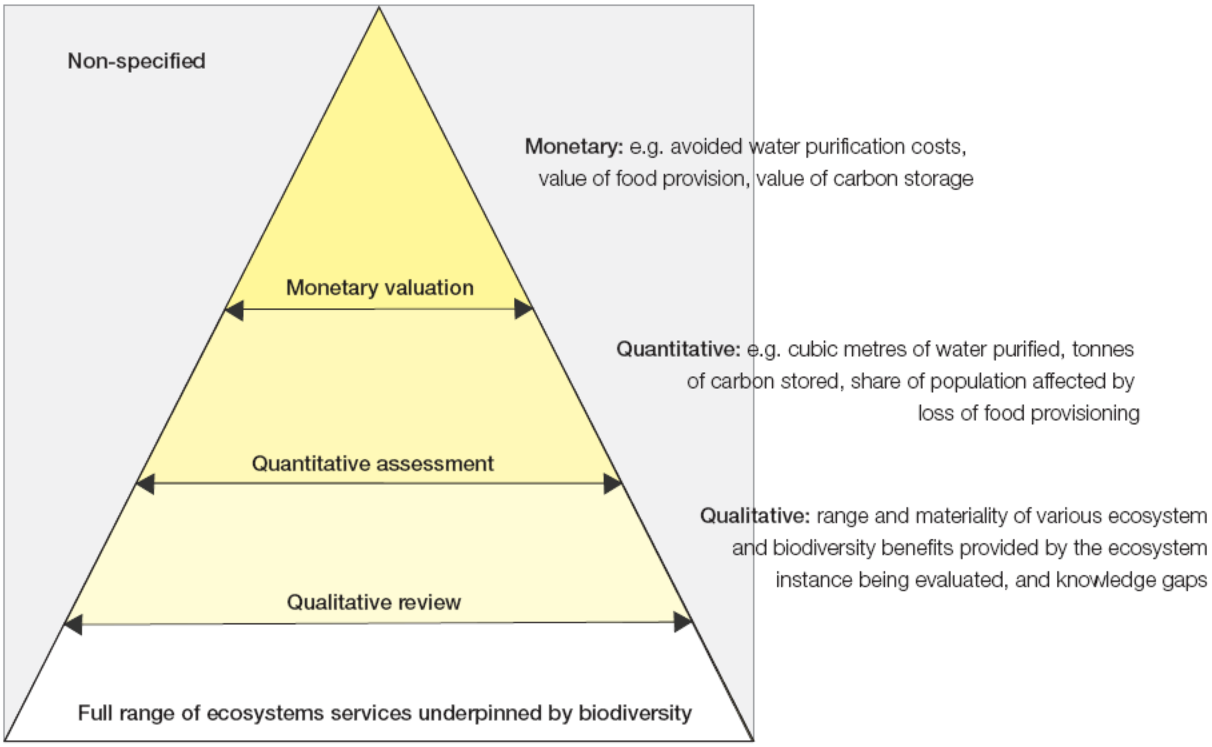


Figure 2.3.3-2 Different levels of valuation of ecosystem services (Source: ten Brink 2008).

To put a value on something means that we express how important something is for us or our well-being. This value can be something immaterial such as to feel happy about the beauty of a landscape, to feel good when listening to music, to relax when walking through nature. Of course, there are also material values such as the market value, which are paid if things are sold on markets. However, it is quite important to distinguish between this market value and the value in use. A good example is that of water and diamonds already used by Adam Smith, the grandfather of economic science. Water has a very high use value, as it is the precondition for our life, but in general, there is a low value in exchange put on it. Whereas diamonds have a pretty low use value, but are exchanged with a very high value.

The term value is often used synonymously by economists with the market price. This would mean a good with a low exchange value has also a low price. This interpretation would mean all goods which, are not traded on markets have no economic value. For public goods often. no markets are available, which is the reason why they often have no market value. Nonetheless, they may have a high economic value for our well-being and our society. Natural capital, ecosystem services and biodiversity are in most cases public goods.

Different approaches of economic valuation

The main challenge for economic valuation is to decide which evaluation approach is appropriate to make an economic valuation of ecosystem services. But also the definition, the origin of the final ecosystem service as well as the methodological differentiation – e.g. which part of the final product comes from natural contribution and which from financial, technical or human contributions - are challenges for using these values in a Green Economy.

There are different approaches on how to achieve economic values for environmental goods and services. In TEEB (2010), an overview on the different kind of values that may contribute to the theoretical “Total Economic Value” (TEV) is presented. Table 2.3.3-1 presents a typology of values of ecosystem services.

Table 2.3.3-1 Typology of values for ecosystem services (TEEB 2010).

Value type	Value sub-type	Meaning
Use values	Direct use value	Results from direct human use of biodiversity (consumptive or non consumptive).
	Indirect use value	Derived from the regulation services provided by species and ecosystems
	Option value	Relates to the importance that people give to the future availability of ecosystem services for personal benefit (option value in a strict sense).
Non-use values	Bequest value	Value attached by individuals to the fact that future generations will also have access to the benefits from species and ecosystems (intergenerational equity concerns).
	Altruist value	Value attached by individuals to the fact that other people of the present generation have access to the benefits provided by species and ecosystems (intragenerational equity concerns).
	Existence value	Value related to the satisfaction that individuals derive from the mere knowledge that species and ecosystems continue to exist.

There are different methodologies to assess such values. Often, the use values do not consider all components of a value or are not comprehensive. In addition, it is difficult to get non-use values for non-market goods. Some methodologies for assessing such prices are:

- Market value: If the ecosystem goods and services are the same or very similar to those which are traded on markets, the valuation uses market prices as values. For instance market prices for deer, fish or fruits can be used;
- Hedonic pricing: The use of ecosystem goods and services may be reflected in rental prices for housing. Housing in green areas is often more expensive as people prefer to live close to green spaces and accept to pay higher rents for that;
- Contingent valuation: In particular for bequest values, existence values and option values it is almost impossible to gather real existing prices. Therefore, the “willingness-to-pay” or the “willingness-to-accept” of selected groups is analysed in questionnaires asking how much people would spend to maintain for instance a rare species or an endangered habitat or how much they would request for accepting a change. In multiple choice analyses also, different alternatives can be asked for;
- Travelling price: The preference of people to visit beautiful landscapes or recreation areas is also reflected in the prices and time they spend for travelling to these destinations.

<u>National accounting</u>

The valuation of ecosystem services is also a key to improve national accounting and by this to internalize external costs for strategic policy decisions. If the GDP is extended to integrate also cost of natural capital and environmental damages, it would reflect a bit more realistically how the national capital (human and natural capital) will develop.

Ecosystem accounts are tools that can be used to describe the quantity and quality of ecosystems systematically, and show their change over time. They can help to understand the effects of such changes to people, either in quantitative units, in risk effects for health and life quality or in monetary terms. The accounts aim to reflect on critical stock and flows of natural capital (EIONET - European Topic Centre on Biological Diversity 2010).

However, this poses serious challenges to define, quantify and value the natural capital and ecosystem services. At the international level, the SEEA (System of Environmental-Economic Accounting) is a subsystem of the United Nations System of National Accounts (SNA). It is foreseen to collect information on three areas in the SEEA, flows of materials and energy, environmental economic statistics and stocks of natural resources[50]. In Europe, the European Environment Agency has started to develop an ecosystem accounting system, based on ecological indicators for landscape, ecosystem production, biodiversity, water, absorption of external inputs and capacity to support healthy populations (EEA 2013b). This Land and Ecosystem Accounting (LEAC) uses CORINE Land Cover data at the European level.

The EU environmental economic accounts are established in Regulation (EU) No 691/2011. This Regulation provides a legal framework for a harmonised collection of comparable data from all EU Member States and EFTA countries. The statistical office of the EU, Eurostat, collects national data for environmental accounting in the categories

- Air emissions accounts (AEA)
- Economy-wide material flow accounts (EW-MFA)
- Physical energy flow accounts (PEFA)
- Environmental taxes
- Environmental goods and services sector (EGSS) accounts
- Environmental protection expenditure accounts (EPEA)
- Forest accounts
- Environmental subsidies and similar transfer accounts.

It is also planned to develop ecosystem accounts and water accounts. There is a multi-annual EU strategy for environmental accounts[51]. The environmental goods and services sector covers the output and export of produced products, the related gross value added and employment. These data will become mandatory in 2017.

Payment for ecosystem services (PES)

The payment for ecosystem services (PES) is a tool category which compensates to some extent the ecosystem services, which are provided by agriculture, horticulture, forestry or fishery beside the provision of food and raw material. According to the UN (2014), the contribution of PES towards a Green Economy is to expand PES schemes and use them as a complement to regulation and other measures. The advantages of PES lie in:

- Boosting public relations for companies as PES contribute to positive company image (cf. chapter 3.4), however, reputation of the PES will to some extent depend on the reputation of the company.
- Making environmental protection schemes easy to understand, as PES simply link the use of an environmental service and the payment. Any system like this which can be easily grasped by the public, the media and opinion formers can be immediately seen to be 'doing good' in environmental matters.

[50] Further information: https://en.wikipedia.org/wiki/System_of_Integrated_Environmental_and_Economic_Accounting.

[51] Further information: http://ec.europa.eu/eurostat/documents/1798247/6191525/ESSC-2014-21-EN-24-EuropeanStrategy-env.

- Raising awareness for the multiplicity of ecosystem services is fostered by the easy to understand PES arrangements.

Alpine relevance of the valuation of ecosystem services

As almost all areas in the world, the Alpine area provides ecosystem services, which are used by the residents of this area. The first concern is to maintain the provision of ecosystem services for the Alpine residents and their well-being. Furthermore, the Alpine area provides ecosystem services, which are highly important services for areas outside the Alpine Convention area and for the well-being of far more residents than living in the Alpine area. The ecosystem service provision in the Alpine area can only be illustrated by using some case studies, since there is no comprehensive overview of the overall contribution of Alpine ecosystem services.

<u>Protected areas and tourism</u>

Alpine tourism plays a significant role for the economy of the Alpine area. In a wider sense, many Alpine tourist destinations are visited due to the natural and cultural assets, such as Alpine landscapes' aesthetics, nature experience or inspiration, which all can be considered as cultural ecosystem services.

In a narrower sense, more concretely relying on natural amenities, tourism in the protected areas of the Alps is most probably more focused on these nature related motivations. Therefore, economic effects of national parks, as the most prominent category of protected areas, give some insight in the economic value of ecosystem services for tourism. Following the IUCN guidelines (IUCN 2008), national parks should not only protect the ecological integrity of ecosystems but also offer opportunities for recreation and tourism as primary goals. Often, national parks are situated in remote areas. They can offer highly attractive destinations for tourism and "can serve as engines for economic development in otherwise often weak regional economies" (Mayer et al. 2010).

The national park Berchtesgaden in the German Alps created regional economy effects in the year 2002 by 1.129m visitors with 1.442m overnight stays causing a gross turnover of Euro 49.1 Mio (Job et al. 2009). Based on the economic analysis of German national parks, ten theses have been formulated byJob et al. (2009), from which four seem well transferable to the Alpine area:

- Regional economy effects of national parks are remarkable in structurally weak, peripheral areas, even if the transfer(ring) structural programmes is not considered;
- State support in national parks has relevant economic effects: the average administration and investment expenses of national parks generated a three times[52] higher income;
- Peripheral areas may take advantage of a branding as wilderness areas, however, an official labelling as national park as unique selling point is important. It is mandatory to offer additional regional tourism services, regional food or other products with a clear relation to nature and the protected area;
- It is recommended to make a qualified assessment of opportunity costs comparing different types of land use in national parks, particularly ecotourism and forestry.

<u>Water discharge and water retention</u>

The Alps receive much higher precipitation, have higher runoff than surrounding lowlands and, therefore, are considered to be the water towers of Europe. This becomes very obvious when looking at the water balance of the Alps and the rest of Europe which means, that the Alps provide almost a three times higher runoff than the rest of Europe. The big river systems Danube, Rhine, Rhône and Po are fed by the discharge of their Alpine catchment areas. For the Rhine River, the Alpine region contributes about 34% of the total runoff in the Netherlands (Weingartner et al. 2009). The lowlands experience

[52] The ratio lies between 1:1 and 1:7, in average of the analysed German national parks a ratio of 1:3 was calculated byJob et al. 2009.

advantages from the Alpine region as the water discharge is maintained even in the dry season in spring and summer. In addition , snow and ice withhold precipitation and thus are regulating services for flood control in the lowlands.

However, climate change effects are threatening this sensitive and complex interaction between lowlands and Alps. "In the future, the combined effects of droughts and increased water consumption in the Alps could cause water supply problems throughout Europe. Future climate change is projected to lead to a shift from summer precipitation to winter precipitation. Together with an earlier and reduced snow melt due to lower storage of winter precipitation as snow as well as less glacial melt water this will lead to an essential decrease in summer run-off all over the Alps. A decrease in water availability has severe impacts on all sectors relying on water, amongst them agriculture (irrigation, particularly in the southern Alps), hydropower production, industry, households, winter tourism (for example snow-making) and river navigation" (EEA 2009, p 17).

Alpine waters also provide an excellent water quality for drinking water. Therefore, water is also a viable resource for the about 14m inhabitants of the Alps and also outside the Alps, as many agglomerations close to the Alps such as Milan, Zurich, Vienna, Munich or Stuttgart derive their drinking water from the Alps (cf. good practice below). Just a very rough estimation of drinking water consumption based on some basis data reveals the economic dimension: The about 14 Mio inhabitants of the Alps use about 1.7 Mio m³ drinking water which accounts to an economic value of more than Euro 2.5 Mio[53] – daily.

<u>Avalanche protection</u>

Avalanches pose severe risks for Alpine residents, municipalities and infrastructures. They are a natural feature which is influenced by natural conditions but also depend on land use effects. Avalanche risks may increase or decrease through the change of land use. In a Swiss study carried out in Andermatt, benefits and costs for avalanche protection in case of changes in mountain forest cover have been analysed for a 300 year avalanche-event (Olschewski et al. 2012). Results compare collective risk (based on loss of life, damages of buildings), willingness to pay for risk reduction, avoidance costs and alternative costs for mitigation measures. The results make visible that residents' willingness to pay is about same amount as the costs of the collective risk (cf.

Table 2.3.3-2). The avoidance costs through appropriate forest management measures would offer the most cost effective measure with about $US 20 per household.

Valuation approach	Assumption/alternative	Lump sum (USD)	Annuity (USD)
Collective risk	300-years event	470	69
Willingness to pay	Risk reduction	390	56
Avoidance costs	Forest management	20	3
Alternative costs	Wooden logs	60	6
	Wooden grills	195	28
	Steel bridges/nets	600	87

Table 2.3.3-2 Results of valuation approaches for avalanche protection in Andermatt in US$ per household (Olschewski et al. 2012).

Within the framework of the Alpine Space project greenAlps, several experts from various sectors have been asked about ecosystem services and their valuation. According to the survey, 80 % of the interviewees said that the ecosystem services concept could be helpful for ensuring the conservation of biodiversity and ecological connectivity and revealing the contribution to human well-being. However, there is still scepticism about economic valuation: about 39% of the interviewees thought that all ESS

[53] Calculation based on an average consumption of 120 l/day/inhabitant and 1.50 Euro/m³

should be assigned a market value, but that general evaluation of all ESS tends to underestimate the real value of them. From the results of the interviews, one can conclude that the ecosystem service approach offers new impulses to make the value of nature conservation in Alpine ecosystems visible. However, the ecosystem service approach has to be translated for the relevant stakeholders and show the concrete benefit for them[54].

Economic role of mountain forests

The income of forest owners still comes substantially from selling wood, despite the increasing importance of ecosystem services and the growing interest in non-wood-forest-products and services (in particular mushroom licences and tourist services, besides more traditional hunting). The productivity of forest work has grown substantially in the last 25 years but management costs have risen more than revenues, and in the mountain area profits from wood production are decreasing. Consequently, the management is more extensive and there is an area where costs are higher than incomes, particularly where the forest road network has not been improved.

Non managed forests, while useful to monitor natural development, at a larger scale and in the medium run not only fail to provide wood (needed in a Green Economy) but also reduce the provision of other ecosystem services: CO2 sequestration (decomposition of wood releases it), soil protection and recreation, landscape and biodiversity are reduced by a simplified and more homogeneous environment.

Maintaining an economic interest in forest management for the owners is important: that can be done through promoting the use of Alpine wood and non-wood products, and also by creating the condition for the payment of ecosystem services, many of them provided by Alpine forests: some of them can be marketed (e.g., water cycle regulation, recreation) directly or through cooperation with the water management and tourist sector local institutions, for others (e.g., CO2 sequestration, biodiversity conservation) some pre-conditions must be created through, for example, the revision of property rights and new contractual agreements; for the regulation service like soil and water protection compensation can be created as in agriculture (rural development)(Contribution by WG Mountain forests)

Economic aspects of transport in the Alps

The objectives of article 14 of the transport protocol of the Alpine Convention include that the Alpine countries agree to apply the polluter-pays principle of the and to introduce gradually systems of pricing which allow to cover in a fair way the real costs, consisting of the costs of infrastructure - linked to the construction and to the maintenance of the infrastructure - and external costs - corresponding to the nuisances suffered by all the other actors.

The Working Group Transport of the Alpine Convention was asked to carry out works on the implementation of such systems of pricing for the heavy goods vehicles.

A first phase, dedicated to the analysis of the measures already adopted by the Alpine countries, highlighted that on all the main Alpine road axes, systems of pricing for the heavy goods vehicles exist taking into account costs of infrastructure. Austria also added an additional amount in the pricing for the axis leading to the Brenner, in accordance with an optional provision included in the EU Directive 2011/76/EU("Eurovignette") on the heavy goods vehicle pricing.

[54] Further information: http://www.greenalps-project.eu/download/.

Considering the conditions of realization of infrastructures, variable according to the geographical zones, prices are variable from one infrastructure to another and are difficult to compare between countries. Besides, variations of price according to the EURO standards are implemented on all the Swiss, Austrian and German networks, as well as for the French-Italian road tunnels (Mont Blanc, Fréjus).

As regards the consideration of the external costs, Switzerland has integrated them for several years into her system of pricing. For the countries of the European Union, the directive Eurovignette authorizes, in its last version (2011), the consideration of certain external costs (air pollution and noise), with the possibility to double the amount in the mountainous zones. Since January 1st 2015, the external costs linked to the atmospheric pollution were so included in the price collected in Germany (Lkw-Maut). Other countries study the possibility of implementing such measures or, when the conditions allow it, an additional amount such as that collected by Austria.

To verify the appropriate and sufficient character, or not, of the terms of the directive Eurovignette with regard to the compliance with the principle of a real cost pricing foreseen in the article 14 of the Transport Protocol, the Working Group Transport (WGT) of the Alpine Convention has begun, in 2015, according to its mandate, a work of collection of the existing studies on the evaluation of the external costs, in particular in the Alps. The objective is to better estimate these amounts, for each of the categories of pollution. If needed, follow-up studies will be considered (Contribution by WG Transport).

Situation in Alpine countries

Austria

There is no official assessment of ESS in Austria. However, a number of preparatory works and case studies have been carried out on the topic. Besides an overview through an inventory of ESS in agriculturally used land and in forests, a recent study (UBA Austria 2015c) tries to evaluate different approaches of economic valuation of ESS, and discusses the pros and cons.

Mountain farming and mountain forestry is particularly connected to ESS and supports many services, which are largely used by the population also outside the Alps (i.e. water supply, agricultural products). In addition , many regulating and supporting functions are based in Alpine agriculture, which in most cases works whithout using environmental problematic substances. The Federal Institute for Mountain Farming has published a research report on this topic(Hoppichler 2013).

A case study on river ESS has been reported from Austria: About 290 Kilometers (or about 60 %) of the river Mur in Styria are within the AC perimeter. The study reports between EUR 93 and 132 Mio per year as value of ESS for the Styrian Mur. The main component, as assessed by a public questionnaire, is seen in recreation services, the second in maintenance of biodiversity.

Germany

In Germany, different studies for a valuation of ecosystem services were carried out. A compilation of 126 monetary values based on existing collections and additional research has been conducted in an overview study (Köllner et al. 2014). Only very few studies have been carried out in the Alpine area, so not many values are available for this area. The analysis of the economic values calculated in the studies revealed that values differ significantly between different ecosystem services as well within one ecosystem service. In particular, the values for regulating services of natural hazards exceed values of other services very remarkably. However it turned out, that values calculated in the studies are strongly influenced by the specific conditions. Therefore, the transfer of values from one study area to another study area appears difficult for all study areas (cf. Figure 2.3.3-3).

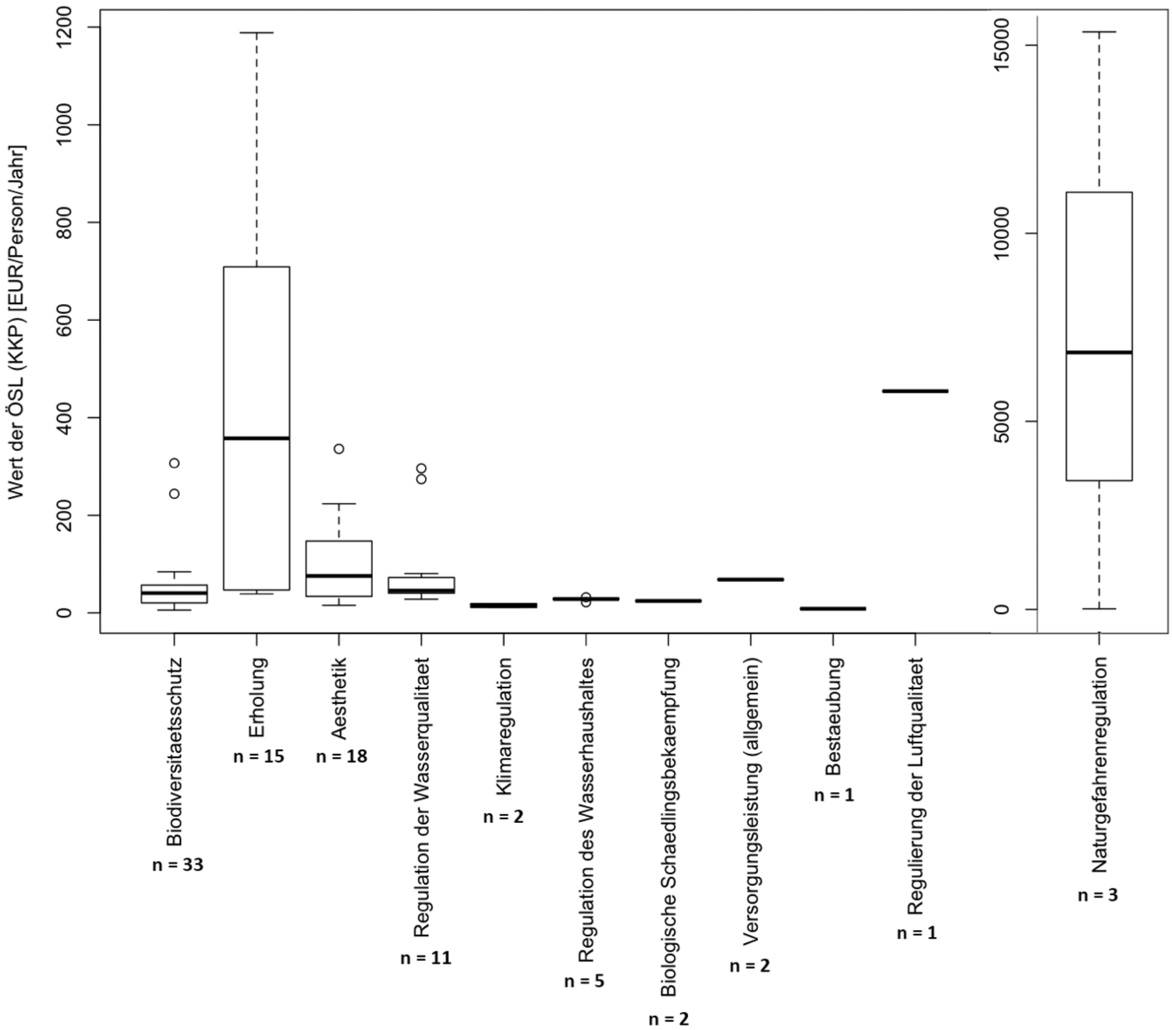


Figure 2.3.3-3 Ecosystem service values in Euro / person / year in Germany (Source: Köllner et al. 2014).

The economic value of avalanche protection by mountain forests in the German Alpine Convention area is estimated to be about 5 Euro / m² / year which adds up to about Euro 4 billion for the German territory per year (BayStMUG 2013).

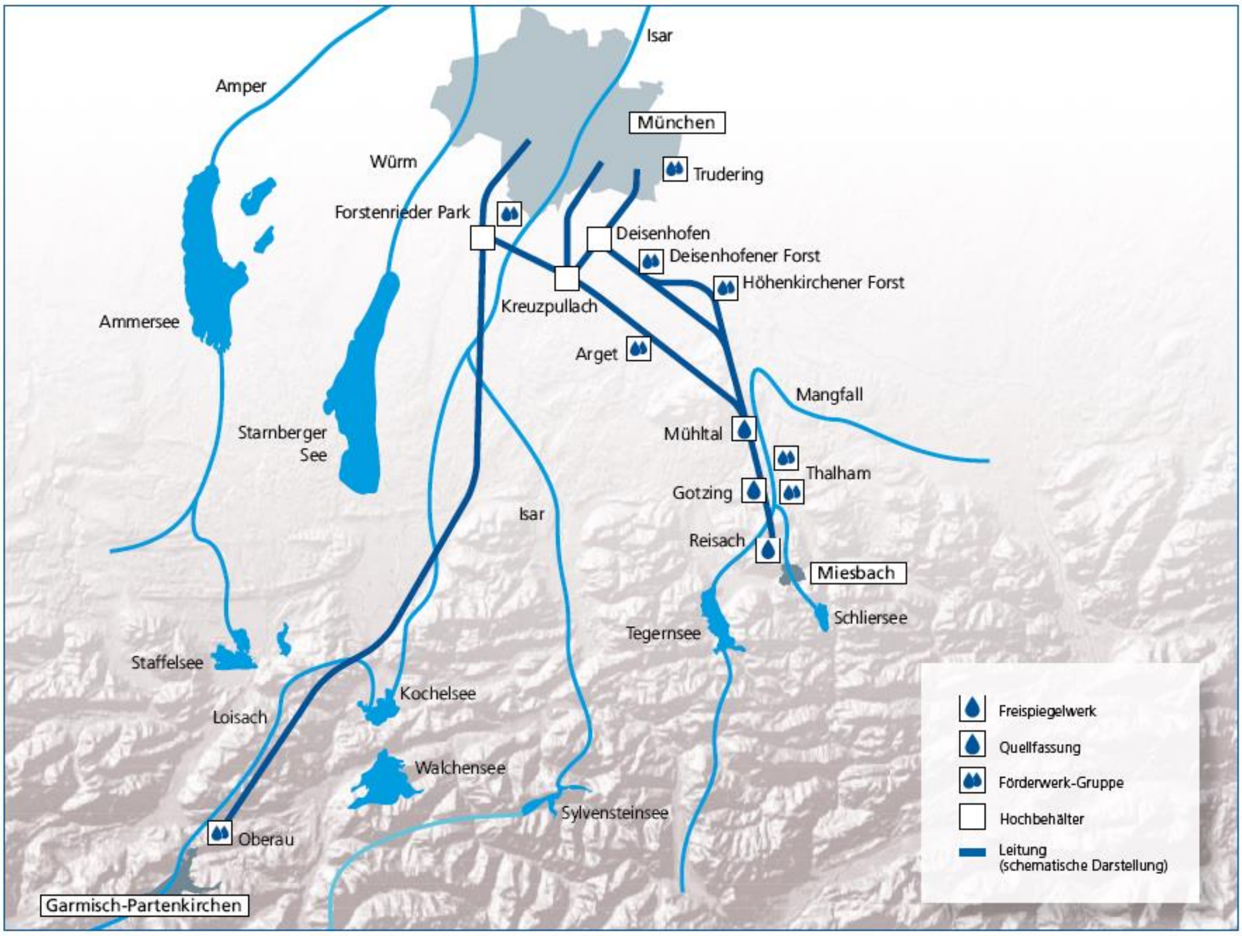
The economic value of clean water provided from Alpine valleys for the drinking water supply of Munich (about 300,000 m³/day) can be estimated to about Euro 178.5 Mio[55] per year (SWM 2016; cf. good practice below).

In Germany, a first attempt has been carried out in former years developing the environmental economics accounting ("Umweltökonomische Gesamtrechnung"). These consider flows of material and energy (in physical units), environmental measures (such as costs for environmental protection, environmental taxes and fees) and sustainability (indicators for sustainable development). The environmental accounting is a satellite system to the national accounting system.

Case study - Water supply for Munich, Germany

[55] Calculation based on an average consumption of 120 l/day/inhabitant and 1.50 Euro/m³.

In the catchment areas of the Alpine rivers Loisach and Mangfall, the water supplier for Munich Stadtwerke München is discharging water for the 1.4 Mio Munich citizen. The discharge is monitored to ensure no environmental damages are caused in the catchment areas.



Since 1992, the water supplier has started the initiative "eco-farmer", supporting organic farming in the catchment area in the Mangfall area. About 150 farmers have shifted their production from conventional to organic farming, managing together an area of about 3,500 hectares which is one of the largest organic farming areas in Germany. The farmers get a payment for organic farming by the water supplier and financial support for the conversion to organic farming. This financial support is only about 0.5 ct/m³ water for the consumer, which is a very small supplement to the water price of 1.63 Euro/m³ (SWM).

Italy

A methodology for the classification, assessment and valuation of ecosystem services based on MEA's approach and categories of ecosystem services (2005) has been prepared before the approval of the National Biodiversity Strategy in 2010. The methodology evolved from the classical "command and control" approach to the relatively innovative approach of the new EU Common Agricultural Policy (CAP) introducing incentives and compensations paid on a voluntary basis, and eventually to the introduction of the principle of "conditionality" of public aids subject to compliance with environmental standards of the actions implemented by the beneficiaries.

Concerning mountain areas and namely the Alps, the methodology identified a set of ESS as is shown in Figure 2.3.3-4.

	Ecosystem Services												
	Supporting		Provisioning				Regulation				Culture		
	Pedogenesis	Nutrient cycle	Food	Water resources	Raw Materials	Genetic and Biochemical resources	Climate	Water Cycle and Quality	Soil conservation	Waste treatment	Educational	Aesthetic and recreational	Cultural and religious
Glaciers													
Mountains													
Forests													
Rivers, Lakes, Wetlands													

Figure 2.3.3-4 Ecosystem Services in mountaineous areas (Note: the “green cases” refer to ecosystem services showing a very significant presence in the Italian Alps, while the "orange cases" refer to services showing only a presence in the Italian Alps) (Source: MATTM 2009).

Possible approaches for ecosystem quantification and valuation at national level have beendeveloped under both the ecological and economic point of view. Under the ecological point of view, a few case studies have been investigated for the purpose of providing information for mapping ESS at the EU level, as noted above (ESMERALDA 2015). Under the economic point of view, local experiments have been conducted and a methodology aimed at defining payments for environmental services (PES) has been proposed in view of the NBS. Regional projects addressing the issue of valuation and legal instruments for a proper implementation of PES exist across the Italian Alps, often involving natural parks and protected areas (*LIFE+ Making Good Natura - Making public good provision the core business of Natura 2000*), even though they did not translate into binding policies, measures or legal instruments.

In methodological terms, the following steps have been declared suitable to be followed to set up a national harmonized approach to ESS assessment and valuation, and for setting up adequate PES schemes (MATTM 2009):

1) Identifying the ecosystems showing higher environmental quality in relationship to local biodiversity

2) Studying the behaviour and dynamics of the selected ecosystems

3) Identifying the stakeholders playing a principal role in ecosystem management

4) Developing assessment and economic valuation techniques for specific services and for the ecosystems that provide them (natural capital)

As a result, knowledge on ESS, ESS and managers of the territories from which they flow is considered as the needed basis for planning measures, actions, payments and compensation involving private and public actors and the local communities.

Some experiences, even if incomplete, exit in the field of water ecosystems and wetlands as well as in one of the forests in Italy. Concerning water management as foreseen by the national law on water management (Law Galli 36/1994), a share of the fee earmarked to safeguarde the basin area. However, in practice this quota is not used for silviculture, but rather for interventions and construction activities within the basins depending on regional regulations, guidelines and plans. Regione Piemonte foresees a variable quota of the fee (between 3 and 8%) to beearmarked for soil and mountain defense by means of a plan managed by mountain communities in the region.

Concerning forest management and water resources, a law on mountain rainfall basins (Law 959/1953) provided for the possibility to make concessionaries pay an extra-fee earmarked for mountain infrastructure and territorial enhancement and as a compensation to mountain communities disturbed by derivations.

Another Alpine practice refers to non-wood forest products (NWFP) and in particular by the permits required by many regional laws for mushrooms collection. For instance, Regione Veneto has set up an "implicit" PES schemes by introducing thresholds for mushroom collection that apply to two different stakeholder groups: the "business users" collecting mushrooms as an integration to their income and aiming at trade; and the "recreational users" collecting mushrooms for direct consumption and leisure. The second group of stakeholders needs to buy a permit with time-limitations (daily, weekly, monthly). The payments' beneficiaries are the forest/land-owners, the trade refers to mushrooms and recreational services, the suppliers are tourists and occasional collectors, the intermediaries are the local mountain communities. There are conditionalities in the use of the revenues from the fee, namely that at least 70% of the revenues have to be spent on conservation and enhancement of the land where mushrooms can be collected and on educational initiatives (Veneto Regional Law 23/1996).

Adventure Parks represent an interesting case of recreational services for the Italian Alps. There used to be more than 70 Adventure Parks in the Alps before 2008. Set up costs for a large Park (10,000 visits per year) can be recovered over 5 to 6 years and the average individual willingness to pay for a visit has been estimated at € 12,00. They can be considered cases for PES, according to Wunder definition (Wunder et al. 2008) as well as suitable alternatives to forestry. However, for both geographical (few suitable locations available) and market (limited segment/ niche) reasons their role is likely to remain a minor one (MATTM 2009).

Liechtenstein

Within the new Alpine Space project "AlpES", it is foreseen to give selected information on economic values of ecosystem services in pilot areas in Liechtenstein.

Slovenia

In recent years, Slovenia has put some efforts into developing different modules of environmental accounts, both physical and monetary. The Statistical Office of the Republic of Slovenia (SURS) has already developed the methodology and introduced it into regular work of environmental accounts on air emissions accounts, material flow accounts and environmentally related taxes that are the first part of modules included in Regulation (EU) No 691/2011 of the European Parliament and of the Council on European environmental economic accounts,.

The first obligatory reporting for these three modules took place in 2013. SURS has already successfully developed the methodology and introduced into regular work also the second part of modules, which was included in Regulation (EU) No 691/2011 in 2014 with Regulation (EU) No 538/2014 of the European Parliament and of the Council amending Regulation (EU) No 691/2011 on European environmental economic accounts.

This part of modules includes environmental accounts on environmental protection expenditure accounts, environmental goods and services sector accounts and physical energy flow accounts. The first obligatory reporting for these three modules will take place in 2017.

The Institute of the Republic of Slovenia for Nature Conservation led the preparation of a study on evaluating ecosystem services for small protected area on Pohorje under the transnational project NATREG. The total economic value was calculated for two scenarios: 1st with conservation and the 2nd without conservation of Lovrenška jezera. Study showed that conservation for the next 50 years is needed if we do not want to lose € 151 million of the ecosystem services. In 2010, a review of the most frequently used methods for the economic valuation of ecosystem services in protected natural areas was also carried out under the NATREG project.

In 2011, a comprehensive study of the valuation of ecosystem services in the Škocjan Caves Park was conducted. The subject of the study was to determine the contribution of the Park to the local, national and global economies and to gain local and political support for the conservation and sustainable use of the ecosystem services of the regional park. The valuation of ecosystem services provided comprehensive information on the impacts of particular measures on the environment and the people living there. The study is considered as a model case in Slovenia for the prevention of "bad" decisions that could degrade the environment and thus worsen the living conditions of people. It was conducted under the project "Protected Areas for the Planet of Life – Protected Areas in the Dinaric region".

Switzerland

The Swiss Federal Institute for Forest, Snow and Landscape Research WSL investigates different aspects of the valuation of the ecosystem services. The following aspects are subject to scientific research:

- Economic valuation of ecosystem goods and services, provided to people by nature, forest and landscapes
- Possibilities to realise the value of, as well as payments for these goods and services by private and public institutions
- Calculation of the costs to maintain these goods and services
- Estimation of the financial effects of nature, forests and landscapes on regional economies

Furthermore, several research activities are focusing on measures and strategies to realise the economic value of nature and landscapes, regional potential of sustainable agriculture and forestry on cultural heritage landscapes, economic valuation of cultural and environmental goods and services provided by nature, forests and (heritage) landscape. Examples for ongoing research are the WSL projects in the framework of “Research in Economic valuation of nature, forest and landscape”:

1) What are the determinants of local growth management regulations at the municipal level and how do they affect urban sprawl? A spatial econometric analysis

2) An economic analysis of Swiss wood markets.

The results of the two projects can serve as a basis for valuated ecosystem services, however none of these projects explicitly aims to follow the ESS concept or PES.

A recent report by Hunnius (2015), highlights Switzerland’s tourism capital of the landscape. The State Secretariat for Economic Affairs (SECO) has quantified the value of the landscape for tourism at around CHF 70 billion. It is intended to give fresh impulse to the sector through new initiatives so that the economy can benefit and boost the appreciation of nature and landscape. According to this study, mobility seems to be a major challenge towards establishing ecotourism in the Alps. 70 percent of tourists travel around Switzerland by car and with little awareness of the environment. Furthermore, the State Secretariat for Economic Affairs has calculated in 2002 the annual willingness to pay of people who travel in the landscape. The researchers ultimately estimated the capitalised value of the Swiss landscape for tourism at between CHF 68 and 79 billion. They stress that this is a minimum value (Hunnius 2015).

Several monetary valuations have been conducted. However due to the context-dependency of monetary valuations, these projects have normally been on a case-per-case basis. Practical implementation of mapping and applied monetary valuations with regard to decisions of land use (e.g. in the context of touristic development) remain major challenges.

Conclusions on opportunities and challenges

The limits of economic valuation of natural capital, ecosystem services and biodiversity are unquestionable due to different available methods and site-specific factors which have to be considered. But still, ecosystem services, natural capital and biodiversity represent significant economic values, which play an important role in the Alpine economy. At present, in some fields their values are already calculated. However, unfortunately in many fields, their values are still under-estimated or mostly rebated in political and economic decisions.

Many economic acitivites in the Alps depend directly on natural capital, ecosystem services or biodiversity or are supported by them. This is relevant in particular for mountain farming, mountain forestry, water management, tourism and recreation and urban development.

The assessment and the valuation of natural capital and ecosystem services might become an important complementary instrument for decision making, in the future. However, most of the existing approaches are at the dawn and do not allow a benchmarking or really decision making support. Therefore, a further development of the valuation of natural capital and ecosystem services may, together with the assessing or monitoring of ecosystem services, better highlight the economic relevance of natural Alpine features and support Green Economy approaches. Values of ecosystem services should be incorporated into decision making also in cases where monetary valuation is difficult or controversial. This can be done in a qualitative manner.

It is important to incorporate their value into decision making to a larger extent through the internalisation of external costs and the application of better and long term payment for ecosystem services schemes and make thus environmental and Green Economy policies more successful. This is a major challenge and will require a clear, comprehensive concept.

2.4 Economy supporting quality of life and well-being

According to UNEP, a Green Economy improves human well-being and social equity. Next to socialequity and decent work, this also includes health issues as environmental conditions affect the quality of life in many different ways.

This chapter will deal with four different subtopics. First, it looks at effects on employment and education of a Green Economy. Then, aspects related to economic well-being and social inclusion are examined. The third subchapter provides examples of sustainable consumer behaviour as a way to contribute to a more sustainable and inclusive economy and a fairer globalisation. Finally, health issues and harmful emissions resulting from economic activities are looked at.

2.4.1 Employment & education

On the one hand, a transition to a low-carbon and sustainable economy can provide opportunities for employment across many sectors of the economy and become a new engine of development. On the other hand, employment also has important impacts on the transition to a Green Economy. Appropriate training and education are necessary to satisfy the needs of a Green Economy in terms of job qualification. The International Labour Organisation defines a green job as any decent job that contributes to preserving or restoring the quality of the environment whether it is in agriculture, industry, services or administration (UNEP 2008). Green jobs help to reduce negative environmental impact leading to environmentally, economically and socially sustainable enterprises and economies. They reduce consumption of energy and raw materials, limit greenhouse gas emissions, minimise waste and pollution and protect and restore ecosystems.

Background about employment and education

The shift towards a Green Economy will have (and has already had) an influence on the world of work and on workers. In order to achieve a successful transition and create job opportunities, several challenges need to be addressed. Greening the economy will involve creating new types of job and transforming existing ones. Workers with specialised skills, knowledge and training will be needed. Additional employment potential can only be realised if appropriate training of skills is provided, facilitating the reallocation of labour. In sectors such as renewable energy, energy and resource efficiency, buildings and construction, and environmental services, the insufficient availability of suitably trained workforce is already recognised as being problematic.

There is also a need for a just and socially acceptable transition for those who now hold jobs in carbon-intensive and polluting industries. While many will benefit from the changes, others may face hardship because of declining industries and consequent job losses. Appropriate policies have to ensure that workers likely to be negatively affected enjoy protection.

Despite an expected downsizing in emission-intensive economies, most scenarios predict a positive net effect on the labour market. There is a consensus that a Green Economy triggers employment across a range of sectors and has the potential to create millions of jobs. According to a report published in 2012 by the ILO (ILO 2012, p. 163), numerous country specific studies indicate a rise in employment of 0.5–2%, translating into 15–60 million additional jobs at the global level.

Chances and opportunities of a Green Economy for employment and the creation of jobs are increasingly recognised at the international, European and national level. Numerous initiatives to support green jobs and respective skill development have seen the light of day in recent years.

In 2007, the United Nations Environment Programme (UNEP), the International Labour Organisation (ILO), the International Trade Union Confederation (ITUC) and the International Organisation of Employers (IOE) jointly launched the Green Jobs Initiative. The aim of this initiative was to analyse and promote the creation of decent jobs in response to the needed policies to address the global environmental challenges. As part of this initiative, the first comprehensive and authoritative report gathering data on green jobs and providing recommendations for policy makers and business was produced in 2008 (UNEP et al. 2008). More recently, the above-mentioned study by the same initiative on the opportunities for jobs and social inclusion of a Green Economy shows the potential of this concept to create decent jobs (ILO 2012).

The ILO Green Jobs Programme was created in 2009 to support the creation of green jobs as a means to generate decent employment and income opportunities while at the same time responding to current environmental challenges such as climate change and resource scarcity. The programme aims at promoting coherence between economic, environmental and social policies at the international level. At the national level, the programme supports initiatives through capacity building and policy advice. Furthermore, it facilitates the exchange of knowledge, offers training and produces tools and general information material.

Within their Green Growth Strategy, the OECD undertakes several activities on green jobs and skills. A report published in 2012 on "The Jobs Potential of a Shift towards a low-carbon Economy" (OECD 2012b), analyses in detail the influence of a transition towards a Green Economy on labour markets. Furthermore, it outlines the role that policies can play in maximising the benefits of economic greening for the labour world. Together with the European Centre for the Development of Vocational Training (CEDEFOP), the OECD organises the "Green Skills Forum", an international conference for researchers, government advisers, employment and policy analysts and social partners. The forum aims to review and discuss research and policy approaches to foster a greener and inclusive economy. Furthermore, the OECD supports capacity building at the local level via the "Climate Change, Employment and Local Development" project. The project aims to support national and local authorities to create good quality greener jobs.

At the EU level, the Employment Package adopted in 2012 identified the Green Economy as a key source of job creation in Europe. Estimates by the European Commission (EC 2012a, p.5) show that the implementation of energy efficiency measures could create or retain 2 million jobs by 2020 and the development of renewable energy sources could lead to 3 million jobs by 2020. In 2014, the European Commission adopted the Green Employment Initiative Communication (EC 2014a), addressing the employment challenges and opportunities of a transition towards a Green Economy. The communication sets out an integrated framework for employment policies to facilitate this transition.

Alpine relevance of employment and education

Polled experts from various regions in the Alps consider the Alpine region as being particularly innovative. There is a high number of businesses in the field of energy efficiency and renewable energies located within this region (see chapters 1.1.2 /1.1.3). Furthermore, the Alps seem to offer an ideal playground for the sustainable production of renewable energies, as the needed natural resources are available and all energy storage systems can be used. On these grounds, the Alpine region offers a particular potential and opportunities for green jobs.

Situation in Alpine countries

Austria

In Austria, a "Masterplan green jobs" was launched in 2010 to systematically stimulate and support the creation of employment in the environmental goods and services sector. In order to implement the Masterplan, six priority areas were identified where appropriate measures are taken:

- Ensuring a high level of qualification. To secure a high level of qualification of labour force in the green sector, innovative and tailor made education and vocational training is needed in all economic sectors of a Green Economy.
- Continuous improvement and innovation are basic requirements for sustainably successful products, technologies and services and thus for creating jobs and maintaining employment.
- Networking and cooperation among all stakeholders of a Green Economy. Due to the size structure of the domestic businesses, the strengths of the Austrian green economic sectors and the related employment situation is dependent on targeted networking activities and intensive cooperation.
- Support and promotion of internationalisation. To be successful on the international market will increasingly be a condition for the growth of the domestic economy and thereby for the creation of green jobs in Austria.
- Promotion of sustainable investment and consumption patterns. Creating incentives for private consumption and public procurement to stimulate the demand for environmentally friendly products, technologies and services along the value chain and consequently to create a tangible effect on the labour market situation.
- Raising awareness has a major role to play in the transition towards a Green Economy. Values have an important influence on investment and consumption behaviour. Awareness raising is therefore a psychological key task for creating and maintaining green jobs.

Since the launch of the Masterplan in 2010, three evaluations of the measures have taken place. Even considering the delay in the availability of statistical data, a stimulating effect of a number of measures on the green economic sectors is noticeable. This is above all true for measures initiated before 2010, such as funding activities through the Climate and Energy Fund.

Highlights include funding activities for thermal rehabilitation, educational measures of the climate protection initiative „klimaaktiv", the implementation of the 2010 action plan for sustainable procurement and the ever increasing number of eco-labelled products and services.

In 2008, 167,000 employees (full time equivalent) were working in the green sector. The number rose to 181,820 in 2014, equating 4.9 % of the total number of employees. Almost one job out of 20 in Austria is consequently a green job. Including public transportation, the number of green jobs in 2014 even reaches 209,864.

The economic activities belonging to the Environmental Goods and Services Sector as well as the products and services produced by these activities are allocated to two main categories, environmental protection activities and resource management activities.

Environmental protection activities are focused on producers of technologies, goods and services to measure, control, restore, prevent, treat, minimise, research and sensitise environmental damages to air, water and soil as well as problems related to waste, noise, biodiversity and landscapes. This includes "cleaner" technologies, goods and services that prevent or minimise pollution. In Austria, the most important environmental protection activities are waste management, wastewater management, protection and remediation of soil, groundwater and surface water as well as protection of ambient air and climate (according to the Classification of Environmental Protection Activities and Expenditure – CEPA; EUROSTAT 2000).

Resource management activities encompass producers of technologies, goods and services to measure, control, restore, prevent, minimise, research and sensitise resources depletion. This results mainly in resource efficient technologies, goods and services that minimise the use of natural resources. In Austria, by far the most important resource management activity is the management of energy resources.

Maps 2.4.1-1 and 2.4.1-2 show the importance of these two kinds of activities for the area of the Alpine Convention in Austria, expressed in output and employment figures. Data are presented by federal provinces.

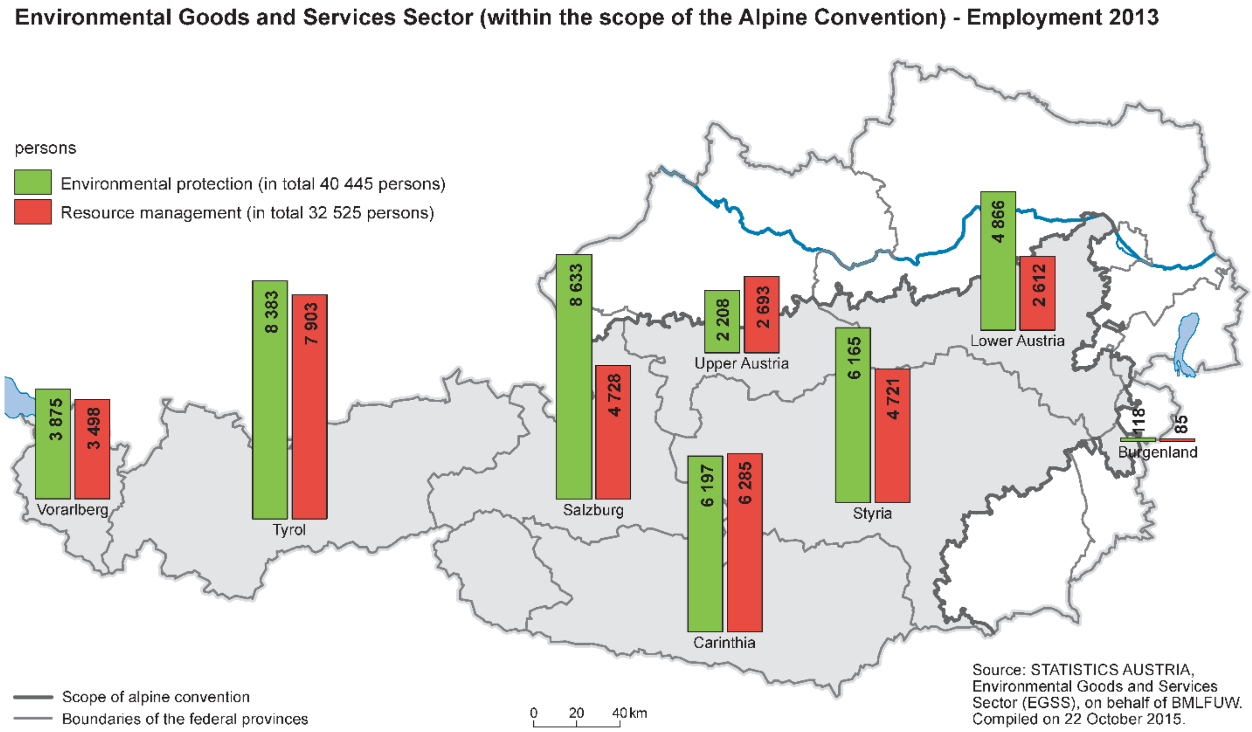


Figure 2.4.1-1 Employment in the environmental goods and service sector 2013, Austrian Alpine Convention area (Source: Statistics Austria 2015).

