

Final Draft

**Greening the Economy in the Alpine Region
Executive Summary of the Report on State of the Alps**

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[This executive summary was approved by the Alpine Conference at its XIVth meeting in Grassau, held on 13 October 2016. It contains the main contents of the sixth Report on the State of the Alps, briefly illustrated by using key indicators.]

[The full version of the sixth Report on the State of the Alps can be downloaded here: <http://www.alpconv.org/en/publications/alpine/default.html>]

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

[Other forewords]

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Abbreviations

AEA: Annual Emission Allocations

CHP: Combined Heat and Power

DMC: Domestic Material Consumption

EEA: European Environmental Agency

EU: European Union

ESS: Ecosystem Service

GDP: Gross Domestic Product

HNV: High Nature Value

IBAS: Important Bird Areas

IUCN: International Union for Conservation of Nature

LCA: Life Cycle Assessment

NEEAP: National Energy Efficiency Action Plans

NGO: Non-Governmental Organisation

OECD: Organisation for Economic Cooperation And Development

PBAS: Prime Butterfly Areas

PEF: Product Environmental Footprint

PES: Payments for Ecosystem Services

PM: Particulate Matter

PSA: Permanent Settlement Areas

RMC: Raw Material Consumption

RE: Renewable Energy

RES: Renewable Energy Sources

UAA: Utilized Agricultural Area

UN: United Nations

UNEP: United Nations Environmental Programme

WG: Working Group

WHO: World Health Organization

Recommendations for a Green Economy in the Alps

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 internalization should be implemented. They could be financed by e.g. saved subsidies. To constantly improve 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.

In a nutshell, 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 engine for 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 to trigger 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

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- 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 hotspot 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 an actual 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 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 such 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 needs 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 sectors. 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 trigger a more socially 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 economies can be supported.

8. *Improve data availability and monitoring*

- The data and good practice examples collected in the framework of the RSA 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 by 2018*

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- This action programme should further elaborate these recommendations and identify concrete fields of actions and the relevant actors;
 - The development of such action programme should involve all relevant stakeholders in the Alpine Convention area, particularly business, municipalities and towns, NGOs and the civil society.

1 Introduction

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. In order to develop towards a Green Economy, the economic activities in the Alps need to respect the specific topography, the natural resources, the 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 to 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/ within/ in the Alpine area to centers and to small settlements, market barriers for small or new companies, limited availability 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: a Green Economy may reduce costs of 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

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 Expert 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 (chapter 2),
- resource efficient economy (chapter 3),
- ecosystem services and natural capital based economy (chapter 4), as well as
- economy supporting quality of life and well-being (chapter 5).

Policy objectives

A Green Economy is an instrument to achieve sustainable development. It is explicitly 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.

The European Commission set in its Europe 2020 strategy the 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 goals¹. 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.

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 nation'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 an indicator to measure economic and social well-being and its shortcomings have been debated for decades. Numerous initiatives to assess well-being other than through GDP have seen the light of day in recent years: notable examples are the OECD Better Life Index, the Happy Planet Index or the Gallup-Healthways Well-Being Index². 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 financial 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 through 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 questions³ 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 economic growth and environmental protection, and the way of producing energy from renewable sources (centralised or decentralised).

The full version of the Report on the State of the Alps, of which the present document is a summary, introduces the relevance of Green Economy in terms of the Alpine Convention, the general economic situation of the Alpine region and the main players in the Alpine region.

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/>.

2 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 (CO₂). 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 characterized by a fully industrialized 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 CO₂ 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 Cooperation Programme (2014) and by stressing the strategic importance of the topic of energy efficiency within the macro-regional strategy for the Alps, EUSALP, in particular in its Action 9 “To make the territory a model region for energy efficiency and renewable energy”⁴.

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 the status and trends of GHG emissions (especially CO₂) and their consequences, policy background and main targets towards low carbon economy in the Alpine countries, as well as potentials for reducing CO₂ 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;

2.1 Carbon emissions

The combustion of fossil raw materials generating CO₂ 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 and 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 call for further collective efforts towards a low carbon economy on a supranational level aimed at avoiding such extremes.

Figure 2.1-1 shows the CO₂-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).

⁴ Further information: http://ec.europa.eu/regional_policy/sources/cooperate/alpine/eusalp_communication_en.pdf

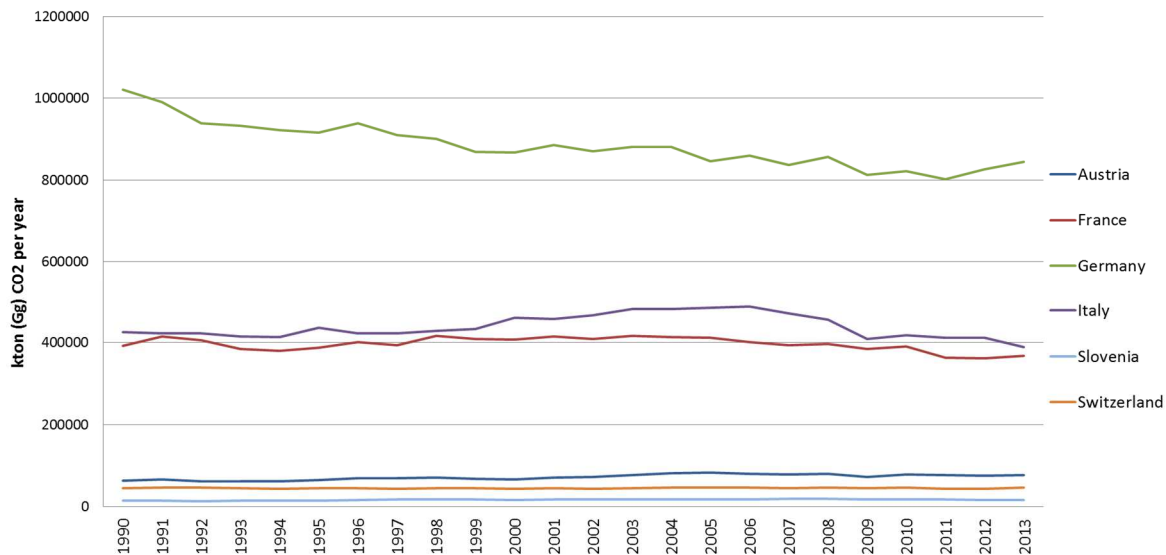


Figure 2.1-1 At national levels: CO₂ emissions in Alpine countries from fossil fuel use and industrial processes between 1990 and 2013 (data source: JRC 2014b, graph: ifuplan 2016). Data of Liechtenstein has been included in the data of Switzerland.⁵

