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GREENING THE ECONOMY IN THE ALPINE REGION

Report on the state of the Alps

ALPINE CONVENTION
Alpine Signals – Special Edition 6

IMPRINT

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The preparation of the sixth Report on the state of the Alps was coordinated by the German Presidency of the ad hoc expert group and the Permanent Secretariat of the Alpine Convention.

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

The full English version of the sixth Report on the state of the Alps, as well as its executive summary in all Alpine languages can be downloaded here: www.alpconv.org

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The ad hoc expert group for the preparation of the sixth Report on the state of the alps (RSA), *Greening the Economy in the Alpine Region*, was set up at the XIIIth Alpine Conference in Torino. It consisted of nominated members from the Alpine countries and was strongly assisted by its Observers, the Permanent Secretariat and the contracted consultants.
As the President of the ad hoc expert group, I would like to extend my sincere thanks to everyone who contributed to the elaboration of this report. The meetings of the ad hoc expert group were characterised by very fruitful discussions, a highly professional exchange and mutual cooperation. The final report strongly benefited from all the different inputs.
The report analyses the status of the development towards a Green Economy in the Alpine region with a range of indicators and good practice examples. A workshop with the Alpine Towns of the Year and expert interviews with relevant stakeholders from the Alpine region generated additional input for the drafting of this report.
The results of this report are encouraging! They show that existing local initiatives and good practice examples could serve as blueprints for the needed transformation process towards a Green Economy in the whole Alpine region. This would provide valuable benefits for the environment and the economy. Despite these positive developments, there is still a strong need to strengthen the efforts at all political levels and in the business community to transform the Alpine economy into an Alpine Green Economy in the long run.

Hans-Joachim Hermann
Umweltbundesamt, Deutschland — Federal Environment Agency, Germany
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From its very preamble, the Alpine Framework Convention stresses the need to reconcile economic interests with the protection of ecological, social and cultural resources. This is indeed the basic purpose of a Green Economy as well as of the Alpine Convention, which has put this very principle at the core of its activities. All this acquires even greater significance this year, when the Alpine Convention celebrates its 25th year of commitment, action and success in working towards this goal.
Despite never being mentioned explicitly in the protocols, the Green Economy concept is paradigmatic of the Alpine Convention's holistic approach to the conservation and development of the Alps. It encompasses and ties together multiple sectors and themes, and it balances the needs of a variety of stakeholders and actors while at the same time being aware of the sensitivity and specificity of the Alpine region.
The 2015 Paris Climate Conference agreement and the renewed commitment of the international community to tackle climate change have provided new impulse for a Green Economy. The Conference of the Parties has recognized that the green economic model has the potential of reducing carbon emissions, ensuring economic growth, social inclusiveness and resource efficiency. This momentum is also highlighted by the Ministerial Declaration adopted by the Alpine Convention ministers in Grassau in October 2016, which stresses the link between a high quality of life and a more sustainable approach to economic activities. It emphasizes how climate challenges can trigger eco-innovation and pave the way to a resource-efficient, circular and cost-effective economy that strengthens both conservation and competitiveness.
To sum up, it is becoming increasingly clear that the old paradigm, according to which economic and environmental goals are antithetic or incompatible, no longer holds true. Rather, there is a third possible way, which considers the economy as an instrument to ensure that environmental resources, ranging from water to landscapes, are sustainably used by local populations to produce revenues and to protect Alpine life, culture and territories. According to such an approach, the value of nature transcends the boundaries of mere economic thinking itself.
For all these reasons, I want to express my satisfaction for a Report on the State of the Alps that analyses the numerous facets of a Green Economy. The study not only addresses the theoretical challenges and describes the current situation in the Alpine countries; it also focuses on specific Alpine problems, provides ad hoc answers and solutions and constitutes an important tool for decision-makers to select measures and policies, to tackle problems, to learn from previous experiences and to take informed decisions. Transferability beyond the Alpine region is also an important aspect of this report. Most of the lessons emerging from it are innovative, scalable and adaptable to other contexts.
Finally, I want to seize this opportunity to thank all the experts, states delegations and Observers whose work made the publishing of this report possible. May this be a catalyst for a shift towards a greener model of development in the Alpine region.

Markus Reiterer
Secretary General of the Alpine Convention

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ABBREVIATIONS

AC:	Alpine Convention
ASP:	Alpine Space Programme
BES:	Benessere Equo Sostenibile – Equitable and sustainable well-being
CHP:	Combined Heat and Power
CICES:	Common International Classification of Ecosystem Services
CIPRA:	Commission Internationale pour la Protection des Alpes – International Commission for the Protection of the Alps
CLC:	CORINE Land Cover
COP:	Conference of the Parties
CORINE:	Coordination of Information on the Environment
DMC:	Domestic Material Consumption
EAP:	Environmental Action Plan
EC:	European Commission
EEA:	European Environment Agency
EGSS:	Environmental Goods and Services Sector
EMAS:	Eco-Management and Audit Scheme
EM-DAT:	Emergency Events Database
EMS:	Environmental Management System
ENEA:	Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico – Italian National agency for new technologies, energy and economic development
ESD:	Effort Sharing Decision
ESS:	Ecosystem Services
ETS:	Emissions Trading Scheme
EU:	European Union
EUROSTAT:	Statistical Office of the European Union
EUSALP:	European Union Strategy for the Alpine Region
FOEN:	Swiss Federal Office for the Environment
FSC:	Forest Stewardship Council
GDP:	Gross Domestic Product
GE:	Green Economy
GEC:	Green Economy Coalition
GGKP:	Green Growth Knowledge Platform
GHG:	Greenhouse Gases
GJ:	Gigajoule
HNV:	High Nature Value
IMAD:	Institute for Macroeconomic Analysis and Development of the Republic of Slovenia
INBS:	Italian National Biodiversity Strategy
INFC:	Inventario Nazionale delle Foreste e dei Serbatoi Forestali di Carbonio – Italian national forest inventory
ISO:	International Organisation for Standardisation
ISPRA:	Istituto Superiore per la Protezione e la Ricerca Ambientale – Italian Institute for Environmental Protection and Research
IT:	Information Technology
JRC:	Joint Research Centre of the European Commission
JTS:	Joint Technical Secretariat of the Alpine Space Programme
kWp:	Kilo Watt peak
LAU:	Local Administrative Unit
LCA:	Life Cycle Assessment
LEADER:	Liaisons entre actions de developpement de l'économie rurale – Rural development programm of the European Union
LED:	Light Emitting Diode

LEED:	Leadership in Energy and Environmental Design
LIFE/LIFE+:	L'Instrument Financier pour l'Environnement – Funding Instrument for the Environment and Climate Action of the European Union
LULUCF:	Land Use, Land Use Change and Forestry
MEA:	Millennium Ecosystem Assessment
MAES:	Mapping and Assessment of Ecosystems and their Services
MSW:	Municipal Solid Waste
MWI:	Municipal Waste Intensity
NC:	Natural Capital
NGO:	Non-Governmental Organisation
NREAP:	National Renewable Energy Action Plan
NUTS:	Nomenclature des unités territoriales statistiques – Nomenclature of Territorial Units for Statistics
OECD:	Organisation for Economic Cooperation and Development
PA:	Protected Area
PEF:	Product Environmental Footprint
PES:	Payment for Ecosystem Services
PJ:	Petajoule
PM:	Particulate Matters
PPP:	Purchasing Power Parity
PPS:	Purchasing Power Standard
PSA:	Permanent Settlement Area
PSAC:	Permanent Secretariat of the Alpine Convention
PV:	Photovoltaic
R&D:	Research and Development
RE:	Renewable Energy
RES:	Renerwable Energy Source
RK:	Reduction Capacity
RMC:	Raw Material Consumption
RSA:	Report on the State of the Alps
SDG:	Sustainable Development Goal
SEEA:	System of Environmental-Economic Accounting
SME:	Small and Medium Enterprise
SOIA:	System for the Observation and Information on the Alps
UAA:	Utilized Agricultural Area
UN:	United Nations
UNEP:	United Nations Environmental Programme
UNESCO:	United Nations Educational, Scientific and Cultural Organization
VDI:	Verein Deutscher Ingenieure – Association of German Engineers
VOC:	Volatile Organic Compound(s)
WEI:	Water Exploitation Index
WG:	Working Group
WHO:	World Health Organisation
Wp:	Watt peak
WWTP:	Wastewater Treatment Plant

1. INTRODUCTION

1.1 OPPORTUNITIES AND CHALLENGES FOR GREENING THE ECONOMY IN THE ALPS

Benefits and challenges for a Green Economy in the Alpine Convention area

The economy in the Alps is influenced and framed by the environmental, economic and social conditions of the Alpine region. In order to develop towards a Green Economy, economic activities in the Alps need to respect the specific topography, the natural resources, the climate and the sensitive Alpine environment. The Alpine topography poses special challenges, such as transport through valleys and across ridges and the limited availability of land with low slope gradients. On the other hand, it forms the basis for a unique landscape, Alpine natural assets and the characteristic Alpine land cultivation, which are crucial requisites for Alpine tourism. The Alpine environment creates special conditions such as different climate and habitat conditions at different altitudes, different water retreat and discharge patterns, and various natural hazards. Therefore, also the reactions of the Alpine environment to climate change deviate from other environments.

Besides these natural conditions, structural limitations for the economy exist in some areas of the Alps i.a. due to limited accessibility from and within the Alpine area to urban centres and to small and remote settlements, market barriers for small or new companies, limited availability of knowledge or a limited supply for consumers. These conditions require integrative approaches for sustainable development and form a framework that predestines the Alps as a pilot area for a Green Economy approach.

A Green Economy can offer sound benefits for an area with a sensitive environment. It may reduce costs of environmental damages, trigger innovation and generate jobs in the green sector and through a green restructuring of the whole economy. This can boost the competitiveness of the regional economic system.

Common understanding of a Green Economy in the Alpine region

One main challenge of our economy is to provide economic opportunities in a world with limited resources. The concept of *planetary boundaries* (Rockström et al. 2009) states that our planet can be considered a spaceship with limited resources. Experts have thus developed the term *spaceship economy*. Sustainable development interlinks the economic, ecological and social dimensions of an economy. A long-term stable economy will need stable social conditions. Therefore, under a normative point of view, in a Green Economy framework, an economic concept should consider and possibly achieve equity, fairness and social justice. This implies that a Green Economy has to respect social requirements and ecological limitations and be compatible with nature and the environment.

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

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

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

Even though the term Green Economy is still not consistently defined, most organisations now have a shared understanding of the concept. For the purpose of this report, the ad hoc expert group for the elaboration of the sixth Report on the state of the Alps (RSA) has agreed to use the UNEP definition of a Green Economy as the most widely used and authoritative one. UNEP (2011b) defines a Green Economy:

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

This implies four key sectors of Green Economy, which are used to structure the Report on the state of the Alps:
- energy-efficient and low-carbon economy
- resource-efficient economy
- ecosystem services and natural capital-based economy
- an economy supporting quality of life and well-being.