In terms of output, the federal province of Tyrol has the highest share among resource management activities (€ 2.3 billion), followed by Carinthia (€ 1.8 billion), Styria (€ 1.4 billion) and Salzburg (€ 1.2 billion). Concerning environmental protection activities, the differences between the provinces are smaller. The highest share again has the federal province of Tyrol (937 million euros), followed by Carinthia (€ 849 million), Salzburg (€ 804 million) and Vorarlberg (€ 717 million).

For most federal provinces, resource management activities are more important than environmental protection activities. In terms of employment, data tell a different story. In most federal provinces, employment is higher in environmental protection activities than in resource management activities. One of the reasons is a strong influence of labour intensive agricultural activities (with low revenues compared to other economic activities) in environmental protection activities whereas in resource management activities there is a strong influence of activities with high output values per employee, like the production of renewable energies.

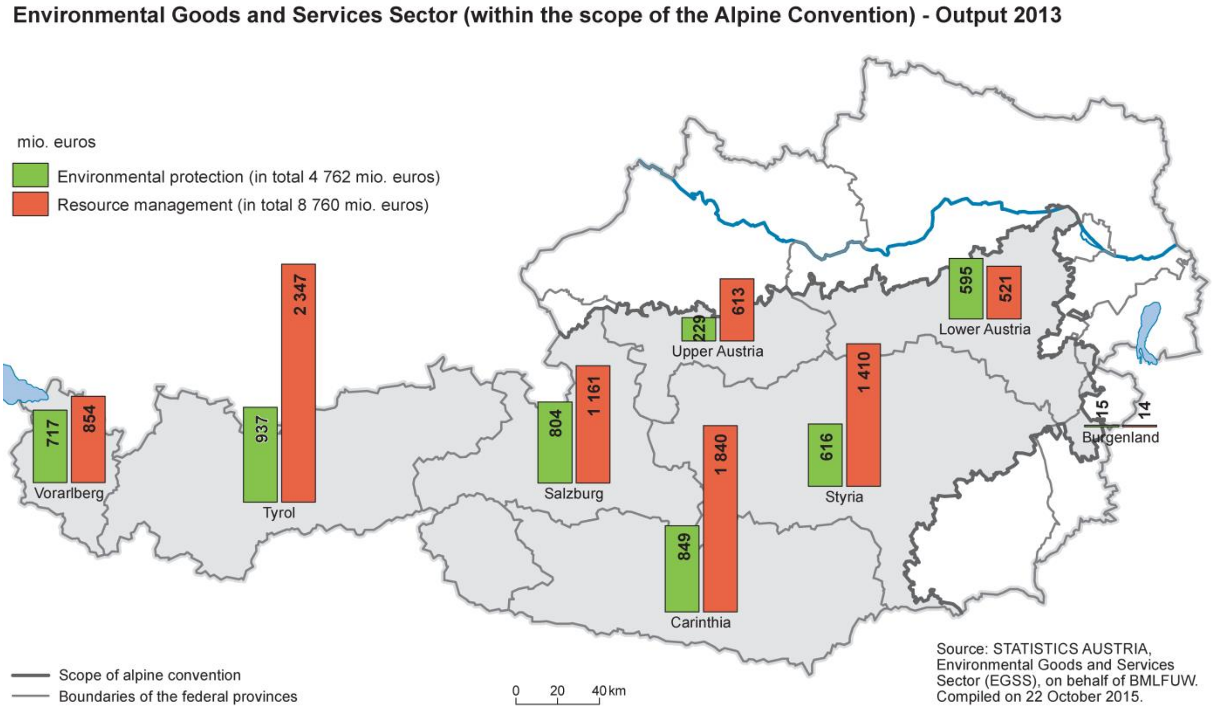


Figure 2.4.1-2 Turnover in the environmental goods and service sector 2013, Austrian Alpine Convention area (Source: Statistics Austria 2015).

In detail, the federal province of Salzburg has the highest share of employees (8,633 persons) among environmental protection activities, followed by Tyrol (8,383 employees), Carinthia (6,197 employees) and Styria (6,165 employees). These are also the most important federal provinces in terms of resource management activities,albeit in a different order. Most of the employees can be found in Tyrol (7,903 employees), followed by Carinthia (6,285 employees), Salzburg (4,728 employees) as well as Styria (4,721 employees).

Germany

Germany does not have a specific programme for green jobs, notwithstanding the Government’s recognition of the potential of a Green Economy for job creation. There are, however, single initiatives in support of qualification and training for employment in the environmental sector (see chapter 3.4.1).

Higher educational institutions have taken up the challenge of ensuring appropriate skills for a Green Economy. Within the German Alpine Convention area, the Kempten University of Applied Sciences offers a Bachelor in Energy and Environmental Engineering. At the University of Applied Sciences in Rosenheim, students can choose among various classes in the Wood, Energy & Construction field. These cover innovative wood and lightweight construction, energy-efficient optimisation of building shells and renewable energies.

Bavaria has a leading position in terms of organic farming with more than 7,300 organic farms and an organic area of 230,000 hectares. Almost one third of all German organic farms are situated in Bavaria. Even though there is no specialised apprenticeship for ecological farmers – education and vocational training for organic agriculture is integrated in the regular educational system for agricultural professions –there are two professional schools for farming with a specialisation in organic agriculture in Bavaria. Within the Alpine Convention area, the Fachschule für Agrarwirtschaft, Fachrichtung Ökologischer Landbau, in Weilheim offers a holistic training in organic farming after graduation from an apprenticeship. Successful students qualify as state-examined economist for organic agriculture.

A study estimated that in 2012, around 2.2 million people were employed in the field of environmental protection in Germany (Edler & Blazejczak 2016) – see Figure 2.4.1-3. This represents 5.2% of the total employment and is thus an important sector for the labour market. Between 2010 and 2012, the number of people employed in environmental protection increased by 245,000. The estimated figure presents the number of people in the whole economy that use part of their working hours to perform environmental protection activities or whose jobs are indirectly induced in upstream industries by environmental protection activities. The estimated figure for 2012 depicts the lower limit of employment in environmental protection, as a number of sectors such as ecological tourism, ecologically oriented insurance industry and product-integrated environmental protection were not included due to a lack of data.

Classical sectors include waste disposal, water protection, noise abatement, and air pollution control. The production of goods necessary for the operation and maintenance of environmental protection facilities also contributes to the creation of jobs in the environmental sector. The environmental service sector accounts for 63% of all environmental jobs (1.38 million employees). 97,000 jobs can be attributed to the exportation of environmental goods. For employment in the renewable energies sector, the figures indicate 393,000 jobs in Germany in 2012.

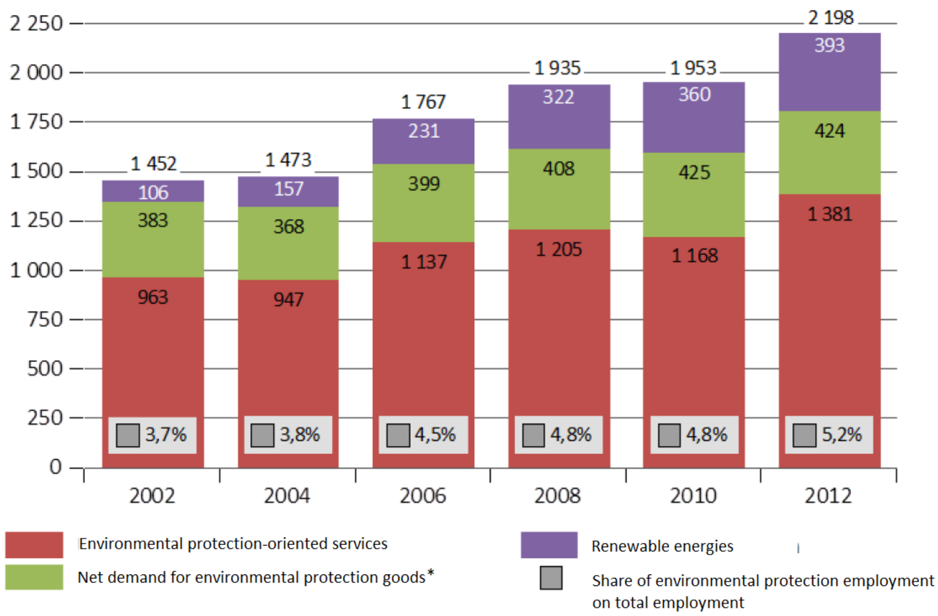


Figure 2.4.1-3 Development of employment in the environmental goods and service sector in Germany, 2002 – 2012, in 1,000 persons. (Source: Edler & Blazejczak 2016) (The comparability of the estimation results between the review years is limited; a substantial part of the differences occur due to methodological and statistical reasons. <*>Net: adjusted for double countings. Contains employment in energetic building refurbishment. (Source: Calculations by DIW)) (Source: Edler & Blazejczak 2016).

Italy

A formal collection of figures concerning green jobs at the national level is not performed in Italy. However, estimates from studies (Fondazione Symbola & Unioncamere 2015) show a significant vitality in some Alpine provinces concerning the planned hiring decisions by companies. Data for 2015 show that a high share of locally created new jobs are green in the Alpine provinces of Monza and Brianza (20.2%), Bolzano (17.9%), Vicenza (15.2%), Trento (15.1%), Torino (14.8%) and Bergamo (14.3%).

A more in-depth analysis (Unioncamere et al. 2016) shows that the three business functions where green jobs tend to concentrate are R&D (66.8%), technical areas (45.3%) and marketing & communication (38.1%). This reflects the prominent role that eco-innovation plays in the Italian economy across different industries, which is due to the joint challenges of increasing the added value and investing in energy and environmental technologies, while keeping competitiveness on the global markets. Furthermore, green jobs are usually characterized by a strong technical expertise. The greening of consumers' preferences has brought an increase in the demand for green expertise in marketing & communication to ensure better market performance.

Over the 2009-2015 period, in Italy a higher share of new staff with previously unavailable skills (intended to occupy new posts) were hired in fields considered to be of green jobs-type, compared with the share of other non-green professionals hired in other fields (Unioncamere et al. 2016). This difference seems to point out that sustainability is a relatively new area for most of businesses, with still a limited number of employees, where new skills are needed more often than in other business areas.

There is a lack of green skills on the Italian job market for companies, due to absolute scarcity of professionals. However, since 2010 this situation has continuously improved, probably because of the introduction of appropriate educational initiatives and of the increased awareness of the young professionals on job opportunities in the green sector.

Sustainability both as a management practice and as a topic to be covered in university classes by means of specific courses or as a cross cutting issue has been addressed as a voluntary initiative by the Conference of Italian University Rectors (CRUI). CRUI has set up a "Network of Universities for Sustainability" (CRUI 2015) aimed at spreading the culture and practice of environmental sustainability and social responsibility in the present and future generations. Among the 48 participating universities in 2015, many host seats within the Alpine Convention area (e.g. Bergamo, Bolzano, LIUC, Politecnico di Torino, Trento, Milano, Udine, Venezia, Verona, etc.). Those Universities are committed both to run their campuses according to sustainability principles andto use oftenindicators that are regularly measured and checked. They aim at promoting high-level environmental education that contributes to the creation of qualified green workforce.

The Italian Ministry of Education, University and Research (MIUR) promoted a formal agreement (implemented by the University of Milano, Unimont – University of the Mountains) aimed at creating a centre of excellence for university education on mountain topics (MIUR – Ministero dell'Istruzione Universitá e Ricerca 2011). The initiative includes a three-year course on mountain sciences run in the Italian Alps in Edolo. The course offers classes on topics being relevant for the mountain economy (such as agro-forestry, environment and energy and tourism). It takes a multi-disciplinary and inter-disciplinary approach and is run in cooperation with other universities holding specific competences and novel learning approaches based on novel technologies (web, virtual classroom, blended learning). Moreover, in the field of research networking among national and international research teams is promoted in the field of mountain studies.

A significant effort has also been put in primary and secondary education. Several guidelines have been issued by the Italian Ministry for the Environment Land and Sea and the Ministry of Education, University and Research. These aim at making education for sustainable development a strategic target for the country by promoting environmental awareness across all cohorts of students and at creating a generation of "environmental natives". This national initiative on environmental education includes a commitment to deliver specific skills to teachers on sustainable development and to students in the framework of the EU Strategy 2020 and EC COM 2008/868 on "New skills for new jobs". Moreover, it has set up eight educational courses to be taught at different educational levels (from primary to secondary education) on specific subjects including green economy, biodiversity, food, waste management and climate change (MATTM & MIUR 2014).

<u>Slovenia</u>

In Slovenia, in the period from 2011 to 2013, the proposal for the introduction of a competence for sustainable development was elaborated in the framework of the Institute of the Republic of Slovenia for Vocational Education and Training (CPI), and based on the principle that all jobs in the country can be "made green". Therefore, it is important that competence for the management of sustainable development combining the environmental, social and economic responsibility of organisations and individual jobs can be integrated into all forms of education and training. The competence is being gradually introduced in the system of occupational standards.

In 2013 and 2014, NGO Umanotera implemented the Supporting Green Jobs project within the framework of the management partnership in EU affairs communication between the European Commission, the Slovenian Government and the European Parliament. The aim of the project was:

• To improve the understanding and knowledge of green jobs and to raise awareness of what green jobs are and what opportunities they bring;

• To provide a comprehensive presentation of green jobs in connection with the green economy;

• To promote the linking of different actors in the field of green jobs with the aim of promoting the creation of conditions for green jobs."

With support from the European structural funds, Slovenia is planning to finance measures for adapting workplaces. This embraces the introduction and promotion of forms of work that are adapted to social and demographic challenges, including the greening of jobs.

The Ministry of Labour, in charge of the programme, focuses on the following areas:

- Creation of new green jobs (e.g. sustainable local supply and forestry-wood chain, waste re-cycling, water management, increase logging, new installations above pre-industrial wood processing, renewable energy production and food processing);
- Provision of high quality and healthy work environment;
- Social inclusion (e.g. renovated brownfield recycling - now mainly within the framework of social enterprises);
- Education and training: The Ministry of Labour is partially responsible for providing training and adult education. A special focus will lie on unemployed and redundant workers. There is a need for education and vocational training to allow workers to acquire the knowledge and skills necessary for the transition to a Green Economy. The situation calls in particular for a professionalization of forest work, new technologies, and new skills with the aim of raising the value added by wood processing industries.

Switzerland

Switzerland considers the cleantech sector to be very important to Swiss jobs and economy and is constantly investing in its development.

The Swiss Cleantech Masterplan (UVEK & EVD 2011), next to other green economy action plans, was to be the motor of a greener economy with its main objective being supporting businesses in developing cleantech applications. The motivation behind this master plan was to harmonise the development of the economy and the protection of the environment: these do not have to be mutually exclusive. With the right action and state support, they can work towards the same purpose of sustaining the environment without compromising, but rather boosting, the economy.

The Federal Government sees c leantech not only as an environmental necessity but also as an opportunity for the Swiss economy. Environmental problems prompt cleantech development, making it an international growth market with some sub-sectors being expected to grow at a rate of 3-8%. The involvement of Swiss businesses from the perspective of the economy means raising their competitiveness, contributing to economic growth and creating more green jobs. The innovative nature of cleantech is an especially relevant issue for Switzerland, given that innovation and technology is its economic backbone.

The Cleantech Masterplan with a series of objectives, areas of action, measured and recommended aims to create the right environment for boosting the development in the cleantech area by motivating various actors. The Federal Government`s vision was to make Switzerland a center for cleantech innovation, to bring the resource use to a sustainable level by setting an example in resource management and to increase resource efficiency. This was to be achieved by leading research on cleantech, progress in transfer of knowledge and technology, leading in cleantech production, and by the Swiss quality in cleantech. The five strategic areas of action were research, knowledge and technology transfer; regulation and market based promotion programmes; international markets; cleantech innovation environment; skills and training. In each of these areas of action, the Federal Government undertook appropriate measures.

The masterplan was a ground for further development of policies and incentives in relevant areas. However, it also focused on encouraging dialogue between actors and shifting their view of the economy towards the understanding that resource efficiency in the long term creates only winners and is beneficial for all: environment, economy and employment.

An important stakeholder of green training courses is *"sanu future learning*". It is not only a leading provider of sustainability-related solutions but supports companies and public bodies as well. Furthermore, it provides a national platform and promotes all kind of courses in the environmental sector.

Conclusions on opportunities and challenges

Given that the Alpine region has a high innovation potential and that there are a lot of activities in the field of renewable energies and energy efficiency, the region is predestined to create green jobs. Figures from Austria show that many of the green jobs in the country are placed in the Alpine Convention area. The creation of green workplaces can also offer an opportunity to keep qualified workers in the region.

As laid down in the beginning of this chapter, there is a need to put in place appropriate policies to achieve a successful and just transition to a Green Economy and to create job opportunities. This includes qualification offers (education and vocational training), supporting innovation in small and medium sized businesses, creating networking structures among all stakeholders of a Green Economy, the promotion of sustainable investments and the setting of incentives to stimulate the demand for environmentally friendly products, technologies and services at the private and public level.

The innovation potential in the Alps and the existence of many RES companies show that green jobs are available. This needs to be supported by fostering green skills with further development of trainings and academic studies. The Slovenian and the Austrian example show that with the right policies in place a Green Economy can have positive effects on the labour market and provides a chance for social inclusion.

2.4.2 Economic well-being and social inclusion

According to the UNEP definition, a Green Economy improves human well-being and social equity. A sustainable economic system should generate sufficient income and wealth to allow people to satisfy their needs and pursue other goals that they deem important to their lives, while complying with ecological and social standards.

A Green Economy should also be inclusive, provide access to jobs, education and health care for all and integrate skills and needs of all groups of society into a sustainable economic system. This includes elderly people having lots of working and organisational experience, people favouring part time working due to private reasons or people having traditional working skills. Appropriate framework conditions have to be designed to allow marginalised groups to contribute to the economic system, including access to public transport for people living in remote areas.

Background about economic well-being and social inclusion

There have been increasing concerns in past years about the relevance of traditional indicators to measure national or societal well-being, namely the GDP (Gross Domestic Product). Well-being does not depend on the functioning of the economic system only, but also on the living conditions of people. Furthermore, GDP does not indicate how income and wealth are distributed among the people. It is now generally recognised that GDP is insufficient as measure of prosperity and well-being and that there is a need for more comprehensive measures of human well-being. The OECD “Better Life Initiative” (OECD 2016) launched in 2011 to bring together internationally comparable measures of well-being aims at addressing these concerns.

There is no commonly agreed definition of well-being, however, the Better Life Initiative identifies three pillars for measuring people’s well-being (cf. Figure 2.4.2-1):

- Material conditions or economic well-being, which determine people’s consumption possibilities and their command over resources;
- Quality of life, which is defined as the set of non-monetary attributes of individuals that shapes their opportunities and life chances, and has intrinsic value under different cultures and contexts;
- The sustainability of the socio-economic and natural systems where people live and work, which is important for well-being to last over time. Sustainability depends on how current human activities impact on the stocks of different types of capital (natural, economic, human and social) that underpin well-being.

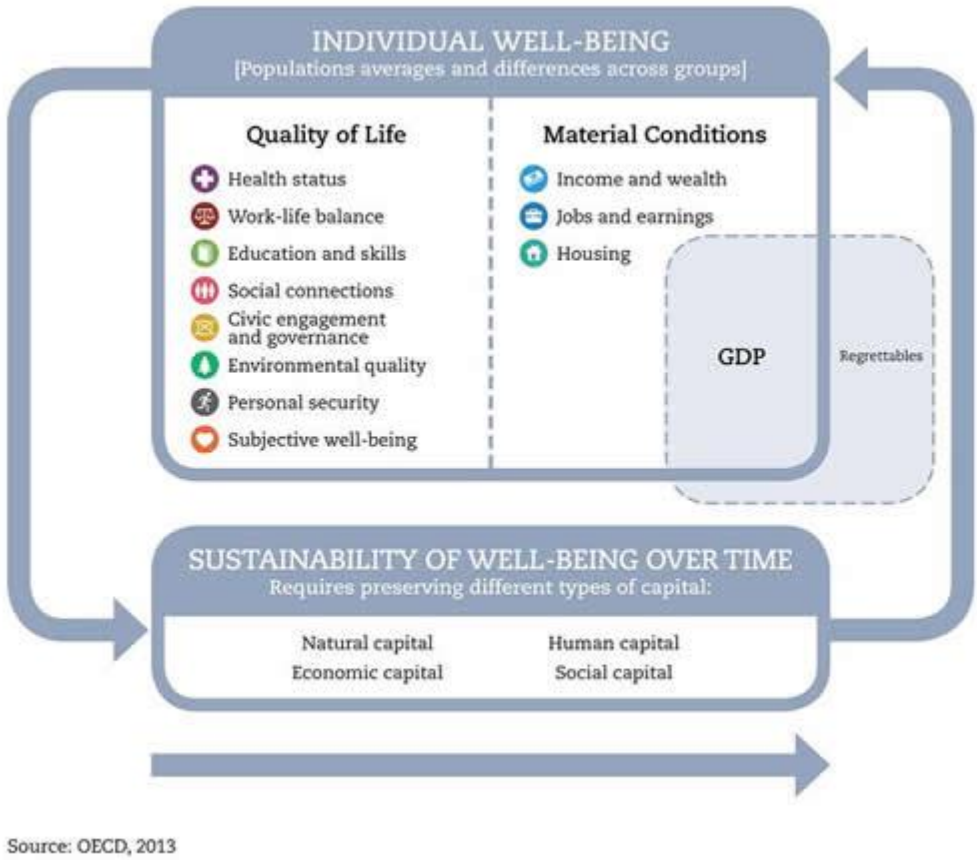
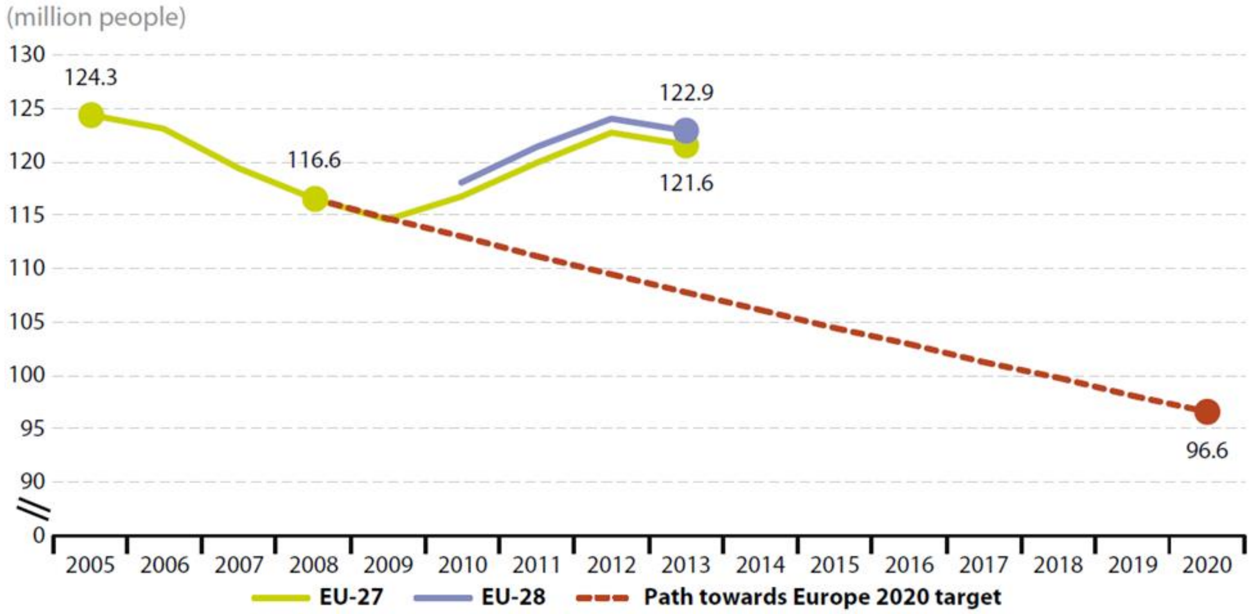


Figure 2.4.2-1 OECD Framework for measuring well-being and progress (Source: OECD 2013).

This chapter will mainly focus on the first pillar, economic well-being, Material living conditions and in particular income and wealth are important aspects of individual well-being. The importance of economic well-being to overall well-being has been recognised by numerous organisations dealing with measures of well-being (OECD 2013, p.29).

At the EU level, the “Beyond GDP” (EC 2016a) initiative of the European Commission aims at measuring wealth and the well-being of nations, taking into account also environmental and social aspects of progress. It develops appropriate indicators to address current challenges such as climate change, poverty, resource depletion, health and quality of life.

The 2015 monitoring report of the EU Sustainable Development Strategy provides a picture of progress towards the objectives of the Strategy, covering a wide range of issues including social inclusion (EUROSTAT 2015i, pp.113). Whereas until 2009 the number of people in the EU at risk of poverty or social exclusion had been falling regularly, it started to raise again this year due to the economic crisis. Although the number reached its peak in 2012 with approximately 122.6 million people affected, in 2013 still almost one in four people (121.6 million people in total or 24.5% of the EU population) in the EU were at risk of poverty or social exclusion.



(¹) 2005–2006 data are estimates. (²) The overall EU target is to lift at least 20 million people out of the risk of poverty or social exclusion by 2020. Due to the structure of the survey on which most of the key social data is based (the EU Statistics on Income and Living Conditions), a large part of the main social indicators available in 2010, when the Europe 2020 strategy was adopted, referred to 2008 data for the EU-27 as the most recent data available. This is why monitoring of progress towards the Europe 2020 strategy's poverty target takes EU-27 data from 2008 as a baseline year.

Figure 2.4.2-2 Development of people at risk of poverty or social exclusion in Europe (Source: EUROSTAT 2015i).

Poverty and social exclusion in Europe embraces monetary poverty, material deprivation or very low work intensity. In 2013, 16.6% of the total EU population was affected by monetary poverty whereas 9.6% (48.3 million people or every tenth person) were suffering from severely material deprivation. Material deprivation includes issues relating to economic strain, durable goods and housing. Affected people suffer from a lack of resources and are unable e.g. to pay a rent or utility bills, heating, holidays or to cover unexpected expenses. Material deprivation measures poverty in absolute terms and thus complements (income-related) monetary poverty. Again in 2013, 10.8% (or 40.2 million) of the EU population aged 0 to 59 were living in households with very low work intensity, meaning the working age members of the household are working less than 20% of their potential. The number of people affected by very low work intensity increased by 5.3% between 2010 and 2013. Economic inactivity substantially increases the risk of being poor. However, poverty and social exclusion do not only affect those who are economically inactive or unemployed. In 2013, 8.9% of employed people in the EU-28 were considered to be working poor.

Long-term unemployment describes people aged 15 or older, who have been unemployed for longer than one year. It is normally more difficult for these people to obtain a job than for people who have been unemployed for shorter periods. Consequently, they face a higher risk of social exclusion. In 2014, the long-term unemployment rate was at 5.1%.

There is a close link between income and education. Tertiary education and lifelong learning enable people to gain knowledge, skills and competences needed for employment in a changing world. Early school leavers and people with only basic education have a higher risk to experience very low work intensity or be among the working poor. Education also has a strong connection to social issues, such as participation and political interest. The share of early leavers from education and training has fallen steadily since 2003, reaching 11.1% in 2014. The share of the population aged 30 to 34 years with tertiary educational attainment has been continuously increasing since 2002. Participation in lifelong learning increased by 27.4% between 2003 and 2014.

Alpine relevance of economic well-being and social inclusion

The quality of life can differ significantly in the Alpine region depending on where people live. Whereas in urban centres, the quality is high, life can be rather difficult in remote areas where there is less access to public services and a higher risk of exclusion. However, especially in remote areas, there are people with traditional working skills, such as dairy farmers on Alpine pastures, who are important for a more sustainable economy and who need to be integrated in the labour market for social and also economic reasons. If such ways of living shall be conserved and protected, it is important to assure the quality of life in the whole Alpine region. Therefore, the topic is of particular importance for the Alps. Figure 2.4.2-3 shows the percentage of people at risk of poverty in the Alpine Convention area.

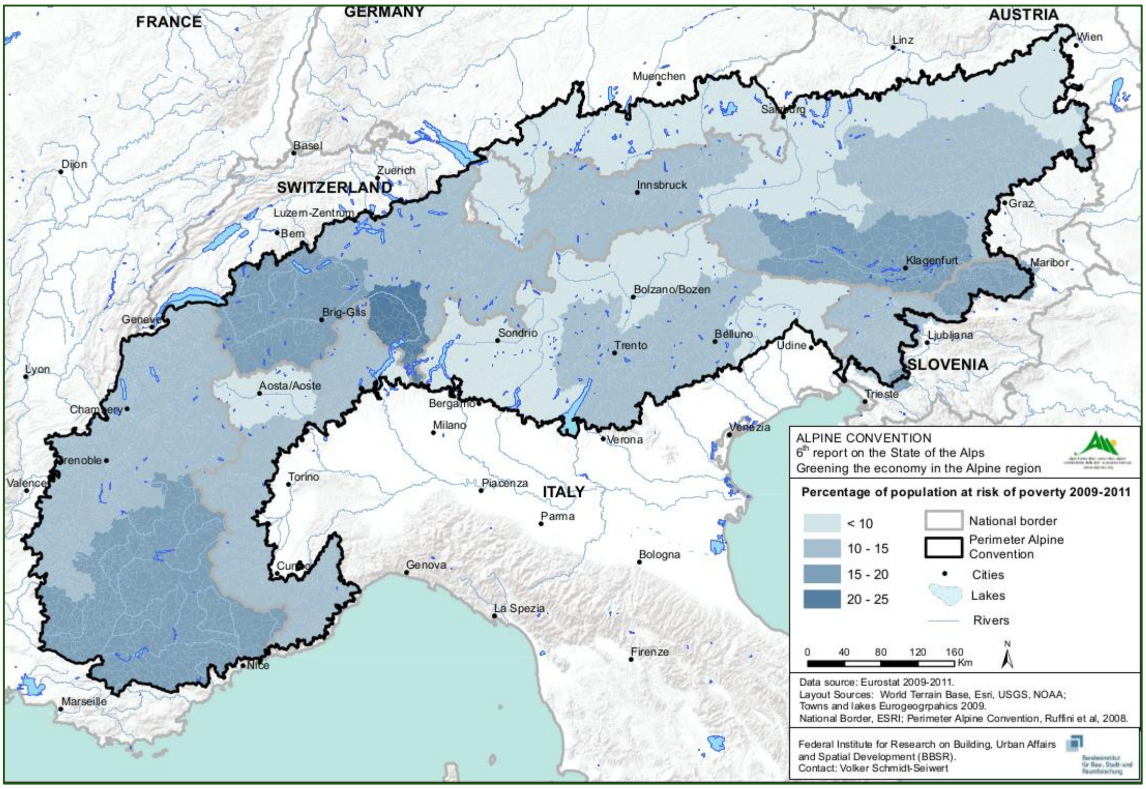


Figure 2.4.2-3 ESPON Atlas 2014: Risk of poverty (Source: ESPON & BBSR 2014, elaboration: Permanent Secretariat of the Alpine Convention).

In the aim of creating an economy that increases "the quality of life for all and not the wealth of a few", the "Economy for the Common Good"[56] was born in 2010, initiated by an Austrian writer and lecturer, Christian Felber. The movement wants to promote the values of human rights and ecological responsibility into day-to-day business practice and works towards an economic system, which places the Common Good at the centre of all economic activity. One of the central elements is the Common Good Balance. Businesses can use the Common Good Balance Sheet as a tool to measure their contribution to the common good. By doing so, the companies are given an account of the degree to which it fulfils certain values, such as human dignity, solidarity, sustainability, justice and democracy.

Originally set up in Austria, the Economy for the Common Good quickly gained participants in Austria, Germany, Italy and later on in Switzerland and then became an international movement. At present, several thousands of individuals, companies, local authorities and NGOs across the globe are actively involved in the initiative. The movement, however, has also been subject to criticism.

[56] Further information: https://www.ecogood.org/en/.

Still today, most of the initiatives and companies adhering to the movement of the Economy for the Common Good are situated in the Alpine region or close to the Alps. This is partly because the initiative was founded in Austria, however, it seems to be of special interest to citizens and companies in this region. This might be due to the high level of identification with the region of Alpine citizens and thus an increased preparedness of all actors to contribute to the common good. Next to companies, also local authorities can establish a Common Good Balance Sheet. The following good practice example describes the approach of the "Common Good Region Vinschgau".

Good practice - Common Good Region Vinschgau, Italy

The Common Good Region Vinschgau started at the beginning of 2013 with the aim to contribute to a more sustainable shape of regional economic cycles. Four municipalities of the district community Vinschgau (Laas, Mals, Latsch and Schlanders) have established their first Common Good Balance Sheet within the "Economy for the Common Good" initiative. This is accompanied by two additional projects: a planned introduction of a regional currency to strengthen regional economic cycles and the development of a prosperity indicator for the Vinschgau region. The latter will measure the well-being in the valley according to own criteria.

A number of regional companies have already established a Common Good Balance sheet and the concept is becoming increasingly popular among business, municipalities, citizens and – in future - schools.

Further information: https://old.ecogood.org/allgemeine-infos/aktuelles/neuigkeiten/vinschger-pilotprojekt-zur-gemeinwohl-oekonomie

Situation in Alpine countries

Austria

In Austria, the initiative "Growth in Transition" [57] brings together transformation activists and decision makers from politics, science, economy and civil society and promotes dialogue and exchange on growth, prosperity and quality of life. It provides an international platform for addressing questions of growth and an alternative, sustainable economy.

The initiative is organised by the Federal Ministry of Agriculture, Forestry, Environment and Water Management and supported by the Vienna University of Economics and Business and 25 other partner organisations, such as other Austrian Federal ministries, NGOs, companies and academic institutions.

Recently, an international conference was held in Vienna. Up to 700 participants met at the Vienna University of Economics and Business, Europe's largest university of economics, to discuss the different aspects of economic and social change and its constraints. Apart from conferences, the initiative organised workshops in Brussels and Dubrovnik to connect decision makers at the European level.

[57] Further information: www.growthintransition.eu.

Good practice - Green Care – where people can grow, Austria

The project "Green Care - where people can grow" is a network of different actors in the agrarian, social and educational sectors and in the health care area, between whom there was previously no connection. The project's intention is to create structures and support in rural areas for a variety of target groups, from people with special needs and kindergarten children, to traumatised, unemployed or disabled and elderly people in need of care. Up to now, these kinds of projects have only been set up in urban areas. They are a collaborative effort between the agriculture and forestry sectors and social institutions.

Green Care in agriculture and forestry includes very different offers, such as:

- Educational activities (teaching on the farm) intended to provide children, young people and also adults with more understanding for nature and agriculture. Examples for this include kindergarten and day care centres on the farm, the project "school on the farm" or forest-related education.

- Provide elderly and disabled people with a daily structure and thus increase their quality of life by offering an environment close to nature. Existing care centres can be given a "green component" using the agricultural sector's social competencies.

Further information: http://www.greencare.at/project/green-care-wo-menschen-aufbluehen/

Germany

Since 2001, the German Government publishes a "Report on Poverty and Wealth" (BMAS 2013) taking stock of the economic and social situation of German citizens. The report includes information on policies and measures taken by the government to improve the living conditions of disadvantaged people and is published by the Federal Ministry of Labour and Social Affairs within each legislative period. An advisory board made up of representatives of the Länder, local authorities, associations and NGOs supports the government in drafting the reports. Furthermore, an expert committee contributes to the process by providing thematic studies and reports.

To date, four reports were published (2001, 2005, 2008 and 2013). The fifth report is currently under preparation and will probably be released in 2016. These reports cover topics such as macro-economic conditions, income and wealth, education and employment, health, housing, political and civic participation, migration and people living under particularly difficult conditions. The last and fourth report on poverty and wealth, published in 2013, has a focus on social mobility, i.e. "the change of living circumstances and the dynamics of social participation occurring within an individual's lifetime (intra-generational mobility)" (BMAS 2013). It covers the years 2007 – 2012. Labour market and distribution indicators show a rather positive development of living standards in Germany.

According to the national statistical office in 2014, 20.6% of the German population was at risk of poverty or social exclusion, amounting to 16.5 million people. In 2013, 20.3% (16.2 million people) were running that risk. Compared to the EU average (24.4 % in 2014 and 24.5 % in 2013), the German figures are significantly lower (cf. Table 1.2.3-12.4.2 1).

Table 2.4.2-1 People at risk of poverty and social exclusion in Germany and EU, 2011-2014 (DESTATIS 2016).

	2011	2012	2013	2014
		in %		
Germany	19.9	19.6	20.3	20.6
European Union	24.3	24.7	24.5	24.4

At the regional and local level, figures are only available for monetary poverty (risk-of-poverty rates). In 2014, 15.4% of the population at the national level were at risk of poverty, 15.5% in 2013. The Bavarian values were considerably lower, corresponding to 11.5% in 2014 and 11.3% in 2013. Corresponding figures for the German Alpine districts are only available at NUTS 2 level and show a value of 8.9% for Oberbayern and 12.1% for Schwaben for the year 2014 and are thus slightly lower in average than the Bavarian average (Statistische Ämter der Bundes und der Länder 2016).

Since 2005 the unemployment rate has fallen continually, reaching 6.8% in 2012 and 5.4% for young people (15-29 years), which is the lowest rate of youth unemployment in the European Union. In addition, the number of long-term unemployed, one of the major causes of poverty risk in Germany, has fallen considerably between 2007 and 2012 - from 1.73 million to 1.03 million (cf. Figure 2.4.2-4).

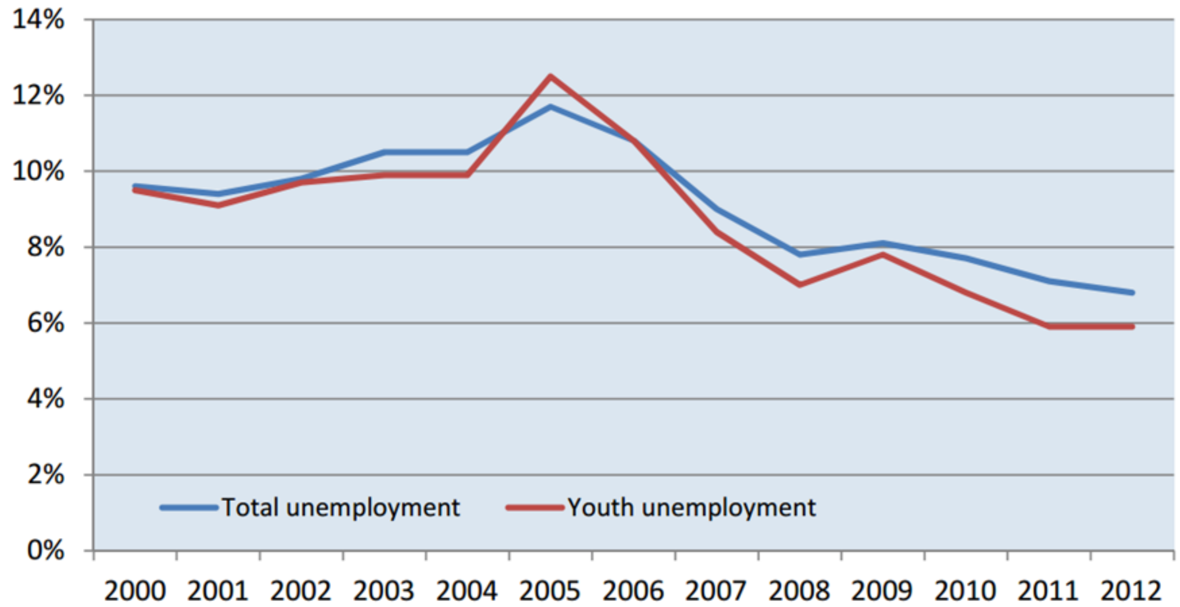


Figure 2.4.2-4 Development of the unemployment rate in Germany 2000 – 2012 (Bundesagentur für Arbeit 2016).

In the German Alpine region, the employment rate is in line or slightly higher than the Bavarian rate (78.6%) and higher than the German average (74.2%). As for the unemployment rate, the German Alpine districts have unemployment rates that are slightly lower than Bavarian average (3.6% compared to 3.8% in 2014) and also lower than the German average (4.6% in 2015).

Young people leaving school without a certificate have less chances of playing their part in society. There is a decreasing number of students between the age of 15 and 17 leaving school without a certificate, falling from 8% in 2006 to 6.5% in 2010.

The rate of the German Alpine population having completed a higher secondary education cycle range from 432 residents on 1,000 residents in low performing areas to 531 in high performing areas and is in average higher than the Bavarian (459) and the German average (460). As for tertiary education, the rates of inhabitants of the German Alpine districts range from 105 to 168 and are lower than the Bavarian (147) and the German (150) average. The difference in performance between secondary and tertiary education levels may be due to the fact that many people with tertiary education have to move to bigger urban centres outside the mountain area, where there are better job opportunities for the respective education level (PSAC 2015a, p.101)

Italy

Since 2011 the National Institute of Statistics (ISTAT) and the National Council for Economics and Labour (CNEL) have been running an extensive work that involved both the scientific community and the civil society aimed to identify a metrics for measuring "equitable and sustainable wellbeing" across the Italian territory. The scientific research combined with the dialogue with citizens and the analysis of feedback brought to identify 12 dimensions of wellbeing, based on 134 indicators. A joint reading of the results of these indicators is expected to deliver information on the trend of wellbeing and inequality for each Region in Italy (NUTS 2). Differences are categorized in the annual Benessere Equo Sostenibile – equitable and sustainable well-being (BES) reports (CNEL & ISTAT 2014) according to gender, age and geographical origin. As a result, statistical information has been improved, some indicators have been refined, and others have been collected for the first time in years: the resulting combination yearns for a more comprehensive view of wellbeing in Italy.

The report delivers information on how the quality of life has changed for Italian citizens under twelve dimensions. The methodology has been recently tested also on the province level (NUTS 3) on a smaller sample (CNEL & ISTAT 2014).

In general terms, northern Italian regions score high enough compared to the national average.

A focus on the BES dimensions named "economic wellbeing" and "social relationships" as registered in the Alpine regions (CNEL & ISTAT 2014), reveal the trends reported in the figures below. These dimensions rely upon a set of 10 and 11 indicators respectively, of which some have a multiregional scope and others a regional one (NUTS 2).

Among the covered indicators, some particularly reflect aspects of employment, disposable income, financial security and exposure, as well as social networks, no profit initiatives and community participation in political life.

An analysis of the indicators under the "economic wellbeing" dimension show a better performance of the Alpine regions compared to the national figures for all indicators. Furthermore, either a better performance or an alignment with the figure for northern Italy is the rule for most indicators. In particular the Alpine regions (NUTS 2) score significantly better than national average concerning risk of poverty (-48%), people living in families with strong material deprivation[58] (-55%)or very low labour intensity (-52%).

Concerning the "social relationships" dimension, the Alpine regions tend to score better in particular in the domains of volunteering (+58%), social participation (+31%) and provision of private financial support to no-profit organisations (+49%) that are coherently more numerous (+65%). Trust in other people (+34%), in families (+18%) and friends (+20%) is significantly higher in the Alpine regions than elsewhere in the country.

Under the labour market point of view, Alpine regions seem to be able to provide more secure and lasting jobs.

[58] Share of people living in families with at least 4 out of 9 problems / total number of residents. The problems taken into account are: i) inability of supporting unexpected expenses higher than €800; ii) inability to spend one week of holiday a year far from home; iii) having arrears to pay for mortgages, rents, bills or other debts (e.g. installment buying); iv) inability to have a proper meal each two days, i.e. with meat or fish proteins (or vegetarian equivalent); v) inability to adequately heat home; vi) inability to pay for vi) a washing machine, vii) a color television, viii) a phone, ix) a motorcar.

Slovenia

The “Indicators of Well-being in Slovenia”[59] have been published since 2013, produced by a consortium of governmental institutions: the Institute for Macroeconomic Development and Analysis, the Statistical Office of the Republic of Slovenia, the National Institute of Public Health and the Slovenian Environment Agency. Recognised relevant factors of well-being were divided into three areas – material, social and environmental well-being - and presented by indicators.

According to the indicator report for 2015, material well-being of the people in Slovenia has been declining since 2008 due to the economic crisis. The at-risk-of-poverty rate in Slovenia in 2013 increased to 14.5% of the population (EUROSTAT 2015b). In the 2009–2013 period it went up by 3.2%, so that in 2013, an additional 50,000 people lived below the at-risk-of-poverty threshold compared to 2008. , Despite the increase, the rate is lower than the EU average, but the gap is rapidly closing, since in the EU the rate is declining. During this period the at-risk-of-poverty rate increased significantly for families with children. In Slovenia above-average rates are recorded for single persons, particularly older women.

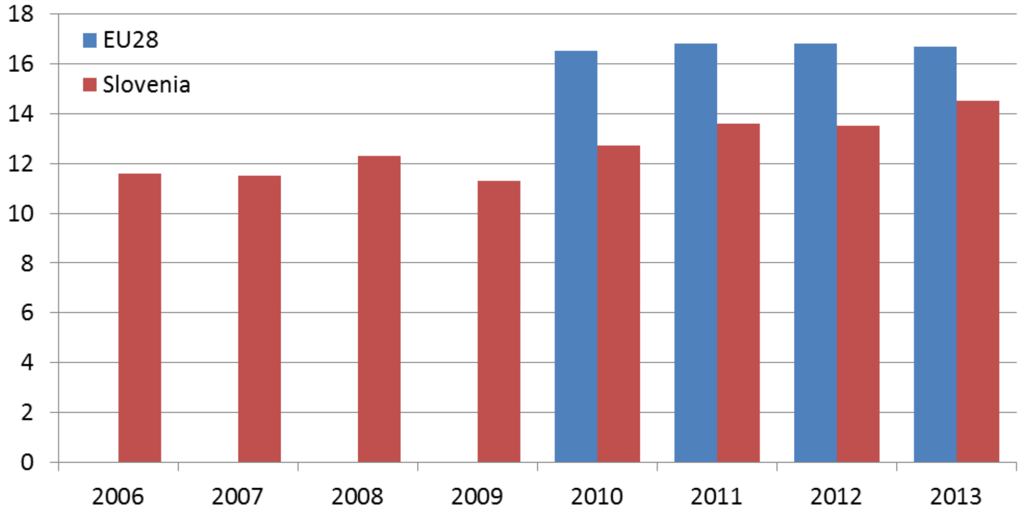


Figure 2.4.2-5 At-risk-of-poverty rate, Slovenia and the EU, 2007–2013 (in %) (Source: EUROSTAT 2015b).

Because work is the main source of income for most individuals, the indicator employment rate for the population aged 20-64 years is a good indicator of the general material well-being of the population.

The indicator, as presented in the Indicators of Well-being in Slovenia, shows a decline since 2009, with economic recovery. In 2014 it increased by 0.6 percentage points to 67.8%, which is 5.2 percentage points less than in 2008.

[59] Institute for Macroeconomic Development and Analysis, the Statistical Office of the Republic of Slovenia, National Institute of Public Health and Slovenian Environment Agency, 2015: Indicators of well-being in Slovenia, www.kazalniki-blaginje.gov.si

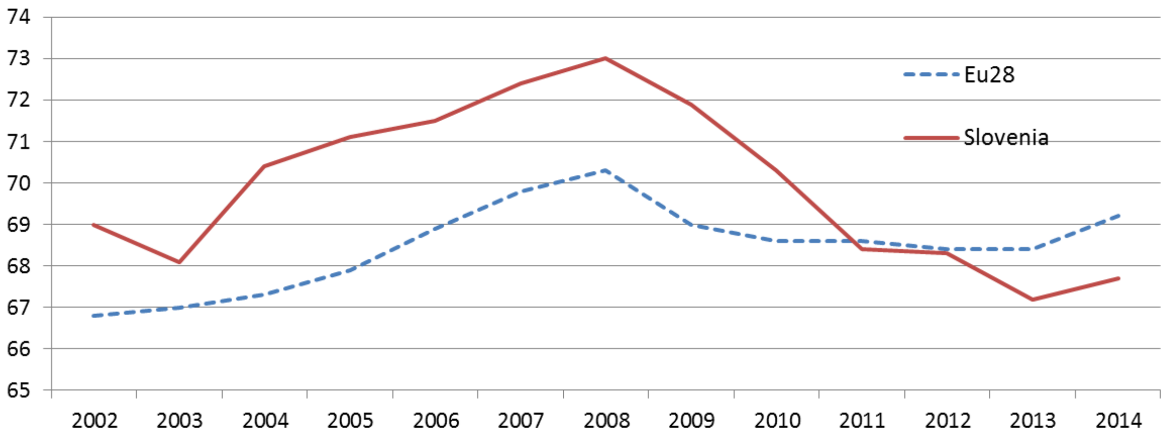


Figure 2.4.2-6 Employment rate for the population aged 20-64 years, Slovenia and the EU, 2002–2014 (in %), (Source: EUROSTAT 2015e)

In 2013, the employment rate of young persons (age group 20-24 years) was 39.7%. In 2014, it remained at a similar level. Since 2008, when it was the highest, it dropped by as much as 15.9 percentage points. It fell below the EU average of 48.5% in 2009. The employment rate of older persons (age group 55-64 years) was 35.4% in 2014, thus considerably lower than the EU average overall (51.8%). The long-term unemployment rate in Slovenia was 5.3% in 2014, higher than the EU average (3%).