The diagram illustrates that until 2013 three Alpine countries have reduced their CO₂ 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 CO₂ tendencies have been reported such as Austria (+22 %), Slovenia (+13 %) and Switzerland (+4%).

On 12 December 2015, the 195 participating countries at the Paris conference on climate change agreed on 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 degrees °C" above pre-industrial levels and pursue efforts to limit it to 1.5°C.

In relation to 2020, the EU has signed up to the second commitment period of the Kyoto Protocol. 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.

Table 2.1-1 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 ⁶ |
|------------------|---|
| 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 |

⁵ 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). CO₂-emission levels differ also due to the different sizes of the countries presented.

⁶ 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.

| | |
|-------------|---|
| Slovenia | 4% above 2005 level |
| Switzerland | 20% (30%) ⁷ below 1990 level |

Status and potential of carbon emissions reduction in the Alpine area:

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 targets.
- EU 2020 climate and energy targets: According to the progress reports on GHG emissions on 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 CO₂ emissions:

- Due to natural as well as anthropogenic circumstances (e.g. CO₂ 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 continuous extensive 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 to 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 CO₂ 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.

Opportunities:

- The Alpine region has multiple capacity for CO₂ reduction based on the potential for installing renewable energy power plants, the increase of energy efficiency by applying innovative technologies and CO₂ sequestration in Alpine forests.

⁷ 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.

- 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.
- Support the initiatives by local, regional and non-state actors (e.g. municipalities, regional governments, businesses) to reduce greenhouse gases taking note of the significant potential of their efforts to achieve regional climate targets.

Challenges:

- One of the biggest challenges towards low carbon economy is the urgent need 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.

2.2 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). The renewable energy power plants have to be planned in accordance with nature conservation and sustainable land use.

Figure 2.2-1 illustrates the shares of RES in total energy production per Alpine country in 2011. The biggest share of energy production from renewable sources 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.

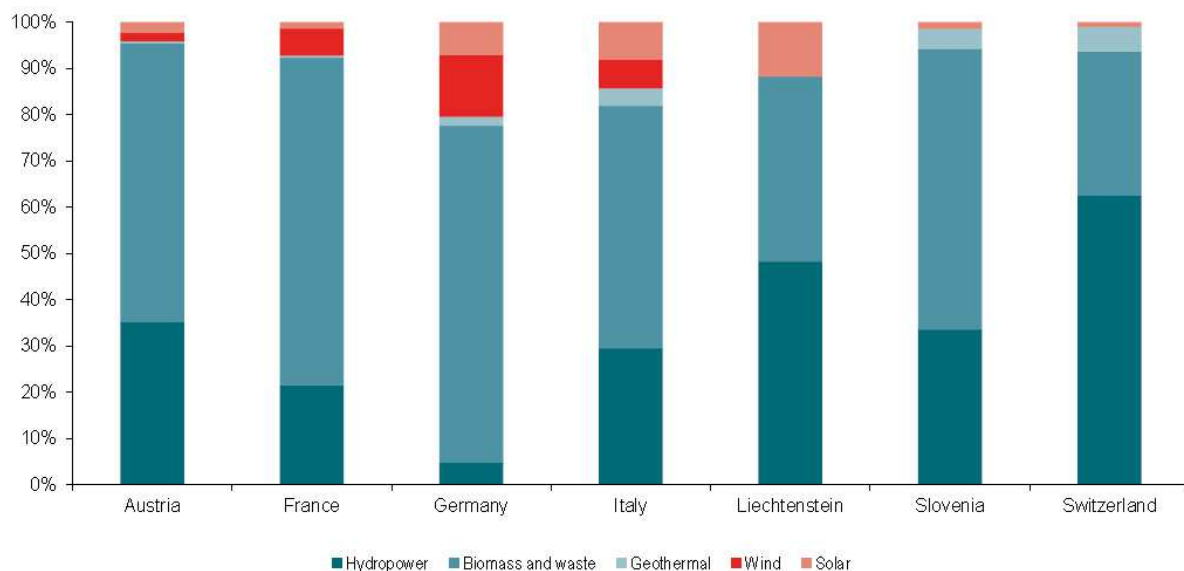


Figure 2.2-1 Share of hydropower, biomass incl. renewable waste, geothermal, wind and solar energy on RE production for each Alpine country in 2011 (Source: Swiss Confederation et al. 2015).

Figure 2.2-2 shows the predicted future development on the share of RES in final energy demand of the Alpine countries for 2020, 2030 and 2050. National renewable energy targets as % of gross final energy consumption until 2020 are as follows: Austria (34%), France (23%), Germany (18%), Italy (17%), and Slovenia (25%).