Policy objectives

A Green Economy is an instrument to achieve sustainable development. It is explicitly referred to in the UN Sustainable Development Goal 8 ('Promote inclusive and sustainable economic growth, employment and decent work for all') and Goal 12 ('Ensure sustainable consumption and production patterns'), but also most other sustainable development goals refer to a Green Economy (cf. Chapter 1.2.1).

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

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

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

The concept of a Green Economy also raises controversial questions[3] regarding the role of market mechanisms and public regulation of the economy, the balance between technological innovation and changing consumption patterns, the economic valuation of natural resources, the trade-off between economic growth and environmental protection, and ways of producing energy from renewable sources (centralised or decentralised).

1.1.1 GLOBAL AND EUROPEAN MEGATRENDS

The Alpine Convention area is strongly intertwined with the rest of Europe and the world. There is an exchange of materials, energy, financial resources, people as well as innovation and ideas. Therefore, the Alpine area is also exposed to most global and

1. *The 20-20-20 goals are: 1) Reducing greenhouse gas emission by 20% compared to 1990; 2) increasing the share of renewables in final energy consumption to 20%; 3) moving towards a 20% increase in energy efficiency.*
2. *Further information: www.oecdbetterlifeindex.org: www.happyplanetindex.org/, www.well-beingindex.com/.*
3. *Further information: whygreeneconomy.org/which-green-economy.*

European megatrends[4]. These are directly or indirectly relevant for the Alpine area and a greening of its economy. Through its consumption of globally produced goods and services and the related effects of production, transport and removal of these goods and services, the Alpine population contributes to these global challenges. The most common megatrends[5] are globalisation, gender shift, connectivity, urbanisation, neo ecology, health, new learning, mobility, new work, individualisation and silver society. The neo ecology megatrend comprises about 30 subtrends of high relevance for a Green Economy such as green jobs, social business, corporate responsibility, green technology, energy grids, fair trade, reuse-reduce-recycle, mixed mobility and smart buildings.

The European Environment Agency has identified 11 global megatrends (cf. Figure 1.1.1-1) of relevance for Europe. Six of them seem to be particularly relevant for the Alpine area:

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

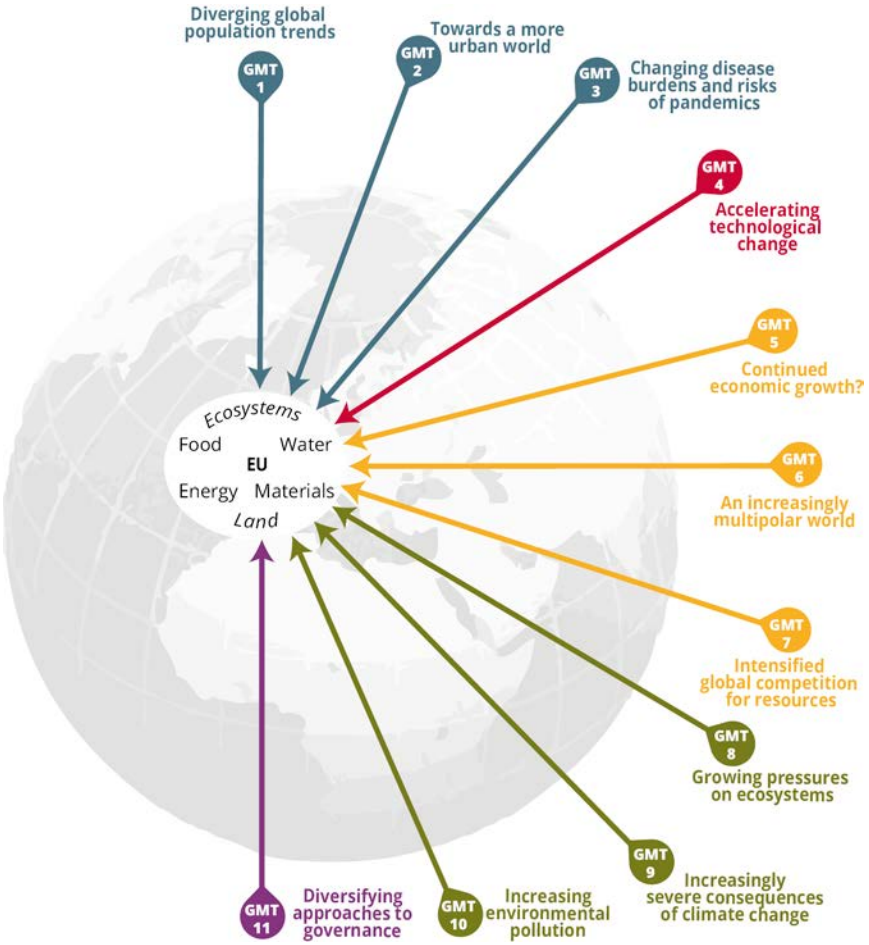


Figure 1.1.1-1 Impacts of global megatrends on EU resource systems (Source: EEA 2015j).

4. *Megatrends influence civilisations, technologies, economies and value systems, often consist of different single, sometimes overlapping trends and last for at least 50 years. This makes them different from short-term product, fashion, or consumption trends.*
5. *Further information: de.megatrends.wikia.com/wiki/Megatrend.*

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

A study on strategy development by the Alpine Space Programme (JTS 2013) has identified the following important trends with relevance for the Alps (cf. Figure 1.1.1-2):

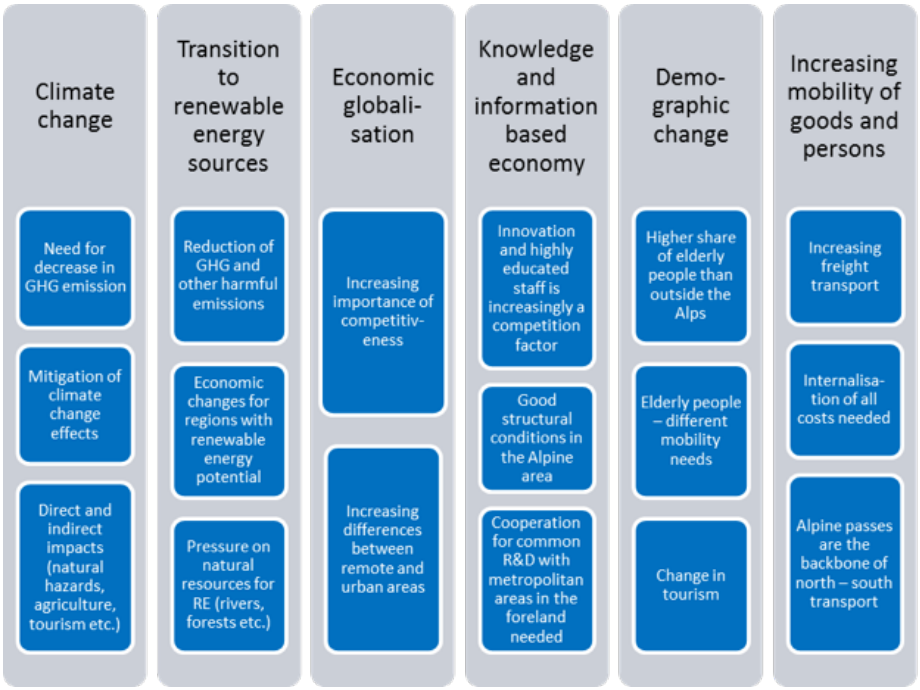


Figure 1.1.1-2 Driving forces in the Alpine area according to JTS (Source: JTS 2013, graph: ifuplan 2016).

Climate change

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

Climate change will lead to economically relevant effects such as increasing losses due to natural hazards, investments to prevent such losses, poor crop yields in agriculture, vinery and horticulture, decreased (respectively unsteady) hydropower generation. This requires adaptation measures to avoid damages or to mitigate the effects. Examples are flood prevention measures, irrigation or adaptation of agricultural practices, increasing expenses for the adaptation of housing (such as insulation and cooling) and the production of artificial snow for ski slopes.

Transition to renewable energy sources

Climate protection strategies require a substantial decrease of GHG emissions from fossil energy sources as one major source of GHG emissions. The use of fossil energy sources leads to economic costs through environmental damage and often releases harmful emissions. Declining stocks of fossil energies on a global level might lead to higher energy prices that put economic pressure on high consumption sectors. Therefore, energy strategies encompass energy efficiency targets and usually include a shift towards renewable energy sources. This is often linked with decentralised energy generation, the use of small power plants

and solutions for energy storage. Regions with a high potential of renewable energy might prosper from this development if efficient and sustainable solutions for the production, storage and transportation of the generated energy are developed or if energy-intensive production is replaced in these regions.

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

Economic globalisation

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

Knowledge and information-based economy

Information technology makes knowledge, inventions and innovation easily accessible around the world. Innovation is a key for fuelling sound economic development through the adoption of improvements in regular production processes. Alpine countries often cannot compete on a global scale in terms of mass production. This is why future economic development in the Alpine area should focus on research and innovation and combine it with traditional regional and local knowledge and employees.

Research and development (R&D) activities in the Alpine area are above European averages. Most peripheral areas of the Alps are relatively close to urban centres, which often have R&D institutions and universities, often with worldwide reputation. The linkage between rural areas and urban centres could produce an innovative edge and create positive economic effects in the peripheral areas.

Demographic change

All Alpine countries are affected by demographic change. In the Alpine area, this has different effects such as an increase of life expectancy, decrease of birth rates, abandonment of rural areas, and an exodus of young people from remote areas. This will lead to an age shift in the Alpine population.

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

Increasing mobility of goods, persons and information

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

Economic pressure will also trigger further increases in freight transport crossing the Alps as well as within the Alpine area. Due to the evident environmental, health and infrastructural impacts of transport, parameters for the internalisation of external costs are

discussed, and effects of different toll models for freight and passenger transport are compared at EU, Alpine-wide and national level. At the same time, access to digital infrastructure becomes an important requirement for business but also private life. It is an indispensable precondition for business activities and can also reduce the need for physical mobility through online services, such as entertainment, medical services and shopping.

These main trends in the Alpine Convention area pose challenges while offering opportunities for further development. They are reflected in the Alpine Space Programme and the projects elaborated within this programme.

1.1.2 ALPINE SPECIFICITIES

Which Alpine specificities need to be considered for a Green Economy in the Alpine Convention area? The most relevant specificities are explained below.