The indicator “Share of the population with at least secondary education” measures the educational level of adult population. The indicator covers upper secondary and tertiary education and is important for well-being because people with at least secondary education are in average more likely to be employed, have a higher income and are less likely to be unemployed and at-risk-of poverty and social exclusion. An increase of the share has a positive impact on well-being.

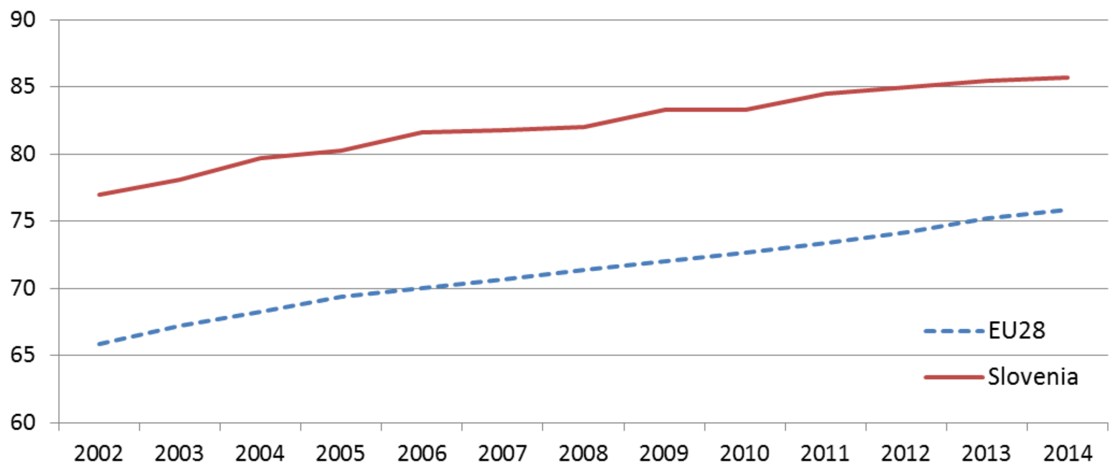


Figure 2.4.2-7 Share of the population with at least secondary education, Slovenia and the EU, 2002–2014 (in %) (Source: SURS 2015 and EUROSTAT 2015h).

In 2014, 85.7% of the population in Slovenia aged 25–64 years completed at least secondary education. The share has been constantly increasing; from 2000–2014 it went up by 10.3%. Compared to the EU average (76% in 2014), the share in Slovenia is higher. The high share is mostly the result of a well-developed public education network, high participation of young people in education, low share of early school leavers and favourable financial possibilities for education. In addition, the share of the population aged 25–64 with tertiary education is growing rapidly. It has grown from 15.9% in 2000 to 28.6% in 2014 and is now very close to the EU average (29.3%). In the total number of tertiary education graduates in 2013, graduates of maths, science and technology represented 25.7%. Participation of adults in lifelong learning has been decreasing since 2010, when it was 16.2%. In 2014, it declined to

11.9% but it is still above the EU average (2014: 10.7%). The share of young people neither in employment nor in education was at 12.0% in 2014.

Switzerland

In 2015 the average unemployment rate in Switzerland was 3.3%. Since 2011 (2.8% unemployment rate), this rate is slightly raising. In the cantons which belong to the Alpine Convention (Appenzell Ausserrhoden, Appenzell Innerrhoden, Glarus, Graubünden, Nidwalden, Obwalden, Uri Schwyz, Tessin, Walllis), the unemployment rate was in the range of 0.9%-4.3% in 2015.

There are various labour market measures, which aim at integrating unemployed persons into the labour market. This is done through improvement of the placement ability as well as strengthening the skills of the unemployed to meet the needs of the labour market; through reducing the risk of long term unemployment and allowing to gather work experience. Other measures include availability of courses and internships, temporary occupations in secondary labour market as well as, in special cases, taking over the housing costs during the months of unemployment. The graphs below show the percentage change of employed persons compared to the year before between 2009 and 2014 as well as the unemployment rate (according to ILO) among men and women between 2009 and 2014.

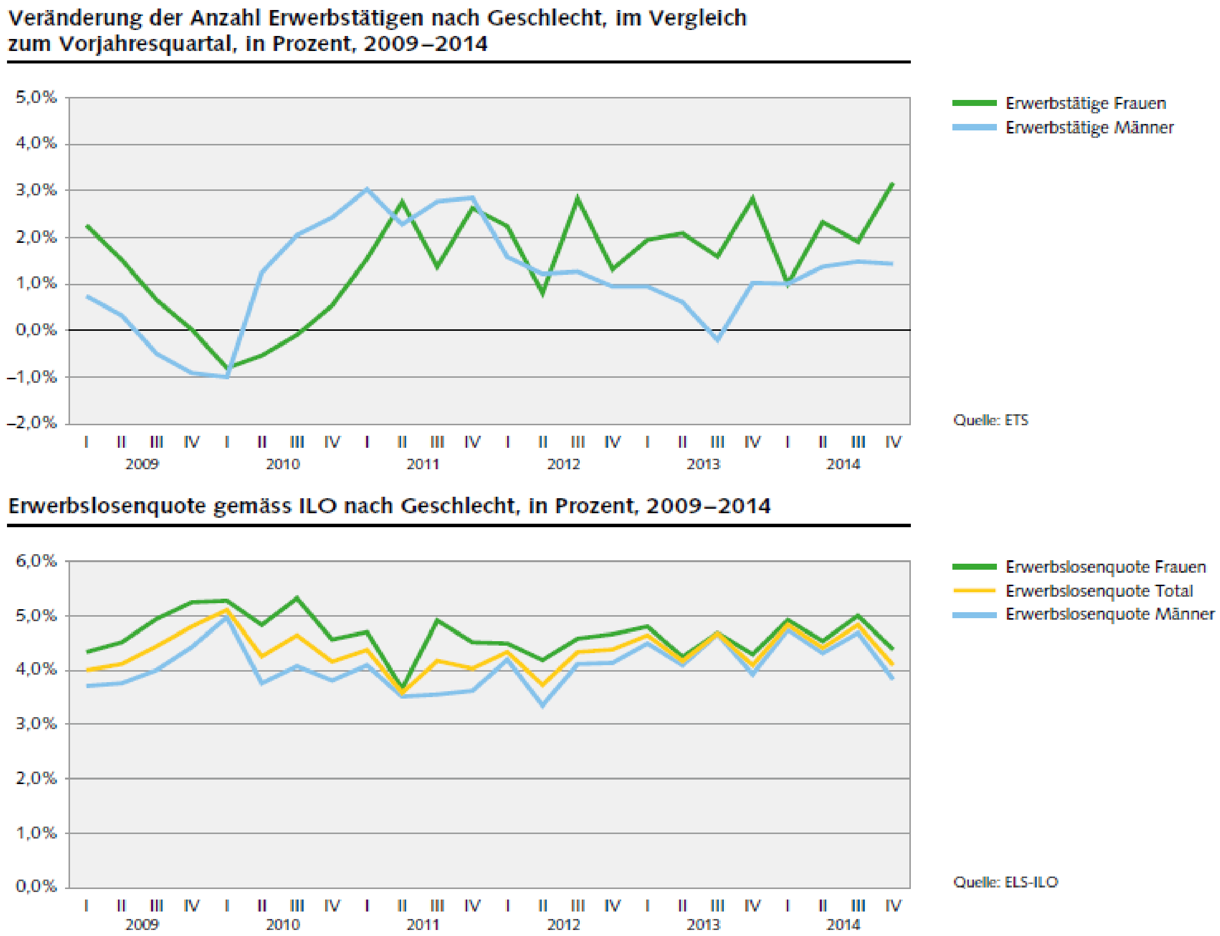


Figure 2.4.2-8 Percentage change of employed persons compared to the year before between 2009 and 2014 and unemployment rate (according to ILO) among men and women between 2009 and 2014 (Sources: BFS 2016a).

Social existence minimum defines people who are affected by poverty i.e. people "who do not have the financial means to acquire goods and services necessary to an integrated social life" (BFS 2014). The poverty line is set to a fixed amount that covers living expenses, individual housing and additional expenses. Currently, poverty affects 7.7% of the society in Switzerland.

The Confederation undertakes various measures in order to fight this problem. There is a 2013 National Program for Prevention and Combatting of Poverty. It has four action fields: education chances for children, teens and adults; social and occupational inclusion; living conditions and monitoring and measurement of effects. Hence it aims at increasing education possibilities for persons affected with or in danger of poverty, supporting integration into labour market of persons with weaker chances, improving their living situation, access to information, as well as the situation of their families and monitoring the measures undertaken in order to fight poverty.

The implementation of these measures is realised in three different ways: elaboration of foundations and good practices, testing of new approaches and working on better informed and networked actors. The Confederation, the cantons and the municipalities work commonly towards those goals.

Conclusions on opportunities and challenges

In general, the quality of life is rather high in the Alpine area. The risk of poverty rate in the German Alpine area is lower than the Bavarian or the national average. In Slovenia, it is lower than at the European level. The German Alpine area shows a higher employment and a lower unemployment rate than at the Bavarian or national level. For these two indicators, Slovenia performs better than the EU average. In Switzerland, there is no noticeable difference in the unemployment rate between the national average and the Alpine area. The share of people with secondary education is higher in the German Alpine areas than in the rest of the country. In Slovenia, the share of people with secondary education is higher than the EU average, for tertiary education the figures come close to the EU ones. In Italy, the Alpine regions show a better performance in terms of economic well-being compared to the country as a whole.

However, the possibility for people living in remote areas to participate in the labour market is limited, which may lead to a lower quality of life and social exclusion. It must be ensured that also in these regions, existing skills and workforces are integrated in the labour market. In terms of a Green Economy, this is especially true for people with traditional working skills.

2.4.3 Sustainable consumer behaviour

Sustainable consumer behaviour means incorporating social and environmental consideration into purchasing and consumption decisions and thereby trigger more sustainable production patterns. There is an increasing awareness among people for healthy and sustainable lifestyle and the environmental and social performance of consumer goods and services. Numerous initiatives and campaigns run by public institutions and NGOs have sensitized and empowered consumers to make use of their purchasing power and influence the market by consuming goods and services with less environmental and social impact than conventional products. The increasing existence of social and environmental labels and certificates has certainly also supported consumers in their efforts to live more sustainably.

Next to private consumption, public procurement has a high potential to contribute to sustainable consumption and production patterns. European public authorities are major consumers with an approximate annual spending of 1.8 trillion ruro; this represents 14% of the EU's gross domestic product.[60] By using their purchasing power to buy goods and services with lower environmental and social impacts, public authorities can make an important contribution to sustainability objectives. They can also provide incentives to the industry to develop more sustainable products and thereby influence the market, especially in fields where they command a large share of the market (building and construction, public transport, health care). Sustainable procurement helps achieving environmental targets that a public authority has set itself, can help reducing costs through a life cycle approach, sets an example to citizens as private consumers and has the potential to raise awareness of environmental and social issues. Furthermore, it provides strong incentives to enterprises to improve their environmental performance and triggers economies of scale.

Further to purchasing and procurement initiatives, there is an increasing number of consumer initiatives such as sharing and exchange initiatives, regional production, repair cafés and local currencies, showing the way to an alternative and more sustainable way of living and consuming.

An economic system consists not only of producers but also of consumers. In the context of a Green Economy, it is important to look at the economy as a whole, i.e. also considering the consumption side. Through conscious consumer behaviour, citizens can improve their quality of life and contribute to resource efficiency. Appropriate policies need to be in place to set the right framework conditions for this to happen.

This chapter will provide an overview of existing approaches for sustainable consumer behaviour, including public procurement, private consumption and consumer initiatives in the Alpine regions and the potential they have to influence the market and the economic system.

Background on sustainable consumer behaviour

EU Level

At the European level, the importance of sustainable consumption (and production) patterns for a sustainable development has recognised for many years and has found its way into important policy documents such as the Sustainable Development Strategy and the Europe 2020 strategy. The 2008 Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) Action Plan includes measures aiming at improving the environmental performance of products and increasing the demand for more sustainable products. It complements further policy instruments in support of sustainable production and consumer awareness. The European Union sees its role in setting up and encouraging tools and frameworks to provide consumers with the product information needed to make conscious choices. The most important are briefly presented in the following.

[60] Further information: http://ec.europa.eu/environment/gpp/what_en.htm.

One of the most important product groups in terms of environmental relief potential and human well-being is food. Food is the biggest single cause of climate change, and one of the biggest causes of other environmental damage. Food is the biggest single cause of health – or ill health. One third of the food produced for humans is never eaten, but thrown away (FAO 2011). Furthermore, of all the hungry people in the world, more than half are farmers or farm workers. [61] Adopting a more sustainable approach to food can thus contribute significantly to environmental protection, health and social equity. Next to avoiding food waste and buying regionally produced or fair-traded products, consuming organically grown food is a way for consumers to protect biodiversity and to contribute to the preservation of natural resources.

More and more consumers in Europe opt for organic food. Over the past decade, land under organic farming increased by half a million hectares yearly. To date, there are more than 186,000 farms cultivating organic farmland across the EU (EC 2015a).

To achieve more transparency on the market, the EU created a European wide label. Since 2012, the use of the EU organic logo is obligatory for all organic pre-packaged food produced within the European Union. It guarantees compliance with the conditions and regulations for the organic farming sector established by the European Union. The compulsory use of the logo make organic products easier to be identified by the consumers and thus supports sustainable consumption.

The EU Ecolabel, was launched in 1992 by the European Commission. The aim was to develop a European-wide eco-labelling scheme that consumers could trust. The label helps to identify goods and services that have a reduced environmental impact throughout their life cycle. The underlying criteria have been developed in a multi-stakeholder approach by scientist, NGOs and business. In September 2015, 44,711 products and services in Europe were certified with the EU Ecolabel. The largest number of EU Ecolabel licences was awarded in France (27%), Italy (18%), and Germany (12%).

Finally, the Green Public Procurement Initiative of the European Commission supports public authorities in their efforts to reduce environmental impact through their purchasing practices by providing legal advice, green procurement criteria, good practice examples and tools for life-cycle and cost analysis. Member States are encouraged to create National Action Plans for Green Public Procurement. As of November 2014, all Alpine countries being EU members have adopted such an Action Plan or an equivalent document.

Alpine relevance of sustainable consumer behaviour

Even though there are no specific opportunities for sustainable consumer behaviour in the Alpine regions, the topic is important for a Green Economy as in all other regions. One important aspect to be considered when setting up future strategies is that many Alpine regions produce high quality, sustainable and regional food products, using also traditional agricultural practices (such as Alpine farming). The consumption of regionally produced products is, therefore, an important aspect of sustainable consumer behaviour in the Alpine region.

Good Practice - Project 100 max, Alpine-wide

100max is an Alpine-wide household programme for climate protection. The Alps are a sensitive living environment and especially vulnerable to climate change. Inhabitants can contribute to climate protection through their behaviour. Local authorities from seven Alpine countries are taking on this challenge and encourage their citizens to take part in the "100max – the Alpine game for climate protection". 100 max empowers households to reduce their energy consumption.

Twice a year during a given week, participating households convert their daily behaviour (including clothing, consumption of goods and services, mobility) into CO2 points. A website

[61] Further information on World Food Programme: https://www.wfp.org/hunger/who-are

(www.eingutertag.org) allows them to calculate and upload their points and to compare themselves with currently around 70 other households. Participants encourage and empower each other to save points. Additional ideas are provided by the website. After the end of the first reporting week, participating households have a few months to reflect upon potential improvements of their lifestyles with respect to climate protection and if the reduction of CO2 points really leads to a reduced quality of life.

The 100max project is coordinated by the International Commission for the Protection of the Alps CIPRA.

Further information: http://100max.org/ueber-100max/

Situation in Alpine countries

Austria

In Austria, a regional brand for organic food products from Tyrolean mountain farmers was created, called "*Bio vom Berg*". It is based on a cooperative of now about 600 farmers, which still control the management and administration. Founded in 2002, the cooperative comprises farmers, cheese and meat manufacturers, and is the only producer owned trademark in Central Europe. About 80 different products are being offered on the market. Customers are Tyrolean food retailers as well as producers of specialities, which recognize and honour the special qualities of the "*Bio vom Berg*" products.

Good practice -feld-association for using the unused, Austria

feld is an association - founded 2014 in Innsbruck - with the aim to use aftercrop that will not be harvested automatically as well as vegetables that will not fit into the "normal markets" and to contribute those victuals in the food retail sector. To reach this goal, the club members meet to harvest crops - in accordance with the local farmers - nearby Innsbruck, use those former unused resources to produce long lasting food (e.g. jam, pickle) and to launch the products on well-chosen food markets in Innsbruck (e.g. food sharing spots, food coops).

The association is open for everyone who wants to contribute to the project goals and to take action against food waste.

Further information: https://www.facebook.com/feldverein

Germany

In Germany, a high number of sustainability labels are on the market. Some orientation is provided by platforms such as Siegelklarheit[62], label-online[63] and Kompass Nachhaltigkeit[64], presenting and evaluating all or at least most of the existing labels.

The environmental label *Blue Angel*, owned by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, certifies environmentally friendly goods and services in different categories (resource efficiency, recycled material, water protection etc.). Standards set are continuously adapted to the technical progress. Currently, more than 12,000 products and services have been awarded the *Blue Angel*.

[62] Further information: [http://www.siegelklarheit.de/home.](http://www.siegelklarheit.de/home)

[63] Further information: http://label-online.de/.

[64] Further information: [http://www.kompass-nachhaltigkeit.de/.](http://www.kompass-nachhaltigkeit.de/)

In 2001, a national label for products from organic agriculture was created. As the above mentioned EU organic label, products have to be produced respecting the EU regulations for organic farming. It can be used additionally to the compulsory EU label. Next to this public label, there are private labels of organic farming associations, applying stricter standards than the EU regulations. The most important ones at least for Bavaria and thus the German Alpine areas are the *Bioland* label, the *Naturland* label and the *Demeter* label. At the Bavarian state level, a new organic label for regional products was launched in late 2015 by the Bavarian State Ministry for Food Agriculture and Forestry. The objective of the new label is to combine organic production with regional (Bavarian) origin. Criteria follow the quality standards of the Bavarian organic farming associations and are thus stricter than the official regulations. The first certified products are available since December 2015.

In the Alpine region Allgäu, a regional organic brand called ”VonHier“ was created in 1998 by the company Feneberg Lebensmittel GmbH. The brand is given to organically grown food that is being produced within a maximum distance of 100 km from Kempten, where Feneberg is situated. To date, more than 400 products including fruit and vegetables, dairy products, meat and cheese and pastries are branded. The brand has been well accepted by consumers and has proved highly successful.

In terms of sustainable procurement, the German government supports the concept through various measures. The “Integrated energy and climate protection programme”[65] of the government includes a measure for the procurement of energy-efficient products and services. The general administrative provision for the procurement of energy-efficient products and services[66] sets a mandatory target for all authorities at the federal level to use life-cycle costing in their procurement procedures to ensure energy-efficient and environment-friendly public procurement. The government provides advice to public authorities through a newly created competence centre for sustainable procurement.[67] Furthermore, procurement criteria for a high number of product groups and further support for public purchasers are available from the German Environment Agency.

In Bavaria, guidelines on the integration of environmental aspects in public procurement procedures[68] provide information and guidance on green procurement for governmental agencies. Apart from the obligation to procure wood products from sustainable forest management, there are no compulsory provisions for the procurement of environmentally sound goods and services.

The Bavarian Parliament was the first one in Germany having taken a decision to exclude products from exploitative child labour from public procurement of the government and state owned companies. Local authorities are encouraged to act accordingly. Around 70 local authorities in Bavaria have adopted similar council decisions, thereof nine from the Alpine Convention area.

[65] Further information: http://www.bmwi.de/DE/Service/gesetze,did=254040.html.

[66] Further information: http://www.verwaltungsvorschriften-im-internet.de/bsvwvbund_13022013_B1581643321841199.htm.

[67] Further information: http://www.nachhaltige-beschaffung.info/DE/Home/home_node.html.

[68] Further information: https://www.lfu.bayern.de/abfall/recycling_neue_produkte/doc/umweltgesichtspunkte.pdf.

Italy

Different voluntary initiatives have been undertaken by businesses of different size and industries aiming at capturing consumer preferences for greener products and services also in the Alpine region.

One of the most interesting aspects is the one of tourist infrastructures and facilities adopting the EU ecolabel in the Alpine parks in Italy. Worth noting is also the development of other park labels, according to a provision of the Italian law on protected areas (National Law n. 394/1991). The latter allows for the release of a park trademark to specific products having a particular link to the territory of the protected area as a way of enhancing the value of the park.

The EU Ecolabel scheme is particularly prominent in Italy. In the case of hotels, of particular relevance for the Alps, the adoption of the EU Ecolabel contributes to reducing the use of home care products and samples, and saves water and energy, which has tangible economic and environmental benefits. Italy is a champion in terms of EU Ecolabel products available to customers, totaling 16815 of them, licenses released are 337 (following 486 in France).

Figures for the Italian Alpine Regions are reported in Figure 2.4.3-1.

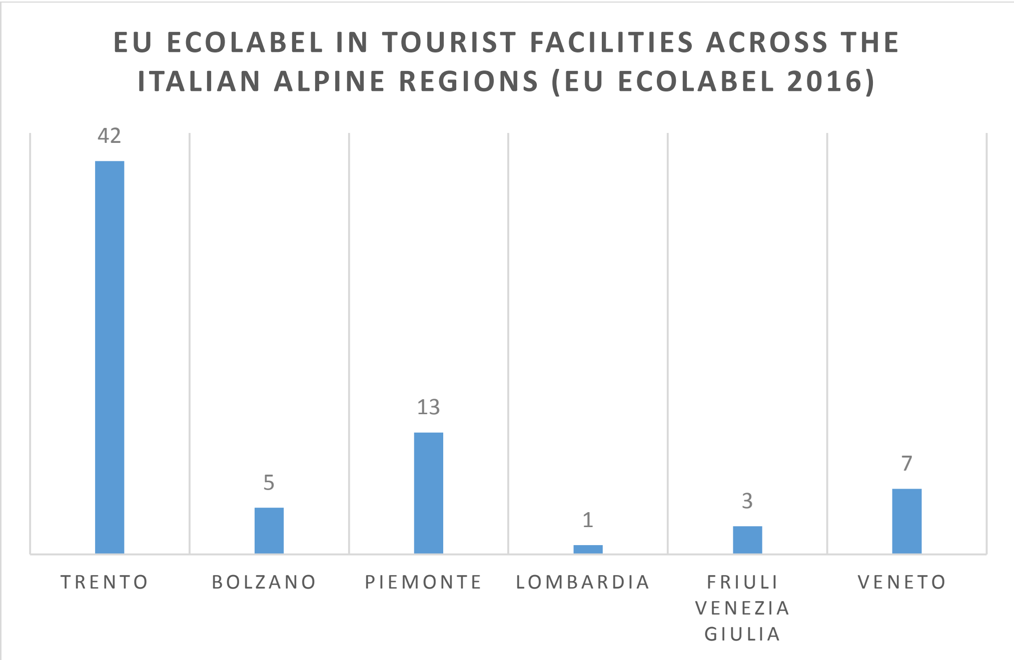


Figure 2.4.3-1 EU Ecolabel in tourist facilities across the Italian Alpine Region (EC 2016b).

The EU Ecolabel in the field of tourism (EC 2016b) has also been adopted by tourist facilities located in many parks across the Italian Alps, often associated with other certifications or voluntary rules that apply to parks themselves (e.g. EU Charter of Sustainable Tourism and own park's label): there are 5 in the Autonomous Province of Trento, 8 in Piemonte, 1 in Veneto and 1 in Friuli Venezia Giulia (Federparchi 2016).

Many other voluntary schemes exist across the Alps, aimed at supporting sustainable consumer behaviour and marketing the nature and landscape value of mountain products (to a large extent in the food category). Figures at the regional level show that some 20% of quality products in the Italian parks concentrate in the Alpine regions, as shown in Figure 2.4.3-2.

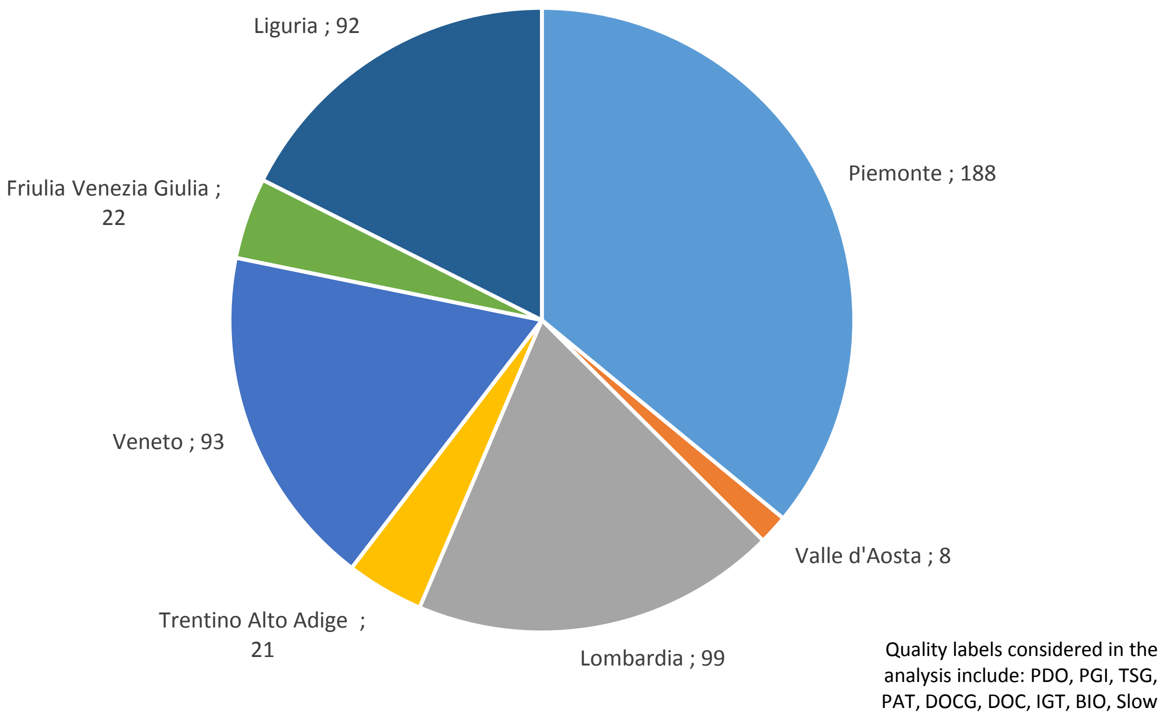


Figure 2.4.3-2 Number of Food Quality Products from parks in the Italian Alpine Regions (Federparchi 2016).

Furthermore, a voluntary program on the environmental footprint of goods, services and organizations has been running since 2011 on the initiative of the Italian Ministry for the Environment. The programme represents, in coherence with the ongoing discussions in Europe on the EU PEF (Product Environmental Footprint) scheme, a good practice of public-private cooperation, with the involvement of more than 200 participants. These include companies, municipalities and universities, some of which are located in the Alps. The project's aims were identifying companies' procedures of carbon management and supporting the use of low-carbon content technologies and good practices in the manufacturing processes. The initiative aimed at the promotion of the companies' voluntary commitment for the evaluation of the environmental performances and the reduction of the GHG emissions, as a tool to enhance the measures of the Kyoto Protocol, the European "Climate and Energy package", and the EU Circular Economy package (MATTM 2011-2015).

The formal introduction of a voluntary certification scheme based on ISO 14040:2006 on LCA – Life Cycle Assessement, called "Made in Green Italy" is very recent. It dates back to the end of 2015 (Legge n. 221/2015 "Collegato Ambiente") and will be operationalised in 2016. This certification is based on a multi-criteria assessment of environmental performance of a product or service, along its full life-cycle. It is based on the product environmental footprint methodology for identifying the environmental footprint of products and services, as defined by EC Recommendation 2013/179/EU. Its main aim is to reduce the environmental impacts of the good or service from the extraction of raw materials to its disposal. The scheme is currently under development. It also aims at reinforcing the competitiveness of the Italian industrial system on national and global markets, taking note of the increasing demand for products of high environmental quality and exploiting the significant consumers' awareness of the "Made in Italy" label.

Liechtenstein

In Liechtenstein, various projects and initiatives support consumer engagement and offer a platform for those willing to contribute to a more sustainable economy and way of living.

The association “Symbiose” addresses people willing to contribute to a sustainable society. Projects include a co-working space, a repair café, a vegan and organic lunch lounge, and the “Zukunftswerkstatt”. The “Zukunftswerkstatt” is a joint project between the symbiotic community, Vaduz and the follow-up project of the former association “Zeitlos” with its project "Tuschzit", which are funded by the Youth in Action Programme.

The “Zukunftswerkstatt” was launched with the aim to promote and shape a sustainable and positive future. Through exchanges and cooperation, people aim at meeting current challenges. The “Zukunftswerkstatt” is a place that brings together people who want to contribute to a happy and sustainable society. An online platform and events support the development and discussion of pioneer projects and provide the opportunity to get involved with the community. Every person can present ideas and projects to those interested and seek cooperation for their implementation.

The regional brand “vo do” is run by the Stiftung Agrarmarketing. By marketing regional products, it aims at providing fresh products with short transportation ways, increasing the regional value, preserving regional structures and traditions, protecting cultural and recreational areas, and protecting biodiversity by promoting the diversity of varieties at the regional level.

Slovenia

In Slovenia, green public procurement for certain products and services is mandatory since 2012 (on 8 December 2011, the Decree on Green Public procurement was promulgated). The Decree is binding for public purchasers and includes core environmental targets for a number of products groups, including buildings, electricity, electronic devices, food and paper.

To help consumers choose green products, some local eco labels have been created like “Biodar”. “Biodar” is a collective trademark for organic food, grown and processed according to the standards of the Union of Slovenian Organic Farmers Association. “Biodar” confirms that the product is of organic origin and controlled from the field or barn to the shelves.

Supervision of compliance with standards for the use of the mark “Biodar”, as well as basic control over the production and processing of organic agricultural products is implemented by three control organizations. A check of farmers is carried out at least once a year, namely the verification of compliance with rules for organic production and processing, and the conditions that the food wanted to be labelled "organic" must meet the standards. The standards of the association are in some cases more stringent than the regulations on organic production and processing of agricultural products and foodstuffs covered by Slovenian and EU legislation, which makes farmers subject to high requirements of organic production and processing.

Good practice - Carpooling Prevoz, Slovenia

In Slovenia, a web application to support carpooling was developed. As Slovenia is predominantly a rural country, mobility is an issue. Having a car is considered to increase the quality of life due to restricted available public transport in some parts of the country. The number of journeys made by car, a largely unsustainable transport mode, has been growing.

Graduate students created an open source application allowing drivers with spare seats to enter their journey details (origin and final destination, date and time) along with the price they want to charge for a seat. Prospective passengers then contact the driver to arrange the ride.

The project proved to be very successful, showing that such solutions are very well accepted in the society. In combination with further projects on urban mobility and public transport, commuters in Slovenia will be able to choose among multiple cost-effective, efficient and environmentally friendly transportation options.

Further information: https://prevoz.org/about/

Switzerland

The WWF in Switzerland made an evaluation of 32 main labels of the food market in Switzerland to show how environment-friendly and sustainable they are[69]. Labels were evaluated in the following areas:

- Environment (water, soil, biodiversity, climate, fishing and fisheries management)
- Animal welfare
- Social aspects
- Risks for consumers and third parties
- Credibility (independence, control, scope, transparency and viability).

One of the most known certifying organisations is “Bio Suisse”, a federation of Swiss organic farmers with over 6,000 members. More than 800 processing and trade companies have a licence contract with “Bio Suisse” to use the “Bio Bud” label.

Special food labels within the Alpine area are:

- “Pro Montagna”[70] which fosters products of the Alps distributed by the supermarket chain coop and
- “Heidi”[71], a label for products of the Swiss mountains, distributed by the supermarket chain Migros.

Swiss products and services enjoy an excellent reputation both domestically and abroad, which is why Swiss indications of source are being used with increasing popularity. Unfortunately, they are also being

[69] Further information: http://www.wwf.ch/de/aktiv/besser_leben/ratgeber/lebensmittellabels.

[70] Further information: http://www.coop.ch/de/labels/pro-montagna.html.

[71] Further information: https://heidi.migros.ch/de.html?_ga=1.56760042.1775146862.1452707751.

abused. The new 'Swissness' legislation strengthens protection for the 'Made in Switzerland' designation and the Swiss cross[72].

An existing sharing initiative within the Alps is the Alpentaxi[73]. The aim of the Alpentaxi is to take passengers traveling without a car from the last public transport stop closer to the mountains - and back again. Local taxi services as well as call-a-bus service are available. It also promotes a rearrangement from motorized transport to public transport, as well as a step towards sustainable tourism. Passengers such as hikers, mountaineers, climbers and ski tourers are able to enjoy their leisure time in a more environmentally friendly way. It provides not only a benefit for tourists, but also for the local population and nature. The Alpentaxi is organised by different companies, not every taxi driver is a full-time employee.

Good practice - Eco-village Čadrg, Slovenia

Village Čadrg is also called eco-village by it's' residents, since four of the five farms are organic. They offer organic milk and dairy products (cheese, cottage cheese, whey) and have their own brand, Tolminc cheese produced in the village dairy. Reconstruction of a dairy was co-financed by the municipality of Tolmin, support was also offered by the Agricultural Advisory Service.

The transition from conventional to organic farming was almost self-evident for Čadrg. Even before opting for organic farming, the breeding of cattle was based on traditional practices, which also applies to the supply of pasture and fodder production for livestock. Even the cheese and cottage cheese are produced according to the traditional procedure.

Thus for the transition to organic farming, they only needed to adapt stables, because animals should have more space and light, but otherwise grazing and feed production continued without major changes. The local pastures provide high-quality forage. In winter, the cattle are fed with grass silage, which forms more than half of all feed and hay.

To date, four farms are certified eco-farms, representing almost the entire village.

The use of local and natural animal feed has resulted in achieving significant reduction in emissions. The transition to organic agriculture and related tourism activities have also improved the economic situation of the local residents, increased the quality of life and helped to preserve the mountain countryside.

Further information: http://www.arhiv.slovenija-co2.si/index.php/dobre-prakse/trajnostni-razvoj-podeelja/dobre-prakse-2012/31.html.

[72] Further information: https://www.ige.ch/de/herkunftsangaben/swissness.html.

[73] Further information: www.alpentaxi.ch

Conclusions on opportunities and challenges

Due to missing statistics on sustainable consumer behaviour, this topic is presented via case studies and good practices rather than comparing figures. It is thus difficult to provide an evaluation of the performance of the Alpine region in terms of sustainable behaviour. However, given the benefits of sustainable consumer behaviour (e.g. contribution to energy savings, sustainable production patterns), the topic has a great potential to contribute to a Green Economy and should not be neglected in future strategies.

A topic of particular relevance for the Alpine region seems to be the production, marketing and consumption of regional products. Regional labels and brands exist in several Alpine regions and have been highly successful. Fostering regional production and consumption and supporting regional marketing initiatives and instruments has the potential to make an important contribution to a Green Economy in the Alps. Local authorities have an important role to play in encouraging regional production cycles.

Furthermore, the introduction of regional currencies promotes also regional environmentally friendly products and services and reduces the necessity of Alpine transport. It is considered to be a successful practice to keep value within the region by those Alpine regions that have introduced such currencies. As keeping added value within the Alps is an important objective for many stakeholders, the introduction of such an Alpine wide currency seems a promising instrument towards a greener economy.

2.4.4 Health and harmful emissions

Environmental quality was always and is still crucial to sustain human health in the sense of the WHO health definition. Human health is affected by harmful emissions from man-made and natural sources (e.g. volcanic emissions). Almost all economic activities from production processes in agriculture and industries to transport of goods and persons emit more or less harmful matters and / or noise. Many of these emissions lead to a degradation of the quality of all environmental media such as air, water and soil. In addition , other natural assets such as biodiversity or silent places are affected.

The release of air pollution has a detrimental effect on public health (UNEP 2011b). Therefore, and in terms of a Green Economy the two main objectives for economic activities are to decrease harmful emissions (including those not directly affecting human health) as these cause environmental costs and to decrease the exposure of people to environmental pollution, environmental risks and the related health costs. There are high indirect costs associated with the pollution arising from the combustion of fossil fuels and biomass (wood).

In the Alps, air quality and noise are in the foreground when harmful emissions come to attention. The harmful effects on human health of many air pollutants and noise emissions are widely described in publications of the WHO, the EEA and other international and national institutions. Although air quality has improved significantly in the last decades, ambient concentrations of some pollutants as nitrogen oxides or particulate matter below 10 µm are still too high, at least occasionally and in some regions. As this report cannot provide a complete overview over harmful emissions and the related health problems, it concentrates on the status quo of two pollutants to represent the topic: ozone and particulate matter. The negative effects on human health will not be presented here in detail either, but only briefly mentioned. Also not within the scope of this report, but nonetheless relevant are the negative impacts air pollution and noise have on ecosystems, such as e.g. disturbances of habitats, eutrophication, acidification or leaf damages (also for crops) caused by ozone, nitrogen oxides, ammonium, sulphur oxides and other air pollutants.

Background

<u>Health impacts</u>

The effects of air pollution on human health are well known. Depending on the pollutant, they reach from diseases of the respiratory system to cardiovascular diseases and include even prenatal problems (e.g. pre-time births, reduced lung function and affected immune system in newborns) (EEA 2014a).

Particulate matter is dust suspended in air, which is categorised according to its size in particles below 10 µm (PM10) or below 2.5 µm (PM2.5). It originates from different natural and artificial sources. Depending on the sources, it is composed by different components, such as elemental carbon, heavy metals, polynuclear aromatic hydrocarbons, sulphate, ammonia, nitrate and many others. Due to its size, it stays in the atmosphere for a certain time instead of sinking immediately to the ground. Particulate matter enters the human body mainly via respiration. Depending on the size, the particles make their way through the body in different depth. Greater particles rest in the upper part of the respiratory system, but ultrafine particles can even enter the bloodstream and pass to inner organs. The particles are very different in their chemistry, even heavy metals and cancer-causing particles can be contained. The most important health effects of PM are on the respiratory and cardiovascular system, an increase of cardial infarction and inflammatory reactions (EEA 2013a).

While ozone in the high atmosphere is protecting the earth from ultraviolet radiation, ground level ozone affects human health and plants. The main effects on humans are pulmonary system effects as e.g. reduced pulmonary function and pulmonary inflammation and effects on the cardiovascular system (WHO 2008). Sensitive persons can suffer headaches, watering eyes and a decrease of physical performance.

Economic effects of air pollution

A new WHO/OECD study (WHO & OECD 2015) estimates (there is still no standard and agreed method available by which to measure the cost of morbidity) the economic costs of the public health impacts of ambient and household air pollution in the 53 countries of the WHO European Region. Table 2.4.4-1 shows that the costs remained static or decreased slightly over the last decade, while the amount of premature deaths decreased in all Alpine countries. As data are only available on a national scale their significance for the Alps is rather restricted as most national “hot spots” of air pollution lie outside the Alps (cf. Figure 2.4.4-4 for PM10).

Table 2.4.4-1 Premature deaths and their estimated economic costs from ambient particulate matter pollution (APMP) in 2005 and 2010 on national level. Source: WHO & OECD 2015, pp. 8-9 and 24-25)

Country	Premature deaths		Economic cost of premature deaths from APMP [US$ millions]	
	2005	**2010**	**2005**	**2010**
Austria	3,642	3,122	34,511	32,447
France	17,916	16,892	53,031	53,295
Germany	50,051	41,582	154,382	144,715
Italy	34,511	32,447	98,612	97,193
Slovenia	1,011	876	2,489	2,539
Switzerland	2,978	2,656	10,471	10,225

Alpine relevance of air pollution

While health effects of harmful emissions are an issue everywhere, there are some special features in mountain regions as the Alps concerning the behaviour of emissions. Brifely, , the diffusion of air pollution as well as noise spreading is much different due to topography and related meteorological effects. The Alps reach high in the atmosphere and form a barrier to the horizontal exchange of air by wind. Additionally, they have special wind systems (valley winds and slope winds), which can transport air pollutants uphill and into valleys where emission sources are distant. Meteorological conditions as inversions occur more often in the Alps compared to the lowlands and they lead to high pollutant concentrations, as air becomes more stagnant and horizontal exchange of air is limited. Especially in the winter half year, inversions tend to be stable over several days and air pollution increases from day to day during these periods (Heimann et al. 2007).

Policy targets and thresholds

Clean air has been an important policy target for years. The European Union has developed a thematic strategy on air pollution with the aim to decrease the negative impacts and risks of air pollution to human health and the environment. The EU Framework Directive on Ambient Air Quality and Cleaner Air for Europe 2008/50/EC (EU 2008) describes basic principles concerning the assessment and management of air quality and sets pollutant concentrations thresholds. The Directive merges most of the existing legislatives as Directive 96/62/EC and a number of daughter directives into a single one and sets new quality objectives for PM2.5. The EU Directive sets thresholds, which are binding for the EU Member States, but e.g. Austria applies stricter limit values for specific pollutants (e.g. PM10 daily mean – number of exceedances). The thresholds for Liechtenstein and Switzerland are defined in the Ordinance on Air Pollution Control (OAPC, SR 814.318.142.1) and partially differ from EU standards. Figure 2.4.4-1 shows the air quality thresholds for PM10 in the Alpine countries (WG EnvAlp 2014). It has to be mentioned that the thresholds cannot be interpreted in the sense that values below them do not harm human health. Any concentration of PM is harmful to human health, less PM is less harmful to health and the smaller the particle are the more harmful they might be. The EEA has stated that PM's mortality effects are clearly associated with the PM2.5 fraction (EEA 2013a).

The annual target value for PM2.5 which is defined in the EU air quality directive is 25 µg/m³, but at the moment there is no target or threshold value for 24 hours averaged.

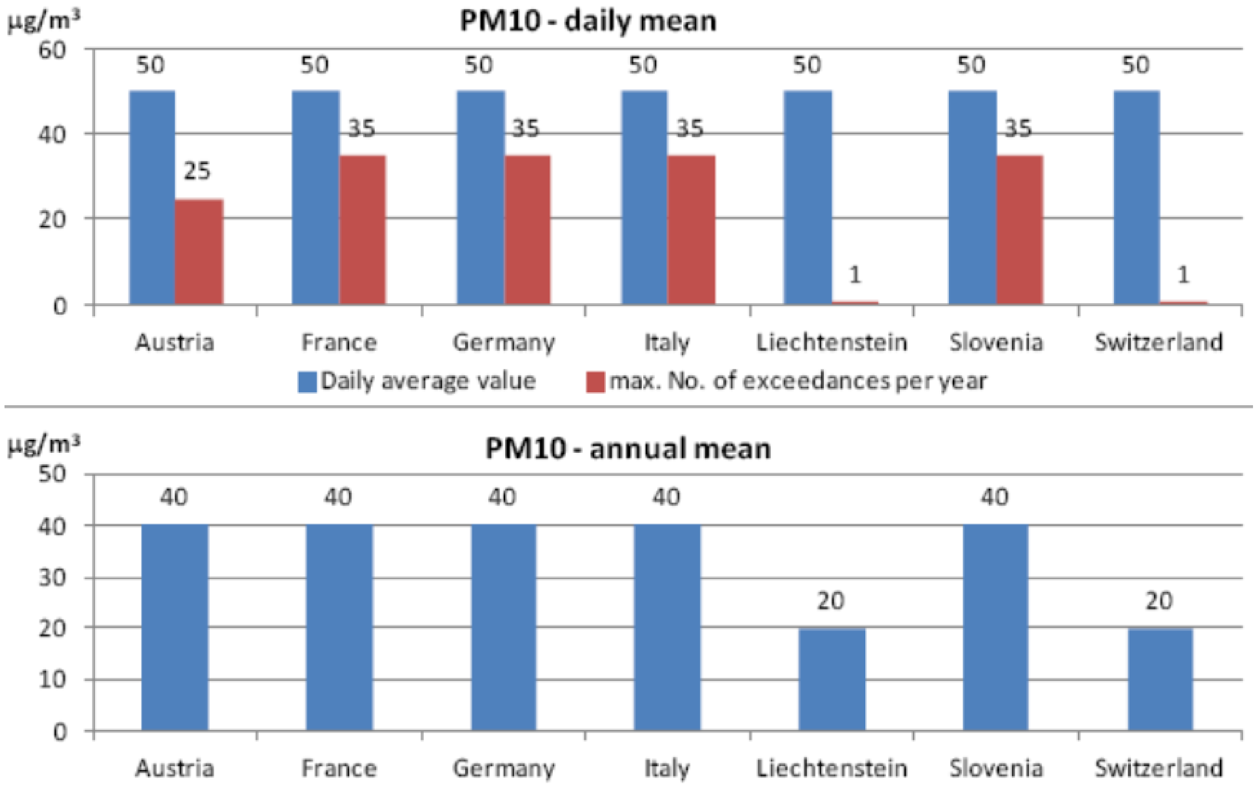


Figure 2.4.4-1 Comparison of air quality standards for PM10 (WG EnvAlp 2014).

For ozone immission the thresholds implemented for the protection of human health are listed in Table 2.4.4-2.

Table 2.4.4-2 Thresholds for Ozone immission for the protection of human health from EU Ambient Air Quality Directive 2008/50/EC.

Emission threshold	statistical definition
120 µg/m³ (25 days per year)	8 h- average value (highest of the day); target
120 µg/m³	8 h- average value (highest of the day); long-term target value
180 µg/m³	1 h- average value; information threshold
240 µg/m³	1 h- average value; alert threshold
Switzerland	
100 µg/m3	98% 1/2 h average value ≤ 100 µg/m3
120 µg/m3	1 h- average value may be exceeded only once/year

Situation in Alpine countries

Harmonised air pollution data are available for member countries of the EEA, they cover the whole Alpine region and can be used to assess air quality in the Alps.

<u>Ozone</u>

In the lower part of the atmosphere, ozone is a molecule which causes damages to human health and to the vegetation. Ground level ozone is not directly emitted, but a so-called secondary pollutant mainly formed by complex chemical reactions of precursor gases like e.g. nitrogen oxides and the oxygen in the air under intense insolation. For this reason, ozone values show a characteristic course during the year and the day with high values in periods of high insolation (summer, noon and afternoon) and lower values in winter time. There is a clear connection between meteorological conditions and ozone formation leading to higher ozone levels in sunny periods and regions with high insolation, as in the southern part of Europe. Precursor gases play not only a crucial role in the genesis of ozone, but also in the destruction of it. Therefore, ozone is more quickly destructed in areas with higher concentrations of precursor gases, and exists longer if transported to areas with lower concentrations of them – a reason why regions with less pollutants show often higher ozone concentrations.

Figure 2.4.4-2 shows the values of SOMO35 (sum of ozone means over 35 parts per billion), which is the new indicator for health impact assessment recommended by the WHO. The Alps have some regions with rather high SOMO35 values. The triangles represent rural background stations, they often show higher ozone values than the urban/suburban background stations, which are represented in the map as squares.

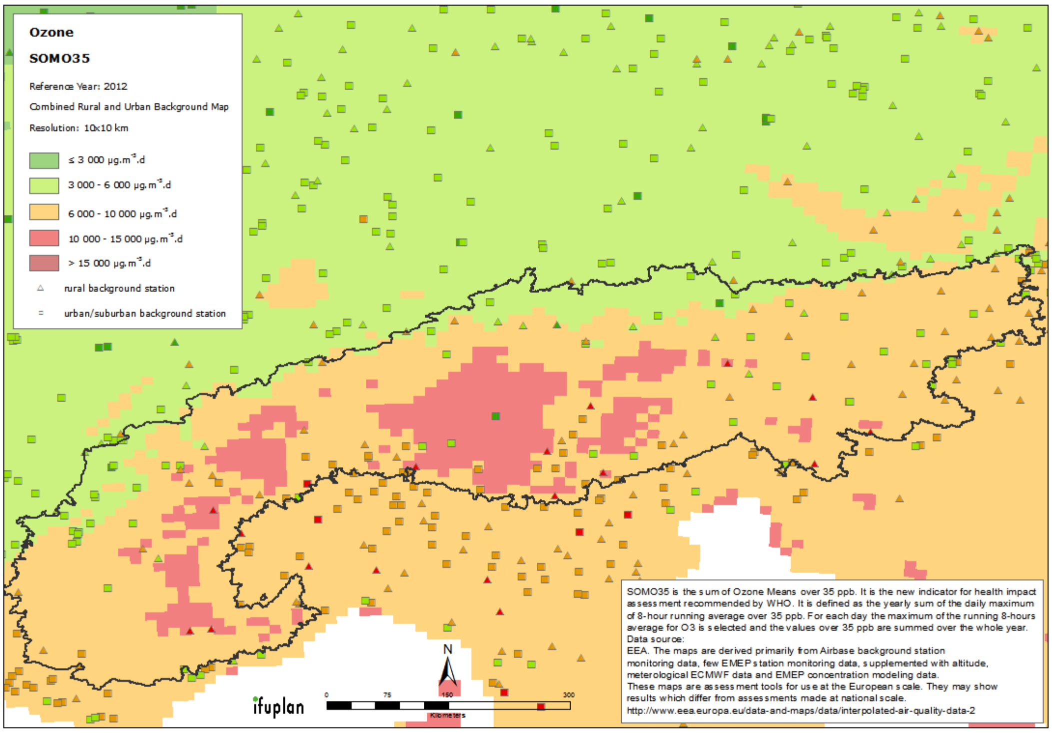


Figure 2.4.4-2 Sum of ozone Means over 35ppb (2012) (Source: EEA 2016).

