



# ALPINE SIGNALS 6

## TOWARDS DECARBONISING THE ALPS

National policies and strategies,  
regional initiatives and local actions



REPUBLIKA SLOVENIJA  
MINISTRSTVO ZA OKOLJE IN PROSTOR



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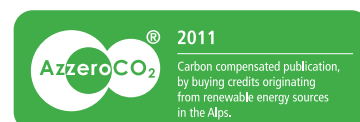
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National policies and strategies,  
regional initiatives and local actions

A project of the Slovenian Presidency of the Alpine Convention  
and the Permanent Secretariat of the Alpine Convention  
in collaboration with  
ARGE ALP – The Working Community of the Alpine Regions



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REPUBLIKA SLOVENIJA  
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Climate change and its consequences is one of the greatest challenges humankind faces today. The changed conditions require serious structural change and adjustments in the economy and society in general. A strong commitment is needed from stakeholders at different levels to tackle climate change and achieve common goals. Climate change is already a fact, asking for concrete action and results, not merely our concern. It is thus necessary to build strong partnerships, establish platforms and pools of knowledge and experience in the Alps, to learn from each other and to work together to develop joint strategies, programmes and projects to provide the right answers to the existing and upcoming challenges. As the environmental factors change, we must adapt and modify our behaviour, find innovative and creative approaches not only to develop synergies among policies but also to implement them effectively.

Climate change adds a new dimension to the issue of sustainable development in the Alps and one which must be appropriately addressed. Scientific facts show that the Alps are more vulnerable to climate change than other areas. There are numerous policies and activities taking place at different levels and scale and being implemented by many and varied stakeholders. In our opinion the raising of awareness is a key issue in stemming the pace of climate change as well as in adapting to the change.

The Slovenian Presidency Programme (March 2009 - March 2011) called *“Alps as development potential of Europe”* sets three priorities, namely climate change adaptation and mitigation, stimulating implementation of the Alpine Convention at regional and local level and raising awareness of the potentials involved, and stimulating regional cooperation. All three contribute to our common goal in the Alps. The Slovenian Presidency, together with the Permanent Secretariat and other Contracting Parties and Observers began implementing of the Climate Action Plan after its adoption in 2009, and organized two thematic seminars, where national and regional climate mitigation and adaptation activities and projects, and examples of good practice were presented and discussed. Their conclusions are reflected in this publication.

This publication *Towards decarbonising the Alps* reflects the momentum in the process of tackling climate change in the Alps; including international agreements and obligations, European legislation and commitments, and also implementation of the Action plan for the climate change in the Alps, together with national and regional policies, programmes and initiatives for the implementation of these political agreements and legislation. The publication represents a milestone in the process of tackling climate change issues and in the search for answers and proper ways to address the inevitable problems. It should serve as an insight into the activities taking place in the Alps in this field, and provide motivation and ideas for future activities.

The seriousness of the climate change and its consequences for the Alps calls for further effort and stronger commitment to continue and improve our response, both collectively and individually. This path opens new opportunities for improving the quality of life and the job market. It is our duty now to transfer lessons of individual cases of good practice into common good practice to achieve sustainable development in the Alps, and to integrate climate change into our daily work and behaviour.

*Tanja Bogataj*

*Slovenian Presidency of the Alpine Convention  
Slovenian Ministry of Environment and Spatial planning*

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Managing climate change is, by common consent, likely to be the biggest challenge facing Planet Earth in the decades to come. It is a truly 'global' issue. However the consequences of a warmer world will not be evenly distributed, some regions will be hit harder than others and it is conceivable there will be local benefits too. The Alpine region, the interests of which are at the heart of the Alpine Convention, is unlikely to be directly affected by rising sea levels, however melting glaciers, a rising snowline, flash floods and droughts, all exacerbated by global warming, could have serious impacts in the Alps.



The challenge of climate change lies not only in the physical realm, for example floods and how best to protect threatened communities from inundation, but in the process of decision-making. Here an incredible variety of factors become involved – political, social, economic and all manner of public and private interests. Such is the enormity of the climate challenge that it calls for new forms of governance at global level, with the attribution of greater competences and responsibilities to international bodies, such as treaties, organizations and cooperative structures.

The Alpine Convention, a multilateral regional treaty aimed at sustainable development and nature protection in the Alps, is one of the existing structures for international governance that is already addressing issues of climate change. When the treaty came into being in the 1990s awareness (or acceptance of the awareness) of human-generated climate change had not yet reached the critical level necessary for the direct inclusion of this topic within the thematic scope of the Convention, although two of its protocols, on energy and forests, made reference to it. However, ministers moved to fill the gap, and in 2009 the Alpine Conference approved an Action Plan on mitigation and adaptation to climate change in the Alps.

This Action Plan is not intended to replace or duplicate national and European Union measures for addressing climate change, and is limited in geographical scope to the alpine zones of the eight Convention States. While being an invaluable reservoir of resources – water, timber, premium dairy products and recreational opportunities – for the cities and people of the 'plains', the Alps and other mountain areas face paying a comparatively higher price in the fallout from global warming. Their vulnerability should make them a specific case in international deliberations on climate change. However, it is unfortunately a fact that the interests of mountain areas hardly figure on the political agenda at international and national level compared to those of the densely populated plains. The Action Plan reminds all decision-making bodies of the States that "share" the Alps of the crucial need to represent the interests of the Alpine population and environment in all relevant law and policy deliberations.

The Action Plan also aims to assist territorial authorities of the Alps, be they regions, provinces or municipalities, find their way through the complex mass of existing international and national measures, laws and policy declarations relating to climate change. Many authorities wish to do more to help meet this global challenge. The Action Plan will provide them with important reference points and the ability to share information on best practice and other data by way of a dedicated portal on the Alpine Convention website.

The fact that the Action Plan is not a binding instrument has the benefit of enabling it to be used speedily and pragmatically. The Alps are already experiencing the visible impacts of climate change and the livelihoods of some inhabitants are already under threat. In such circumstances action cannot be further delayed. The Action Plan provides for communities to respond to climate change without denying the competence of any of the higher levels of governance in which they participate.

This publication, released two years after the adoption of the Action Plan, gives an insight into the initiatives which the Alpine states and authorities have taken, or plan to take, to tackle the avoidable effects of climate change and to mitigate the impact of those that are unavoidable. Although the challenge remains formidable, both globally and for the Alps, it is hoped that this sharing of knowledge and experiences will serve as a spur for increased resources and further action in the interests of both future generations and the Alps themselves.

*Marco Onida*  
*Secretary General of the Alpine Convention*



In a region as environmentally sensitive as the Alps, climate change is a key challenge. The exchange of information on climate protection and measures adopted in the Alpine countries is one of the priorities of the Association of Alpine States - Arge Alp. Although climate change is a common challenge for the Alpine countries, in dealing with this issue it is important to take into account the different conditions of individual regions: each region should adopt its own climate protection strategy suited for the local specificities and possibilities. At the same time, we should not lose sight of the scientifically proven needs relating to climate change. Climate protection can and should be seen as an opportunity: a chance to protect our habitat, a chance of economic development, innovation and cultural change, a chance to improve the quality of life of the inhabitants in the Alpine regions.

Active protection of the climate is closely linked to a sustainable energy policy: the intelligent use of energy, energy efficiency and energy production from renewable sources. Especially the Alpine regions have a whole range of opportunities to replace fossil fuels with indigenous, renewable and environmentally friendly energy sources. On the issue of climate protection the Alps can serve as a role model and take the lead with an active climate policy.

We must always remember that the fight against climate change is a must: it has to do with our habitat, with nature, for which human beings have to take responsibility and which is necessary for our lives. We must also remember that we have to look at climate protection in a totally new way if we want to seize the opportunities before us.

*Luis Durnwalder*  
*President of the Autonomous Province of Bolzano/Bozen*



## INTRODUCTION

Climate change is affecting, or will affect each region of the world in different and specific ways. The vulnerability of mountain ecosystems to global warming and climate change is particularly high. Although globally the Alps may not be a major contributor to CO<sub>2</sub> emissions, it is important that the Alps, their authorities and population reduce their greenhouse gas emissions and prepare for the future impacts of a changing climate, which threaten the ecosystem of the Alps and the eco-services the mountains bestow on the human race.

The first chapter of this publication provides some brief information about the expected developments in the climatic conditions and illustrates the effects of climate change in the Alps, both on their northern and southern sides. Scientific studies show that, even within the region of the Alps, the effects of climate change can be quite different according to the geographical location.

The following chapter focuses on the legal and policy framework: after recalling the core aspects of EU strategy, focus is on the Alpine Convention and in particular its 2009 Action Plan on climate change adopted after a four-year negotiation period under the leadership of the Austrian and French Presidencies of the Convention (2004-2009). We then move to the implementation of the Action Plan, presenting firstly summaries of the strategies adopted at national level on climate change mitigation and adaptation, as presented by the Contracting Parties of the Alpine Convention to a thematic seminar organised by the Slovenian Presidency in October 2009 in Brdo pri Kranju. The Alpine Convention being a treaty for the territory, and in light of the fact that regions have become very active in this field as they hold key competences (such as on energy production), the subsequent chapter presents the experience and strategies of a number of regions of Austria, France, Germany, Italy and Switzerland. Most of these were presented at the Conference “The Alps as model region for climate protection?” jointly organised by ARGE ALP and the Permanent Secretariat of the Alpine Convention in Bolzano/Bozen in September 2010. The last chapter deals with implementation through good practice and concrete proposals, both by authorities at national and regional level and by voluntary networks and relevant NGOs.

An innovative aspect of this publication, which is part of the “Alpine Signal” series of publications of the Alpine Convention, lies in the cooperation between the Alpine Convention, through its Presidency and Permanent Secretariat, and ARGE ALP, demonstrating that joint efforts and creating synergies between different political and administrative levels, besides being an obligation in pursuit of sustainable development strategies, also has tangible advantages in better informing the general public about the measures adopted and the relevant implementation projects. By spreading information and enhancing awareness, it is hoped this publication will further contribute to the mobilisation of energies for countering climate change and adapting to its consequences in the Alps.



# 1. CLIMATE CHANGE IN THE ALPS: FACTS, CHALLENGES AND OPPORTUNITIES

## 1.1. HOW CLIMATE CHANGE IS AFFECTING THE ALPS: KEY SCIENTIFIC FINDINGS

FACTS	IMPACTS
<ul style="list-style-type: none"> <li>• The average increase of the temperature in the Alps during the last century has been the double of the average increase of the Northern hemisphere (RSA II, 2009)</li> <li>• Alpine Permafrost warmed by 0.5-0.8°C</li> <li>• Patterns of seasonal precipitation are being modified (EEA, 2009)</li> <li>• For every Celsius degree of warming the snowline will rise by about 150 m (IPCC, 1997) and the duration of snow cover will decrease by several weeks (IPCC, 2007), with possible impact on winter tourism (OECD, 2007)</li> <li>• Future scenarios will make those changes more significant, increasing the natural risks and hazards occurrence</li> </ul>	<ul style="list-style-type: none"> <li>• The consequence is: rapidly increasing human and environmental vulnerability in Alpine communities</li> <li>• Even a slight rise in the probability of storms occurring could have substantial impacts of economic relevance, comparable with the Lothar Storm (Fuhrer et al. 2006)</li> <li>• Direct and indirect effects of climate change will have far-reaching consequences for mountain forests, including their protective function against natural hazards</li> <li>• Changes in glaciers, snow cover and permafrost may induce increased flooding, ice falls and avalanches, destabilization of rock formations, or a combination of all these events (Kääb, 2005)</li> <li>• Species of alpine flora in mountains with restricted habitats above the tree line will suffer biotope loss and severe fragmentation in the event of a temperature increase of 2°C or more (Dirnböck, 2003)</li> </ul>

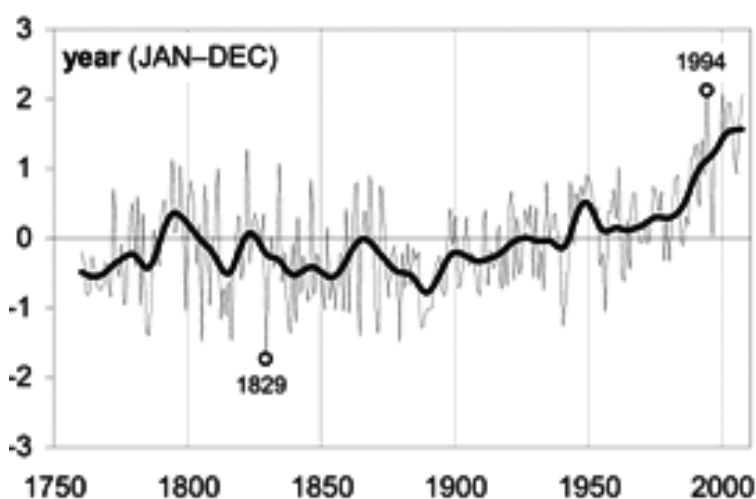


Figure 1: Increase of surface temperatures in the Alps  
Source: ZAMG-HISTALP database (version 2008), taken from EEA (2009) Report on Regional Climate change and adaptation. The Alps facing the challenge of changing water resources.

## 1.2. EFFECTS OF GLOBAL CLIMATE CHANGE IN THE SOUTHERN ALPS

*Hans Richard Knoche*

It has been clear for some time now that the global climate is changing, as testified by the constant increase in surface temperatures observed worldwide. Even the last decade (2000-2009) was exceptionally hot, in fact it was the hottest ever registered since the broad recording of temperatures started 130 years ago (NASA GISS, 2010). It is quite possible that the fifty years between 1950 and 2000 were the hottest in the last 1,300 years (IPCC, 2008).

The impact of climate change differs between regions: the temperatures in temperate and polar regions are increasing faster than in the tropics, and continental areas are warming faster than the oceans. This also causes a shift in the macro-system of the currents, which in turn gives rise to climate variations which also differ between regions. Major changes are detected in areas affected by the withdrawal of land glaciers or marine glaciers.

In Europe, the temperature has increased by some 1.2 degrees compared to 1900, while the average global increase is 0.8 degrees (EEA, 2009). The areas most affected by changes are the south-western and north-eastern parts of Europe in addition to Europe's mountain areas that are particularly sensitive to climate change.

The increase in temperatures recorded in the Alpine region was almost double compared to the global average (Auer et. al., 2007). The increase was especially dramatic over the last 25 years (approx. 1.2 degrees), with summer warming exceeding winter warming. Observed consequences include the increase in the snow line level and, in part, the clear withdrawal of the glaciers, associated to the melting and disappearance of the permafrost in areas previously affected by this event. The amount and seasonal distribution of precipitations have also changed: in the Southern Alpine area, the six summer months are generally dryer, while the winter semester is wetter. The different rainfall trend associated to the melting of the glaciers can have major consequences on local water balance, leading to new risks of flooding and droughts.

### **What are the reasons for this?**

Our planet's long history has always been characterised by varying degrees of climate fluctuation, mainly driven by external causes, including changes in the intensity of solar radiations, variations of the Earth's orbit around the sun, changes on the solar surface or in the composition of the atmosphere. In addition there are numerous other changes of different origin and duration associated to the intrinsic variability of the climate. The 'modern' origin of climate change should mainly be investigated in the increased natural greenhouse effect, caused by the emission of additional greenhouse gases (especially carbon dioxide CO<sub>2</sub> and methane CH<sub>4</sub>). As a result, CO<sub>2</sub> concentrations, which amounted to 280 ppm in the pre-industrial era, have now increased to 380 ppm (IPCC, 2008). In the future, the variation of the intensity of solar radiations observed in the twentieth century, which are partly responsible for the recorded increase in temperatures, is expected to be less dramatic, while the intensity of the greenhouse effect caused by man will increase.

### **How will the climate evolve in the future?**

The future development of global warming depends on how greenhouse gas emission trends will change. Taking into account numerous factors, including increasing demographic trends, economic

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growth, the development of new technologies and the implementation of measures to protect the climate, the Intergovernmental Panel on Climate Change (IPCC; WMO, UNEP) has envisaged several future scenarios with reference to the emission and associated concentrations of greenhouse gases. Climate models for different parts of the world were applied to these scenarios to provide an approximate calculation of future climate trends. For the current century, the assessments and the results provided by these models suggest temperature increases between 1.8 and 4.0 degrees in an interval between 1.1 and 6.4 degrees (IPCC, 2007). Expected temperature increases for Europe are expected to reach 1.0 - 5.5 degrees, with warming mostly affecting Southern and Eastern Europe in winter and south-western and Mediterranean Europe in the summer (EEA, 2009).

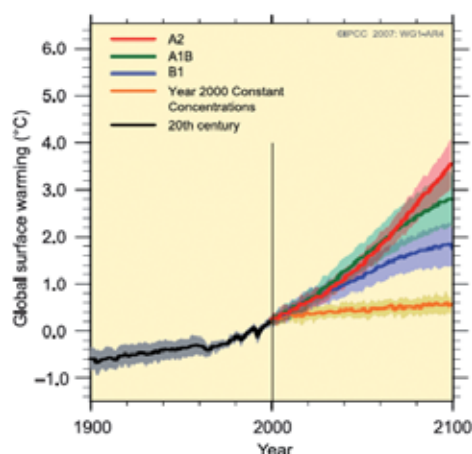


Figure 2: Trend of average world temperatures detected near ground level for the emission scenarios A2, A1B, B1, considering constant concentrations from year 2000 onwards (orange). The unbroken lines represent the average value provided by the calculations made for the different models; the shaded area shows the first standard deviation. Source: IPCC 2007

### Results of climate simulations at regional level

To identify the greatest number of region-specific characteristics and details, it is possible to refine the results of the simulation conducted on a global scale (the grid size usually measures hundreds of kilometres) by resorting to a regional climate model. Numerous regional simulations were performed for central Europe and the Alpine region and the resulting calculations suggested possible climate change outlooks.

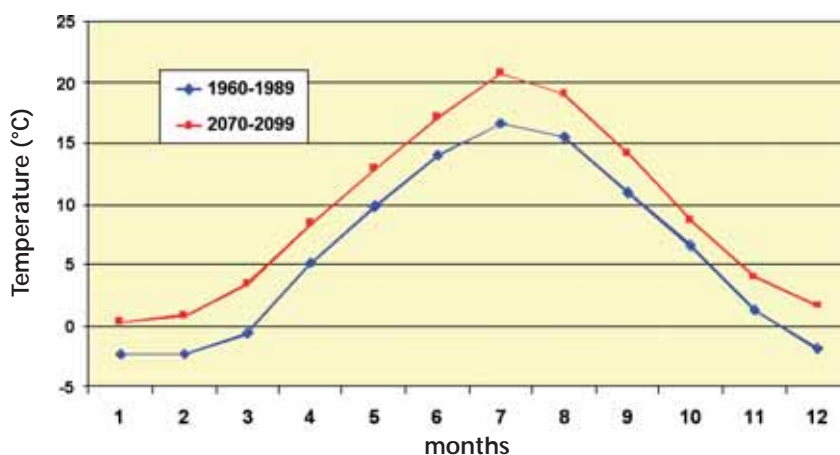


Figure 3: Yearly trend temperatures detected near ground level calculated with the regional model MM5 for the periods between 1960-89 and 2070-99; average calculated on the southern area of the Eastern Alps. Source: R. Knoche, IMK-IFU

For the rather optimistic scenario B2, the simulations carried out by IMK-IFU of Garmisch-Partenkirchen using regional model MM5 led to the following results for the southern area of the Eastern Alps: according to the model, by the end of the century the temperatures will increase over the years by 2 - 4



degrees compared to the 1960-89 period, with the greatest increases affecting the months of July and August (approx. 4 degrees) and the lowest increases affecting the month of October (2 degrees). Overall, in winter the precipitations will increase by approx. 10%, whereas in summer they will decrease some 20 - 30%. Generally speaking, there will be more days characterised by heavy precipitations. For example, a more detailed assessment of the results generated by the models for the area of Chiemgau-Berchtesgadener Land (Marx et. al., 2008) shows an increase in the frequency of precipitations having an intensity exceeding 2mm/h. The model also reveals intensity values that had never been detected between 1960-89. As expected, the model forecasts a clear reduction of the snow coverage. The number of days that the snow cover will remain on the ground decreases in all months, by 40% in winter and approx. 50% in spring. The smallest decrease (20%) is forecast in autumn, in the month of October.

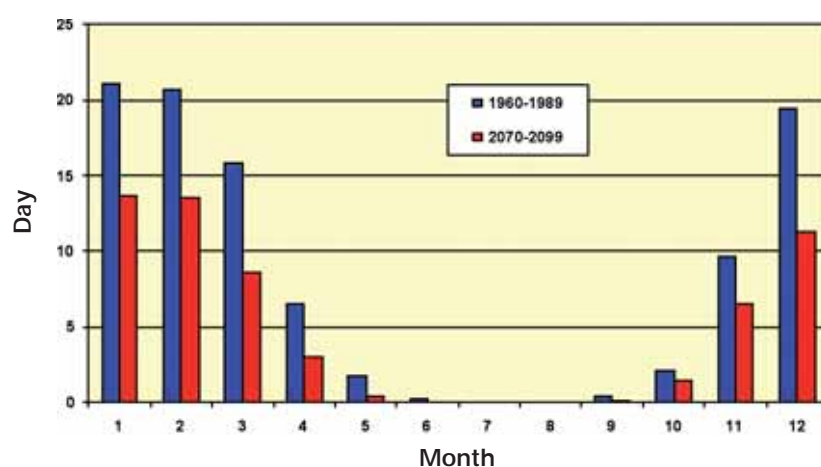


Figure 4: Snow coverage calculated using the regional model MM5 for the periods between 1960-89 and 2070-2099, average calculated for the northern area of the Eastern Alps  
Source: R. Knoche, IMK-IFU

The simulations using regional model CLM (climate version of the COSMO local model) for scenario A1B forecast a further temperature rise of 3.9 degrees for the Alpine region by the end of the century (overall 3.3 degrees for Europe). Warming will be more dramatic above 1500 m, where an average rise of 4.2 degrees is expected (the greatest rise of 6 degrees is expected in mountain tops in the summer). Variations in total precipitations differ amongst regions and between seasons. For the Southern Alps,

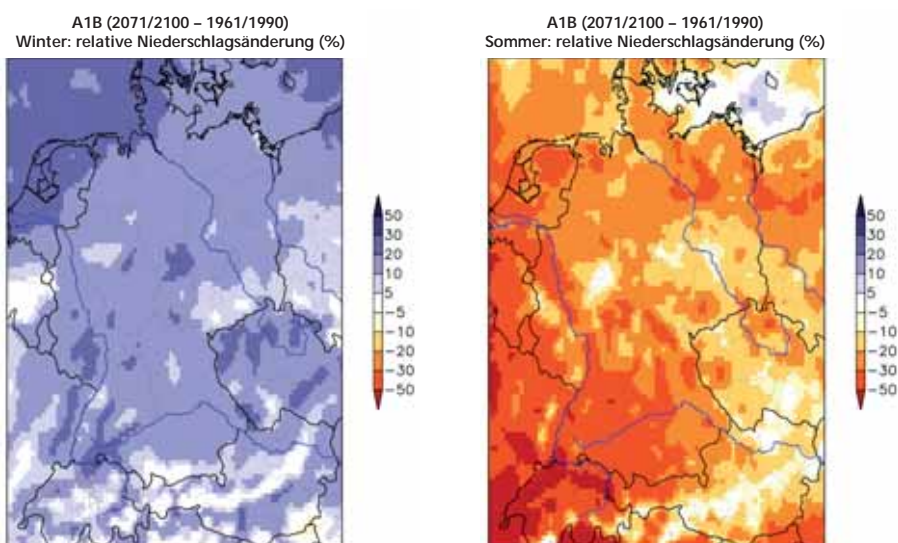


Figure 5 & 6: Relative precipitation variations calculated using the regional model REMO by comparing the period between 1961-1990 and 2071-2100 for scenario A1B in winter (left) and summer (right).  
Source: MPI, Hamburg

the model forecasts few major changes in autumn and winter, with an approx. 20 % increase in spring and an approx. 20 - 30% decrease in summer (EEA 2009).

The most recent studies conducted using the regional model REMO by MPI in Hamburg provide fundamentally similar results, and forecast that in the A1B scenario the temperatures in the southern Alpine region will increase by approx. 4 - 5 degrees both in winter and in summer. The percentage variation of total precipitations changes from region to region and ranges between 0 and 15 % in winter, and 0 and 40 % in summer (Jacob et. al., 2008).

Also other studies, some of which were conducted many years ago (e.g. Knoche and Forkel, 2004), reach the same conclusions in their broad-scale observations. The greatest differences in climate parameters are observed in the small-scale models and in the seasonal distribution. The main uncertainty factor is the real trend of emissions, which cannot in fact be forecast. Nevertheless, the simulations show that, considering the climate system's characteristic inertia, the climate trend for the next 20 - 30 years will be similar for the different scenarios and that, as a result, it will be difficult to influence the climate in the coming years.

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### 1.3. CLIMATE OUTLOOK, IMPACT AND ADAPTATION IN THE ALPINE ECOSYSTEM: THE EXAMPLE OF LOMBARDY

*Antonio Ballarin-Denti*

#### The Kyoto-Lombardy project

Between 2005 and 2008, an integrated research project was carried out, with the support of the Italian Ministry for Environment (MATTM), on climate change in the Lombardy Region. The project was co-financed by Lombardy's Regional Administration, ISPRA (formerly APAT) and Fondazione Lombardia per l'Ambiente. The Foundation acted as the scientific coordinator of the Project which involved 25 operational units reporting to six different universities, the European Commission's Joint Research Centre (JRC), the Italian National Research Centre (CNR), Fondazione ENI "E.Mattei" in addition to other research bodies and institutions ([www.kyotolombardia.org](http://www.kyotolombardia.org)).

The assessment investigated all the environmental and economic factors (climatology, emissions, absorption, impact assessments and policies) that contribute to creating policies aimed at controlling greenhouse gas emissions on the regional level, and implementing climate change mitigation and adaptation actions. The Project also developed an original 'science for policy' approach to encompass both scientific research and the demands of local policy makers in the areas of climate change, air quality and protection of the local environmental heritage.

#### Climatology

Activities in the area of climate studies included the detection, collection, validation, harmonisation and analysis of a broad range of historical meteorological, hydrogeological and glaciological data on the region's territory, especially in its Alpine area. The activities conducted also led to the creation of a new method to retrieve data on the past, current and future climate in individual areas of the regional territory (high-resolution spatial projections).

In addition, in some sample areas, the link between meteorological and hydrogeological phenomena was investigated to assess whether events recorded in historical series of meteorological data had a relevant effect on agriculture and forestry.

The emerging results show that over the recent decades the average yearly temperature in Lombardy grew twice as fast as the average planetary increase: approximately 1.5-2 degrees Celsius over the last 100 years (Figure 7). As to total precipitation figures (figure 8), although the yearly average has not changed, it emerges that the frequency and intensity of the 'more extreme' precipitations has increased in Lombardy and their seasonal and territorial distribution has altered.

Another observation hinted to a visible shrinkage of all glaciers (with reductions in mass and surface area) and of snow coverage in Lombardy: unless this trend changes, there is a real risk that by the middle of this century the glaciers in Lombardy will practically disappear.

The outputs of this research line include: **updated databases** of meteorological, glaciological and hydrogeological data; **specific methods** to spatialise data and calculate thermometric and pluviometric climatology trends, to develop climate change scenarios and manage the risk of geological responses; ad hoc hydrogeological **models** and models for the simulation of culture yields, that could potentially benefit future research on climate change and its effects in Lombardy.