Population distribution

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

The population, seen as an important resource (workforce) and demand factor (market) for the economy, is thus relatively small within the Alpine Convention area compared to the national population of the majority of Member States right outside the Alpine

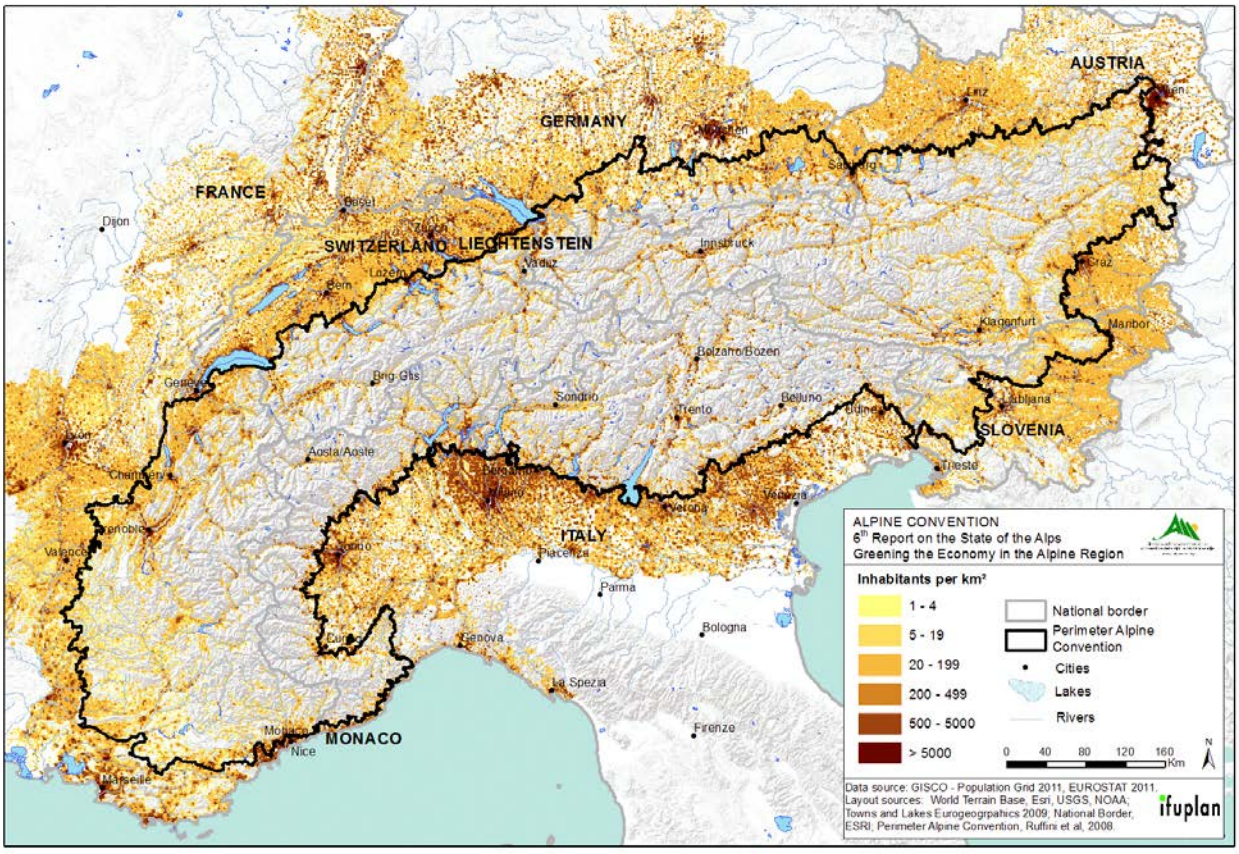


Figure 1.1.2-1 Population density inside and outside the Alpine Convention area (Source: EUROSTAT 2011).

Convention area. The influence of the adjacent population and metropolises representing major economic centres in Europe – on the Alps is fairly strong. On the one hand, they offer opportunities for the Alpine population, such as job markets and innovation hubs. On the other hand, the metropolises put a certain risk on the Alps to be used as a source for natural resources such as water, food, wood, recreation landscapes, etc. and to be dominated from external interests. Therefore, a strong and fair cooperation between the Alps and their forelands is needed.

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

Alpine Convention area – An area with many different entities

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

Landscape amenities

The picturesque mountain landscapes and the rich natural and cultural heritage are attractive for short and long-term visitors (day tourists, holiday tourists but also permanent or second homes for retired people) and are the economic basis for tourism.

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

Since tourism is an important economic sector for the Alpine area, landscape preservation is of greatest importance to the Alpine economy. Rural areas and small cities between European metropolises are attractive destinations for the urban population. However, public goods such as landscapes, nature experiences and cultural heritage of the rural areas and little towns are often used without generating any economic revenues.

Traditional skills

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

Alpine vulnerabilities

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

Due to the harsh climate and thin soil layers, vegetation and ecosystems are often at their limits. Consequently, land use has been adapted to these specific natural circumstances and has produced cultural landscapes such as high altitude pastures, mountain forests and bush lands. All these landscapes make the Alps attractive for tourists.

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

1.1.3 ALPINE ECONOMY CHARACTERISTICS

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

Employment and unemployment

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

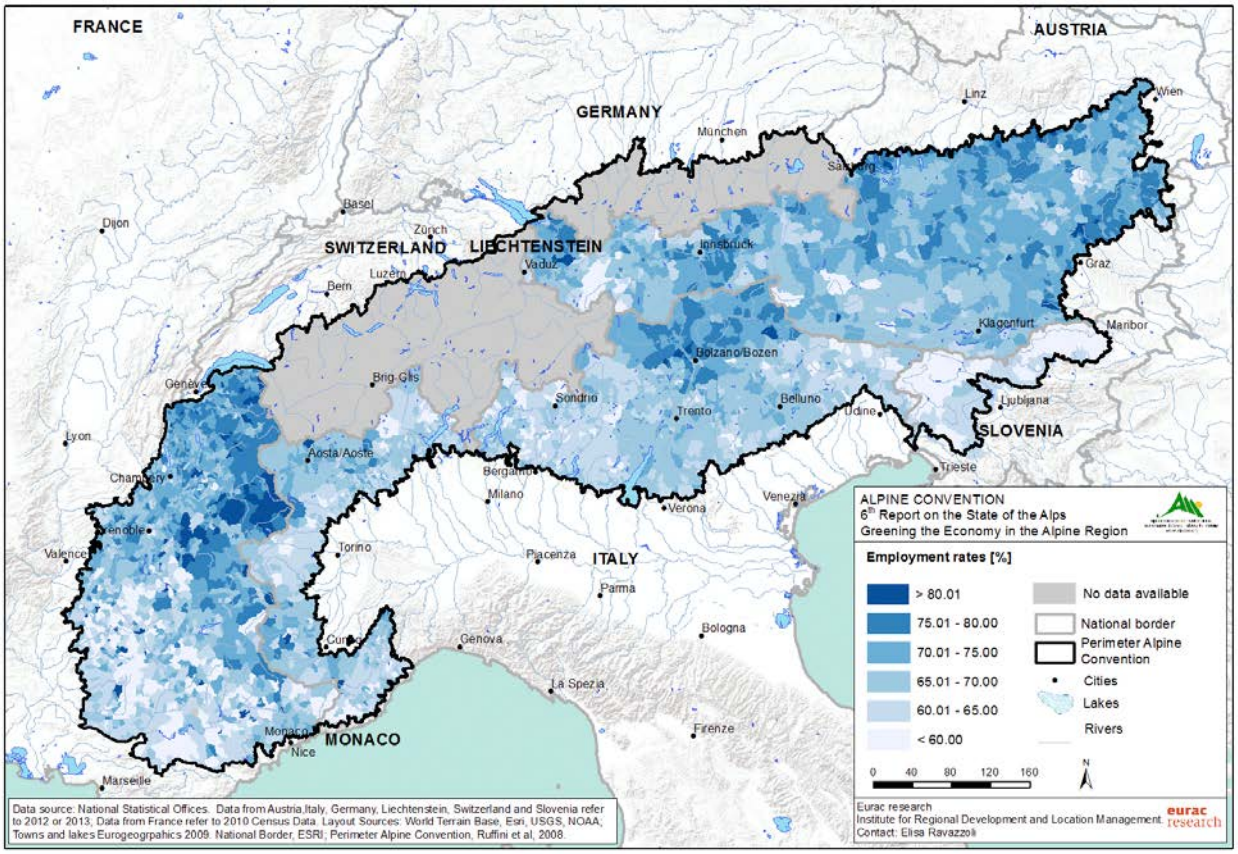


Figure 1.1.3-1 Employment rates in the Alpine Convention area[6] (Source: SOIA 2016).

Main economic branches

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

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

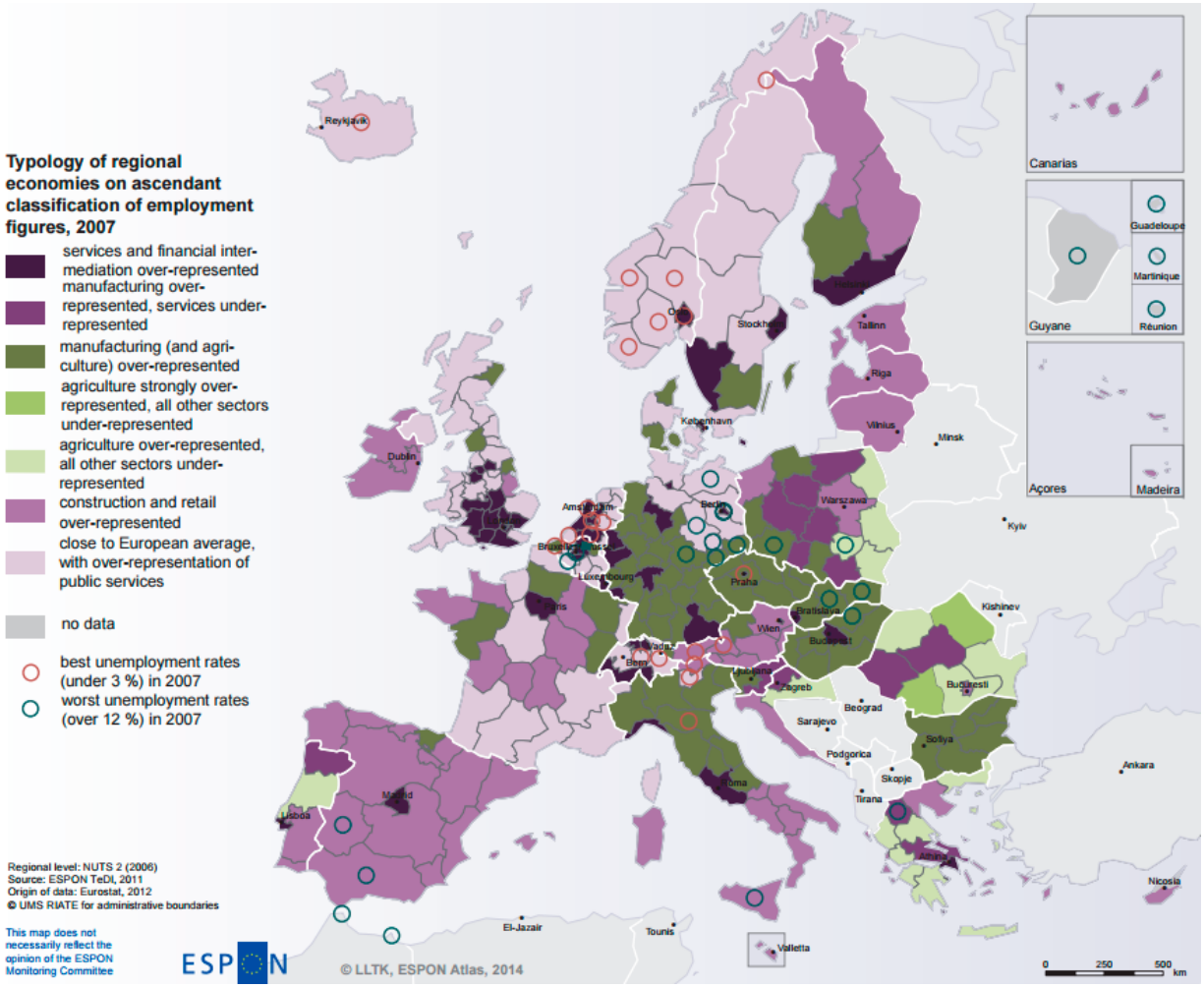


Figure 1.1.3-2 Regional types of economy (Source: ESPON & BBSR 2014, p.39).