Particulate Matter – main source sectors

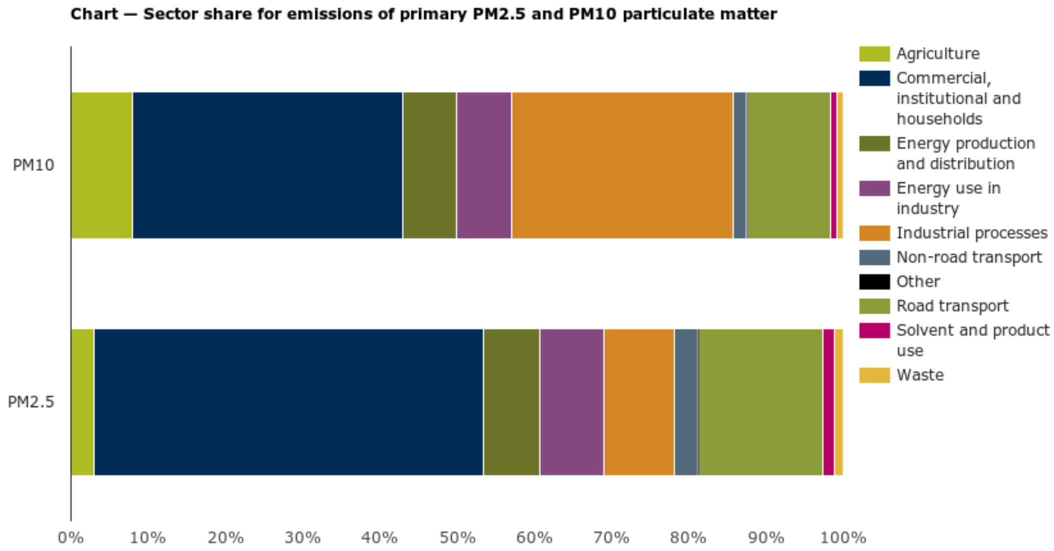


Figure 2.4.4-3 Sector share for emissions of primary PM2.5 and PM10 (Source: EEA 2014b).

Figure 2.4.4-3 shows the sources of primary PMin Europe. The highest shares of PM2.5 and PM10 are emitted from the commercial, institutional and household sector, road transport and industrial processes. An explication may be that the combustion of fossil fuels – no matter for which purpose (heating, transport or industrial processes) contributes significantly to PM emissions. Consequently, replacing fossil fuels by renewable energy sources and decreasing the demand by increasing energy efficiency is necessary also from the perspective of human health.

The newest EEA report on air quality in Europe (EEA 2015a) analysed the contribution of different sectors to emissions of several air pollutants. Even if the data do not differentiate between different regions or countries, some of the findings are interesting also for the Alps. It states that all primary and precursor emissions contributing to ambient air concentrations of PM, O_3 and NO_2 have decreased over the past decade (2004–2013) as a whole in the EU‑28. The smallest reduction was for NH_3 – a precursor gas of PM10 – and the largest was for SO_x (EEA 2015a, p. 15). The main sectors emitting air pollutants are transport, energy, the commercial, institutional and households sector, agriculture and waste.

The commercial, institutional and households fuel combustion sector dominates the emissions of primary PM2.5 (58% of total primary PM2.5) and PM10 (43% of total primary of PM2.5). This sector has increased its emissions of PM between 2004 and 2013. One reason is the increasing use of wood and biomass combustion for heating, as it is perceived as a more climate friendly option compared to fossil fuels (EEA 2015a).

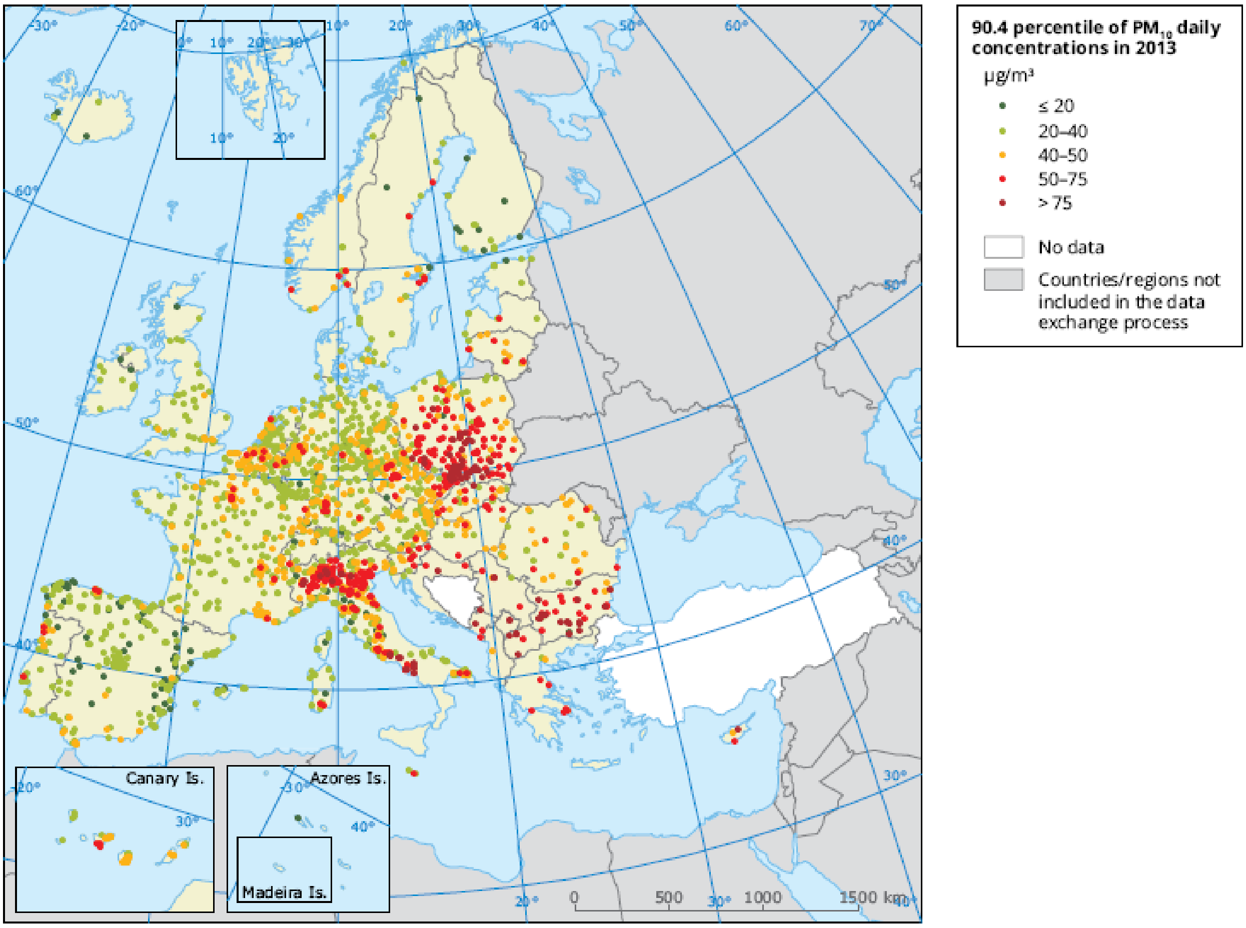
Industry is still the second largest source of primary PM, contributing to 22% of PM10 and 16% of PM2.5 in EU-28. This may be different in the Alps, where large industial plants are rare, but there is no data available for the Alpine area (EEA 2015a).

Energy production and distribution has cut its emissions for all pollutants between 2004 and 2013 in the EU-28 with the exception of primary PM10 (EEA 2015a).

Agriculture is the sector with the least decrease of air pollutants, especially of ammonia (NH_3 –), which is a precursor gas of secondary PM[74]. It is now the third most important source of PM10 primary emissions in the EU-28 (EEA 2015a).

The transport sector has reduced its emissions considerably over the last decade, but is still the largest contributor to NO_x emissions (46% of total EU-28 emissions) and remains a very important emittent of GHGs. It contributes to 13% of total PM10 and 15% of total PM2.5 primary emissions. Non-exhaust emissions (e.g. abrasion of brakes and tires) are estimated to have a noteworthy share of PM10 emissions (about 50%) and PM2.5 (about 22%). Therefore, traffic will continue to contribute to PM emissions even with zero tail-pipe emissions (EEA 2015a).

Exceedances of the EU daily limit value (cf. Figure 2.4.4-4: red and dark red dots) occurred in EU-28 primarily (92% of cases) in urban or suburban areas, mainly in Eastern Europe and Italy, but also in the big agglomerations in other countries, e.g. in Munich (DE), which are mainly outside the Alps. The map shows that within the area of the Alpine Convention most monitoring stations are within the allowed exceedances of the daily limit value. Some exceptions are agglomerations as e.g. Grenoble and some stations in Italy.



Notes: The map shows the 90.4 percentile of the data records in one year, representing the 36th highest value in a complete series. It is related to the PM_{10} daily limit value, allowing 35 exceedances over 1 year of the 50 μg/m³ threshold. The red and dark-red dots indicate stations with exceedances of this daily limit value. Only stations with > 75% of valid data have been included in the map.

Source: Based on Air Quality e-reporting database (EEA, 2015a).

Figure 2.4.4-4 Concentrations of PM10 in 2013 (Source: EEA 2015a, p. 21).

[74] NH_3 reacts with NO2 or SOx to ammonium nitrate or ammonium sulphate.

Figure 2.4.4-5 shows the interpolated annual average of PM10 in the Alps in 2012. There were no exceedances of the EU annual threshold for PM10 of 40 µg/m³ in the Alpine Convention area. Close to the Alps, several stations in northern Italy feature threshold exceedances. Figure 2.4.4-6 shows the interpolated annual average of PM2.5 in 2012. The target value of 25 µg/m³ is exceeded at several urban/suburban background stations in the Italian part of the Alpine Convention area. The interpolation shows – as for PM10 - also exceedances mainly at the southern borders. As both maps show interpolated data primarily from background stations, the picture may be different if industrial and traffic stations would be included. Due to the interpolation, local hot spots of particle pollution caused by domestic heating with wood are not shown but frequently occur in the Alpine region.

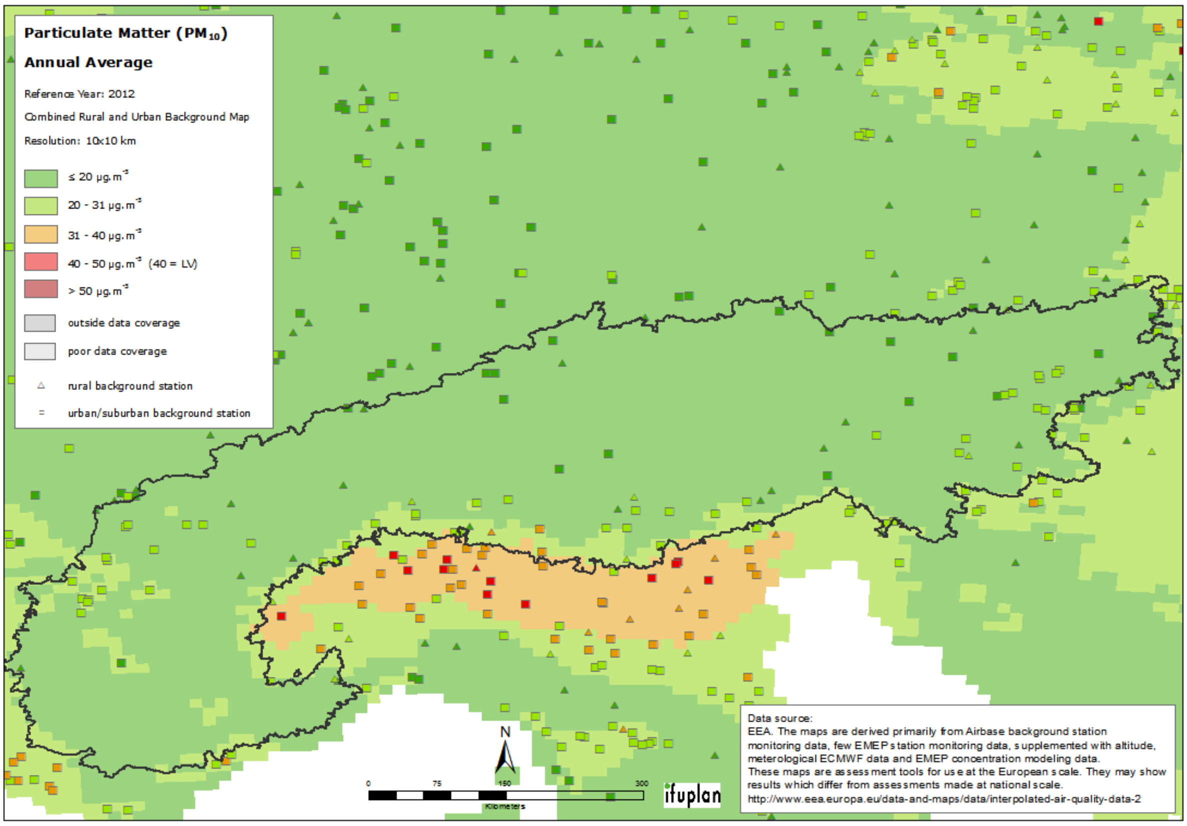


Figure 2.4.4-5 Interpolated Annual Average of Particulate Matter (PM10) in 2012 (Source: EEA 2016).

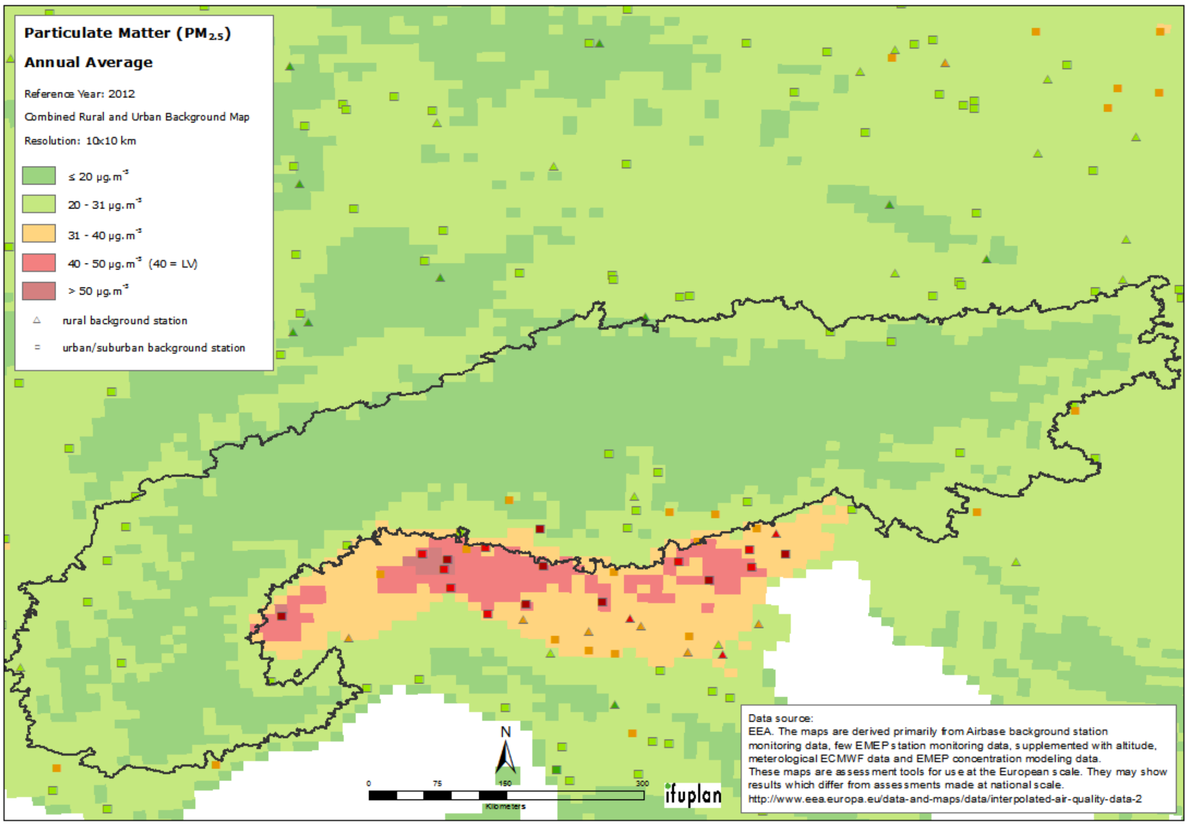


Figure 2.4.4-6 Annual Average of Particular Matter (PM2.5) (Source: EEA 2016).

Transport sector – Case study MONITRAF and iMONITRAF!

As transport is an important sector causing air pollution in the Alps, a few facts from the project MONITRAF/iMONITRAF! are interesting. The project partners installed from 2005 onwards a monitoring system along five main transport corridors in the Alps.

Figure 2.4.4-7 shows a decreasing trend of PM10 concentrations along the iMonitraf corridors with the exception of Avio (Brenner corridor) and Entreves (Mont Blanc). Concentrations do not spread over a wide range. The highest values in 2014 were measured in Avio (22 µg/m³) and Vallée de la Maurienne (20 µg/m³, Fréjus corridor). "A diachronic analysis reveals that after a significant decrease between 2005 and 2007, the concentrations remain overall more or less constant until 2010. An increasing trend is visible in 2011, followed by three years of significant decrease. As for NO_2, a main reason for the decreasing trend is the improvement of the emission factors of diesel vehicles. It is caused technically by the increasing number of vehicles equipped with particle filter systems, which are mandatory for the latest Euro classes. Year-to-year fluctuations are also driven by meteorology. An example is the station Erstfeld (Gotthard), where the wavy pattern happens simultaneously for PM10 and NO_2.

Some caveats are necessary: PM10 concentrations are influenced also by other sources than transport, such as wood heating installations, and by secondary PM10 built from gaseous precursor pollutants like NO_x, SO_2, NH_3, VOC, which may have been emitted long distances form the iMONITRAF! corridors away. Secondary PM10 can contribute to half of the concentration measured. Therefore, the fluctuations identified in Figure 2.4.4-7 may not only be explained by the development of the road transport emissions.

The EU limit value for the annual average (40 µg/m3) is not exceeded at any station; the limit value of Austria and Switzerland (20 µg/m3) is not hit at any Austrian or Swiss station" (Lueckge et al. 2016), p. 22).

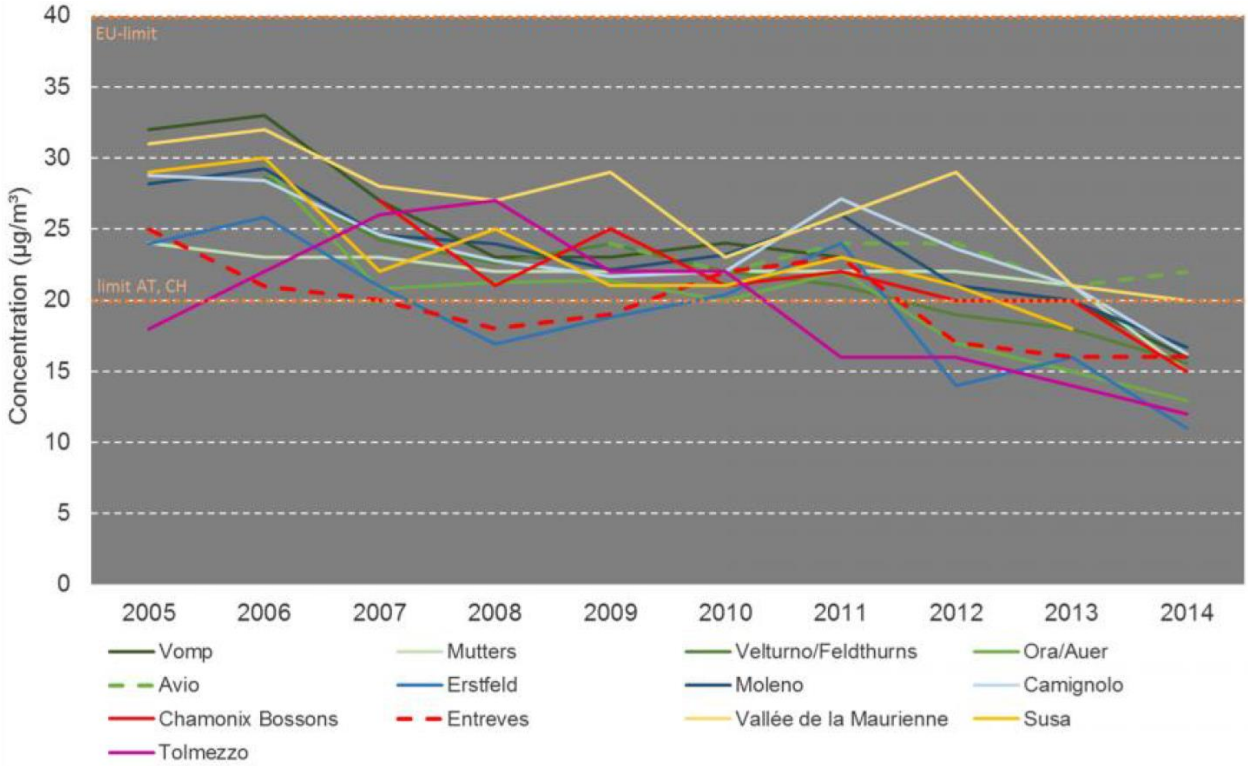


Figure 2.4.4-7 PM10 trend in annual average concentrations (2005-2014)[75] (Source: Lueckge et al. 2016, p. 22).

Case study Italy – Air pollution in the Italian Alps

Based on of the identification of concentration-response functions for a group of polluting substances and for each cause of mortality from pollution, which results in a "relative risk level", it is possible to correlate a concentration of a polluting substance to an increase in the mortality rate within a geographic region. This type of assessment has been run across Italy on emissions from road traffic (NOx) and biomass combustion in heating (PM2. 5), that are felt a relevant policy issue. NOx are also among the main precursors of air particulates and, together with VOCs, of ozone. For three pollutants (PM2. 5, NO2, O3) an estimation has been made of the ground concentrations for 2005, 2010 and 2020 over three different scenarios, providing for the adoption of policies to reduce atmospheric pollution.

In the Italian Alpine provinces (NUTS 3), estimates on mortality by PM2.5 for 2005, 2010 and 2020 show relatively low values if compared with other territories in Italy, however in the provinces of Torino, Bergamo and Varese the values are relatively higher, also due to the vicinity and influence of large urban centres. In addition, for NO2 Bergamo and Varese appear to be the most exposed provinces, however all the scenarios at 2020 foresee important reductions for this pollutant. In the case of O3, quite a sharp reduction is foreseen in all Italian Alpine provinces, with significant shifts in Veneto and Piemonte (VIIAS 2015).

Conclusions on opportunities and challenges

[75] The value for Vallee de la Maurienne in 2011 represents the average of the years 2010 and 2012.

Air quality (measured for PM and ozone) in the Alps is mainly within the EU thresholds or target values. Within the Alpine Convention area, threshold exceedances occur locally, such as along some main transit corridors and in towns or agglomerations. One reason for higher PM concentrations in towns and agglomerations is the commercial, institutional and household fuel combustion sector and the urban road traffic, which contribute significantly to the emissions of primary PM. The population living in towns, agglomerations and some transit routes is exposed to higher PM concentrations. There are no data available how many people are exposed to threshold exceedances.

There are high ozone values in summers with high insolation. Ozone as a secondary pollutant cannot be directly addressed, but only its precursor gases. The exposure of people in rural areas may be higher compared to people living near the areas where the ozone is formed as certain air pollutants help to destruct ozone.

Greening transport and increasing the share of renewable energy for electric power generation for household and industrial consumption will further improve air quality and can reduce external environmental and health costs. Even though a major goal of a Green Economy is to promote the sustainable use of wood and biomass, there might be a conflict regarding increased air pollution due to the combustion of wood and biomass. Promotion of installations with particle filters instead of inefficient household installations should be considered, taking into account best available technologies.

The transport sector is still an important emitter of air pollution, even if the emissions of PM were and are decreasing. It is responsible for a relevant share of emissions of nitrogen oxides, which are inter alia ozone precursor gases. A mountain-specific and well-adapted system of tolls may internalize external costs of freight and passenger transport within and across the Alps and improve air quality along transit routes.

Agriculture contributes significantly to ozone and PM precursor gas emissions, especially by emitting ammonia and nitrogen oxides. Greening agriculture would help to decrease these emissions.

An increased use of certification schemes and the deployment of eco-innovation by businesses across the region might help to reduce negative externalities from air pollution resulting in market and social cost for the Alpine economy.

3 Instruments and measures of Green Economy

For the implementation of a Green Economy, different instruments and measures can be applied. In this chapter, the report outlines the many options which are already in place or might be transferred for an implementation of a Green Economy in the Alpine Convention area.

As a first orientation, the main types of instruments are introduced below. The instruments and measures are then presented according to the four chosen main topics of Green Economy in the subchapters 3.1 to 3.4 and within these subchapters according to the types of instruments.

Sometimes, it remains difficult to recognize which type of instrument exists as often instruments may carry different characteristics or are crosscutting.

Policies and regulations

Policies define the framework for the implementation in form of strategies, actions plans and so on. Regulations then set the frame in a legal and more detailed scale, such as to achieve a certain level of environmental protection (e.g., air pollution, wastewater treatment or noise-level) and can be adopted by a responsible body. Regulations exist in a wide range form the EU, national, regional and local level. In the EU, and EU regulation is a binding legislative act. It must be applied in its entirety across the EU

Financial instruments and market development

Fincancial instruments and market development include environmental taxes & fees to internalise environmental or social costs, subsidies supporting market entries of green products and services, tradeable permits, deposit refund systems, reduction of market barriers for green products and the phasing out of harmful subsidies.

Green technology and innovation

Green technology and innovation can include support for research and development related to Green Economy, the protection of intellectual property rights and support for environmental related innovation (patents, scholarships, prizes, consulting, and networking) as well as the support and implementation of green business models.

Labels, certifications and awards

Products and services can be earmarked with labels and certifications to inform customers about the quality, external effects, and product chains. Awards are also a measure to highlight remarkable efforts or success stories of projects but also of single persons.

Sustainable public procurement

Governments can focus on how their existing spending is being used and foster sustainable public procurement. By this, they also act as role model for citizens and the private economy encouraging a shift to sustainable consumption patterns.

Education, training and skills development

Transforming an economy into one that is resource-efficient and that produces optimal socio-economic results requires targeted educational measures at , public institutions (universities, schools), NGOs, public and private media to individual citizens. For individuals, these would include targeting their ability to be employed productively and meaningfully in the economy and to adopt environmentally friendly behaviour in their daily life.

Corporate accountability and Corporate Social Responsibility (CSR)

Corporate accountability and CSR can be reasons for private and public entities to implement and continuously improve environmental and social standards along the supply chain. This can include environmental management, sustainable procurement, extended producer responsibility, sustainable supply chain management and participatory processes/employee engagement.

Civic engagement and participation

Civic engagement and participation is the encouragement of the general public to become involved in the political process and the issues that affect them. The term includes a series of private initiatives and supporting actions, e.g. sustainable consumption and labels that support the change of consumption as well as public referenda and energy cooperatives.

Financial flows/investment

Public and private investment in green economic sectors and infrastructures are needed for the implementation of green economy policies.

3.1 Energy efficient and low carbon economy

3.1.1 Overview on policies towards energy efficient and low carbon economy

Instruments and measures supporting an energy efficient and low carbon economy are difficult to oversee and even more difficult to structure as depending on the national structure the type of instruments are often overlapping or different types of instruments are combined within a regulation, funding scheme or strategy. Therefore, instruments and measures mentioned here can only give an impression of the ongoing process but will remain somehow incomprehensive.

Table 3.1.1-1 lists existing political strategies, action plans and regulations in the field of energy efficiency and low carbon economy. Given that there is a high number of policies in the energy field, only the most recent and important initiatives at the EU, Alpine and national levels relevant for Green Economy are listed.

Table 3.1.1-1 Overview on the policiesand regulations concerning low carbon and energy efficient economy including the year of adaptation.
Note: The list includes only the most relevant strategies, action plans and regulations concerning Green Economy (data source: IEA 2016; NEEAP 2014; PSAC 2011).

Level	Energy efficient economy & Renewable energy	Low carbon economy
EU	Renewable Energy Directive (2009/28/EC) Energy Efficiency Plan (2011/109/EC) Energy Efficiency Directive (2012/27/EU) Energy Labeling Directive (2010/30/EU)	EU strategy on adaptation to climate change (2013) 2020 Climate and energy package Emissions Trading Directive (2003/87/EC) Green Paper on a 2030 framework for climate and energy (2013/169/EC) Thematic Strategy on air pollution (COM/2005/446) Ambient Air Quality Directive (2008/50/EC) Roadmap to a low-carbon economy (EC, 2011)
Alpine Convention / Alpine Space	Protocol on Energy of the Alpine Convention (2005) Vision “Renewable Energies” (2015)	Alpbach Declaration on Climate Change (2006) Action Plan on Climate Change in the Alps (KLIMALAND) (2009) Guidelines on local adaptation to Climate Change for Water Management and Natural Hazards in the Alps (2014) Guidelines for Climate Change Adaptation at the Local Level in the Alps (2013-2014)
Austria	Austrian Energy Efficiency Law (2014) Austrian Energy Strategy (2010) National Energy Efficiency Action Plan (2014)	KlimaAktiv: Climate Strategy 2008 – 2012 (2002)
France	National Energy Efficiency Action Plan (2014) Energy efficiency target declared by France under the EU Directive (2013) Energy Efficiency Performance Labels for Buildings (2003) National Renewable Energy Action Plan (NREAP) (2010) RT 2012 thermal regulations (2010)	National Low-Carbon Strategy (SNBC) (in preparation) National Adaptation Plan (2011) National Adaptation Strategy (2006)
Germany	Renewable Energy Sources Act 2014 (EEG 2014) 3rd National Action Plan on Energy Efficiency	German Strategy for Adaptation to Climate Change (2008)

	(2014) Energy Concept (2010) KfW Energy-efficient Construction (2009) Renewable Energies Heat Act (EEWärmeG) (2009)	The German Integrated Energy and Climate Package (2008) Adaptation Action Plan (APA) (2011) Energy and Climate (EKF) Act, (2010) National Climate Protection Programme (2005) Adaptation Action Plan II (APA II) (2015)
Italy	National Energy Efficiency Action Plan (2007) Transposition of the Directive on Energy Efficiency (2014) National Intelligent Transport System (ITS) Action Plan (2014) National Renewable Energy Action Plan (NREAP)	National Action Plan (2003-2010) (2002) National Adaptation Strategy (has been approved) Sectoral Adaptation Plans are being developed 2050 South-Tyrol Energy Climate Strategy (2011)
Liechtenstein	Energy Strategy 2020 (2012) Energy Ordinance of the respective Building Act (2008) Energy Efficiency Act (2008)	Climate Protection Strategy (2007) Action Plan Air (2007) Environmental Protection Act (2008) Emissions Trading Act (2012) CO_2 Act (2008) CO_2-Law (2009) The climate cent (2005)
Slovenia	Action Plan for Energy Efficiency 2014-2020 (2015) Long-term strategy for promotion of investment in energy renovation of buildings (2015) Action plan for the nearly zero-energy buildings for the period up to 2020 (2015)	National Adaptation Strategy (being developed) Draft Strategy for the Transition of Slovenia to a Low-Carbon Society by 2050 (2012) Adaptation of Slovenian Agriculture and Forestry to Climate Change (2008) Action plan for 2010 and 2011 Climate Change Act (started in 2010)
Switzerland	Energy Efficiency Action Plan (2008) Swiss Energy Programme (2011-2020) Electricity Supply Act Sustainable Development Strategy 2016-2019; Green Economy Action Plan Energy Strategy 2050 (2011) Building Refurbishment Programme financed by the CO2 tax (2010) Climate cent	CO2 Act (2000, revised in 2013) Swiss National Adaptation Strategy (2012)

3.1.2 Instruments and measures towards low carbon economy

At the strategic level, the EU policy sets out a broad framework specifically for low carbon policy, including a variety of long-term objectives. As an example, the Roadmap to a low-carbon economy (EC 2011d) stipulates that, by 2050, the EU should cut its emissions to 80% below 1990 levels through domestic reductions. Differentiated adaptation and more mitigation strategies and measures are needed to reach this ambitious goal.

In terms of the topical project of cc.Alps from 2010, 299 innovative adaptation and mitigation instruments and measures in place in the Alpine region have been evaluated. According to the evaluation, there are more mitigation measures (88%) than adaptation strategies (12%) in place (CIPRA

International 2010). Good practice examples for mitigation measures have been also collected on the regional/local level.[76]

Policies and regulations

Policies on carbon emissions act particularly at the national level. However, policy implementations as well as supporting strategies are acting more at the regional and local level. The approach to low carbon economy is closely interlinked with energy saving, efficiency and renewable energies.

Detailed information on national policies can be found in chapter 6.2.1.

There are different regulations concerning carbon emissions and GHG emissions in the parties to the Alpine Convention in place. They focus on the limitation of emissions, sometimes including also harmful emissions for human health and the environment.

Financial instruments and market development

International level

One of the key objectives of the 7th Environment Action Programme (EAP) entered into force in 2014 is to turn the European Union into a resource-efficient, green, and competitive low-carbon economy. The programme supports the phasing out environmentally harmful subsidies (EHS) using “an action-based approach, inter alia via the European Semester, and considering fiscal measures in support of sustainable resource use such as shifting taxation away from labour towards pollution” (EC 2011d).

Beside adaptation and mitigation strategies, green taxation as well as a reform of environmentally harmful subsidies are important measures towards a low carbon economy. Green Budget Europe (GBE), a Brussels-based non-profit expert platform on Environmental Fiscal Reform (EFR), promotes bringing tax and spending into line with environmental goals. By means of green taxes, emissions trading, reform of harmful subsidies, green public procurement, border tax adjustments, deposit-refund schemes and promotion of renewable energy, GBE aims to increase the price of pollution and environmental damage and to correct market distortions.

According to the Report on Vivid Economics, carbon fiscal measures are crucial and cost effective instruments to reduce Europe´s GHG emissions. Carbon fiscal measures, having great potential role in fiscal policy “may raise significant revenues while having a less detrimental macro-economic impact than other tax options” (Jacobs & Bassi 2012).

For achieving the 2-degree (1.5-degree) goal set by the Paris Agreement as well as for an effective reduction of GHG emissions concrete and broader mitigation measures of the Alpine countries are essential. Particularly within the transport sector, CIPRA (2010) lists in this context several opportunities such as:

- To increase the price of mineral oil and stop the so called fuel tourism;
- To strengthen a circular economy based on regional products;
- To introduce a road pricing systems for trucks, using rolling highways - as a form of combined transport involving the conveying of road trucks by rail - more frequently;
- To introduce a speed limit for passenger cars;
- To aim for more e-cars fuelled by photovoltaic systems and less cars fuelled by biofuel;
- To introduce soft mobility programmes.

[76] Further information: http://www.cipra.org/de/cipra/international/projekte/abgeschlossen/cc-alps/good-practice.

Good practice - Alpine Crossing Exchange – an instrument within the transport sector

The Alpine Crossing Exchange is an instrument proposed by the Alpine Initiative that wants to transfer transalpine freight traffic from road to rail by issuing transit rights for truck trips. The transit rights issued can be traded on the market. As with other limited goods, demand fixes the price. It works based on the following 3 principles:

- *Cap: A political decision limits the number of transalpine truck crossings to an environmentally acceptable level by issuing a limited/fixed amount of transit rights. The upper limit can be reduced progressively from today's figure to the desired level. All trucks with a gross vehicle weight rating of more than 3.5 tonnes need a transit right if they want to cross the Alps.*
- *Allocate: The Alpine transit rights will either be allocated as a free bonus to freight companies who voluntarily use rail (1 transit unit for the road for every X units by rail), or sold to the highest bidders.*
- *Trade: Alpine transit rights can either be used by their owners or be freely traded. An information system supplies reference prices for rail transport*

Further information: http://www.cipra.org/en/media-releases/an-alpine-crossing-exchange-is-legally-feasible

National instruments

Liechtenstein's financially most relevant and for projections most reliably quantifiable measures currently in place, focus on the refurbishment of old buildings, on solar collector systems and on substitutions towards heat pumps and wood heater induced under the Energy ordinance (EEG). Their effects are visible in a reduction in the consumption of heating fuels and finally in the reduction of emissions in the sectors industry and "others". The municipalities individually supplement the national subsidies with additional funds. Other measures, such as savings through more efficient, new private heaters or recovery of steam in industry, are independent of the EEG but relevant for emission reduction.

In Switzerland, the CO_2 levy is a key instrument to achieve statutory CO_2 emission targets. This steering levy on fossil combustible fuels, such as heating oil and natural gas, has been introduced in 2008. In making fossil fuels more expensive, it creates an incentive to use them more economically and choose more carbon-neutral or low carbon energy sources. Two-thirds of the revenue from the levy is redistributed annually to the public and the economy independently of consumption. One-third (max. CHF 300 million) is invested in the buildings programme to promote CO_2-reduction measures such as, e.g., energy-efficient renovations or renewable energies. Another CHF 25 million is provided to the technology fund. Energy-intensive companies can be exempted from the CO_2 levy if they commit to reducing emissions in return. No levy is imposed on wood and biomass because these energy sources are CO_2-neutral: the amount of CO_2 released during combustion is equal to the CO_2 absorbed during their growth or formation.

Green technology and innovation

Several projects of the Alpine Convention area are matching concrete measures within the field of energy efficiency and RE in the Alps (see chapter 3.1).

The development of smart grids in the Alpine area, focusing on energy management and sustainable mobility solutions is one example, which was analysed in the AlpStore project.

Shaft power plants are going to be tested as a kind of hydropower plants which offers higer energy efficiency combined with less or almost no harmful impacts to surface waters while improving the ecological connectivity of rivers.

Labels certifications and awards

European level

, International and national awards can be an essential motivation instrument towards green economy. Prices such as the European Energy Award, Smart Cities, Environmental Innovation Award, EU Sustainable Energy Awards, and the European Solar Prize Award are good examples at the European level for this.

At the organizational level, environmental management systems such as EMAS or ISO 14001 provide incentives for business and administrations to continuously improve their environmental performance and reduce energy and resource consumption. The same holds true an energy management system.

The Energy Platform of the Alpine Convention suggested that ”Alpine-specific” energy awards might be a good approach to motivate people and organizations to support e.g. energy efficient buildings and to improve the visibility of lighthouse projects. Also networking and exchange of experience were assumed to be important factors for innovation and a successful implementation of measures/actions towards an energy efficient and sustainable Alpine region (Swiss Confederation et al. 2015). As an example the ArgeAlp award (2011) has been a prize for renewable energies, which has been supported by the municipalities of 10 Alpine member regions.

National instruments:

In Germany the Fuel Efficiency Labelling of Passenger Cars Regulations (known as "Pkw-EnVKV"), which went into effect on 1 December 2011, requires new cars to be equipped with fuel economy labels that describe the vehicle's CO_2 emissions for consumers

In Switzerland since March 2003, an energy label for passenger cars must be clearly displayed at each new car offered for sale, classifying the energy efficiency in seven classes including information such as the fuel consumption or CO2 emissions. The energy label is yearly updated to the latest technology[77].

Education, training and skills development

European level

On the European level the European Climate Foundation (ECF) as one of the most influential climate NGO’s in Europe is important to mention, whose aim is to collaborate among stakeholders in ensuring the necessary transformation from a high-carbon to a low-carbon economy, as well as to shape the European context for ambitious and effective policies. One of the main issues of the ECF is to support the low carbon society and play an even stronger international leadership role to mitigate climate change. The European Climate Foundation (ECF) has launched the “Industrial Innovation for Competitiveness” (i24c) initiative, whose mission is to enhance understanding and confidence in how Europe’s industry can successfully compete and drive prosperity thanks to a systemic industrial policy focused on innovation. i24c bases its activities on research, multi stakeholder dialogue and high-level engagement[78].

National instruments

Slovenia has collected good practices for educational purposes and as incentive for further practical solutions for mitigation of climate change effects (see box).

[77] Further information: http://www.bfe.admin.ch/themen/00507/index.html?lang=de.

[78] Further information: https://europeanclimate.org/initiatives/cross-cutting/innovation/.

Good practice - Slovenia is Reducing CO_2: good practices

The project Slovenia is Reducing CO_2: good practices provides for the promotion of good practice, the dissemination of knowledge and encouragement to change. Successful stories inspire and demonstrate that the dramatic changes on the way to a low-carbon society is not only possible, but also bring a series of synergistic effects: create savings and new green jobs, to offer innovative solutions and development opportunities, protect the environment and human health, bring chancesto reduce government costs and increase revenue and increase quality of life and inspiration.

In the years 2011 – 2015, Umanotera (Slovenska fundacija za trajnostni razvoj, ustanova), a Slovenian foundation focusing on sustainable development selected and publicly presented 92 good practices that have been selected under the project Slovenia reduces CO_2: good practice. They, encourage green jobs and were compliance policies - a precondition for achieving the objectives of international development co-operation and presented in catalogues (Catalogue 2012 Catalogue, 2013 Catalogue, 2014 Catalogue 2015), on websites www.slovenija-co2.si and www.zelenadelovnamesta.si and in short animated films. Based on the presentations, recommendations to decision makers for further dissemination and application of good practices were also developed.

The project continues in the years 2015 – 2016 and will deliver a holistic recording of existing good practices in Slovenia. It is looking for good practices in the following priority areas: (1) energy efficiency, renewable energy and energy renovation of buildings, (2) sustainable management of forests, wood processing craft trade and industry, wood as a construction material and supply of wood-based fuels (3) organic farming, (4) sustainable rural development, sustainable community (5) sustainable mobility, (6) sustainable production and consumption (7), adaptation to climate change.

Further information: www.slovenija-co2.si ; www.zelenadelovnamesta.si

3.1.3 Instruments and measures towards energy efficient economy

As mentioned in chapter 2.1.3 the Energy Protocol of the Alpine Convention sets essential targets towards energy efficiency in the Alpine Convention area. In the first mandate phase 2013-2014 of the Energy Platform of the Alpine Convention, the following 3 main domains have been identified: 1) energy usage, 2) energy production and 3) energy distribution and storage systems. Within this framework several workshops have been organized to establish an exchange within the most relevant stakeholders of these 3 topics. The aim of these meetings was to strengthen the vision “Renewable Alps” showing that Alpine regions and municipalities have gathered a vast pool of energy knowledge and innovation potential (Swiss Confederation et al. 2015).

Besides the fact, that the Alps have a big potential on installing RE power plants, there is a big need to analyse the existing RE constructions on their environmental compatibility. Thus, instruments for repowering hydropower and wind power plants are an essential issue to achieve higher energy efficiency in the Alps.

Regulations and policies

Roadmaps and regulations for the development and fostering of energy efficiency embrace action plans and strategies at the national level, sometimes also specifically for some sectors such as the building sector or the mobility sector.

The Italian Law No 99/2009 provided for the publication of an Extraordinary Plan for Energy Saving and Efficiency. The plan envisages: improved coordination among central and local administrations, promotion of sustainable construction and refurbishment of buildings, provisions for stimulating the supply of energy services, incentives for micro and small co-generation systems, mechanisms apt to boost the demand of white and green certificates, encouraging autoproductions of energy in SMEs.

Detailed information on national policies can be found in chapter 6.2.2.

Financial instruments and market development

The internalisation of external energy costs is a well introduced topic in mobility costs. Therefore, the WG Transport of the Alpine Convention is engaged to analyse different costs for freight transport, different national approaches and toll systems in the Alpine Convention area.

In addition, the ALBATRAS study on behalf of the Zurich group of the transport ministries of the parties to the Alpine Convention has deeply analysed different economic effects of different toll systems for freight transport.

As a first major step towards reducing consumption, Germany implemented the ecological tax reform on fossil fuels and electricity consumption in 1999. Thus, energy consumption and GHG emissions, most notably in the transport sector, could be reduced.

Table 3.1.3-1 summarizes the financial instruments and measures in Germany towards energy efficiency. The data has been collected from the IEA energy efficiency database, by selecting the most important economic instruments such as funds, direct investments, R&D, labels, standards or fiscal and financial incentives incl. taxes and loans being in force and relevant for a Green Economy.

Table 3.1.3-1 Financial instruments and measures in force towards energy efficiency in Germany (Source: IEA 2016).

Funds, Direct investments
Energy Efficiency Fund (2011)
Directive for the promotion of energy efficient and climate friendly production processes
Financial support for investments in cross sectional technology (last amended 2015)
Energy Efficiency Initiative (20002)
Grants for consulting on Energy Performance Contracts
Urban Lighting (2011)

Fiscal financial incentives, taxes, loans
Heavy goods vehicle toll (2005)
Fiscal consideration of commuting expenses (2001)
KfW Energy-efficient Construction (2009)
Future Investments Act (ZuInvG) (2009)
IKK - Energy-Efficient Urban Refurbishment - Energy-efficient Redevelopment (2009)
National Innovation Programme for Hydrogen and Fuel Cell Technology (2008)
Third-Party Financing for Public Buildings
Energy Provisioning (2012)
Clean Truck Procurement Subsidies (2007)
KfW-Programme Energy-Efficient Rehabilitation (Energieeffizient Sanieren) (2009)
Tax cap ("Spitzenausgleich")
Energy Taxes: Coal, Biodiesel, Natural Gas (2006)
New vehicle car tax system (2009)

In Italy regarding the household and building sector, measures provided in Budget Law 2007 relevant to the energy saving potential include a tax deduction, available to both domestic and commercial consumers of energy, worth 55% of the total amount of expenditures sustained to enhance the energy efficiency of buildings. Eligible expenditures include those aimed at reducing thermal losses, the installation of solar collectors for hot water production, the installation of condensing boilers and the construction of high efficiency buildings. Budget Law 2008 confirmed fiscal incentives and added further measures including the extension of the 55% tax deduction to 2010. This rebate is fully monitored by ENEA, so that results in terms of costs, energy saving, number and variety of measures is documented.

Furthermore, the 2008 Financial Act grants tax deduction to the “Fair Purchasing Groups” (Gruppi di Acquisto Solidali - GAS). These groups, fostering the seasonal products consumption, contribute to the reduction of the environmental impact due to transport of goods over long distances.

Good practice - effeLED, Switzerland

effeLED is a funding programme with the goal to achieve an energy saving of light of at least 54 million kWh of electricity. The national programme effeLED promotes energy-efficient lighting solutions with innovative LED technology in commercial buildings. It supports new construction and renovation projects that are realized in the years 2014-2016 in Switzerland. effeLED is based on an initiative of the Swiss Association of Lighting Industry (FVB) and is promoted as part of the Federal Office of Energy. The basic idea of the funding is to support the planner and mechanics in the implementation of energy efficient lighting solutions and to cover the overhead cost of planning.

Further information: http://www.effeled.ch/nutzen/

Green technology and innovation

A selection of German research and funding activities for development of energy efficiency technologies and for e-mobility is listed below:

- Funding Programme for Electromobility Pilot Regions (2009)
- Government Electromobility Programme (2009)
- E-Energy – ICT-based energy system of the future (2007)
- Environment Innovation Programme
- KfW Special Fund for Energy Efficiency in SMEs (2013)
- 6th Energy Research Programme "Research for an environmentally sound, reliable and affordable energy supply" (2011)
- R&D programme for battery electric mobility "Show Cases Electric Mobility" (2012)

In Switzerland, the Swiss Federal Office of Energy SFOE fosters various energy efficiency technologies. To name a few examples (BFS 2016c), it supports or promotes research on:

- fuel cells, which are capable of directly converting chemical energy into electricity
- congeneration, a form of heating that at the same time produces electricity, and the other way around,
- district heating, an idea where heat is produced in a central facility such as thermal power plant or a wood-chip combustion plant, an then delivered via pipelines to consumers,
- electricity technologies and application research programme which aims to optimize use of electricity from production until the end of consumption

Good practice - LEEN-Learning Energy Efficiency Networks, Germany

LEEN offers a management-system – originally coming from Switzerland – aiming to set up and run energy efficiency networks among participating companies to reduce their energy demand. This is supported by exchanges of experience among the companies as well as the provision of professional assistance and advice. The Networks are based on the principle of self-help as companies explore their energy efficiency potential assisted by professionals.

The LEEN – System includes a variety of computer based calculation tools (e. g. pumps, electrical drives, compressed air, lighting systems) as wells as management guidelines. The launch of the LEEN-System is currently supported by the German Environmental Ministry (BMUB).

Further information: http://leen.de/en/

Good practice - Energy autonomy Vorarlberg - 101 measures suited to grand children , Austria

The Programme Energy Autonomy in Vorarlberg has been initiated by the federal government of Vorarlberg. In 2009 the provincial parliament made the unanimous decision that Vorarlberg would be energy autonomous by 2050. The activities towards achieving this vision are connected to the project called "101 Enkeltaugliche Maßnahmen". A group of experts divided in 4 groups according to the topics on 1) renewable energies, 2) industry and trade, 3) construction as well as 4) mobility and spatial planning has worked out a set of concrete measures until 2020 to achieve the EU energy efficiency targets.