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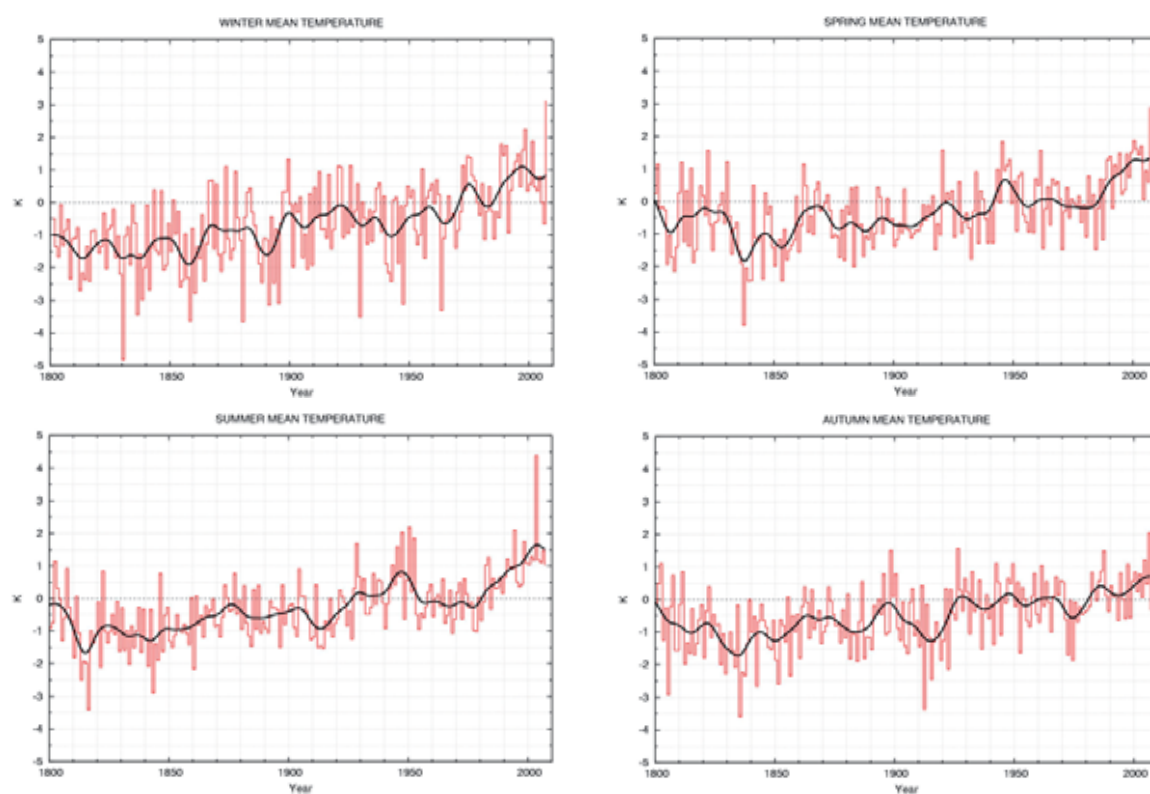


Figure 7: Variation of average yearly and seasonal temperatures between 1800-2007 compared to the 1961-1990 reference period (from "Progetto Kyoto Lombardia", FLA 2008)

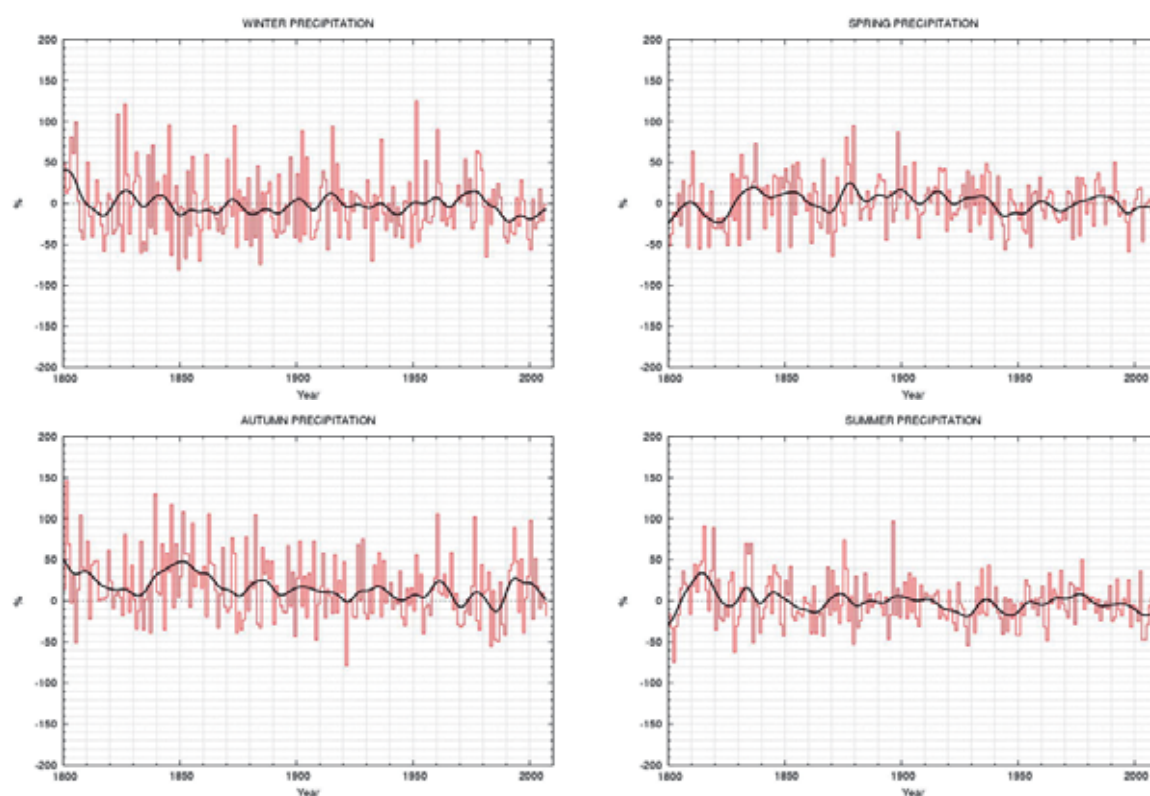


Figure 8: Variation of yearly and seasonal precipitation between 1800-2007 compared to the 1961-1990 reference period (from "Progetto Kyoto Lombardia", FLA 2008)

## Impact

As to the impact of the ongoing or forecast climate change, the research delivered territorial vulnerability maps and estimates of the potential impact and damage affecting human health, infrastructure, natural systems, agriculture, biodiversity and tourism as a result of ongoing or forecast climate change in various parts of Lombardy. The increase in the frequency of extreme events, especially heat waves and flooding, gives rise to greatest concern: the former for their impact on health and the latter for the tangible damage caused to natural ecosystems and infrastructure.

The quantitative assessment conducted on the main cities of Lombardy especially stressed the significant link between heat waves and **human health, assessed in terms of** acute disease onsets, hospital admissions and deaths (for cardio-circulatory and respiratory diseases) in the population aged 75 and over. The impact of the suggested increase in the frequency of extreme events, which is very likely to occur, is expected to become deeper and deeper: indeed, it is forecast that the elderly population will double over the coming decades.

The study conducted on Lombardy's main rivers stressed that the increase in intense rainfall could lead to an increase in landslides and a decrease in flood return periods (up to twice the capacity).

On the other hand, the hydric stress is a main reason for concern in some areas of **agriculture**, especially for the cultivation of maize and vines.

As to the **social and economic** fabric, the reduction of the water capacity in the summer season could damage the whole lake and river inland waterway system. Winter tourism, on the other hand, could lose a remarkable part of its tourist assets, as the freezing level increases and causes the withdrawal of the snow coverage. Indeed, all Lombardy's ski resorts below 1,500 mt. risk being below the freezing level.

A major impact has already been observed on some of the region's **natural systems**, especially those in Alpine and lakeside areas: increasing temperatures cause species to try and migrate towards more suitable habitats (as observed for some flora and fauna species in the Bernina and Stelvio natural parks) but are hindered by the geography of the area.

Meeker winters, on the other hand, cause early blossom, and anticipate the end of the dormant state of allergens, toxic algae and mycotoxins produced by the metabolism of some mushroom species.

## Adaptation and mitigation

The data retrieved for the Lombardy region on the trend of climate-changing emissions, the climate change outlook and the fallout in terms of the impact on anthropic and natural targets was used to conduct economic and environmental assays (cost-effectiveness and benefits) on the adaptation and mitigation tools and policies that could be implemented in the region. This exercise resulted in the definition of a **regional mitigation plan** to keep a check on greenhouse gas emissions and promote sustainable energy initiatives.

The latter objective was pursued by assessing economic policies and technology solutions available to build a model for the region's energy needs.

The detailed assessment of energy policies that could be implemented in Lombardy resorted to a bottom-up technology model (MARKAL-TIMES) developed in European universities. Assessments on the feasibility and potential benefits of greenhouse gas emission reduction policies were exploited, to identify potential means to save energy and cut polluting emissions by promoting new choices in the areas of constructions, mobility (vehicles and fuels), thermoelectric power generation, industry and agriculture in Lombardy.

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Trends for the emission of greenhouse gases were studied and linked to demographic trends and various economic growth scenarios. Models were created to mirror one scenario based on existing trends and two alternative models, each striving towards different environmental aims in terms of cutting emissions and generating energy from renewable sources, taking into account the implementation in the region of the national aims set in the Kyoto protocol and the commitments envisaged in the '*European climate and energy package*'.

The best technologies and choices were highlighted for each scenario and in each considered field. The research was able to find a solution to the issue of *optimising resources*, and identified the best technology mix to achieve the reduction of the total costs of the system by 2020 considering the system's specific limitations (of environmental, legal or technological origin).

Finally, the project especially dwelled on the evaluation of mapping carbon *sinks* and potential *stocks* in the region's agricultural and forest ecosystems and soil. The assessment was also carried out by means of direct experiments on carbon flows conducted on the field. As to the forests of Lombardy, their total net absorption capacity was calculated at 2.39 million tonnes of carbon per year, leading authors to calculate the total forest *sink* in Lombardy at up to one tenth of the man-made carbon emissions (some 9 M T CO<sub>2</sub>). The study also highlighted that the net carbon absorption of hardwood forests is double that of conifers (0.2 - 0.5 kgCm<sup>2</sup>/y<sup>2</sup>), although there is a high disparity between categories and seasons.

This map will enable agricultural, forestry and land management policies to be planned to more rapidly achieve the Kyoto Protocol's aims in terms of removing the sources of carbon dioxide emissions (CO<sub>2</sub>). At the same time, however, the amount of carbon stored in the soil is a potential risk as a source of CO<sub>2</sub> emissions, should an inappropriate management of the climate change lead to the impoverishment of this stock. In Lombardy, the actions aimed at ensuring constant and long-lasting stocks in time including planting and managing permanent forests, long life-cycle forests and poplar forests, all of which are means to significantly contribute to local carbon reservoirs.

## 1.4. CLIMATE CHANGE AS A CHALLENGE FOR ENTERPRISES: FROM RISK TO OPPORTUNITIES

*Timo Busch*

### Climate change – a new challenge for enterprises

The combustion of fossil raw materials generates CO<sub>2</sub>. This chemical transformation, which mankind exploits, tends to modify the natural environment, in two main ways: on the one hand, the anthropic emissions of CO<sub>2</sub> and other greenhouse gases contribute substantially to global warming (IPCC, 2007), whose consequences include - among other things - more frequent extreme weather events, melting of glaciers and a rise in sea level; on the other hand, fossil resources undergo progressive depletion. In the past these two trends – which are closely connected with the natural environment – have been often neglected by business management literature, which considered them irrelevant to business. However, it is precisely climate change that shows how necessary it is to rapidly rethink this rationale: the physical effects of progressive climate change (i.e. the negative consequences of extreme weather events) are already affecting many companies and industry sectors – a trend that might increase significantly in the future. That's why the aspect of *adaptation*, namely adjustment to the consequences of climate change, is important for enterprises. It should also be noted that the unrestricted emission of greenhouse gases can no longer be considered as a static business factor. Instead, from a resource economics and a socio-political perspective it should be seen as a dynamic factor that is likely to intensify in the future. Hence the aspect of *mitigation* – that translates into active climate protection policies - is also important. Both of these aspects will be discussed in greater detail during this talk, and some concrete steps will be proposed to help companies develop a proactive management strategy.

### New risks for companies

Climate change and unsustainable use of fossil resources generate new risks for our society and for companies in particular (Busch/Hoffmann, 2007). In analysing the exposure of a company to the physical effects of climate change, one should distinguish between two developments, both related to global warming. On the one hand, exposure largely depends on the increasing number of single events occurring in a fortuitous manner, such as storms and floods, which can cause physical and material damage. Reinsurers have been reporting an increase in these extreme meteorological events and the economic losses resulting therefrom for some time now (Munich Re, 2009). On the other hand, exposure to climate change is also influenced by 'slow' developments associated with global warming, such as the increase in the average temperature or the rise in sea level. In the case of these continuous and progressive events, the change - and therefore the increase in exposure - strikes only over the long term. However, since these events are less sudden, the negative consequences for companies are fairly foreseeable, even in the short term.

Beyond these physical impacts, climate change poses additional risks to enterprises. Looking at the legal framework, for example, one political measure (to fight global warming) is the EU's plan to reduce CO<sub>2</sub> emissions by 20% from 1990 levels by 2020, then aiming for a 60-80% carbon reduction by 2050. Businesses are already experiencing the effects of this plan, which takes concrete form in a European emissions trading scheme. The market context has changed. So, for example, more and more investors are joining the *Carbon Disclosure Project* (CDP, 2010), which calls for the disclosure of detailed information concerning a company's carbon emissions and climate protection strategies.

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Also the economic picture has changed due to the scarcity of fossil fuels. For example, for a long time the International Energy Agency (IEA) refused to consider that crude oil prices could grow remarkably and above average; but then, in its 2008 report, it admitted that oil prices, starting from 2025, could begin to rise in a very dramatic manner (IEA, 2008). This suggests that the days of cheap crude oil are over and that in the foreseeable future the world oil consumption will exceed maximum oil production capacity. The maximum amount of oil that can be produced world-wide in one year is called 'peak oil'. After reaching that peak, the annual oil production will begin to shrink and in all likelihood it will trigger price hikes.

In general, it can be said that the availability of cheap fossil fuels and the unrestricted and free emission of greenhouse gases can no longer be considered as static components of economic activity. In the fields of resource economics and social policy, it can be assumed that the dynamics which are emerging now will consolidate in the future. Enterprises will therefore have to engage in rethinking their carbon usage altogether. Enterprises are facing not only the direct effects of climate change – such as higher losses due to weather events (*which require adaptation* efforts) – but also the indirect effects of it, for instance the need to comply with legislation aimed at reducing greenhouse gas emissions (which require *mitigation* efforts).

### **Adaptation – what should companies do?**

Companies should respond to the aforesaid developments by appropriate risk management measures. Let's first take a look at the question of adaptation. The rule in this case is to minimise the (potentially) negative consequences of climate change for the economy in general and for individual companies in particular. A study to forecast the 2030 scenario conducted by Schweiz Tourismus (2008), the Swiss National Tourism Office in charge of promoting Switzerland as a tourist destination, indicated that climate change will expose Swiss tourism to a variety of risks, including a loss of attractiveness of pre-Alpine regions due to reduced snow cover, the disappearance of the winter atmosphere in the Central Plateau, with the consequent reduction in the number of visitors interested in winter sports, greater investments required to adapt to changing conditions, higher risk management costs for protection against natural hazards and a loss of attractiveness due to changes in the landscape (glacial retreat).

Once the risks for the economy have been identified – initially in a somewhat general manner – the next step is to implement risk management systematically at company level. First of all, in order to determine the company's current risk exposure, a qualitative and/or quantitative assessment of the company's operational risks should be performed. Such analysis will serve as a basis for determining, at a later date, whether the risk management strategies implemented were successful or not. An example from the tourism sector may clarify this point: a study conducted by the Zurich Polytechnic (ETH Zürich) and the University of Zurich on behalf the Swiss Cableway Company determined the risks cableway operators could be exposed to as a result of changing weather conditions (snow cover, in particular). The results showed that four out of five operators clearly understand what the consequences of global warming are; in the future, therefore, management of this risk will be an integral part of their corporate strategy. For 15% of the smaller operators withdrawal from the snow sports sector might be an option<sup>1</sup>.

Once the existing risks have been identified, the company executives must decide what actions are possible and suitable in the light of the magnitude and characteristics of the risks identified. Three main strategies are available: *risk reduction*, *risk prevention (avoidance)* and *risk transfer* (Merna & Al-Thani, 2008).

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<sup>1</sup> [www.seilbahnen.org/dcs/users/132/Medienmitteilung\\_GV\\_Seilbahnen\\_Schweiz\\_25\\_Okt\\_2007.pdf](http://www.seilbahnen.org/dcs/users/132/Medienmitteilung_GV_Seilbahnen_Schweiz_25_Okt_2007.pdf)

The objective of *risk reduction* strategies is to minimise the sources of risk through targeted measures. A survey indicated that electric power producers in Austria and Switzerland pursue risk reduction by stockpiling coal reserves to protect themselves from supply shortages, or by moving (partially new) production plants to regions that are less exposed to climate change, hence opting for geographical differentiation. These strategies provide no immunity from risk, but can significantly reduce the negative impacts of global warming. They are effective strategies, inasmuch as they are the first step in risk management, but a permanent solution should seek to avoid risk entirely.

By means of *risk prevention strategies* companies seek to completely eliminate climate-related risks and thus to free themselves from the consequences thereof. Some of the aforementioned electric power producers are adopting also this type of strategy. So, for instance, they install new cooling technologies to become less dependent on the availability of adequate cooling water, or they resort to technical measures to protect production plants. Thanks to the implemented actions, cooling water shortages or the occurrence of floods in the local area – which are both possible consequences of global warming – would not bring the companies to their knees. Therefore, companies that adopt this strategy succeed in eliminating the risk completely. It should be noted, however, that the possibility to apply this strategy extensively depends on the sector and on the associated climate-related risks. In some cases it might be necessary to change the business model altogether. For example, some regions traditionally oriented towards snow sports but located at moderate altitudes might have to consider diversifying towards summer tourism to completely avoid the risk of the absence of snow.

*Risk transfer strategies* seek to alleviate the negative consequences for the companies by externalising the risks – namely by taking action to ensure that selected third parties shoulder such risks. For instance, electric power producers resort to insurance companies that provide them with coverage in the event of production interruptions due to climate change or in the event of physical damage to production plants as a result of storms or floods. In this case a company may suffer negative consequences, but does not have to defray the costs firsthand. Over the short term this is definitely a sensible risk management strategy, but since climate change will continue, it offers no long-term solution. Insurance companies will end up being faced with a growing number of compensation requests for damage and will have to raise their premiums. Depending upon the type of company and its specific risk exposure, beyond a certain premium amount it may be justified for the company to invest directly to reduce the risk or, if possible, to remove it completely.

### **Mitigation – what should companies do?**

It is important that companies develop also mitigation strategies which can help them gain real competitive advantages in three ways: cost reduction, improved corporate reputation and improved products.

Using less fossil resources can result in *cost reductions*. In the literature such cost savings go under the name of ‘eco-efficiency’ (DeSimone & Popoff, 1997) or ‘material efficiency’ (Liedtke, 2005). If efficiency improvements require additional investment (for new machinery, for instance), companies should consider two aspects: on the one hand the investment’s payback period is often short thanks to the savings realised; on the other hand, in the long run, the company becomes less dependent on increasingly costly resources. There are four fundamental strategies:

- Replacement of fossil fuels: move to renewable energy or use of biopolymers instead of petroleum-based materials.
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- Efficiency gains: through optimized processes which require less energy and carbon-based inputs.
- Logistics optimisation: improvements in the supply chain and choice of transport.
- Employee motivation: thanks to small changes in behaviour and the possibility to make suggestions of their own, personnel may help control the company's CO<sub>2</sub> emissions.

Regardless of cost savings, a company can earn a *better reputation* if it seeks to make an active contribution to protecting the climate. Many consumers consider climate change a worrisome issue and actively engage in climate protection, for instance by choosing more energy efficient vehicles or heating systems that produce fewer emissions. Consumers are interested in knowing whether companies do the same in their production processes. Many companies therefore use their climate protection activities as a means to improve their corporate reputation, but to do that they need an appropriate communication strategy.

Companies can improve their products by focusing on their energy efficiency. Products that consume too much energy during use – compared to similar products that provide the same benefits – end up becoming costly and unattractive for consumers. Even the fact that a lower amount of emissions is released during the production phase can induce consumers to prefer a specific product over another. The strategy chosen by many companies therefore is that of assessing their carbon footprint or the energy efficiency of their products (during use) and then pass on such information to consumers.

A good example in this context is provided by company Knecht & Müller AG based in Stein am Rhein. This Swiss company employs 55 people and manufactures lenses. The production is very carbon-intensive: plastic lenses are obtained from petroleum and the processing machines for tempering and anti-reflection treatment consume a lot of energy. Gradually, between 1998 and 2002, the company changed to energy renewable sources. In addition to significantly reducing its environmental impact, the company is now less sensitive to oscillations in the price of electricity or oil. Since 2006 the company has implemented climate-neutral production and is involved in projects for the protection of mountain forests. The results obtained and the commitments undertaken are exploited by Knecht & Müller AG in their communication policy and are illustrated, for example, in a special brochure distributed to customers. This has had a remarkable effect on the company's reputation: as a tangible result of its environmental commitment, the company has recently obtained an order from a large optical buying group.

## Conclusions

Climate change is a key challenge for companies. Very often, however, it is considered only from the risk perspective. Indeed, taking risks into account is essential to be able to adapt to change: global warming is here to stay and companies that are greatly exposed to the negative consequences of it must implement appropriate risk management strategies. However, in order to win the fight against climate change, a proactive mitigation strategy is needed. Climate change must be seen as a business opportunity! In order to take advantage of this opportunity, company executives must take decisive action to dismantle the barriers that are often present within an organisation and motivate employees to become involved in active climate protection. There are many best-practice examples in this connection.

The fundamental rule can be summarised as follows: prevent, reduce, offset. This means that companies should primarily aim to replace fossil fuels as much as possible – and that goes for the resources used at the plant during production as well as for those needed to operate the manufactured products. Thus, the company and its products are no longer dependant on fossil resources and can contribute to the abatement of CO<sub>2</sub> emissions. In sectors where this is not viable, or where it is only partially



feasible, companies must seek to reduce the consumption of energy and materials from non-renewable resources as much as possible. The associated risk can also be reduced, for example, through climate protection policies and standards. As a final step, it would be wise to think of carbon offset mechanisms. Many 'carbon offsetting agencies' engage in emissions trading and issue special 'carbon offset certificates' to compensate for or to offset emissions produced by a variety of entities. The emission reduction is thus taken over by third parties and a company can become almost carbon neutral. It is obvious that this option is a last resort, since every company should first and foremost focus on direct substitution and reduction options.

From a macro-economic perspective, it can be said that taking action now is not only necessary, but also beneficial! The Stern Report commissioned by the British Government (2006) quantified the potential risk posed by climate change and estimated that, in the absence of countermeasures, it might reach 20% of world GDP. By contrast, the annual costs of mitigation measures are relatively low. The necessary technologies are already available today – their use must only become more widespread – and it is time to take action now. The business sector could be the first to start and seize the opportunities available. While corporate executives often hide behind the uncertainty that surrounds climate change to justify a policy of inaction and waiting, in business management it makes sense to do exactly the opposite: uncertainties require proactive responses; only in this manner can a company be successful in the medium and long term.

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## 2. POLICY AND LEGAL FRAMEWORKS

### 2.1. EU CLIMATE POLICY: A REGIONAL FRAMEWORK

*Benjamin Caspar and Stéphane Isoard*

The European Union aims to develop and implement cost effective international and domestic climate change policies and strategies in the areas of mitigation and adaptation, in the context of keeping global average temperature increase below 2 degrees Celsius compared to pre-industrial levels.

The EU assists Member States in setting and meeting their targets for 2020 and beyond, to reduce greenhouse gas emissions, including the establishment of robust and transparent EU-wide monitoring, reporting and verification systems. Another key objective of EU climate change policy is the promotion and development of low carbon and adaptation technologies, especially through the development and implementation of cost effective regulatory frameworks for their deployment (e.g. carbon capture and storage, fluorinated gases, ozone depleting substances, vehicle efficiency standards, fuel quality standards).

Regarding Adaptation, and due to the regional variability and severity of climate impact, most adaptation measures will be taken at national, regional or local level. However, these measures can be supported and strengthened by an integrated and coordinated approach at EU level.

The EU has a particularly important role when the impact of climate change transcends the boundaries of individual countries (e.g. river and sea basins, mountain ranges, and bio-geographic regions). The White Paper on Adaptation recognizes/identifies the Alps as a particularly vulnerable area to the impact of climate change, and the European Environment Agency published in 2009 a report specifically dedicated to climate change impacts, vulnerability and adaptation in the Alps.

Adaptation will require solidarity among EU Member States to ensure that disadvantaged regions and areas most affected by climate change will be capable of taking the measures needed to adapt. Moreover, coordinated EU action will be necessary in certain sectors (e.g. agriculture, water, biodiversity, fisheries, and energy networks) that are closely integrated at EU level through the single market and common policies.

While a number of EU Member States have prepared national adaptation strategies, others have yet to do so. The EU is well placed to facilitate coordination and the exchange of good practice and guidance between Member States and the various levels of decision-making on climate change adaptation.

The objective of the EU's Adaptation Framework is to improve the EU's resilience to deal with the impact of climate change. The framework will respect the principle of subsidiarity and support overarching EU objectives on sustainable development. The EU adaptation framework aims at developing a comprehensive strategy by 2013, to be supported by a clearinghouse for sharing and maintaining information on climate change impacts, vulnerability and adaptation.

The EU's framework adopts a phased approach. The intention is that phase 1 (2009-2012) will lay the ground work for preparing a comprehensive EU adaptation strategy to be implemented during phase 2, commencing in 2013.

Phase 1 will focus on four pillars of action:

- 1) building a solid knowledge base on the impact and consequences of climate change for the EU;
- 2) integrating adaptation into EU key policy areas;
- 3) employing a combination of policy instruments (market-based instruments, guidelines, public-private partnerships) to ensure effective delivery of adaptation, and

- 4) stepping up international cooperation on adaptation. For phase 1 to be a success, the EU, national, regional and local authorities must cooperate closely.

To address the current lack of knowledge-sharing and management, the EU plans to develop a European Clearinghouse on climate change impacts, vulnerability and adaptation to maintain a wide range of information at European, national, regional and sectoral levels on climatology and impacts, vulnerability assessments, good adaptation practices and policy frameworks. The EU Adaptation Clearinghouse for Europe (ACE) would also link to other similar or related initiatives such as the Biodiversity Information System for Europe (BISE)/European Community Biodiversity Clearing House Mechanism, the Water Information System for Europe (WISE) and the Global Monitoring for Environment and Security (GMES). To further ensure synergies and avoid duplication of work, the clearinghouse would also link to initiatives and knowledge platforms in European regions, which would provide regional nodes to the knowledge base. The European Environment Agency will be hosting the clearinghouse as of 2012 and will maintain it thereafter.

Strengthening the knowledge base is further supported by numerous regionally oriented adaptation EU projects, notably the EC's INTERREG and FP7 research programmes and the European Environment Agency's work on updating key indicators on climate change impacts (observed and projected). This work is undertaken with the view of publishing in 2012 an indicator-based report on climate change impacts in Europe (update of 2008 edition) in close collaboration with the European Commission - Joint Research Centre, other EU dedicated agencies and the World Health Organization – Europe.

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## 2.2. THE ALPINE CONVENTION'S ACTION PLAN ON CLIMATE CHANGE

*Marcella Macaluso and Patricia Quillacq*

International scientific reports and documentation available at European level have shown that mountainous regions are especially sensitive to climate change. In Europe, climate change is having a major impact on the Alps. According to the monitoring system of the entire region, temperatures in the Alpine region have risen twice as much compared to the rise in mean global temperature. That is notoriously leading to progressive snow thinning and to the melting of glaciers and permafrost. The Alpine countries agree that appropriate long-term strategies and measures to adjust to the consequences of climate change need to be developed by acting collectively and on a large scale to **make the Alpine region a model of how to prevent and adapt to climate change**. In this regard the Alpine Convention has committed itself first to the adoption of the 2006 Alpbach Ministerial Declaration and then to the adoption of an Action Plan on the occasion of the 10th Alpine Conference in March 2009.

Effective as of 1995, the Alpine Convention is an international treaty signed in 1991 by the Alpine countries (Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia and Switzerland) and by the European Union to promote sustainable development and safeguard the interests of the local population while taking into due account the complex environmental, social, economic and cultural issues. In order to pursue this objective, a Framework Convention and eight thematic Protocols on spatial planning, agriculture, forests, nature and the landscape, energy, soil conservation, tourism and transportation have been adopted. The Alps are a natural and cultural environment where almost 14 million people live and work as well as a major tourist destination that draws about 120 million visitors every year.

Area covered by the Alpine Convention, of which:	Surface	Inhabitants
	190.568 km <sup>2</sup>	13,9 millions
Italy	26,9%	30,2%
Austria	28,7%	23,3%
France	21,4%	7,6%
Switzerland	13,0%	13,1%
Germany	5,8%	10,6%
Monaco	0,001%	0,2%
Liechtenstein	0,08%	0,2%
Slovenia	4,1%	4,7%

*Table 1: Distribution of surface area and population within the boundaries of the Alpine Convention.*

*Source: Report on the State of the Alps - Transport and Mobility in the Alps – Permanent Secretariat of the Alpine Convention, 2007*

The Alpine regions can contribute to the collective effort to cut the emissions of greenhouse gases by seeking appropriate solutions to address specific issues relating, in particular, to transport, energy efficiency of buildings, tourism, agriculture and water management. The Climate Action Plan is based



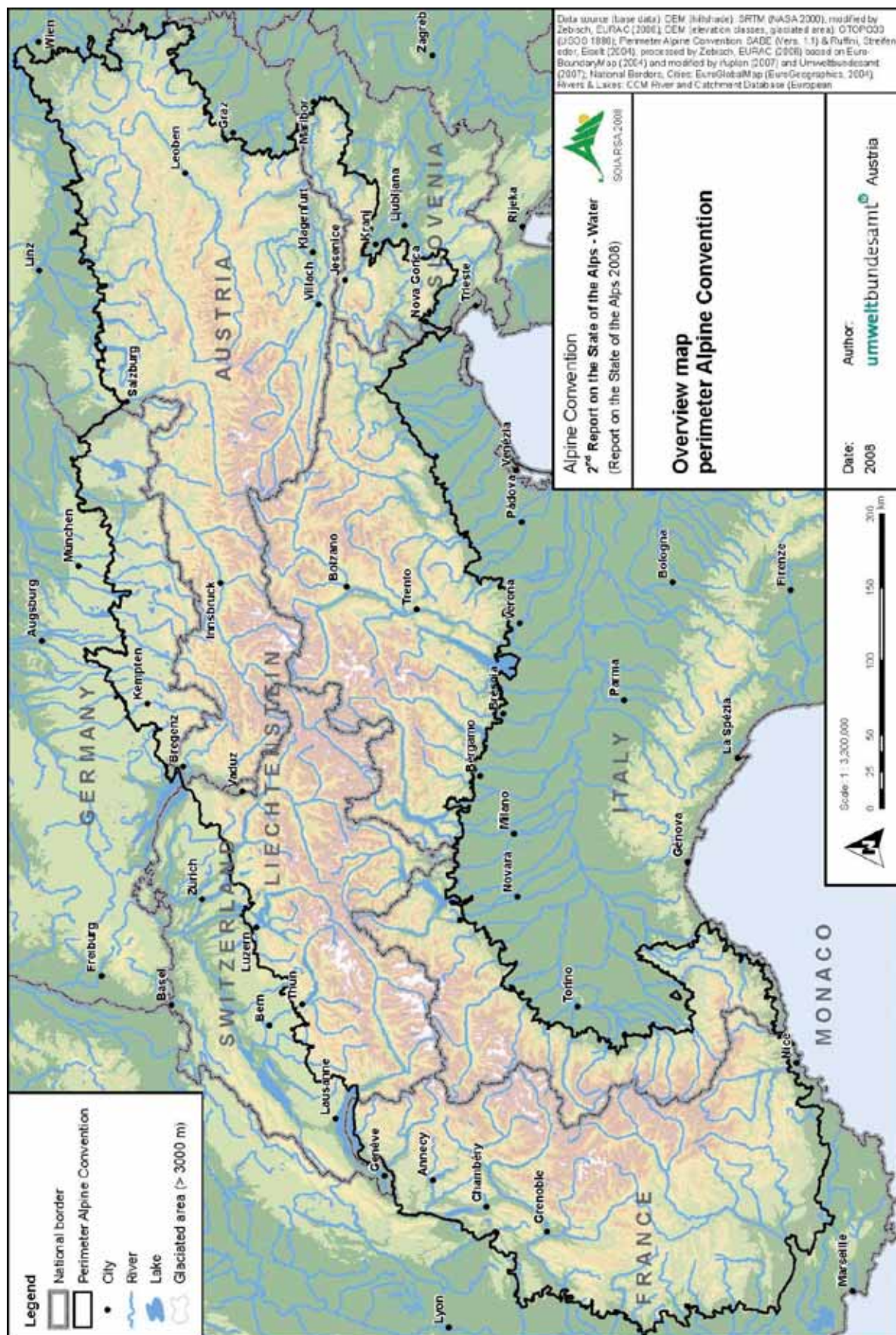


Figure 9: The boundaries of the Alpine Convention



on the collective commitments undertaken by the Alpine countries within the framework of the UN Framework Convention on Climate Change and the Kyoto Protocol. Its objective is to propose tangible measures specific to the Alps in terms of both mitigation and adaptation. The following are the **nine strategic sectors** which the 24 main objectives in the plan are divided into:

- Spatial and urban planning
- Energy: heating, a key sector in the Alpine environment;
- Transport: promotion of the shift of traffic to more environment- and climate-friendly modes of transport
- Tourism
- Preservation of biodiversity
- Water and water resources
- Promotion of mountain forests and development of the wood production chain
- Mountain agriculture
- Awareness-raising and applied research

The Climate Action Plan is aimed at integrating the implementation of the eight thematic Protocols of the Alpine Convention (on issues of spatial planning, agriculture, forests, nature and landscape, energy, soil conservation, tourism and transport) by the Alpine countries. The fight against the impact of climate change must go hand in hand with a tangible policy on sustainable development. It should be underscored in this regard that a number of measures proposed in the Climate Action Plan implement provisions already contained in the various Protocols. The examples of measures recommended are addressed to multiple entities: public bodies – at a local, regional or national level – and private entities to raise the awareness of the public at large and in particular of young people and change their behaviour in order to tackle climate change. The Action Plan also aims to support joint projects, favour the development of tangible regional cooperation, encourage the exchange of experiences and favour targeted scientific research.