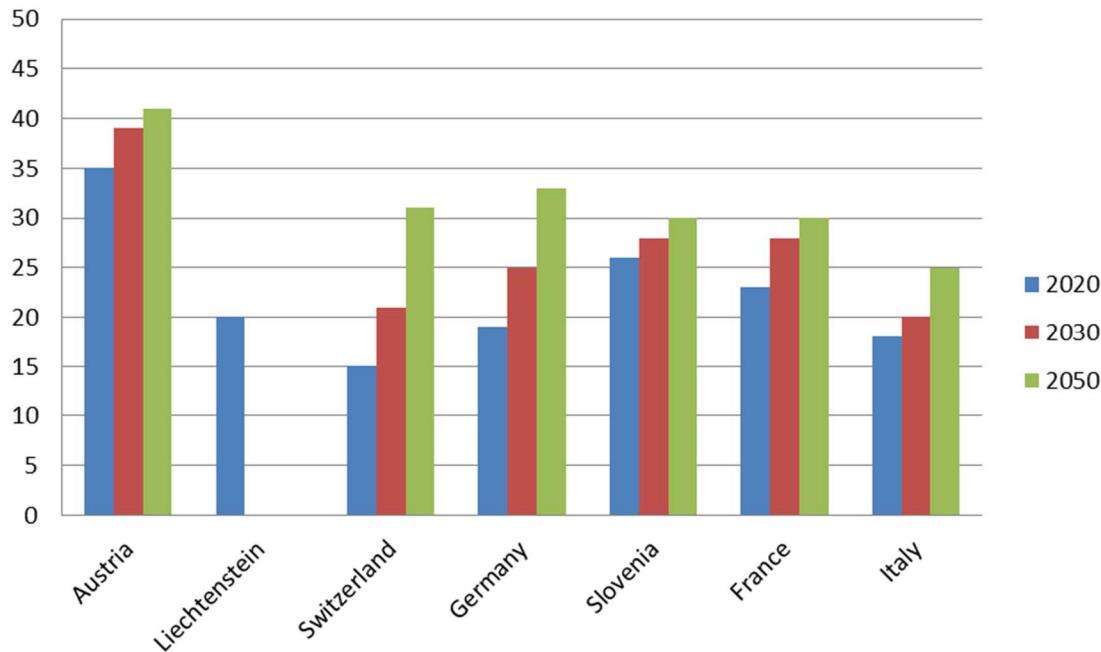


Figure 2.2-2 Projected share of RES in final energy demand (%) per year of the Alpine countries in 2020, 2030 and 2050 (data source: Swiss Confederation et al. 2015, p. 26, graph: ifuplan 2016).

Status and potential to use renewable energy in the Alpine area:

- The Alps have a significant potential for the use of renewable energy, making a valuable contribution to reduce CO₂ emissions and so to mitigating climate change.
- The biggest share of renewable energy production lies in all Alpine countries in biomass as well as hydropower.
- Concerning renewable energy 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 of 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 renewable energy 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 potential renewable energy in the Alps offers great opportunity towards energy independent, CO₂ neutral Alps;
- Existing infrastructure for renewable energy power plants (e.g. existing hydropower plants) can be used to feed in the electricity grid system from other RES 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 endogenous 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 trans-border cooperation;
- Preservation of environment: The renewable energy power plants have to be planned in accordance with nature conservation and sustainable land use. More holistic assessment is needed to plan new renewable energy power plants in accordance with environmental regulations (e.g. EU Water Framework Directive).

2.3 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).

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 2015d).

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

Figure 2.3-1 shows trends on the average annual change of energy intensity between 2005 and 2013 in the following five sectors in the EU countries in 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 2.3-1: Average annual change on energy intensity indicators from 2005-2013 in different sectors of the Alpine countries within the EU (Source: data source: EC 2015d, 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 Alpine countries from 2005-2013 (Germany -1.9%, Austria -1.6%, France -1.3%, Italy -1.2%, Slovenia -1.1% (EC, 2015d)).

The Alpine countries have set ambitious targets towards the Europe 2020 strategy in their National Energy Efficiency Action Plans (NEEAP 2014). Table 2.3-1 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 2.3-1 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 | |
|---------------|---|---|--|-------------------------|
| | | | 2030 | 2050 |
| 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".

Status and potential to increase energy efficiency in the Alpine area:

- 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 CO₂ 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 third sector (service sector) are identified as action fields.

Opportunities:

-
- 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 also 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.

Challenges:

- 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 Green Economy.
- 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 (CO₂ 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.

3 Resource efficient economy

A resource efficient economy is an essential brick in 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 to scarcity of many 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 many points of view, especially in a 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 and hence, the subject of sufficiency is an important dimension.

As described in the EU Factsheet “Resource efficiency – a business imperative” (EC 2011c), a 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.

3.1 Efficient use of resources

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)⁸. DMC measures the total amount of materials directly used by an economy. It is defined as the annual quantity of raw materials extracted from the domestic territory of the focal economy, plus all physical imports minus all physical exports (Eurostat 2010). 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 in Germany and Switzerland. The largest reduction had been achieved in Italy and Slovenia. For resource productivity the Alpine countries achieved values from 1.7 to 3.7 PPS⁹ per kg in 2014. In relation to these figures, Switzerland and Italy achieved the highest values for resource productivity among the Alpine countries

⁸ Other approaches to measure resource productivity rely on footprint indicators, e.g. on Raw Material Consumption (RMC) instead of DMC.

⁹ 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.

in 2014. However, a direct comparison is difficult, since the industry structures of the Alpine countries differ a lot. As a matter of 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 increased their resource productivity in this timeframe. Slovenia and Italy actually 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 3.1-1)

Table 3.1-1 Domestic material consumption in Alpine countries (in tonnes per capita), 2014.

| 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.

(Data source: Eurostat 2015e, FSO 2016)

Status and potential to increase resource efficiency in the Alpine area:

For a comprehensive picture, the data availability for resource efficiency on 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 challenges 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 CO₂ 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.

3.2 Land use changes

Across Europe, artificial surfaces¹⁰ 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.

To present the status quo of land use, land use change is 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.