Further information: http://www.energieautonomie-vorarlberg.at/de/schritt-fuer-schritt-ans-ziel

Labels, certifications and awards

The Austrian National award for environment and energy technology (Start up "resource efficiency") is another example for suitable awards in this sector. Especially in researching efficient building solutions, Austria is one of the leading countries. The federal government's programme is committed to promote low energy and passive house standards by implementing strict energy efficiency regulations. Building related targets from the programme are that 50% of new buildings should meet the «Klima:Aktiv» standard. The standard defines criteria for energy-efficiency, the quality of the planning and execution, the building material and construction quality as well as the comfort and ambient air quality. These are neutrally assessed and need to be fulfilled in order to achieve the standard. The klima:aktiv building standard exists for residential and office buildings, for new buildings and also for renovations. From 2015 on, only those residential buildings meeting the standard should receive government financial support for their construction (Swiss Confederation et al. 2015).

Germany supports the identification of energy efficient products with different guidelines and labelling activities, such as:

- Directive fort he promotion of energy management systems (2013)
- Compulsory energy efficiency audits in large companies (2015)
- Mandatory Fuel Efficiency Labelling for Passenger Cars (2004)
- Energy Consumption Labelling Ordinance (EnVKV)
- Blue Angel Ecolabel example: Hot Water Tank (2006)
- Passenger Vehicle Energy Consumption Labelling Ordinance (Pkw-EnVKV) (2004)

In Italy the main measures towards energy efficiency are as follows: white certificates, fiscal measures to encourage energy efficiency of buildings, transport, biofuels, domestic electrical appliances, lighting, industrial motors.

The Italian white certificate scheme was introduced in 2005. The obligations are set for distributors of electricity and gas with more than 100,000 clients, who carry out energy efficiency projects for their clients (households and all kinds of industries) to meet these obligations. In Italy at least 50 % of the energy savings have to be achieved through direct energy savings of electricity or gas. Up to 50% of energy savings may be realised through changes in fuels.

Green certifications such as "Energy City" or "Energiestadt" in Liechtenstein and Switzerland are important measures on the way to energy efficiency.

The Swiss Federal Energy Ordinance sets out labels for electricity efficiency of various products such as household appliances, electric lamps, TV sets, motor vehicles, tyres as well as bathroom products[79].

Good practice - effeLED, Switzerland

effeLED is a funding programme with the goal to achieve an energy saving of light of at least 54 million kWh of electricity. The national program effeLED promotes energy-efficient lighting solutions with innovative LED technology in commercial buildings. It supports new construction and renovation projects that are realized in the years 2014-2016 in Switzerland. effeLED is based on an initiative of the Swiss Association of Lighting Industry (FVB) and is promoted as part of the Federal Office of Energy. The basic idea of the funding is to support the planner and mechanics in the implementation of energy efficient lighting solutions and to cover the overhead cost of planning.

Further information: http://www.effeled.ch/nutzen/

Sustainable public procurement

The Italian National Action Plan on Green Public Procurement, invites public purchasers to use the "best economic" offer system to award tenders, instead of the "minimum price" system. They are also invited to use environmental technical specifications in the calls for bids, both as minima (core) criteria and award criteria. Core and award environmental criteria are defined by the Ministry of the Environment (by the way of the NAP GPP Committee) and formally adopted by a ministerial decree. Criteria for some product groups have been formally issued: IT (computers, printers, copiers, and multifunction equipment), paper, and soil amending. Others have been submitted to the GPP NAP Committee for approval: construction materials, energy services, food and catering, furniture, textiles. The national target is set to 30% of all the public purchases with environmental criteria by the end of 2010. The monitoring will be made with the collaboration of ISPRA (the National Institute for Environmental Protection and Research), and will use as indicator the amount of green public purchase (in euro) / total public purchase for every product group.

Education, training and skills development

Financial, technical and regulative measures will be not sufficient alone as a main influence on energy consumption comes from the way people are using energy and their awareness about energy use.

The Alpine Space project THE4BEES (Transnational Holistic Ecosystem 4 Better Energy Efficiency through Social innovation) is a good example for this and builds on the hypothesis: energy is consumed by people rather than by buildings. Although most of the strategies to achieve energy efficiency in buildings focus on technical mitigation measures, to reach the ambitious goals on low carbon set by EU and the Alpine Strategy (EUSALP), both structural and soft approaches shall be considered complementarily across the Alpine Space. THE4BEES project[80] focuses on the behavioural changes of users in public buildings needed to achieve reduction of energy consumption. Such changes will be originated by the use of innovative ICT applications developed by a transnational system. Those applications will be used by the target groups in the demonstration sites (schools, houses, factories) to encourage behavioural changes for energy efficiency and carbon footprint reduction.

The Swiss Federal Office of Energy SFOE established a platform, EnergieSchweiz, which informs and raises awareness of various actors, such as cantons, municipalities, private sector, about energy

[79] Further information: http://www.bfe.admin.ch/energieetikette/index.html?lang=de

[80] Further information: http://www.irees.de/irees-en/inhalte/projekte/laufend/sowi/The4Bees.php.

efficiency as well as offers advice, education and quality assurance. It also acts as a place for networking, andcoordinates various measures undertaken on the subject of energy efficiency. As such, it is actively engaged in fostering energy efficiency in five different areas: buildings, electronic devices, industry and services, mobility, as well as renewable energy[81].

[81] Further information: http://www.energieschweiz.ch/home.aspx.

3.2 Resource efficient economy

3.2.1 Policies, instruments and measures towards resource efficiency

Overview of policies

Resource efficiency is an important economic and environmental topic of the policy discourse. As such, it is a priority of the Europe 2020 Strategy as well as of the sustainability strategies in the Alpine countries. In 2011 the Roadmap for a Resource-Efficient Europe has been adopted which defines roughly a hundred individual actions to be taken by the European Commission and the Member States. Moreover, to turn the EU into a resource efficient, green and competitive low-carbon economy is a priority objective of the 7th Environment Action Programme (EEA 2015i).

The Alpine countries implemented a diverse set of policies and measures to improve the resource efficiency of their economies. Table 3.2.1-1 gives an overview on relevant strategies and policies.

Table 3.2.1-1 Overview of selected policies on resource efficiency.

Level	Relevant Strategies and Policies
EU	• EU 2020 Strategy • Roadmap for a Resource-Efficient (2011) • 7th Environment Action Programme • EU Eco Design Directive • European Eco-Management and Audit Scheme (EMAS)
Austria	• Austrian Resource Efficiency Action Plan (REAP)
Germany	• German National Sustainable Development Strategy • Bavarian Sustainable Development Strategy • German Resource Efficiency Programme (ProgRess) • Environment Agreement for Bavaria 2010-2015
Italy	• Environmental Action Strategy for Sustainable Development (2002)
Liechtenstein	• Participation in Swiss Initiative Reffnet
Slovenia	• Operational programme for the implementation of EU Cohesion Policy 2014 – 2020 • Slovenian Industrial Policy, 2013 • Action plan: Wood is beautiful • Smart Specialisation Strategy
Switzerland	• Sustainable Development Strategy (2016-2019) • Action Plan Green Economy (since 2013) • Masterplan Cleantech (2011-2015) • Reffnet initiative (since 2014)

Green technology and innovation

To foster innovation in resource efficiency, several Alpine states support their private sector with consultancy measures, e.g. via the establishment of **resource efficiency agencies** or the assistance of **resource efficiency networks**.

A German success story is the implementation of regional resource efficiency agencies. A prototype is the Effizienz Agentur NRW[82], which had been established by the state of North Rhine-Westphalia to

[82] For more information: http://www.ressourceneffizienz.de/startpage-en.html

provide industrial companies and tradesman with concrete support in the identification and implementation of efficiency potential. On the national level, the VDI resource efficiency competence[83] center follows a similar approach. Especially relevant for the German Alpine region, the Bavarian “Infozentrum UmweltWirtschaft (izu)” has been established and offers web-based general and sector-specific information on resource efficiency. Moreover, the Bavarian Environmental Consultancy and Audit Programme (BUBAP) assists industrial companies with resource efficiency improvements. Until December 2015, they consulted more than 6,500 companies in Bavaria including more than 1,000 in the Alpine region of Bavaria. Furthermore, the Bavarian Working Group on the Raw Material Strategy (with members from administration, science and business) gives policy advice on topics such as securing raw materials, material efficiency and material substitutes, recycling, and knowledge transfer (BMUB 2015).

For the further development of innovative national policies and measures on resource efficiency, path-breaking studies give guidance for Alpine states. For instance, a Slovenian study (MKGP 2014) on approaches addressing resource efficiency and waste prevention was prepared in 2014 with the aim to present several concrete suggestions on the topics and to recommend the preparation of an action plan on resource efficiency in Slovenia. The Slovenian Operational Programme for the implementation of EU Cohesion Policy 2014 – 2020, supports measures on material resource efficiency for enterprises and uses the opportunities from domestic and foreign markets of green products. These measures under the priority axes for research, development and innovation and for small and medium-sized enterprises also include measures to support eco-innovations (Energetika Portal 2015).

Switzerland recognizes the problem of scarce natural resources and aims to find its way around it by introducing various measures in order to maximize resource efficiency. In order to assess the impact of Switzerland on the planet`s capacities, including the impact of the Swiss consumption on planet`s natural resources, the Swiss Federal Office for Environment FOEN has launched a pilot study which helped to develop the concept of "Planetary Boundaries". The goal of this study is to develop recommendations for a set of footprint limits for a Green Economy, by translating the environmental limits of our planet (“Planetary Boundaries”) to the context of Swiss demand (i.e. consumption). The proposed limit values serve as a rough orientation on a sustainable level of resource consumption from a scientific point of view. (UNEP 2015)

With the target of increasing resource efficiency, the Swiss Federal Office for Environment has decided to focus specifically on Swiss enterprises and their handling of the problem. In 2014, Reffnet.ch was opened, a network for efficient resource use. Reffnet.ch supports recognition of potentials and planning, and offers support with the application of various projects and for the measurement of results. The Network`s website informs about good practice examples, knowledge, contacts, tools for a self-control, as well as engagement in various measures; it also organizes events. Resource efficiency may be difficult to achieve, hence appropriate guidance, which Reffnet.ch offers, is very much needed. Liechtenstein participates in the Swiss Initiative Reffnet. The LIFE climate foundation Liechtenstein sponsors up to 50% of the consultation fees for seven consultation services for the next two years.

A major project of the Swiss Confederation was the Masterplan Cleantech. It focused on creating a good environment for companies that specialize in clean technologies, thereby increasing their competitiveness and environmental benefits simultaneously. Resource efficiency is an important element of the Cleantech technologies. A report about the implementation for the years from 2011 to 2014 has been published recently. The Masterplan functioned as such until 2015. The Swiss government had then mandated the Federal Department of Environment, Transport, Energy and Communications (DETEC) in collaboration with the Federal Department of Economic Affairs, Education and Research

[83] For more information: www.ressource-deutschland.de.

(WBF) to investigate further measures and steps. In the period of 2016-2019 it continues as a coordination instrument. However, similar measures as in the Masterplan are now implemented in the Green Economy Action Plan.

Labels, certifications and awards

The certification of environmental management systems (EMS) is a successful instrument to encourage the implementation of such tools in private as well as public organisations. An EMS coordinates and controls environmental relevant activities in an organisation, reduces the environmental impact of a company and therefore, guarantees the long-term success of an organisation. One important aspect of this tool is the efficient use of resources. An EMS structures responsibilities, practices, processes, and legal requirements for the implementation of environmental policies of an organisation. The two most commonly applied EMS in the Alpine countries are the European Eco-Management and Audit Scheme (EMAS) and the international environmental standard ISO 14001 (Eco Innovation Observatory 2016).

Table 3.2.1-2 shows the development of the number of organisations with EMAS and ISO 14001 certification in the Alpine countries. The number of ISO 14001 certificates is significantly higher than the number of EMAS organisations. The number of EMAS organisations has been constant in Austria, France and Slovenia in 2014 compared to 2005. In Germany the number decreased by ¼ and in Italy it increased almost by a factor of four. The highest amount of EMAS certified organizations has Germany with a number of 1,229 in 2014. The number of ISO 14001 certificates has been slightly raising in Lichtenstein and Slovenia. Contrary, in Austria, France and Italy the number more than doubled. Italy has the highest amount of ISO 14001 certificates with a number of 19,705. For Slovenia and Switzerland, the number of ISO 14001 certificates in the Alpine area is available. In Slovenia, the number within the Alpine regions amounts 169 and in Switzerland 644.

Table 3.2.1-2 Number of organisations with EMAS and ISO 14001 certification in Alpine countries.

Country	Number of EMAS organizations in 2005	Number of EMAS organizations in 2014	Number of ISO 14001 cert. in 2005	Number of ISO 14001 cert. in 2012
Austria	253	249	481	1,084
France	20	19	3,289	7,975
Germany	1,619	1,229	4,440	7,034
Italy	258	1,017	7,080	19,705
Liechtenstein	-	-	19	21
Slovenia	1	1	417	420
Switzerland	-	-	1,561	2,762

(Source: EUROSTAT 2015g, Eco Innovation Observatory 2016)

The higher number of ISO 14001 certificates is not surprising, since the requirements for an EMAS certification are more demanding than for ISO 14001. Exemplary, EMAS organisations are required to continuously improve their environmental performance above the legal requirements. Companies have to state clearly, how their strategies incorporate social and environmental aspects. Moreover, strategic processes have to include the involvement of stakeholders and monitoring with specified indicators, which evaluate environmental progress.

Good practice - From EMS towards Sustainable Management Systems, Germany

A cooperation project of chambers of industry and commerce, chambers of crafts and the Bavarian State Ministry of the Environment and Consumer Protection has collected a series of good practices in medium sized enterprises who are testing the enhancement of EMAS/ ISO14001 towards sustainability management. In total nine companies, including one from the Alpine administrative district Lindau (Bodensee), have participated in this project.

Further information:
http://www.stmuv.bayern.de/themen/wirtschaft/umweltpakt/nachhaltigkeitsmanagement/index.htm

3.2.2 Policies, instruments and measures towards land use changes

Overview on policies

The need to reduce the steady increase of settlement and infrastructure areas is acknowledged at the polical level. A visible sign is that some countries have target values for the reduction of land take e.g. in their sustainability strategies.

Table 3.2.2-1 Overview on land use policies.

Country	Document	Target
Europe / EU	Road Map for Resource-Efficient Europe	No net land take until 2050
Austria	Sustainability Strategy	Reduce land take urban areas and transport infrastructure to 2,5 ha per day
Germany	Sustainability Strategy	Reduce increase of settlement and transport area to 30 ha per day until the year 2020
Slovenia	Spatial Planning Act	Limitation of using agricultural land for urbanisation and promotion of inner-urban development
Switzerland	Spatial Concept Switzerland (Raumkonzept Schweiz) Revision of the Spatial Planning Act (RPG) - Stage 1	Limitation of land use and promotion of inner-urban development Obligatory revision of land use planning documents in the following 9 years in order to reduce the size of the building zones and in favour of a more sustainable spatial development.

More information about land use policies in the Alpine coutries is given in Annex 6.2. The most important instruments for a responsible land use are spatial planning, urban planning, agricultural and subsidy policies. While agricultural and subsidy policies can be influenced for EU Member States by institutions and regulations on the EU level, spatial and urban planning is made on regional and local levels and the influence of international and even national policies is limited. Instruments and measures to reduce land take need to be applied on the regional and local level. An Alpine-wide overview of such instruments capable to manage land take has been compiled in the Alpine Space project DIAMONT in its instruments database[84]. A wide range of single measures is taken and cannot be presented in total, but only exemplarily in the Annex.

[84] Further information: http://diamont.alpconv.org/sites/ALpenDB_instrument_index.html.

Good practice - Spatial densification in Brig-Glis, Switzerland

The project on spatial densification in Brig-Glis is an example of development inwards in order to avoid more land consumption It aims to provide solutions that do not pose problems for land owners. The project focuses on production of an urban development model which will be used in future development plans of the area. It has three main strategies: densification of the city, protection of the surrounding landscape and smart use of traffic systems.

The aims are to be achieved by finding areas that could be downgraded from construction zones, areas that could be re-zoned and densified as well as developing instruments that help identifying areas suitable for those processes. Moreover, the project encourages affected parties to be involved, aims to raise awareness about living quality in the area, thereby involving the society, and promotes development inwards instead of further land take. As such, it also contributes to a shift in thinking about spatial development and spatial planning in urban areas.

The project is carried out by the Municipality of Brig-Glis and it receives financial support from the Confederation within the funding programme "pilot projects for sustainable spatial development"; other involved actors are the Canton of Vallis and the Agglomeration Brig-Visp-Naters.

Further information: http://www.are.admin.ch/themen/raumplanung/modellvorhaben/2014-2018/05002/index.html?lang=de

3.2.3 Policies, instruments and measures towards circular economy, recycling and waste

Overview of policies

Table 3.2.3-1 Overview of selected policies on circular economy, recycling and waste.

Level	Documents and measures
EU	• EU Action Plan for the Circular Economy. The Action Plan (EC 2015d) • Circular Economy Package (EEB 2015): Funding 650 million from Horizon 2020 and 5.5 billion from structural funds for waste management, and investments in the circular economy at national level • EU Directive 2008/98/EC on Waste (Waste Framework Directive) (EC 2008) • European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste • Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE) • Directive 1999/31/EC on the landfill of waste • European Parliament resolution on the Commission Green Paper on integrated product policy (COM(2001) 68 - C5-0259/2001 - 2001/2117(COS))
Austria	• Waste Management Act • Austrian Waste Management Plan
Germany	• Law on Circular economy (Kreislaufwirtschaftsgesetz) • Waste management plan of Bavaria (Abfallwirtschaftsplan Bayern)
Italy	• Environmental Action Strategy for Sustainable Development
Liechtenstein	• Environmental Protection Act (RDR 2008& Ministero Dell´Ambiente & Fondatione per lo Sviluppo Sostenible 2015)
Slovenia	• Waste Management Programme • Framework Programme for Transition to a Green Economy
Switzerland	• Regulation on avoidance and disposition of waste (Abfallverordnung) • Ordinance on Movements of Waste • DETEC Ordinance on Lists relating to Movements of Waste • Ordinance on beverage Containers • Ordinance on the Return, Take-back and Disposal of Electrical and Electronic Equipment • Ordinance on the prepaid disposal contribution for glass beverage containers • Ordinance on the prepaid disposal fee for batteries and accumulators

More detailed information about policies and regulations is given in Annex 6.2.

Financial instruments and market development

Regional currencies may strengthen regional economy and local supply chains and can contribute to circular economy not only by short transport ways, but also by rising awareness for sustainability in general and by offering sustainable products (cp. GP example Chiemgauer).

Good practice - The Chiemgauer – a successful regional currency, Germany

The Chiemgauer as a regional currency started in 2003 at small scale as a company of a private school. It grew fast and has about 600 enterprises in the counties of Rosenheim and Traunstein in Germany accepting the payment with Chiemgauer as banknotes or by a special Regiocard. The regional currency sees itself as regional supplement to the Euro and has some innovative elements such as that 3% of the purchase is given by the enterprise to a social institution or association. The buyer chooses the purpose. The Chiemgauer aims at keeping the added value in the region, to help to keep the city and village centers alive with shops and to encourage togetherness in the region by supporting non-profit associations. An important part is the stimulus for circulation of the Chiemgauer: the comsumers have to upvalue the banknotes every 6 months by 3% with adhesive stamps, if he keeps them instead of purchasing goods. This way the Chiemgauer circulates faster and supports business activities. Speculation is that way prevented. One Chiemgauer has the value of one Euro and is covered by this. The exchange of Chiemgauer with a Regiocard is free, but the respective person has to be a member of the non-profit association. In addition, the membership at the Chiemgauer e.V. is free, only a signature is needed.

In 2015 more than 200 social institutions or no- profit associations got over 65.000 € by the 3% which were given for each payment with Chiemgauer. Since 2003 more than 450.000 € were handed to over 270 non-profit associations.

Further information: www.chiemgauer.info

Concerning waste management, Italy has a special landfill toll and a provincial environmental protection toll.

In Switzerland, old electrical and electronic equipment can be returned free of charge for recycling due to a recycling fee paid when purchasing a new product. The recycling of electronics is organized and managed through collection schemes of SENS eRecycling, Light Recycling Foundation Switzerland and SWICO Recycling. The institutionalized redemption of electronic waste was launched at the beginning of the 1990s as an industry solution, and before 1998, when the take-back and recycling obligation has become a law. Switzerland is not only a pioneer, but with much higher response rates than the rest of Europe also one of the world champions in recycling electronic products. A reason for the high return rate could be the extremely dense collection network with more than 6000 collection points, the involvement of all market players as well as a high social acceptance (Swiss Recycling 2016).

Labels, certifications and awards

People, organization and successful communication affect recycling. The Swiss recycling Award should be an incentive for the recycling industry as well as for consumers. Furthermore, it underlines the importance of recycling. The winners of the Swiss Recycling Awards 2014 have been honoured for their exceptional performance: The three winners Migros, Maag Recycling AG and the Montreux Jazz Festival have all contributed in different areas and played a valuable role for the recycling in Switzerland (Swiss Recycling 2016).

Education, training and skills development

One of organizations that offer education for schools as well as municipalities in Switzerland is PUSCH. It was established in 2000 by Schweizerische Vereinigung für Gewässerschutz und Lufthygene VGL as well as Siga/ASS. It is a politically independent and a non-profit organization. PUSCH organizes meetings, seminars, courses, environmental education classes that target both school children as well as adults, for whom environmental education and education on waste management is relevant in some way. Annually, it benefits 60,000 students and a few thousands adults. In addition, it also offers publications, as well as exhibition, campaigns, and runs a website Labelinfo.ch that provides information on environmental labels. Education on environment and waste management is a strategy for raising awareness on environmental protection. It is especially important for children who very early learn the habit of segregation of waste and recycling.[85]

Civic engagement and participation

Consumers and their behaviour play an important role in waste generation and consequently there are many initiatives to reduce waste which are initiated by the civil society and NGOs in Germany. Especially, food waste attracts the attention of many people. As it is impossible to present all initiatives, some examples are given here:

- Food-sharing initiatives offer platforms to give super numerous food to others and save waste (example www.foodsharing.de)
- Use of agricultural products which are not “tradeable” because of their unconventional forms and would therefore be casted off (example: www.etepetete-bio.de)
- Internet information about how to save food from being wasted: www.zugutfuerdietonne.de
- Initiative by the Center of Excellence for Nutrition of the Bavarian Ministry for Nutrition, Agriculture and Forestry (http://www.kern.bayern.de/en/index.php); example project: innkeeper looks for farmer (“Wirt sucht Bauer”) with the aim to establish a regional economic circle in terms of food: internet platform)
- Repair-cafés offer repair on a voluntary, unsalaried base and give instructions to repair things instead of casting it off
- Internet platform to trade old construction elements as stairs, windows, doors and others, which can be reused[86]

Slovenia started some promotion and educational activities towards circular economy:

- Cooperation with Ellen MacArthur Foundation, activities for membership in the program of CE 100 Regions with key goal to raise the capacity of key players (public administration, economics) to understand and use the concept of circular economy.
- Co-organization of a conference on the circular economy in November 2015 (http://ebm.si/p/circonf/) - goals: raising the skills of the participants, identifying opportunities for industry, and young people, networking among participants.
- Pilot project to promote circular economy among businesses aimed to promote the concept of the Slovenian economy with a focus on small and medium-sized enterprises and local communities and to enhance the interest in sustainable and energy and material efficient operations of Slovenian companies together with understanding the basic principles of circular economy in selected public.

With a total of 13 prominent recycling confessors from sports, music, politics, etc., the campaign "Ich trenne" has achieved a high level of acceptance and is a valuable contribution to further raise awareness of the Swiss population for recycling and separate collection.[87]

---

[85] Further information: http://www.pusch.ch/.

[86] Further information: http://www.bauteilnetz.de/ (“Börse für wiederverwendbare Bauteile”).

Good practice - Clean Alps, Austria

Littering of waste is a global problem and a significant amount of potential secondary raw material gets lost through improper disposal of waste. Especially in the Alps as an ecologically very sensitive region, littering also poses serious environmental, economic and also aesthetic problems with negative effects both on human and wildlife. Once waste has been disposed of inappropriately, clean-up costs are very high.

For more than 40 years, the Austrian Alpine Club organises an annual clean up event, called "Clean Alps", which is funded by the Austrian Provincial Alpine Governments and the Federal Ministry of Agriculture, Forestry, Environment and Water Management as well as several private bodies. The aim of this nationwide campaign is not only combing through areas of the Alps and picking up litter but also general awareness-raising of the population and of recreation seekers for waste and littering problems in the Alps. In the course of this initiative, littered waste is picked up separately, collected and fed into recycling channels, substituting and preserving natural resources. Besides, additional focus is put on the collection of disposed waste around mountain huts.

Further information: http://www.alpenschutzverband.at/portfolio/aktion-saubere-alpen/

Corporate accountability and CSR

In Germany about half of the waste originates from the construction, deconstruction and demolition branch. The recycling quotes are rather high (more than 90%). The initiative for circular economy in the building sector (Initiative Kreislaufwirtschaft Bau), a business association, reports every two years about the reuse and recycling in its branch. Measures to reach this high quotes were taken by the branch on the base of voluntary commitments.

[87] Further information: http://www.ich-trenne.ch/.

3.3 Ecosystem services and natural capital based economy

3.3.1 Overview on policies on biodiversity and nature conservation

In recent years, EU environmental policies such as the 7th Environment Action Programme (7th EAP) and the Biodiversity Strategy to 2020 have pushed perception towards a more systemic perspective on managing the environment, explicitly addressing natural capital. For example, a priority objective of the 7th EAP is 'to protect, conserve and enhance the Union's natural capital'. There are many synergies and co-benefits of a more integrated management approach. Implementation of ecosystem-based management approaches that consider the entire ecosystem, including humans, offers much potential. Adopting this approach in the management of human activities in the aquatic environment and in developing green infrastructure development will provide important evidence and learning (EEA 2015j).

A wide range of policy instruments (conventions, regulations, directives, strategies and policies) directly or indirectly provide recommendations for the goals of conserving biodiversity, maintaining ecological connectivity and preserving ecosystem services. These are summarized inTable 3.3.1-1.

Table 3.3.1-1 Overview on the selected EU policies concerning biodiversity and ecosystem services and relevant for concerning green economy (Source: EEA 2015d; greenAlps 2014b).

Topic	Strategies and Directives
Biodiversity	• EU Biodiversity Strategy to 2020 (COM(2011)244 final) • Birds Directive (2009/147/EC) • Habitats Directive (1992/43/EC) • Invasive Alien Species Regulation (1143/2014) • Communication on Green Infrastructure (GI) – Enhancing Europe´s Natural Capital (COM(2013) 249 final) • Common Strategic Framework (CSF) Cohesion Policy 2014-2020
Environment (in general)	• 7th Environment Action Programme (1386/2013/EU) • Strategic Environmental Assessment Directive (2001/42/EC (2001) • Environmental Impact Assessment EIA Directive (2011/92/EU)
Water	• Water Framework Directive (EC 2000) • Flood Risk Directive (2007/60/EC) • Urban Waste Water Treatment Directive (91/271/EEC) • Priority Substances Directive (COM (2011)876) • Drinking Water Directive (98/83/EC) • Groundwater Directive (2006/118/EC) • Nitrates Directive (91/676/EEC) • Blueprint to Safeguard Europe's Water Resources
Land and soil	• Thematic Strategy on Soil (COM/2006/0231) • Roadmap to a Resource Efficient Europe (COM(2011) 571) • New EU Forest Strategy (2013) • Common Agricultural Policy (CAP) reform (2013)
Air	• Thematic Strategy on air pollution (COM(2005) 446) • Ambient Air Quality Directive (2008/50/EC) • National Emission Ceilings Directive (2001/81/EC)
Climate	• Biomass Action Plan (COM(2005) 628) • Renewable Energy Directive (2009b) • Energy Efficiency Directive (EC) (2012/27/EU) • Europe 2020 Strategy for Smart Sustainable and Inclusive Growth

3.3.2 Instruments and measures towards biodiversity preservation

Financial instruments and market development

EU level

Within the already mentioned EU Biodiversity Strategy as action 8 the enhancement of direct payments for public goods in the EU Common Agricultural Policy is claimed. The delivery of environmental public goods is going further than cross-compliance measures. For forests the Commission has in action 11 called upon to protect and enhance forest biodiversity (and ecosystem services) through forest management plans and to integrate biodiversity measures in forest management plans (action 12).

One of the most prominent promotion instruments for nature protection is **LIFE-Nature**. With this programme, the EU supports measures for the conservation or restoration of threatened habitats. LIFE-Nature helps implement the Habitat Directive and the Birds directive as well as creating the Natura 2000 European network of protected sites. As an important LIFE financial instrument, the **Natural Capital Financing Facility (NCFF)** has to be mentioned, that supports projects working on payment of ecosystem services, green infrastructure, innovative pro-biodiversity and adaptation investments, and biodiversity offsets.

The EU supports measures for the protection of nature by means of considerable funds also through the European Development **Programme for Rural Areas** (ELER).

National level

The Austrian subsidies for less favoured areas ("Ausgleichszulage") support the maintenance of farming in mountain areas, which is needed to cultivate also cultural landscapes with a high importance for biodiversity. The subsidies are limited to farms with less than 100 hectares[88].

In the German Alpine area, the Nature Conservation Contract Programme ("Bayerisches Vertragsnaturschutzprogramm") supports financially measures for the support of biodiversity particularly for the network Natura 2000 and the Bavarian habitat network Bayernnetznatur. Farmers are supported for extensive farming of high nature value farmland areas; the implementation of the measures is controlled by the county authorities. Measures embrace i.a. conversion of cropland to Greenland, extensive use of meadows, extensive pasturing, and renouncement of mineral fertilizer.

The Bavarian Fund for Nature Conservation (Bayerischer Naturschutzfond) is with a stock of almost € 56 Mio one of the biggest nature conservation foundations in Germany. The foundation is using revenues from the lottery "Glücksspirale". It is supporting nature conservation measures such as safeguarding biodiversity, protection of endangered species and habitats, the development of a habitat network, support of natural dynamic in surface waters and forests and the maintenance of cultural landscapes (Bayerische Naturschutzfonds 2016).

The habitat network in Bavaria ("Biotopverbund BayernNetzNatur") is the umbrella structure for a statewide network of natural and semi-natural habitats. The network development was launched by the government and takes part in the nature conservation legislation. Since the start in 1998, about 399 biodiversity projects have been launched and implemented in the country. Core areas are nature protected areas, floodplains, the edges of mountain ranges and habitat stepping-stones.

The programme chance.natur is a common support activity of the Federal Ministry for Food and Agriculture and the Federal Agency for Nature Protection which is awarded to selected projects which combine nature conservation and rural development activities. Up to now, more than 70 projects have received aid of more than € 390 million and currently around € 14 million per year is available for this programme. In the Alpine area, the project "Allgäuer Moorallianz" (alliance for bog protection in the

[88] Further information: http://www.agraroekonomik.at/fileadmin/download/AB39_Volltext.pdf.

Allgäu region) is supported with about € 7.9 Mio and the project “Murnauer Moos” (the largest bog complex of Alpine bogs in middle Europe) has received about € 17.8 Mio.

A new instrument in Germany is the so-called MoorFutures, a system of integration of additional ecosystem services into carbon credits. As drained peatlands are the largest source of total agricultural emissions and a rewetting of peatlands reduces GHG emissions according measures are an important contribution to climate, biodiversity and habitat protection. The MoorFutures are the first carbon credits from peatland rewetting on the voluntary market in the world (Joosten et al. 2015).

In Italy, ecosystem services have been managed by means of classical “command & control” regulatory instruments (constraints, emission standards, non-tradable permits, etc.) or economic instruments (taxes, fees, etc.) until the 1980s. Since the 1990s, when agro-environmental and forestry measures were introduced in the EU Common Agricultural Policy (CAP) 1992, voluntary incentives and compensations have complemented the instruments which were formerly adopted.

After introduction of the concept of “decoupling” in Italy, i.e separating the support of agricultural production measures from the income support at the end of 1990s and the success of conditionality of public aid to respect minimum environmental protection standards, new criteria have been introduced also for managing ESS. The Natura 2000 network creation and the offer of compensations to protected sites’ managers contributes to enhancing the diversification of ESS protection instruments. More recently newer economic instruments such as environmental payments and payments for ecosystem services schemes (PES) received an increasing attention by the policymakers community (MATTM 2009).

At a practical level, Liechtenstein is offering financial incentives. Thus, ordinances are used to create or expand the preconditions for paying financial compensation for services relating to the protection or sustainable use of biological resources, e.g. payments for ecological services in agriculture, which promote sustainable management via the criteria of the Proof of Ecological Performance (PEP) and organic farming. The PEP is the precondition for entitlement to direct agricultural payments and requires inter alia a balance of nutrients, regular crop rotations and compliance with water protection requirements. The goal of having all farms throughout the entire territory operating in accordance with the PEP has already very nearly been achieved, with the PEP having been actually implemented on 98 % of farmland. The number of organic farms increased dramatically in the 1990s. Today, 28 % of farms meet the criteria not only of the PEP but also of organic farming (EEA 2015b).

In Slovenia, nature protection is, as a rule, mainly a non-profit activity that must be provided by the state and local communities in accordance with their responsibilities. The funding thereof is generally carried out through the state budget. The state provides the funds for measures aimed at biodiversity conservation and the protection of natural assets, for the public service providing nature conservation and for compensation. Local communities provide funds for measures aimed at the protection of natural assets, for the public service providing nature conservation and for compensation when related to the protection of natural assets. The legislation also provides for other sources for the financing of the public service providing nature conservation, which are regulated through the funding of institutes as entities that perform a public-service. This includes payments for services performed, grants, donations and other sources allowed by law. In addition to the system of public, direct and purpose-based financing of nature protection, its financing by means of funds provided by other sources, in particular international financial sources, foreign and domestic donations, and sponsorships, is of equal importance. These funds can be used by public institutions, local communities, non-governmental organisations, companies or individuals. Important sources are the European Regional Development Fund, the European Agricultural Guarantee Fund, the Rural Development Programme, the LIFE programme, the Cohesion Fund, the EEA and the Norwegian Financial Mechanisms and the Swiss contribution.

The Swiss Action Plan for Biodiversity includes as one of its 10 targets the review of financial stipulations. The idea is to investigate if taxes and subventions are working in a damaging way towards actions that support biodiversity. Based on this review damaging instruments should be adjusted in order to support targets of the Action Plan. This work is already in progress in many areas (agricultural and forest policy). A good example for such mechanisms comes from the agriculture policy 2014-2017, which introduces an incentive to have more animals per area. It is considered vital to check and develop new financial incentives in areas where market failure is probable (BFS 2016g).

Good practice -Allgäuer Moorallianz, Germany

The project Allgäuer Moorallianz is financed by the chance.natur programme of BMU/BfN. The aim of the project is to maintain sustainably the biological, landscape diversity of the hydrologically intact moor ecosystems in the hilly pre-alpine hill and marsh land of Oberallgäu and Ostallgäu. Furthermore, it aims to match nature conservation with regional development in this area. The project has already developed (2009-2012) its management plans and is in the implementation phase of the defined measures from 2012-2020.

Further information: http://www.moorallianz.de/index.php?id=109

Green technology and innovation

As an outcome of the Alpine-wide Econnect project the tool Jecami allows as an online application the analysis of ecological connectivity in alpine regions based on indicators. The application uses the Continuum Suitability Index for an analysis of structural landscape connectivity and landscape permeability. It also offers a tool to identify favourable areas for certain large mammals[89].

The recently approved INTERREG project called AlpES with the participation of Austria, France, Germany, Italy, Slovenia, Liechtenstein and Switzerland is going to analyse possible instruments and measures fostering and developing ecosystem services of the Alpine area.

The German R&D project "Greenconnect" identifies and analyses measures of ecological connectivity based on the "catalogue of measures to improve ecological connectivity in the Alps".

In Germany, the Bavarian Action programme 2020plus is dedicated to the improvement of flood protection through fostering the infiltration of soils, renaturalisation of rivers, reactivation of natural retention areas, improving the interaction of river and floodplains. Up till now for more than 8,000 km streaming waters development concepts have been elaborated and about 25 Mio m^3 of retention volume has been reactivated (LfU 2016).

Gaps in the habitat network and migration corridors of big mammals in Germany caused by the existing road network have been identified in a rule based methodology using a geographic information system. Based on these results, the German Defragmentation Programme was developed which locates priority sites for measures to overcome road-related barriers.

Innovative, practical and widely usable nature conservation concepts are tested in Germany as part of trial and development (T+D) projects. The Federal Ministry for Environment provide scientific back-up for these projects, which focus on nature conservation, regional development, ecological urban development, climate change adaptation and awareness raising models. The projects have to test or develop innovative approaches, must have a regional impact and should have model character. Since the start in 1987 around € 120 million has been provided for more than 90 projects and currently the T+D programme has an annual budget of around € 3 million (EEA 2015e).

89 Furhter information: http://www.jecami.eu.

A Swiss example for the implementation of nature conservation is the Centre for Sustainable Use of Biomass in the UNESCO Biosphere Entlebuch. The project develops a binding, regional biomass strategy, creating a centre for the sustainable use of biomass in the UNESCO Biosphere Entlebuch. The regional biomass flows are recorded and visualized. This data is used not only as a basis for the solution of conflicts of interest, but also to simulate and illustrate different processing techniques. There are pilot plants like a biochar reactor, educational opportunities and an exhibition to make the experience gained in the long term available to the public and a professional audience. The regional biomass strategy should also be integrated into the regional structure plan.[90]

A tentative tool to systematically analyse effects on ecosystem services, addressed to planners, has been developed by the University of Zurich (ETHZ).[91] Although universities have carried out substantial work towards improving land use decisions (e.g. PALM potential analysis for sustainable land management[92]), the practical implementation of mapping of ecosystem services for land use decision makers (e.g. in the context of touristic development) remains a challenge.

Labels, certifications and awards

In the Alps by the platform ecological Network of the Alpine Convention a concept for the nomination of pilotregions has been developed. Since 2011 eight pilot regions have been identified in a nomination concept. The experiences and lessons learnt from this process are summarized in the 'Implementation Recommendations'.[93]

In the German Alpine Convention area, the award "Bayerischer Biodiversitätspreis" is awarded to activities of associatons, municipalities and their institutions, schools, churches which support the public perception of nature conservation and environmental protection, in particular the diversity of species and habitats. Every two years, the € 15,000 award is granted for implementation projects and biodiversity survey activities.

In Bavaria, the study "Enterprise Nature"[94] has examined the options for the engagement of enterprises for biodiversity: There are many options how the area and buildings of companies can be redesigned to offer secondary habitats, save resources such as groundwater, soil and may also serve as green corridors and green spaces. The blue print for this approach are the activities of the Swiss foundation "Nature & Economy"[95] which has already certified more than 300 companies in the country for the nature friendly design of their areas.

In Switzerland federal instruments such as the park label, product label and global financial aid for parks are supporting parks:

- Park and product labels: A park project becomes a park of national importance as soon as it has been awarded a park label by the federal authorities. From the time when the park is labelled, the authority is also allowed to award a product label for businesses and individuals for certain goods or services.

[90] Further information: http://www.are.admin.ch/themen/raumplanung/modellvorhaben/05237/index.html?lang=de.

[91] Further information: http://oesl-check.ethz.ch/.

[92] Further information: http://www.nsl.ethz.ch/index.php/Projekte/Projekte-der-einzelnen-Professuren/Prof.-Dr.-Adrienne-Gret-Regamey/Projekte-Prof.-Regamey/PALM-Gemeindeuebergreifende-PotentialAnalyse-der-Ressource-Boden-fuer-nachhaltiges-LandManagement

[93] Further information: http://www.alpine-ecological-network.org/the-alpine-ecological-network/pilot-regions.

[94] „Unternehmen Natur": Further information: http://unternehmen-natur.de/.

[95] Further information: http://www.naturundwirtschaft.ch/.

- Park label - For the operation phase, park projects whose long-term future is assured and which meet the requirements specified by the federal authorities are awarded the park label by the FOEN. Parks in the development phase can use the candidate label.
- Product label - The park authority can award the product label to individuals or businesses if the products fulfil the specified sustainability criteria and are manufactured in the park area. The product label is designed to promote traditional skills/crafts of the region (BFS 2015b).

Civic engagement and participation

The **Natural Capital Coalition** as a global multi stakeholder open source platform brings together the many different initiatives and organizations working in natural capital under a common vision. Its aim is to achieve a shift in corporate behaviour to preserve and enhance, rather than deplete the earth's natural capital. It is made up of early adopters from the business, policy, accounting and NGO communities.[96]

[96] Further information: www.naturalcapitalcoalition.org

3.4 Economy supporting quality of life and well-being

3.4.1 Policies related to green jobs, economic well-being and consumer behaviour

Level	Documents and measures
EU	• *Green Employment Initiative*: Communication by the European Commission addressing the employment challenges and opportunities of a transition towards a Green Economy. The communication sets out an integrated framework for employment policies to facilitate this transition. (COM (2014) 446 final) • *Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) Action Plan*[97]: by the European Commission to further strengthen green public procurement GPP. • *Public procurement for a better environment*[98]*:* Communication by the European Commission to provide guidance on how to reduce the environmental impact caused by public sector consumption and how to use green public procurement to stimulate innovation in environmental technologies, products and services.
Austria	• *Masterplan Green Jobs*[99]: stimulate and support the creation of employment in the environmental goods and services sector. It identifies six priority areas where a high number of measures are identified to implement the Masterplan. The objective of achieving 200,000 green jobs by 2018 shall be realised through e.g. investment in thermal isolation, the increase of renewable energies, the improvement of public transport and the development of eco-tourism. • *Action Plan for sustainable procurement*[100]*:* adopted in 2010 and consisting of two parts. The first part includes the objectives and measures as well as the practical implementation of the action plan; the second part includes procurement criteria for 16 product groups.
France	• *National plan for green occupation and jobs:* The objectives are to*:* ○ identify and monitor green-related occupations; ○ integrate green-related skills into the initial and vocational education systems, through the adaptation of existing curricula, the creation of specific formations and the related modification of diploma systems and certificate systems; ○ integrate green occupations into active labour market policies such as apprenticeship contracts or subsidised jobs for disadvantaged workers.
Germany	• *National Programme for Sustainable Consumption 2016*[101]: containing ideas on sustainable consumption policies, including concrete measures.
Italy	• *National Action Plan for green public procurement*[102]*:* of the Ministry for the

---

[97] Further information: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52008DC0397.

[98] Further information: COM (2008) 400, published on 16 July 2008: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52008DC0400.

[99] Further information: https://www.bmlfuw.gv.at/greentec/green-jobs/masterplan/masterplan_greenjobs.html.

[100] Further information: http://www.nachhaltigebeschaffung.at/.

[101] Further information_:
http://www.bmub.bund.de/fileadmin/Daten_BMU/Download_PDF/Produkte_und_Umwelt/nat_programm_konsum_bf.pdf.

	Environment provides a general framework for green public procurement, sets national objectives, identifies priority product groups to realise the environmental relief potential of this instrument and defines minimum green criteria.
Slovenia	• *Decree on Green Public procurement 2011:* sets core environmental targets to be integrated in all public procurement procedures for 11 different product groups.
Switzerland	• *Sustainable Development Strategy 2016-2019*[103]*:* aims at promoting full and productive employment as well as decent work. The strategy also focuses on sustainable and inclusive economic growth as well as inclusive societies, institutions, gender equality as well as promoting well-being at all ages.

[102] Further information: http://www.minambiente.it/pagina/il-piano-dazione-nazionale-il-gpp-pan-gpp.

[103] Further information: http://www.are.admin.ch/themen/nachhaltig/00262/00528/index.html?lang=en.

3.4.2 Instruments and measure related to green jobs, economic well-being and consumer behaviour

Labels, certifications and awards

***Environmental, energy and social lab*els** help to create green jobs by triggering the demand for more sustainable products and services. They are an important instrument for sustainable consumer behaviour, allowing consumers to make conscious choices.

The number of labels available at the European and national level is by far too high to permit us to provide a comprehensive picture here. Under the following links, overviews on the national label landscape of the Alpine countries are provided:

The EU Ecolabel[104], was launched in 1992 by the European Commission. The aim was to develop a European-wide eco-labelling scheme that consumers could trust. The label helps to identify goods and services that have a reduced environmental impact throughout their life cycle. The underlying criteria have been developed in a multi-stakeholder approach by scientist, NGOs and business. In September 2015, 44,711 products and services in Europe were certified with the EU Ecolabel. The largest number of EU Ecolabel licences was awarded in France (27%), Italy (18%), and Germany (12%).[105]

The EU organic farming logo[106] is robligatory for all organic pre-packaged food produced within the European Union.

In Germany, the website label online[107] provides a comprehensive overview on existing labels on the German market, including an evaluation. Further to that, the website Kompass Nachhaltigkeit[108], initiated by the Federal Ministry for Economic Cooperation and Development, provides an overview on sustainability labels and standards for public and corporate procurers. Here as well, a critical evaluation of the standard in question allows a better orientation.

The "*Kompass Nachhaltigkeit*" exists also for the Swiss market[109]. Addressed to private consumers and companies, the website "*Labelinfo*"[110] informs since 2001 about environmental and social labels and standards and is run by the foundation Pusch. Currently, infomation about 135 labels is provided in German and French.

As described in chapter 2.4.3, some Alpine regions have introduced ***regional brands*** to support the regional economy and reduce negative environmental impacts through transportation. This covers mainly the production and marketing of regional foodstuff. Examples include:

In Austria, the „*Genuss Region Österreich*"[111] is a protected trademark owned by the Austria Marketing GesmbH and the Federal Ministry of Agriculture, Forestry, Environment and Water Management. The aim is to make the regional agricultural products and specialities visible. Consumers and tourists receive information about the offers in the specific Austrian regions, allowing them to make conscious choices.

[104] Further information: www.ecolabel.eu.

[105] http://ec.europa.eu/environment/ecolabel/facts-and-figures.html

[106] Further information: http://ec.europa.eu/agriculture/organic/

[107] Further information: www.label-online.de

[108] Further information: http://www.kompass-nachhaltigkeit.de

[109] Further information: http://www.kompass-nachhaltigkeit.ch/

[110] Further information: www.labelinfo.ch

[111] Further information: http://www.genuss-region.at

As already described in Chapter 2.4.3, the regional brand for organic food products from Tyrolean mountain farmers "Bio vom Berg"[112] offers about 80 different regional and high quality products

In the German Alpine region Allgäu, the regional organic brand called „Von Hier"[113] labels organically grown food that is being produced within a maximum distance of 100km from the city of Kempten, where the company that owns the brand is situated.

In Switzerland, similar initiatives exist, such as a label created by the Swiss supermarket cooperative Migros called "*Aus der Region. Für die Region*"[114]. The label was created as a reaction to the various food scandals in the late 1990's and is now one of the most popular and known labels in Switzerland. Coop, the second big supermarket cooperative has created a similar label called „*ProMontagna*"[115]. "*ProMontagna*" labels high quality food products stemming from mountainous areas, conserving workplaces in the mountains. The association „*alpinavera*"[116] is marketing Alpine, mountain and regional food products in the cantons Graubünden, Uri, Glarus and Tessin. A minimum of 80% of the ingredients must come from the region for the product to receive the label.

Since a few years, local authorities in Austria, Germany, France, Italy and Switzerland have the possibility to apply for the certification as a ***Fair Trade Town***[117]. Fair Trade Town is any community in which people and organisations use their everyday choices to increase sales of Fair Trade products and bring about positive change for farmers and workers in countries of the global South.

Sustainable Procurement

The enormous purchasing power of public authorities makes sustainable public procurement a powerful instrument for creating green jobs and for sustainable production and consumption patterns. To implement sustainable procurement activities, local authorities should strive for decisions by local bodies on sustainable procurement (to get the necessary political support for sustainable procurement activities), and develop a sustainable procurement strategy or action plan containing priority action fields and targets to be set.

Supporting instruments include:

- The Green Public Procurement Initiative of the European Commission supports public authorities in their efforts to reduce environmental impact through their purchasing practices by providing legal advice, green procurement criteria, good practice examples and tools for life-cycle and cost analysis. Member States are encouraged to create National Action Plans for Green Public Procurement.[118] As of November 2014, all Alpine countries being EU members have adopted such an Action Plan or an equivalent document.[119]
- At the transnational level, ICLEI's ***Sustainable Procurement Campaign Procura+***[120] provides a frame to sustainable procurement activities at the local level, including procurement criteria on

[112] Further information: http://www.biovomberg.at

[113] Further information: http://www.feneberg.de/marken/vonhier/

[114] Further information: https://aus-der-region.migros.ch/aus-der-region/de.html)

[115] Further information: http://www.coop.ch/de/labels/pro-montagna.html

[116] Further information: http://www.alpinavera.ch

[117] Further information: http://www.fairtradetowns.org

[118] See Communication on Integrated Product Policy 2003: http://ec.europa.eu/environment/ipp/ippcommunication.htm.

[119] Further information: http://ec.europa.eu/environment/gpp/action_plan_en.htm.

[120] Further information: http://www.procuraplus.org/en/.

the most relevant product groups. Within the Alpine Convention area, only the city of Zurich is a member of Procura+.

There are also national initiatives in the Alpine countries to encourage and support sustainable procurement. In Austria, the website of the national action plan for sustainable procurement[121] provides advice, good practice examples and procurement criteria for a number of product groups. In Germany, the competence center for sustainable procurement (Kompetenzstelle für nachhaltige Beschaffung[122], run by the Procurement Agency of the Federal Ministry of the Interior provides support for local authorities and other public procurers to integrate sustainability aspects into public purchasing processes.