The Action Plan calls for better sharing of information on climate change in the Alps, among which good practices to mitigate and adapt to climate change, and on the management of water resources to help competent authorities and all the players involved to develop appropriate adaptation strategies. The thematic Working Groups set up by the bodies of the Alpine Convention to allow for the production of scientific reports and the exchange of information on some major issues directly contribute to the implementation of the Action Plan on Climate Change in the Alps, which in some case makes express mention of these Working Groups.

To date there are seven active working groups or platforms<sup>2</sup>. Of these, four are carrying out extremely important activities on climate change<sup>3</sup>:

### The Working Group on Transport

Transport and Transport Industry is addressed in the Action Plan as a priority topic. Mobility of individuals and transports of goods affect the quality of the environment and contribute highly to GHG emissions. The Group aims at promoting alternative and less polluting ways of moving in the Alps, for the residents themselves, for the tourists, for the economic sector which depend on the transport of goods. This Working Group has produced several reports and studies, namely on tourist sustainable mobility in the Alps, public transport accessibility of tourist resorts from major European regions and cities, collection of good practices and the true costs of transport on the transalpine corridors (including external costs). These are all available on [www.alpconv.org](http://www.alpconv.org).

<sup>2</sup> In formal terms, there is no difference between a Working Group and a Platform. The tendency is to define platforms as those working groups created to widen the debate also to players not belonging to the Alpine Convention (scientific experts, stakeholders).

<sup>3</sup> All relevant documents are available on [www.alpconv.org](http://www.alpconv.org).

The Working Group on transports is also essential for the implementation of one core request of the Action Plan, inscribed in point 2 of the final decision, by which it is asked to the Ministers “belonging to the Zurich Group who survey different regulation methods for the Alpine transit of goods, such as an Alpine transit exchange to acknowledge the urgency linked to climate change and the need to implement concrete solutions rapidly in order to limit greenhouse gas emissions”. The “Zurich Group” was set up in 2001 with the objectives to enhance road-safety, in particular in tunnels thorough the Alps, as well as to support the modal shift towards the railway. It is composed of the transport Ministers of Austria, France, Germany, Italy, Slovenia and Switzerland. The European Commission participates as an observer. Cooperation between the Zurich Group and the Transport Working Group of the Alpine Convention is ongoing.

### **The Water Management Platform in the Alpine Space**

The mandate of the Water Platform adopted in 2009 implies the assessment of the river basin management plans (RBMP), which are being developed within the framework of the EU Water Framework Directive, with a view to the necessary adaptation of the Plans in light of climate change, including considerations as to the effects on downstream areas. This assessment identified gaps in the RBMP, such as for example insufficient knowledge about the effects of climate change on quantitative aspects of water resources. It also highlighted the challenge of identifying residual flows taking into account changing climatic conditions and the future management of reservoirs. Important information on water resources and water management concerning alpine waters, under changing climatic conditions, has also been provided by the 2<sup>nd</sup> Report on the State of the Alps ‘Water and Water Management Issues in the Alps’. Furthermore, the Water Platform has produced a report and guidelines on small hydropower in the Alps, which contribute concretely to implement the decision of the Xth Alpine Conference, which adopted the Action Plan on climate change.

### **The Ecological Network Platform**

Through this platform, Alpine countries seek to share, compare, and revise crucial information on measures and methodologies concerning the protection of biodiversity through the approach of ecological connectivity, both inside and outside protected areas. Biodiversity is highly at risk in the Alps because of climate and land use changes, fragmentation and habitat loss. The main objective of this Platform is the creation of an alpine ecological network, based on existing protected areas and the links between these areas. This is a long-term effort pursued in the first stage through the identification of ‘pilot regions’, which are particularly active in ecological connectivity. The active participation of the relevant actors of these regions is fundamental to this process.

Some representative examples described in a document, the ‘Catalogue of Measures’ (restoration of wetlands), have a clear link to climate change and contribute directly to improve ecological connectivity. The conservation, restoration and creation of ecological networks are considered as central elements of climate change mitigation by offering alpine species the possibility to shift their distribution ranges. The protected areas that form the core zones of this ecological network have identified the question of climate change as a crucial issue and are involved in the science of climate change assessment.

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## **The Natural Hazards Platform (PLANALP)**

Adaptation to the impacts of climate change in the Alps, and notably to the increasing risk and intensity of natural hazards has been one of the key messages since the 2006 Alpach Ministerial Declaration and included in the 2009 Action Plan under the parts on Adaptation and Research and Awareness. Therefore, it is no surprise that the Action Plan refers to the Platform working on Natural Hazards, commonly called 'PLANALP', and requests specific actions to be taken. The first is to be the base structure to "document the effects on climate change on natural hazards in the Alps". However, the Action Plan is even more specific on natural hazards. The general objective is to "Promote an integrated approach to adapt alpine space to new climatic conditions and (...) better control natural hazards and limit their consequences." To this end, the Natural Hazards Platform has been empowered to implement a coordinated observation system on phenomena, by surveying current evolutions, mapping territories, giving priority to areas that are most at risk and assess the costs of damage linked to climate change. As regards the prevention and strategic management of natural hazards, PLANALP published a series of recommendations on the 'Integrated Natural Hazards Risk Management', touching on the following aspects: residual risk arising from natural hazards; adaptation to climate change; risk dialogue: information & education of the public; land use.

## **The Permanent Secretariat of the Alpine Convention**

The Permanent Secretariat of the Alpine Convention has been trusted with specific tasks regarding the implementation of the Action Plan on Climate Change in the Alps. The Permanent Secretariat has the primary responsibility to disseminate the Action Plan on Climate Change in the Alps and make it known to the general public as well as to more targeted audiences. The Climate Portal was launched in 2009 to that effect, using the occasion of the International Mountain Day (11<sup>th</sup> of December). The Climate Portal is still growing and contains different sections: one can check all the Alpine Space projects related to climate change, or discover how long is the list of good practice already on the database to provide inspiration to decision makers and local authorities. Resources have been selected for teachers and younger generations, as well as for the large public or concerning specific topics: tourism for example or a knowledge centre with links to all energy agencies of the Alpine territory (which could help, for example, in house refurbishment etc).

A concise brochure was published in March 2010, "the Action Plan in a Nutshell", and this current publication intends to amplify the plan further. Participation in conferences and workshops also pursues the same goal, and little by little, the Action Plan is gaining publicity and attracting potential partners from civil society and local authorities; partners willing to endorse the objectives and measures listed in the text of the Action Plan could be essential in bringing it alive from the grass roots.

## SUSTAINABILITY & CLIMATE CHANGE POLICY FRAMEWORK FOR THE ALPS

A REGIONAL VISION FOR SUSTAINABLE  
DEVELOPMENT

ALPINE CONVENTION (1991)

THEMATIC PROTOCOLS

The climate change challenge

Alpbach Declaration  
(IXth Alpine Conference, 2006)



### Action Plan (Xth Alpine Conference, Evian 2009)

Preamble

Part I - Mitigation

Part II - Adaptation

Part III - Public Awareness  
and Applied Research

#### Priority policy fields

- Spatial Planning
- Energy
- Transports
- Tourism
- Biodiversity
- Forestry
- Mountain Farming
- Water
- Applied Research
- Public awareness

Objectives and measures

Decision of the Xth Alpine  
Conference

## 2.3. PHILOSOPHY AND SCOPE OF THE ALPINE CONVENTION'S ACTION PLAN ON CLIMATE CHANGE

The Preamble of the Action Plan recalls the supra-regional and inter-generational interests of protecting the alpine natural resources from the impacts of climate change, and it states that the Alpine countries, whilst pursuing the quality of life of Alpine populations should « **take part in the collective effort** *to reduce the greenhouse effect by searching for adapted solutions to tackle the specific issues that affect them.* » The Action Plan therefore « *rests on the joint commitments taken by the Alpine countries which fall under the UN Framework Convention on climate change (UNFCCC) and the Kyoto Protocol (...) and takes into account the commitments made in this regard by the European Union.* »

Yet, the Action Plan following the Ministers' Declaration of Alpbach aims to « **go beyond the general framework** *to offer concrete measures that are specific to the Alps by promoting, both in terms of mitigation and adaptation, themes and measures that could be the subject of regional co-operations in the frame of the Alpine Convention, and by taking into account actions that are already in place on a national, regional and local level.* » Another key statement is the fact that the « *Plan complements a full and complete implementation of the Protocols of the Alpine Convention by the Contracting Parties. The fight against the effects of climate change goes hand in hand with a real policy on sustainable development (...) and therefore some of the measures of the Action Plan materialise provisions mentioned in the various Protocols .*»

Lastly, the Preamble exposes that *"The Action Plan should also bring about common projects, promote the development of concrete regional cooperation and the exchange of experiences, and support specific scientific research projects."* To achieve so, the Alpine Conference will « secure the help of its various Working Groups and will integrate in its Multiannual Work Programme the objectives of this Action Plan, and it will promote the Plan with institutional partners assisting in its implementation, including European partners. »

## 2.4. THE ALPINE CONVENTION'S ACTION PLAN ON CLIMATE CHANGE: 24 OBJECTIVES AND 81 MEASURES

### I. MITIGATION

Mitigation refers to measures that seek to avoid, reduce or delay global warming by reducing Greenhouse Gas emissions

#### A. Spatial and land planning

##### Objectives

1. Ensure efficient space management, promote urban densification
2. Promote CO<sub>2</sub> efficient urbanisation and planning

##### Measures

**N°1** – promote the integration of bioclimatic criteria (exposure to the sun, natural ventilation...) in the tools used for land planning, particularly on a municipal level

**N°2** – localise urbanisation projects in areas served by eco-friendly public transports

**N°3** – maintain natural areas (as carbon sinks)

#### B. The Energy sector

##### Objectives

3. Significantly reduce CO<sub>2</sub> emissions
4. Promote the use of renewable energy sources

##### Measures

**N°4** – elaborate in a participative way an energy policy specific to the Alps in order to create a consensus for a future sustainable management of energy in the Alpine space

**N°5** – increase the energy efficiency of buildings by promoting the rehabilitation of existing buildings and the construction of «passive» buildings.

**N°6** – in order to respect natural balance and landscapes, promote the production of renewable energies, and their use for heating purposes on a local level by individuals and communities, by using recent technologies with high energetic efficiency which, in the case of biomass, limit pollution emissions in the atmosphere.

**N°7** – disseminate existing techniques that reduce energy consumption by favouring local resources while building, particularly by improving the training of mountain building professionals (training campaigns, networking...)

**N°8** – launch information campaigns and take concrete measures to promote the use of biomass (mainly wood from mountain forests) and other renewable energies respecting the environment and produced locally

### C. Transports

##### Objective

5. Significantly reduce CO<sub>2</sub> emissions linked to transports

##### Measures

**N°9** – shift as much of the transalpine traffic of goods and persons as possible towards means of transportation emitting less CO<sub>2</sub>:

**9a.** spur and support the cooperation between national managers of railway networks, companies and local authorities to improve the service offer in terms of quality and frequency on existing railway networks, whether it be for the transport of goods or for the transport of persons (more particularly the Brenner plan and the BRAVO project, the IQ-C plan on the Gotthard/Simplon corridor, the French-Italian programme on the historical line between Turin and Lyon, the Alpfrail project on the Tauern axis).

**9b.** continue with the implementation of new transalpine railway infrastructures on all major Alpine passes in order to create a trans-european network adapted for traffic shift : Swiss programme NLFA (*nouvelles liaisons ferroviaires alpines* or new Alpine railway networks), priority projects of the EU (axis Lyon - Turin - Trieste- Divaca - Ljubljana – Ukrainian border, and Berlin - Munich - Verona - Bologna - Naples via the Brenner).

**9c.** continue with the surveys initiated by the transport Ministers of the Alpine countries within the Zurich Declaration in order to determine the most efficient means to regulate road traffic for goods through the Alps (better management of the traffic on an hourly and daily basis, optimisation of flows, feasibility of an Alpine transit exchange, etc.).

**9d.** survey available options that rely on marine navigation (motorways of the sea) to replace transalpine road traffic when conceivable.

**N°10** – encourage regional and local authorities to reduce within the Alpine space the traffic impact on environment and climate, especially for means that produce CO<sub>2</sub>:

**10a.** promote policies that reduce the use of individual cars (cheaper public transports, carpooling, use of bicycles within city centres) or make it less polluting (programmes on how to drive in a more ecological way)

**10b.** develop on all scales a network of public transports which will guarantee practical continuity between the various means, mainly for reaching mountain resorts and tourist areas, and promote the means of transportation that emit less CO<sub>2</sub> and pollute less

**10c.** develop planning tools (urban and interurban logistics plans, circulation plans, traffic plans, keeping or creating local services...)

**10d.** ensure application in full of the provisions of article 12, paragraph 2, of the Transport Protocol on air traffic which plans to restrict the construction of new airports and « to improve public transport systems from



airports on the fringes of the Alps to the various Alpine regions ».

#### **D. Tourism**

##### **Objectives**

- 6. Reduce CO<sub>2</sub> emissions produced by tourist activities and ensure travel professionals offer the option of sustainable transports**
- 7. Promote Alpine holidays offers that are « climate neutral »**

##### **Measures**

**N°11** – put into place a regular environmental audit of tourist destinations containing a « carbon report » and refer to this audit when granting authorisations and/or public subsidies

**N°12** – promote soft mobility for reaching tourist sites by favouring the least polluting means of transportation (adapted rates, using aerial lifts such as cable cars to go from the valleys to the nearby resorts ...)

**N°13** – develop with transport operators the « last mile » connection and long-distance access to tourist sites using railways

**N°14** – favour the rehabilitation of real estate aimed at tourists by adapting it to climate change instead of building new infrastructures which generate « empty beds » (tourist beds that remain unoccupied for most of the year)

**N°15** – adapt the resorts' communicating and marketing strategies to reflect the new measures

**N°16** – develop cross-border public transports and simplify tariff offers for tourists in the Alps

**N°17** – ensure travel and tourism professionals develop together practical information on the soft mobility options that are available in different Alpine sites and make it accessible to the general public

**N°18** – harmonise school holidays calendars in order to limit peak season and the development of infrastructures

## **II. ADAPTATION**

Adaptation strategies are those objectives and measures directed at anticipating the adverse effects of climate change and preventing or minimising the damage they can cause.

#### **A. Spatial planning**

##### **Objectives**

- 8. Promote an integrated approach to adapt Alpine space to new climatic conditions and more particularly to:**
  - **better control natural hazards and limit their consequences**
  - **ensure sustainable development in terms of housing and economic activities**

##### **Measures**

**N°19** – define risk areas in the whole Alpine region following harmonised procedures, taking into account risks resulting from climate change (landslides, rock slides, avalanches, floods, fires ...) and consequently adapt town planning documents by defining adequate security perimeters.

**N°20** – reinforce prevention and strategic management of natural hazards

**20a.** keep land sealing to a minimum, mainly by improving the ratio between built and open space in town planning projects

**20b.** establish efficiency indicators on policies and risk prevention tools

**20c.** identify a master event that is the most relevant for floods and avalanches by taking into account climate change and adapt practices and regulations accordingly

**20d.** anticipate the risks of transport infrastructures deteriorating due to climate change in the Alps and develop a map of itineraries potentially at risk along with crisis management plans and a survey on prospects for the next 20 years

**N°21** – reinforce the territories' adaptation capacity to climate change

**21a.** adapt existing tools and planning methods for an innovative management looking towards the future

**21b.** integrate into all levels of spatial planning the objective of risk prevention and vulnerability reduction

**21c.** use participative method of risk governance in the planning process

**N°22** – inform the population and make it aware of its responsibilities

**22a.** improve public access to data on natural hazards

**22b.** support and maintain a « risk culture » in mountain areas with adapted preventive information aimed at permanent and seasonal residents, and keep the public involved when measures and prevention strategies are drawn up

**22c.** develop and adapt pre-warning and warning systems, particularly in case of torrential floods

22d. disseminate « good practices »

N°23 – anticipate deterioration of transport infrastructures

### ***B. Enhancement of mountain forests and development of forestry***

#### **Objectives**

9. Favour the adaptation of forest stands to climate change by keeping the Alpine forests in a good ecological state and by increasing their biodiversity
10. Develop wood industries so that wood can be used as a material and as an energy source that would benefit the economic development of local populations, and the use of scrap wood as raw material
11. Reinforce the role played by the forests in preventing natural hazards

#### **Measures**

N°24 – encourage the diversification of forest stands by favouring autochthonous species that are ecologically resistant

N°25 – allow natural regeneration of mountain forests by limiting populations of hoofed animals according to article 2b of the Mountain forests Protocol

N°26 – ensure eco-certification of all forests part of the public right of way of each member state, give better information to private forest owners and encourage them to exploit their land in accordance with the demands of an accredited certification system and assess the actions

N°27 – promote continued maintenance and exploitation of forests in natural hazard areas in order to reinforce prevention and ensure sustainability of populations

N°28 – identify difficulties and potential congestions in local industries exploiting and transforming wood in order to implement adapted solutions

N°29 – implement coordinated observation methods on the effects of climate change on forests

### ***C. Preservation of biodiversity***

#### **Objectives**

12. Create an ecological continuum in order to facilitate the migration of Alpine fauna and flora species
13. Preserve the biodiversity of protected areas and maintain ecosystem services
14. Ensure habitat preservation for species that are representative of the Alps
15. Support quality agriculture which contributes to the quality of the environment and to the stability of biodiversity

### **16. Maintain peatlands as CO<sub>2</sub> sinks and biodiversity reservoirs**

#### **Measures**

N°30 – implement concrete measures that will be suggested by the « Ecological Network» Platform to maintain biodiversity through a perennial « ecological continuum » (this measure might necessitate the demarcation of new protected areas and the reinforcement of existing protected areas)

N°31 – adapt management plans for large protected spaces in order to take into account expected climate changes in the Alpine space and adapt them according to the results of monitoring programmes implemented for this purpose (adaptation and management of leisure activities, maintenance measures for infrastructures ...)

N°32 – implement in a coordinated way, and on the whole of the Alpine range, special protection programmes aimed at species representative of the Alps (*Tetraonidae*, ptarmigan, globe thistle...) and other endemic species endangered by climate change

N°33 – perform an ecological follow-up on experimental plots (e.g. on sample plots of 15 ha) to survey fauna adaptation to climate change

N°34 – promote mountain farming based on small structures and/or maintain quality farming work on all Alpine territories

N°35 – preserve existing peatlands and renaturalise the ones that can be renaturalised

### ***D. Tourism***

#### **Objective**

### **17. Adapt winter tourism and diversify the tourism offer**

#### **Measures**

N°36 – supervise the construction of tourist infrastructures in glaciated and wilderness areas

N°37 – combine investment of public funds in snow-making equipment with the assessment of the consequences of such techniques on the environment and direct public funds towards other alternatives

N°38 – support local authorities which diversify their activities and offer an alternative to Alpine skiing in winter, and spread the information in order to attract new customers.

N°39 – aim at a better complementarity between summer and winter tourist seasons by favouring interseasonal tourism

N°40 – favour the pooling between a mountain tour-

ist resort and its surrounding territory (valley, mountain range...)

**N°41** – support the rehabilitation of existing dwellings

#### **E. Water and water resources**

##### **Objectives**

- 18. Reinforce the implementation of the Water Framework Directive**
- 19. Prevent water shortage**
- 20. Develop plants according to the ecology of water streams**

##### **Measures**

**N°42** – reduce water consumption:

- 42a.** promote water saving in all areas by supporting an integrated approach of the resource and its uses
- 42b.** systematically take into account the impact on water resource when granting administrative permits
- 42c.** favour rain water collection and the use of waste water

**N°43** – improve the use of water:

- 43a.** rationalise the use of water resources, unevenly distributed throughout the year
- 43b.** favour collaborative management between the various uses for water
- 43c.** identify water catchment areas for various uses (in particular for snow-making equipments)

**N°44** – reduce the impact of hydro-electric plants on the environment:

- 44a.** improve the efficiency of existing artificial lakes and electricity plants
- 44b.** decide on common guidelines for the construction of small power stations

#### **F. Mountain farming**

##### **Objective**

- 21. Improve mountain farming contribution to the environment, the maintenance and the attractiveness of Alpine territories**

##### **Measures**

**N°45** – supervise adaptation approaches to climate change for farming methods and systems

**N°46** – encourage breeders to choose more resistant autochthonous species and favour extensive grazing

**N°47** – support agricultural holdings and territories which aim for excellence in terms of production and environment protection

**N°48** – favour synergies and co-operations between tourism and agriculture in order to diversify mountain tourism activities

### **III. APPLIED RESEARCH AND PUBLIC AWARENESS**

##### **Objectives**

- 22. Improve knowledge to better understand the impact of climate change on a local level, particularly as far as water, natural hazards and socio-economic balance are concerned.**
- 23. Reinforce cooperation in order to gain common knowledge of the existing risks**
- 24. Reinforce public awareness, especially among the youth**

##### **Measures**

**N°49** – reinforce homogenous and coordinated observation on the effects of climate change on a local level by using, if necessary, regional and inter-Alpine research networks (ISCAR, ClimChAlp...)

**49a.** use the results of the « ClimChAlp » project and ensure a follow-up (particularly in terms of establishing a platform that would synthesise, in a biographical manner, the different types of impact)

**49b.** proceed with the interoperability of existing databases

**49c.** promote research networks associating scientists and economists and integrating a social and economic dimension in order to better identify on a local level what is at stake as far as climate change is concerned, and create adaptation scenarios for valleys as well as for mountain sites.

**N°50** – empower the Natural Hazards Platform (PLANALP) to implement a coordinated observation system on phenomena:

**50a.** survey current evolutions (rhythm, extent and characteristics of floods, avalanches, torrential muds, landslides, temperature rise, fire recrudescence)

**50b.** map territories according to their vulnerability on the basis of completed works by giving priority to areas that are the most at risk

**50c.** assess the cost of damages linked to climate change on the basis of specific cases and identify adequate response mechanisms, through insurance companies for example

**N°51** – increase public awareness

**51a.** organise interactive exhibitions and scientific events to make the population, especially youth and tourists, more aware of what is at stake in terms of climate change and of the solutions advocated by the Alpine Convention

**51b.** communicate periodically through different elements of the media (local newsletters, press, local and regional TV and radio channels ...) to inform the public on the objectives and measures defined in this Action Plan



## 3. NATIONAL STRATEGIES

### 3.1. AUSTRIA

In February 1994 Austria became the 58<sup>th</sup> nation to ratify the UN Framework Convention on Climate Change (UNFCCC) and in May 2002 it ratified the Kyoto Protocol. In the same year Austria adopted a National Climate Strategy. After a comprehensive evaluation an adapted Strategy was adopted in April 2007 by the federal government (Climate Strategy II, BMFLUW). The current Climate Strategy's main focus is to ensure that the Greenhouse Gas (GHG) reduction targets set out in the Kyoto Protocol are met. Climate Strategy II relies on a wide range of different measures, in particular the implementation of the EU emissions trading scheme for industry and electricity production, the promotion of energy efficiency in existing and new buildings, various measures to reduce greenhouse gas emissions from transport, the promotion of renewable energy sources and the purchase of CO<sub>2</sub> emission credits from other countries until 2012. In 2007 the Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) announced the development of a National Adaptation Strategy (NAS) with the aim of reducing the negative impacts and building resilience to climate change. In 2008 the Ministry asked "AustroClim" – a climate research initiative set up in 2002 – in cooperation with the Environment Agency Austria (Umweltbundesamt) and the Upper Austrian Academy for Environment and Nature (ÖÖ Akademie für Umwelt und Natur) to prepare a study on the status of adaptation to climate change in Austria. At the end of 2008, AustroClim published another study called *Identification of recommendations for action on adaptation to climate change*. This study recommended initial adaptation measures for five sectors (agriculture, forestry, water, tourism and electricity) based on regional scenarios and on a vulnerability study. A consequent policy paper titled *Towards a national adaptation strategy* was issued in June 2009. In 2010 and 2011, AustroClim and the Environment Agency Austria are preparing initial recommendations for the sectors of natural hazards, natural ecosystems/biodiversity, health, housing and construction and transport infrastructure. All the results will be continuously integrated into the policy paper. A participatory process accompanies the strategy from summer 2008 until summer 2011. The main objective of the participation process is to discuss the adaptation options identified in the policy paper with relevant stakeholders. The discussion focuses on topics such as responsibilities for implementation, financial resources, knowledge gaps and open research questions. All stakeholders relevant for the implementation of adaptation activities are involved in this process, including national and provincial government, special interest groups, and academic institutions. Furthermore, in 2009 citizens had the opportunity to present their views on adaptation and experiences in an online survey. All results gained from the participation process will be considered in the development of the national adaptation strategy. The final NAS can be expected early in 2012.

*MELTING GLACIERS AND RISING OCEANS: The most recent documentation and data on the mountain cryosphere are of special significance because melting mountain glaciers are considered to be second major contributors to sea level rise in the 20th century. (Austrian 5<sup>th</sup> National Communication to the UNFCCC, p. 141)*

*A FAIR WIND FOR RENEWABLES: In 1990, biomass (including bio-waste) contributed 8% to heat production in district heating systems, but this share has increased to 41% (figure 2007). This is to a large extent due to existing public support schemes, granted both by the federal government and the Länder, and in many cases co-funded by the EU. Growth rates of wind power and electricity from biomass will be higher than the growth of other electricity sources. (Austrian 5<sup>th</sup> National Communication, p. 77)*

### 3.2. FRANCE

France holds a particular position among developed nations and parties to the UNFCCC and the Kyoto Protocol in that its GHG emission levels in 2007 were already 5,6% below its Kyoto target. France thus could consider its international obligations fulfilled and limit its climate change policy to the strict minimum. Yet, the "Grenelle Environment", a major political process regarding the environmental problems – carried out in a largely participatory way during 2007 and 2008, resulting in specific commitments by stakeholders and later adopted as formal law establishes that by 2020 France has to reduce its GHG emissions by 22% compared to 1990 levels. If all the Grenelle commitments are met in the coming years, GHG reductions are estimated to be even greater, thus being in line with the EU ambition of a 30% reduction target in case of an international binding agreement.

The Grenelle process selected a complementary set of measures to achieve the GHG emission reduction: regulatory measures are complemented by market-based measures and fiscal incentives as well as information and training for all sectors. Thus, for example, an ambitious target of minus 38% by 2020 concerning the existing buildings' energy consumption has been set. Regarding transportation sector, a new infrastructure will be put in place to reduce road transport and a large share of efforts is devoted to the production of renewable energies, not to mention the full implementation of the Emission Trading System directive for the industry. The French government expects to reach these targets by maintaining a high momentum in the renovation of existing buildings (supported by incentives, by specific training of the professionals of the sector), by mobilizing all sectors of society and all levels of authorities. France has been working steadily on adaptation issues since the creation of the National Observatory on the Impact of Climate Change (ONERC), a public body that reports to the Prime Minister and the Parliament and publishes reports on regional scenarios, including one on the Alps, and since the adoption in 2006 of the first national adaptation strategy (p. 95). A working group was set up to consider the impacts and costs of climate change and this currently finances more than 20 research projects. In February 2009, the National Strategy was confirmed and a wide-ranging (Grenelle-like) consultation to elaborate the national action plan, including adaptation and regional plans, was proposed. The whole process should ultimately lead to the National adaptation plan in 2011.

*FORESTRY AND CLIMATE CHANGE: In the short to medium term (up to 2030 or 2050 depending on the scenario), the impact of gradual climate changes on wood production will be more or less positive, with economic benefits that could reach € 150M per year. Nevertheless, in the long term (up to 2100), the effect will be clearly negative because of more frequent extreme events and the spread of Mediterranean forest. (FRANCE 5<sup>th</sup> UNFCCC National Communication; 2009)*

*THE CREATION OF A RENEWABLE HEAT FUND of € 1 BILLION (2009-2011). It aims to sharply develop heating production in the tertiary and industrial sectors from renewable sources and to improve and diversify the heating sources in collective housing. This fund will enable financing dedicated to these energies to be increased by four or five.*



### 3.3. GERMANY

In 2010 the German government has adopted a long-term, cross-sectoral Energy Concept (Energy Concept 2050) that paves the way for the age of renewable energies ([www.bmu.de/energiekonzept/doc/46394.php](http://www.bmu.de/energiekonzept/doc/46394.php)). With its Energy Concept the German government has formulated guidelines for an environmentally sound, reliable and affordable energy supply to reach its ambitious climate protection goals. The aim is to develop and implement an overall strategy for the period up to 2050. This approach takes account of the long investment cycles in the energy industry and the building sector and gives all players sufficient time to take appropriate steps. The Energy Concept contains a concrete vision for the year 2050 with ambitious reduction targets for greenhouse gases, ambitious expansion targets for renewable energies and targets for tapping the considerable efficiency potential, a specific programme of measures for achieving these targets, a sound financing plan for implementation that is reliable for the long term and scientifically founded monitoring to review whether targets are being achieved.

- The **greenhouse gas emissions** are to reduce by 40% by 2020, 55% by 2030, 70% by 2040 and 80-95% by 2050 (compared with 1990 levels).
- By 2020, the **share of renewables in final energy consumption** is to reach 18%, and then gradually increase further to 30% by 2030 and 60% by 2050. Germany is even striving for an 80% share in **electricity production** by 2050.
- **Energy efficiency:** It is aimed to reduce primary energy consumption by 20% by 2020 and 50% by 2050 compared with 2008.
- The **building renovation rate** will be doubled from 1% to 2%.
- It is planned to cut energy consumption in the **transport sector** by around 10% by 2020 and around 40% by 2050. The goal is to have six million electric vehicles on Germany's roads by 2030.