Situation in Alpine countries – Analysis of land use changes based on national statistical data¹¹

Germany (cf. Figure 3.2-1), Liechtenstein (cf. Figure 3.2-2) Slovenia (cf. Figure 3.2.3) and Switzerland (cf. Figure 3.2-3) 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. But 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 3.2-1).

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.

In Austria, the utilized agricultural area in all LAU2 units within the Alpine Convention perimeter 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).

¹⁰ Artificial surfaces include all land use classes within “Artificial surfaces” of the CORINE land cover classes.

¹¹ National land use data are in most cases more precise than CORINE data, but each country has its own classification scheme and data source. Regarding changes over longer time series may be difficult even within one country, as data sources and classifications sometimes are changed.

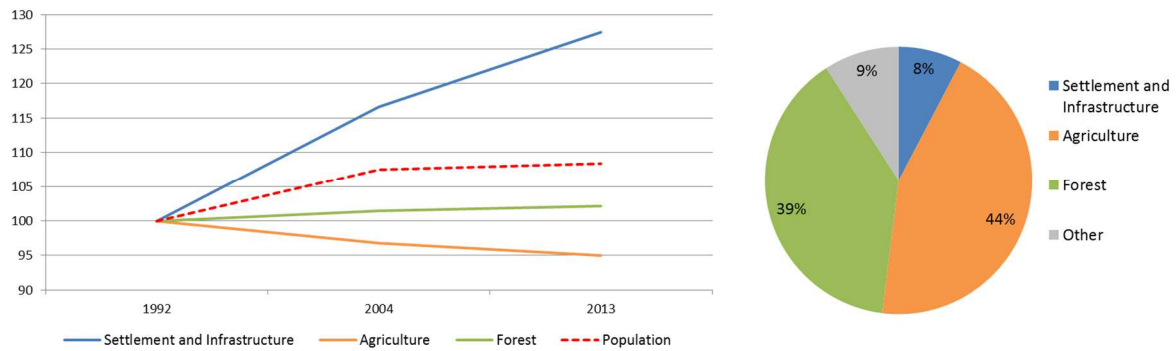


Figure 3.2-1 Development (1992-2013) and share (2013) of different land use classes in the German part of the Alpine Convention area between 1992 and 2013¹² (Base year 1992 = 100), (data source: Bayerisches Landesamt für Statistik und Datenverarbeitung 2004, graph: ifuplan 2016).

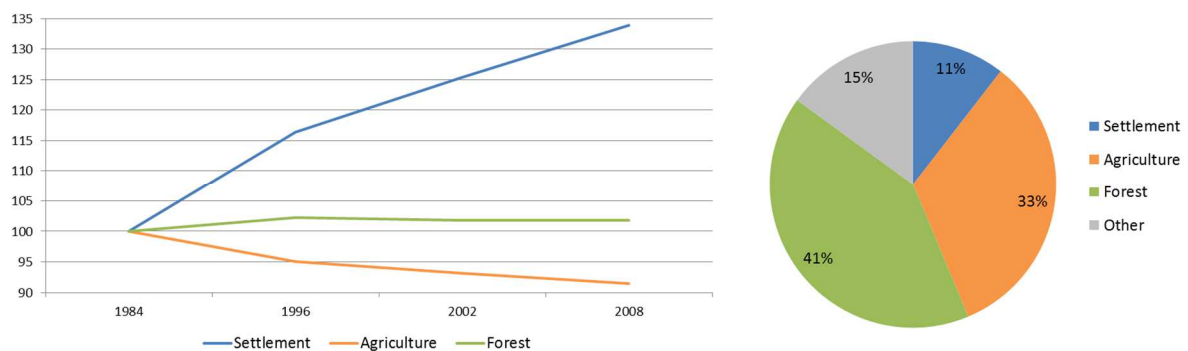


Figure 3.2-2 Development (1984-2008) and share (2008) of different land use classes in Liechtenstein (data source: Schweizerische Eidgenossenschaft 2009, graph: ifuplan 2016).

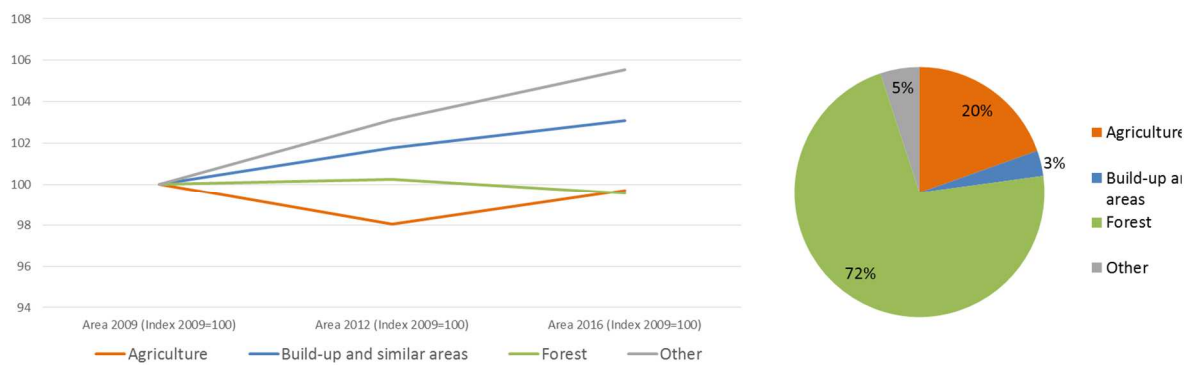


Figure 3.2-3 Development (2009-2016) and share (2016) of different land use classes in the Slovenian part of the Alpine Convention area (Data source: Ministry of Agriculture, Forestry and Food and Slovenian Environment Agency).

¹² Due to changes in the land use statistics, the data from 2014 onwards are not directly comparable with data until 2013.