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

Regional economic development

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

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

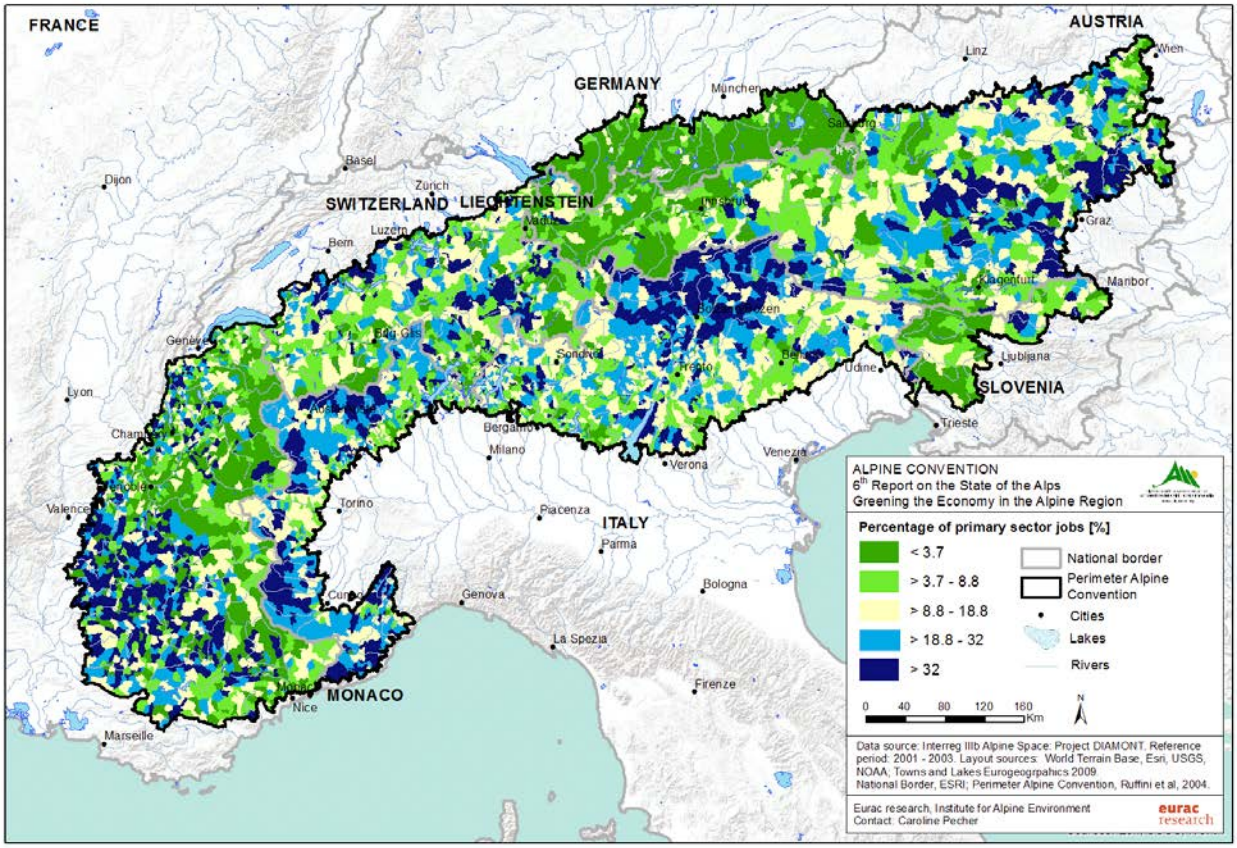


Figure 1.1.3-3 Percentage of primary sector jobs on total jobs in the Alpine Convention area[7] (Source: SOIA 2016).

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

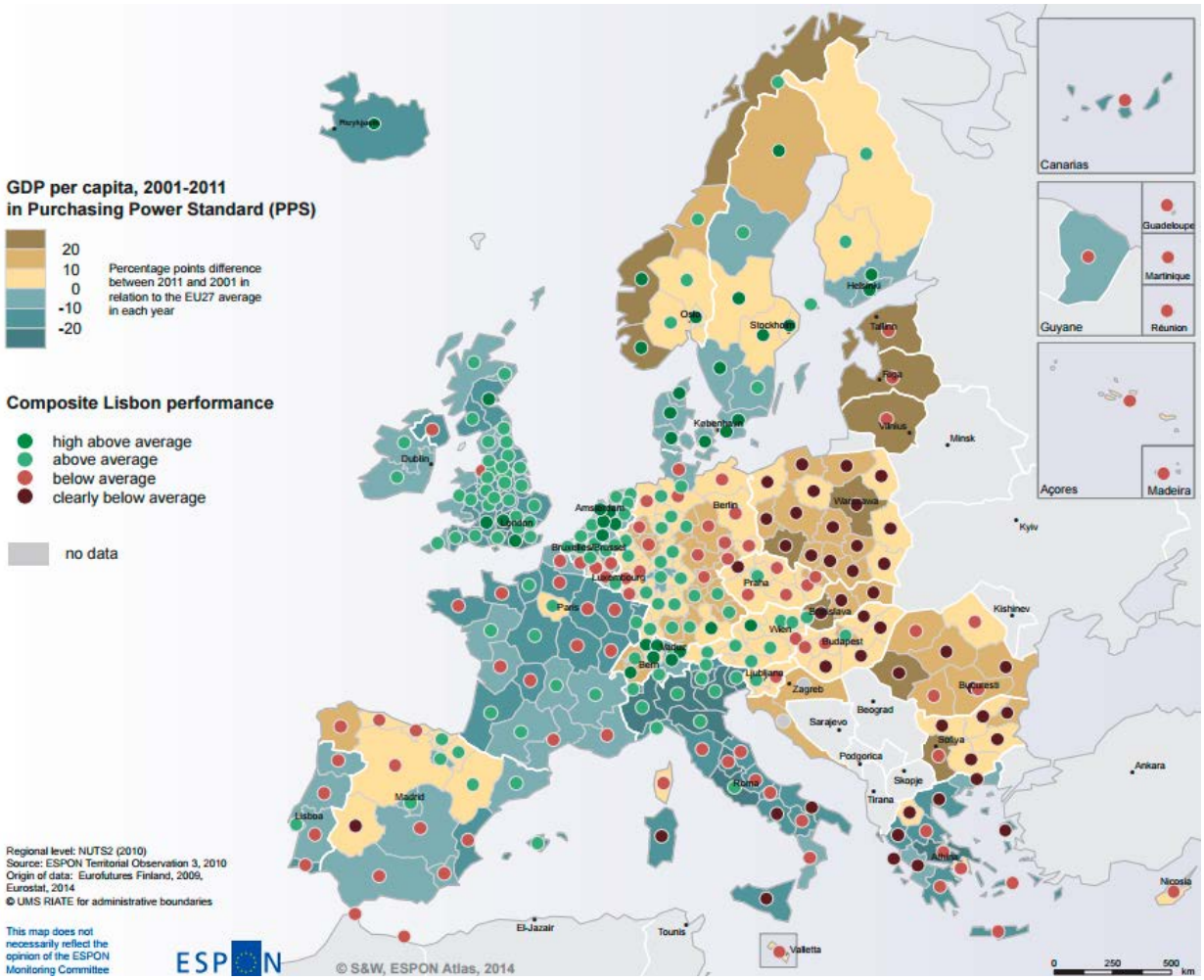


Figure 1.1.3-4 Lisbon performance and regional economic development in the EU (Source: ESPON & BBSR 2014, p.41).