The German Strategy for Adaptation to Climate Change (Deutsche Anpassungsstrategie an den Klimawandel – DAS) was adopted in December 2008 by the national government. This first strategic document offers a common base for understanding and a framework for national adaptation in Germany and it takes a close look at contributions of the federal level. The German Adaptation Strategy lays the foundation for a medium-term, step-by-step approach undertaken in close cooperation with the federal states ("Länder") and other civil groups. On regional level, the Climate Programme Bavaria 2020 has been adopted in 2008 aiming at both, reducing the greenhouse gas emissions and adapting climate-sensitive and vulnerable areas to the inevitable consequences of climate change by the year 2020 in the best way possible. Actions in the fields of water management, agriculture, forestry, georisks and soil protection, town, regional and spatial planning, building and tourism as one of the main industrial sectors of the Alps are of particular interest. The next step in the national adaptation process is the elaboration of an Adaptation Action Plan until summer 2011.

Finally, special note should be made of the results of the pilot study 'The Alps- Climate Neutral in 2050: Executive summary for policy-makers' which was initiated by Germany contributing to the Action Programme of the Alpine Convention and which was carried out by the Wuppertal Institute for Climate, Environment and Energy.

*1990-1999 was the warmest decade of the 20<sup>th</sup> century in Germany. In addition, the first years of the 21<sup>th</sup> century were considerably warmer than the average for the latest climate normal period (1961-1990). The temperature increase observed since 1901 has been especially pronounced in south-western Germany. (Germany UNFCCC 5<sup>th</sup> National Communication)*

*The main pillars of Germany's national climate protection strategy include saving energy, improving energy efficiency, achieving a balanced mixed of energy sources and expanding use of renewable energies.*

### 3.4. ITALY

Italian climate change policy is consistent with the general principles set at international and EU level, and the emissions' reductions are in line with its Kyoto targets. Italy is committed to reduce its GHG emissions by 6.5% below 1990 levels over the first commitment period (2008-2012) and, under the Effort Sharing directive, to reduce non-ETS sector emissions by 13% from the 2005 level by 2020. The monitoring of emissions' trend at national level is overseen by an inter-ministerial committee that is also in charge of implementing measures for GHG reduction, including the identification of additional measures to meet the Kyoto targets. The National GHG Inventory System is managed by ISPRA, also in charge of transmitting the information to the UNFCCC's Secretariat and to the European Commission, after endorsement by the Ministry for the Environment, Land and Sea.

Guidelines for national policies and measures for the reduction of GHG and the related National Action Plan (2003-2010) have been in existence since 2002.

These documents identify policies and measures already in place and additional measures envisaged to meet the Kyoto commitments. A further update of the 2002 Guidelines and the related national action plan is being prepared according to the principles set by the Interministerial Committee for Economic Planning. Implemented or adopted policies and measures which had or are expected to have a large impact on GHG emissions in Italy can be read in the 2009 Italian biannual report for the European Commission. The analysis was developed according to UNFCCC's guidelines and examines the following sectors: Energy, Transport, Industry, Agriculture, Forestry, Waste, Buildings' sector and cross-sectoral policies.

Both national and regional institutions in the Italian Alps have made substantial efforts to research, monitor and report on the impacts on climate change. A crucial role in identifying the regional trends is played by regional authorities ("Regioni") and regional environmental agencies (ARPA) which provide a reliable and abundant flow of data and information concerning climate variability in the alpine regions of Italy.<sup>4</sup> Alpine regions are increasingly interested in adaptation to climate change. Due to their powers in land planning and energy, regions can define governance measures and procedures relating to the energy certification of buildings and guidelines for technical planning of generation, distribution and use of energy. Often the regions also deliver energy plans, which establish the objectives to be pursued in order to meet the Kyoto targets and provide for a proper development of the regional energy system, improved energy efficiency in several economic sectors and in distribution networks. A remarkable role has been played by regional governments in the Alps in the field of renewable energy, energy savings and control, and the availability of energy supply for industrial and civil installations. Worth noting is the increased interest in climate change by municipalities.

*A first attempt to assess the economic costs of climate change for Italy show that aggregate GDP losses induced by climate change in the first half of the 21<sup>st</sup> century are likely to be small, in the order of 20-30 billion €. Nevertheless, some economic sectors, such as tourism and the economy of the Alpine regions will suffer significant damages. (UNFCCC Italian 5<sup>th</sup> National Communication, 2010, p. 7)*

*Budget Law 2008 established that, for the period 2008-2010, the minimum quota of renewable electricity to be fed in the grid has to be increased every year by 0,75%. It also introduces a specific support scheme for renewable energy from biomass. (UNFCCC Italian 5<sup>th</sup> National Communication, 2010, p. 68)*

<sup>4</sup> Studies and reports focusing on climate change in the alpine territory tend to reflect the territorial scope of administrative boundaries (mainly region and province). This fact is also a consequence of the assignment of most planning competences to the regions, especially after the reform of the Constitutional Law in 2001. It should also be mentioned that often those studies focus on a portion of land vaster than the alpine area strictly delimited by the Alpine Convention, which is mostly due to the fact that the territory of Italian regions is not entirely falling within the Alpine Convention perimeter, with the exceptions of Valle d'Aosta and the Autonomous Provinces of Trento and Bolzano. The study provided by Piemonte refers to the entirety of its mountainous territory.

### 3.5. LIECHTENSTEIN

One could think that the Principality of Liechtenstein, being among the smallest nations of the world, and having a minor contribution to GHG emissions, could easily skip the responsibility of fighting climate change. Nothing is less true. Liechtenstein contributes in a noticeable way to the global efforts against climate change. Liechtenstein ratified the UNFCCC in 1994 and the Kyoto Protocol in 2005. The measures to fulfill its international obligations are not only taken by public actors. The Government makes an effort to involve the private sector by stimulating the flow of private investments into more climate friendly technologies. The slogan of its climate policy is "think global, act local", and cross-border cooperation with other States is crucial to it: having a Customs Treaty with Switzerland and by thus being included in the Swiss economic area, Liechtenstein associates itself with the Swiss efforts on CO<sub>2</sub> reduction and mirrors some important measures of Swiss legislation. Within the framework of Clean Development Mechanism projects, Liechtenstein has established a firm cooperation with the Swiss-based organization "myclimate".

Liechtenstein is a member of the EEA (European Economic Area) and therefore fully participates in the EU-Emissions Trading Scheme through the work of the organization "LIFE Climate Foundation Liechtenstein". This initiative became a non-profit foundation in 2009. LIFE makes an important contribution to raising awareness of climate protection and sustainability. It cooperates with the University of Liechtenstein and together they work on topics such as alternative investments funds, emissions trading market, connectivity of climate protection and the market. Liechtenstein fully supports efforts aimed at enhancing the global carbon market and the Clean Development Mechanism.

The National Climate Protection Strategy, passed in September 2007, established a 10-point framework for the future development of the national, as well as a credible international climate policy. The comprehensive climate protection strategy adopted by the Liechtenstein government defines and regulates State-operated purchase of carbon credits and GHG reduction measures. It sets criteria for the use of Kyoto mechanisms and emphasises the need to harmonise development in the field of environment, energy, transport, forestry, agriculture and fiscal policies. Similar to other European countries, Liechtenstein has endorsed the target of a 20% reduction of GHG emissions from 1990 levels by 2020 and announced an intention to move beyond 20% (to 30%), if certain conditions are fulfilled.

The Energy Concept 2013 and the Energy Efficiency Act provide the framework for a sustained promotion of emissions cuts and renewable energy production. Within the framework of the Alpine Convention, Liechtenstein initiated an architectural competition for best practices in the building sector, aimed at combining good architecture and climate efficiency ("Constructive Award"). Covering all the Alpine states, this award is of an international character. An important objective related to energy saving is the increase in the share of renewable energies to over 10% of total energy consumption by 2013. The main emphasis has been laid on usage of domestic biomass, also biogas for example, and as in many other states, increased use of solar energy.

*The mean annual temperature of Liechtenstein is currently 10.4°C, which mean that it has increased from 1980 to 2007 by 1.3°C. According to the mean estimate, temperatures will increase in Liechtenstein and northern Switzerland by 1.8°C in winter and 2.7°C in summer. (Liechtenstein 5<sup>th</sup> UNFCCC National Communication, 2010, p. 15)*

*Natural hazard: Liechtenstein has established so called "Geological Risk Maps" with a special focus on residential areas. These maps provide regional information on the specific risks regarding avalanches, rock and landslides and flooding. (Liechtenstein 5<sup>th</sup> National Communication, p. 16)*

### 3.6. PRINCIPALITY OF MONACO

The Principality of Monaco joined the global effort on climate change by signing the UNFCCC in 1998 and by ratifying the Kyoto Protocol in 2006. The Principality also joined the UNEP Climate Neutral Network, a worldwide network of countries, regions, companies and organisations that have publicly committed to reduce their carbon footprint. The objectives of the climate policy of Monaco were presented during the 15<sup>th</sup> UNFCCC Conference of the Parties in Copenhagen in 2009: a 30% reduction in GHG direct emissions in comparison to the 1990 levels by 2020, and an 80% reduction by 2050 to achieve climate-neutrality. So far, the Principality of Monaco has succeeded in reducing its GHG emissions by 9% in comparison to 1990 levels.

For the Monegasque authorities, tackling climate change is also an opportunity to progress towards shifting the energy supply sources and securing the energetic future of the country. Therefore, an important dimension of climate policy concerns energy supply and efficiency: improving the energy efficiency by at least 20% by 2020 and obtaining a 20% share of renewable sources in the final consumption of energy in the Principality. Subsidies to replace fossil heating by solar heating are being offered and the building sector targeted: energy performance diagnosis will be realized in all public buildings, and HQE® Standards will be applied in new public building projects. Specific agreements on sustainable development will be worked out with energy distributors, in particular to create a smart system to measure energy consumption, and a special fund on sustainable development will contribute to financing actions under the Energy and Climate Plan.

Monaco is trying to reduce emissions from the transport sector by: increasing commuter trains with neighbouring regions, improving public buses and facilitating walking in town, subsidising the purchase of electric vehicles and hybrid cars. The publicly owned vehicle fleet is turning electric as well. Monaco actively promotes electric mobility; the EVER Exhibition on Electric Vehicles and the JEUN'ELEC are held annually at the Grimaldi Forum and also the country's tradition and passion for motor vehicles is turning green thanks to the Monte-Carlo Rally of Alternative energy Vehicles.

Last, but not least, the global efforts supported by the Prince Albert II Foundation must be mentioned; the Foundation gives financial support to projects that propose solutions in the fields of biodiversity, water and specifically climate change.

*"We, **scientists** who met in Monaco to review what is known about ocean acidification, declare that we are deeply concerned by recent, rapid changes in ocean chemistry and their potential, within decades, to severely affect marine organisms, food webs, biodiversity and fisheries. To avoid severe and widespread damages, all of which are ultimately driven by increasing concentrations of atmospheric carbon dioxide (CO<sub>2</sub>), we call for policymakers to act quickly to incorporate these concerns into plans to stabilize atmospheric CO<sub>2</sub> at a safe level to avoid not only dangerous climate change but also dangerous ocean acidification."*

MONACO DECLARATION (2008)

### 3.7. SLOVENIA

With increasing evidence of impacts and growing emissions, climate change has become an important priority for Slovenia over the last decade. To achieve the Kyoto target of an 8% reduction of emissions (base year 1986), in December 2006 the Slovenian government adopted the "Operational programme for reduction of greenhouse gas emissions until 2012". This programme was revised in July 2009. Before the Copenhagen Conference in 2009 the Parliament adopted the Declaration on the Active Role of Slovenia in Shaping the Future International Climate Policy, providing a broad mandate for climate policy in Slovenia and internationally.

An important step was made by establishing the Government Office of Climate Change in June 2009. The Office is preparing the Climate Act, Low Carbon Strategy till 2050 and takes initiatives in relation to sectoral policies and measures towards achieving mitigation and adaptation objectives. It also works with government, civil society and business stakeholders at different levels to implement programmes and measures. It promotes educational and training programmes to raise awareness about climate change.

The draft Climate Act and the long-term (low-carbon) strategy currently under preparation represent a part of the Slovenia's exit strategy from the global economic crisis 2010-2013. "Green growth" is therefore becoming an important element of a more sustainable economic development. Towards this goal, Slovenia funds research and development in low carbon technologies. Feed-in tariffs and subsidies for renewable energy have already spurred a rapid growth of photovoltaic installations and related business. New building standards are pushing for more energy efficient buildings and the Slovenian Eco-fund provides subsidies and loans for energy efficiency and renewable energy supply in new and existing buildings. Since 2009 energy accounting is mandatory for all public buildings and the Government has introduced a voluntary programme of environmental and energy efficiency in the public administration. EU cohesion funds are being used to improve energy efficiency in hospitals and schools. In the year 2011 Slovenia will prepare the program of subventions for electric vehicles, the goal of which is to put on the street at least from 800 to 900 electric vehicles until the year 2014 as well as develop the necessary infrastructure in partnership with municipalities and electricity distributors.

Another initiative is to improve the utilization of wood from Slovenian forests both as a low carbon material and a source of renewable energy. In order to secure the long terms stability of the forests, which cover 60% of the territory, the harvest is to be increased to 75% of the annual increment of wood biomass, thereby providing both an increased resource base of wood and a carbon sink in the future. In 2008 the government adopted the "strategy of adaptation of agriculture and forestry to climate change", stressing the importance of acquiring new knowledge, as well as awareness-raising and education in this field.

Another aspect that is key to both adaptation and mitigation is spatial planning. The major strategic document in this field is the "Spatial development strategy of Slovenia" issued in 2004. Climate change is addressed indirectly through general guidelines on rational and hazard safe spatial development and through more detailed ones on design of urban areas. Both should be followed by lower planning levels.

*As a result of Slovenia joining the European Union in 2004 and the Schengen area in 2007, and the development of the highway network, greenhouse gas emissions from transport have increased by more than 50% between 2003 and 2008.*

*A draft proposal for a Climate Act has been under broad public consultation since June 2010. The Act will provide for the long term climate objectives of Slovenia in line with the Copenhagen Accord, a carbon budget for the non-ETS sector, methodology for carbon footprint, integration of sectoral policies and funding of measures in developing countries.*

*There are between 15 and 20 companies in Slovenia involved in projects related to electric vehicles. Companies that are active in the field of electric drives (engines), various components, mechatronic components and systems for construction of light vehicles, have the total annual export of 1,2 billion €. Currently, 50% of the electric vehicle could be produced in Slovenia.*



### 3.8. SWITZERLAND

Switzerland ratified the Kyoto Protocol in 2003, committing itself to an 8% reduction in its GHG emissions by 2008-12 compared to 1990 levels. At national level, the CO<sub>2</sub> Act, which was adopted in May 2000, provides the legal basis for emission reductions. The Act covers only energy-related CO<sub>2</sub> emissions, with a reduction target of 10% by 2010 compared to 1990, which corresponds to the 8% target for GHG as set out in the Kyoto Protocol. Like other alpine countries, such a commitment is not easy to meet due to a highly industrialized economy, and whilst many efforts have been made by the public authorities and voluntarily by private actors, the total GHG emissions have remained approximately at the level of 1990. Yet Switzerland is supportive of the Copenhagen process and has now committed to a reduction of 20% in GHG emissions by 2020 compared to 1990, and may upgrade the commitment to 30% if other developing and developed nations commit as well, thus giving meaning to a globally shared effort. The origin of GHG emissions in Switzerland is mostly concentrated in three sectors (percentages for 2008): Transport (31%), Residential (20%) and Industry (19%); other important sources are Agriculture (11%), Commercial (9%) and Waste (8%).

Through the CO<sub>2</sub> Act and supporting legislation (e.g. Energy Act) Switzerland aims to implement Kyoto and post-Kyoto commitments through a series of combined strategies and policy measures among which the following should be emphasised:

- the introduction of the Energy Act, an Energy Programme and the second edition of the "SwissEnergy" programme (2006-2010), pursuing the efforts of the first one (2000-2005). The objectives are to reduce the consumption of fossil fuels, to slow down the growth of electricity demand and to increase the contribution of renewables to energy supply.
- the introduction of a CO<sub>2</sub> levy on fossil fuels for stationary users in 2008, at 12 CHF/tonne CO<sub>2</sub> (approx. 11\$/tonne of CO<sub>2</sub>). The rate has been increased in 2010 to 36 CHF/tonne CO<sub>2</sub> (approx. 35\$/tonne of CO<sub>2</sub>), as intermediary 2008 targets were not met.
- the introduction in 2005 of a special levy called the climate cent ("Klimarappen") on fossil transport fuels, which is fed into the Climate Cent Foundation, an initiative of the private sector. The climate cent (1,5 cents per litre) raises 100 million \$ per year and the revenues are invested cost-effectively in offset projects in Switzerland and abroad. Switzerland considers some crucial lessons have been learned in regard to mitigation: More stringent measures are needed for the transport sector, and additional incentives and regulations may be necessary. Finally, adaptation is also a dimension of climate change policy, and a National Adaptation Strategy is currently being prepared.

*Various sectors of the Swiss economy are likely to be affected by progressing climate change. In particular, the tourism industry will be hard hit, as the potentially beneficial effects for summer tourism will not compensate for the loss of income in mountain resorts during winter due to scarcity of snow. (Swiss 5<sup>th</sup> UNFCCC National Communication, 2009, p. 22)*

*The Swiss GHG inventory is managed according to a quality management system (QMS), designed to comply with the quality objectives of the good practice guidance of IPCC (2000), i.e. to ensure and continuously improve transparency, consistency, comparability, completeness, accuracy and confidence in national GHG emission and reduction estimates. The NIS quality management system complies with the ISO 9001:2008 standard and has been certified by the Swiss Association for Quality and Management Systems. (Swiss 5<sup>th</sup> National Communication to the UNFCCC, 2009, p. 17)*



## 4. REGIONAL STRATEGIES

### 4.1. THE BAVARIAN CLIMATE PROGRAMME 2020

Jörg Stumpp

Over the last one hundred years the average annual temperature in the area of the Alps has risen by 1.5° C, which is double the world average. That was revealed by an ambitious large-scale climate research programme started in 1990. Global warming will increase and by 2030 the Bavarian Alpine region will record temperatures 2.4° C higher than one hundred years ago. From now until 2050, winter precipitation will increase by 35%, while summers will be significantly dryer and the number of hot days with temperatures above 30° C will double. This will have consequences for the natural environment as well. A temperature increase of 1° C is likely to displace vegetation zones between 200 and 300 km towards the Poles; in the mountains that would translate into an upward altitudinal shift of 200 m, which, for example, would seriously endanger the survival of spruce. The economic consequences of uncontrolled climate change will be severe. Losses for Bavaria alone could amount to about 100 billion euros by 2050.

In 2000 the Bavarian Government launched an initial 'climate concept' aimed at reducing the annual energy-related CO<sub>2</sub> emissions from a level of over 90 million tonnes at the end of the 1990s to 80 million tonnes by the year 2010. The Bavarian measures were implemented alongside those of Germany's Federal Government and the target was reached and exceeded as early as 2007, when emissions were reduced to 75 million tonnes.

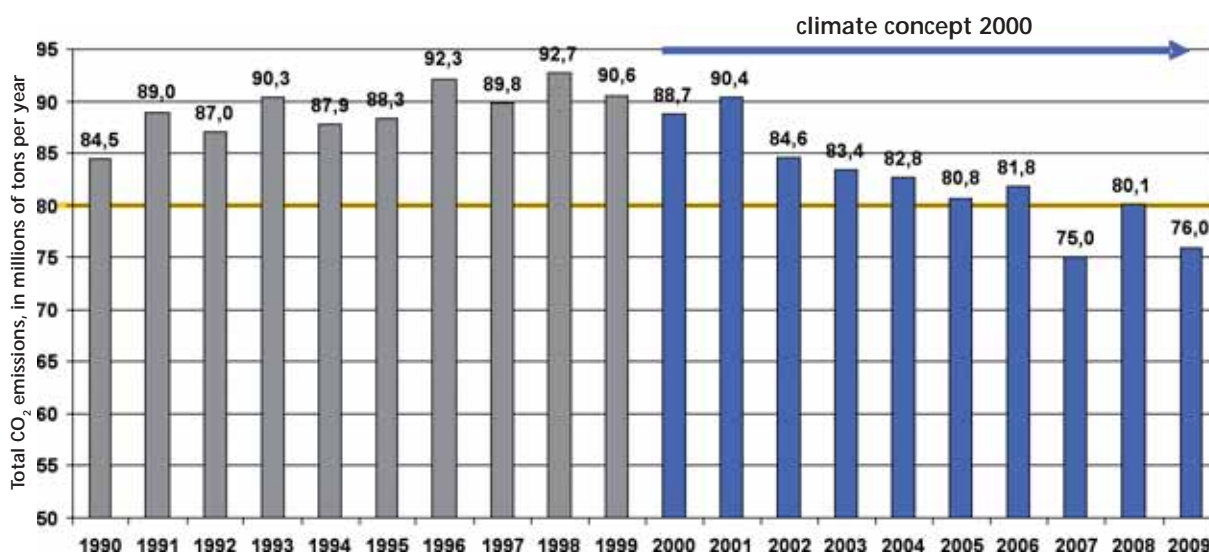


Figure 10: Total CO<sub>2</sub> emissions, in millions of tons per year

Bavaria's climate protection efforts further intensified in 2008. The Bavarian Climate Programme 2020 (*Klimaprogramm Bayern 2020*) introduced a package of additional measures worth 350 million euros for the period 2008 - 2011; measures were tailored to Bavaria's specific conditions with the aim of further reducing greenhouse gas emissions while enhancing adaptation to the inevitable consequences of climate change. Research activities are planned to improve existing databases so as to facilitate future strategic decisions.

The Bavarian Climate Programme 2020 was developed jointly with the Climate Council (*Klimarat*) of the Bavarian Ministry of the Environment and Public Health. Chaired by Prof. Graßl, the Council has been advising the Bavarian Government on climate policy matters since April 2007. The Programme contains 14 priorities, characterised by a favourable cost-benefit ratio.

Some 223 million euros will be made available to **reduce greenhouse gas emissions**, for activities such as the low energy refurbishment of state, municipal and church buildings and the promotion of renewable energy. By 2020, CO<sub>2</sub> emissions should be reduced below 6 tonnes per capita/year. In 2030 such figure should drop below 5 tonnes. By 2020 the share of renewable energy in final energy consumption should double from 10% to 20%. An additional goal is to ensure that, by 2020, 25 to 30% of Bavaria's electricity is generated from renewable sources.

About 84.7 million euros have been earmarked to enhance **adaptation strategies** to deal with the inevitable consequences of climate change, including the conversion of spruce forests into mixed forests, which endure climate change better. By 2020 this measure must involve 100,000 of the 240,000 hectares of private forests. Additional actions include measures for the protection of mountain forests or improved flood protection.

42.3 million euros have been allocated for **research and development**. Three research groups are investigating the impacts of climate change on ecosystems, energy-efficient technologies and modern power plant technology.

Climate change also offers **economic opportunities**. 19% of Germany's turnover from the production of environmental protection good is generated in Bavaria. Bavaria is a high-tech export-oriented region, a place of innovation that can boast excellent economic and research capabilities and extensive know-how in the field of environmental technologies. Against this background, business related to climate protection means opening up important markets and prospects for the future. Innovations, new technologies, materials and systems solutions developed in Bavaria can help create and implement technical solutions to reduce GHG emissions and adapt to climate change throughout the world.

Bavarian climate policies follow a cooperative approach and involve partners of the Bavarian Climate Alliance (*Bayerische Klimaallianz*), economic actors represented in the Pact for the Environment and the entire Bavarian population. Since 2008, Bavaria has been organising a **Bavarian Climate Week** every year, which sponsors about a thousand different events. Action is taken on all fronts to exhaustively inform the population, thus raising awareness of the theme of climate protection.

The countless impacts of economic, environmental and social developments do not stop at state borders. For this reason, Bavaria fosters **targeted cross-border cooperation** at regional and national level. For example, Bavaria is working on the development of a Strategy for the Alps, together with other regions of the Alpine area. A joint statement was the first step towards closer collaboration among the Alpine regions to develop this strategy. Currently there is a Europe-wide debate on macro-regions – namely regions that operate across traditional administrative boundaries and agree upon a method to deal with common challenges, such as those posed by climate and biodiversity protection, risk prevention and transport management. In collaboration with several DGs of the European Commission, Bavaria also participates as a partner in a number of European projects (i.e. AdaptAlp, CLISP, E-Connect) or provides support for the development of the relevant programmes. These forms of cooperation enable the Region to keep abreast of important themes at European level, encourage the mutual exchange of know-how and information on examples of good practices and thus contribute to greater European integration.

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## 4.2. HOW CANTON GRAUBÜNDEN DEALS WITH CLIMATE CHANGE

Remo Fehr

Switzerland bases its climate policy on the Kyoto Protocol [1] and has made a commitment to reduce greenhouse gas emissions by 8% below 1990 levels between 2008 and 2012 (from 52.8 to 48.6 million tonnes of CO<sub>2</sub> equivalent). A 20% reduction is planned by 2020. Greenhouse gas emissions can be efficiently controlled and ultimately reduced through energy-savings measures. Hence climate policy and energy policy go hand in hand. Aware of that functional link Canton Graubünden (or Grisons in French) is promoting energy conservation by means of various measures and incentives. Of course, that cannot reverse rising temperature trends in Graubünden, but it can curb CO<sub>2</sub> emissions. In fact, curbing and reducing greenhouse gas emissions is crucial, since the consequences of global warming are already clearly visible today. Through appropriate adaptation strategies, such as the construction of early warning systems and the realisation of defence works, Canton Graubünden is attempting to fight the dangers of climate change.

### Background

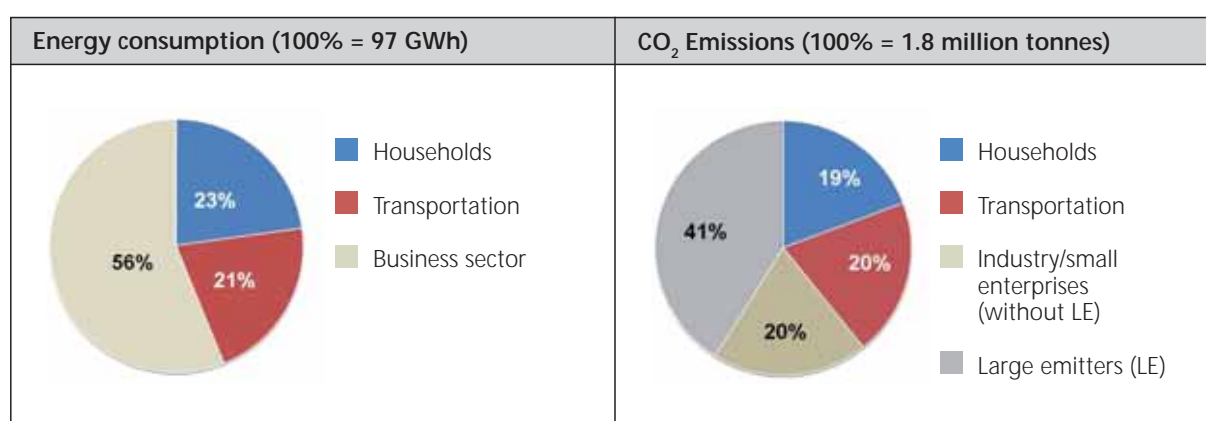


Figure 11: Energy consumption and CO<sub>2</sub> emissions divided by user and emitter groups

Overall energy consumption in Graubünden amounts to approximately 9700 GWh (last updated 2008). This corresponds to a per-capita energy consumption of 5 – 6 kilowatts. The business sector is the largest energy consumer (56%); the remaining consumption is divided almost equally between the transportation and household sectors (see chart on the left in figure 1). Energy from fossil fuels accounts for 67% of total consumption; renewables therefore provide one third of the energy used in Graubünden. The following table shows a breakdown of these non-fossil energy sources.

Fossil fuels are the largest source of CO<sub>2</sub> emissions. Overall, in Graubünden, almost 1.8 million tonnes of CO<sub>2</sub> are emitted every year (last updated 2009). That amounts to about 3% of the CO<sub>2</sub> emissions of Switzerland. Almost 20% of the 1.8 million tonnes of CO<sub>2</sub> emissions are produced by small-sized industrial and artisan establishments, while 41% are generated by large-sized enterprises, such as the largest cement facility of Switzerland at Untervaz, for example, which is responsible for almost one third of the Canton's CO<sub>2</sub> emissions. The remaining 39% of CO<sub>2</sub> emissions (similarly to the consumption of energy) is divided almost equally between transportation and household consumption (see figure 1 - chart on the right).

Energy source	Number of plants	Energy produced	Share
<b>Water</b>	Large power plants Small power plants Hydroelectric power plants fed by drinking water pipelines	5500 GWh (Exported) 2400 GWh (Domestic consumption)	87.1%
<b>Biomass</b>	1 Power plant	136 GWh Electric power 220 GWh Thermal power	4.9% 8.0%
<b>Biogas</b>	5 Plants	500 kWh Thermal power 500 kWh Electric power	<0.01%
<b>Wind</b>	0 Plants	0 kWh	0%
<b>Geothermal</b>	986 Heat pumps with geoprobe	85 MWh	<0.01%
<b>Sun (solar cells)</b>	774 Installations subsidized since 2007	(10'000 m <sup>2</sup> solar cell area)	<0.01%

Table 2: Energy sources other than fossil fuels and their importance

Source: Office of Energy and Transport for Nature and the Environment-Graubünden

## Prospects

According to the scenarios modelled by Meteo Schweiz [2], by the mid-21<sup>st</sup> century the average temperatures in Graubünden should increase by almost 2° C in winter and by a good 2.5° C in summer, with likely regional differences (see table 2 below). Precipitation could increase by about 10% in winter and decline by as much as 20% in the summer months.