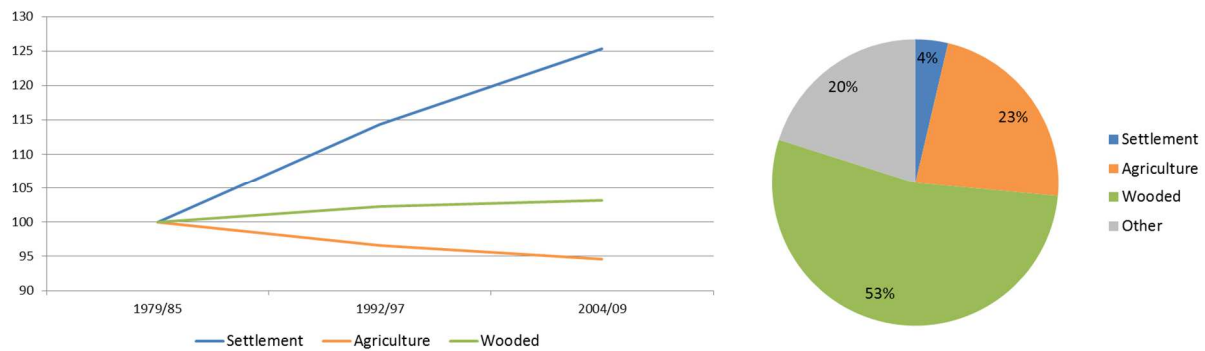


Figure 3.2-4 Development (1979-2009) and share (2004-2009) of different land use classes in the Swiss part of the Alpine Convention area¹³; (Data source: BFS 2016b¹⁴, graph: ifuplan 2016).

Status and potential of land use changes in the Alpine area:

Due to topographic and climate conditions, land suitable for settlement, transport and agriculture 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 (PSA) 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, 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 where soil productivity is – in most cases - higher than in higher altitudes and at steeper slopes. Therefore, agriculture has lost and still loses 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.

¹³ Data were provided for Cantons. Four Cantons are only partly in the AC area, but included completely in the figures.

¹⁴ The term “settlement” stands as an abbreviation for the land use class “settlement and urban areas”.

3.3 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 efficient, 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 materials (e.g. plastics by regrowing or compostable alternatives or synthetics by natural materials). It also includes strategies such 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. In a nutshell, 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 burnt¹⁵. This means there is still a high loss of potential secondary raw material, although some progress was made in the past.

Circular economy, recycling and waste management in the Alps are not very different from the lowlands. The EU Member States follow the respective framework directives. Waste and circular economy regulations and policies are made mainly at national level. Waste management is often organised by regional or local administrations. 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.

Opportunities and challenges of circular economy in the Alpine Region

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 CO₂ emissions due to reduced transport needs.

¹⁵ Further information: <http://ec.europa.eu/environment/waste/index.htm> (January 2016).

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.

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

4 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 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, financial and social capital. And the services nature provides are also 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.

4.1 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, over-exploitation and destruction of natural capital and ecosystem services would lead to an ecological “bankruptcy”. This means tremendous disadvantages for economy, culture and social life. Examples are the costs arising from flood damages, which are related to degraded regulating services of rivers. The flood damages in summer 2013 in Germany sum up to about 11.7 billion Euro (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.

What are specific contributions of the Alps in terms of natural capital and delivering ecosystem services? As no cross country analysis of natural capital and ecosystem services exist, it is difficult to answer this question. 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. The Alpine landscapes offer also a vast amount of cultural services which have inspired generations of painters, musicians and poets.

Natural capital - the example of forests in the Alps

From the different types of natural capital for this report, forest has been chosen 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.

The total wood volume of Alpine forests is 2,000 million m³, with an average of almost 240 m³/ha, much higher than the European 28 average (146 m³/ha). The annual increment is 50 million m³, equal to 5.7 m³/ha, which is higher than the EU 28 average of 4.8 m³/ha. The annual cutting is 28.5 million m³ (Contribution of WG Mountain Forest, 2015). Figure 4.1-1 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 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, by the increase in atmospheric higher CO₂ content concentration and temperatures (Bellassen et al. 2011).

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.

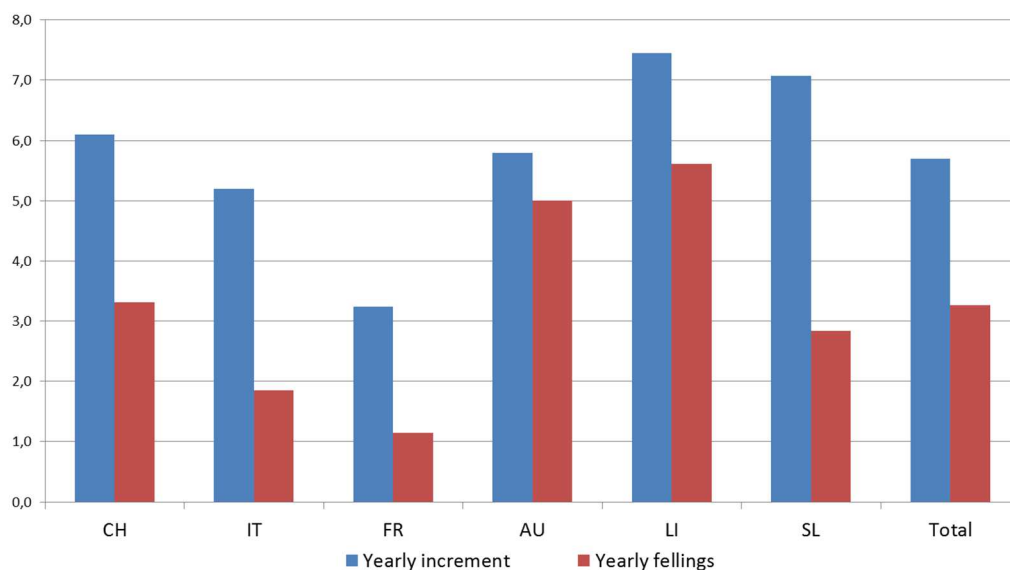


Figure 4.1-1 Annual forest increments and fellings per ha in the Alpine countries (Data source: Working Group Mountain Forests of the Alpine Convention 2014); In the south – west Alps, fellings achieve a quote of 35% of the forest-increment, while in the north-eastern area they are 75%.