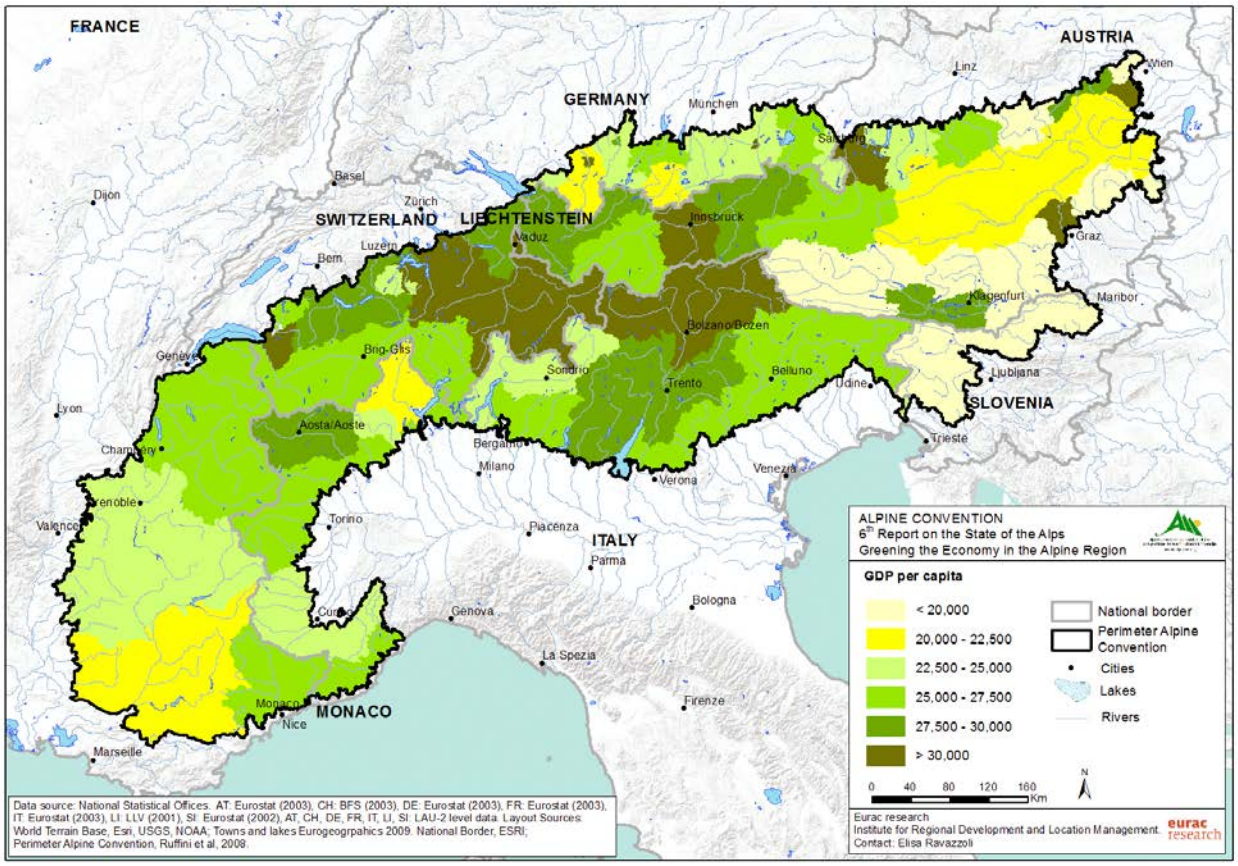


Figure 1.1.3-5 GDP per capita 2002/2003 in the Alpine Convention area (Source: SOIA 2016).

Innovation and knowledge

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

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

Greening the economy

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

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

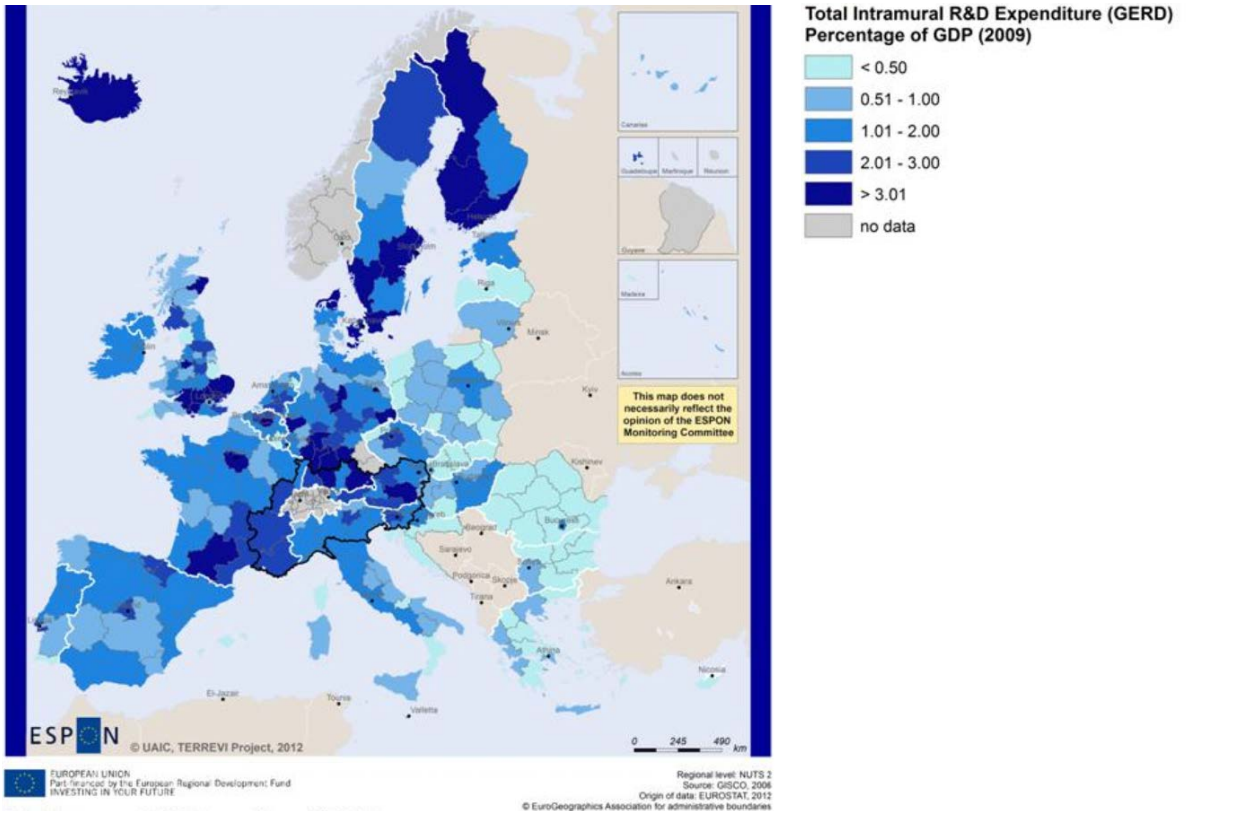


Figure 1.1.3-6 Total intramural R&D expenditures in the EU (Source: ESPON 2013a, p.20).

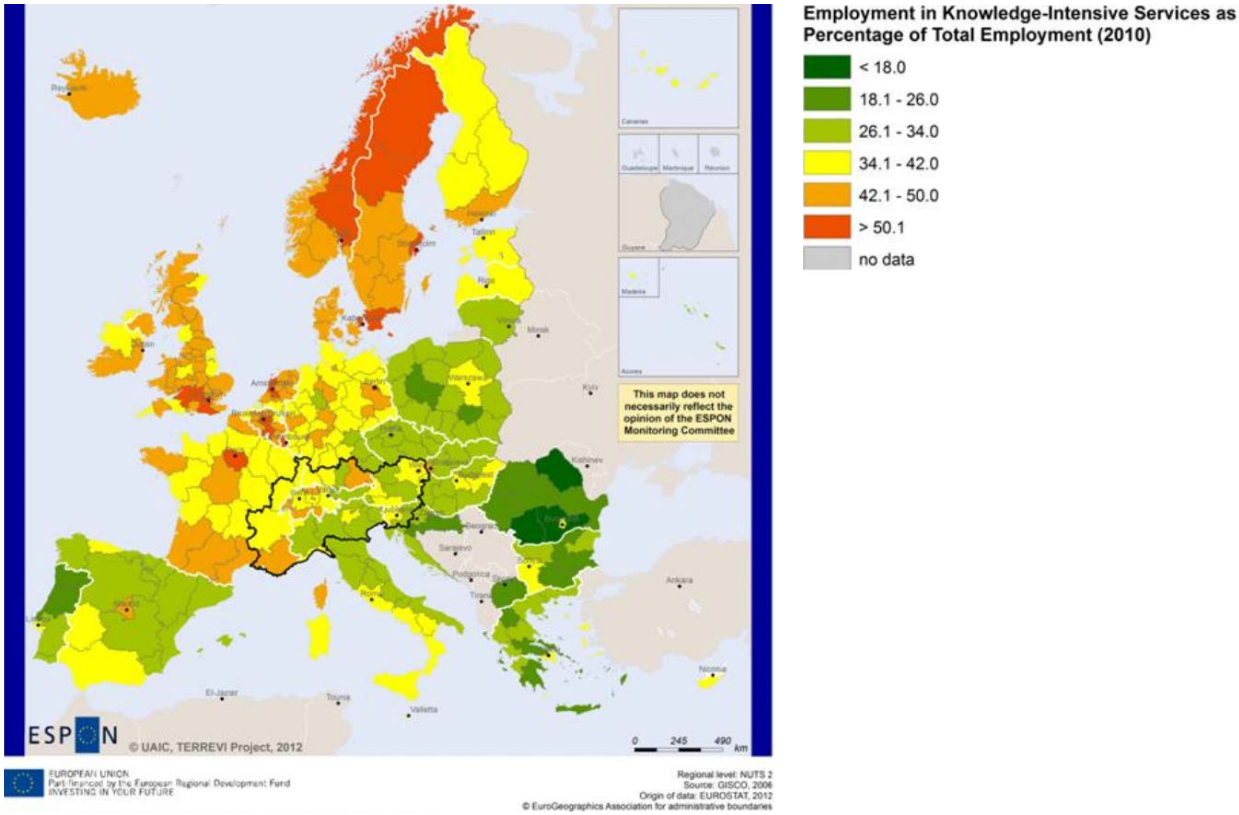


Figure 1.1.3-7 Employment in knowledge-intensive services in the EU (Source: ESPON 2013a, p.23).