Season	Temperature changes		Precipitation changes	
	Northern Graubünden	Southern Graubünden	Northern Graubünden	Southern Graubünden
<b>Hiver</b>	+ 1.8 °C	+ 1.8 °C	+ 8%	+ 11%
<b>Eté</b>	+ 2.7 °C	+ 2.8 °C	- 17%	- 19%

Table 3: Temperature and precipitation changes expected as a result of warmer climate in the northern and southern parts of Graubünden

Source: OcCC[3]

Rising temperatures and changing precipitation regimes will bring extreme meteorological events, with alternating periods of draught and heavy rains; the freezing level will rise and push the treeline higher, moving the distribution of forest species upwards in altitude. The alpine forests will be increasingly dominated by drought-enduring species. There will be less snowfall at higher altitudes and glaciers will shrink further. If the glaciers disappear there will be detrimental consequences for the drinking water supply and flood protection. The flow regime of rivers and streams will very probably change due to the lack of the 'cushion effect' of the glaciers. As a result, flooding will be more frequent along creeks and rivers with ensuing dangers for agricultural land, settlements and infrastructures. Also the habitats of the native fish species, such as the brown trout (Bachforelle) and the grayling, are likely to be threatened. However, many plant and animal species could benefit from a rise in temperature: species from lower altitudes and warmer climate zones will spread and force autochthonous species to resettle at

higher altitudes. In Graubünden, the most endangered species will be summit flora that has adapted to extreme conditions. Yet, the spread of new species may also pose risks and dangers, as shown by the examples of the ragweed and tiger mosquito.

### **(Adaptation) Strategies**

Future prospects are daunting by uncertainty. The only sure thing is that climate change will leave its mark in the Alps. The 'colourful bouquet' of possible changes shows what type of deep repercussions global warming could have in the Alpine region. Every profession - politicians, scientists and administrators - are called upon to respond to these changes in an adequate and farsighted manner. Any reaction, or intervention, should be based on facts. For this reason, comprehensive monitoring of the environment will be a precious tool, to be followed up by accurate research on the interconnections, causes and effects across environmental sectors.

The data and knowledge so acquired will form the basis for developing suitable adaptation strategies. The Canton of Graubünden is only at the beginning of this path.

Currently, comprehensive measurement and monitoring systems, information technology systems, maps of intervention and concepts for the management of emergencies are being formulated and strategies are being developed for waterways, along with a cadastral registry of defence works. Nevertheless, adaptation strategies will serve their purpose only if they are coordinated, communicated and implemented consistently. In order to coordinate and exchange information, Canton Graubünden's offices and administrative services produced a joint report on climate change last year [4], which illustrates climate protection policies, exploring problems, such as air quality, water use and flood protection, wildlife, spatial planning, natural hazards and tourism.

### **Implemented and planned measures**

Canton Graubünden has launched several measures to reduce greenhouse gas emissions.

For example, under the law entered into force at the beginning of 2009 [5] the road tax for motor vehicles shall be calculated on the basis of their CO<sub>2</sub> emissions (in g/km) and less polluting vehicles may enjoy up to 60 - 80% discount on it. The revised Energy Act, which is due to enter into force in 2011, contains more stringent requirements for new buildings, including compliance with a 'Minergie' standard in the absence of air conditioning systems; energy conservation incentives will be greatly enhanced. The Canton is already providing grants for retrofitting buildings and improving their energy efficiency (2009: 2.5 million francs for 115 building renovation projects). Incentives are also provided for the production of energy from renewable sources (2009: 406 solar panel installations, 482 heat pumps). Concerning the plan to improve air quality, an attempt is being made to reduce soot emitted from the diesel engines of vehicles and large sized equipment (construction machinery, tractors); actions were introduced to reduce nitrogen oxide emissions (ammonia, nitrous oxide) from the agricultural sector. In the future, more wood and district heating produced by cogeneration and waste incineration plants should be used for heating purposes. In this field, a concrete project is now being realised in Chur.

### **Conclusion and outlook**

A comprehensive environmental monitoring system and the construction of defence works tackle the symptoms rather than the causes of global warming. Global warming cannot be undone: it is an



irreversible phenomenon that can only be slowed down or stopped at best. Planet Earth is getting warmer as a result of our actions, and these are something we can control, if we want to. Otherwise, the only other possible response to the consequences of global warming is represented by adaptation strategies. Only by dealing with the root causes of global warming can we curb and control the risks of rising temperatures. We can, for instance, create laws to increase energy efficiency or provide incentives to encourage the use of renewable energy sources and low emission vehicles. Initiated measures will be effective only if they are implemented consistently and on a large scale across borders.

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### 4.3. REGIONAL POLICY TO FIGHT CLIMATE CHANGE IN THE PROVENCE-ALPS-CÔTE D'AZUR REGION

#### Climate and climate risks in the Provence-Alps-Côte d'Azur Region

Awareness of energy issues needs to be raised: the Provence-Alps-Côte d'Azur (PACA) Region must consider its strong energy dependency and consumption, which is concentrated along the rivers Durance and Rhône and the coast. It is difficult to satisfy the regional strong demand for energy, especially in the summer months.

It should also be noted that the growing consumption of energy has a direct impact on the regional environment: climate warming due to the greenhouse effect leads, among other things, to extreme meteorological events on the coast, to a reduction of snow cover in the mountains, catastrophic floods and the siltation of the Rhône delta caused by the rising sea level (+ 2 mm annually), not to mention air pollution and the ozone alarm in large cities and in the proximity of the Étang de Berre.

Regional energy production is dominated by the hydroelectric sector, which accounts for almost 60% of production. The refineries around the Étang de Berre cover one third of the national production capacity. The regional territory is also a transit area for energy on account of its infrastructures, which include a liquefied natural gas (LNG) terminal in Fos-sur-Mer, the coal terminal and oil port of Fos and the oil and gas pipelines that depart from Fos to supply a part of Europe. However, the PACA Region produces only 14% of the energy it consumes.

PACA is responsible for 8% of France's greenhouse gas emissions (GHG). With an emission level – expressed in tonnes of carbon dioxide equivalent – of 8.6 t CO<sub>2</sub> eq per capita in 2007, the Region produces an amount of greenhouse gas emissions slightly above the national average of 8.5 t CO<sub>2</sub> per inhabitant per year.

Almost 90% of the Region's GHG emissions are related to energy consumption. This demonstrates how closely the issues of energy and climate change are correlated. So, managing energy consumption and promoting sources of energy that do not emit greenhouse gases helps prepare for transition to the post-oil era.

#### Assessment of greenhouse gas emissions in the Provence-Alps-Côte d'Azur Region

This assessment of greenhouse gas emissions concerns only direct emissions linked to the consumption of energy and takes into account only the use of fossil fuels. In 2004, these emissions accounted for 85% of the total greenhouse gas emission in the PACA Region (source: Atmo PACA, Regional Inventory of Emissions – 2004). Only the first three of the six greenhouse gases regulated by the Kyoto Protocol (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFC, PFC, SF<sub>6</sub>) have been taken into consideration.

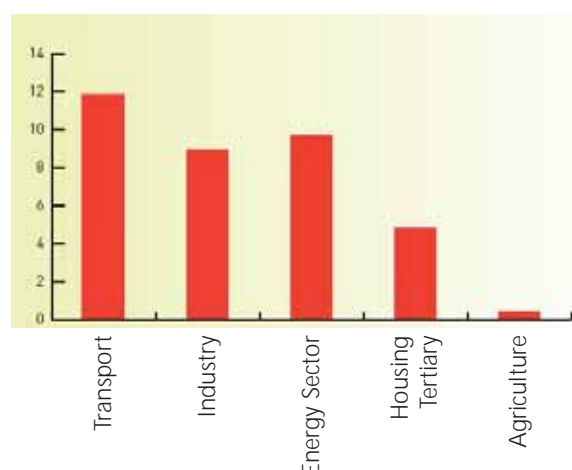


Figure 12: GHG emissions - 2008 (million tonnes of CO<sub>2</sub> equivalent)

## An innovative regional policy

The Region has been committed to contrasting climate change for ten years now, through the promotion of renewable energy and energy efficiency. Building on past experience, the Region has consolidated its action with the adoption of the 'Energy 2010' Plan in 2005.

In 2006 the Region reached another important milestone with the launch of the AGIR Programme (*Action Globale Innovante pour la Région*- Innovative Global Action for the Region). With an allocation of 70 million euros for the period 2007-2010, AGIR finances innovative and exemplary projects designed to promote energy conservation and renewable energy, while drawing on regional initiatives and talent.

Almost four years after its launch, 'AGIR for Energy' has witnessed a multiplication of initiatives promoted by all types of players: 600 projects, 14 million kWh of primary energy (kWhpe) saved and 11 million kWh of renewable energy produced every year (these are the results from one fourth of the projects) and over fifty directly created jobs. This new scheme has given priority to innovation and has recognised the effectiveness of the chosen approach, which has encouraged many regional operators to take action: farmers, businesses, professionals in the sector of tourism, Regional poles for innovation and inclusive economic development, the so-called 'Citizens' Regional Internet Spaces' of the ERIC Programme (*Espaces Régionaux Internet Citoyen*), vocational training centres and educational institutions, municipalities, territories, festivals and cultural facilities, low-rent housing agencies (HLM – *Habitation à loyer modéré*), developers, etc.

## Actions undertaken by the Region

### • Solar energy

In three years between 2006 and 2009 some 10,412 individual solar thermal plants were installed for a total area of 55,643 m<sup>2</sup>. The year-on-year increase was remarkable. Many of these plants are also for collective use: about 400 plants since 2006, for a total area of 13,500 m<sup>2</sup>. Concerning the solar photovoltaic technology, the number of installations has increased considerably since 2007, with almost 2,400 plants installed and about 19 MW of power generated in three years.

### • Wind power

There were four farms in operation in 2009, whose estimated production was 173 GWh. The construction of 3 more farms has been authorised, for a capacity of 80 MW.

### • Firewood

127 wood-burning systems for collective use were put into service (installed capacity: 30.3 MW); 48 wood-burning systems were installed for industrial use (installed capacity: 22.5 MW).

### • Buildings

In 2008, the urgent need for action led the Region to set up a 'Regional pole for innovation and inclusive economic development' (*Pôle Régional d'Innovation et de Développement Économique Solidaire* - PRIDES) dedicated to 'Sustainable Mediterranean construction' (*Bâtiment Durable Méditerranéen*). Two years after its establishment, PRIDES' activity is gaining momentum: the organisation is supporting 100 construction projects, providing assistance to members for training; it is also promoting collective actions to encourage the development of new supply chains for ecological materials and energy rehabilitation of buildings. A European project has been presented to develop a shared Mediterranean instrument for the assessment of buildings. The Region has also launched

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two calls for projects involving the construction or renovation of model buildings: the call entitled '100 exemplary buildings' (*100 bâtiments exemplaires*) led to the identification of 71 projects, which received total funding of 10.5 million euros. The call concerning projects for the retrofitting of social housing (*réhabilitation thermique des logements sociaux*), whose objective is to support lessors willing to improve the energy performance of social housing properties in a comprehensive way, led to the identification of 23 projects, for which the Region allocated 10 million euros.

- **'AGIR for Energy' sponsors municipalities**

The primary objective of this project is to help municipalities in the Region pursue an ambitious policy of energy management throughout the territory. It proposes a framework and methodology that enable municipalities to make progress in the implementation of concrete actions over a period of four years. To date, 75 municipalities are involved at different stages in this project. Such mechanism acts as an engine for the creation of energy-related jobs and stimulates investments.

- **Call for proposals '100 exemplary farms' (*100 exploitations agricoles exemplaires*)**

85 farms are currently participating in this action and 55 projects have been chosen: 10 agricultural schools, 1 cooperative and 44 farms. Here are some figures:

- Estimated energy savings: 1.12 GWh (forecast)
- Renewable energy produced: 1.5 GWh (85% photovoltaic, 13% firewood, 2% solar thermal)
- Estimated water savings (through the collection of rainwater): 1800m<sup>3</sup>.

- **The PREMIO Project for the production of renewable energy and the integrated and optimised management of energy (*Production Répartie Enr (énergies renouvelables) et MDE (maîtrise de l'énergie), Intégrées et Optimisées*)**

This project is supported by the CAPENERGIES Association – which is based in the innovation park that has the same name - and is included in the 'AGIR for the future' section. This project aims to implement an innovative decentralised energy architecture in the region, integrating local energy production with thermal or electric storage distributed among consumers/ producers of energy, the development of renewable energy sources, the dynamic management of energy loads and energy saving initiatives. The challenge is to reduce peaks in consumption on the local power grid, saving energy and reducing CO<sub>2</sub> emissions.

- **Regional call for proposals for Territorial Energy & Climate Plans (*Plans Climat-Energie territoriaux -PCET*)<sup>5</sup>**

To meet the challenge of climate change, the Region - in partnership with State Agencies (Agency for Environment and Energy Management and Regional Directorate of Environment, Planning and Housing) and with the assistance of the European Regional Development Fund (ERDF) - has participated in a call for projects entitled 'Development and implementation of territorial energy and climate plans in Provence-Alps-Côte d'Azur' (*Construire et mettre en œuvre des plans climat-énergie territoriaux en Provence-Alpes-Côte d'Azur*). The purpose of this call for proposals is to encourage and support those PCETs that have ambitious objectives and wish to implement a program of exemplary actions based both on the sharing of resources and cooperation among territories and on a community-centred approach.

The region has 34 communities (excluding the Region itself) with over 50,000 inhabitants, which must adopt a PCET before 31 December 2012 (Grenelle II Act). Other territories could start a process to define a PCET without being obliged thereto under Article 26 of the Grenelle II Act. The call for projects will favour the emergence of synergies and exchanging of experiences between these different territories.

<sup>5</sup> Under Article 75 of Grenelle II Act, "Regions, Departments, urban communities, conglomerate communities, Municipalities and Associations of Municipalities with over 50,000 inhabitants must adopt a Territorial Energy & Climate Plan (PCET) before 31 December 2012. If the above-indicated local authorities decide to develop a plan for sustainable spatial development or the Local Agenda 21, the PCET will be valid as climate chapter of it. Before drawing up the PCET, an assessment of greenhouse gas emissions should be performed. The PCET will establish objectives, an action plan and system for monitoring energy efficiency and emission reduction. The PCET will be updated every 5 years."

- **Proposed actions**

After the first phase of AGIR, the Region is determined to work towards an inclusive society and has renewed its commitment to deal with climate change and its consequences on the territory. A new framework for regional action will be launched for the period 2011 - 2014 under the title 'For Energy and the Planet, AGIR PLUS (+)' (*Pour l'énergie et pour la planète, AGIR PLUS (+)*); it will be based on specific collaborative projects with the territory, the industry and peers (groups of professionals) with the aim of accelerating the dynamics of change and training. AGIR PLUS will therefore focus on managing relationships while fostering solidarity and community responsibility in addressing environmental issues.

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#### 4.4. REGIONAL POLICY TO FIGHT CLIMATE CHANGE IN THE RHÔNE-ALPES REGION

##### Objectives

The Rhône-Alpes Region promotes actions to contrast global warming and favour adaptation to its effects as part of a structured approach to sustainable development, to which it has been committed since July 2004. The Region participates in the development of regional monitoring instruments in the fields of energy and the climate, supporting and co-managing the OREGES, the Regional Observatory of Energy and Greenhouse Gases (*Observatoire régional de l'énergie et des gaz à effet de serre*).

The regional objectives established in October 2010 go beyond current national and European targets. The aim is to reduce greenhouse gas emissions by 40% by 2020 and to cut them to a fifth of the current level by 2050. The regional climate and energy plan, whose drafting is in progress, will be based on the pursuit of these objectives and will be supported by the regional programme for the climate, air and energy, developed in collaboration with the French national government.

##### Priority Actions

###### • Energy Efficiency

The Region adopted a plan for the promotion of renewable energy and energy efficiency in April 2005. In this context, the Region is implementing a policy to improve energy efficiency in buildings and has published various calls for tender for the construction or rehabilitation of 'low-energy' buildings, also supporting testing of model buildings in the territory. The Rhône-Alpes pavilion at the Shanghai Expo 2010 is an example of green construction.

The Rhône-Alpes Region provides support to companies for eco-innovation projects, some of which concern the field of energy (call for projects 'INNOV'R'). In 2008 the Region also started an Energy Plan for Upper Secondary Schools (*Plan énergie des lycées*), which places energy management at the centre of regional policy:

- The Region has implemented a financial incentive scheme for energy efficiency. Since 2006 upper secondary schools that have undertaken actions to reduce their energy consumption have benefited from this scheme.
- The policy of 'ecologically responsible' schools raises awareness among the actors involved and training courses in energy management are offered to all secondary school personnel.
- The community is committed to enhance the energy performance of school buildings. All upper secondary schools have undergone an energy audit (2006-2010). The renovation and construction of schools must comply with a standard concerning the 'environmental quality of buildings', whose objectives go beyond the legal provisions in force (four projects are under study for 'passive buildings' to be used as schools and boarding schools).

The Region also encourages the inclusion of environmental issues, especially those concerning the climate and energy efficiency criteria, in the specifications for the realisation of student housing facilities, sports facilities and training centres for apprentices.

Concerning new social housing, the Region provides support to the owners only if the housing units comply with the environmental quality standard established jointly with the Agency for the Environment and Energy Management (ADEME - *Agence de l'environnement et de la maîtrise de l'énergie*).



The standard focuses on ambitious energy performance (low-energy buildings). A similar approach is currently under study for the energy retrofit of older public housing.

#### • Renewable energy

Through its energy and environmental management policy the Region promotes renewable energy sources on its territory. Measures include:

- financial support to individuals (so-called 'energy cheque', in particular);
- support to businesses (advice provision and support for clean energy investments);
- assistance for the development of supply chains in the fields of wood, solar thermal energy and biogas production and for the optimisation and enhancement of hydroelectric energy production;
- finally, the Region has promoted calls for projects for the use of wood or photovoltaic panels for energy production.

Under the Energy Plan for Upper Secondary Schools, the Region intends to expand the use of renewables on a large scale and is aiming at increasing their share in school energy consumption to 20% by 2020. In addition to the wood boilers that currently provide 5% of heating in secondary schools, a call for tender was published in 2010 for the installation of over 60,000 m<sup>2</sup> of photovoltaic solar panels.

Through the Regional Programme of Research and Higher Education launched in 2005, the Rhône-Alpes Region made a commitment towards the promotion of a knowledge-based economy that relies on strong synergies between the research community and the economic fabric of the territory. Therefore, in order to promote technological innovation, the Region supports research, including a cluster of research facilities dealing with renewable energy and energy efficiency (solar, biomass, hydrogen, the management of networks and the social impact of new technologies). The Region also supports 'clusters for competitiveness' (*pôles de compétitivité*) in the territory. In particular, it contributes to financing the TENERDIS cluster, which includes over 2,500 researchers, whose objectives are the production and optimisation of the use of renewable energy.

#### • Transportation

Within the framework of the Regional Programme for Transport Services adopted in April 2008, the Region has defined the long-term objectives and commitments of its transport policy, following a sustainable development approach and aiming to increase the use of public transport, enhance intermodal services for motorists and take greater account of transport interfaces in urban, transport and environmental planning projects. Such are the guiding principles for public intervention in the field of transport.

The Region is responsible for organising public transport services of regional interest, which are known as the TER (*Transport Express Régional* - Regional Express Transport). In this connection, the Region has considerably widened and improved its transport supply since 2007. Between 2007 and 2009, TER's offer grew by 15% and reached 27 million train-kilometres supplied annually. The Region's TER Policy is also accompanied by improved services for users, the provision of intermodal public transport, including intermodal services at the station, experimental eco-friendly equipment for small stations, attractive regional pricing that considers both social and intermodal issues (combined forms of pass for regional and urban transport) and a unified ticketing system. As a result, the number of users increased by 11% in 2008 and by 1.6% in 2009 to achieve 140,000 daily trips. Since the regionalization of TER in 1997 the passenger count has increased by 70% –an outstanding achievement indeed.

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The Region has developed a policy in favour of 'soft mobility', whose primary objective is to promote new forms of mobility for local transport, encouraging users to change their habits in an attempt to reduce the impacts of transport on the environment. The Region is now developing a 'TER + Bike Service' by equipping all train stations with a bicycle storage and supporting the realisation of bicycle lanes in the proximity of stations.

Faced with the challenge of shifting freight from roads to more environmental-friendly modes of transport, the Region has also intervened in favour of rail and river freight transport, using two strong levers: development of a combined road-rail transport system –so called 'piggyback transport system' (for example by making use of the Alpine Rolling Highway) and co-financing to modernise infrastructures in order to facilitate intermodality (renewal of river ports, railway and river junctions and modernisation of the structure gauge of railway tunnels).

Under the *Plan Rhône*, the Region is fostering the growth of river transport; it is also supporting the 'Voie Rhône' project for a cycle route connecting Lake Geneva to the Mediterranean Sea (a total of 700 km, of which 415 km in the Rhône-Alpes) and has realised a regional section of the 'Voies Vertes' national system of cycle routes.

The Region is also implementing measures to favour the dissemination of digital technologies in the territory. Launched in 2005, the policy to promote an information society for the development of Rhône-Alpes (SIDERHAL - *Société de l'Information pour le Développement de Rhône-Alpes*), is an important step towards the realisation of an 'information society' and is organised around three axes:

- providing services to the inhabitants, businesses, communities and partners of Rhône-Alpes;
- developing a regional programme for ensuring 'reasonably fast' connectivity;
- supporting innovation.

#### • **Agriculture, forestry and sustainable land use**

The territorial policies of the Rhône-Alpes Region concern urban planning, housing, the natural environment and sustainable planning and territorial development, including sustainable agricultural and forest management practices.

According to its contractual policy based on 'Contracts for the Sustainable Development of Rhone-Alps' (CDDRA – *Contrats de développement durable de Rhône-Alps*), the Region has made a commitment to help local stakeholders adopt local Climate Plans concerning climate and energy matters. To this end, it has called upon the Regional Observatory of Energy and Greenhouse Gases to make use of available statistics to obtain standardised profiles of greenhouse gas emissions for each individual territory involved in the CDDRA and provide such profiles to the relevant stakeholders. Assisted by the regional network of energy information desks (*Points Info Energie*), the Region has also developed a toolkit to be made available to all project areas to facilitate the development and implementation of 'climate-compatible' projects and actions.

Since 2009, through a process of experimentation in 10 territories, the Region has provided support to integrate climate issues in the projects of the territories that enjoy regional support. Starting from 2011, that approach should progressively become the norm for the entire Rhône-Alpes Region.

In addition to the actions taken under the previously cited housing policy, in 2009 the Region launched the call for projects 'Sustainable Neighbourhoods in Rhone-Alps' (*Quartiers durables de Rhône-Alpes*) with the objective of identifying good practices in the field of planning. These projects must take a comprehensive approach capable of integrating a variety of issues linked to urban planning and transport, a diversified housing offer, energy efficiency and the participation of citizens. The Region intends to provide greater support to local winners, providing for the widespread dissemination of innovative practices.

The Region finances climate-related actions in regional natural parks, whose statute is recognised as 'Local Agenda 21' by the French national government.

Rhône-Alpes is endeavouring to promote the conversion of areas to uses that are better adapted to the expected effects of climate change. In particular, it has launched measures to help mid-altitude winter sports resorts find alternative sources of income, not related to snow tourism.

Within the framework of the Regional Plan for Agriculture and Rural Development, the Region supports the development of organic and local supply chains and short distribution chains for agricultural and forest products (subsidies to the local timber industry).

In addition, the 'Regional Plan for the Quality of Life in Upper Secondary Schools' (*Plan régional de la qualité de vie lycéenne*) aims to reduce the impact of catering on greenhouse gas emissions. Therefore, the Region supports the introduction of local products and the increased use of organic foods in 40 schools. It has also launched the development of a tool to measure greenhouse gas emissions produced by catering activities and intended for cooks, managers, teachers and students in secondary schools. Several French regions and the ADEME have joined Rhône-Alpes in this project.

#### LINKS

- Citizen Portal of Région Rhône-Alpes (<http://www.rhonealpes.fr>)
  - Observatory of Energy and Greenhouse gases (<http://www.oreges.rhonealpes.fr/home.seam>)
  - [www.etablissement-ecoresponsable.rhonealpes.fr](http://www.etablissement-ecoresponsable.rhonealpes.fr)
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#### 4.5. CLIMATE PROTECTION AND CLIMATE CHANGE IN AUSTRIA: REGIONAL OUTLOOK, THE EXAMPLE OF SALZBURG

Gunter Sperka

Stretching over 7,154 km<sup>2</sup> and with a population of some 525,000 inhabitants, Salzburg is one of the smallest of Austria's nine Federal Länder. The regional economy is mainly driven by services (70.6% of the regional GDP) and especially by tourism (with some 24 million overnight stays a year for some 237,000 available beds).

Despite the distribution of the EU burden envisaged in the framework of the Kyoto Protocol, from 1990 to 2008 the greenhouse gas emissions increased instead of diminishing throughout Austria, and also in the region of Salzburg. Nevertheless, a slight decrease was recorded from 2005.

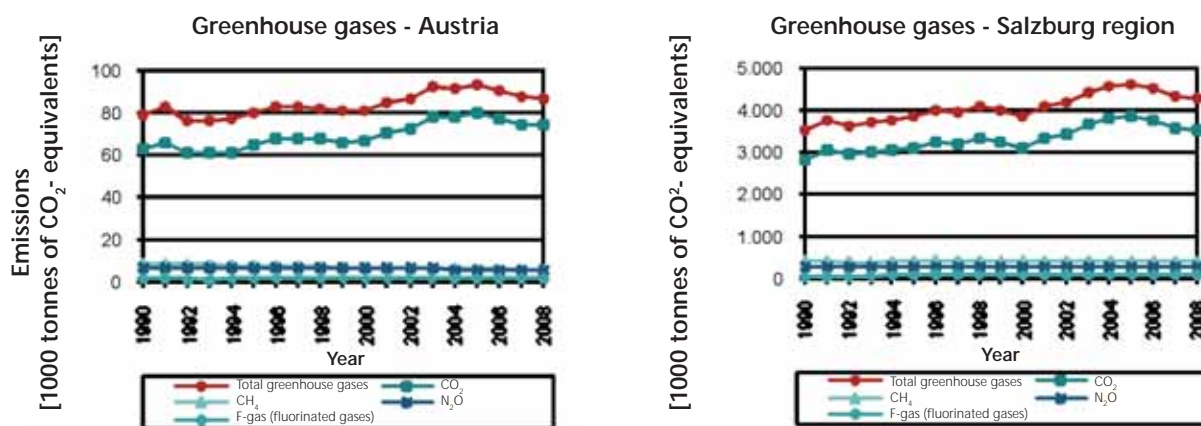


Figure 13: Greenhouse gas emission trends in Austria and in the Salzburg region  
Source: Federal Environment Agency, Vienna 2010.

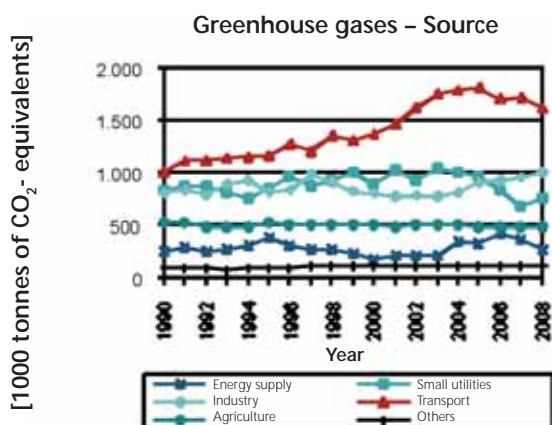


Figure 14: The largest sources of emissions in the Salzburg region are transport followed by indoor heating and hot water, and manufacturing. If we observe the breakdown by energy sources, it emerges that although there is a clear increase in the use of renewable energy, the Salzburg region continues to be strongly dependent on oil and gas  
Source: Federal Environment Agency, Vienna 2010.

Emissions are decreasing in sectors that have reacted well to regional policies, as testified in the area of indoor heating: in this field the reduction is basically associated to the better quality of insulation systems and the adoption of different types of heating systems; nevertheless, the heated residential surface area that requires heating continues to increase.

It is clear that there is still room to improve in the production of heating/hot water; what is mainly needed is the energy revamping of buildings.

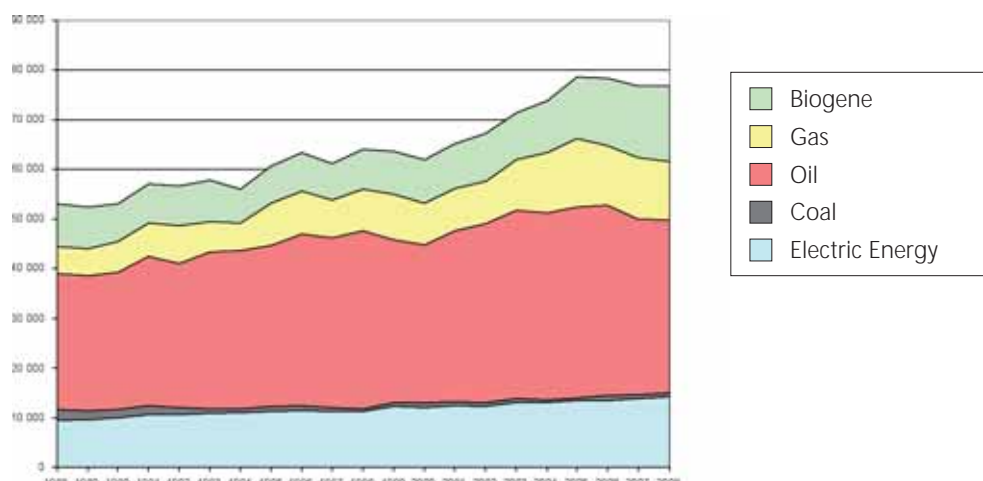


Figure 15: Percentage contribution to the energy needs of the Salzburg region broken down by energy source  
Source: Salzburg registry of energy and emissions - Salzburger Energy- und Emissionskataster, 2009

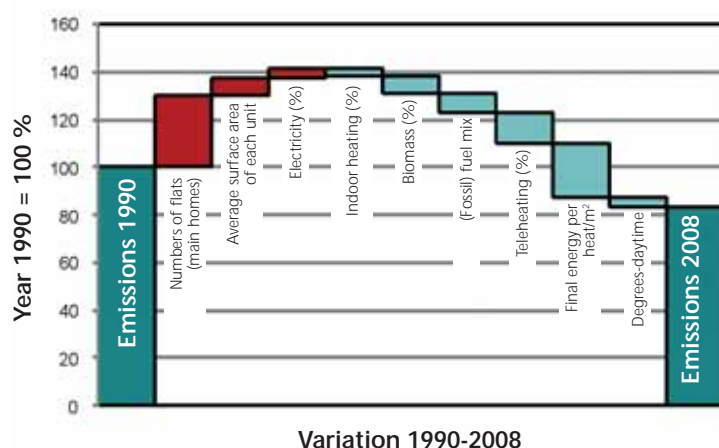


Figure 16: CO<sub>2</sub> emission for private homes – Salzburg 1990-2008

Source: Federal environment agency, Vienna 2010

Due to their geographical position, economic structure, major incidence of tourism and the significant amount of hydroelectric energy produced, some areas of the Salzburg region are especially exposed to the consequences of climate change.