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).

Opportunities and challenges of natural capital and ecosystem services in the Alps

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.

4.2 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 (e.g. regional recipes) or clothing accessories for traditional costumes and enriches our personal nature experiences. More than this, biodiversity is also an important economic factor such as marketing and image asset in tourism (such as eagle or alpine ibex), input for pharmaceutical products, biochemical products or cosmetics, 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.

Biodiversity cannot be maintained by only creating protected areas. Due to the rich biodiversity in the Alpine area, protected areas are however, an important backbone for a transnational green infrastructure in the Alpine area covering almost 28 % of the total Alpine Convention area. These protected areas already today generate significant added value.

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 high nature value 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, these authors categorised three types of high nature value 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 Joint Research Centre and the European Environmental Agency have prepared the first EU27 map of High Nature Value farmland, 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 4.2-1 presents the likelihood of HNV farmland presence in the Alpine region indicating that in the most part of the Alpine area the likelihood of HNV lies in the interval high and very high.

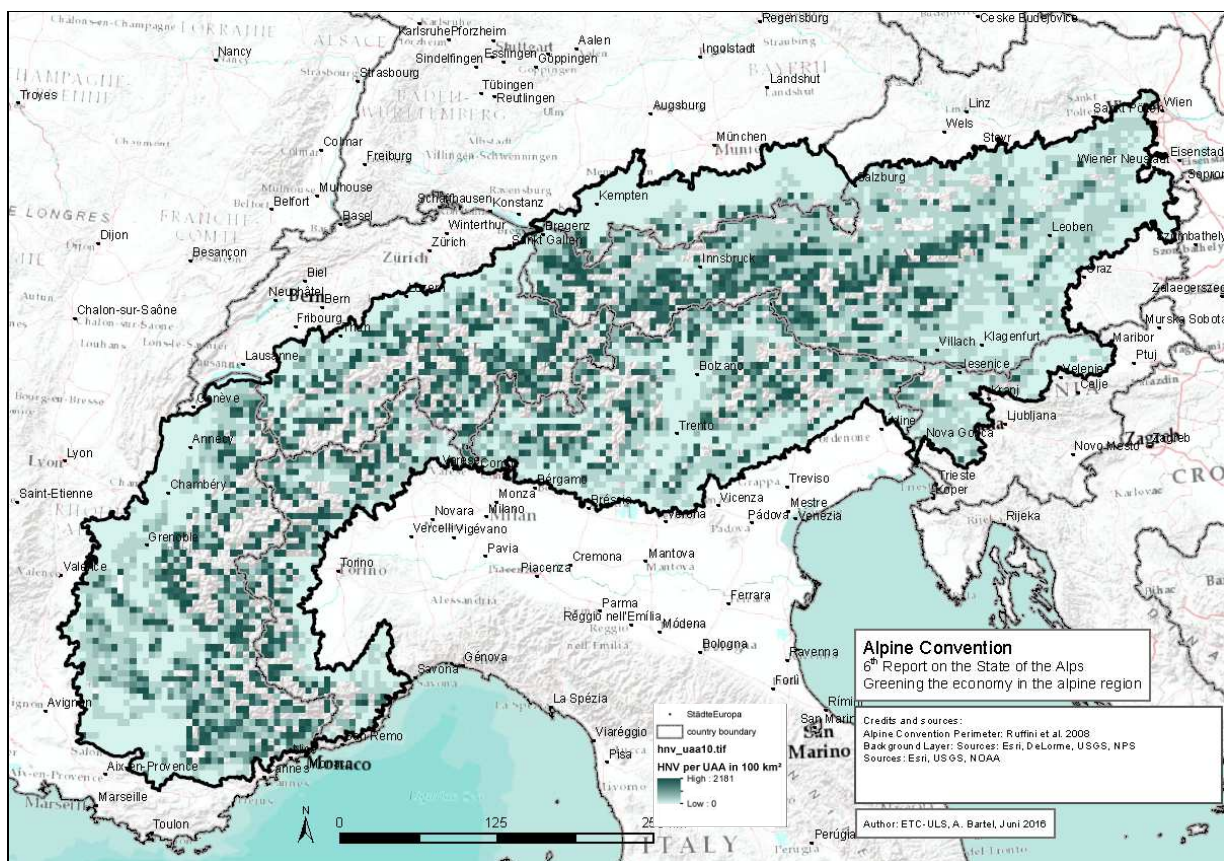


Figure 4.2-1 Likelihood of HNV Farmland presence based on CORINE land cover data (Source: ETC-ULS 2016b).

Opportunities and challenges of biodiversity in the Alps

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 biodiversity¹⁶. 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.

4.3 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.

Is it necessary to valorise ecosystem services and biodiversity? In principle, economics is about making choices and making decisions while weighing the values of different alternatives. However, often economists equate “values” with “prices”. 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 is widely used as a criterion to measure material welfare. GDP measures the total value of all goods and services produced within the national territory within a specified period of time. However, GDP normally does not regard damages to the environment and nature, but paradoxically 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 2013b).

One needs to be aware that the term “value” has different meanings: value may mean to regard something being of importance or worth. Also, value 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

¹⁶ Further information:https://www.iucn.org/news_homepage/events/iucn___rio___20/iucn_position/green_economy/.

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.

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 (such as provision of wood, food, recreation, landscape amenities). Furthermore, the Alpine area provides ecosystem services which are highly important services for areas outside the Alpine Convention area (such as water provision, run-off regulation) 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.