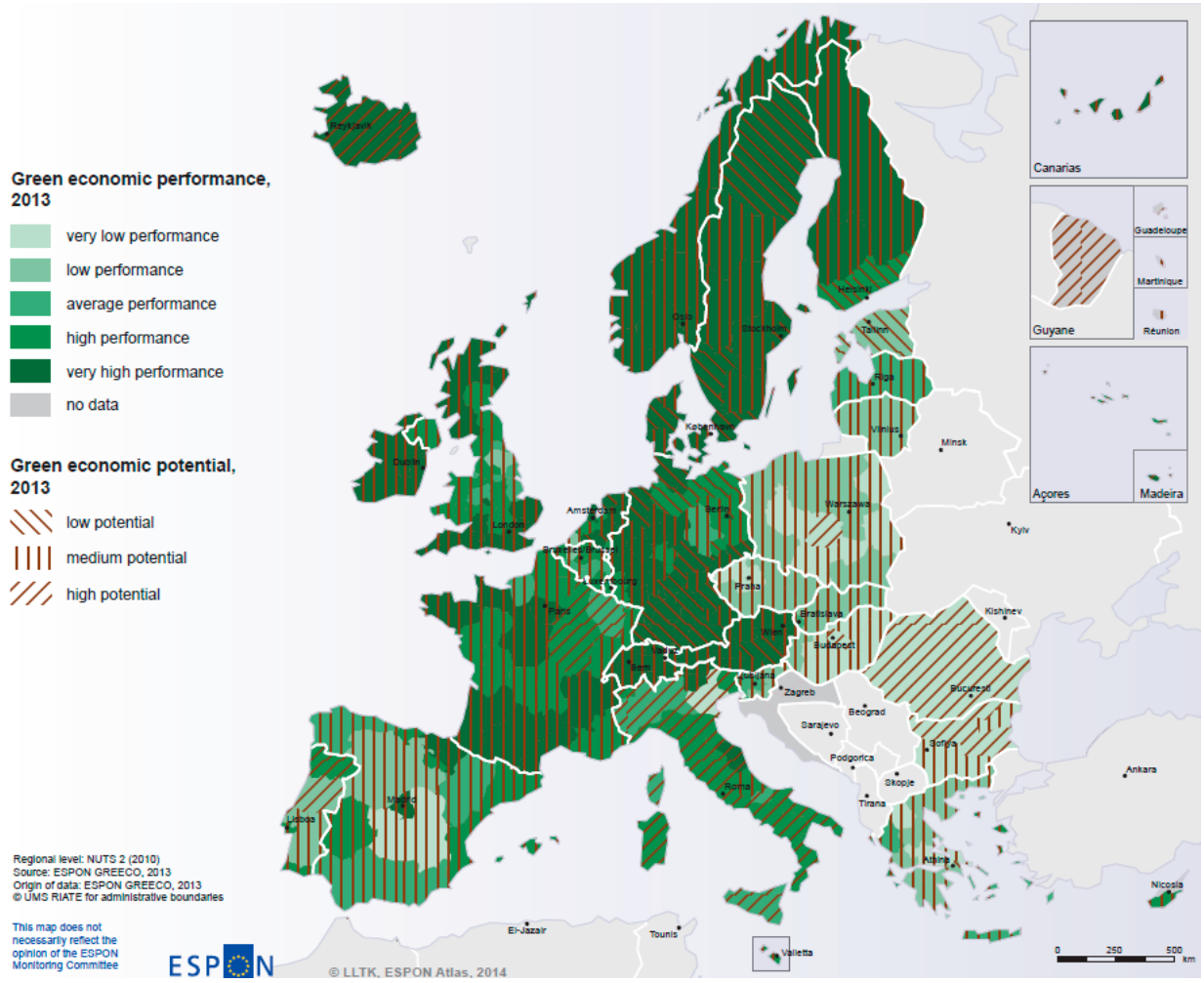


Figure 1.1.3-8 Green Economic Performance in the EU (Source: ESPON & BBSR 2014, p.91).

Different territories for cooperation and economic activities

The Alpine countries cooperate within different organisations with different territorial extents (cf. Figure 1.1.3-9). The delineation of the Alpine Convention most adequately reflects the geomorphological Alps. The Alpine Space Programme comprises a larger territory and includes lowlands with neighbouring metropolitan areas. The territory covered by EUSALP, the European Union macro regional strategy, is almost identical with the Alpine Space Programme's territory, except in the north, where the German states of Bavaria and Baden-Württemberg are included entirely and the French area of Alsace is excluded.

The numerous economic activities in the Alpine Convention area are closely linked to the surrounding areas, particularly to the big agglomerations within the Alpine Space Programme. The influence of the EUSALP territory on the Alpine economy is not yet identifiable.

Even within the Alpine Convention area different spatial types exist due to the natural conditions, population density, infrastructure and accessibility. Switzerland has developed a spatial typology of five categories with different kinds of economic development (cf. Figure 1.1.3-10).

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

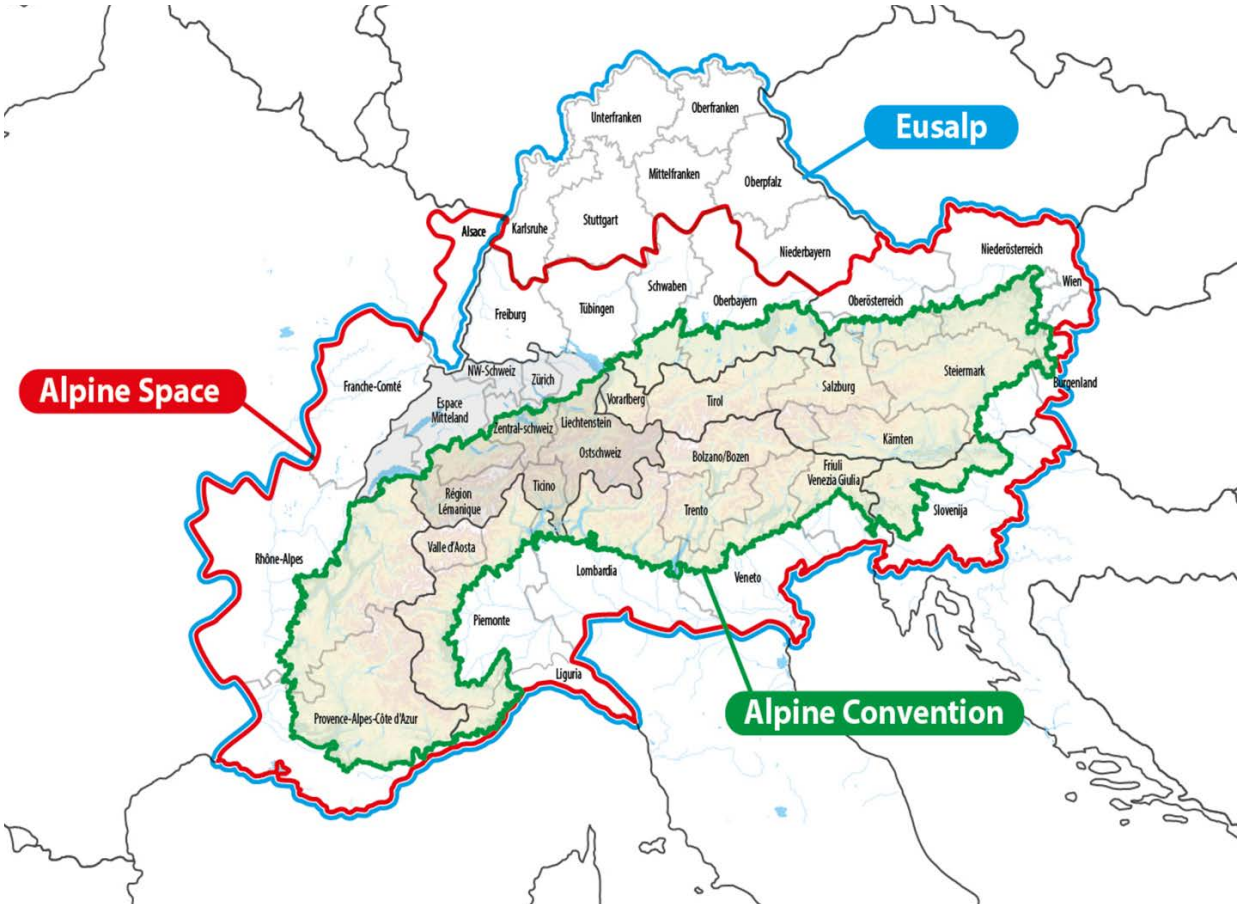


Figure 1.1.3-9 Overview of Alpine areas: Alpine Convention area, Alpine Space Programme area and EUSALP area (EUSALP 2015).

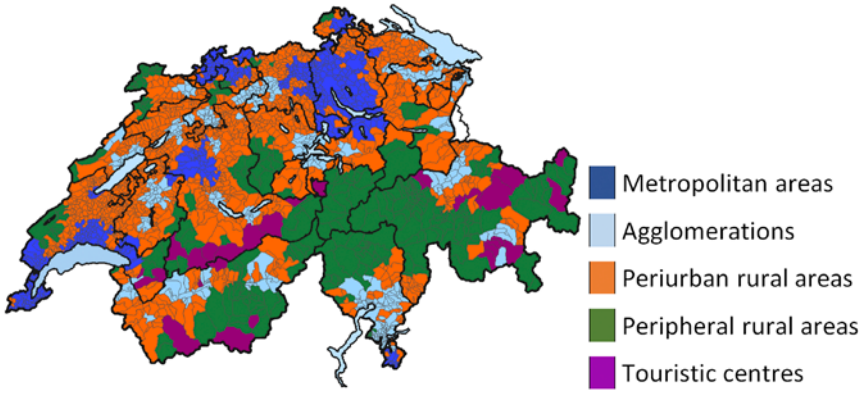


Figure 1.1.3-10 Spatial typology in Switzerland (Source: Regiosuisse 2011, p.7).

Economic situation in Alpine countries

The following information on economic sectors, activities and employment supplied by the Alpine countries may provide further insight into the characteristics of the economy in the Alpine countries.

GERMANY

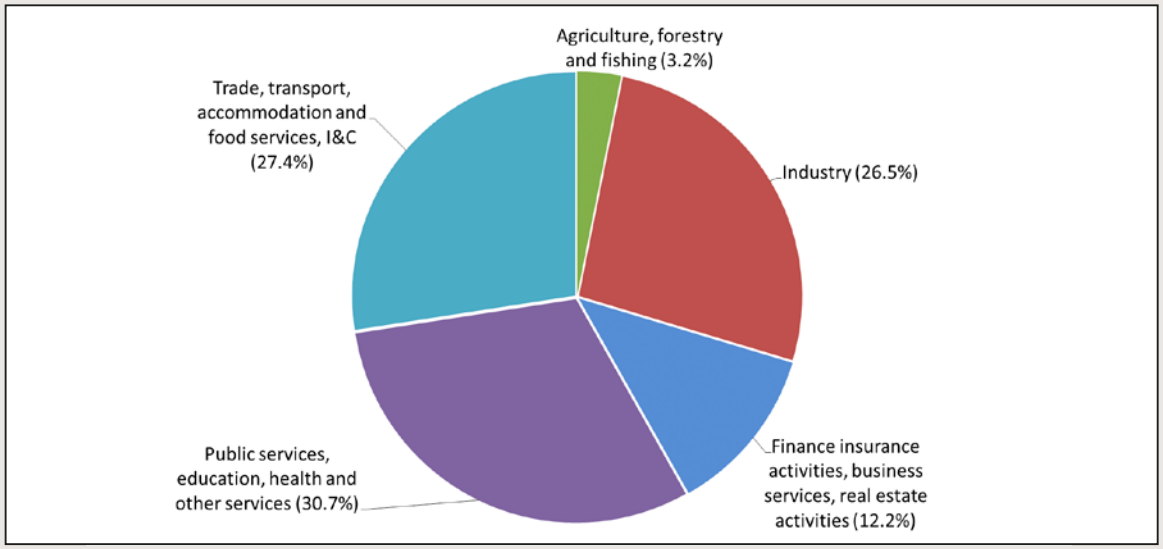


Figure 1.1.3-11 Share of economically active people per sector in the German Alpine Convention area in 2013.

Figure 1.1.3-11 shows the economic sectors of the German Alpine Convention (AC) area expressed by the share of economically active people (2013 data compared to NUTS3 levels[9]). Comparing the situation within the Alpine Convention area and the rest of Bavaria one can observe:

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

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

Job density: job density is measured as the number of economically active people per 1,000 inhabitants aged 15-65 years, data for NUTS3 level: the mean value of 841 (outside AC: 806) is higher within the AC area, especially in Rosenheim (1,150) and Kempten (1,217), which are important labour markets.
Agriculture: the share of ecologically used agricultural land is higher within the Alps than in the foreland. The density of livestock units (expressed in count of livestock units per 100 ha of agricultural area) is rather high (more than 200 livestock units / 100 ha) in some parts of the AC area (counties of Rosenheim, Traunstein and Bad Reichenhall).