The calculations based on the envisaged scenarios show that, generally speaking, precipitations in the winter months will increase while they will decrease in the summer seasons, especially in the southernmost areas of the region. The soundest outlooks for the temperatures suggest a clear increase throughout the region and in all seasons. According to the available calculation models, the temperatures are expected to increase 2-3°C over the coming 30 years.

Considering that climate change will continue even if an immediate and lasting decrease in greenhouse gases were to take place, the Salzburg Government and its dedicated technical units, such as the Unit for hydraulic management, have been investigating which measures are needed for adaptation to climate change. The problem here is that in many areas a lot of research activity will have to be conducted before concrete measures can be implemented based on sound data.

In addition to the climate issue, the central part of the Salzburg region and areas rising along the main motorways are affected by heavy traffic and this causes the levels of nitrogen oxides and particulate to exceed the thresholds. This leads to potential conflicts amongst different aims set for the environment, for example the aim of using more biomass to generate energy and others associated to air quality. Therefore, to the extent possible, amongst all the measures launched by the Land, one should identify

and implement those that best serve the purpose of achieving both the aim of protecting the climate and curbing air pollution.

Even by exploiting each available option, it is impossible to cover the entire current energy demand through the renewable energy sources available: as a result, once priorities have been defined, energy efficiency and consumption reduction must be at the forefront; at the same time, it is essential to increase the recourse to renewable energy sources. The scientific community maintains that at least an 80% reduction of greenhouse gas emissions (from fossil fuels) must be achieved by 2050. Until we are able to cover all energy needs through renewable sources it will be necessary to generate part of the needed energy also from fossil fuels. For climate protection issues, natural gas should be preferred over other sources. Nevertheless, a preliminary requirement in this scenario is the existence of an efficient supply and distribution infrastructure.

According to Austrian law, the reduction of greenhouse gas emissions and possible climate change adaptation measures are entrusted to the Federal Government and the Länder.

The strategic climate plans approved in 2002 and 2007 were not binding: Austria continues to be very far from achieving the Kyoto aims. The complex distribution of competences means that almost all the departments of the Federal Government and of the Regional Government can influence the curbing of greenhouse gas emissions, as highlighted in a research commissioned to the Austrian Agency for Energy by the Länder.

Possible measures		
Field	Range of influence	
	Bund	Länder
Indoor heating and small utilities: domestic consumption, public and private services	37%	63%
Indoor heating and small utilities: machinery for agriculture and forestry	80%	20%
Energy generation	97%	3%
Waste management and other	90%	10%
Transport	91%	9%
Industry and manufacturing (F-gas excluded)	95%	5%
F-gas (fluorinated greenhouse gases)	90%	10%
Agriculture	80%	20%
<b>Total</b>	<b>85%</b>	<b>15%</b>

Table 4: Possible measures

Source: Austrian Energy Agency 2009

As to the laws on the reduction of greenhouse gases, in June 2010 a draft agreement was signed between the Federal Government and the Länder to pass a Federal law on climate protection defining the procedures for implementing environmental protection measures from 2013 onwards. The concrete measures, possible allocations, monitoring and rules applicable if emissions exceed the maximum allowed thresholds will be defined in separate and specific agreements between the Federal Government and the Länder.

As to the measures for the adaptation to climate change, Länder and the Federal Government are working very closely to define an Austrian adaptation strategy that will include all the regional programmes. Further information is available on the strategy's homepage ([www.klimawandelanpassung.at/](http://www.klimawandelanpassung.at/)).



For the time being, the Salzburg region is testing and implementing a range of different innovative approaches for the protection of the climate. They include:

- Land planning tools (field-based technical plan for the development of settlements - "*Sachprogramm Siedlungsentwicklung*") to concentrate traffic flows (studies on this issue prove that this can drastically curb the emissions generated by road transport);
  - The guided enhancement of renewable energy sources (in this case solid biomass and hydroelectric energy have proven to provide the best potential);
  - New legal rules for the construction of residential homes (CO<sub>2</sub> thresholds for buildings "*CO<sub>2</sub> – Grenzwert für Gebäude*") to further reduce the greenhouse gas emissions and improve energy efficiency; the regulation on this item will enter into force on 1.1.2011;
  - Special financing for energy efficient home renovations (interest free credit for total energy retrofit);
  - A new incentive programme where the reduction of emissions is translated into money and 'purchased' in bulk while works are ongoing ('*Klima- und Luftreinhaltetpakt*'- Climate and Clean Air Pact ); the aim is to (further) promote measures aimed at improving energy efficiency in firms and the transition from fossil fuels to district heating in metropolitan areas (this would contribute to the reduction of (traditional) emissions into the air and develop alternative drive concepts for private vehicles and buses);
  - Awareness raising initiatives, for example on the ecological footprint (amongst others, see: [www.salzburg.gv.at/themen/nuw/umwelt/nachhaltigkeit/fussabdruck.htm](http://www.salzburg.gv.at/themen/nuw/umwelt/nachhaltigkeit/fussabdruck.htm)).
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## 4.6. THE CANTON OF ST. GALLEN'S ENERGY CONCEPT

Thomas Brunner

### The '2000-watt society' as a long-term goal

Over the last 20 years, energy consumption in the Canton of St. Gallen has steadily increased and has concerned fuels and electricity alike. CO<sub>2</sub> emissions have grown together with energy consumption, and in spite of the Canton's internationally agreed commitment to reduce them, emissions rose by about 9% between 1990 and 2005.

Our success in reducing energy consumption and CO<sub>2</sub> emissions by 2020 will greatly depend on how we shape our energy and climate policies today. There is considerable room for improvement in terms of energy efficiency and the use of renewable energy.

### The history of the energy concept

Following cancellation of the cantonal programme of energy incentives due to budgetary cuts in 2004, the Cantonal Council (*Kantonrat*) changed its strategy and called on the Government to react proactively to the challenges posed by climate change, energy shortages and the increase in energy prices. The Government's initial response was an energy development programme which started on 1<sup>st</sup> January 2008.

During the session of February 2008, the Cantonal Council approved the Report '*Energiekonzept Kanton St. Gallen*' (Canton of St. Gallen's energy concept) and ratified the initiative called '*Für eine Energiepolitik mit Weitsicht*' (For a far-sighted energy policy). Both documents focus on encouraging production and use of renewable energy and increasing energy efficiency in buildings.

The energy concept is based on the long-term vision of a '2000-watt society'. The initial target is to cut the cantonal fossil fuel consumption by 15% by the year 2020, compared to 2005 levels. Within the same period of time, electricity consumption can be increased by a maximum of 5%. The cantonal government intends to meet these targets through measures in five key sectors:

1. Energy efficiency and renewable energy in buildings: comprehensive low energy refurbishment projects, thermal insulation, use of solar energy, wood and ambient heat;
2. Production of renewable energy: development of projects and promotion of renewable energy production not related to buildings, coordinated energy use at the cantonal and municipal level;
3. Improved power efficiency: more efficient use of electricity in industry, households and trade;
4. Good examples set by the public sector: in buildings and plants under its jurisdiction, the Canton will set a good example in terms of energy efficiency and renewable energy;
5. Information, advice and education: competent technicians and a network of energy policy actors will provide information, advice and training and create state of the art solutions.

At the same time, the people's initiative '*Für eine Energiepolitik mit Weitsicht*' was approved, whose objective for the Canton of St. Gallen is to double the production of energy from renewable sources - such as wood, biomass, biogas, sun, wind and geothermal energy - by the year 2020. In its report the Government stated that this initiative can be implemented in the framework of the Canton's energy concept. Overall, the Government has proposed 32 measures, including both voluntary schemes and incentives - such as support measures - and binding requirements.

## Measures cost money, but boost investments

The measures proposed have positive repercussions on the cantonal economy: instead of purchasing fossil fuels abroad, regional resources are used, which means that value creation occurs mostly within the region. Using more renewable energy will reduce dependence on foreign sources, hence the energy supply will become more secure and energy prices more stable. For example, five million francs of incentives could trigger investments of about 25 million francs, with positive effects on employment that can be quantified in 130 – 160 man-years.

Initiatives at municipal and regional level are also important. For instance, the association '*Energietaal Toggenburg*' (Energy Valley Toggenburg) intends to achieve energy self-sufficiency for the region within 25 years by supporting energy efficiency and production. Another example is the 'Energy Concept 2050' of St. Gallen's cantonal capital: heavily focused on heating at first, it has then taken on board the themes of electricity and transport. Moreover, after accurate assessment of the geo-seismic characteristics of the area, a project is expected to be launched to exploit hot water from deep water tables for the purpose of supplying geothermal district heating to large areas of the city.

The cantonal Government is convinced that a successful energy policy can be implemented only in cooperation with the Confederation, Municipalities, companies, industry and all of the stakeholders involved. As a first step, additional staff has been recruited for the technical info-point for energy, so as to ensure a rapid implementation of all measures. Over the mid term, the responsibility for implementing selected measures and the associated human resources will be transferred to a new organisation that does not yet exist.

## The 2000-watt society as a long-term goal

The Canton of St. Gallen's energy concept is based on the vision of a 2000-watt society – namely a society which – without lowering its standard of living – consumes significantly less energy.

Considering the world average, a person consumes 17.500 kWh of energy per year (i.e. about 1.750 litres of oil, or 17.500 km travelled by car). This corresponds to continuous power of 2.000 watts (equivalent, for example, to 20 always-lit 100-watt incandescent light bulbs). On the average, in Switzerland every individual consumes three times as much, or 6.000 watts. Under the '2000 watt society' vision, the Canton of St. Gallen has set a goal of reducing its per capita energy consumption to the current world average by 2080 – 2100. This is possible, on one hand, by improving the energy efficiency of buildings, appliances and vehicles and, on the other, by developing new technologies.

The 2000-watt society model is now well known throughout the world and both the Swiss Confederation and several Cantons have included it as a long-term goal in their energy concepts.

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#### 4.7. SOUTH TYROL IS GEARING UP TO BECOME A TRUE 'KLIMALAND': THE 2050 SOUTH TYROL ENERGY STRATEGY FOR CLIMATE PROTECTION

*Michl Laimer*

##### **Introduction**

The international financial crisis, with all its repercussions on South Tyrol, is still one of the main issues. The concerns on the impact of the crisis on the region's economy are deep-seated and it will take time before these can be overcome. In difficult economic times like these, it is not easy at all to discuss strategies on how to shape our future in a sustainable fashion going beyond the economic outlook. It is clear that issues relating to environmental protection and to an economy that makes responsible use of resources are left aside. The concepts of flexibility and liberalization are trendy even when it comes to environmental management. In light of these fears, the provincial authorities are being increasingly called upon to do what is necessary to weather the storm.

All too easily people forget that the cost of environmental destruction must be repaid with interest and compound interest in the future.

##### **The need for a strategy**

A Chinese saying goes: «He who travels on sunny days will never reach his destination». One might even add that knowing the direction can be useful. Sustainability and the ability of looking ahead to the future are essential especially in difficult times like these because they can find tangible measures in this changing context without losing sight of the objective pursued.

How can South Tyrol supply its inhabitants and economy with sustainable energy? How can the population and the economy save energy in a smart fashion? What contribution can the provincial authorities make to climate protection? How is it possible to balance the preservation of natural and local resources and economic growth? How is it possible to take advantage of the energy crisis to pursue cultural and economic renewal? The 2050 South Tyrol Energy Climate Strategy seeks to find answers to these questions.

It is essential that sustainability become the driving force of society as a whole. Sustainability is a cultural challenge. In order to act in a sustainable fashion, one needs to refer to the local context and consider all the correlations going well beyond strictly environmental issues. The aspects relating to business, regional and political economy are just as important as the interaction with the culture, history and traditions of the place and the active participation of all the stakeholders involved. In this regard, sustainability is to be understood as an ongoing process for the optimization of the Province's local development.

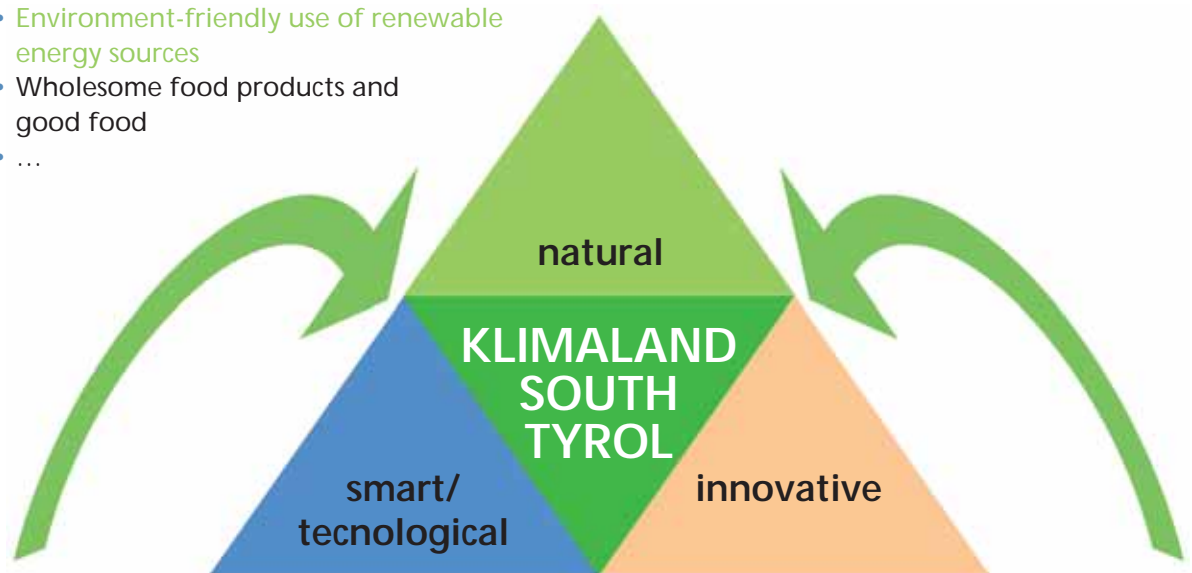
##### **South Tyrol 'KlimaLand'**

You cannot start a process to become a model region in the field of environment protection (KlimaLand) and a European region of sustainability simply because the context is favourable. You do so for a reason clearly expressed by Albert Einstein when he said: « One cannot solve a problem using the same mind that created it ».

Making South Tyrol become the hallmark of quality of life and an innovative economic driving force: this is the contribution that the 2050 South Tyrol Energy Climate Strategy wishes to give the Province. The

strategy is a *road map* that describes the course to be followed to make South Tyrol become a true 'KlimaLand', a model region for climate protection in the heart of the Alps and a region of sustainability in Europe. This aspiration goes well beyond the sustainable use of energy and climate protection (figure 17). The vision of South Tyrol as 'KlimaLand' is supported by a healthy environment and good natural resources - such as clean and healthy water, air and soil - a scenario in which pristine natural landscapes coexist with pleasant cultural landscapes where genuine, high-quality agricultural products are grown, while having respect for natural resources and biodiversity. It should be borne in mind that some of South Tyrol's landscapes and particularly the Dolomites were declared World Natural Heritage by UNESCO in 2009.

- Great biodiversity
- Pristine natural landscapes and interesting cultural landscapes
- UNESCO World Natural Heritage and nature reserves of excellence
- Clean water and air and healthy soils
- Environment-friendly use of renewable energy sources
- Wholesome food products and good food
- ...



- Smart use of energy;
- Energy-efficient buildings;
- Spatial planning that spares land and protects the climate;
- Sustainable mobility;
- Green energy;
- Modern and smart procurement networks;
- Modern technologies;
- ...

- Informed and interested inhabitants;
- Participation;
- Rooted culture of sustainability;
- Modern training;
- Performance-oriented research centres;
- Economic activities with a low environmental impact (low CO<sub>2</sub> emissions)
- Appropriate planning and authorization tools;
- ...

## 2050 SOUTH TYROL ENERGY CLIMATE STRATEGY

Figure 17: The vision of South Tyrol as 'KlimaLand' is based on a form of sustainable development in which climate protection and sustainable energy development play a key role. In green: issues addressed in the climate strategy.

The 2050 South Tyrol Energy Climate Strategy covers the part of the vision concerning the climate protection and smart use of energy and the relevant correlations with environmental resources, innovation, quality of life, building heritage, economy and culture. A climate-friendly development also depends on preserving a good quality of life in South Tyrol in the long term. The smarter South Tyrol and its inhabitants are in using energy, the less the Province will be dependent on others, the healthier the air will be, the greater respect there will be for its resources and the lesser the costs that will have to be borne. Innovation and training also have their own place in this vision.

## Current situation

Looking at the trend from 1995 to present, in South Tyrol – except for transport - energy consumption has grown by average of 2.1% a year, reaching 8,268 GWh in 2007. The peak in energy consumption in South Tyrol was reached in 2006. Since then there has been a slight downward trend.

Without considering transport, an inhabitant of South Tyrol uses on average 16,741 kWh a year (2007 figure). If transport is included, the average amount reaches 23,706 kWh per person a year. Measured in continuous power per person, it is equal to a total of 2,706 W. 'Continuous power' is understood as the quantity of energy that an inhabitant of South Tyrol constantly needs: it means that every inhabitant needs a continuous amount of energy equal to that consumed by 27 100W incandescent light bulbs. This value is relatively low at an international level.

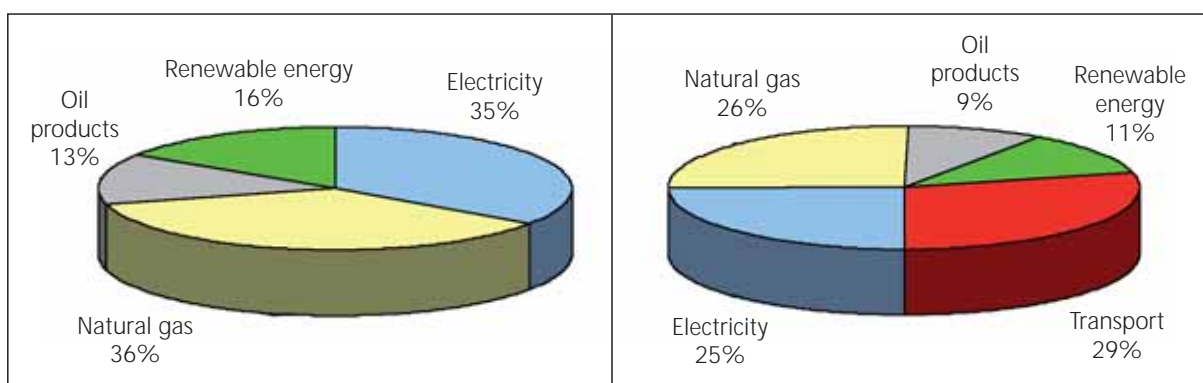


Figure 18: Energy mix in South Tyrol in 2007 (with and without transport).

Looking at the energy mix, the relatively high percentage of renewable energy is quite striking: in 2007, without considering transport, 51% (2010: 56%) of energy consumed in South Tyrol came from renewable energy sources:

- 35% from electricity (mainly from local hydropower facilities)
- 14% from biomass
- 2% from other renewable energy sources.

The high percentage of energy from renewable sources is also the result of the long-standing policy of incentives that provincial authorities have pursued. Over the past 25 years about 500 million euro have been allocated to promote energy-saving measures and the use of renewable energy.

In the transport sector the energy demand is still widely covered by fossil fuels, which at present cannot be entirely replaced or substantially reduced due to the lack of alternative products (Fig. 18).

## 2050 South Tyrol Energy Climate Strategy

South Tyrol aims to become the promoter of climate protection and a sustainable energy policy is a key prerequisite in this regard. The Province is poised to play an even more assertive role, even internationally, as a guiding force in the field of climate protection and energy policies (favourable context, autonomous powers, characteristics of the economic fabric, etc.).

2050 South Tyrol Energy is divided into various phases and steps. Intermediate objectives have been set for 2020. Another milestone has been set for 2035 (if necessary, 2030). Every five years new knowledge gained from technological innovations or changes in the framework conditions will be duly translated into measures (Fig. 19).



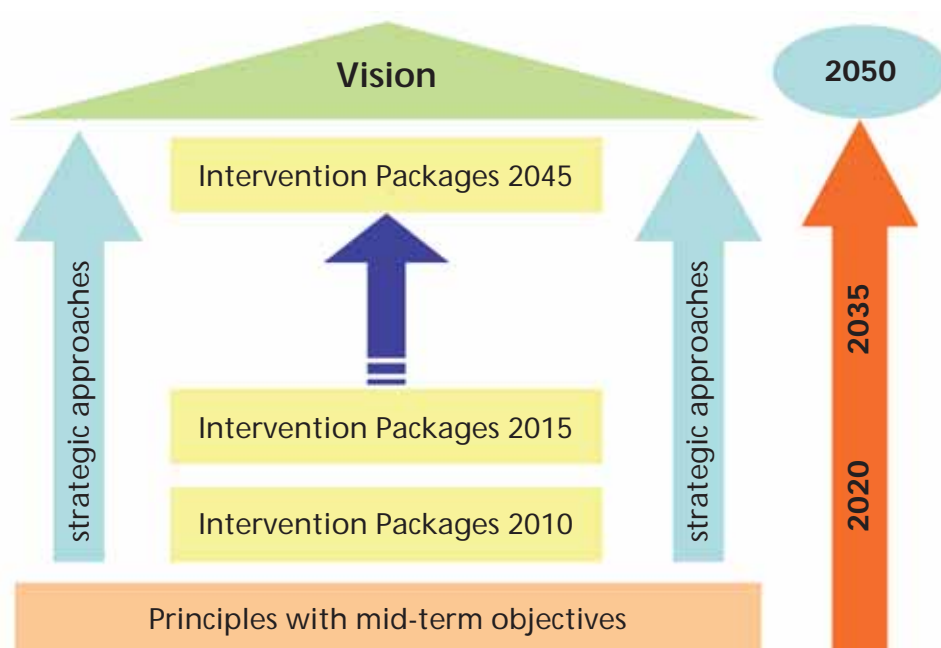


Fig. 19: 2050 South Tyrol Energy Climate Strategy takes its inspiration from a future-oriented vision and intermediate principles and objectives and is based on interventions to be integrated and expanded on a periodic basis

The strategy is characterized by:

- long-term quantitative objectives;
- principles to define basic conditions;
- step-by-step approach;
- ongoing and systematic fine-tuning;
- leading players and coordination functions;
- implementation based on strategic intervention axes;
- partnership between society, economic players, stakeholders, authorities and political decision-makers.

The reorganization of the energy sector requires basic conditions that are:

- environmentally sustainable
- economically appropriate
- socially sustainable
- transparent and fair
- innovative.

The strategy for climate protection falls within the framework of a general set of objectives to be reached through a series of international, national and regional instruments. On the one hand, these will allow for the implementation of international obligations (Kyoto Protocol, EU 2020/20, Climate Declaration, Socioeconomic Development Program of the Province) and, on the other, make it possible to prevent or alleviate those actions that have a negative impact on other fields of life. The strategy is also a means to better use existing synergies and shape the necessary radical changes needed in the long run by implementing them in a more socially sustainable fashion.

## 2050 Vision for energy policy

The objective is that of transforming the Province of Bolzano into a 'KlimaLand', a model region for climate protection in the heart of Europe and the Alps. The Province has a key role to play in the implementation of measures to protect the climate and promote the innovations called for by said measures. There are two main priorities to be achieved by 2050: reduction of CO<sub>2</sub> emissions per inhabitant to less than 1.5 t (<1/3 of 2007 per-capita emissions – 2020 intermediate target: <4 t) and reduction in consumption measured in continuous power per person to less than 2200 W per capita (2020 intermediate target: 2500 W).

Therefore, the imperative of the energy policy for South Tyrol is to save as much energy as possible, namely avoid consuming energy. This way it is possible to reduce the overall per-capita consumption and organize the development of the Province in a more energy-efficient fashion. The residual energy demand can be widely covered by renewable energy sources. The Province has set the following objectives for a sustainable energy policy:

- greater energy efficiency in all sectors
- reduction of dependency on fossil fuels
- reduction of CO<sub>2</sub> emissions
- renovations required to implement economic and technological innovations
- promotion and consolidation of the culture of sustainability.

All of the objectives need to be considered as a whole. It is not enough to pursue the cutting of CO<sub>2</sub> emissions without taking advantage of technological advances to consume less energy.

## CHARACTERISTICS OF THE 2050 SOUTH TYROL ENERGY CLIMATE STRATEGY

### Improving energy efficiency through existing opportunities of energy saving

The provincial authorities promote measures to progressively reduce per-capita energy consumption. Without considering the so-called 'grey energy' - namely the total amount of energy used during a product's entire life cycle - by 2020 the annual energy consumption in South Tyrol, measured in continuous power per person, will drop to below 2,500 W, and, by no later than 2050, to 2,200 W.

### South Tyrol is doing its share in climate protection

By 2020 South Tyrol will reduce the per-capita annual emissions of CO<sub>2</sub> from today's 5.5 tons to less than 4 tons and by no later than 2050 to below 1.5 tons per person/year.

### Adequate energy supply while showing respect for eco-social aspects

The Province provides for an adequate supply of energy to families and businesses at a fair price.

### Reducing the use of fossil fuels while promoting renewable energy sources available at a regional level

South Tyrol covers its energy demand by resorting increasingly less to fossil energy sources. Without considering motor vehicles, by 2020 at least 75% of the energy needed will be covered by renewable energy sources and by 2050 the percentage will exceed 90%.

**Modern, environment-friendly infrastructures for the generation and distribution of energy**

Through direct action or by setting specific requirements, the Province ensures that the generation and distribution of energy are carried out at the state of the art in an extremely effective manner and in compliance with environmental regulations.

**Partnerships and networking as a foundation for a new culture of sustainability**

Platforms are being established to promote cooperation among the Province, Municipalities, schools and businesses. The objective is to consolidate initiatives aimed to favour efficient energy use and cut CO<sub>2</sub> emissions.

**Cross-border and international cooperation**

South Tyrol actively participates in international, national and interregional programs and promotes innovation together with its neighbours.

**Greater transfer of know-how and more research in the climate protection and energy sectors**

South Tyrol promotes research and the transfer of know-how in energy efficiency, of new energy technologies and of smart energy design practices. An energy agency (South Tyrol Agency for Energy) will be set up for the purpose. It will be the 'control centre' for the implementation of the 2050 South Tyrol Energy Strategy.

**Intersectoral work has a tremendous innovation potential**

Coordinated intersectoral interventions are carried out at an administrative level.

**Who is the strategy addressed to?**

The strategy has been designed for all of the Province's inhabitants. It is addressed to:

- those who wish to actively participate in shaping the future of the Province;
- economic operators who believe that innovations over the next 40 years will allow for environment-friendlier production processes with lower CO<sub>2</sub> emissions and that said technologies also have economic advantages;
- workers who are concerned about the future framework conditions for the education of their children;
- parents and teachers who believe that sustainability is also a cultural task;
- students and pupils who wish to be a part of the solution;
- senior citizens who are seeking new tasks and wish to participate in this process;
- homeowners who wish to renovate their homes to improve living comfort and the quality of life at home;
- Provincial and Municipal decision-makers who are willing to take on the responsibility of advancing the sustainable development of the provincial and municipal area falling under their competence;

**Application**

In order to achieve these objectives the Province has several instructions and options for intervention:

- economic instruments;
  - policies and regulations;
  - education, awareness-raising and information strategies;
  - the Province's clout in the market;
  - promotion of targeted research.
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The single measures fall within a series of 'strategic intervention axes':

- procurement and smart management of energy;
- rational and smart use of energy;
- renovation and construction of buildings;
- sparing use of renewable energy sources;
- general prevention measures for climate protection;
- participation, innovation and transfer of *know-how*.

The interventions comprise initiatives aimed to promote the energy renovation of existing buildings, a progressive tightening of criteria for the construction of new buildings, incentives for the generation of renewable energy, technological upgrading of distribution infrastructures (*Smart Grids*), a wide array of ideas for spatial planning that takes into account energy consumption needs, widespread public relations initiatives and strategies for the active participation of the population and entrepreneurs, and many research projects.

## Conclusion

KlimaLand describes the vision of a sustainable and vital future in South Tyrol. It must be the expression of the local culture, of the local potential for innovation, the local spirit of enterprise and the innate pioneering spirit of the local population. The 2050 South Tyrol Energy Climate Strategy charts out the course - which is both viable and ambitious - to be followed up to 2050 and suggests how to address the challenges that characterize it. The Strategy shows how the Province can make a contribution to climate protection at an international level and describes how a sustainable energy future can be implemented in South Tyrol to the benefit of innovations in the social, economic and administrative sectors. It is a course marked by responsibility and respect and the expression of a culture fully lived out.

#### 4.8. CLIMATE CHANGE AND TRENTO: ONGOING WORK AND FUTURE OPPORTUNITIES

*Roberto Barbiero*

The issue of climate change made its powerful entrance into political agendas only in recent years and has now started to receive consistent attention also from the media. The major thrust to its emergence came from the publication in 2007 of the fourth report of the Intergovernmental Panel on Climate Change (IPCC) that stressed that the climate is unequivocally warming both globally and in the Alps. It also provided scientific confirmation that the increase in greenhouse gases generated by human activities is responsible for most of the global warming issues observed in the last 50 years.

Generally speaking, the issue is especially felt by the public opinion and by the population at large on what could be called an 'emotional' level. Nevertheless, it is easy to expect that the growing attention towards this issue will require the enhancement of individual scientific knowledge and of collective awareness of the issue - especially amongst local institutions - of its implications and possible solutions. The issue of climate change requires public administrations to carry out assessments on the planned adaptation and mitigation actions needed to face its current and expected impacts. In spring 2007, the Autonomous Province of Trento launched the '*Progetto Clima*' initiative. To start, six focus groups were established: one in charge of the scientific assessment and monitoring of main physical variables associated to climate change; another dedicated to issues of perception, information and communication; the others focused on current and expected impacts on areas considered to be strategic for Trentino, including the management of water resources, tourism, energy, environment, health and ecosystems.

Each focus group had the following aims: identify measures to reduce the impact of climate change and pinpoint means to promote adaptation to those same changes, trying to grasp any emerging opportunities; increase awareness in the local community on the effects of climate change and facilitate cultural change to promote lifestyles that reduce consumption and the waste of energy; contribute concretely to reducing greenhouse gas emissions, despite awareness that, due to its size, the impact of Trentino on the overall global situation will be negligible.