The example of protected areas and tourism

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 to 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 by Job 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 transferring 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 times¹⁷ 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.

Opportunities and challenges of valuation of ecosystem services in the Alps

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. But unfortunately in many fields, their values are still under-estimated or mostly debated in political and economic decisions.

Many economic activities 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.

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. 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.

¹⁷ The ratio lies between 1:1 and 1:7, in average of the analysed German national parks a ratio of 1:3 was calculated by Job et al. (2009).

5 Economy supporting quality of life and well-being

According to UNEP, a Green Economy improves human well-being and social equity. Next to social justice and decent work, this also includes health issues as environmental conditions affect the quality of life in many different ways.

This chapter deals 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.

5.1 Employment and education

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 need 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.

In 2008 in Austria, 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.

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.

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).

For Germany, 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 5.1-1. 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 (cf. Figure 5.1-1).

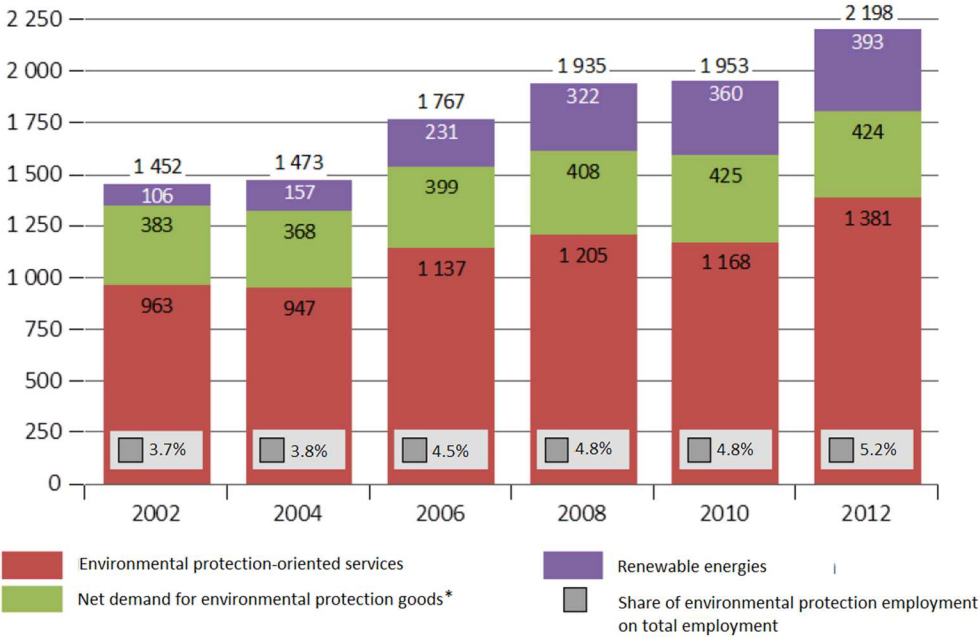


Figure 5.1-1 Development of employment in the environmental goods and service sector in Germany, 2002 – 2012, in 1,000 persons. (Source: Edler & Blazejczak 2016) (The comparability of the estimation results between the review years is limited; a substantial part of the differences occur due to methodological and statistical reasons. <*> net: adjusted for double countings. Contains employment in energetic building refurbishment. (Source: Calculations by DIW)))

Opportunities and challenges of green employment and education in the Alps

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.

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 Austrian example shows 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.

5.2 Economic well-being and social inclusion

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.

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 5.2-1 shows the percentage of people at risk of poverty in the Alpine Convention area.

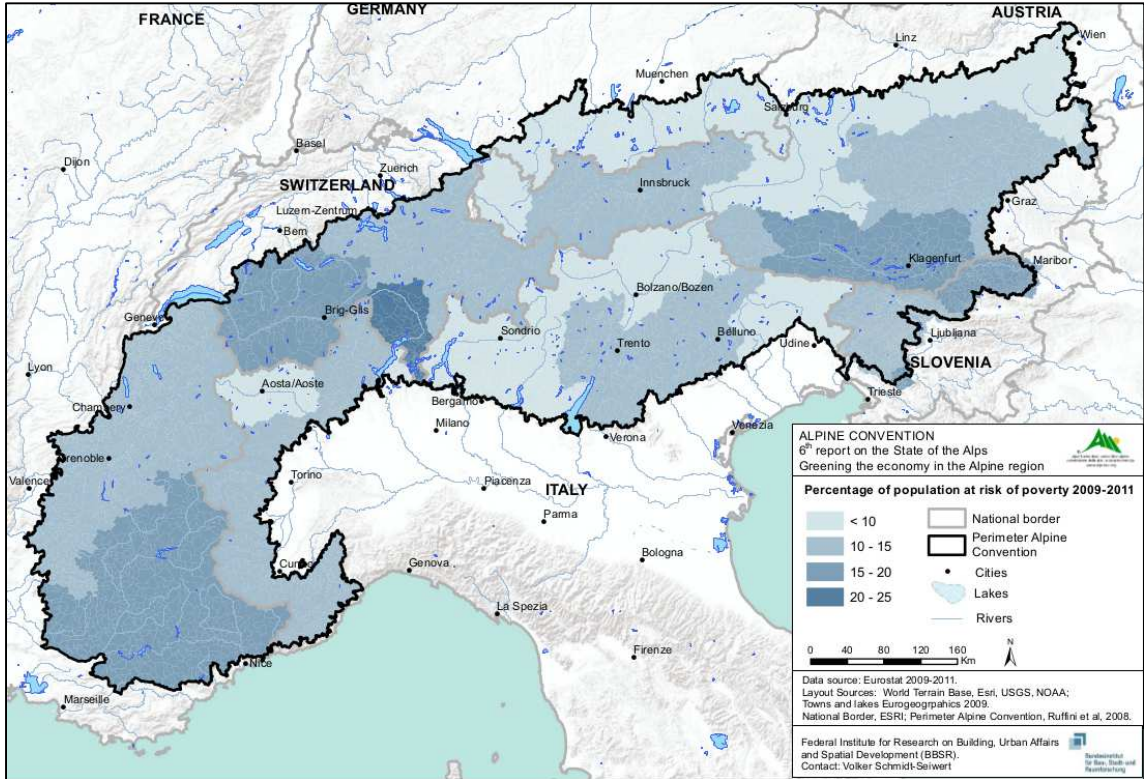


Figure 5.2-1 ESPON Atlas 2014: Risk of poverty (Source: ESPON & BBSR 2014, elaboration: Permanent Secretariat of the Alpine Convention).