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

9. Data provided by the Bavarian State Agency for Statistics.

ITALY

In terms of GDP per capita (2013), Italian Alpine regions rank relatively high – with some significant differences – compared to the national level. Notwithstanding the still visible effects of the financial downturn, which has lowered GDP per capita since 2011 in the entire country, a few Alpine regions and autonomous provinces show the highest GDP p.c. in Italy: the Autonomous Province of Bolzano and Valle d'Aosta (€32,284 and €30,843 p.c. respectively), are followed by Lombardia (€29,434) and the Autonomous Province of Trento (€26,547). Valle d'Aosta suffered the biggest drop in GDP p.c. between 2011 and 2013 (-3.8%).

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

Inflation has not been a major issue over the last few years due to reduced consumption following the economic crisis. However, some Alpine regions appear to be less sensitive to price increases than the national average. The slowest growth was registered in Lombardia (0.1%), and prices in Veneto and Friuli Venezia-Giulia were unaltered during the first ten months of 2014.

LIECHTENSTEIN

Liechtenstein's economy is extremely diverse with a large number of small and medium-sized enterprises. The high level of value added can mainly be attributed to a strong industrial sector and to financial service providers. The contribution of the public sector to the national economy is comparatively small.

A distinctive feature of Liechtenstein's national economy is the large number of inward cross-border commuters. In 2013, 53% of Liechtenstein's workforce consisted of this group. Since GDP is generated by the entire workforce, country comparison of GDP per capita may lead to misleading conclusions. Hence, GDP per person employed may be considered a more appropriate figure to compare Liechtenstein with other countries.

The value added by agriculture and households mainly corresponds to real estate rental activities and the imputed rent of owner-occupied dwellings.

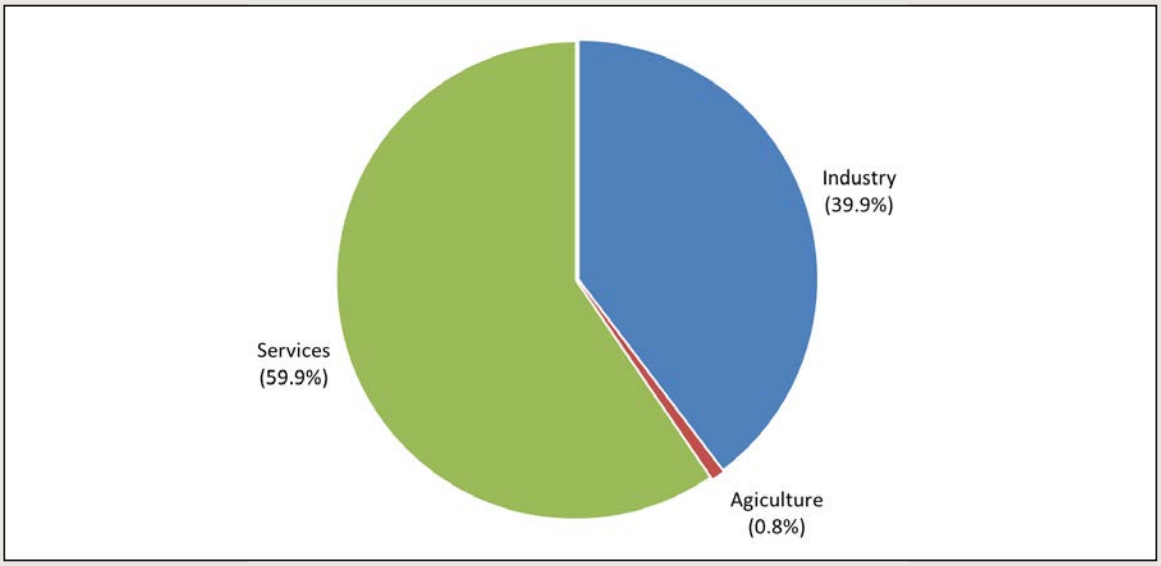


Figure 1.1.3-12 Employment within different sectors in Liechtenstein, 31/12/2013 (Source: Liechtenstein delegation).

SLOVENIA

The economic sectors in the Alpine part of Slovenia show a significantly higher proportion of industrial production, mainly metallurgical industry (machinery and electrical equipment production). In other industries the value added slightly lags behind the Slovenian average. This economic structure also has an effect on the employment rate.

In Slovenia, 29% of the total employed population lives in the Alpine part[10] of the country. In comparison with the national level, the value added in the Alpine part is slightly lower – around 27%.

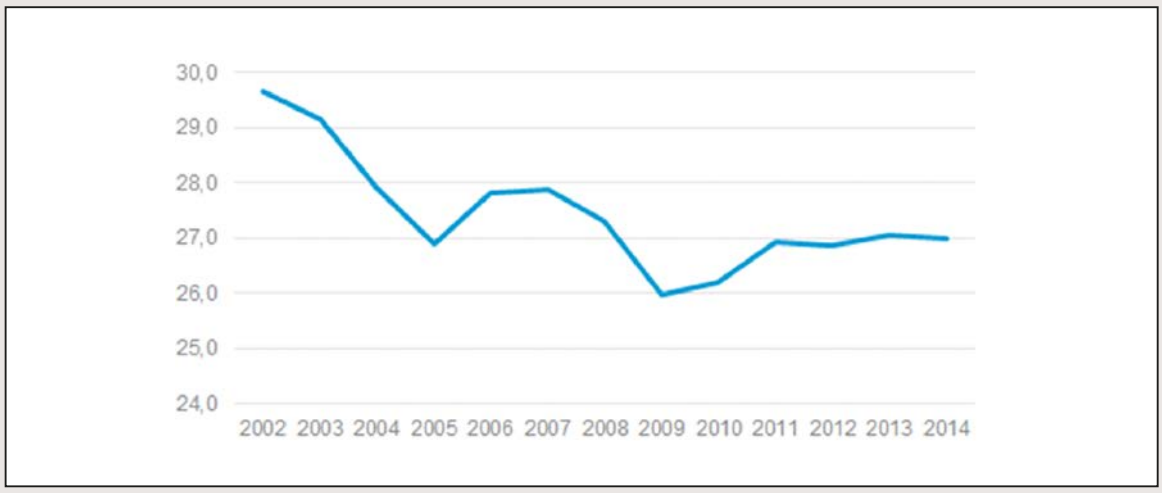


Figure 1.1.3-13 Development of value added of non-financial corporations in the Slovenian Alpine Convention area (Source: Slovenian delegation).

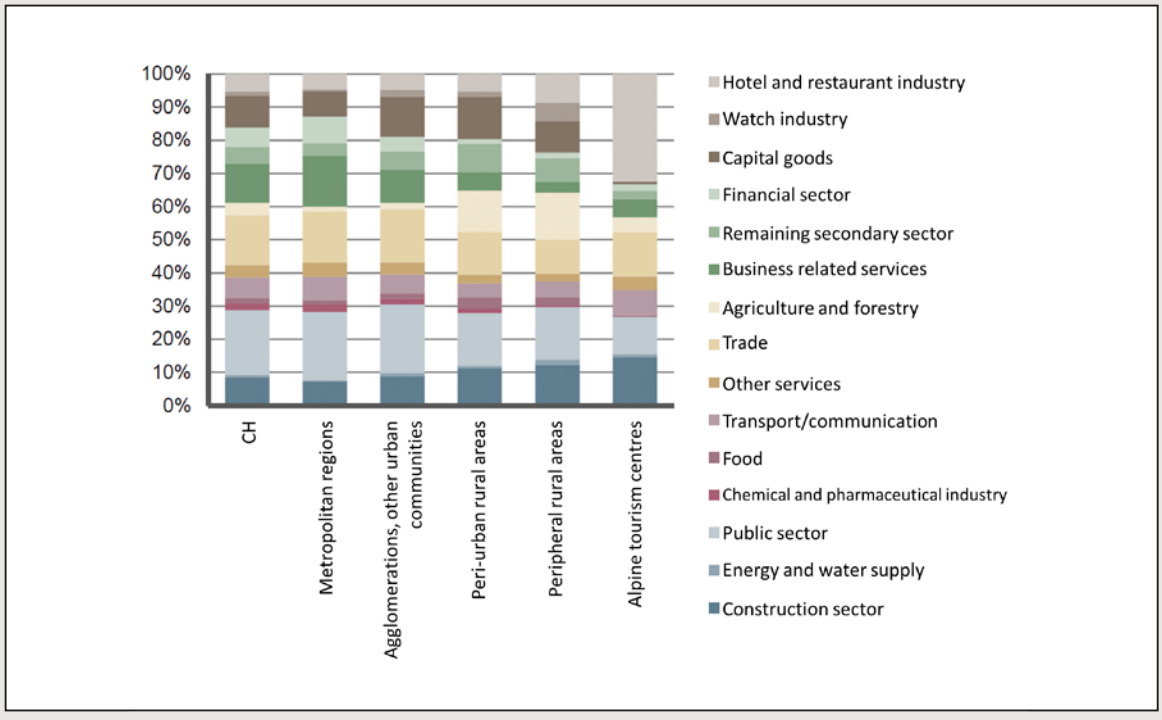


Figure 1.1.3-14 Mix of economic sectors in Switzerland measured as number of workplaces in 2008 (Regiosuisse 2011).

10. For this analysis, the Alpine part was defined as all postcode areas that are completely or partially within Alpine Convention area.

SWITZERLAND
Figure 1.1.3-14 depicts the different sectors for the different territorial categories in Switzerland measured in number of workplaces in 2008 (cf. Figure 1.1.3-14). It shows that the most relevant industry in terms of employment within the Alpine area is the hotel and restaurant industry. A striking difference between the Alpine and the non-Alpine area can be found in the financing sector, which is much larger in the metropolitan areas. The construction sector is stronger in the Alpine area than in the Swiss average.

1.2 GREEN ECONOMY – THE POLITICAL AND STRUCTURAL FRAMEWORK

1.2.1 GREEN ECONOMY – STRATEGIES AND POLICIES

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

International level

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

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

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

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

EU level

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

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

The European Environment Agency (EEA) publishes reports and provides data to increase the Green Economy knowledge base to support informed decision-making by policy-makers, businesses and citizens.

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

Situation in Alpine countries

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

AUSTRIA

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

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

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

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

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

GERMANY

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

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

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

ITALY

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

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

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

LIECHTENSTEIN

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

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

SLOVENIA

Slovenia adopted a framework programme for the transition to a Green Economy in October 2015, which builds on the coalition agreement as well as strategic documents of the European Union. It sets the framework for measures Slovenia is planning and implementing to react to global challenges like population growth, environmental degradation and resource scarcity. One main objective of the programme is to promote the Green Economy concept as an opportunity to enhance competitiveness and thus an impetus for the development of new green technologies and new jobs. Furthermore, the programme aims to promote the development of knowledge and the cooperation of stakeholders to make the transition to a Green Economy feasible and efficient. A set of indicators will help to monitor the progress towards a Green Economy in Slovenia.