The outcomes of these activities are described in the publication 'Forecasts and consequences of climate change in Trentino' (*Previsioni e conseguenze dei cambiamenti climatici in Trentino*)[1], which has provided an overview of the initiative's results and supplied an indication of the reasonable outlook for Trentino, while also providing concrete suggestions for the future.

This publication is doubly important. On the one hand, it bears witness to the commitment shown by the Provincial Administration in facing the issue of climate change. It is also fully in line with the attention for ecological and environmental issues that the province of Trento has cultivated over the years, aware that its environmental heritage is its major and fundamental resource and also that man and environment are necessarily bound together: if one suffers, so does the other. On the other hand, this publication sets an important precedent in terms of methodology and approach to this issue: indeed it is a fully interdisciplinary study, which benefited of the collaboration of various offices of the provincial administration (departments, services and sections reporting to the different administrative offices) in addition to some of the main 'scientific players' located in the area. Finally, the report constituted a nicely organised contribution to building information: it promoted the dissemination of more in-depth knowledge on events associated to climate change amongst the population, especially as regards data assessment and interpretation. It also tried to promote the adoption of 'virtuous' behaviours, convinced that while the decisions taken by public authorities are important, the sum of the behaviours of individual citizens are equally essential to contrast climate change, particularly to reduce greenhouse

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gas emissions and cut waste, especially in the energy field. Of course, this report that was published in 2008 is only a starting point for future action.

The data collected and their scientific assessment is part of an ongoing process that has confirmed that Trentino is affected by global warming. Looking at the historical series from stations that have been detecting data for the last century, one can learn that in Trentino the average yearly temperatures have increased by some 0.6°C. It also confirmed that most of the increase in temperature took place over the last 20-30 years, with a growth rate exceeding that recorded in the last century. In addition, just like the whole Alpine stretch, Trentino is witnessing the reduction of the surface area covered by glaciers: in just over ten years, the glaciers have shrunk by almost 25% and shrinkage is estimated to exceed 50% by 2025 if the current pace continues.

The Alpine environment thus emerges as being extremely vulnerable to climate change. Warming and the expected variation of precipitation trends do and will trigger major physical changes (the reduction of the surface area covered by glaciers, the variation of water flows, longer droughts, permafrost variations, etc...) that will have an impact - which is partly already ongoing - on ecosystems and human health, with major consequences on some social and economic sectors such as tourism and agriculture.

These considerations are supported by scientific data and encouraged the Provincial Administration to plan suitable methods to promote adaptation to climate change, attempting to minimise the negative effects on the environment and on human health and to enhance potentially favourable changes. At the same time it tried to identify the actions needed to concretely contribute to reducing climate-changing emissions. Within this context, a major step forward was provided by the Provincial Energy and Environment Plan (*Piano energetico-ambientale provinciale*)[2] that was launched in 2003: this legal tool sets the aims for the reduction of carbon dioxide emissions, identifying the strategies that best suit the real needs of Trentino. The Plan was supported by an assessment of the aims reached by the end of 2008 (*Verifica degli obiettivi raggiunti al 31.12.2008 ed aggiornamento*)[3] that provides an overview of the province's energy balance and the status of initiatives for the promotion of energy efficiency and renewable sources.

Overall, the assessment showed the success of the initiative, as testified by the fact that the number of energy saving and efficiency initiatives that benefited of a financial contribution from the province matched the expectations set out in the plan. The amount of energy saved through these initiatives, for the 2000-2008 period, amounted to 73,000 TOE (tonnes of oil equivalent) and in fact exceeds the expected 62,000 toe (the planned aim for 2000-2012 is 90,000 toe).

As to energy consumption, domestic use emerges as the most energy consuming sector, followed by transport which ranks first for carbon dioxide emissions. 17% of consumption is accounted for by electricity, which is entirely catered for by power produced in the province which exceeds local needs by 30% (data for the hydrologically favourable year 2008). Nevertheless, the new standard values for the minimum vital flow of water courses will decrease energy production, meaning that in the future the province will record an energy deficit also in the field of electricity. 88% of electric power is generated from renewable sources (119 main hydroelectric plants, 3 thermoelectric biomass based and 1200 photovoltaic plants linked to the grid). The remaining 83% of consumption is accounted for by heating and energy for transport, of which 7% is generated by renewable and 76% by fossil sources. As to solar energy, Trentino has more than 13,000 solar energy collectors and more than 1,500 photovoltaic plants. Excluding transport, 31% of the energy consumed in Trentino is generated from renewable sources.



Currently, the overall consumption of energy in this province is decreasing, and so is the amount of emitted CO<sub>2</sub>, although levels still exceed the amounts recorded in 1990. This implies that additional and environmentally acceptable actions need to be implemented to take into account the technological and legal novelties that have emerged in the meantime. The aim is to enhance energy saving and a more widespread use of renewable energy sources, especially for domestic use and in transport, which are the main sectors for consumption and emissions alike.

To suitably address and govern the range of available actions, the Autonomous Province of Trento passed a dedicated law (Provincial Law no. 5 of 9 March 2010) on climate protection, and established a dedicated Fund for climate change. This strategy provides Trentino with an all-encompassing tool to face the issue of climate change, by adopting appropriate adaptation and mitigation tools within its planning and programming strategies for the province, including both general and specific measures, consistent with the aims set nationally and by the European Union. To implement the principles set out in this law and provide a blueprint for each of its different areas of implementation and priorities, a process was recently launched to establish two new bodies: a 'Provincial coordination and action platform on climate change' (*Tavolo provinciale di coordinamento e di azione sui cambiamenti climatici*) which includes the provincial bodies and agencies involved in these issues, and a 'Provincial climate observatory' (*Osservatorio Trentino sul clima*) which will coordinate technical and scientific aspects of activities performed by the most important institutions of Trentino committed to research and monitoring climate variables, the dissemination of scientific information and the organisation of environmental information and education campaigns.

These actions are expected to promote an organic and all-encompassing approach and will result in a number of shared initiatives for the coming future. They will enable the stakeholders to be more strict and responsible in their work on climate change issues instead of limiting their involvement to an expression of their concern for these events. This approach will also encourage a more in-depth study of particularly sensitive issues which require the scientific players to be more synergically committed and coordinated. In particular, cooperation must be reinforced amongst the community of Alpine states and regions, as available and fresh data and information is a sound foundation for any thorough decision made by administrators, and also of any reasonable choice made by citizens.

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#### 4.9. VORARLBERG'S ENERGY FUTURE – THE PATH TO ENERGY SELF-SUFFICIENCY

*Adolf Gross*

On 8<sup>th</sup> July 2009 the Regional Council of Vorarlberg unanimously decided that the long-term objective of the regional energy policy should be energy self-sufficiency based on renewable sources.

The results of the 'Vision' process that led to setting the agenda for Vorarlberg's energy future (*Energie-zukunft Vorarlberg*) provide a foundation for the path towards energy self-sufficiency. Since December 2007, 90 experts have been working on a voluntary basis, in 10 workshops, to identify how a sustainable energy system hinging on renewable energy sources can be put in place by 2050.

By the fall of 2010, the four working groups, which deal with industry, construction, transport and spatial planning and renewable energy sources will identify concrete measures to be implemented between now and 2020. Representatives from business, politics, administration and civil society will then evaluate the applicability of those measures in the light of the information gathered while developing the programme.

##### **The 'Vision' as a central element**

The 'Vision' of a self-sufficient Vorarlberg in the field of energy is based on the following:

- farsighted policies in compliance with sustainability principles;
- intelligent and efficient energy systems for production and consumption;
- sustainable structures for a high quality of life;
- energy in education and innovation;
- symbols and values for a sustainable lifestyle;
- the creation of regional added value and competitive advantage.

Each workshop has produced value-based statements that substantiate these key ideas. Starting from this 'vision' of Vorarlberg moving towards energy self-sufficiency through sustainable supply, over 300 recommendations for action addressed to various actors have been drafted, and 'measurable' steps have been identified to achieve energy autonomy. To that end, only the technologies available today and most likely capable of transforming the ecological, social and economic dimensions of the current energy system by 2050 have been taken into account. Ultimately it is a question of progressively putting an end to our current dependency on fossil fuels, which is far from easy. The objective of energy self-sufficiency requires an energy system capable of satisfying the needs of citizens by using the energy sources available in the region.

##### **The objective is energy self-sufficiency**

Currently, Vorarlberg consumes some 9.500 GWh per year – almost 30 percent of which come from renewable energy sources such as wood, water or solar energy. On the way towards energy self-sufficiency, the Regional Council experts believe that renewable energy production can be increased by 50% by 2050, that is by about 1.500 GWh.

However, the mere replacement of fossil fuels will not secure energy self-sufficiency. It will be necessary also to improve energy efficiency in buildings, mobility infrastructures and industry in order to progressively reduce energy consumption, without sacrificing comfort.

## Wide use of known high-efficiency technologies

Experts involved in the workshops and regional council members are convinced that energy consumption could be reduced by about 70 percent, or 6,350 GWh, if the use of high-efficiency technologies that are already available today becomes widespread over the next few decades.

The greatest energy saving potential lies in the building stock and in the transport sector. It appears realistic to expect a reduction in the heating demand of buildings by 75% by 2050, provided, however, that every year 3% of the housing units are renovated or demolished and rebuilt and that building envelopes meet a minimum thermal requirement of 20-25 KWh/m<sup>2</sup>. The use of energy efficient appliances, a sparing use of resources and replacement of electric heating of buildings by other forms of heating, can help cut household electricity consumption by 61%.

Similar savings are possible also in the transport sector. With the help of spatial planning authorities 'soft' mobility concepts could be introduced and electric vehicles could be used for residual private transport. In this context, efforts to repopulate and revitalize town centres play an important role, as well as those to encourage walking and cycling in the so-called 'meeting zones' (*Begegnungszonen*) - namely areas with mixed traffic intended for social activities, where the speed limit is normally 20 km per hour - and all initiatives to concentrate residential development along key transport nodes. This would reduce the energy needs of the transport sector by about 25% from current levels. Concerning electricity, the use of electric vehicles for private transport would increase electricity consumption by 15% compared to that currently produced in Vorarlberg. However, this energy could be made available by improving efficiency in the areas mentioned above.

In the field of industrial production, current energy needs could be cut by 62%, because – as a study demonstrates – the technologies already available today allow reducing industrial energy needs by 39% for power applications and by 77% for heating applications, keeping the production level unchanged. These estimates reflect the fact that currently available technologies will become cheaper over time.

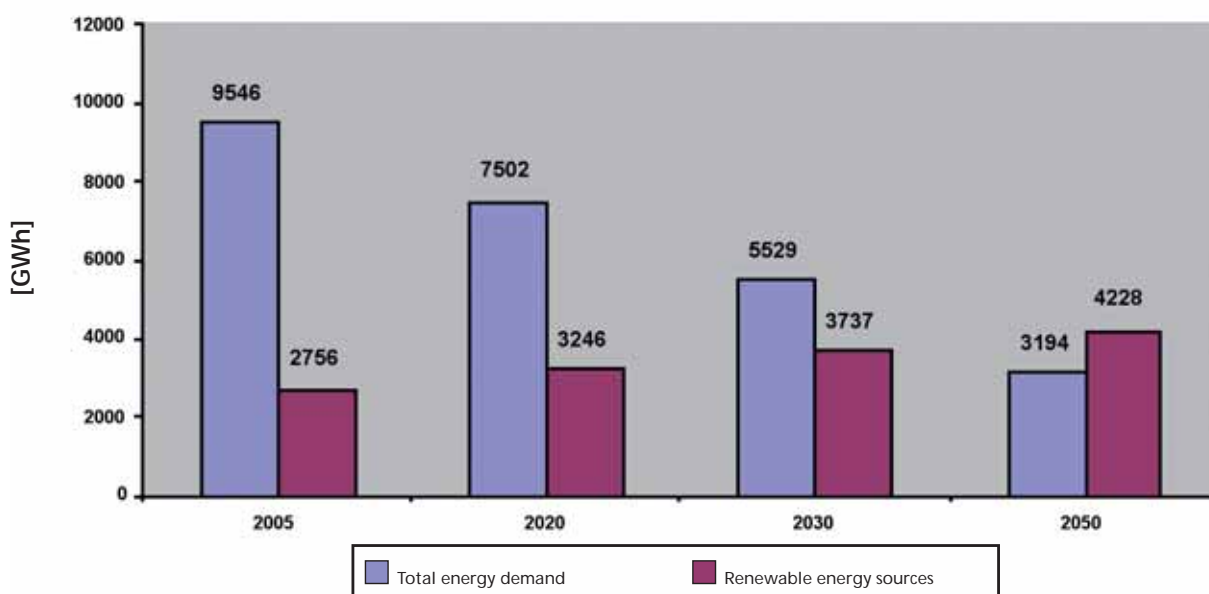


Figure 20: The results of the 'Vision' process: possible trends of energy consumption and production of renewable energy

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### Step by step towards energy self-sufficiency

In line with the concept of energy self-sufficiency, Land Vorarlberg has launched a communication campaign to raise public awareness of the principles that support a sustainable lifestyle.

Renovation works will be encouraged through financial incentives, which will be an important contribution to the local economy. The '*Vlotte*' project (use of electric vehicles for mobility) or the '*Landrad*' initiative (promotion of electrically-assisted cycles as an alternative to the car on short distances) should pave the way for sustainable mobility. Ultimately, the decision to become energy self-sufficient involves all areas of life and all of us will have to make a contribution, because even a small contribution, multiplied by many, can lead to a noticeable change. Energy self-sufficiency is within reach if we act consistently.

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## 5. THE ACTION PLAN ALIVE: ILLUSTRATION THROUGH BEST PRACTICE

The following exemplary initiatives were either presented by the contracting parties during the second seminar concerning the Action Plan by the organized Slovenian presidency in Bolzano in March 2009, or by different partners and collaborators of the Alpine Convention directly to the Permanent Secretariat during the Slovenian Presidency of the Alpine Convention (March 2009 to March 2011). They perfectly illustrate how the dispositions of the Action Plan are already materialising in the real world.

### 5.1. MAKING THE MOST OF BEST PRACTICE: MONITORING PRO-CLIMATE INITIATIVES IN THE AUSTRIAN ALPS AND MOBILE MUNICIPALITIES

The Action Plan emphasises the importance of existing initiatives and of spreading their details and positive aspects to all other interested actors in order to replicate them if possible. Spreading good ideas, new solutions and the best technologies for responding and adapting to the climate change constitutes one of the core principles of the Action Plan. However, in an equally pragmatic way, another question arises: how to distinguish the good from the bad, or the good from the best practice? This question has been addressed by the Austrian authorities. In the Austrian Alps, projects and best practice are being monitored by the Austrian Federal Environment Agency, in cooperation with the Federal Ministry of Agriculture and Forestry, Environment and Water Resources, with a view to understanding the reasons for their success and the potential or obstacles to reproducing them in further local projects. This monitoring frame has been named "Climate Action Plan". The first step, as usual, is to gather information and relevant data for each example of good practice. But the Austrian project goes deeper: the technical information will be supplemented by literature studies, interviews etc. The findings about each case have to be presented publicly with the purpose of motivating everybody and spreading the message that it is possible to adopt measures that will mitigate the consequences of climate change. So far, Austrian authorities have analysed the seven most promising regions and their pilot projects and initiatives regarding spatial planning, forestry, biodiversity, tourism, water management and mountain farming, which are also priority themes in the Action Plan adopted by the Contracting Parties of the Alpine Convention.

One of the best projects is "Gemeinden Mobil", that is "mobile municipality" in Tyrol ongoing since 2008 and now including 45 municipalities. The main aim was to decrease the amount of transit freight and passenger transport whilst promoting the image of public transport to make it "fashionable". The key was to improve the public transport system. For this purpose the regional mobility centre has been re-organised and detailed public transport schedules issued. For personal urban mobility, the project recommends cycling and use of the biking infrastructure. Such comprehensive initiative makes it a "best practice" illustrating **Objective N°5** of the Action Plan, and most concretely **Measures N°9 and n°10, 10a) or 10c)**.

Another very successful project is the project run in the ecological region of Trumer Seenland. The region has been developing principles of sustainable farming since 1996, starting with the idea and project of a few local organic farmers who are now gathered in a cooperative with more than 180 members. It has become well known mostly among tourists, for its biological farming and effective "bio-marketing" (Umweltbundesamt, 2010). This initiative, in turn, falls perfectly under **Objective N°21** of the Action Plan.



## 5.2. LIECHTENSTEIN'S AWARD FUND FOR SUSTAINABLE CONSTRUCTION AND BUILDING RENOVATION IN THE ALPS: PURSUING ENERGY EFFICIENT AND CLIMATE PROOF BUILDINGS

The Action Plan, in respect of Energy, points towards the improvement of the energy efficiency of buildings, *"by promoting rehabilitation of existing buildings and the construction of passive buildings", or by "disseminating existing techniques that reduce energy consumption (...) particularly by improving the training of mountain building professionals (training campaigns, networking...)"* (Objectives n°2, 3, 4, Measure n° 5)

The Principality of Liechtenstein has responded in a remarkable way, by deciding to promote better housing standards on energy efficiency. The **Liechtenstein's Architecture Award Fund** (for sustainable construction and building renovation in the Alps) has been created. It was first announced in spring 2010 and will be awarded every five years. The first award will go to three projects completed between 2006 and 2010 after an assessment by an international committee including an on-site examination. Given the importance of disseminating the results of the Award in order to meet other objectives of the Action Plan, such as awareness-raising and training, the winning projects will be publicly presented and details of the best 20 projects will be published in a special edition of *Hochparterre*, a specialist magazine about architectural achievements, especially in the Alps.

It is hoped that this architectural award will attract recognition in all countries of the Alps and highlight all three basic elements of sustainable development: ecological, economical and social. The use of renewable resources and energy-efficient construction is deemed to be one of the pillars of sustainable development in the Alps and an important measure for the implementation of the Action Plan on Climate Change of the Alpine Convention.

## 5.3. IMPLEMENTATION OF THE ALPINE CONVENTION IN SLOVENIA: SPREADING BEST PRACTICE

In a similar approach to the Austrian experience cited above, underlining the importance of "best practice", the implementation of the Alpine Convention in Slovenia is being monitored by CIPRA Slovenia in cooperation with Ministry of the Environment and Spatial Planning. Both organisations are studying local development projects and researching examples of good practice by public and private organisations such as municipalities, local agencies, companies, tourist agencies, alpine associations, non-governmental organisations and research institutes. Seventy six cases have been collected, each one selected as it included at least one measure of the Alpine Convention. However not all were examples of good practices. After five new criteria were introduced into the selection (raising local identity as leverage to increased tourist value; investment in economic infrastructure; sustainable energy and innovations; maintenance of cultural landscape; social learning) only 17 remained. Like in the CIPRA cc.alps project (see 5.8), a comparison has been made between the principles guiding the individual cases and the provisions of the Alpine Convention to see how many measures of the Alpine Convention the project contains. Alpine Convention provisions notwithstanding, examples of good practice are mainly the result of local initiative, innovative individuals, environmental awareness and the support of Slovenian government and European Union regional funds etc.

Landscape Park Logarska Valley was created by the Solčava municipality in 1987 in an area where development had been slow because of under investment. After 1990 increased tourist pressure

created new environmental problems. The beauty of the response to this challenge is that it was local: resident families and citizens obtained a concession from the municipality to manage the protected area and then step-by-step, created a clean and tourist-attractive area, concentrating infrastructure (such as picnic places, parking plots, etc) in the village in order to decrease pressure in the protected area, dispersing tourists over the territory. Work was also done on the internal sustainability of the project, particularly with regard to energy efficiency. Finally, Authorities support the project of a larger Regional park Kamniško Savinjske Alps. This case illustrates the objectives and measures falling under the titles “Preservation of Biodiversity” (Objectives 12 to 16 of the Action Plan) and “Tourism”. A similar development occurred in the Tuhinjska valley at Snovik spa, the highest situated spa in Slovenia. As a result, the spa has become well known for its energy-efficient buildings; lights have a “power save” mode, appliances are energy-efficient, water is heated by a highly efficient heat pump, air conditioners have converters, etc. Investment is planned for a photovoltaic power plant and a biomass heating plant.

#### 5.4. CLIMATE CHANGE RESEARCH: THE KYOTO PROJECT AND HOW TO START BUILDING REGIONAL LOW-CARBON SCENARIOS AND POLICIES

The Kyoto Project developed in Lombardy illustrates how regional initiatives may further the objectives described under Part III of the Action Plan, concerning research on climate change. It also serves the **general mitigation objective** of the Action Plan, by trying to define future trends and scenarios for the region, which in turn will be used to establish GHG emission reduction objectives. It will support future implementation of the Action Plan on Climate Change in the Alps and contribute to the shift towards a low-carbon alpine economy and society.

Detailed studies on climate variability in Lombardy have been carried out using indicators allowing for comparison with other regions and countries party to the Kyoto Protocol. The climate component of the project included meteorological data: temperature and precipitation measurements, retreat of glaciers, frequency and intensity of extreme weather events and their impact on characteristic alpine species. In addition an emission inventory has been undertaken based on the INEMAR methodology. The project also analyses GHG fluxes, sinks and stocks. Finally, the Kyoto Project has made an impact analysis of climate change on macro-areas: human health, sensitivity of different crops, increased risk of forest fires, economic losses and insurance costs. Based on all these different parts of the project, a comprehensive picture has emerged, enabling the drafting of scenarios and guidelines for Lombardy. The econometric model MARKAL-TIMES has been applied to the different scenarios to evaluate sectoral economic regional policies and their cost and benefit effects on emissions reduction targets.

These scenarios and policies aim to:

- a) Define an emission reduction objective at regional level
- b) Build-up emission trend scenarios targeted for different reduction objectives
- c) Propose direct and indirect economic policies aimed at supporting reduction objectives
- d) Evaluate technological paths and methods to achieve the objectives (focus on buildings, transport, biomass, biofuels)
- e) Propose Guidelines for Regional Mitigation Plans

### 5.5. PLAN ENERGIE CLIMAT CHAMONIX – MONT BLANC: A COMPREHENSIVE APPROACH TO SUPPORT THE IMPLEMENTATION OF THE ACTION PLAN

The Chamonix – Mont Blanc Valley forms a fragile area, due to the contrast between its exceptional natural resources and the intensity of tourism activity, with several dense cores of settlement and major traffic arteries. In this region, meteorologists have undertaken studies on climate change, glacier retreat, snow cover reliability etc., and have proved that the annual mean temperature recorded in Chamonix has risen by 1.5°C in less than a century.

Based on these facts, elected representatives have made a strong commitment for the long term, and have adopted a Territorial Climate Energy Plan (Plan Energie Climat Territorial-PECT) for the entire Valley. This initiative takes place within a larger sustainable development policy frame and benefits from the support of the French Environment and Energy Management Agency (ADEME) to mobilize all the local stakeholders and main actors. This integrated approach reflects several objectives of the Action Plan, which is built on two main tracks:

- a) The mitigation dimension of the PECT (corresponding to Part I of the Action Plan) aims to reduce GHG emissions through action on transport, energy saving and the development of renewable energy sources (Objectives N°3, 4, 5 of the Action Plan). Of central importance is the fact that this general objective is being pursued through the consistent and climate-conscious revision of the town and country planning and the urban planning documents, thus tying the objectives and measures described under the title “Spatial and Land Planning” of the Action Plan (Objective N°1 & 2). Another important part of the PECT is an energy diagnosis of public buildings, such as the French National Ski and Mountaineering School. Not only has the energy consumption and efficiency of the school's building been much improved, but the exercise will direct trainee alpine mountain guides towards more sustainable practice. Other concrete example taken under the mitigation part of the Plan have been the promotion of energy efficiency in second residency houses and for an increase in the share of renewable energy in general (hydro-electricity and timber industries and wood as heating energy). Transport is another important area of intervention: the number of trains in operation has been doubled, thus multiplying by at least three times the number of people who use them. Frequency and reliability are key factors in improving the number of public transport users.
- b) The adaptation provisions mirror Part II of the Action Plan, particularly by studying the evolution of natural risks in the Valley and creating prevention mechanisms such as the device to prevent avalanches set up at the Taconnaz Glacier (see Objective N°8, Measure n°21). Other measures include the adoption of a Local Charter of Timber Industry, as well as decisive adaptive measures in the tourism sector, thus supporting (Objectives N°10, 11 and 17).

### 5.6. THE ALPINE SPACE PROGRAMME: EU TERRITORIAL COOPERATION AND CLIMATE CHANGE

The Alpine Space Programme is the EU transnational cooperation programme for the Alps with three main priority thematic fields, all of them having great potential to contribute to research and policy development on climate change.

- The first thematic field is *Competitiveness and attractiveness* and relates to climate change because it promotes renewable energies and eco-innovation as tools and strategies to maintain the Alps as a vivid and sustainable territory.

- The second field, *Accessibility and Connectivity*, encourages reflection and new solutions on the complex issue of transport and transit traffic which particularly affects the Alps due to its mountainous terrain. Projects under this chapter analyse integrated transport planning and mobility issues, the reliability of public transport systems, as well as the assessment and monitoring of transport and traffic.
- The third priority area, *Environment and Natural Risk*, includes the objective of “coping with the effects of climate change”, closely linked to the objective concerning management and mitigation of natural hazards in the Action Plan.

An expert workshop was organized in 2010 on “Coping with Climate Change – Transnational Action in the Alps”, in order to facilitate exchanges on current activities and projects, and help create bridges between the different initiatives. All the running projects cannot be presented here, however the three introduced below illustrate what is being done and how these projects might support implementation of the Alpine Convention Action Plan on Climate Change.

The **CLISP** (Climate Change Adaptation by Spatial Planning) project seeks to demonstrate how crucial spatial planning can be as a tool for future and effective implementation of measures to mitigate climate change consequences (as in Action Plan **Objectives N°1, 2, & 8**). Fourteen partners from six Alpine countries (most of them being national and regional planning agencies) participate in CLISP. The main aim of the project is development of “climate change proof” regionally planned systems, but other important expected results are: natural hazards maps and schemes for (non)functioning ecosystems (considering climate variability).

The following two projects are extremely relevant to the objectives of the Action Plan related to water resources and water management (**Objectives N°18, 19, 20** and consequent measures).

**SILMAS**, (Sustainable Instruments for Lakes Management in the Alpine Space) with fifteen partners and four observers aims at monitoring lakes in five different Alpine countries. Alpine lakes are highly sensitive ecosystems and are thus excellent bio-indicators for monitoring climate change and its impacts. SILMAS is trying to predict future climate conditions and increase public awareness about the vulnerability of Alpine lakes. An important part of the project is gathering information and meteorological data on which to build a model able to predict possible changes in typical Alpine lakes, including changes in physical and chemical characteristics and composition of the lake’s water ecosystem.

**Alp-Water-Scarce** (Water Management Strategies against Water Scarcity in the Alps) meanwhile considers water ecosystems from the point of view of forecasts that project the Alps, in future, will experience mild or more severe periods of droughts and water scarcity. The aim is firstly to create an early warning system against water shortage. The long-term objective is to encourage authorities and stakeholders to develop integrated and sustainable water management systems, and to suggest socio-economic adaptation and mitigation strategies. The project is supported by a large number of partners, 30 observers and 28 pilot sites, all with concerns in such a strategic issue. An interesting fact emerging so far from the Alp-Water-Scarce project is that tourism is directly or indirectly connected with more than half of all water problems in the Alps.

## 5.7. RAISING THE VOICE OF CIVIL SOCIETY: THE POSITION OF THE “CLUB ARC ALPIN” ON CLIMATE CHANGE

The **Club Arc Alpin (CAA)** is an association whose founding principles are supportive of the Alpine Convention, with which it has observer status. The CAA aims at defending the common interests of

alpine clubs not only in regard to alpinism per se but also in respect of environmental protection, land planning, and alpine culture.

Climate change is already causing damage to mountain trails and other mountain infrastructure (for instance huts that were built on rock where permafrost is melting). The CCA is very aware that adaptation to climate change is expensive, yet equally urgent, in all the fields mentioned by the Action Plan (Part II). Not only is there infrastructural damage, but also mountaineers must adapt to face new risks such as increased rock fall. In 2009 the CAA General Assembly adopted a document presenting political demands regarding climate change: substantial financial measures should be adopted to cut down GHG emissions according to the polluter-pays principle; a programme for a gradual shift away from dependency on fossil fuels (promoting clean renewable energies); a reduction of emissions caused by traffic by means of more stringent legislation, speed limits on highways, improved (and supported) public transport systems. Finally, the CAA has also presented a series of suggestions concerning adaptation in mountain areas: improved control and management systems for natural hazards regarding mountain huts and trails, exchange of information throughout the Alps on the issues of integrated water management to ensure reliable supplies of water to mountain huts and on the impact of climate change on mountaineering. The CAA's continuing reflection on the adaptation of Alpinism and other leisure activities in the Alps to new climatic conditions is a good example of how associations and non-governmental organisations, in all fields of alpine life, can have their say about climate change.

This seemingly modest action by the CAA is an illustration of how civil society need not always be the receiver of public policy or information, but can itself be the promoter of changes. It also demonstrates how an association may be a crucial vehicle of public awareness: with 1.8 million affiliates (club members) over the alpine region, the CAA can make a considerable contribution to the spreading of knowledge about climate change, its consequences for the alpine way of life, including hiking, and about the text and implementation of the Action Plan. It therefore contributes to [Part III of the Action Plan](#).

## **5.8. THE CIPRA CC.ALPS PROGRAMME: NOT ONLY GOOD PRACTICE, BUT EXEMPLARY MEASURES!**

CIPRA's project cc.alps starts from the simple fact that consequences of climate change in the Alps are already visible and questions how this problem is faced. The answers are not always convincing in terms of sustainability. CIPRA illustrates this point by referring, for instance, to the fact that so far the main response by ski resorts to the rising snowline has been to produce more artificial snow (thus increasing pressure on water resources), or how glaciers have been "covered" to prevent their further melting etc... Ultimately these measures have only a very limited effect in tackling climate change. CIPRA is convinced that the society and authorities must think one step ahead, and that the measures adopted to deal with climate change must be evaluated according criteria of sustainability. This is why the programme cc.alps was launched. In its first stage, the project has been gathering and documenting activities that have already been implemented, as their impact is already visible and can be assessed scientifically. The second stage is to bring the issue to the public, raising awareness about sustainability and the incoherence of some climate change adaptation measures. In 2008, a competition was launched across the entire alpine range, in order to find out the most successful activities and projects. Each entry was scrutinized according to the principles within the protocols of the Alpine Convention. Finally 34 projects, initiatives and activities were selected as exemplary climate response measures.