Corporate accountability and CSR

The Economy for the Common Good movement was presented in chapter 2.4.2. The ***Common Good Balance Sheet*** is a central tool of the Economy for the Common Good (ECG) to measure the contribution of a company to the Common Good of a democratic society. It gives an account of the degree to which the company fulfils the five most important constitutional values of democratic states: human dignity, solidarity, sustainability, justice and democracy.

Education, training and skills development

The Austrian climate protection initiative ***klima:aktiv*** sets quality standards for the education and vocational training in the fields of renewable energies, energy efficiency, construction and renovation and sustainable mobility.

In 2015, a European Social Fund (ESF) programme was initiated in Germany, entitled "Promote vocational training for sustainable development – green key competences for climate friendly and resource efficient action on the job" (Europäische Sozialfonds für Deutschland 2016). For this first ESF programme in Germany with an explicit focus on environment and climate, the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety and the European Union will provide Euro 35 million until 2020. The programme shall secure qualification for green jobs and counter the shortage of skilled labour. There are two priority action fields, "Multidiscipline qualification for the energy-efficient refurbishment of buildings" and "Greening of jobs". The latter aims to provide information on green jobs and production methods by supporting work camps and roadshows.

Since 2012, a Green Day[123] for environmental jobs takes place once a year on 12 September in Germany. Business, universities and research institutions open their doors for students from 13 to 19 years old. Since the first Green Day, more than 10,000 students gained an insight into study opportunities in environment and climate protection. The Green Day is supported by the Federal Ministry for Environment with funds from the national climate protection initiative and is implemented by the Zeitbild Foundation.

Furthermore, the network "***Education for Resource Protection and Resource Efficiency"*** (BilRess)[124] was established in 2014 with support of the Federal Ministry for the Environment and the Federal Environment Agency. Founding members came from all education and training areas and include the Federal Institute for Vocational Education and Training (BIBB), the Federal Agency for Civic Education

[121] Further information: http://www.nachhaltigebeschaffung.at/

[122] Further information: http://www.nachhaltige-beschaffung.info

[123] Further information: http://www.greendaydeutschland.de.

[124] Further information: http://www.bilress.de/.

(bpb) and the German Federal Foundation for the Environment (DBU). The BilRess Network created a "Road Map Resource Education" in cooperation with the key players in the education sector for a prospective integration of a curriculum on resource efficiency and resource conservation in all essential educational contexts. An online communication platform was established and a number of events have taken place already.

Civic engagement and participation

Sustainable consumer behaviour obviously lives from civic engagement. The ever growing number of sharing and "use the unused" initiatives, repair cafés and swop parties shows an increasing awareness and engagement of the civil society. Examples of such initiatives are also given in chapter 3.2.3. Some concrete instruments in place in the Alpine Convention area are:

- Foodsharing in Kempten, Germany: Food savers in the city of Kempten collect left-over food from participating shops and restaurants and distribute it in a central point to the local population, who is informed via a platform. The initiative is part of the national movement foodsharing[125].
- Application for carpooling in Slovenia: an open source application allowing drivers with spare seats to enter their journey details (origin and final destination, date and time) along with the price they want to charge for a seat. Prospective passengers then contact the driver to arrange the ride[126].

[125] Further information: https://foodsharing.de

[126] Further information: https://prevoz.org/about/

3.4.3 Instruments and measures related to health and harmful emissions

Policies on air quality

An overview over the most relevant policies and regulations concerning ambient air quality is given in Table 3.4.3-1.

Table 3.4.3-1 Most relevant policies and regulations on ambient air quality.

Level	Policies and regulations
EU	• Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants • Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe • Directive 2011/76/EU (Eurovignette Directive) • European Union emission regulations for light-duty vehicles (Directive 98/70/EC) and for heavy-duty vehicles (Directive 2005/55/EC) • 7th Environment Action Programme of the EU 2014-2020 (EU 2013)
Germany	• Federal law on emissions (Bundesimmissionsschutzgesetz) and its regulations (1. BImSchV: Ordinance on small combustion installations, 28th BImSchV: Ordinance on emission limits for combustion engines; 39th BImSchV: Ordinance on air quality standards and emission limits) • Bavarian law on emissions (Bayerisches Immissionsschutzgesetz) • Measures are defined on local level in the framework of clean air plans, where exceedances occurred
Switzerland	• Legislation on federal level which regulates harmful emissions from heating systems, industrial installations, motor vehicles, construction machines, boats and trains, quality of combustibles and heating fuels

Financial instruments and market development

The new Directive 2011/76/EU (Eurovignette Directive) implements the polluter pays principle at least partly by giving the possibility to include external costs of air pollution by freight transport into the national toll systems. Annex IIIb Table 1 determines the maximum chargeable air pollution costs differentiated by EURO classes and suburban roads or interurban roads. “The values may be multiplied by a factor of up to 2 in mountain areas to the extent that it is justified by the gradient of roads, altitude and/or temperature inversions.” (2011/76/EU Annex IIIb)

But there are also other alpine–wide instruments in discussion, including the Alpine Crossing Exchange, the Alpine Emission trading system and Toll+. The Working Group Transport of the Alpine Convention and the Zurich Process contribute steadily to the process of a “greener” transport in and through the Alps.

In Germany a toll is levied on the freight transport sector for the use of federal highways and federal roads, the use of all other roads, inclusive urban roads is free of toll. The toll is differentiated by emission classes, so that external emission costs are included. There is no supplement for mountain areas. Busses and vehicles with maximum gross vehicle weight of less than 7.5 tonnes use all public roads for free.

To decrease the emissions of buildings, solar and geothermal energy as renewable energy sources can play an important role. However as the housing stock in many regions features relative low energy standards compared to new buildings, a high potential to save emissions lies in modernisation and especially in heat insulation. In Germany several subsidy programmes for private and public buildings regarding heat insulation, solar or geothermal heating etc. were set up over the last years. Besides national programmes also regional or even local subsidies are available.

Switzerland has introduced taxes: mileage-related heavy vehicle tax and the incentive tax on volatile organic compounds; moreover, the content of various types of fuel is regulated.

Swiss federal authorities have also been fostering low-emission methods in livestock farming. Relevant incentives are included in the Agricultural Policy for 2014-2017, which should culminate in reduction of ammonia levels.

Green technology and innovation

As the transport sector contributes significantly to air pollution, many measures are targeted towards decreasing its emissions. Not only technical solutions are in demand - they are taken for years, as the emission standards of vehicles have decreased continuously - but also infrastructural (e.g. tunnels) and organisational measures are on track. Initiatives to shift freight transport from road to rail are wide-spread in the Alps and some projects of the Alpine Space programme were dedicated to that issue (e.g. AlpFrail, Transitecs).

Civic engagement and participation

Reducing the use of private cars will decrease air pollution from the transport sector. Such measures are often initiated by civil society (e.g. car sharing and citizen-buses) or by regional authorities responsible for public transport (e.g. on-demand services or shuttles for special user groups such as hikers). In every Alpine country various options exist for car sharing and car pooling.

One example is Mobility car sharing in Switzerland, founded in 1997. Mobility car sharing provides its 120,300 customers with some 2,700 vehicles in nine different vehicle categories at 1,400 stations throughout Switzerland round-the-clock (Mobility Carsharing). The main customer argument in favour of using the Mobility fleet is the convenient self-service, the central and non-central stations, the efficiency of the multi-modal mobility and the option to use the vehicles round-the-clock at short notice and for short periods. During the last years, mobility has steadily grown in its number of locations, vehicles and customers. The cooperative's financial situation is both solid and positive.

4 Conclusions and recommendations

4.1 Conclusions

The Alpine Convention area is characterised by the specific ecological conditions of a high mountain range, which means a specific vulnerability towards impacts on climate conditions, on soil, on water household, biodiversity and on space. This makes this area more sensitive towards impacts than lowland areas. Stakeholder and decision makers as well as the community hold a responsibility to preserve the Alpine area in terms of its high biodiversity, natural and cultural landscapes, and delivery of ecosystem services as well as living space for its residents and as an economic region.

The area covered by the Alpine Convention is exposed to global drivers such as climate change, demographic change, loss of biodiversity or global economic competition. These challenges cannot be answered sustainably by single solutions but require a great transformation of the patterns of production and consumption within the regional carrying capacity and planetary boundaries, while considering human well-being, social inclusion and economic welfare.

In this report, a Green Economy is described as low-carbon, energy and resource efficient, considering natural capital and ecosystem services and supporting quality of life and human well-being. Some visions for such a future development in the Alps already exist, as pictured in initiatives such as “Renewable Alps”, “CO2-neutral Alps”, the “2000-Watt society” or “Zero-land-take”. These could serve as examples for an Alpine development and feed into the development of a Green Alpine Economy.

Such a transformation of the economy will be relevant for all economic sectors, including agriculture, energy, transport, construction, tourism, industry and production and also private households.

Based on the conclusions of the single chapters of this report, these overall conclusions on the development of a Green Economy in the Alps are synthesised. They follow a horizontal viewpoint and are structured along aspects being particularly relevant for a greening of the economy.

Regional economy development

Regional economic cycles are an important contribution and offer opportunities for a Green Economy: the sustainable production of regional products can take advantage of endogenous natural capital. Examples for regional capital are wood from mountain forests, dairy products from alpine pastures, but also sites of natural beauty and landscape amenities. To use this appropriately requires taking stock of sustainably usable natural capital and ecosystem services at the regional level. For the time being a systematic assessment of the stock has not yet been carried out in the Alpine area. The production of regional goods and services can take advantage of regional traditional skills, valuing them at the same time. The use of regional currencies may support the development of regional economic cycles. Regional products are appreciated by consumers and there is a high identification of the Alpine population with their region.

Relevant actors for a development of regional economies are regional and local authorities supporting the economic interrelations, local and regional businesses investing in their region and residents, tourists as well as other consumers selecting consciously regional products for their consumption. Moreover, external investment can also support regional economic development in the Alps on a sustainable basis.

Innovation as economic trigger and key to more sustainability

Challenges of the future, particularly climate change, the transition to renewable energy sources, demographic change or growing mobility needs put pressure on the economy. At the same time, they are opportunities for change and innovation.

There is a clear need for further reduction of GHG emissions and adaptation to unavoidable effects of climate change. Social innovation, technical innovation and innovative business models for production and transport means are needed for this reduction.

The use of regional renewable energies opens the door to reduce dependency from fossil fuels, at the same time fostering innovation while reducing greenhouse gas (GHG) emissions. The Alpine area offers a high potential of regional renewable energies in particular energy from sustainable and environmentally friendly use of biomass and hydropower. Using existing energy infrastructures such as power plants as supply points or the refitting of old hydropower plants are starting points for an innovative energy grid. Moreover, a high potential for renewable energy technologies as solar and wind exists.

Storage of renewable energies, but also a restructuring and upgrade of power grids can help to integrate decentrally produced renewable energies and to allow a flexible reaction to energy demand and supply. For both, innovative approaches are needed. They are important for the development of an energy supply based on renewable energies.

Such innovative solutions not only support environmental goals of emission reduction and decoupling, but contribute significantly to the competitiveness and sustainability of enterprises and regions and foster regional economies.

Cost effective and efficient economy

In terms of water use, land take, and loss of productive soils the current practice in the Alpine area needs to significantly improve in terms of an efficient use of resources.

There are lot of opportunities to raise energy and resource efficiency in the Alps and to generate economic and ecological benefits at the same time. Resource and energy efficiency do not only reduce material and energy input – they also save costs in the long run, increasing the competitiveness of enterprises, municipalities and regions. For example, sustainable production with a lower resource and energy input and in return lower waste production means cost benefits for enterprises. Also the use of regionally sourced material instead of imports may save costs and supports the regional economy. Wood, as a renewable resource available in many parts of the Alps, can substitute other, more energy consuming and non-renewable, materials for construction. It also offers options for innovative products and regional economic development.

Avoided costs are an economic benefit. If environmental damages, such as health effects through air pollution, damages by natural hazards and loss of productive soils through land take can be prevented by precautionary action, society will save costs. In addition, the mitigation of GHG emissions and adaptation to climate change can prevent costs which otherwise may arise through climate change impacts in the future.

A truly cost effective economy will have to change to a holistic approach to include external and often hidden costs, such as health impacts, loss of landscape amenities and ecosystem services. Instruments are also required to stimulate economic activities with positive externalities such as payments for ecosystem services (PES). Moreover, the phasing out of environmental harmful subsidies is indispensable to avoid detrimental effects on the environment. The revenues created from the reduction of environmentally harmful subsidies offer the opportunity to promote green investments. Where necessary, supporting measures to reduce negative social impacts by the phasing out should also be financed by the saved subsidies.

Competitiveness of Green Economy

Cost effective and innovative enterprises are increasing their competitiveness by producing at lower costs and offering better products and services. Responding to future challenges and adopting more sustainable production patterns can thus represent an economic opportunity for them.

The use of the natural endogenous potential of regions such as the natural capital, available knowledge and skills of the residents may also increase the ability of enterprises and regions to successfully compete successfully.

Benefits from a Green Economy also include the improvement of the enterprises' sustainability performance and image when reducing environmental impacts. Certifications of environmental management systems such as EMAS or ISO 14001 are a suitable instrument for communicating engagement. Different labels for agricultural, forestry and food products can make the green transformation visible and can be used for marketing. This is a relevant issue particularly for farms, food and tourism enterprises and tourism municipalities in order to meet the expectations of their customers.

Positive employment effects through green jobs

A Green Economy has positive effects on the job market and can offer a wide variety of new jobs or reshape existing jobs. Potentials for such jobs lie in particular in the construction, energy, transport, tourism, forestry, agriculture and industrial sector. Tasks comprise design and planning of energy efficient new buildings, power plants and grids, machinery, renovation of existing buildings, and exchange of heating systems, repowering of existing infrastructures, production of renewable insulation material, etc. But also nature related jobs can be developed within integrative green and regional economy concepts such as jobs for management, customer and park service or monitoring in national parks and other protected areas. In addition, traditional skills might be used for the development of innovative products.

When using regional resources these jobs will be created at the regional level and strengthen the regional economy. In some cases, qualification measures will be needed to ease and support the transition from conventional to green jobs.

Cooperation for an Alpine Green Economy

The development of a Green Economy requires an overarching cooperation between the different actors in the Alpine Convention area: Enterprises and entrepreneurs are the main actors to initiate new types of businesses and implement ideas. However, they need support; in particular, SMEs often do not have capacities to bring innovative ideas to the markets.

Public authorities need to put in place appropriate policies and structures to pave the way for innovation, particularly for small and niche businesses. This could mean to lower administrative burdens, to support financially promising ideas and to raise awareness among consumers. There is also a strong need for continuity in framework conditions (e.g. green stimulus packages), which offer enterprises a reliable and long-term foundation for their development and investments.

Furthermore, new cooperations among citizens, public authorities and regional enterprises support new sustainable initiatives to enter green markets. Civic engagement is reactivating community life and triggers the regional economy and governance.

Well-being of residents

A Green Economy also contributes to the well-being of the residents in different ways. For example, innovation and efficiency effects in agriculture, transport, energy or industry can further reduce harmful emissions such as PM10 and ozone and thus increase health and well-being of residents.

Residents benefit from more efficient technologies through cost savings for energy and resources, which contribute to their personal economic welfare.

The development of new green jobs enlarges the employment options and offers sustainable, often stable options for personal income. As mentioned in the section on green jobs, job development may also contribute to well-being of residents.

Consumption of regional sustainable products or services establishes a relation to the home region and offers occasions for personal interrelations between producers, service providers or sales people and consumers.

Data and monitoring of an Alpine economy

For the Alpine Convention area, only little data are at hand to describe the present status and the transformation towards a Green Economy. However, steering and reshaping the economy in the Alps needs to take stock of existing structures and to report on progress towards new objectives.

In particular, data for the Alpine Convention area and data on the regional scale are not available for many topics of Green Economy such as resource efficiency, waste management, natural capital or ecosystem services.

The data provision and monitoring of relevant indicators is a task of regional authorities, they are the actors to collect and provide data or support the processing of existing data for a regional level.

Long-term goals and strategies for a Green Alpine Economy

Finally, the development of a Green Alpine Economy would need long-term goals, clear objectives and scenarios how such a sustainable economy could be realized in the different branches and sectors. For these long-term goals, new concepts such as those of natural capital, and ecosystem services can deliver approaches and methodologies.

Based on these, one can develop concrete regional long-term strategies for an economic transition. This includes establishing governance approaches, addressing actors and stakeholders, selecting supporting instruments and measures and taking appropriate action.

4.2 Recommendations

The Alpine region is a unique territory, with an outstanding nature and landscape and impressive cultural diversity. The 6th Report on the State of the Alps presents the status of Green Economy approaches by selected topics and indicators. Several opportunities for the development of a Green Economy in the Alpine region have been identified based on this analysis. Despite some progress, there is a strong need to strengthen the efforts to fully integrate the environmental and social dimensions into economic policies.

The sustainable development of the Alpine Convention area depends on the implementation of comprehensive measures on EU and national as well as on regional and local level. To promote a Green Economy, a further evolution of the existing regulatory and economic framework is needed. The coherent objective is to avoid environmental damage by internalising external costs of environmental pollution, phasing out environmentally harmful subsidies, ensuring sustainable resource consumption and conserving the natural capital. Where necessary supporting measures to reduce negative social impacts of the phasing-out and internalisation should be implemented. They could be financed by e.g. saved subsidies. To improve constantly the quality of life and health as well as to enhance social inclusion, policies and instruments need to strongly encourage sustainable production and consumption patterns.

Briefly, the long-term goal for the Alpine Convention area is to shift to a Green Economy, which considers and respects the environmental limits of the Alpine area, takes into account global challenges like climate change and limited natural resources and supports the quality of life and well-being of its residents. This Green Economy needs to be specified by objectives on greenhouse gas reduction and adopting an integrated approach tackling mitigation and adaptation to climate change, on energy and resource efficiency and on the preservation and continuous improvement of natural capital, ecosystem services and biodiversity. These objectives need to be transferred into long-term economic strategies to establish a framework for a Green Economy.

These recommendations are based on the conclusions of the report on an Alpine Green Economy:

1. *Use Green Economy as an engine for the regional development.*
   - The Alpine convention area is rich of natural and cultural resources and energy sources, which offer the economic basis for regional economic development. For a sustainable management of these resources, the natural and cultural capital has to be assessed and taken into account;
   - Foster green innovative businesses and start-ups in their regional territories and support a high capability of eco-innovation for technological and non-technological solutions;
   - The Green Economy approach should be integrated into regional strategies, e.g. by developing concepts for sustainable agriculture, forestry, energy, tourism or transport.

2. *Climate and energy challenges should be used as trigger for eco-innovation.*
   - Increasing efforts of the Alpine countries for GHG mitigation measures and a decoupling of GHG emission and production are needed – energy saving, the development of less emitting production, transport and energy are core issues of a Green Economy. The Alpine region should aim towards an ideal goal of overall climate neutrality;
   - The expansion of renewable energy production capacities, especially - where appropriate - the sustainable and environmentally friendly use of biomass and hydropower and high potential technologies as solar and wind energy should be encouraged in accordance with nature

conservation concerns and sustainable land use. Encouragement and innovation is needed also for the development of energy storage and smart power grids;
- Constantly improve the implementation of innovative, low carbon and energy-efficient technologies in particular in the following sectors: transport, energy generation, construction industry, tourism and agriculture.

3. *Consider ecosystems and biodiversity also as an economic asset in the Alpine area.*
    - Policies and programmes should respect and incorporate the value of landscape, natural capital, ecosystem services and biodiversity, even in an economic sense. This is of particular importance in the Alpine area as a European hot spot for habitat and species diversity.
    - Introduce and explain the benefits of innovative concepts such as natural and cultural capital and ecosystem services to decision makers, support research and develop a common approach on how to assess, monitor and value Alpine ecosystem services.
    - Internalise external costs into the market prices using innovative concepts and instruments. Examples are green accounting from national to local level or schemes for payments for ecosystem services (PES). The latter could for example include services produced by agriculture and forestry for society.

4. *The Alpine region has to take steps towards a resource efficient, circular and cost effective economy.*
    - Resource efficiency needs to be improved, particularly in terms of water use, energy, material, land take and loss of productive soils. Moreover, possible measures and instruments in these fields should be promoted like learning energy efficiency networks, consulting programmes and voluntary schemes for enterprises. Policies and programmes on resource efficiency should stress that efforts in this field lead to cost savings and thus economic benefits;
    - In terms of efficiency, the use of regionally available, renewable resources such as wood should be considered to substitute non-renewable resources;
    - The decision on land take should be based upon an integrated consideration of land use objectives and protection of environmental and cultural heritage steered by existing and innovative spatial planning and land management instruments. Spatial planning and urban planning should reduce land take and loss of soils by applying an efficient land management fostering on inner urban development, reusing brownfields, performing cost benefit and environmental impact assessments and reassuring that there is really a demand before developing the land. The regional responsibility and co-operation across the boundaries of local communities for a resource-conserving land management is to be strengthened.

5. *Use Green Economy to support the competitiveness of the Alpine Convention area*
    - Facing the challenges of the future and developing a Green Economy represents an economic opportunity for enterprises and regions;
    - Enterprises should be encouraged to use a comprehensive environmental management instrument which includes all environmental aspects, such as EMAS (EUROSTAT 2015g) and ISO 14001. Energy efficiency aspects may also be addressed by applying energy management systems such as ISO 50001. In addition, the use of instruments such as credible sustainability labels should be encouraged. Furthermore, consolidated methodologies as Life Cycle

Assessment (LCA) should be promoted also by taking into consideration the ongoing efforts on EU level (Product Environmental Footprint (PEF)).

6. *Use opportunities for the creation of green jobs*

- The transition to a Green Economy offers a wide range of opportunities for positive employment effects in the Alpine region by creating new green jobs and strengthening regional development. This should be supported by appropriate policies.
- Such policies should include the support of innovation in small and medium sized businesses, the creation of networking structures among all stakeholders of a Green Economy, the promotion of sustainable investments and the setting of incentives to stimulate the demand for environmentally friendly products, technologies and services at the private and public level.
- Appropriate training and education measures for the present and future workforce should be implemented to develop the green skills that are needed for future jobs and to satisfy the need of a Green Economy in terms of job qualification.
- Potentials for green jobs and employment lie in particular in the construction, energy, transport, tourism, industrial and service sector. Therefore, sector specific strategies should be developed to tap these potentials.

7. *Improve the quality of life and well-being of Alpine residents through a Green Economy*

- Through innovation and efficiency gains in agriculture, transport, energy or industry, harmful emissions should be further reduced and thus health and well-being of residents increased. By this also the negative economic impacts of emissions can be reduced;
- Progress in energy and resource efficiency should also result in cost benefits for residents;
- The evolution of the job market towards green jobs should offer new opportunities of economic well-being and enable a more social inclusive development;
- The promotion of regional sustainable products should be fostered. Their consumption can contribute to well-being of residents while at the same time regional producers and economy can be supported.

8. *Improve data availability and monitoring*

- The data and good practice examples collected in this report will be accessible to interested stakeholders;
- Increase availability of and regularly update relevant and comparable data and indicators for measuring Green Economy at the appropriate regional level in synergy with the System of Information and Observation on the Alps, according to already existing international indicators. In particular, this is needed to evaluate achievements in terms of carbon reduction, installed capacity of renewable energy, improvements of energy and resource efficiency, regional green jobs as well as new indicators beyond GDP;
- A knowledge pool for a Green Economy in the Alpine region should be created and maintained, as this is an essential step for the promotion of this concept. In this respect, the Permanent Secretariat of the Alpine Convention plays a key role.

9. Prepare a comprehensive and ambitious Action Programme for Green Economy in the Alpine Region until 2018

- This action programme should further elaborate these recommendations and identify concrete fields of actions and the relevant actors;
- The development of such an action programme should involve all relevant stakeholder in the Alpine Convention area, particularly business, municipalities and towns, NGOs and the civil society.

5 Bibliography

Ajanovic, A. & Haas, R. (2014): CO2-reduction potentials and costs of biomass-based alternative energy carriers in Austria. In: *Energy* 69, pp. 120–131. DOI: 10.1016/j.energy.2014.01.038.

Albert, C.,Bonn, A.,Burkhard, B.,Daube, S.,Dietrich, K.,Engels, B.,Frommer, J.,Götzl, M.,Gret-Regamey, A.,Job-Hoben, B.,Koellner, T.,Marzelli, S.,Moning, C.,Müller, F.,Rabe, S.-E.,Ring, I.,Schwaiger, E.,Schweppe-Kraft, B. & Wüstemann, H. (2016): Towards a national set of ecosystem service indicators. Insights from Germany. In: *Ecological Indicators* 61, pp. 38–48. DOI: 10.1016/j.ecolind.2015.08.050.

ALPARC (2016): Alpine Protected Areas Database. Large protected areas (> 100 ha) in the Alpine Convention area. Online: http://www.alparc.org/the-protected-areas, last downloaded 02-08-16.

AlpEnergy (2013): Final report on the project Virtual Power Systems as an Instrument to Promote Transnational Cooperation and Sustainable Energy Supply in the Alpine Space.

Alpine Convention (AC) (2005): Energy Protocol. Protocol on the implementation of the Alpine Convention of 1991 in the field of energy.

Alpine Convention (AC) (2009): Action Plan on Climate Change in the Alps. Action Plan on Climate Change adopted by the X Alpine Conference in Evian in March, 2009.

Alpine Space Programme (2014): Cooperation Programme Approved by the European Commission on 17 December 2014 – Interreg Alpine Space.

Amt für Wald, Natur und Landschaft des Fürstentums Liechtenstein (AWNL) (2012): Liechtensteinisches Landeswaldinventar. Ergebnisse der dritten Erhebung 2010.

Andersen, I. (2015): Failing to protect nature's capital could cost businesses trillions. The Guardian. Online: https://www.theguardian.com/sustainable-business/2015/jan/28/natural-captial-profit-world-economy, last downloaded 18-08-16.

Auer, I.,Böhm, R.,Jurkovic, A.,Lipa, W.,Orlik, A.,Potzmann, R.,Schöner, W.,Ungersböck, M.,Matulla, C.,Briffa, K.,Jones, P. D.,Efthymiadis, D.,Brunetti, M.,Nanni, T.,Maugeri, M.,Mercalli, L.,Mestre, O.,Moisselin, J.-M.,Begert, M.,Müller-Westermeier, G.,Kveton, V.,Bochnicek, O.,Stastny, P.,Lapin, M.,Szalai, S.,Szentimrey, T.,Cegnar, T.,Dolinar, M.,Gajic-Capka, M.,Zaminovic, K.,Majstorovic, Z. & Nieplova, E. (2007): HISTALP – Historical instrumental climatological surface time series of the Greater Alpine Region 1760-2003. In: *International Journal of Climatology* (27), pp. 17–46.

Auer, I.,Böhm, R.,Jurkovic, A.,Orlik, A.,Potzmann, R.,Briffa, K. R.,Jones, P. D.,Efthymiadis, D.,Mestre, O.,Moisellin, J.-M.,Bergert, M.,Brazdil, R.,Bochnicek, O.,Cegnar, T.,Gajic-Capka, M.,Zaninovic, K.,Majstorovic, Z.,Szalai, S.,Szentimrex, T. & Mercalli, L. (2005): A new instrumental precipitation dataset for the greater alpine region for the period 1800-2002. In: *International Journal of Climatology* 25 (2), pp. 139–166.

Bätzing, W. (1998): Regionale Wirtschaftsverflechtungen im Alpenraum - Leitidee, Konzepte, Potenziale und Erfahrungen aus langjähriger Praxis. In: *Politische Ökologie*, pp. 1–9.

Baumbach, G. (1993): Verkehrsbedingte Schadstoffimmissionsbelastung in Städten und an Autobahnen. In: *Staub-Reinhaltung der Luft 53: pp. 267-274*.

Bayerische Naturschutzfonds (2016): Bayerischer Biodiversitätspreis. Online: http://www.naturschutzfonds.bayern.de/biodiversitaetspreis/, last downloaded 18-08-16.

Bayerische Staatsregierung & Staatsministerium für Umwelt und Verbraucherschutz (StMUV) (2014): Natur Vielfalt Bayern. Biodiversitätsprogramm Bayern 2030.

Bayerischer Landtag (2015): Interpellation vom 15.10.2014 zur Umsetzung der Alpenkonvention in Bayern. Drucksache 17/6592 des Bayerischen Landtags. Bayerischer Landtag.

Bayerisches Landesamt für Statistik und Datenverarbeitung (2004): Flächennutzung Bayern - Flächenerhebung nach Art der tatsächlichen Nutzung (auf Ebene des Freistaats, der Regierungsbezirke und der Städte/Landkreise; Stand 31.12.2004). Online: https://www.statistikdaten.bayern.de/genesis/online/logon.

Bayerisches Landesamt für Umwelt (LfU) (2014): Entwicklung des Flächenverbrauchs für Siedlungen und Verkehr in Bayern seit 2001. Online: http://www.lfu.bayern.de/umweltqualitaet/umweltbewertung/ressourcen_effizienz/flaechenverbrauch/index.htm, last downloaded 16-08-16.

Bayerisches Landesamt für Umwelt (LfU) (2015): Hausmüll in Bayern - Bilanzen 2014. Informationen aus der Abfallwirtschaft.

Bayerisches Landesamt für Umwelt (LfU) (2016): Natürlicher Rückhalt. Online: http://www.lfu.bayern.de/wasser/hw_aktionsprogramm_2020_plus/natuerlicher_rueckhalt/index.htm, last downloaded 18-08-16.

Bayerisches Staatsministerium der Finanzen, Landesentwicklung und Heimat (BayStMF) (2013): Landesentwicklungsprogramm Bayern 2013. LEP, vom 2013. Online: https://www.landesentwicklung-bayern.de/instrumente/landesentwicklungsprogramm/landesentwicklungs-programm-bayern-lep/, last downloaded 26-07-16.

Bayerisches Staatsministerium für Umwelt und Gesundheit (BayStMUG) (2013): Der Wert von Natur und Landschaft.

Bayerisches Staatsministerium für Umwelt, Gesundheit und Verbraucherschutz (BayStMUG) (2009): Strategie zum Erhalt der biologischen Vielfalt in Bayern [Bayerische Biodiversitätsstrategie].

Bayerisches Staatsministerium für Wirtschaft und Medien, Energie und Technologie (StmWi) (2014): Bayerischer Windatlas.

Bayerisches Staatsministerium für Wirtschaft und Medien, Energie und Technologie (StmWi) (2015): Bayerisches Energieprogramm. Für eine sichere, bezahlbare und umweltverträgliche Energieversorgung.

Bayerisches Staatsministerium für Wirtschaft und Medien, Energie und Technologie (StmWi) (2016): Bayerisches Energieprogramm.

BayKompV (2013): Bayerische Kompensationsverordnung. GVBl Nr. 15, pp. 517 ff.

Bellassen, V.,Viovy, N.,Luyssaert, S.,Le Maire, G.,Schelhaas M.-J. & Ciais, P. (2011): Reconstruction and attribution of the carbon sink of European forests between 1950 and 2000.

Benessere Equo Sostenibile (BES) (2016): Misurare e valutare il progresso della societa italiana. Online: http://www.misuredelbenessere.it/index.php?id=24, last downloaded 16-08-16.

Beniston, M. (2003): Climatic change in mountain regions: a review of possible impacts. Climate variability and change in high elevation regions: Past, present & future.

BGBl.: Bundesgesetzblatt für die Republik Österreich.

Brink, P. ten (2008): Workshop on the Economics of the Global Loss of Biological Diversity. An interim Report. TEEB, 05-03-08.

Brink, P. ten,Mazza, L.,Badura, T.,Kettunen, M. & Withana, S. (2012): Nature and its Role in the Transition to a Green Economy. Institute for European Environmental Policy (IEEP).

British Ecological Society (British ES) (2016): Ecosystem Services and Valuing Natural Capital. Online: http://www.britishecologicalsociety.org/public-policy/policy-priorities/ecosystem-services-and-valuing-natural-capital/#sthash.BeLzmsHi.dpuf, last downloaded 12-04-16.

Bundesagentur für Arbeit (2016): Arbeitsmarktinformationen – Forschungsergebnisse und Statistiken. Online:

https://www.arbeitsagentur.de/web/content/DE/Unternehmen/Arbeitsmarktinformationen/index.htm, last downloaded 16-08-16.

Bundesamt für Energie, Schweiz (BFE) (2012): Das Potenzial der erneuerbaren Energien bei der Elektrizitätsproduktion, Bericht des Bundesrates an die Bundesversammlung nach Artikel 28b Absatz 2 des Energiegesetzes, August 2012.

Bundesamt für Energie, Schweiz (BFE) (2015): Synthesebericht Ex-Post-Analyse des schweizerischen Energieverbrauchs 2000 bis 2014 nach Bestimmungsfaktoren.

Bundesamt für Naturschutz (BfN) (2015): Ökologischer Tourismus und Naturtourismus. Online: http://www.bfn.de/0323_iyeoeko.html, last downloaded 16-08-16.

Bundesinstitut für Bau-, Stadt- und Raumforschung, Deutschland (BBSR) (2012): Deutschland in Europa Ergebnisse des Programms ESPON 2013. In: *Energie und Klima* (1), pp. 10.

Bundesministerium für Arbeit und Soziales Deutschland, German Federal Ministry of Labour and Social Affairs (BMAS) (2013): Life Situation in Germany. The German Federal Government´s 4th Report on Poverty and Wealth. Executive Summary: Creating Opportunities, Enabling Social Mobility. Online: http://www.armuts-und-reichtumsbericht.de/DE/Bericht/Archiv/archiv.html, last downloaded 16-08-16.

Bundesministerium für Naturschutz, Umwelt und Reaktorsicherheit, Deutschland (BMU) (2007a): Nationale Strategie zu biologischen Vielfalt (NBSAP).

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Deutschland (BMU) (2007b): The Integrated Energy and Climate Programme of the German Government (IECP).

Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit Deutschland, German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) (2015): German Resource Efficiency Programme (ProgRess). Programme for the sustainable use and conservation of natural resources - Second edition.

Bundesministerium für Verkehr, Innovation und Technologie, Österreich (BMVIT) (2011): Zukunftsfähige Energieversorgung für Österreich. Berichte aus Energie und Umweltforschung (13/2011).

Bundesministerium für Wirtschaft und Energie, Deutschland (BMWi) (2014): Ein gutes Stück Arbeit. Mehr aus Energie machen. Nationaler Aktionsplan Energieeffizienz.

Bundesministerium für Wirtschaft und Energie, Deutschland (BMWi) (2015): Ein gutes Stück Arbeit. Die Energie der Zukunft. Vierter Monitoring-Bericht zur Energiewende.

Bundesministerium für Wirtschaft und Energie, Deutschland (BMWi) (2016): Zeitreihen zur Entwicklung der erneuerbaren Energien in Deutschland unter Verwendung von Daten der Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat).

Bundesministerium für Wirtschaft und Technologie Deutschland, German Federal Ministry of Economics and Technology (BMWi) & Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit Deutschland, German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMBU) (2010): Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply.

Bundesministerium für Wirtschaft und Technologie, Deutschland (BMWi) & Institut für Kraftfahrzeuge (IKA) (2012): CO2-Reduktionspotentiale bei Pkw bis 2020. Abschlussbericht 113510.

Bundestag, Deutschland (2009): Bundesnaturschutzgesetz vom 29. Juli 2009 (BGBl. I S. 2542), das zuletzt durch Artikel 4 Absatz 100 des Gesetzes vom 7. August 2013 (BGBl. I S 3154) geändert worden ist.

Cambridge Econometrics (2015): Assessing the Employment and Social Impact of Energy Efficiency. Final Report.

Cipra (2010): Verkehr im Klimawandel Ein Hintergrundbericht der Cipra. In: *Compact*.

CIPRA International (2002): Jahrbuch Erneuerbare Energien 2001. Online: http://www.cipra.org/de/publikationen/108, last downloaded 02-08-16.

CIPRA International (2010): Massnahmenkatalog. Online: http://www.cipra.org/de/cipra/international/projekte/abgeschlossen/cc-alps/massnahmenkatalog?set_language=de, last downloaded 18-08-16.

Conferenza dei Rettori delle Università Italiane (CRUI) (2015): RUS – Rete delle Università per la sostenibilità. Online: https://www.crui.it/rus-rete-delle-universita-per-la-sostenibilita.html, last downloaded 02-08-16.

Consiglio Nazionale dell'Economia e del Lavoro (CNEL) & Italia, Instituto nazionale di statistica (ISTAT) (2014): Rapporto Bes 2014 – Il Benessere equo e sostenibile in Italia, Roma.

Convention on Biological Diversity (CBD) (2014): Aichi Biodiversity targets. Online: https://www.cbd.int/sp/targets/, last downloaded 24-05-16.

Corpo Forestale dello Stato & Consiglio per la Ricerca e la Sperimentazione in Agricoltura (CRA) (2005): Secondo Inventario Nazionale delle Foreste e dei Serbatoi Forestali di Carbonio (INFC). Online: http://www.sian.it/inventarioforestale/, last downloaded 29-07-16.

Corpo Forestale dello Stato & Consiglio per la Ricerca e la Sperimentazione in Agricoltura (CRA) (2015): Terzo Inventario Nazionale delle Foreste e dei Serbatoi Forestali di Carbonio (INFC). Online: http://www.sian.it/inventarioforestale/, last downloaded 29-07-16.

Corporate Eco Forum & The Nature Conservancy (2012): The new business imperative: Valuing natural capital. Corporate Eco Forum; The Nature Conservancy.

Danez, G.,Kozinc, Z.,Zujo, J. & Karajcic, D. (2014): Evaluation of Ecosystem Services as Prerequisite for Sustainable Development. The Case of Lovrensko Barje Meres and Skocjan Caves. In: *Varstvo Narave* 27, pp. 73–86.

Desjeux, Y.,Dupraz, P.,Kuhlman, T.,Paracchini, M. L.,Michels, R.,Maigné, E. & Reinhard, S. (2015): Evaluating the impact of rural development measures on nature value indicators at different spatial levels. Application to France and The Netherlands. Ecological Indicators. pp. 41-61.

DESTATIS (2016): Lebensbedingungen, Armutsgefährdung. Online: https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/EinkommenKonsumLebensbedingungen/LebensbedingungenArmutsgefaehrdung/LebensbedingungenArmutsgefaehrdung.html, last downloaded 16-08-16.

Deutscher Alpenverein (DAV) (2015): Pflanzengeschichten Brauchtum, Sagen und Volksmedizin zu 283 Pflanzen der Alpen.

Deutscher Alpenverein (DAV) (2016): Der Alpenplan in den Bayerischen Alpen. Online: http://www.alpenverein.de/der-dav/parlamentarischer-abend/alpine-raumordnung_aid_15707.html, last downloaded 16-08-16.

Deutsches Bundesministerium für Wirtschaft und Technologie (BMWi) (2012): Wirtschaftsfaktor Tourismus Deutschland. Kennzahlen einer umsatzstarken Querschnittsbranche.

Die Bundesregierung Deutschland (2002): Perspektiven für Deutschland. Unsere Strategie für eine nachhaltige Entwicklung.

Eco Innovation Observatory (2016): Number of ISO 14001 certificates. Online: http://database.eco-innovation.eu/indicators/view/99/1, last downloaded 20-07-16.

E-control Austria (2014): Ökostrombericht 2014. Die Richtung vorgeben, wo immer nachhaltige Energie gefragt ist.

Edler, D. & Blazejczak, J. (2016): Beschäftigungswirkungen des Umweltschutzes in Deutschland im Jahr 2012. Reihe Umwelt, Innovation, Beschäftigung 02/14. Dessau-Roßlau. Editor: Umweltbundesamt, Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit. Online: https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/uib_01_2016_beschaeftigungswirkungen_des_umweltschutzes_in_deutschland_2012.pdf, last downloaded 29-07-16.

Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation (UVEK) & Bundesamt für Raumentwicklung (ARE) (2015): Background report of the Alpine Convention Energy Platform.

EIONET - European Topic Centre on Biological Diversity (2010): Online report on Article 17 of the Habitats Directive:conservation status of habitats and species of Community interest (2001-2006). Online: http://bd.eionet.europa.eu/activities/Reporting/Article_17/Reports_2007/index_html, last downloaded 16-08-16.

Energetika Portal (2015): Operativni program za izvajanje evropske kohezijske politike. Online: http://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/operativni-program-za-izvajanje-evropske-kohezijske-politike/, last downloaded 20-07-16.

Energieatlas (2016): Bayern. Online: https://www.energieatlas.bayern.de/.

Energy Service Directive (2006): Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC (2006/32/EC).

ENGIS (2016): Geografski informacijski sistem za področje obnovljivih virov energije. Online: http://www.engis.si/portal.html, last downloaded 16-08-16.

Enhancing ecosystem services mapping for policy and decision making (ESMERALDA) (2015): Country Fact Sheet: Italy (IT). Online: http://biodiversity.europa.eu/, last downloaded 21-07-16.

ETC ULS (2016a): Ecosystem types based on CLC data. Maps prepared for the RSA 6.: ETC ULS - European Topic Centre on Urban, Land and Soil systems.

EU Strategy for the Alpine Region (EUSALP) (2015): EUSALP, Alpine Space Programme and Alpine Convention. Map.

EURAC Research (2014): RE Potential Atlas. EURAC.

Europäische Sozialfonds für Deutschland (2016): Berufsbildung für nachhaltige Entwicklung befördern. Über grüne Schlüsselkompetenzen zu klima- und ressourcenschonendem Handeln im Beruf. Online: http://www.esf.de/portal/DE/Foerderperiode-2014-2020/ESF-Programme/bmub/berufsbildung-entwicklung-bbne.html?nn=31220., last downloaded 18-08-16.

European Climate Foundation (ECF) (2010): Roadmap 2050. A practical guide to a prosperous, low-carbon Europe.

European Commission (EC) (1992): Council Directive 92 /43 /EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. 92 /43 /EEC, vom No L 206 / 7. Online: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN, last downloaded 02-08-16.

European Commission (EC) (2000): Water Framework Directive 2000/60/EC.

European Commission (EC): DIRECTIVE 2007/2/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE). Online: https://ec.europa.eu/growth/tools-databases/minventory/content/primary-raw-materials, last downloaded 16-08-16.

European Commission (EC) (2008): EU Directive 2008/98/EC on Waste. Online: http://ec.europa.eu/environment/waste/framework/, last downloaded 16-08-16.

European Commission (EC): Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020. Effort Sharing Decision (ESD). Online: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009D0406.

European Commission (EC) (2009b): Directive on Renewable Energies. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

European Commission (EC) (2011a): EU biodiversity strategy to 2020. COM (2011), 244.

European Commission (EC) (2011b): Regulation 691/2011 of the European Parliament and of the Council on European environmental economic accounts.

European Commission (EC) (2011c): Resource efficiency – a business imperative.

European Commission (EC) (2011d): Roadmap to a Resource Efficient Europe. Online: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011DC0571, last downloaded 10-12-15.

European Commission (EC) (2012a): Communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Towards a job-rich recovery. COM(2012) 173 final. Online: http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52012DC0173, last downloaded 02-08-16.

European Commission (EC) (2012b): Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC, Text with EEA relevance. Energy Efficiency Directive.

European Commission (EC) (2012c): Germany Country Profile 2010. Monitoring Member States' Policy Developments on Resource-Efficiency/environment in Europe 2020.

European Commission (EC) (2013a): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Green Infrastructure (GI) - Enhancing Europe´s Natural Capital. COM (2013) 249 final.

European Commission (EC) (2013b): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A new EU Forest Strategy: for forests and the forest-based sector. COM (2013) 659 final.

European Commission (EC) (2014a): Green Employment Initiative: Tapping into the job creation potential of the green economy. Communication from the Commission tothe European Parliament, the Coucil, the European Economic and Social Committee and the Committee of the Regions. COM (2014) 446 final.

European Commission (EC): Regulation 538/2014 of 16 April 2014.

European Commission (EC) (2015a): Agriculture and rural development. Organic farming. Online: http://ec.europa.eu/agriculture/organic/organic-farming/index_en.htm, last downloaded 18-08-16.

European Commission (EC) (2015b): Assessment of the progress made by Member States towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency Directive 2012/27/EU as required by Article 24 (3) of Energy Efficiency Directive 2012/27/EU. Commission staff working document accompanying the document.

European Commission (EC) (2015c): Commission Staff Working Document. Country Factsheet Slovenia, State of the Energy Union.

European Commission (EC) (2015d): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Closing the loop. An EU action plan for the Circular Economy.

European Commission (EC) (2015e): Report from the Commission to the European Parliament and the Council. Assessment of the progress made by Member States towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency.

European Commission (EC) (2016a): Beyond GDP - Measuring progress, true wealth and well-being. Online: http://ec.europa.eu/environment/beyond_gdp/index_en.html, last downloaded 18-08-16.

European Commission (EC) (2016b): Environment. The EU Ecolabel. Online: http://ec.europa.eu/environment/ecolabel/, last downloaded 02-08-16.

European Commission (EC) (2016c): Environment - Waste. Online: http://ec.europa.eu/environment/waste/index.htm, last downloaded 18-08-16.

European Commission (EC) (2016d): Growth - Internal Market, Industry, Enterpreteurship and SMEs. Secondary raw materials. Online: https://ec.europa.eu/growth/tools-databases/minventory/content/secondary-raw-materials, last downloaded 16-08-16.

European Envionmental Bureau (EEB) (2015): Circular Economy Package 2.0.

European Environment Agency (EEA) (undated): Environmental Terminology and Discovery Service (ETDS). Online: http://glossary.eea.europa.eu, last downloaded 02-08-16.

European Environment Agency (EEA) (2002): Europe’s biodiversity - biogeographical regions and seas. The Alpine region - mountains of Europe.

European Environment Agency (EEA) (2006): CORINE Land Cover. Online: http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2006-raster, last downloaded 18-08-16.

European Environment Agency (EEA) (2009): Regional climate change and adaptation. The Alps facing the challenge of changing water resources. 8/2009 (EEA report).

European Environment Agency (EEA) (2010a): Europe's ecological backbone: recognising the true value of our mountains (6/2010).

European Environment Agency (EEA) (2010b): Forest: growing stock, increment and fellings. Online: http://www.eea.europa.eu/data-and-maps/indicators/forest-growing-stock-increment-and-fellings, last downloaded 16-08-16.

European Environment Agency (EEA) (2010c): Permanent settlement area within the Alpine Convention area. Online: http://www.eea.europa.eu/data-and-maps/figures/permanent-settlement-area-within-the/permanent-settlement-area-within-the, last downloaded 16-08-16.

European Environment Agency (EEA) (2010d): The European environment — state and outlook 2010.

European Environment Agency (EEA) (2011a): GHG trends and projections in Austria.

European Environment Agency (EEA) (2011b): GHG trends and projections in France.

European Environment Agency (EEA) (2013a): Air quality in Europa - 2013 Report. Euopean Environment Agency (EEA) (EEA report, 9/2013).

European Environment Agency (EEA) (2013b): Common International Classification of Ecosystem Services (CICES):Consultation on Version 4,Common International Classification of Ecosystem Services (CICES):Consultation on Version 4,August-December 2012, last downloaded 21-07-16.

European Environment Agency (EEA) (2013c): The time is ripe for green accounting. Online: http://www.eea.europa.eu/articles/the-time-is-ripe-for-green-accounting, last downloaded 02-08-16.

European Environment Agency (EEA) (2013d): Towards a green economy in Europe — EU environmental policy targets and objectives 2010–2050 (8/2013).

European Environment Agency (EEA) (2014a): Air quality in Europe. 2014 Report (EEA report, 5/2014).

European Environment Agency (EEA) (2014b): Sector share for emissions of primary PM2.5 and PM10 particulate matter. Online: http://www.eea.europa.eu/data-and-maps/daviz/sector-split-of-emissions-of-4#tab-chart_1, last downloaded 16-08-16.

European Environment Agency (EEA) (2015a): Air quality in Europe. 2015 Report (EEA report, 5/2015).

European Environment Agency (EEA) (Hg.) (2015b): EU 2010 biodiversity baseline. Adapted to the MAES typology. Luxembourg (EEA Technical report, 9).

European Environment Agency (EEA) (2015c): European briefings. Natural capital and ecosystem services. In: *SOER 2015*, pp. 1–4.

European Environment Agency (EEA) (2015d): European ecosystem assessment — concept, data, and implementation. Contribution to Target 2 Action 5 Mapping and Assessment of Ecosystems and their Services (MAES) of the EU Biodiversity Strategy to 2020 (6/2015).

European Environment Agency (EEA) (2015e): Exploring nature-based solutions — The role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards.

European Environment Agency (EEA) (2015f): Natural capital and ecosystem services. Online: http://www.eea.europa.eu/soer-2015/europe/natural-capital-and-ecosystem-services, zuletzt aktualisiert am 3/9/2015, last downloaded 29-04-16.

European Environment Agency (EEA) (2015g): Renewable energy in Europe — approximated recent growth and knock-on effects. Copenhagen (EEA Technical report, 1/2015).

European Environment Agency (EEA) (2015h): Renewable Energy Progress report. COM (2015) 293 final.

European Environment Agency (EEA) (2015i): Resource efficiency — material resource efficiency and productivity. Online: http://www.eea.europa.eu/soer-2015/countries-comparison/resource-efficiency, last downloaded 20-07-16.

European Environment Agency (EEA) (2015j): SOER — The European environment — state and outlook 2015.

European Environment Agency (EEA) (2015k): The European environment — state and outlook 2015. A comprehensive assessment of the European environment's state, trends and prospects, in a global context.

European Environment Agency (EEA) (2015l): Trends and projections in Europe 2015. Tracking progress towards Europe's climate and energy targets. In: *EEA Report* 4/2015.

European Environment Agency (EEA) (2016): Interpolated air quality data. Online: http://www.eea.europa.eu/data-and-maps/data/interpolated-air-quality-data-2, last downloaded 02-08-16.

European Observation Network for Territorial Development and Cohesion (ESPON) (2013a): ESPON Evidence Report Alpine Space. EPSON Project TerriEvi.