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”¹⁸ was born in 2010, initiated by the 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 they fulfil certain values, such as human dignity, solidarity, sustainability, justice and democracy.

¹⁸ Further information: <https://www.ecogood.org/en>.

Opportunities and challenges of economic well-being and social inclusion in the Alps

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 European 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 European average, for tertiary education the figures come close to the European 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.

5.3 Sustainable consumer behavior

Sustainable consumer behaviour means incorporating social and environmental consideration into purchasing and consumption decisions and thereby triggering 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 two trillion Euro; this represents 19% of the EU's gross domestic product.¹⁹ 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 taking the consumption side into account. 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.

¹⁹ Further information: http://ec.europa.eu/environment/gpp/what_en.htm.

Opportunities and challenges of sustainable consumer behavior in the Alps

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 is 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 and regional 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.

5.4 Health and harmful emissions

Environmental quality always was and still is 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. Also, 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 (PM) 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. 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.

While health effects of harmful emissions are a general issue, there are some special features in mountain regions as the Alps concerning the behaviour of emissions. In a nutshell, 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).

Figure 5.4-1 shows the interpolated annual average of PM_{2.5} 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 also exceedances mainly at the southern borders. As the map shows 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.

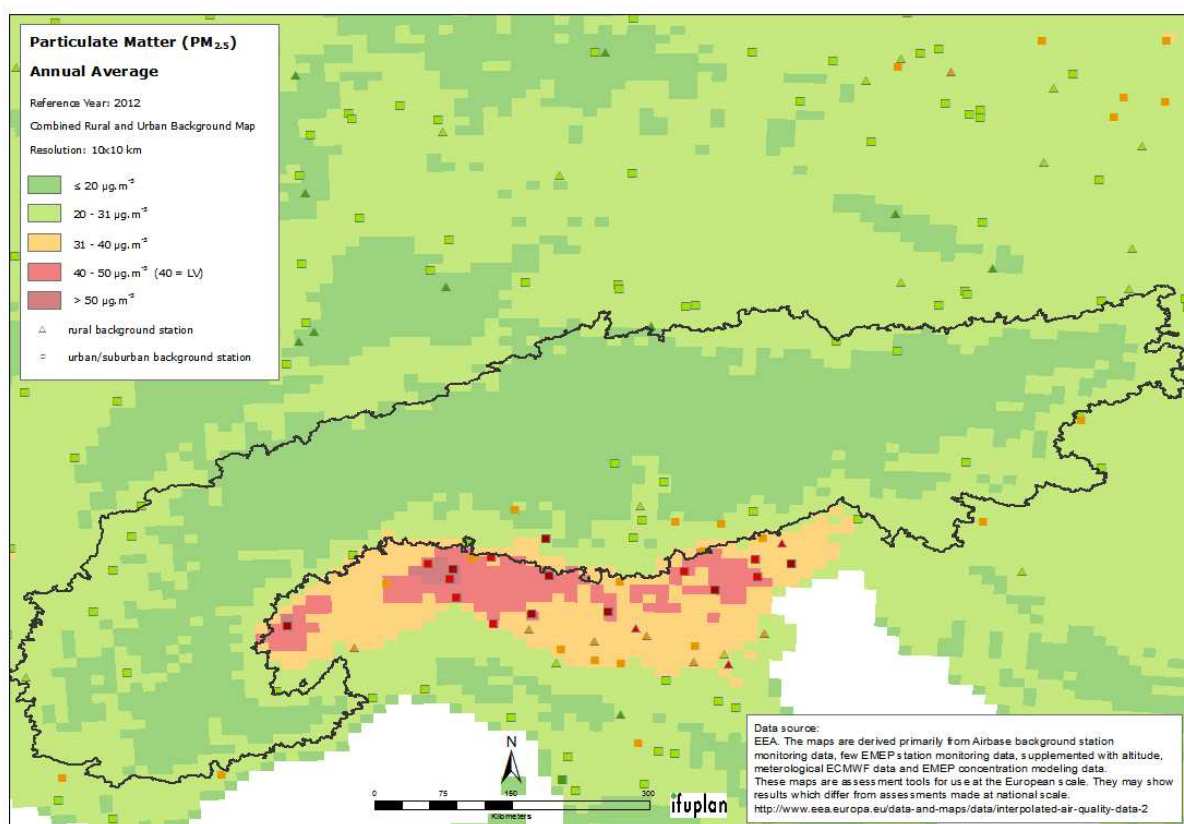


Figure 5.4-1 Annual Average of Particulate Matter (PM_{2.5}) (Source: EEA 2016).

Opportunities and challenges of improving health by decreasing harmful emissions in the Alps

Air quality (measured for particulate matter 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 particular matter 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.

6 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 challenges 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

Present and future challenges, 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 decentralized renewable energy production 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 numerous 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 negative 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. 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.

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 financially support 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 forms of cooperation 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.

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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, Stefano della Chiesa

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 Eggenberger

Berchtesgaden National Park
Michael Vogel

Club Arc Alpin
Liliana 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 Dellagiacomma (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)