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Based on CIPRA's long experience of promoting sustainable development, the cc.alps programme reinforces the core concept and philosophy of the Action Plan on Climate Change in the Alps ([Preamble](#)), mostly by promoting concrete measures and disseminating best practice, by acknowledging and rewarding those projects which constitute "exemplary climate response measures". Through this initiative CIPRA complements the work of the Permanent Secretariat regarding good practice, carried out in response to the request by the Ministers at Evian for the promotion of best practices among local authorities and decision-makers ([Final decision of Evian](#)).

### 5.9. ALPINE TOWN OF THE YEAR: LIVING UP TO COMMITMENTS TOWARDS THE ALPINE CONVENTION

Alpine municipalities and their communities are of fundamental importance for the Alpine Convention. Each year since 1997 a jury has awarded the title "Alpine Town of the Year" to the municipality whose projects and activities best serve as a model for the implementation of the Alpine Convention. The jury includes representatives from the "Alpine towns work community" ("Arbeitsgemeinschaft Alpenstädte"), CIPRA, and the "pro-Alpine life" association. The towns that have up to now enjoyed this title have joined in an association called "Alpine Towns of the Year". These towns really live up to their commitments to the Alpine Convention. Several of them are working actively in the field of climate change and demonstrate in particular how they support implementation of the Alpine Convention objectives in the fields of energy efficiency and heating ([Objectives N°3 and 4](#)).

**Villach**, Alpine Town of the Year 1997, has recently joined the Programme e5 for high energy efficiency municipalities. The e5 programme, introduced in the late 1990s currently supports 83 Austrian municipalities in their choices to improve and modernise their energy policies. Villach's efforts have earned it the «double e» («ee») rating; in recent years, the town has invested 16,5 million Euros to modernise the energy systems of residential buildings; by making decisive choices on renewable energies it has saved more than 4,5 million of petrol-equivalent litres, using among other things, heat from industrial processes in the town's heating distribution system, and cogeneration from biomass.

**Belluno**, Alpine Town of the Year 1999, has set ambitious goals to improve its own climate balance through measures that will be implemented thanks to an EU project within the framework of the "Covenant of Mayors". In the National park of Dolomiti Bellunesi an Action Plan for a sustainable energy will be realized. Up to now, more than 1.850 towns have adhered to the Covenant of Mayors, yet only two of these are alpine towns. Belluno is the third alpine town to have decided to reduce its CO<sub>2</sub> emissions by at least 20%, following similar decisions by Bozen/Bolzano, and Chambéry métropole.

**Briga-Glis**, Alpine Town of the Year 2008, is setting even higher objectives as it points towards energy self-sufficiency by 2035. Briga-Glis wants to reduce the use of fossil fuels and together with the neighboring municipality of Naters has elaborated an "Energy Model Guide". With 20.000 inhabitants, the region aims at creating a geothermic network that will completely replace petroleum. The electric company EnBAG has presented a project to build 12 micro hydro-power plants to cover electricity needs. Finally, a major contribution to CO<sub>2</sub> reduction should come from the Lonza chemical company, based in another neighboring municipality: starting in 2010, a vapor pipe originating from the waste incinerator of Briga-Glis will cover Lonza's heating requirements, completely substituting the previous use of natural gas.



## 5.10. A CONCRETE PROPOSAL FOR THE MODAL SHIFT OF HEAVY TRAFFIC: THE ALPINE CROSSING EXCHANGE

*Toni Aschwanden*

The continuous growth, over the recent years, of freight transport on road in the Alps has led to a gradual increase of pollution, noise, accidents, queues and greenhouse gas emissions. The introduction of cleaner engines alone will not solve these problems, not even if traffic volumes stop increasing. Thanks to innovative tools, such as the Alpine crossing exchange, a market economy tool to shift freight from road to rail, the Alpine region can take a leading role in climate protection, in line with the requirements of the Alpine Convention that demand the shift towards cleaner and safer modes of transport, such as transport on rail.

The Alps are a unique habitat and an extremely sensitive ecosystem. They present a very broad biodiversity which is comparable to very few other regions in the world. The springs and glaciers of the Alps supply water to most of Europe's continental areas. Nevertheless, the ecological balance of the Alps is under threat: air pollution, noise and climate change impact these areas more than flatter terrains; pollutants have less space in which they can disperse and, in addition, the Alps are characterised by frequent thermal inversion layers which trap air pollution. Noise bounces off the sides of narrow valleys and causes an echo effect. It had been forecast that the increase of temperatures in the Alps arising from climate change will be double the global average.

Increasing international freight transport flows are one of the main sources of these negative effects. The volume of freight traffic that crosses the Alps has increased threefold since 1970 and continues to grow, especially on road. The numerous transiting lorries damage the health of the local population and make the roads more dangerous. In addition to increasing global CO<sub>2</sub> emissions, there are other consequences arising from road traffic in the Alps: the long steep slopes generally cause the emission of more pollutants: the particulate then deposits on the glaciers darkening their surface and causing the glaciers to melt even faster under the sunrays. The melting of the permafrost is another direct threat for the Alps, as it can cause, amongst other events, debris flows and rockfall on the roads.

The measures currently assessed by the European transport policy makers, including the internationalisation of costs and stricter laws on emissions, are major steps that go in the right direction. However, they are not enough to solve the traffic problem in the more sensitive regions. Additional measures are needed in these areas: reduced speed limits, transit restrictions for specific types of transport or the introduction of stricter safety standards are possible solutions. However, even if policies do manage to successfully shift heavy freight traffic from road to rail - as promised by politicians in their nice speeches and urgently demanded by the population - it will still be necessary to introduce a tool that is applicable throughout the whole Alpine area: the Alpine crossing exchange. This tool merges the environmental aim of the modal shift with a principle of the market economy and could contribute to bringing heavy traffic down to a level that is acceptable for humans and nature.

### **How does the Alpine crossing exchange work?**

Once the Alpine crossing exchange has been introduced, lorries will only be allowed to cross if they own a transit permit (right). Alpine States will set a limit to the number of permitted trips. Transit

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permits will be sold in an auction and freight forwarders will be able to buy and trade them freely. The price of the electronic transit permits will be set by the market based on offer and demand: the greater the demand, the higher the price will be: it is a game that will be fully governed by the free market. A freight forwarder who considers that the cost of the license is too high, will be able to choose to transport his goods by rail. As a result, the policies set the limits but it is the market that sets the rules of the game. This is how the Alpine crossing exchange would actually work:

1. Limitations of capacity. Policy makers restrict the number of heavy lorries allowed to transit the Alps to a tolerable level. This limit can be gradually brought down from the current level to the required level to allow logistics to gradually adapt to the new circumstances.
2. Distribution. The allowed trips (transit licenses) will be divided amongst all the Alpine passes bearing in mind parameters such as the health and safety of the population.
3. Issuance. The transit permits could be distributed free of charge as a bonus for rail transport users (one transit permit every x units transported by rail) or sold to whoever places the best bid in an auction.
4. Trade. The transit permits can be either used by their owners or sold on the Alpine crossing exchange Internet platform. Booking and payments would be managed automatically. The exchange simultaneously views the price of rail transport for bidders to make the comparison.

The Alpine crossing exchange follows the pattern shown below, mimicking the license trade mechanisms that have already been implemented and tested in other fields.

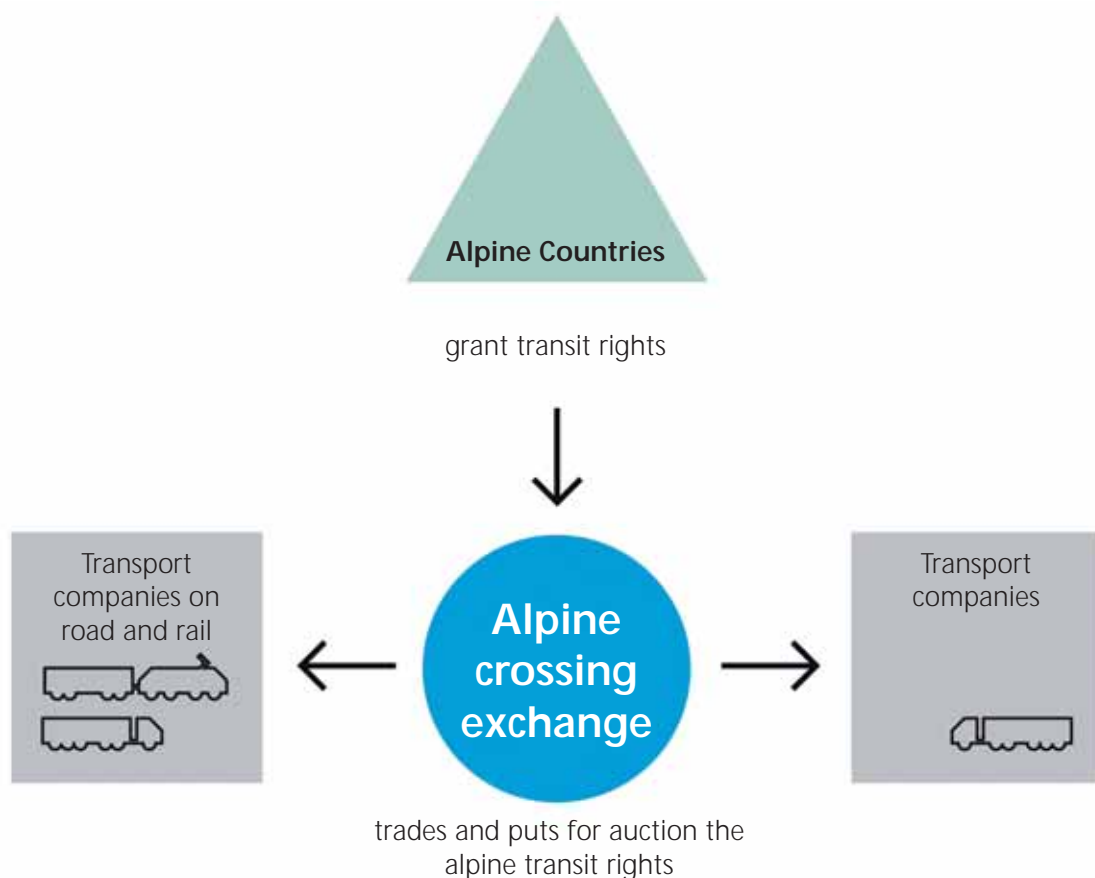


Figure 21: Overview of the Alpine crossing exchange

The Alpine states (green triangle) issue the transit permits to the ATB, the Alpine crossing exchange (blue circle), that manages or puts the permits in an auction where they can be bought by freight forwarders resorting to road or rail transport (grey squares)

There are numerous advantages to the Alpine crossing exchange: it exploits the full potential of the railways, it reduces the negative effects on the population, it cuts the queues of lorries and its associated costs, helps improve the ability of companies to plan deliveries, and improves the safety of the dangerous Alpine tracts and in tunnels. In addition, rail transport operators receive long-term incentives to invest in more silent freight trains.

### At what stage is the political process for the establishment of the Alpine crossing exchange?

The idea for an Alpine crossing exchange was presented in 2001 by the Alpine Initiative (the association that pushed for the inclusion of an article on the protection of the Alpine region from the negative effects of transit traffic in the Swiss Federal Constitution) in the aftermath of the St. Gotthard road tunnel disaster. Over the coming years, two detailed studies commissioned by the Swiss government confirmed the feasibility and the need to concretely implement this idea. In 2008, the Alpine crossing exchange was included in the new Swiss law on the transfer of freight traffic from road to rail (Traffic Transfer Law - GVVG /LTrasf). The Swiss government is now in a position to start international negotiations to agree on the Alpine crossing exchange with foreign interlocutors.

Many Alpine regions are demanding the actual establishment of the Alpine crossing exchange. In the Action Plan on Climate Change in the Alps drafted in the framework of the Alpine Convention, the Environment Ministers of the Alpine States confirmed their will to 'shift traffic towards more eco and climate-friendly means of transportation' and to 'significantly reduce CO<sub>2</sub> emissions caused by transport', quoting the crossing exchange as a possible solution. On the other hand, for years the transport ministers of Alpine countries have discussed the possible solutions for the issue of controlling freight transport on road in the context of the so-called 'Zurich Process' (*'Suivi de Zurich'*). In addition to the Alpine crossing exchange, other tools are being considered, including the implementation of a differentiated toll system (Toll +) and a crossing permit trading system linked to emissions.

The European Commission, in its mid-term review of the White Paper on Transport (2006), also contemplated the Alpine crossing exchange as a possible solution: "Fees may be modulated to take environmental impact or congestion risks into account, in particular in environmentally sensitive and urban areas. In such areas, other forms of capacity allocation could be used such as market exchanges of transit rights."

On the other hand, the affected population expects policy makers to take concrete steps towards the implementation of the Alpine crossing exchange instead of just commissioning studies and releasing declarations of intent. The studies that are already available prove that the Alpine crossing exchange could be introduced in just a few months, as long as there is the political will to do so.



Figure 22: The Alps are a sensitive area, a limited resource with limited capacity. Nevertheless, there is an enormous demand to cross this delicate area with heavy commercial vehicles. The trading of transit rights in the Alpine crossing exchange uses market tools to bring the situation back to a balance.

## Why do we need the Alpine crossing exchange?

The Alps are a unique and ecologically sensitive habitat. To avoid an even greater exposure to the negative effects of freight transport on road it is necessary to resort to tools such as the Alpine crossing exchange.

- **Traffic must be controlled to solve its capacity issues.**

Indeed, the Alps are affected by a capacity issue. The amount of traffic cannot increase indefinitely: the narrow Alpine valleys do not provide any more space to build extra lanes and motorways. We need a system to manage these limited resources. Just like the urban *road-pricing* systems introduced in large cities, the Alpine crossing exchange is a solution to curb rising transalpine freight traffic.

- **Capacity management has become a normal practice also for other transport modes.**

Why are lorries the only means of transport that can transit uncontrolled? Pilots cannot take off when they want, they have to wait for the take-off slot they have been allocated by the airport. Equally, a freight train can only use the rail line that has specifically booked; for a lorry to cross the Channel it needs a ferry ticket or a Eurotunnel ticket. Even now, the distribution of this limited capacity is governed by price mechanisms, such as the flight slot auctions in airports. The Alpine crossing exchange implements all these principles and enables the effective management of lorries crossing the Alps.

- **Rail alternatives are in place and must be exploited.**

Alpine States have an available and efficient rail network that is not exploited to its full capacity. In addition, a number of major rail tunnels are in the pipeline and are expected to be opened and available within a few years. Summarising, in the coming future there will be enough transport alternatives available for transalpine traffic and, taking into account all the transport modes, the traffic flows to Italy will not be subjected to restrictions.

- **The transport sector is one of the major so-called 'climate sinners'**

In recent years, many sectors like the industry or private households have managed to considerably cut their CO<sub>2</sub> emissions, thus managing to increase efficiency. In the transport sector, on the contrary, technical progress has been neutralised by the further increase in demand, and CO<sub>2</sub> emissions have continued to increase. However, if Alpine States and the European Union want to comply with their international obligations to reduce CO<sub>2</sub> emissions, they will have to implement specific measures targeting transport. Although the contribution provided by the Alpine crossing exchange is rather small if we consider the global scale of the problem, taking this decision in a region that is so vulnerable to climate change would have a strong symbolic impact. The central position of the Alps in Europe is expected to generate positive effects on the policies promoting the modal shift in all the rest of the continent.

- **The Alpine crossing exchange gives the Alps a central role in the field of climate protection.**

In the Alps, the effects of climate change emerge earlier and with a greater impact than in other areas of the world. Although CO<sub>2</sub> emissions are a global problem, the Alpine region must acknowledge its responsibilities and adopt exemplary steps for safeguarding the climate. The Alpine crossing exchange is a new and innovative tool in the transport sector.

- **The Alps are acknowledged as a sensitive region: as such, targeted management tools are justified**

With the Alpine Convention, the status of the Alps as a 'sensitive region' was acknowledged internationally and set within an institutional framework. This treaty for the global protection and the sustainable development of the Alps should be supported assertively and provided with a tangible meaning by Alpine States. The Alpine crossing exchange is a real example of this type of strategy.

- **The Alps as a workshop for sustainable transport policies**

Considering their vulnerability, the narrow Alpine valleys act as early indicators of traffic problems. In the past, various transport policy tools were implemented with varying success in the Alpine States, such as the prohibition to drive at night, the Swiss performance-related heavy vehicle fee (HVF/LSVA) to internalise external costs, or the transit prohibitions for specific types of transport. The Alps are an ideal workshop to test the European sustainable transport policies for the future.

## Conclusions

The Alpine crossing exchange is the perfect solution for the issue of transalpine freight transport. Although it is a market tool, the exchange does not leave the achievement of a political aim set by transport policy makers to the market forces; on the contrary, the market's task is to set the price of road transport as a fundamental means to achieve the system's final aims. The current de facto quantitative limitations linked to safety and capacity will no longer be managed by the unforecastable trend of queues: instead it will be managed indiscriminately by an intelligent system through the trading of transit permits. At the same time it will be possible to reach the political and environmental aim of achieving the modal shift from road to rail with the lowest price possible for the community.

Further information is available at: [www.alpentransitboerse.org](http://www.alpentransitboerse.org)

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[www.zuerich-prozess.org/en](http://www.zuerich-prozess.org/en)
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## CONCLUSIONS / OUTLOOK

This publication "Towards decarbonising the Alps" presents some milestones in the process of meeting the climate change challenge and determining how best to address the various problems such changed conditions will create in a mountainous region. It is meant to provide an insight of the activities taking place in the Alps in this field, and as a source of motivation and reservoir of ideas for the future.

Drawing together activities at different levels and scales and by different stakeholders, including the implementation of the Action plan on Climate Change in the Alps, the results of two thematic seminars organized by the Slovenian Presidency of the Alpine Convention in 2009 and 2010, a conference organized by Arge-Alp and the Permanent Secretariat of the Alpine Convention in 2010, national and regional strategies and programmes, initiatives and examples of good practice, some **key messages and conclusions** can be drawn as guidelines for future steps and activities:

The **Alps are an important forerunner** in mitigation and adaptation processes; several Alpine regions and local initiatives have already gone further than commitments made at international or national level;

- The **motivation** of different stakeholders for further improvements of current achievements **is very high**;
- **Mitigation and adaptation projects are not perceived as mere expenses but rather as investments**;
- A **major challenge is to accelerate the implementation** of measures and spread projects across the whole of the Alps in order to learn from each other; individual cases of good practice need to be disseminated widely to achieve sustainable development and a shared response to climate change; the Alpine regions and their networks are key actors in this process;
- **Decarbonising not only** industry agriculture, energy production and transport, **but also peoples' lifestyle** is a complex and **long-term** process, however there is a need for strong commitment to continue in this direction;
- This process requires **structural changes and adjustments in economy and society in general**; it calls for innovative approaches and changes in our understanding;
- In order to formulate both proper policy frameworks and programmes and activities for their implementation, **it is important to support research and obtain quality data on** climate change in order to prepare reliable scenarios on possible impacts;
- **Diverse forms of cooperation between contracting parties** at the levels of administration, research and projects are crucial for achieving synergies in adapting to climate change and mitigating the effects; good cooperation and coordination, strong commitment, partnership, mutual learning and understanding, working together in establishing joint policy frameworks, programmes, measures, guidelines and in implementing joint projects are all crucial elements of effective strategies;
- In light of the complexity of climate change, **the specific role of different levels and institutions** in mitigation and adaptation activities and their coordination is of utmost importance. Addressing all



relevant actors (households, schools, firms, local communities, regions) is a very suitable, integrated approach;

- An important role in implementation is played by the **regions** as several competencies related to climate change, such as energy, fall directly to them. They **are substantial contributors to innovation** and their functions, together with those of municipalities, should be further emphasised and supported; in this context greater integration between the alpine regions as well as reinforced links within the Alpine Convention bodies should be sought.
- **Spatial planning and development**, with its integrated and cross-sectoral approach and multi-level governance system, can provide a basis for implementation strategies and measures in climate protection and adaptation; sustainable spatial development can provide an integrated framework to link-up vulnerability and risk assessment to capacities and adaptation responses, thus facilitating the identification of policy options and cost-efficient strategies;
- Adaptation should go hand in hand with mitigation measures. **Spatial and urban planning can contribute to implementing mitigation measures** by providing guidelines and rules on spatial organization of activities, land-uses and infrastructure;
- **Awareness raising** is a key issue in the field of protection of the climate as well as in adapting to climate change;
- A crisis always contains the seed of its solution. Climate change offers the possibility for society to “change”, to move to cleaner productive systems, more sound products and in general a greener economy. The Alps have, in this context, **a great potential for innovation**, in particular in the energy sector but also as regards sustainable tourism and the use of local agricultural products.

And finally **the “cultural” dimension** of the response to climate change should not be forgotten, for climate change reminds us of the bond between mankind and nature which technology and globalisation have tended to obscure. This bond remains very strong in mountainous areas.

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## TAKE IT INDIVIDUALLY!

### 17 ways to decarbonise your life and help controlling climate change!

- 1 First things first: **be and stay informed!** Discover what your national government and local authority is doing about climate change, and how you can contribute to the implementation of public policy.
- 2 Calculate your carbon footprint and take the decision to reduce it, step by step.
- 3 Reduce your electricity consumption. Simple actions are important: use low-energy consuming bulbs, turn off the lights when leaving a room, switch off electronic devices when not in use; reduce the use of (sometime superfluous) electric gadgets.
- 4 Control your indoor environment: upgrade insulation of your house or company buildings, reduce the temperature of your house in winter by 1° during the day and/or 2°C during the night. For more information, check the advice of your local energy agency.
- 5 Choose renewable energy: if you cannot use renewable technology for your home, choose an energy provider that produces energy from renewable sources.
- 6 Reduce fossil fuel consumption: travel by train or carpool, whenever possible walk or cycle, including when taking children to school. Changing the tyres or controlling their pressure can also impact on how much CO<sub>2</sub> you produce when driving. Reduce your speed!
- 7 Become a carbon-conscious professional by offering or buying low-carbon products and services: life-cycle assessment for more ecological products and services is an expanding market that can be a winning strategy for your business.
- 8 Become a carbon-conscious consumer and tourist: when travelling by plane, for instance, compensate your CO<sub>2</sub>.
- 9 Buy locally-produced food and opt for seasonal fruits and vegetables.
- 10 Recycle more and buy recycled.
- 11 Think before printing and print double face.
- 12 Use re-usable bags for shopping.
- 13 Avoid products with a lot of packaging.
- 14 Whenever replacing or buying new electric domestic appliances, buy energy saving ones.
- 15 Save water, and use less hot water.
- 16 Plant a tree... or 100!
- 17 Spread the word! Communicate your actions!

## LINKS AND WEB RESOURCES

### National policies and strategies

#### Austria

[www.austroclim.at/](http://www.austroclim.at/)  
[www.accc.gv.at/anpassung1.htm](http://www.accc.gv.at/anpassung1.htm)  
[www.klimawandelanpassung.at/nationale-anpassungsstrategie/](http://www.klimawandelanpassung.at/nationale-anpassungsstrategie/)  
[www.klimawandelanpassung.at/klimawandel-in-oesterreich/](http://www.klimawandelanpassung.at/klimawandel-in-oesterreich/)  
[umwelt.lebensministerium.at/article/articleview/71847/1/7781/](http://umwelt.lebensministerium.at/article/articleview/71847/1/7781/)  
[www.umwelt.net.at/article/archive/7583](http://www.umwelt.net.at/article/archive/7583)  
[http://unfccc.int/resource/docs/natc/aut\\_nc5.pdf](http://unfccc.int/resource/docs/natc/aut_nc5.pdf)

#### France

[www.developpement-durable.gouv.fr/-Energie-et-Climat,123-.html](http://www.developpement-durable.gouv.fr/-Energie-et-Climat,123-.html)  
[www.legrenelle-environnement.fr/+ -Climat-+.html](http://www.legrenelle-environnement.fr/+ -Climat-+.html)  
[www.onerc.org/](http://www.onerc.org/)  
<http://unfccc.int/resource/docs/natc/franc5abs.pdf>

#### Germany

[www.bmu.de/english/climate/aktuell/3821.php](http://www.bmu.de/english/climate/aktuell/3821.php)  
[www.bmu.de/english/climate/downloads/doc/42841.php](http://www.bmu.de/english/climate/downloads/doc/42841.php)  
[www.bmu.de/files/pdfs/allgemein/application/pdf/das\\_zusammenfassung.pdf](http://www.bmu.de/files/pdfs/allgemein/application/pdf/das_zusammenfassung.pdf)  
[www.anpassung.net/cln\\_117/DE/Home/homepage\\_node.html?\\_nnn=true](http://www.anpassung.net/cln_117/DE/Home/homepage_node.html?_nnn=true)  
[www.umweltbundesamt.de/index-e.htm](http://www.umweltbundesamt.de/index-e.htm)  
[www.umweltbundesamt.de/klimaschutz-e/index.htm](http://www.umweltbundesamt.de/klimaschutz-e/index.htm)  
[www.wupertal.org/](http://www.wupertal.org/)  
[http://unfccc.int/resource/docs/natc/deu\\_nc5\\_resubmit.pdf](http://unfccc.int/resource/docs/natc/deu_nc5_resubmit.pdf)

#### Italy

[www.isprambiente.it/site/it-IT/](http://www.isprambiente.it/site/it-IT/)  
[www.sinanet.isprambiente.it/it/strumenti/catalogo/dettagli\\_metadati?testo=clima&document\\_type=6&metadata\\_lookup=1001&docid=2617](http://www.sinanet.isprambiente.it/it/strumenti/catalogo/dettagli_metadati?testo=clima&document_type=6&metadata_lookup=1001&docid=2617)  
[www.apat.gov.it/site/it-it/Temi/Protezione\\_dell'atmosfera\\_a\\_livello\\_globale/Cambiamenti\\_climatici/Italia\\_-\\_politiche\\_sul\\_clima/](http://www.apat.gov.it/site/it-it/Temi/Protezione_dell'atmosfera_a_livello_globale/Cambiamenti_climatici/Italia_-_politiche_sul_clima/)  
[http://unfccc.int/resource/docs/natc/ita\\_nc5.pdf](http://unfccc.int/resource/docs/natc/ita_nc5.pdf)

#### Liechtenstein

[www.climatefoundation.li](http://www.climatefoundation.li)  
[www.klimastiftung.li](http://www.klimastiftung.li)  
[www.liechtenstein.li/klimaberich05\\_fl\\_eng.pdf](http://www.liechtenstein.li/klimaberich05_fl_eng.pdf)  
[http://unfccc.int/resource/docs/natc/lie\\_nc5.pdf](http://unfccc.int/resource/docs/natc/lie_nc5.pdf)

#### Monaco

[www.gouv.mc/devwww/wwwnew.nsf/1909\\$/e0e116840439f348c1256f6d005583fffr?OpenDocument&Count=10000&InfoChap=Dossiers%20&InfoSujet=Environnement&6Fr](http://www.gouv.mc/devwww/wwwnew.nsf/1909$/e0e116840439f348c1256f6d005583fffr?OpenDocument&Count=10000&InfoChap=Dossiers%20&InfoSujet=Environnement&6Fr)  
[www.fpa2.com/](http://www.fpa2.com/)  
[www.fpa2.com/pdf/declaration\\_monaco.pdf](http://www.fpa2.com/pdf/declaration_monaco.pdf)

#### Slovenia

[www.slovenija-CO2.si/index.php/o-projektu/opis-projekta](http://www.slovenija-CO2.si/index.php/o-projektu/opis-projekta)  
[www.evropa.gov.si/si/podnebne-spremembe/boj-proti-podnebnim-spremembam/cilji-slovenije-na-podrocju-podnebnih-sprememb/](http://www.evropa.gov.si/si/podnebne-spremembe/boj-proti-podnebnim-spremembam/cilji-slovenije-na-podrocju-podnebnih-sprememb/)  
[www.ekosklad.si](http://www.ekosklad.si)  
[http://unfccc.int/resource/docs/natc/svn\\_nc5.pdf](http://unfccc.int/resource/docs/natc/svn_nc5.pdf)  
[www.svps.gov.si](http://www.svps.gov.si)

#### Switzerland

[www.bfe.admin.ch/energie/00458/index.html?lang=en](http://www.bfe.admin.ch/energie/00458/index.html?lang=en)  
[www.bfe.admin.ch/themen/00612/00613/index.html?lang=en](http://www.bfe.admin.ch/themen/00612/00613/index.html?lang=en)  
<http://klimarappen.ch/>  
[http://unfccc.int/resource/docs/natc/svn\\_nc5.pdf](http://unfccc.int/resource/docs/natc/svn_nc5.pdf)

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**Best practice**

[www.constructive.li/](http://www.constructive.li/)  
[www.gemeindenmobil.at/](http://www.gemeindenmobil.at/)  
[www.dasmondseeland.at/bio-heuregion-trumer-seenland](http://www.dasmondseeland.at/bio-heuregion-trumer-seenland)  
<http://orgprints.org/12099/1/12099.pdf>  
[http://orgprints.org/13999/1/Druckfahne\\_%C3%96k%26LB\\_End.pdf](http://orgprints.org/13999/1/Druckfahne_%C3%96k%26LB_End.pdf)  
[www.kyotolombardia.org/](http://www.kyotolombardia.org/)  
<http://world.chamonix.com/PDF/planclimat.pdf>  
[www.alpine-space.eu/](http://www.alpine-space.eu/)  
[www.silmas.eu/](http://www.silmas.eu/)  
[www.clisp.eu/](http://www.clisp.eu/)  
[www.alpwaterscarce.eu/](http://www.alpwaterscarce.eu/)  
[www.club-arc-alpin.eu/](http://www.club-arc-alpin.eu/)  
[www.cipra.org/en/cc.alps](http://www.cipra.org/en/cc.alps)  
[www.cipra.org/en/netzwerke/alpine-town-of-the-year-2](http://www.cipra.org/en/netzwerke/alpine-town-of-the-year-2)  
[www.termesnovik.si/podjetje/](http://www.termesnovik.si/podjetje/)  
[www.logarska-dolina.si/ang/index\\_a.html](http://www.logarska-dolina.si/ang/index_a.html)

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## NOTE

The highest attention and professionalism have been brought to this publication. Nevertheless, the responsibility of the content of every contribution falls exclusively on the author himself. The editors cannot be responsible of possible mistakes or errors in the information presented. Neither do the contributions reflect systematically the opinion of the editors.

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Climate change is affecting, or will affect each region of the world in different and specific ways. The vulnerability of mountain ecosystems to global warming and climate change is particularly high. Although globally the Alps may not be a major contributor to CO<sub>2</sub> emissions, it is important that the Alps, their authorities and population reduce their greenhouse gas emissions and prepare for the future impacts of a changing climate.

[www.alpconv.org](http://www.alpconv.org)

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