European Observation Network for Territorial Development and Cohesion (ESPON) (2013b): Europe 2020. Territorial Dimensions of the Europe Strategy.

European Observation Network for Territorial Development and Cohesion (ESPON) & Deutsches Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) (2014): ESPON Atlas. Mapping European Territorial Structures and Dynamics.

European Topic Centre on Urban, Land and Soil systems (ETC ULS) (2016b): Likelihood of HNV Farmland presence based on CORINE land cover data.

European Union (EU) (2008): Official Journal of the European Union L 152, 11.06.2008. Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. Luxembourg: Publications Office of the European Union (EDC collection).

European Union (EU) (2013): DECISION No …/2013/EU on a General Union Environment Action Programme to 2020 "Living well, within the limits of our planet". No …/2013/EU, vom PE-CONS XX/YY - 2012/0337(COD).

EUROSTAT (2000): Classification of Environmental Protection Activities and Expenditure (CEPA). Online: http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=CEPA_2000&StrLanguageCode=EN&IntPcKey=&StrLayoutCode=HIERARCHIC, last downloaded 02-08-16.

EUROSTAT (2010): Environmental statistics and accounts in Europe. Luxembourg.

EUROSTAT (2011): GISCO population grid. Population Distribution / Demography. Online: http://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/population-distribution-demography, last downloaded 16-08-16.

EUROSTAT (2014): Development Report 2014 - Indicators of Slovenian development. Energy intensity. EUROSTAT.

EUROSTAT (2015a): Agri-environmental indicator - High Nature Value farmland. Online: http://ec.europa.eu/eurostat/statistics-explained/index.php/Agri-environmental_indicator_-_High_Nature_Value_farmland, last downloaded 16-08-16.

EUROSTAT (2015b): At risk of poverty rate by poverty threshold, age and sex - EU-SILC survey. Online: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_li02&lang=en, last downloaded 02-08-16.

EUROSTAT (2015c): Biodiversity statistics. Online: http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Biodiversity_statistics&oldid=270283, last downloaded 18-08-16.

EUROSTAT (2015d): Early estimates of CO2 emissions from energy use In 2014, CO2 emissions in the EU estimated to have decreased by 5% compared with 2013. Online: http://europa.eu/rapid/press-release_STAT-15-5183_en.htm, last downloaded 20-07-16.

EUROSTAT (2015e): Employment and activity by sex and age - annual data. Online: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsi_emp_a&lang=en, last downloaded 02-08-16.

EUROSTAT (2015f): Eurostat database, environment. Online: http://ec.europa.eu/eurostat/data/database, last downloaded 10-12-15.

EUROSTAT (2015g): Organisations and sites with eco-management and audit scheme (EMAS) registration. Online: http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=de&pcode=tsdpc410&plugin=1, last downloaded 20-07-16.

EUROSTAT (2015h): Population by educational attainment level, sex and age (%) - main indicators. Online: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=edat_lfse_03&lang=en, last downloaded 02-08-16.

EUROSTAT (2015i): Statistical book. Sustainable development in the European Union. 2015 monitoring report of the EU Sustainable Development Strategy.

EUROSTAT (2016a): Early estimates of CO2 emissions from energy use In 2015. CO2 emissions in the EU estimated to have slightly increased compared with 2014. In: *PressRelease* 89/2016.

EUROSTAT (2016b): Glossary: Material flow indicators. Online: http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Material_flow_indicators, last downloaded 16-08-16.

EUROSTAT (2016c): History of NUTS. Online: http://ec.europa.eu/eurostat/web/nuts/history, last downloaded 16-08-16.

EUROSTAT (2016d): Material flow accounts and resource productivity. Online: http://ec.europa.eu/eurostat/statistics-explained/index.php/Material_flow_accounts_and_resource_productivity, last downloaded 16-08-16.

Federal office for the Environment, Schweizer Bundesamt für Umwelt (BAFU) (2015): Switzerland's Greenhouse Gas Inventory 1990-2013. National Inventory Report Including reporting elements under the Kyoto Protocol. Bern. Online: http://www.bafu.admin.ch/klima/13879/13880/14487/index.html?lang=de, last downloaded 11-08-16.

Federparchi (2016): Prodotti tipici nei Parchi. Online: http://www.parks.it/prodotti.tipici/prodotti.php, last downloaded 02-08-16.

Fondazione Symbola & Unioncamere (2015): Green Italy. La Sfida del Futuro. Rapporto 2015. Online: http://www.symbola.net/assets/files/rapportogreenitaly2015%20BASSA_1447064245.pdf, last downloaded 11-08-16.

Food and Agriculture Organization of the United Nations (FAO) (2011): Global food losses and food waste. Extent, causes and prevention.

Franke, H. (2015): Liechtenstein sieht sich auf Kurs. Inland. In: *Volksblatt*, 21-10-15.

German Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) (2012): German Resource Efficiency Programme (ProgRess). Programme for the sustainable use and conservation of natural resources. First edition.

Gesellschaft für Ökologische Zusammenarbeit (GTZ) (2001): Nachhaltiger Tourismus Tourismus und nachhaltige Entwicklung. Online: https://www.giz.de/fachexpertise/downloads/de-tourismus-themenblatt.pdf, last downloaded 16-08-16.

Gestore Servizi Energetici (GSE) (2015): Rapporto Attività 2015.

Gouvernement France (2015): Adoption of the national low-carbon strategy for climate. Online: http://www.gouvernement.fr/en/adoption-of-the-national-low-carbon-strategy-for-climate, last downloaded 18-08-16.

greenAlps (2014a): Connecting Mountains, People, Nature. Shaping the framework for an efficient European Biodiversity policy for the Alps.

greenAlps (2014b): The EU biodiversity policy landscape. Existing policies and their perceived relevance and impact in key sectors in the Alpine region.

Gret-Regamey, A.,Kienast, F.,Rabe, S.-E. & Singer, C. (2014): Machbarkeitsabklärung. Datenverfügbarkeit für ein Mapping der Ökosystemleistungen in der Schweiz. Studie im Auftrag des Bundesamtes für Umwelt.

H. C. von Carlowitz (1713): Sylvicoltura oeconomica; H. Cotta early 19th century. Freiberg.

Hastik, R.,Basso, S.,Geitner, C.,Haida, C.,Poljanec, A.,Portaccio, A.,Vrščaj, B. & Walzer, C. (2015): Renewable energies and ecosystem service impacts. In: *Renewable and Sustainable Energy Reviews* 48, pp. 608–623.

Heimann, D.,Franceschi, M. de,Emeis, S.,Lercher, P.,Seibert, P. & ALPNAP Lenkungsgruppe (2007): Leben an der Transitroute. Luftverschmutzung Lärm und Gesundheit in den Alpen ALPNAP. In: *Trento*.

Höhne, N.,Hagemann, M.,Moltmann, S. & Escalante, D. (2011): Consistency of policy instruments. How the EU could move to a -30 % GHG emission reduction target.

Hoppichler, J. (2013): Vom Wert der Biodiversität. Wirtschaftliche Bewertungen und Konzepte für das Berggebiet. Forschungsbericht 67.

Hunnius, Y. von (2015): Landscape: a plus for holidays in Switzerland. Online: https://www.gruenewirtschaft.admin.ch/grwi/de/home/Gruene_Wirtschaft_konkret/Landschaft-als-Pluspunkt-fuer-Ferien-in-der-Schweiz.html, last downloaded 26-01-16.

Institute for Macroeconomic Analysis and Development of the Reupublic of Slovenia (IMAD) (2015): Development report 2015.

Instituto nazionale di statistica (ISTAT) (2016): I.Stat. Prodotto interno lordo lato produzione - dati territoriali (milioni di euro). Online: http://dati.istat.it/Index.aspx?DataSetCode=DCCN_PILPRODT, last downloaded 02-08-16.

Instituto nazionale di statistica (ISTAT) & noi italia (2015): Greenhouse gas emissions. Online: http://noi-italia2015.istat.it/index.php?id=7&L=1&user_100ind_pi1[id_pagina]=166&cHash=d716b254e34bd0f3ce0be80603a1ec88, last downloaded 02-08-16.

Instituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA) (2016): Italian Greenhouse Gas Inventory 1990-2014. National Inventory Report. In: *Rapporti 239/2016*.

Instituto Superiore per la Ricerca Ambientale (ISPRA) (2015a): Il consumo di suolo in Italia.

Instituto Superiore per la Ricerca Ambientale (ISPRA) (2015b): Rapporto rifiuti urbani.

Intergovernmental Panel on Climate Change (IPCC) (2007): Climate Change 2007. The Physical Science Basis.

Intergovernmental Panel on Climate Change (IPCC) (2013): Climate Change 2013: The Physical Science Basis.

International Commission for the Protection of the Alps Germany (CIPRA Deutschland) (2013): Naturverträgliche Umsetzung der Energiewende in den bayerischen Alpen. Online: http://www.cipra.org/de/positionen/119, last downloaded 19-01-16.

International Commission for the Protection of the Alps (CIPRA) (2011): Tourismus im Klimawandel. Ein Hintergrundbericht der CIPRA. Herausforderungen für die Tourismusforschung. In: *Compact* 01/2011. DOI: 10.1515/tw-2011-0203.

International Commission for the Protection of the Alps (CIPRA) (2015): Climate change mitigation now! An appeal from the Alpine municipalities and their inhabitants to the participants of COP 21.

International Energy Agency (IEA) (2013): Energy Policies of IEA Countries. Germany. 2013 Review. OECD/IEA reports.

International Energy Agency (IEA) (2014a): Capturing the Multiple Benefits of Energy Efficiency.

International Energy Agency (IEA) (2014b): Energy Policies of IEA Countries. Austria. 2014 Review.

International Energy Agency (IEA) (2016): Energy Efficiency Policies and Measures Database. Online: http://www.iea.org/policiesandmeasures/energyefficiency/?country=Germany, last downloaded 16-08-16.

International Labour Organization (ILO) (2012): Working towards sustainable development: Opportunities for decent work and social inclusion in a green economy.

International Renewable Energy Agency (IRENA) (2015): Remap 2030. A renewable Energy roadmap, Renewable Energy prospects: Germany.

International Union for Conservation of Nature (IUCN) (2008): Guidelines for applying protected area management categories. Ed. Dudley, Nigel. Gland.

Jacobs, M. & Bassi, S. (2012): Less pain, more gain: the potential of carbon pricing to reduce Europe’s fiscal deficits. LSE, Granthzam Research Institute on climate change and the Environment. Online:

http://www.lse.ac.uk/GranthamInstitute/publication/less-pain-more-gain-the-potential-of-carbon-pricing-to-reduce-europes-fiscal-deficits/, last downloaded 02-08-16.

Jessel, B.,Tschimpke, O. & Walser M. (2009): Produktivkraft Natur.

Job, H. (2008): Estimating the Regional Economic Impact of Tourism to National Parks: Two Case Studies from Germany. In: *GAIA: 17/S1*, pp. 134–142.

Job, H. (2015): Regionalwirtschaftliche Effekte von Tourismus. Integration in das Nationalpark-Monitoring; Endbericht zur Fallstudie Nationalpark Berchtesgaden.

Job, H.,Woltering, M. & Harrer, B. (2009): Regionalökonomische Effekte des Tourismus in deutschen Nationalparken.

Joint Research Centre (JRC) (2014a): EDGAR database CH4 time series 1990-2014. Online: http://edgar.jrc.ec.europa.eu/part_CH4.php, last downloaded 02-08-16.

Joint Research Centre (JRC) (2014b): EDGAR database CO2 time series 1990-2014 from fossil fuel use and cement production. Online: http://edgar.jrc.ec.europa.eu/overview.php?v=CO2ts1990-2013, last downloaded 02-08-16.

Joint Research Centre (JRC) (2014c): Trends in global CO2 emissions 2014 Report. Background studies. PBL Netherlands Environmental Assessment Agency.

Joint Technical Secretariat (JTS) (2013): Strategy development for the Alpine Space 2014+. Results of an inclusive dialogue process.

Joosten, H.,Brust, K.,Couwenberg, J.,Gerner, A.,Holsten, B.,Permien, T.,Schäfer, A.,Tanneberger, F.,Trepel, M. & Wahren, A. (2015): MoorFutures. Integration of additional ecosystem services (including biodiversity) into carbon credits. Standards, methodology and transferability to other regions (BfN Skripten, 407).

Köllner, T.,Poppenborg, P. & Sommer, L. (2014): Überblick ökonomische Bilanzierung von Ökosystemleistungen in Deutschland. In: TEEB-Deutschland Übersichtsstudie. Teil A. Bilanzierung von Ökosystemleistungen. Forschungsvorhaben 3510 81 0500 im Auftrag des Bundesamtes für Naturschutz. ifuplan Institut für Umweltplanung (ifuplan), München; ETH-Zürich, Institut für Raum und Landschaftsentwicklung; Universität Bayreuth, Lehrstuhl für Ökosystemleistungen.

Kosonen, K. & Nicodème, G. (2009): The Role of Fiscal Instruments in Environmental Policy. CESIFO WORKING PAPER NO. 2719CATEGORY 10: ENERGY AND CLIMATE ECONOMICS. Online: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1437501, last downloaded 16-08-16.

Kraxner, F.,Leduc, S. & Serrano León, H. (2015): Recommendations and lessons learned for a renewable energy strategy in the Alps. Balancing Alpine Energy and Nature.

KSG (2011): Österreichisches Bundesgesetz zur Einhaltung von Höchstmengen von Treibhausgasemissionen und zur Erarbeitung von wirksamen Maßnahmen zum. Klimaschutzgesetz. Fundstelle: StF: BGBl. I Nr. 106/2011, mit Änderungen BGBl. I Nr. 94/2013, BGBl. I Nr. 128/2015.

Landesverwaltung Fürstentum Liechtenstein, Amt für Statistik (2014): Umweltstatistik. Online: http://www.llv.li/#/12176, last downloaded 02-08-16.

Landesverwaltung Fürstentum Liechtenstein, Rechtsdienst der Regierung (RDR) (2008): Liechtensteinisches Landesgesetzblatt Nr. 199 vom 29.05.2008. Environmental Protection Act (Umweltschutzgesetz). USG. Landesverwaltung Fürstentum Liechtenstein, Rechtsdienst der Regierung (RDR). Online: https://www.gesetze.li/lilexprod/lgsystpage2.jsp?formname=showlaw&lgblid=2008199000&version=5&search_text=Umweltschutzgesetz&search_loc=text&sel_lawtype=conso&compl_list=1&rechts_gebiet=0&menu=0&tablesel=0&observe_date=02.08.2016, last downloaded 02-08-16.

Landesverwaltung Fürstentum Liechtenstein, Rechtsdienst der Regierung (RDR) (2012): Liechtensteinisches Landesgesetzblatt vom 19.09.2012. Emissions Trading Act (Emissionshandelsgesetz). EHG. Online: https://www.gesetze.li/lilexprod/lgsystpage2.jsp?formname=showlaw&lgblid=2012346000&version=1&search_text=Emissionshandel&search_loc=text&sel_lawtype=conso&compl_list=1&rechts_gebiet=0&menu=0&tablesel=0&observe_date=02.08.2016, last downloaded 02-08-16.

Lueckge, H.,Heldstab, J.,Cavallo, F.,Muscella, C.,Vivier, S.,Kistler, R. & Joos-Widmer, N. (2016): MONITRAF. Annual Report 2015.

Maes, J.,Braat, L.,Jax, M.,Hutchins, M.,Furman, E.,Termansen, M.,Luque, S.,Paracchini, M. L.,Chauvin, C.,Williams, R.,Volk, M.,Lautenbach, S.,Kopperoinen, L.,Schelhaas, M.-J.,Weinert, J.,Goossen, M.,Dumont, E.,Strauch, M.,Görg, C.,Dormann, C.,Katwinkel, M.,Zulian, G.,Varjopuro, R.,Ratamäki, O.,Hauck, J.,Forsius, M.,Hengeveld, G.,Perez-Soba, M.,Bouraoui, F.,Scholz, M.,Schulz-Zunkel, C.,Lepistö, A.,Polishchuk, Y. & Bidoglio, G. (2011): A spatial assessment of ecosystem services in Europe: methods, case studies and policy analysis - phase 1 (PEER Report No 3.).

Maes, J.,Liquete, C.,Teller, A.,Erhard, M.,Paracchini, M. L.,Barredo, J. I.,Grizzetti, B.,Cardoso, A.,Somma, F.,Petersen, J.-E.,Meiner, A.,Gelabert, E. R.,Zal, N.,Kristensen, P.,Bastrup-Birk, A.,Biala, K.,Piroddi, C.,Egoh, B.,Degeorges, P.,Fiorina, C.,Santos-Martín, F.,Naruševičius, V.,Verboven, J.,Pereira, H. M.,Bengtsson, J.,Gocheva, K.,Marta-Pedroso, C.,Snäll, T.,Estreguil, C.,San-Miguel-Ayanz, J.,Pérez-Soba, M.,Grêt-Regamey, A.,Lillebø, A. I.,Malak, D. A.,Condé, S.,Moen, J.,Czúcz, B.,Drakou, E. G.,Zulian, G. & Lavalle, C.: An indicator framework for assessing ecosystem services in support of the EU Biodiversity Strategy to 2020. In: Ecosystem Services, Bd. 17, pp. 14–23.

Manahan, S. E. (2006): Environmental Science and Technology – A sustainable Approach to Green Science and Technology. Second edition.

Marzelli, S.,Gret-Regamey, A.,Köllner, T.,Moning, C.,Rabe, S.-E.,Daube, S.,Poppenborg, P.,Riedel, M.,Sommer, L.,Szücs, L. & Moos, V. (2014): TEEB-Deutschland Übersichtsstudie. Teil A. Bilanzierung von Ökosystemleistungen. Forschungsvorhaben 3510 81 0500 im Auftrag des Bundesamtes für Naturschutz. ifuplan Institut für Umweltplanung (ifuplan), München; ETH-Zürich, Institut für Raum und Landschaftsentwicklung; Universität Bayreuth, Lehrstuhl für Ökosystemleistungen.

Mayer, M.,Müller, M.,Woltering, M.,Arnegger, J. & Job, H. (2010): The economic impact of tourism in six German national parks. In: *Landscape and Urban Planning* 97 (2), pp. 73–82. DOI: 10.1016/j.landurbplan.2010.04.013.

Metzler, D. & Job, H. (2003): Regionalökonomische Effekte des Tourismus im Nationalpark Berchtesgaden 45, pp. 29–46.

Millenium Ecosystem Assessment (MEA) (2005): Ecosystems and Human Well-being. Synthesis.

Ministerio dell´ambiente e della tutela del territorio (MATTM) (2002): Environmental Action Strategy for Sustainable Development.

Ministero Dell´Ambiente (2013): Parchi Nazionali: dal capitale natural alla contabilita ambientale.

Ministero Dell´Ambiente & Fondatione per lo Sviluppo Sostenible (2015): La Carta di Roma e i Parchi Nazionali | Primo rapporto sulle sinergie tra Capitale Naturale e Capitale Culturale. Primo rapporto sulle sinergie tra Capitale Naturale e Capitale Culturale. Online: http://www.minambiente.it/sites/default/files/archivio/allegati/biodiversita/capitale_culturale_nei_parchi_nazionali.pdf.

Ministero dell'ambiente e della tutela del territorio e del Mare (MATTM) (2009): Definizione del metodo per la classificazione e quantificazione dei servizi ecosistemici in Italia.

Ministero dell'ambiente e della tutela del territorio e del Mare (MATTM) (2010): Strategia Nazionale per la Biodiversità.

Ministero dell’ambiente e della tutela del territorio e del Mare (MATTM) (2011-2015): Programma per la valutazione dell’impronta ambientale. Online: http://www.minambiente.it/pagina/impronta-ambientale, last downloaded 29-07-16.

Ministero dell’ambiente e della tutela del territorio e del Mare (MATTM) (2013): Parchi Nazionali: dal capitale naturale alla contabilità ambientale.

Ministero dell’ambiente e della tutela del territorio e del Mare (MATTM) & Italia Ministero dell’Istruzione Universitá e Ricerca (MIUR) (2014): Linee guida sull’educazione ambientale MATTM/MIUR. Roma.

Ministero dell’ambiente e della tutela del territorio e del Mare (MATTM) & Unioncamere (2015): L’economia reale nei parchi nazionali e nelle aree naturali protette. Fatti, cifre e storie della Green Economy. Rapporto 2014. Ministero dell’Ambiente e della tutela del territorio e del Mare, Unioncamere.

MIUR – Ministero dell’Istruzione Universitá e Ricerca (2011): Accordo di programma - Affermazione in Edolo del Centro di Eccellenza "Università della Montagna" (Ufficio III Prot. n. 1293 del 05/08/2011).

Mobility Carsharing: Homepage Mobility Carsharing. Online: https://www.mobility.ch/de/privatkunden/, last downloaded 18-08-16.

MunichRe (2014): Overall picture of natural catastrophes in 2013 dominated by weather extremes in Europe and Supertyphoon Haiyan. Munich. Online: http://www.preventionweb.net/news/view/36161, last downloaded 23-01-16.

National Energy Efficiency Action Plans (NEEAP) (2007): First NEEAP submitted by 30 June 2007. Online: https://ec.europa.eu/energy/en/content/first-neeaps-submitted-30-june-2007, last downloaded 22-07-16.

National Energy Efficiency Action Plans (NEEAP) (2014): National Energy Efficiency Action Plans and Annual Reports of 2014 and 2016. Online: https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive/national-energy-efficiency-action-plans, last downloaded 22-07-16.

Office of the Environment (2013): Liechtenstein´s Greenhouse Gas Inventory 1990-2011. National Inventory Report.

Olschewski, R.,Bebi, P.,Teich, M.,Wissen Hayek, U. & Grêt-Regamey, A. (2012): Avalanche protection by forests — A choice experiment in the Swiss Alps. In: *Forest Policy and Economics* 15, pp. 108–113. DOI: 10.1016/j.forpol.2011.10.002.

Operationalisation of Natural Capital and Ecosystem Services (OpenNESS) (2016): Case 15: Multipurpose wetland construction and landstcape restoration in a peri-urban area. Case Gorla Maggiore in northern Italy. Online: http://www.openness-project.eu/node/41, last downloaded 22-07-16.

Organisation for Economic Co-operation and Development (OECD) (2001): Glossary of statistical terms. Natural capital. Online: https://stats.oecd.org/glossary/detail.asp?ID=1730, last downloaded 16-08-16.

Organisation for Economic Co-operation and Development (OECD) (2007): Climate change in the European Alps. Adapting winter tourism and natural hazards management. Paris: Organisation for Economic Co-operation and Development.

Organisation for Economic Co-operation and Development (OECD) (2008): Climate change mitigation. What do we do?

Organisation for Economic Co-operation and Development (OECD) (2012a): OECD Environmental Performance Reviews: Germany 2012.

Organisation for Economic Co-operation and Development (OECD) (2012b): The Jobs Potential of a Shift towards a low-carbon Economy.

Organisation for Economic Co-operation and Development (OECD) (2013): OECD Framework for Statistics on the Distribution of Houshold Income, Consumption and Wealth.

Organisation for Economic Co-operation and Development (OECD) (2016): Better Life Initiative: Measuring Well-Being and Progress. Online: http://www.oecd.org/statistics/better-life-initiative.htm, last downloaded 18-08-16.

Österreichische Strategie Nachaltige Entwicklung (ÖSTRAT) (2010): Nachhaltigkeitsstrategie des Bundes und der Länder.

Österreichisches Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) (2010): Budget 2009/2010.

Österreichisches Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (BMLFUW) (2002): Die österreichische Klimastrategie.

Österreichisches Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (BMLFUW) (2007): Die nationale Klimastrategie Österreichs.

Österreichisches Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (BMLFUW) (2011): Federal Waste Management Plan 2011. Volume 1.

Österreichisches Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (BMLFUW) (2012): Ressourceneffizienz Aktionsplan (REAP). Wegweiser zur Schonung natürlicher Ressourcen.

Paracchini, M. L.,Petersen, J. E.,Hoogeveen, Y.,Bamps, C.,Burfield, I. & van Swaay, C. (2008): High nature value farmland in Europe. An estimate of the distribution patterns on the basis of land cover and biodiversity data. JRC Scientific and Technical Reports EUR, 23480.

Permanent Secretariat of the Alpine Convention (PSAC) (2007): Report on the State of the Alps. Alpine Signals. Special edition 1. Transport and Mobility in the Alps.

Permanent Secretariat of the Alpine Convention (PSAC) (2009): Water and Water Management Issues, Report on the State of the Alps. Alpine Signals. Special edition 2.

Permanent Secretariat of the Alpine Convention (PSAC) (2010): The Alpine Convention- Reference guide; Alpine Signals Special 1.

Permanent Secretariat of the Alpine Convention (PSAC) (2011): Alpine signals 6. Towards decarbonising the alps. National policies and strategies, regional initiatives and local actions.

Permanent Secretariat of the Alpine Convention (PSAC) (2013): Report on State of the Alps 4 – Sustainable tourism in the Alps.

Permanent Secretariat of the Alpine Convention (PSAC) (2014): 1st report 2013-2014 of the Working Group “Mountain Forests” of the Alpine Convention:

Permanent Secretariat of the Alpine Convention (PSAC) (2015a): Demographic Changes in the Alps. Report on the state of the Alps. Innsbruck, Bozen.

Permanent Secretariat of the Alpine Convention (PSAC) (2015b): Guidelines for climate change adaptation at the local level in the Alps.

Philipp, T. (2013): Recent heat flow in the Alps. Geothermal energy.

Privacy Policy (2015): Business & Finance.

Pronatura Zentrum Aletsch (2015): Ein Gletscher kommt ins Schwitzen. Online: http://www.pronatura-aletsch.ch/klimaerwaermung, last downloaded 21-07-16.

Recharge Green (2015): Renewable Energy and Ecosystem Services in the Alps. Status quo and trade-off between renewable energy expansion and ecosystem services valorization. EURAC Research.

Regione Piemonte,Regione Autonoma Vallee d´Aosta,Region Emilia Romagna & Regione Veneto (2012): Agenda di Bologna 27.01.2012. Tavolo interregionale per lo sviluppo territoriale sostenibile dellárea Padano-Alpino-Maritima.

Regions for Sustainable Change (2011): Handbook - Tackling climate change by shifting to a low-carbon economy. Online: www.rscproject.org/indicators/index.php?page=tackling-climate-change-by-shifting-to-a-low-carbon-economy, last downloaded 20-07-16.

Regiosuisse, N. R. (2011): Analyse der Wirtschaftsbranchen nach Raumtypen.

Republic of Slovenia Statistical Office (2015): European Week for Waste Reduction 2015: Waste reduction, reuse and recycling in Slovenia. Online: http://www.stat.si/StatWeb/en/show-news?id=5580&idp=13&headerbar=8, last downloaded 16-08-16.

Republika Slovenija Ministrstvo za Gospodarski Razvoj in Tehnologijo (MGRT) (2012): Akcijski načrt za povečanje konkurenčnosti gozdno-lesne verige v sloveniji do leta 2020. "Les Je Lep".

Republika Slovenija Ministrstvo za Kmetijstvo, Gozdarstvo in Prehrano (MKGP) (2014): Učinkovita raba virov. Na poti k akcijskemu načrtu, Slovenije.

Republika Slovenija Ministrstvo za okolje in prostor (MOP) (2016): Prvo letno poročilo o izvajanju Operativnega programa ukrepov zmanjšanja emisij toplogrednih plinov do leta 2020.

Republika Slovenija Ministrstvo za okolje in prostor (MOP),Agencija Republika Slovenije za okolje (ARSO) & Kazalci okolja v Sloveniji (KOS) (2016): EN30 Proizvodnja in raba električne energije, ENGIS. Dravske elektrarne Maribor, Savske elektrarne Ljubljana, Soške elektrarne Nova Gorica.

Republika Slovenija Statistični urad RS (SURS) (2015): Odrasli, ki so končali izobraževanje, po spolu, vrsti programa, področju programa, statistična regija, Slovenija, letno. Online: http://pxweb.stat.si/pxweb/Database/Dem_soc/09_izobrazevanje/07_srednjesol_izobraz/03_09530_kon_sol_leta_odrasli/03_09530_kon_sol_leta_odrasli.asp, last downloaded 02-08-16.

Rockström, J.,Steffen, W.,Noone, K.,Persson, A.,Chapin, F. S.,Ill,Lambin, E. F.,Lenton, T. M.,Scheffer, M.,Folke, C.,Schellnhuber, H. J.,Nykvist, B.,Wit, C. A. de,Hughes, T.,van der Leeuw, S.,Rodhe, H.,Sörlin, S.,Snyder, P. K.,Costanza, R.,Svedin, U.,Falkenmark, M.,Karlberg, L.,Corell, R. W.,Fabry, V. J.,Hansen, J.,Walker, B.,Liverman, D.,Richardson, K.,Crutzen, P. & Foley, J. A. (2009): A safe operating space for humanity. In: *Nature* 24 (461), pp. 472–475.

Schirpke, U.,Leitinger, G.,Tasser, E.,Schermer, M.,Steinbacher, M. & Tappeiner, U. (2013): Multiple ecosystem services of a changing Alpine landscape. Past, present and future. In: *International Journal of Biodiversity Science, Ecosystem Services & Management* 9 (2), pp. 123–135. DOI: 10.1080/21513732.2012.751936.

Schmidt, M. & Schneider, M. (2010): Kosteneinsparungen durch Ressourceneffizienz in produzierenden Unternehmen (UmweltWirtschaftsForum).

Schweizer Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation (UVEK) & Schweizer Eidgenössisches Volkswirtschaftsdepartement (EVD) (2011): Masterplan Cleantech. Eine Strategie des Bundes für Ressourceneffizienz und erneuerbare Energien. Online: https://www.cleantech.admin.ch/cleantech/de/home/ueber-cleantech/cleantech-strategie-des-bundes.html, last downloaded 02-08-16.

Schweizerische Eidgenossenschaft (2009): Arealstatistik Fürstentum Liechtenstein 1984 – 1996 – 2002 – 2008. Online: http://www.llv.li/files/abi/pdf-llv-slp-arealstatistik_fl_resultate_84_96_02_08.pdf, last downloaded 16-08-16.

Schweizerische Eidgenossenschaft (2014): Ressourcenverbrauch und Auswirkungen auf die Umwelt. Online: http://www.bfs.admin.ch/bfs/portal/de/index/themen/21/02/ind32.indicator.72205.3211.html, last downloaded 02-08-16.

Schweizerische Eidgenossenschaft (2015): Activity report of the Energy Platform for the years 2013 - 2014. Federal Department of the Environment, Transport, Energy and Communication DETEC, Federal Office for Spatial Development ARE.

Schweizerische Eidgenossenschaft (BFS) (2011): Federal Act on the Reduction of CO2 Emissions. Chapter 3: Sinks. Online: https://www.admin.ch/opc/en/classified-compilation/20091310/index.html#id-ni4, last downloaded 18-08-16.

Schweizerische Eidgenossenschaft (BFS) (2014): Standard of living, social situation and poverty – Data, indicators - Poverty. Online: http://www.bfs.admin.ch/bfs/portal/en/index/themen/20/03/blank/key/07/01.html., last downloaded 16-08-16.

Schweizerische Eidgenossenschaft (BFS) (2015a): Core indicator Recycling rate. Online: http://www.bafu.admin.ch/umwelt/indikatoren/08484/08653/index.html?lang=en, last downloaded 16-08-16.

Schweizerische Eidgenossenschaft (BFS) (2015b): Pärke von nationaler Bedeutung. Online: http://www.bafu.admin.ch/landschaft/14534/15821/15839/index.html?lang=de, zuletzt aktualisiert am 2015, last downloaded 18-08-16.

Schweizerische Eidgenossenschaft (BFS) (2016a): Arbeitslosigkeit, offene Stellen – Detaillierte Daten - Detaillierte Ergebnisse der SAKE. Online: http://www.bfs.admin.ch/bfs/portal/de/index/themen/03/03/blank/data/02.html, last downloaded 16-08-16.

Schweizerische Eidgenossenschaft (BFS) (2016b): Arealstatistik der Schweiz. Online: http://www.bfs.admin.ch/bfs/portal/de/index/infothek/erhebungen__quellen/blank/blank/arealstatistik/02/04.html, last downloaded 16-08-16.

Schweizerische Eidgenossenschaft (BFS) (2016c): Energy efficiency technologies. Online: http://www.bfe.admin.ch/themen/00507/05399/index.html?lang=en, last downloaded 18-08-16.

Schweizerische Eidgenossenschaft (BFS) (2016d): Forstwirtschaft – Detaillierte Daten - Waldflächen und Holzvorrat. Online: http://www.bfs.admin.ch/bfs/portal/de/index/themen/07/04/blank/data/01.html, last downloaded 16-08-16.

Schweizerische Eidgenossenschaft (BFS) (2016e): Nachhaltige Entwicklung - MONET Energie und Klima - Erneuerbare Energie. Online: http://www.bfs.admin.ch/bfs/portal/de/index/themen/21/02/ind32.indicator.72505.3211.html, last downloaded 16-08-16.

Schweizerische Eidgenossenschaft (BFS) (2016f): Statistisches Lexikon. Online: http://www.bfs.admin.ch/bfs/portal/de/index/themen/08/22/lexi.html, last downloaded 16-08-16.

Schweizerische Eidgenossenschaft (BFS) (2016g): Strategie Biodiversität Schweiz und Aktionsplan. Online: http://www.bafu.admin.ch/biodiversitaet/13721/14385/15120/index.html?lang=de., last downloaded 18-08-16.

Schweizerische Eidgenossenschaft (BFS) (2016h): Topic Waste. Online: http://www.bafu.admin.ch/abfall/index.html?lang=en, last downloaded 16-08-16.

Služba Vlade Republike Slovenije za razvoj in evropsko kohezijsko politiko (SVRK) (2015): Slovenska Strategija Pametne Specializacije. S4.

SOIA (2016): WebGIS Alpine Convention. Alpine Convention (AC). Online: http://webgis.alpconv.org/, last downloaded 16-08-16.

Stadtwerke München (SWM) (2016): M-Wasser - Erstklassiges Naturprodukt direkt von der Quelle.

Statistics Austria (2015): Environmental Goods and Services Sector (EGSS). On behalf of BMLFUW. Online: http://www.statistik.at/web_en/statistics/EnergyEnvironmentInnovationMobility/energy_environment/environment/eco_industries_environmentally_goods_and_services/index.html, last downloaded 02-08-16.

Statistische Ämter der Bundes und der Länder (2016): Armut und soziale Ausgrenzung. Online: http://www.amtliche-sozialberichterstattung.de/A1armutsgefaehrdungsquoten.html, last downloaded 18-08-16.

Staub, C.,Ott, W.,Hausi, F.,Klinger, G.,Jenny, A.,Häcki, M. & Hauser, A. (2011): Indikatoren für Ökosystemleistungen. Systematik Methodik und Umsetzungsempfehlungen für eine wohlfahrtsbezogene Umweltberichterstattung. In: *Umwelt-Wissen 1102*, 2011.

Stern-Report (2007): Stern Review: The Economics of Climate Change.

Svadlenak-Gomez, K.,Badura, M.,Kraxner, F.,Fuss, S.,Vettorato, D. & Walzer, C. (2013): Valuing Alpine ecosystems: the recharge. green project will help decision-makers to reconcile renewable energy production and biodiversity conservation in the Alps. Preprinted. In: *eco. mont-Journal on Protected Mountain Areas Research* 5 (1), pp. 21–28. DOI: 10.1890/080025.

Swiss Confederation (2012): Das Potenzial der erneuerbaren Energien bei der Elektrizitätsproduktion - Bericht des Bundesrates an die Bundesversammlung nach Artikel 28b Absatz 2 des Energiegesetzes. Swiss Confederation.

Swiss Confederation,Bundesamt für Raumentwicklung (ARE),Energy Platform Presidency & Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation (UVEK) (2015): Background report of the Alpine Convention Energy Platform.

Swiss Ferderal Statistical Office (FSO) (2016): Sustainable Development - MONETDecoupling - Material consumption. Online: http://www.bfs.admin.ch/bfs/portal/en/index/themen/21/02/ind9.indicator.73017.906.html, last downloaded 31-05-16.

Swiss Recycling (2016): Homepage of Swiss recycling. Online: http://www.swissrecycling.ch/, last downloaded 18-08-16.

Tappeiner, U.,Borsdorf, A. & Tasser, E. (2008): Mapping the Alps. Society – Economy – Environment (Spektrum).

Terna (2014): Dati statistici sull´energia elettrica in Italia. Online: https://www.terna.it/it-it/sistemaelettrico/statisticheeprevisioni/datistatistici.aspx, last downloaded 02-08-16.

The 2007 Finance Act (296/2006): Italia: Legge 27 dicembre 2006, n. 296. Disposizioni per la formazione del bilancio annuale e pluriennale dello Stato (finanziaria 2007). G.U. n. 299 del 27 dicembre 2006, s.o. n. 244. Online: http://www.parlamento.it/parlam/leggi/06296l.htm, last downloaded 02-08-16.

The Economics of Ecosystems and Biodiversity, Naturkapital Deutschland (TEEB Germany) (2012): Der Wert der Natur für Wirtschaft und Gesellschaft. Eine Einführung. Ein Beitrag Deutschlands zum internationalen TEEB-Prozess.

The Economics of Ecosystems and Biodiversity, Naturkapital Deutschland (TEEB Germany) (2013): Die Unternehmensperspektive. Auf neue Herausforderungen vorbereitet sein.

The Economics of Ecosystems and Biodiversity, Naturkapital Deutschland (TEEB Germany) (2016a): Ökosystemleistungen im ländlichen Raum. Grundlage für menschliches Wohlergehen und nachhaltige wirtschaftliche Entwicklung.

The Economics of Ecosystems and Biodiversity, Naturkapital Deutschland (TEEB Germany) (2016b): Ökosystemleistungen in der Stadt. Gesundheit schützen und Lebensqualität erhöhen.

The Economics of Ecosystems and Biodiversity (TEEB) (2010): Ecological and Economic Foundations. Chapter 5: The economics of valuing ecosystem services and biodiversity.

The European Monitoring and Evaluation Programme (EMEP) (2016): Definitions, statistics used. Online: http://www.emep.int/mscw/SR_data/definitions.pdf, last downloaded 16-08-16.

Umweltbundesamt Deutschland (UBA Germany) (2012): Glossar zum Ressourcenschutz.

Umweltbundesamt Deutschland (UBA Germany) (2015a): Green Economy: an Engine for Development? (45/2015).

Umweltbundesamt Deutschland (UBA Germany) (2015b): Rebound-Effekte. Ihre Bedeutung für die Umweltpolitik (31/2015).

Umweltbundesamt Deutschland (UBA Germany) (2016): GHG emissions in Germany from 1990-2015 by sources and emission reduction targets to 2020 and 2030.

Umweltbundesamt Österreich (UBA Austria) (2013): GHG Projections and Assessment of Policies and Measures in Austria.

Umweltbundesamt Österreich (UBA Austria) (2014): Bioabfallstrategie. Report REP-0483.

Umweltbundesamt Österreich (UBA Austria) (2015a): Emissionstrends 1990-2013. Ein Überblick über die österreichischen Verursacher von Luftschadstoffen (Datenstand 2015) (REPORT, REP-0543).

Umweltbundesamt Österreich (UBA Austria) (2015b): Österreich: Nationale Treibhausgas-Inventare 1990 bis 2013 und Zeitnahprognose für 2014.

Umweltbundesamt Österreich (UBA Austria) (2015c): Wirtschaftliche Bedeutung von Ökosystemleistungen. Monetäre Bewertung: Risiken und Potenziale. Report REP-0523.

Umweltbundesamt (UBA) (2015): Deutschlands Abfall. Online: https://www.umweltbundesamt.de/daten/abfall-kreislaufwirtschaft/abfallaufkommen, last downloaded 16-08-16.

Unioncamere,European Union (EU) & Ministero del Lavoro e delle Politiche Sociali (Lavoro) (2016): Sistema Informativo Excelsior. Online: http://excelsior.unioncamere.net/, last downloaded 11-08-16.

United Nations Development Programme (UNDP) (2007): Human Development Report 2007/2008. Fighting Climate Change: Human Solidarity in a Divided World. Basingstoke: Palgrave Macmillan Ltd (Human Development Report).

United Nations Environment Programme (UNEP) (2011a): Introduction. Setting the stage for a green economy transition.

United Nations Environment Programme (UNEP) (2011b): Towards a Green Economy. Pathways to Sustainable Development and Poverty Eraduction.

United Nations Environment Programme (UNEP) (2011c): Universal ownership - Why environmental externalities matter to institutional investors. UNEP Finance initiative. Online: http://www.unepfi.org/fileadmin/documents/universal_ownership_full.pdf, last downloaded 18-08-16.

United Nations Environment Programme (UNEP) (2015): Environmental limits and Swiss Footprints based on Planetary Boundaries. Online: http://pb.grid.unep.ch, last downloaded 20-07-16.

United Nations Environment Programme (UNEP),International Labour Organization (ILO),International Orgnisation of Employers (IOE) & International Trade Union Confederation (ITUC) (2008): Green Jobs. Towards decent work in a sustainable, low-carbon world. Nairobi.

United Nations Environmental Programme (UNEP) (2008): Green Jobs. Towards decent work in a sustainable, low-carbon world.

United Nations Framework Convention on Climate Change (UNFCCC) (2015): Adoption of the Paris Agreement FCCC/CP/2015/L.9/Rev.1.

United Nations (UN) (1992): Convention on Biological Diversity.

United Nations (UN) (1998): Kyoto Protocol to the United Nations framework Convention on Climate Change.

United Nations (UN) (2014): The Value of Forests. Payments for Ecosystems in a Green Economy. Geneva (ECE/TIM/SP/35).

University of Innsbruck (UIBK) (2011): CONHAZ. Report on Costs of Alpine Hazards.

(Metodi per la) Valutazione Integrata dell' Impatto Ambientale e Sanitario dell'inquinamento atmosferico (VIIAS) (2015): Home. Online: http://www.viias.it/, last downloaded 29-07-16.

Wegmann, M.,Merz, H. A. & Meierhans Steiner, K. (2007): Jährliche Aufwendungen für den Schutz vor Naturgefahren in dfer Schweiz. Projekt B1. Strategie Naturgefahren Schweiz. Umsetzung des Aktionsplans Nationale Plattform Naturgefahren (PLANAT) 2005 - 2008.

Weingartner, R.,Viviroli, D. & Greenwood, G. (2009): Mountain waters in a changing world. Alpine space Workshop. Global Change and Sustainable Development in Mountain Regions. In: *man & environment* 7.

WG EnvAlp (2014): Synthesis Report on the Environmental Legislation with a special focus on the Alpine Area. Synthesis and Country Information. Unpublished. Editor: Working Group on 'Environmental Indicators and the Impacts of Traffic Management Systems and other Measures on the Alpine Environment of the Zurich Process'.

Winkelmeier H. & Geistlinger, B. (2004): Development of information base regarding potentials and the necessary technical, legal and socio-economic conditions for expanding wind energy in the Alpine Space,. Alpine Windharvest Partnership Network Report No.A/I-2/3.1./5, 2004. (Alpine Windharvest Report Series).

Working Group Mountain Forests of the Alpine Convention (2014): 1st Report 2013-2014 of the Working Group "Mountain Forests" of the Alpine Convention. Working Group Mountain Forest.

Working Group Mountain Forests of the Alpine Convention (2016): Contribution of WG mountain forest for the RSA6.

World Health Organization (WHO) (2008): Health risks of ozone from long-range transboundary air pollution. Copenhagen.

World Health Organization (WHO) & Organisation for Economic Co-operation and Development (OECD) (2015): Economic cost of the health impact of air pollution in Europe. Clean air, health and wealth. Copenhagen.

6 Annex

6.1 Glossary

Adaptation

Adaptation are those objectives and measures directed at anticipating the adverse effects of climate change and preventing or minimizing the damage they can cause (PSAC 2011, p. 32-33).

Annual fellings

It means the average standing volume of all trees, living or dead, measured overbark to minimum diameter of 0 cm (diameter at breast height) that are felled during the given reference period, including the volume of trees or parts of trees that are not removed from the forest, other wooded land or other felling site. It includes silvicultural and pre-commercial thinnings and cleanings left in the forest; and natural losses that are recovered (harvested) (EEA 2010b).

Artificial surfaces

All land use classes within the “Artificial surfaces” in the CORINE Land uses nomenclature.

Background station

“Station to monitor background concentration levels of air polluting substances that are significant for a given region or for the globe as a whole. Regional stations are located far enough away from industry and urban areas in order not to pick up day-by-day fluctuations in pollution levels. The purpose is to measure long-term changes in the composition of the atmosphere”(EEA undated). For more information about station types cf. 2001/752/EC Annex II.

Biological diversity

Biological diversity (or in a short version biodiversity) means the multiplicity of life on earth. It ensures the variety of living organisms drawn from its ecological complexes. It includes the following three levels: 1) the diversity of ecosystems as well as cohabitations, habitats and landscapes 2) the diversity of species as well as 3) the genetic diversity within the different species. This is different from ecosystem services, which are generated with help of biodiversity (cf. chapter 2.3.2).

Biodiversity products

In the Alpine space, biodiversity is one main reason for nature experience as a basis for ecotourism or close to ecotourism. With biodiversity products we refer to specific products or services that are supporting eco – or close to ecotourism.

Carbon fiscal measures

Carbon fiscal measures are instruments such as tax instruments and subsidies levied on goods directly or indirectly linked to polluting activities (Kosonen & Nicodème 2009).

Decoupling

“Decoupling can take several forms:

- Relative decoupling is achieved when an environmental pressure (e.g. resource use or emissions) grows more slowly than the related economic activity (e.g. sectoral gross value added (GVA) or national GDP).
- Absolute decoupling is achieved when an environmental pressure remains stable or decreases while economic activity increases.
- Impact decoupling is achieved when environmental impacts decline relative to resource use and economic activity.” (EEA, 2015b, p. 2)

Domestic Material Consumption (DMC)

“DMC measures the total amount of materials (in tonnes) used by an economy. It is defined as the annual quantity of raw materials extracted from the domestic territory, plus all physical imports and minus all physical exports. The DMC indicator provides an assessment of the absolute level of the use of resources. It allows differentiating consumption driven by domestic demand from that driven by the export market. DMC does not include upstream 'hidden' flows related to imports and exports of raw materials and products.” (Eurostat, 2015a)

“Domestic material consumption (DMC) is often used as a proxy for the environmental pressures of resource use. DMC measures resources directly consumed within a national economy, with an understanding that eventually each tonne of material entering an economy will come out as waste or emissions. However, such a mass-based approach does not address the large differences in environmental impacts between different materials” (EEA 2010d, p.79).

Econosphere

The econosphere links the environment with the economy and is measured by environmental and resource productivity indicators (ESPON & BBSR 2014).

Ecotourism

Ecotourism is defined as responsible travel to natural areas that conserves the environment and improves the well-being of local people. It is practised in relatively undisturbed natural areas, for the main purpose of admiring and learning more about them (BfN 2015). It means a sustainable tourism form in sensible areas that also contributes to financing of nature conservation (GTZ 2001).

Emissions Trading Scheme

In the EU Emissions Trading Scheme, sectors considered are heavy energy-using installations in power generation, manufacturing industry, and aircraft operators performing aviation activities (Quelle?).

Finite resources

A resource that does not renew itself at a sufficient rate for sustainable economic extraction in human time frames (Quelle?).

Hemeroby

The degree of human influence on the natural environment.

Land take

Defined here as the area of land that is converted into settlements, economic sites and transport infrastructures. The EEA defines land take as “The area of land that is 'taken' by infrastructure itself and other facilities that necessarily go along with the infrastructure, such as filling stations on roads and railway stations.” (EEA undated).

Mitigation

Mitigation refers to measures that seek to avoid, reduce or delay global warming by reducing GHG emissions (PSAC 2011, p. 32-33).

Natural capital

According to the EEA (2015f) nation´s wealth is grounded in four core stocks of capital: manufactured capital (e.g. machines and buildings), human capital (e.g. people, their skills and knowledge), social capital (e.g. trust, norms and institutions) and natural capital. Natural capital is the most fundamental of the forms of capital since it provides the basic conditions for the other kinds of capital and enables human existence, delivering food, clean water and air, and essential resources. It sets the ecological limits for our socioeconomic systems, which require continuous flows of material inputs and ecosystem services.

The OECD (2001) defines natural capital as the world's stocks of natural assets which include geology, soil, air, water and all living things (World Forum on natural capital) providing natural resource inputs and environmental services for economic production. Natural capital is generally considered to comprise three principal categories: natural resource stocks, land and ecosystems. All are considered essential to the long-term sustainability of development for their provision of "functions" to the economy, as well as to mankind outside the economy and other living beings.

Natural capital comprises two major components 1) abiotic natural capital including subsoil assets (e.g. fossil fuels, minerals, metals) and abiotic flows such as wind and solar energy as well as 2) biotic natural capital of ecosystem capital that consists of ecosystems delivering a wide range of valuable services being essential for human well-being.

Nature tourism

Nature tourism simply describes travel to natural places. Nature tourism serves nature as a scenery for multiple, especially sport acivities e.g. diving, climbing, air sports, survival, expedition and adventure tourism. A goal of protection or maintenance of nature is not necessarily implied. This is why there are several critisisms on this form of tourism as commercialisation of nature (BfN 2015).

Net annual increment of forests

It indicates the average annual volume over the given reference period of gross increment less that of natural losses on all trees to a minimum diameter of 0 cm (diameter at breast height) (EEA 2010b).

NUTS

Abbreviation for "Nomenclature des unités territoriales statistiques". A single, coherent system for dividing up the EU's territory in order to produce regional statistics for the Community (EUROSTAT 2016c).

Opportunity costs

Cost deriving if other use options are missed.

Permanent Settlement Area (PSA)

The term refers to the area suitable for permananet settlement and agricultural use in the Alps. This area is limited mainly due to topographic and climate conditions, but different definitions exist in alpine countries. An alpine-wide standardised calculation was carried out by Tappeiner et al. (2008) considering settlement areas plus inentsively used agricultural areas. Based on this about 17.3 % of the total area are available for permanent settlement.

Primary PM

Primary PM is directly emitted into the atmosphere, while secondary PM results from precursors which are transformed into particles by chemical reactions.

Primary raw materials

A primary raw material is a natural inorganic or organic substance, such as metallic ores, industrial minerals, construction materials or energy fuels, used for the first time. This may include previously unexploited raw materials from formerly abandoned mines. The scope of this work excludes agriculturally derived substances and energy reserves and resources. (Definition adapted from the INSPIRE Directive (EC 2007).

Purchasing Power Standard (PPS)

Purchasing Power Standard (PPS) is an artificial currency unit. It is used by Eurostat for the common currency in which national accounts aggregates are expressed when adjusted for price level differences.

Resource productivity

"Resource productivity relates domestic material consumption to economic activity (GDP). It provides insights into whether decoupling between the use of natural resources and economic growth is taking place. Resource productivity (GDP/DMC) is an EU sustainable development indicator for policy evaluation.

The simple weight of traded goods fails to take account of the raw materials used to produce these traded goods. To obtain a more comprehensive picture of the 'material footprints', traded goods can be converted into their raw material equivalents (RME), i.e. amounts of domestic extraction required to provide the traded goods concerned" (EUROSTAT 2016d).

Raw material consumption (RMC)

"RMC is defined as the annual quantity of raw materials extracted from domestic territory, plus all physical imports and minus all physical exports (both expressed in raw material equivalents)." (EUROSTAT 2016b).

Resource efficiency

Resource efficiency is a more holistic concept, aiming at the "increase (of) prosperity without increasing resource use and environmental impacts" (EEA 2013d). Prosperity includes economic prosperity, but also social factors as health, education, welfare and others as well as ecological factors. While resources in the concept of "resource productivity" are only materials in a stricter sense, resources in this concept include fertile soils, biodiversity, clean air and other ecosystem services, which contribute to human well-being.

Secondary raw material

"Waste materials that have been identified for their potential for recycling or reprocessing to generate raw materials (potentially displacing the use of primary materials), for example: mining wastes, manufacturing and processing waste, including scrap, and contents of landfill. For the purposes of this work, only the long-lived, accumulated and hence permanently geo-located sources have been considered, namely mining and landfill wastes" (EC 2016d).

Social Innovation

Social innovations are novel concepts, practices and ideas that are developed and implemented to meet the needs in different aspects of society. They support and strengthen civil society and provide value to society rather than to private individuals. Social innovations are often linked to interaction of people. Examples of social innovations are sharing initiatives, microcredits or fair trade.

SOMO35

SOMO35 is the sum of Ozone Means Over 35 ppb and the new indicator for health impact assessment recommended by WHO. It is defined as the yearly sum of the daily maximum of 8-hour running average over 35 ppb. For each day, the maximum of the running 8-hours average for O3 is selected and the values over 35 ppb are summed over the whole year (EMEP 2016).

Sustainable land use

The term means to use the resource land for human interests, but in a way, which ensures the maintenance of ecological and socio-economic functions for now and all future generations. Sustainable land use is a holistic concept including all aspects, such as maintaining structural diversity of land, sustainable agricultural practices excluding soil degradation, avoiding land take etc.

Water abstraction

Water removed from any fresh water source, either permanently or temporarily. Mine water and drainage water as well as water abstractions from precipitation are included, whereas water used for hydroelectricity generation (in situ use) is excluded.

Water exploitation index (WEI)

The WEI is the mean annual total demand for freshwater in a country divided by the long-term average freshwater resources. “Water abstraction as a percentage of the freshwater resource provides a good picture, at the national level, of the pressures on resources in a simple manner that is easy to understand, and shows trends over time. […] The warning threshold, which distinguishes a non-stressed from a water scarce region, is around 20 %, with severe scarcity occurring where the WEI exceeds 40 %.” (EEA 2010d, p. 82)

Well-to-wheel

Well-to-wheel is the specific life cycle assessment used for transport fuels and vehicles.

6.2 Further policies and regulations

6.2.1 Carbon emissions

Austria

Austria has implemented environmental policy instruments and measures such as laws, subsidies and initiatives for reducing energy-related emissions. Since Austria's accession to the European Union (1995) the country's energy efficiency policy is based primarily on EU policy. The Austrian government is supporting efficiency improvements through research and funding programs in all sectors of the economy.

France

The SNBC will help to rise both public and private funding for the energy transition. An 'energy transition for climate' label will help identify investment funds that are funding the green economy, promote the creation of new green funds and encourage businesses to highlight the green aspects of their operations. The SNBC targets for the following sectors are:

- In the **transport** sector, the SNBC aims to achieve a 29% reduction in emissions over the 2015-2028 period, notably by improving the energy efficiency of vehicles consuming 2 litres per 100 km and developing clean vehicles (electric cars, biofuels, etc.).
- In **construction**, the SNBC aims to achieve an emissions reduction of nearly 54%, including by rolling out ultra-low energy and energy-plus buildings, accelerating energy renovation work, implementing the concept of eco-design and using smart meters to manage consumption.
- In **agriculture**, the SNBC aims to achieve a 12% reduction in emissions through the implementation of the agroecology project. This will involve methanation, which means the synthesis of CH_4(Manahan 2006), ground cover, maintaining pastureland, developing the agroforestry sector and optimising the use of inputs.
- In the **industrial** sector, the SNBC aims to achieve a 24% emissions reduction, notably by improving energy efficiency, which is also a source of competitiveness, enlarging the circular economy (reuse, recycling, energy recovery, etc.) and replacing fossil fuels with renewable energy sources.
- In the **waste management** sector, the SNBC aims to achieve a 33% reduction in emissions, by reducing food waste, developing the concept of eco-design, fighting planned obsolescence, promoting reuse and improving waste recovery efforts (Gouvernement France 2015).

Germany

The German Integrated Energy and Climate Package (IECP) (BMU 2007b)has defined measures towards low carbon economy. The Energy Concept (2010) presents a strategy towards 2050 incl. targets for the reduction of GHG, the increase in renewable energies and for energy efficiency. The IECP and the Energy Concept describes 1) legally binding frame for a clear perspective and conditions for reaching the targets 2) funding schemes 3) feed in tariffs 4) information on creating savings and win-win situations 5) monitoring of implementation.

Liechtenstein

Liechtenstein's legislative and administrative main arrangements towards low carbon economy are to be found in the Emissions Trading Act, the CO_2 Act and the Environmental Protection Act (RDR 2008).

The **Emissions Trading Act** (EHG) (RDR 2012) sets up the general framework for the fulfilment of Liechtenstein's reduction obligations originating from the respective ratification of the Kyoto Protocol. The **CO_2 Act** - in force since 2008 - introduces a levy on the consumption of fossil fuel. It is part of "The Bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on

Environmental Levies within the Principality of Liechtenstein”. Due to the CO2 Act, rom 2014 on Liechtenstein will levy CHF 60 per ton CO2, which corresponds to around Rp 16 per liter heating oil (until 2013 it was CHF 36 per ton CO2, which corresponded to around Rp 10 per liter oil). Approximately 2/3 of the total CO2 levy revenues from 2014 are earmarked for environmental purposes, thus strengthening the financial capabilities of the Government with respect to future measures within the national climate change framework.

The **Environmental Protection Act** (2008) summarized a set of individual legislative measures in order to streamline procedures within environmental law. With respect to climate and air quality related measures (see Air Quality Ordinance, Luftreinhalteverordnung) the Act builds the legal basis for emission limits, for example combustion installation within industry and households. It also provides the legal basis for the so called “Action Plan Air” a measure plan effective since 2007 in order to reduce all kind of emissions. The Action Plan Air itself, however, is not legally binding but provides proposals that have to be considered for future decisions by the Government.

Liechtenstein’s Climate Strategy will be revised in the course of 2015/2016. It requires an interdisciplinary coordination of the focussed areas. The focus will be on the coordination of climate relevant measures within Liechtenstein´s energy policy, transport policy, environmental policy, agricultural and forestry policy. In addition to that the relevant CO2-Act will be revised in the course of 2016 / 2017 to reflect the targets for 2030 (40 % of GHG reduction compared to 1990 level).

The bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on **Environmental Levies** within the Principality of Liechtenstein was concluded in 2010. The agreement enables Liechtenstein to implement several environmental levies of Switzerland into national law while using the existing infrastructure of the Swiss authorities for the execution of the respective national laws. The environmental levies are:

- Act on the tax for the rehabilitation of contaminated sites (ASAG)
- Act on the incentive tax on petrol and diesel oil with a sulphur content of more than 0.001 per cent (BDSG)
- Act on the incentive tax on “extra light” heating oil with a sulphur content of more than 0.1 per cent (HELG)
- Act on the incentive tax on volatile organic compounds (VOCG)
- CO_2 Act

Environmental levies on pollutants serve to "internalize" externalized costs, and to reduce the costs of pollution to society by increasing the proportion paid by polluters themselves.

In accordance with the new centralized allocation of the revised EU ETS scheme Liechtenstein submitted its so called “**National Implementation Measures** (NIM)” in 2011.[127] The EFTA Surveillance Authority accepted Liechtenstein’s NIM’s in July 2013. Due to the new regulations only one of the two installations covered by the EU ETS will receive free European Union Allowances (EUA) until 2020.

Slovenia

The **Operational Programme for Reducing GHG emissions** by 2020 with a view to 2030 (OP GHG 2020), adopted by the Slovenian Government in December 2014, is an implementation plan of actions to achieve legally binding targets for Slovenia to reduce GHG emissions by 2020 from the climate and

[127] Further information: http://ec.europa.eu/clima/policies/ets/allowances/index_en.htm

energy package under Decision 406/2009/EC and, as such, a key part of a programme to transform Slovenia into a resource efficient, greener and a more competitive low-carbon economy.

Switzerland

Switzerland understands a green economy as one that takes into account the scarcity of limited natural resources and the regeneration capacity of renewable resources, enhances resource efficiency, and hence boosts the overall performance of the economy and quality of life[128].

The Federal Act on the Reduction of CO_2 Emissions was introduced by 23rd December 2011. It deals with technical measures to reduce CO_2 emissions in buildings and passenger cars; compensations in case of fossil fuel thermal power plants and motor fuels, establishes Emissions Trading Scheme (ETS), as well as sets CO_2 levy.

With 1st of July 2012 Switzerland introduced regulations for CO_2 emissions for cars. According to these regulations, a penalty applies to imported cars which emit more than 130 grams of CO_2 per kilometer (BFS 2011).

[128] http://www.bafu.admin.ch/wirtschaft/15556/15557/15558/index.html?lang=en

6.2.2 Efficient use of energy

Austria

The Austrian Energy Efficiency Act was adopted on 9 July 2014 with the necessary constitutional majority by the National Council and published in the Federal Law Gazette on 11 August 2014. The Act aims at improving the energy efficiency by 20 % by 2020 and thus at improving at the same time the security of supply, increasing the share of renewable sources of energy in the energy mix, as well as achieving a reduction of greenhouse gas emissions. Moreover, it provides a positive impetus for the economy - thus a gross domestic product which is € 550 million higher and 6,400 new jobs can be expected in the branch of industry of the future “energy efficiency”. With this Act, the EU Directive 2012/27/EU on energy efficiency and the promotion of energy efficiency measures, closely related to it, are implemented.

Key subject areas of the Austrian Energy Efficiency Act are listed here:

Not least due to measures, such as the Federal Energy Efficiency Act, could the energy efficiency be increased in the course of the past few decades and the energy consumption development be decoupled from the economic development. This development is supported by the figures of the Federal Ministry of Science, Research and Economy.[129]

Italy

Concerning “energy efficiency”, the 2007 Finance Act launched the Programme “Industria 2015”, promoted by the Ministry of Economic Development with the aim of increasing national companies’ competitiveness e.g. in the energy efficiency and renewable markets. To this end, the Programme foresees new instruments such as the “Industrial Innovation Projects” (Progetti di Innovazione Industriale – PII). The first tender has been launched in March 2008 in the field of “energy efficiency” and has financed 30 projects in the fields of photovoltaic, bioenergy, wind, high efficiency building materials and advanced industrial technologies. The total amount of incentives is € 200 million, 54% of which is to be awarded to SMEs.

Slovenia

In Slovenia, the following plans and strategies are the most topical towards energy efficiency:

- Action Plan for Energy Efficiency for the period 2014 – 2020, adopted by the Government on 21/5/2015 in accordance with the requirements of the Energy Efficiency Directive (2012/27/EU), raises the national objective of improving the energy efficiency of energy use by 20% by 2020. The target is that primary energy consumption in 2020 will not exceed 7.125 million tons (82.86 TWh). This means that compared to the year 2012 it will not increase by more than 2%.
- Long-term strategy for promotion of investment in energy renovation of buildings, adopted by the Government on 29/10/2015;
- Action plan for the nearly zero-energy buildings for the period up to 2020, adopted by the Government on 22/4/2015.

Slovenia has not yet established a medium to long-term strategy for climate and energy covering the post-2020 period. An Operational Programme for Reducing GHG Emissions by 2020 with an outlook to 2030 has been adopted by the government in December 2014. The Operational Programme includes indicative goals for 2030. The 2014 Energy Act provides a legal basis for the adoption of national strategic documents that will determine the long-term trend in energy supply and use. Following the

[129] Further information:
http://www.bmwfw.gv.at/EnergieUndBergbau/Energieeffizienz/Documents/Kerninhalte%20des%20EEFFG%20barrierefrei.pdf

adoption of the act, an Energy Concept (to be adopted in 2016), and a National Energy Development Plan will be developed, which will guide major investments in energy infrastructure in the future.

The measures in the Action Plan NEEAP 2020 are planned in the household sector, the public sector, the economy and transport. Most of the measures constitute existing measures that are being implemented and of whichthe interim objectives have hitherto been achieved. The new action plan brings in the public sector are some of the new measures, since it is necessary to fulfill the obligation to annually renovate 3% of government buildings. The aim of the state is to ensure that all new buildings, which are owned and occupied by public authorities consume almost zero energy from 2018 on, in other sectors from 2020 on. Additional measures are planned in the economy, because energy efficiency is increasingly important factor for improving the competitiveness of the economy.

The existing building stock represents the sector with the greatest potential to achieve energy savings. To achieve the objective, it will be necessary by 2020 to restore a quarter of the energy, which represents around 22 million m^2 of building land. This will decrease energy use in buildings by almost 10%. Furthermore, these measures will also speed up economic growth, because they are generating investments of EUR 500 million per year. The effects of these investments are in addition to high savings in energy costs and a consequent reduction in energy imports in the workplace and at the level of 10,000 jobs.
For existing and new measures to be implemented efficiently, the necessary funds are to be provided, namely funds programmed in the efficient use of energy resources investment priorities in cohesion funds and funds of the Climate Fund.

<u>Switzerland</u>

The Swiss Federal Office of Energy (SFOE) is responsible for several ongoing strategies and projects regarding energy efficiency. Increasing the degree of energy efficiency is one of the most important actions to reduce energy consumption without incurring losses in terms of quality and comfort. A higher level of energy efficiency means consuming less energy while maintaining the benefits, which we are used to (e.g. availability of lighting, heating, electric motors). Increased energy efficiency not only uses less resources but also leads to a reduction of greenhouse gas emissions associated with energy consumption.

In terms of an energy efficient economy, the following two national programmes are the most relevant.

1. The Swiss Federal Office of Energy has set up a programme named "**EnergieSchweiz**" which is active in the domains of energy efficiency and renewable energies. EnergieSchweiz is an information platform as well as a funding programme.
2. The Swiss Federal Office of Energy created the **Energy in Buildings research programme** in order to identify ways in which the reduction of energy consumption in buildings by fifty percent and the elimination of the consumption of fossil fuels in heating systems in buildings can be achieved.

Introduced in 1998, the Energy Act involves two articles, Art. 8 and Art. 9, which concern economical and rational use of energy in production of devices, equipment and vehicles as well as in buildings.

The articles mention measures that aim at testing and clearly describing products' energy efficiency, as well as establishes introduction of market-oriented instruments. Concerning energy efficiency in buildings, article 9 urges cantons to produce appropriate regulations in this area.

The Action Plan consists of 15 measures which consist of various incentives, support measures, rules, minimum standards, as well as measures in area of research and education. During a consultation phase, which these measures are a product of, they were met with a considerable appreciation. It is also emphasized, that in the middle and long term these are also attractive from economical point of view as the costs invested in innovation are compensated by lower energy costs.[130, 131]

[130] Further information: https://www.admin.ch/opc/de/classified-compilation/19983485/index.html#a8

[131] Further information: http://www.bfe.admin.ch/themen/00526/02577/index.html?lang=en&dossier_id=02578

6.2.3 Resource efficiency

Austria:

The Austrian Resource Efficiency Action Plan (REAP) sets the target to increase resource efficiency by 50% until 2020 compared to 2008 levels (BMLFUW 2012).

Germany:

The German National Sustainable Development Strategy defines the target to double resource efficiency until 2020 compared to 1994 (Die Bundesregierung Deutschland 2002). The most prominent instrument to enforce this target is the German Resource Efficiency Programme (ProgRess), . The ProgRess Programme (BMUB 2012) is based on a proposal of the German Environment Agency. It identifies 20 strategic approaches which are underpinned with specific measures (e.g. market incentives, expert advices, education, and research etc.). Moreover, adopting ProgRess, Germany decided to report on the development of resource efficiency every four years, to assess progress and to continue and update the Resource Efficiency Programme accordingly.

Italy:

The driving element for the Environmental Action Strategy for Sustainable Development (EASSD) and for the definition of targets is essentially a decoupling between economic growth and pressure on the use of natural resources and on the environment, especially in the agriculture, power and transport sectors. The specific indicators for use of material, soil, energy, water, resources, and waste production per units of economic wealth, added value or per capita, must decrease relative to economic growth (partial decoupling) and finally stabilise or decrease in absolute terms (absolute decoupling).

Italy has recognised the need to diversify its energy portfolio to reduce the strong dependence on imports of fossil fuels and electricity and also to reduce emission levels. In July 2009, the Government announced a Law to recommence the country’s nuclear power programme and to start building a new nuclear power plant by 2013. A one-year moratorium on the work was adopted in March 2011, after the Fukushima nuclear plant accident. So far, there is no national strategy explicitly devoted to “Resource efficiency”, but its underlying aspects are integrated in the following documents:

1. Environmental Action Strategy for Sustainable Development (2002)

The Italian Environmental Action Strategy for Sustainable Development (EASSD) (MATTM 2002)was approved by the Inter-ministerial Committee for Economic Planning (CIPE) on the 2nd August 2002 and is currently in its implementation phase. CIPE is organised into six Commissions, one of which is devoted to Sustainable Development.

The Italian EASSD contains four broad priority themes:

1. Climate Change and stratospheric ozone;
2. Protection and sustainable valorisation of Nature and Biodiversity;
3. Quality of the environment and quality of life in urban areas;
4. Exploitation of resources and waste generation

Priorities addressed in this last section are the use of natural resources, production-consumption cycles, water resources and waste.

The CIPE identifies the structures and bodies to ensure monitoring of the implementation and see that the objectives are fulfilled by means of a Technical Board to the CIPE Commission for Sustainable Development, which is formed by representatives of the Ministry of Economy, the Regions and other Ministry representatives competent on the treated subject.[132]

Targets

- Reduction of Italian total material requirements by -25% by 2010, -75% by 2030 and by -90% by 2050;
- Within public administrations, by the end of 2009;
- At least 30% of the public purchases shall match ecological requirements. The monitoring will be made with the collaboration of ISPRA and will use as indicator the amount of green public purchase (in euro) / total public purchase for each product group;
- 30-40% of durable goods with reduced energy consumption.

In relation to water resources, the overall objectives are: the preservation and the restoration of water resources, the improvement of the quality of water resources, a sustainable management of the water resources production/consumption system.

Liechtenstein:

Liechtenstein participates in the Swiss Initiative Reffnet. This consultation service for companies allows them to find resource efficient solutions in their processes. The LIFE climate foundation Liechtenstein sponsors up to 50% of the consultation fees for 7 consultation services for the next two years.

Slovenia:

Slovenia does not have a national resource efficiency strategy or action plan. Some other political documents that address also the material efficiency are as follows:

- Slovenian Industrial Policy, 2013 recognises material resource efficiency as a challenge for sustainable construction and in processing activity (wood, metals) sectors (MGRT 2012).
- Action plan: Wood is beautiful contains measures which should lead towards better utilisation of the wood as a resource which is still plentiful in Slovenia, but the value added stays relatively low what means that the resources productivity in this sector stays rather low (MGRT 2012).

[132] (http://www.minambiente.it/index.php?id_sezione=396 in Italian only. An unofficial translation in English is available at: http://www.un.org/esa/agenda21/natlinfo/countr/italy/Italian%20NSDS.pdf)

- Smart Specialisation Strategy which includes one of the areas related to the “smart use of resources” (SVRK 2015).
- The study on approaches addressing resource efficiency and waste prevention in Member States was prepared in 2014 with the aim to present several concrete suggestions on the topics and to recommend the preparation of action plan on resource efficiency in Slovenia (MKGP 2014).

Switzerland:

The action plan Green Economy, introduced in 2013, focuses on this problem in two of its four topics: production and consumption as well as waste and resources. The action plan brings attention to food waste, which at the same time means resource waste and aims to tackle the problem. It also greatly invests in circular economy, which makes use of waste, instead of further resources and increases efficiency by improving recycling systems, as well as introducing limitations on the use of new resources in the field of construction. In April 2016, the Federal Council approved the report "Green Economy-Federal measures for a resource-conserving, future proof Switzerland" where past Green Economy actions were assessed and further measures for the 2016-2019 period were outlined. Moreover, the Action Plan Wood focuses specifically on sustainable use of wood and supports projects that tackle this problem. The action plan includes 6 priorities; it was constantly further developed during its years of functioning between 2009 and 2016 and has yielded many various projects. The Spatial Concept Switzerland, elaborated by the Swiss Federal Office for Spatial Development ARE, also includes as one of its five targets the securing of natural resources. Finalyy yet importantly, a major Swiss strategy which fosters sustainability in many aspects, including a focus on resources as Action Area 4, is the most recent Sustainable Development Strategy 2016-2019. The Strategy includes five goals that aim at achieving the long term vision of respecting the qualitative and quantitative capacity and usage limits of the planet`s natural resources. The goals focus on preserving ecological infrastructure of reserves and habitat networks, soil function, forests and landscapes as well as making the food industry environmentally friendly.

Additionally, FOEN has launched various studies that aim to deepen the understanding of material flows from ecological, economic and social points of view. It focuses its research on materials which through extraction, processing, use and disposal cause considerable pollution, materials difficult to procure in the future, as well as materials which may have a better recycling potential. In addition, two other studies concerning material flows have been completed.

6.2.4 Land use changes

Germany

In Germany the Federal Building Code (Baugesetzbuch) and the Federal Spatial Planning Act (Raumordnungsgesetz, ROG) form the legal framework for spatial planning documents. Both documents ask for sparing and careful use of natural resources, particularly water and soil. The specific instruments to deal with these regulations on the regional level are layed down in spatial development plans or programmes of the Federal States. They are the main instruments of regional planning. At the federal level, the Federal Building Code has been amended several times in the past decade to promote inner-urban development and to protect open landscape. The Federal Building Code now sets a clear priority for the reduction of new land take and for inner urban development instead of developing agricultural areas or forests: Article 1 asks for a justification if agricultural land or forests are planned to be converted into urban land. This justification must include an assessment of the possibilities for inner urban development in particular including brownfields, building vacancy, vacant lots and other possibilities for redensification. However, due to the planning authority at the local level greenfield land development is still a widely applied practice.

For the German Alpine area, defined as the morphological mountain area, the Bavarian State Development Plan contains since 1972 the so-called “Alpenplan”. It regulates the development of infrastructures (transport and ski lifts) by dividing the whole region in three zones (cf. Figure 6.2.4-1):

- Zone A (about 35% of the German Alps) comprises all settlements and most parts with already existing substantial land uses (as tourism sites and valley bottoms). Apart from the usual restriction, no additional criteria have to be met for new infrastructure.
- Zone B (about 22% of the German Alps) is a neutral zone or buffer zone in which projects can be allowed after detailed ecological examinations. New infrastructures require individual evaluation and are mostly permissible if needed for agriculture or forestry.
- Zone C (almost 43% of the German Alps) was designed as a protected zone, where every transport project except necessary measures for traditional agriculture and forestry are inadmissible. The zone comprises the higher mountainous regions, protected areas and almost all mountain ridges at the German-Austrian border.

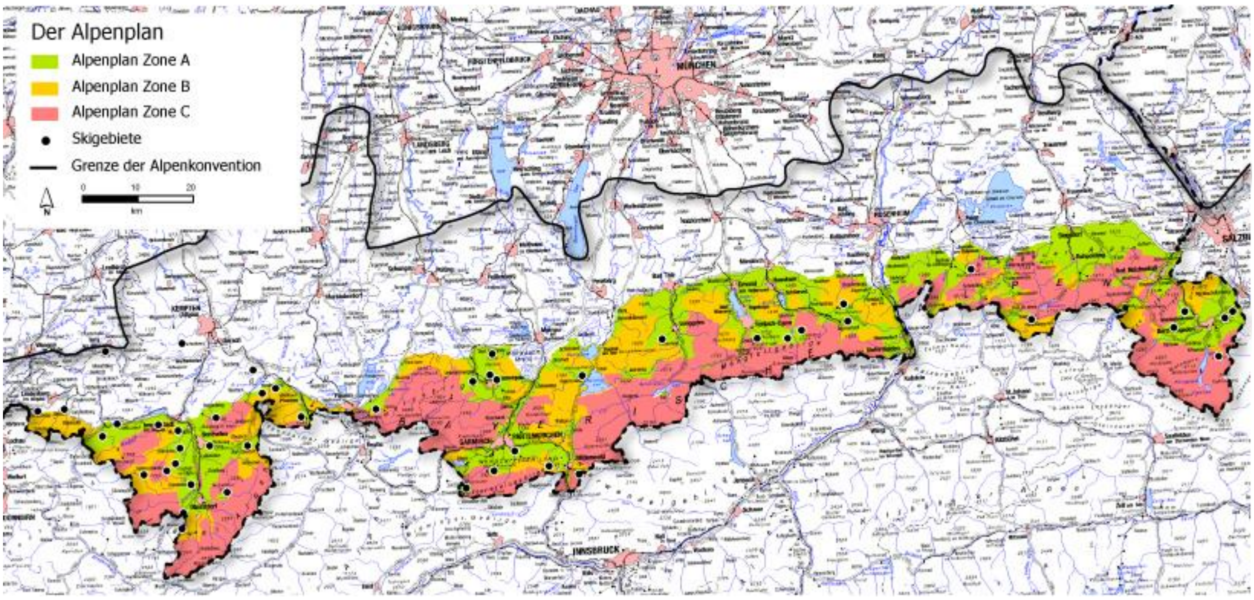


Figure 6.2.4-1 Zones in the Alpenplan (Source: DAV 2016).

Several policy initiatives in Bavaria support municipal efforts on land take and to promote inner urban development. In 2003 an alliance for reducing land take ("Bündnis zum Flächensparen") was founded. In this alliance, ministries and authorities, associations of municipalities, NGOs and private enterprises work together, share their ideas and exchange their experiences with inner-urban development. Besides a common declaration all partners have committed to reduce land take. Participating ministries have developed several tools to support municipalities or inter-municipal alliances. The instruments are e.g. an easy to use free database for systematic registration of inner-urban development potentials, a computer based free tool to compare the cost for land development at different locations (inner-urban compared to greenfield development) and a collection of good practice examples. It organises regular meetings and a biannual public conference to exchange experiences and promote the issue. A mobile exhibition for the public was designed and is available for lending to present it to a broad public and raise awareness on the issue.

Italy

Regions are the competent level for spatial planning in Italy. They are responsible for legal provisions and instruments, including spatial and territorial plans for the Alpine areas where a few open issues and barriers towards a harmonized Alpine-wide approach still exist at the country level (e.g. exchange of data, territorial mapping systems, governance issues, etc.).

However, a consultation process among the six Italian Alpine Regions and two Autonomous Provinces is ongoing as a shared initiative of the responsible governments. Another initiative that deserves to be mentioned is a cooperation among protected areas and sites of particular natural interest across the Italian Alps, where spatial planning and ecological continuum are at the centre of the debate.

Slovenia

Land use management and planning is regulated by the Slovenian Spatial Planning Act. The responsible ministry is the Ministry of the Environment and Spatial Planning. According to the law, the state prepares laws and national policies, and other instruments that are adopted by the National Assembly or the Government of the Republic of Slovenia (RS). They define the spatial planning system and provide strategic spatial development objectives, guidelines and measures. In addition to the spatial development laws and strategic documents, the state also has the authority to perform measures concerning spatial arrangements for infrastructure of national importance and is issuing construction permits for structures of national significance.

There is no administrative regional level, the planning authority at lower level are municipalities. Each municipality has to prepare a spatial plan with a strategic and an implementation part. The latter is the basis for issuing the construction permits on local level. They are issued by the state administrative units, operating at regional level.

The state uses laws and other strategic documents (such as the National Spatial Development Strategy and Spatial Order of Slovenia) to provide frameworks for spatial planning at regional and local levels. The state has the authority to monitor the lawfulness of spatial planning at lower levels. In case that a local community adopts a local plan against the opinion issued for a single spatial development plan, the state institutions can bring the case to the constitutional court.

In relation to land use management, the Spatial Planning Act sets some basic principles, among them the principle of the use of underused or degraded land for spatial development prior to plan development on greenfield. This principle is used during the reconciliation between the responsible national sector and municipality on its spatial plan. The second important principle (guideline) is given by the National Spatial Development Strategy according to which spatial development shall be performed in urban centres of certain significance (i.e. central places with certain range of functions) and not in rural settlements. They are specifically mentioned in the document as the key nodes of a polycentric urban system. An important instrument is also the State of Spatial Development Report, being issued in May 2015 for the first time, showing the implementation of the national strategy objectives and priorities in the field of spatial development.

Switzerland

In Switzerland, there is a national framework legislation and some strategic documents at national level regarding land use planning. The Federal Act on Spatial Planning (RPG) entered into force in 1980. It lays down the aims and principles of spatial planning for the whole of Switzerland. Based on the mandate anchored in the Swiss Constitution, it calls for a careful management of land use in Switzerland. The federal law only lays down the principles but does not constitutes a set of rules, which answers all important questions. Cantonal spatial planning and building regulations contain also often road construction and land rationalization.

The Confederation promotes and co-ordinates Cantonal spatial planning and also takes into consideration the "demands" of spatial planning in its own activities. The limited legislative responsibility of the Confederation leads to a variety of spatial planning concepts and instruments. In fact, Confederation, Cantons and communes are jointly responsible for ensuring economical land use. They do this by harmonizing their activities, which have spatial impact.

However, the main land use planning documents and strategies are issued at regional and local levels. There are two important strategies on national level regarding a careful land use management:

1) The Spatial Concept of Switzerland (Raumkonzept Schweiz) is a strategic framework for the future of spatial development. It was elaborated by representatives of the national, regional and local levels and should help national, regional and local authorities to plan settlements, transport and energy infrastructures or to deal with activities which have an impact on landscape or land use.
2) Revision of the Spatial Planning Act (RPG) - Stage 1.
   In Switzerland, it is only allowed to build new buildings within areas, which have been flagged as building zones by the authorities in the land use planning documents. In various cantons and municipalities, building zones are oversized, potentially leading to urban sprawl, loss of agricultural lands and degradation of landscapes. In order to prevent this, the national Spatial Planning Act was revised. All 8 cantons and many municipalities will have to revise their land use planning documents in the following 9 years in order to reduce the size of the building zones and in favour of a more sustainable spatial development. The Federal Council has decided to put the partially revised Spatial Planning Act and the revised Spatial Planning Regulation on 1 May

2014 in force. The revision provides for measures against urban sprawl and facilitates the conditions for the construction of solar plants.

6.2.5 Circular economy, recycling and waste management

The EU adopted in 2015 a Circular Economy Package, which includes legislative proposals on waste and an EU Action Plan for the Circular Economy. The Action Plan (EC 2015d) includes suggestions regarding production, consumption, waste management, the secondary raw material market and highlights the following priority areas:

- Plastics: Less than 25% of the collected plastic waste is recycled, an increase of plastic recycling is needed.
- Food waste: Along the whole value chain from the farmer to the consumer many food is lost, in the EU about 100 million tons annually, about 40% of food loss occurs at retail and consumer level.
- Critical raw materials: Materials of high economic importance and vulnerable to supply disruption, which are often present in electronic devices, are currently recycled at very low rates.
- Construction and demolition waste: It accounts for approximately 25-20% of all waste in Europe, many of the materials are reusable or recyclable, but the recycling rates vary from country to country significantly.
- Biomass and bio-based products: These products can contribute to the circular economy as they are renewable, biodegradable or compostable, but attention to environmental impacts and pressure on land use has to be paid.

<u>Austria</u>

At the national level, the Waste Management Act (Abfallwirtschaftsgesetz AWG 2020. Federal Law Gazette I No 102/2002 as amended) implements the provisions of the Waste Framework Directive. In the Waste Prevention Programme of the Federal Waste Management Plan 2011 (BMLFUW 2011), the objectives of waste prevention were put in concrete terms as follows:

- Decoupling of economic growth from the life-cycle environmental effects of wastes;
- Reduction of emissions;
- Minimisation of the dissipation of pollutants;
- Reduction of pollutants and
- Saving of resources.

For biogenic wastes, the national Biowaste Strategy (UBA Austria 2014) demonstrates the most appropriate possibilities of treatment.

<u>Germany</u>

The Federal Law on Circular Economy (“Kreislaufwirtschaftsgesetz”, 2012) aims at fostering circular economy to reduce resource input and to protect men and environment. The central principle of this law is a five-step hierarchy for waste: 1. Avoid waste, 2. Prepare waste for reuse, 3. Recyling of waste, 4. Other utilisation, 5. Removal of waste.

It promotes circular economy and environmentally sensitive waste management and was adopted to implement the European Waste Directive. It forms the central part of waste regulations and is supplemented by regulations concerning special waste as e.g. old vehicles, batteries and electronics. One aim is a reuse / recycling rate for municipal waste of 65% by weight at the minimum from 2020 onwards (§14 (2)) and for construction and demolition waste 70% by weight.

The federal law is concretised by laws of the Federal States, for the German Alpine Convention area the Bavarian Waste Management Act (Bayerisches Abfallwirtschaftsgesetz). The counties and county free towns in Bavaria are responsible for waste removal, but they may delegate it to others (public or private companies and cooperation); municipalities are obliged to support them by e.g. offering places and staff for the collection of the recyclable fraction. As foreseen in the relevant EU Directive and the respective federal law, a waste management plan was deployed.

Italy

Regarding Waste, the general objective is a reduction of production, recovery of materials and energy from waste.

Specific objectives (and related indicators) are:

- reduction of urban waste production;
- reduction of special waste production;
- reduction of dangerous waste;
- recovery of materials and recycling of urban waste;
- recovery of energy from waste.

Liechtenstein

In Liechtenstein, the Ministry of Environment together with the Office of Environment is responsible for developing legislation and policies to ensure the recovery and environmentally sound disposal of waste, coordinating the planning of waste disposal facilities and for the implementation of the policy framework in close collaboration with the eleven communes. The basis for waste legislation in Liechtenstein is the Environmental Protection Act (RDR 2008).

Because of the customs union treaty with Switzerland, the Swiss waste law is also applied in Liechtenstein and there is no custom control between Liechtenstein and Switzerland. The borders are controlled by Swiss authorities. The Swiss Federal Office for the Environment (FOEN) monitors the import, export and transit of wastes and hazardous wastes for Liechtenstein. Switzerland is a member of the OECD and the Basel Convention and, therefore, carries out these controls according to the OECD and the Basel Convention-Decisions. The authorities of Liechtenstein will be informed in every case and have the possibility to refuse unwanted exports, imports and transits of wastes under control.

Moreover, the Ordinance on the Reduction of Risks relating to the Use of Certain Particularly Dangerous Substances, Preparations and Articles (Chemical Risk Reduction Ordinance, ORR-Chem) contains special regulations in terms of restrictions and bans of handling of chemicals of all sorts. It substitutes the old Ordinance on Dangerous Substances. Pursuant to the Customs Treaty, these new provisions are again applicable to Liechtenstein.

The limited landfill space and the existing difficulties to deposit new landfill sites, as well as the changing conditions in neighbouring countries necessitated a revision of the waste planning. Therefore, the Office of Environment was commissioned by the Government to create, together with the Liechtenstein municipalities, a new waste planning, which will ensure the safe disposal of waste in Liechtenstein in the future. Waste management planning is carried out within the framework of a Strategic Environmental Assessment (SEA).

With regard to the waste planning by 2070, all of the town’s further stakeholders and the general public have been included for each group of waste:

- The actual state has been surveyed,
- The short, medium or long-term demand have been analysed,
- The fields of action have been defined,
- Alternatives were assessed and possible solutions presented.
- In an initial workshop, landfill and organic waste recovery planning were defined as key areas of action. From those results, the developed alternatives for the fields of action will be assessed and possible solutions and their effects highlighted. Waste management planning should be completed by 2016.

Slovenia

The Waste Management Programme (in preparation) will be an umbrella strategic document in accordance with the Framework Directive (2008/98/EC) and will introduce a new approach in the treatment of waste. Waste is a valuable source and in planning policy and law making the five-step waste hierarchy should be taken into account.

Switzerland

Switzerland is highly committed to waste reduction and recycling. Its impressively high return rate makes it a pioneer and a world champion in recycling of electronic products; however it is also very successful in recycling of other materials. This situation is a product of an efficient infrastructure, high standards, clear legislative stipulations and an involvement of both public and private stakeholders.

The Regulation on Avoidance and Disposition of Waste (Abfallverordnung) sets general standards for planning, reporting, reducing, utilization and deposition of waste; though the cantons are free to choose specific measures. There are other ordinances concerning movements of waste, beverage containers, returns and disposals of electrical and electronic equipment, prepaid contribution for glass beverage containers as well as fee for batteries and accumulators.

There are various measures forwarded by the Swiss Federal Office for Environment (FOEN), as well as cantons and municipalities. Waste management is an important element of environmental education. Information and awareness are propagated at schools: cantons and municipalities conduct their own projects and initiatives. On the federal level, there is a Fund for School Projects in Environmental Education, which is administered by the foundation éducation21. This fund supports specific work in environmental education during obligatory school. The organization Kommunale Infrastruktur organizes a course on Waste Management which takes place every 2 or 3 years in cities and municipalities and consists of 4 modules. Beginners in the field, as well as specialists from private and public sectors can benefit from it. In addition, there is an annual course on Environmental Protection Act organized by the Vereinigung für Umweltrecht. In addition, the FOEN also has a comprehensive list of various organizations that arrange various events, workshops and trips on this topic; as well as offers links to education material.

FOEN`s Action Plan Green Economy also focuses to a large extent on waste management: it is one of its four priority areas. The aims are to raise the effectiveness of waste plants, as well as production facilities; raising demands for building materials and construction methods as well as improving recycling of rarely used technical materials. Moreover, it seems important to boost the use of other raw materials in order to secure the ones used more frequently. The function of the Concept on Securing Raw Materials, which is currently in development, is to create a basis for action. In addition, there are also comprehensive regulations on transboundary movements of waste. The federal Government also financially supports investigation, monitoring and remediation of contaminated sites; for this purpose, it has set up the OCRCS Contamination Fund.[133] [134]

[133] Further information: http://www.bafu.admin.ch/abfall/14015/15232/index.html?lang=de

[134] Further information: http://www.bafu.admin.ch/abfall/index.html?lang=en

6.2.6 Natural capital and ecosystem services

Italy

Natural capital is not yet formally considered in national accounting systems. However data are regularly collected by the national (and regional) statistical offices that participate in measuring the natural capital stored across the country and national programmes have been launched to try informal assessments of the value of the nature and its services in Italy.

According to CNEL & ISTAT (2014), in order to ensure a real well-being to all the members of a society, an environment has to be vital and resilient, i.e. hosting natural capital able to couple health with human social and economic activities: which means that environmental resources such as water, air and food should be safe and of good quality. Natural heritage should then be given a central position in the economy being able to provide for goods and services being essential to ensure human well-being (Millennium Ecosystem Assessment, www.maweb.org and The Economics of Ecosystems and Biodiversity, www.teebweb.org) and environmental resources' valorization allows all members of society to enjoy tangible and intangible assets and contributing to the reduction of inequality.

Looking for an appropriate metrics for natural capital, the following indicators listed have been adopted in the framework of a successful pilot project named "Equitable and Sustainable Well Being" (BES).

Table 6.2.6-1 Dimensions of well-being included in the pilot project "Equitable and Sustainable Well Being". A set of indicators for the above-mentioned dimensions of well-being is available (BES 2016).

Dimension of wellbeing	Description
Water quality	Impact on human wellbeing and health
Air quality	Impact on environmental and human health thus on human wellbeing
Soil and territory quality	Soil has an impact on the water cycle, quality and floods and landslides. Soil use and consumption impact on the wellbeing of people living in a territory.
Biodiversity	Biodiversity loss puts at risk ecosystems and their services on which human wellbeing and economic activities rely. Biodiversity conservation proxies natural capital conservation
Subjective valuation of the quality of the natural environment	Individual and citizens' perception on the overall quality of the environment they live in impacts their wellbeing.
Matter, energy and climate change	Material consumption, energy use and climate change impact on development and its sustainability through emissions and dramatic reduction of assets on which human well-being is based.

Another indirect essay to identify the value of natural capital stored in the Italian protected areas - including the Alpine ones - has been made by delivering a Report on natural capital accounting in national parks, where 56,000 animal species have been counted (the highest figure in the EU), important forest resources are stored contributing to CO_2 storage, and which have a role in halting land consumption (urbanization in national parks covers 4.5% of total surface). 23 areas have been analysed with regard to plants, animals, ecosystems and landscapes as a contribution to the National Biodiversity Strategy 2011-2020 (Ministero Dell´Ambiente 2013).

The unique characteristics of storing also cultural heritage and landscapes that is common to many Italian protected areas has also found a formal recognition in the Charter of Rome on Natural and Cultural Capital and the subsequent report, where Alpine specificities have been highlighted for the National parks included in the Alpine area: Parco Nazionale della Val Grande, Parco Nazionale delle Dolomiti Bellunesi, Parco Nazionale dello Stelvio, Parco Nazionale del Gran Paradiso (Ministero Dell´Ambiente & Fondatione per lo Sviluppo Sostenible 2015).

6.2.7 Biodiversity

Table 6.2.7-1 Biodiversity targets of Germany according to the National Strategy on Biological diversity (2007) (Source: EEA, 2015).

Biodiversity targets in Germany	
Protecting biodiversity	
Population size	Species for which Germany has a particular conservation responsibility should have achieved viable population sizes. By 2020 the threat status of the majority of species on the Red List should have improved by one level.
Wildnerness	Nature should be able to develop undisturbed and according to its own laws across 2 % of Germany, and areas of wilderness should be developing.
Forests	Forests that have developed naturally should account for 5 % of woodlands.
Water	Watercourses and their water meadows should be protected, so that their typical diversity as a natural area is guaranteed; river flood plains should be extended by at least 10 % by 2020.
Water	The water regime in intact peatlands should be protected and regenerable peatlands permanently restored.
Biodiversity sustainability	
Renewable Energies	The production and use of renewable energies should not come at the expense of biodiversity.
Land use	The additional land taken for human settlement and transport should be no more than 30 ha/day.
Transport	The current proportion of unfragmented low-traffic areas > 100 km^2 should be maintained.
Transport	Existing transport routes should no longer cause major adverse effects for the network of linked biotopes. Fragmented areas should be ecologically passable.
Environmental influences	
	Cultivation-related discharges of substances into soils used in agriculture and forestry will be reduced.

Slovenia

The **National Reform Programme (NRP**) is the Government's medium-term plan of priority measures and projects focused on achieving the objectives of the Europe 2020 strategy. It states that the preservation of a high level of biodiversity and vital ecosystems would be ensured through the effective management of existing protected areas and the accelerated implementation of measures intended to maintain the Natura 2000 network. Among its fundamental goals, the 2007–2013 National Development Programme lists the conservation and sustainable use of biodiversity.

The **Rural Development Programme** is a strategic document under which agri-environmental measures are implemented, whose objectives are to establish the concept of sustainable agriculture and preserve natural resources and biodiversity. As stated in the Strategy for Implementing the Resolution on the Slovenian Agriculture and Food Industry Strategic Guidelines up to 2020, the green component is implemented within direct payments under the reformed Common Agricultural Policy, which includes obligatory agricultural practices with a favourable impact on climate and the environment. In the Operational Programme for the Implementation of the EU Cohesion Policy 2014–2020, a special priority investment is dedicated to the protection and restoration of biodiversity and soil and the promotion of ecosystem services. In 2004, Slovenia established the network of Natura 2000 sites, which following a slight increase in 2013 now covers 37% of the country's territory. This is an important achievement in nature conservation and contributed to the greater inclusion of nature protection considerations in spatial planning and planning of the use of natural resources.

6.2.8 Valuation of ecosystem services

Germany:

- Landscape planning is the key precautionary instrument for conservation and landscape management in Germany at different spatial scales such as state, regional and local level. Its role is to identify, define and establish conservation and landscape management objectives in landscape programmes, framework landscape plans and landscape plans. In combination with the development plans, it is the main legally binding planning instrument for bringing together and coordinating the conservation of nature, landscapes, ecosystems and biodiversity. It regards also the role of protected habitats, Natura 2000 sites, and the connectivity of habitats or precautionary planning for recreation sites. Landscape planning also provides conservation principles and standards for management of sustainable land use.
- For biodiversity conservation, the German Impact Mitigation Regulation ("Ausgleichsregelung") has to be mentioned as one of the most important tools. The aim of this nationwide regulation is to prioritise the prevention of major damage to the natural balance, landscape and biodiversity. Where this is not possible, priority must be given to natural mitigation and replacement measures to offset the damage. In national terms, the Impact Mitigation Regulation has been applied successfully for more than 30 years as an instrument of nature conservation.
- At the state level in Germany the Bavarian Biodiversity Programme (described in chapter 2.3.3 is the umbrella for several nature conservation instruments and measures. With the new Bavaria 2030 biodiversity programme, the state is investing €3 million in a new resource research foundation to research potential for the sustainable protection of valuable resources and hereby also press ahead with Bavarian energy transition.

Switzerland

In Switzerland, different national policies relevant for the valuation of ecosystem services are in place:

- Biodiversity Strategy
- Swiss Biodiversity Action Plan
- Federal Act on the protection of Waters
- Federal Act on Forest
- Federal Act on the protection of Nature and Cultural Heritage
- Ordinance on the protection of Nature and Cultural Heritage
- Federal Act on Hunting and the Protection of Wild Mammals and Birds
- Ordinance on Hunting and the Protection of Wild Mammals and Birds
- Federal Act on Fisheries

The Biodiversity Strategy Switzerland was passed in 2012. The main target is to preserve biodiversity and ecosystem services in a way that makes them capable to respond to changes. Ten targets serve this purpose:

1. Sustainable use of biodiversity
2. Development of ecological infrastructure
3. Improvement of the situation of national priority species
4. Preservation and support of genetical diversity
5. Review of financial stipulations
6. Registration of ecosystem services
7. Generation and dissemination of knowledge
8. Fostering of biodiversity in settlements
9. Strengthening of international engagement
10. Monitoring of changes in biodiversity

The Action Plan aims to facilitate implementation of the strategy. It is led by FOEN, however, its elaboration is a product of cooperation with various stakeholders, as well as other federal offices. In 2014, FOEN developed stages of the implementation of the plan, and announced the need for further resources and legal adjustments. The basic framework of the action plan was implemented in the context of a participatory process, including federal offices but also various stakeholders from cantons and municipalities as well as from NGOs, the economy, policies, science or interest groups. For example, on 19th November 2014 it organized a meeting on ecological infrastructure where stakeholders had a chance to discuss the measures provided by the action plan.

In order to protect biodiversity in specific areas, natural reserves and national parks are established. Under protection are also certain mire landscapes and their preservation is regulated by the Ordinance on Mire Landscapes (Moorlandschaftsverordnung). Moreover, Swiss Nationalpark, as well as Biosfera Val Müstair belong to the UNESCO Programme "Man and Biosphere"[135].

Furthermore, fostering natural parks is another important nucleus of a Green Economy and ecosystem services in the Alpine area. The federal authorities support regional initiatives for the establishment and operation of parks of national importance by providing financial aid and awarding the park label. The aim is to promote regions characterised by high natural and landscape values, which are pursuing sustainable development and meet the specified criteria. The legislation enabling the creation of parks of national importance was put into force on 1st December 2007.

The federal policy on parks is based on the following principles[136]:

- The establishment of a park of national importance is voluntary.
- A park of national importance arises from a broad-based participatory and democratic (bottom-up) process in a region.
- The development of parks does not involve the introduction of any new protection regulations, except in the core zones of national parks and nature discovery parks.
- High natural and landscape values are the fundamental requirement for the recognition of a region as a park of national importance.
- In parks of national importance, high natural and landscape values are to be preserved and enhanced and natural resources are to be used sustainably.
- Instruments for supporting parks of national importance.

[135] Further information : http://www.bafu.admin.ch/biodiversitaet/13721/14385/15120/index.html?lang=de

[136] Further information : http://www.bafu.admin.ch/landschaft/14534/15821/15839/index.html?lang=de.