The focus lies on the following areas: sustainable resource management, promotion and support of green businesses, support for green jobs, demand for green services and products, green public procurement, green fiscal reform, sustainable urban development, education and skills for green growth and green agriculture and forestry. An action plan for 2015-2016 accompanies the programme.

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

SWITZERLAND

The Swiss government aims to protect natural resources and at the same time strengthen the economy. In order to achieve the goal of an environmentally sustainable economy, the federal government has created a framework that contributes to both the interests of environmental and economic policies. The Federal Office for the Environment (FOEN) has the lead, and other ministries are pursuing this goal as part of the Federal Council's mandates for a Green Economy. In 2013, the Swiss Government adopted the Green Economy Action Plan. In doing so, it intended to conserve natural resources, make consumption more environmentally friendly and strengthen the circular economy. The action plan includes 27 existing and new measures in four main areas of action: consumption and production; waste and raw materials; horizontal instruments; objectives, follow-up, information and reporting.

The Green Economy – Federal measures for a resource-conserving, future proof Switzerland[11] report from April 2016 assesses the implementation of the 2013 Green Economy Action Plan and outlines further developments towards a Green Economy based on the existing legislative basis. The measures are based on the UN Sustainable Development Goals as well as on the Federal Council`s Sustainable Development Strategy. The discussed measures fall under three categories: (1) consumption and production, (2) waste and raw materials and (3) cross-cutting instruments. More specifically, the report assesses past actions and future goals concerning consumer behaviour, transparency of standards for ecologically important resources and products, product and process optimisation, waste avoidance, closing life cycles of materials, sector-specific approaches for increasing efficiency, international involvement, incentives and strengthening of knowledge base, aims, dialogue and reporting.

11. Available at: www.bafu.admin.ch/bafu/en/home/topics/economy-consumption/info-specialists/green-economy/political-mandate-for-a-green-economy.html; indicator report available at: www.bafu.admin.ch/wirtschaft/15556/15610/index.html?lang=en&download=NHzLpZeg7t,lnp6I0NTU042l2Z6ln1ad1IZn4Z2qZpnO2Yuq2Z6gpJCHeoF3fWym162epYbg2c_JjKbNoKSn6A--.

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

1.2.2 GREEN ECONOMY AND THE ALPINE CONVENTION

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

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

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

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

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

Relevant Alpine economic sectors, such as farming, forestry and tourism can play a key role in the reduction of greenhouse gas emissions. The Protocol on Mountain Farming highlights the economic relevance of this sector in the Alps, which traditionally has been rooted in a balance with the environment. Moreover, it takes into account the well-being of consumers by fostering the provision of quality products. The Protocol on Mountain Forests emphasizes how wood is a renewable resource that should be used in a sustainable fashion, such as, for example, through reforestation in a natural way, through the use of indigenous forest material and adequate tree species. The Protocol recognizes the role of forests in a Green Economy, by highlighting their

economic as well as their protective, recreational and social function, and their provision of substantial ecosystem services. Finally, greening strategies in the Alps need to effectively address tourism and its environmental, social and economic balance. The Protocol on Tourism highlights the specific environmental conditions in which Alpine tourism takes place and the subsequent need to take in account 'ecological data, natural resources and limitations in the ability of ecosystems to adapt'. The greening of specific parts of the service tourism chain – such as accommodation – can also provide an important contribution to a low-carbon economy and has been a focus of the conference on climate protection and energy efficiency in the hotel and catering industry organized in 2016 in the framework of the German Presidency of the Alpine Convention.

1.2.3 MAIN PLAYERS OF A GREEN ECONOMY

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

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

Type of player	Potential role for greening the economy
Policy makers	Putting Green Economy on the policy agenda, raising awareness of other players for needs and benefits of a Green Economy, taking decisions fostering a greening of the economy.
International organisations	Development of strategies and overarching concepts; linking approaches in different countries; exchange of information.
Public administrations	Implementation of greening instruments such as regulations and financial incentives according to the level of organisation. Consideration of greening instruments within the responsibility of the administration such as sustainable public procurement.
Towns and municipalities	Coordination and implementation of instruments for greening the local economy; raising awareness amongst businesses and citizens; promoting and offering business opportunities to green businesses; sustainable public procurement. Important fields of action are energy efficiency, renewable energies and sustainable mobility.
Science and R&D institutions	Development, testing and analysis of new economic concepts, technical solutions and governance approaches.
Associations	Dissemination of knowledge and new approaches among their members: promotion of benefits of greening effects; raising awareness and responsibility of companies.
Industry and enterprises	Implementation of measures to save energy and increase efficiency in their production; good practice examples.
Consumers	Acknowledging the power of consumers; taking conscious decisions when purchasing services and products, and steering demand.

Table 1.2.3-1 Potential roles of key players.

12. Further information: www.greengrowthknowledge.org.
13. Further information: www.greeneconomycoalition.org/.

2. GREEN ECONOMY - STATUS AND TRENDS

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

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

The issues raised above are discussed in the following subchapters, focusing on:
1. an energy-efficient and low-carbon economy (chapter 2.1)
2. a resource-efficient economy (chapter 2.2)
3. ecosystem services and a natural capital-based economy (chapter 2.3)
4. an economy supporting quality of life and well-being (chapter 2.4)
5. economic well-being and social inclusion.

These topics are examined within the Green Economy framework, describing status, potentials and trends in the Alpine countries.

2.1 AN ENERGY-EFFICIENT AND LOW-CARBON ECONOMY

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

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

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

The European Union has recognized the importance of a low-carbon Alpine space by making it a priority axis in the 2014 Alpine Space Programme. It is also addressed in the macro-regional strategy for the Alps, EUSALP. There, the objective of 'Building further on the position of the Alpine region in terms of energy efficiency and sustainable production of renewable energy' is clearly emphasised and supported by a special action group.[14]

In this chapter, the focus is on three main aspects of an energy-efficient and low-carbon economy in the Alps:
1. Carbon emissions, focusing on status and trends of GHG emissions (especially CO_2 and CH_4) and their consequences, policy background and main targets for a low-carbon economy in the Alpine countries, as well as potentials for reducing CO_2 in the Alpine area.

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

2. Renewable energy sources, highlighting the situation of installed renewable energy (RE) capacity in the Alpine countries as well as the potential use of RE within the Alpine area.
3. Efficient use of energy, in particular primary and final energy consumption in different Alpine countries as well as their status and goals towards energy efficiency.

The required instruments and measures are described in chapter 3.1.

2.1.1 CARBON EMISSIONS

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

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

Background on carbon emissions

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

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

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

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

Situation of CO_2 and CH_4 emissions at the EU level

CO_2 emissions are a major contributor to global warming and account for around 80% of all greenhouse gas emissions in the EU (EUROSTAT 2016a). Several factors influence the diverse picture of CO_2 emissions in the Alpine countries. It is important to

mention that economic factors, such as the recession in 2008, as well as natural circumstances, such as cold winters resulting in higher heating rates, particularly affect CO_2 emissions. According to the JRC report (2014c) on trends in global CO_2 emissions, the economic recession after 2008 accounted for almost 50% of the greenhouse gas emission reductions in the EU countries. Another important factor in specific fossil fuel consumption is the fuel price. Last but not least, energy policies can have a strong impact on CO_2 emissions.

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

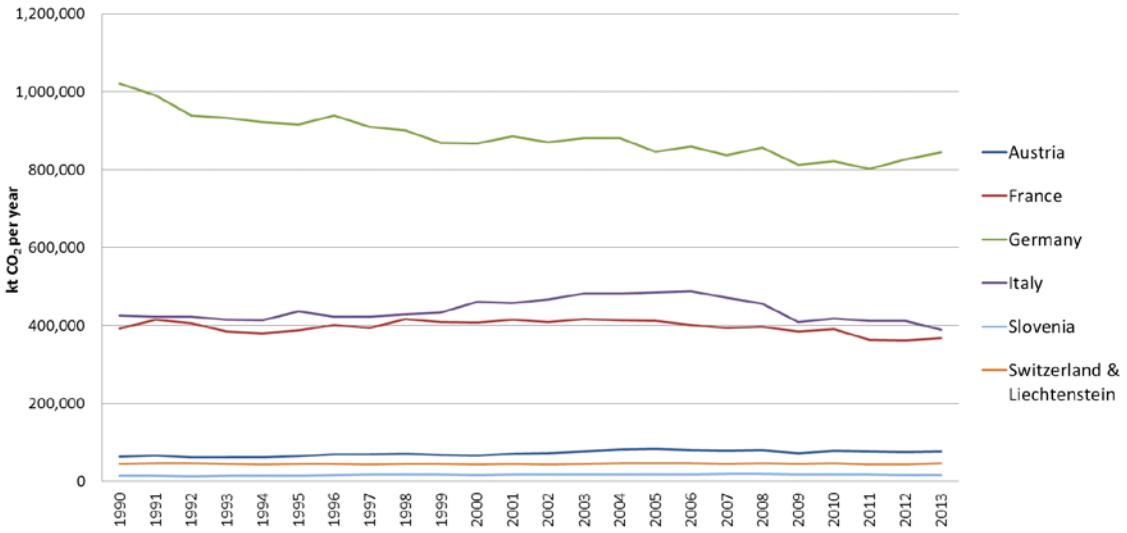


Figure 2.1.1-1 National CO_2 emissions (in kt per year) in Alpine countries from fossil fuel use and industrial processes from 1990 (base year) to 2013, in kt (Gg) CO_2 per year (Data source: JRC 2014b, graph: ifuplan 2016). Liechtenstein data have been included in the Swiss data[15].

The data show that between 1990 (base year) and 2013 three Alpine countries have reduced their CO_2 emissions: Germany (-17%), Italy (-8%) and France (-6%). In Austria (+22%), Slovenia (+13%) and Switzerland including Liechtenstein (+4%) increasing CO_2 tendencies have been reported.

Methane emissions are often underrepresented in the discussion on GHGs. Farming is a particularly relevant sector for CH_4 emissions in the Alpine region. National trends for the Alpine countries from 1990 to 2012 are reported below (Figure 2.1.1-2). Data is reported at the national level and include biofuel and biomass burning (such as agricultural waste burning, forest fires, post-burn decay, peat fires and decay of drained peatlands).

Figure 2.1.1 2 shows a decrease in CH_4 emissions in Austria (-20%), Switzerland including Liechtenstein (-17%), Germany (-51%), Italy (-25%) and Slovenia (-7%) and an increase in France (+7%).

Detailed information on GHG emission trends and contributing sectors on the national level can be found in the 'Situation in Alpine countries' section of this chapter.

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

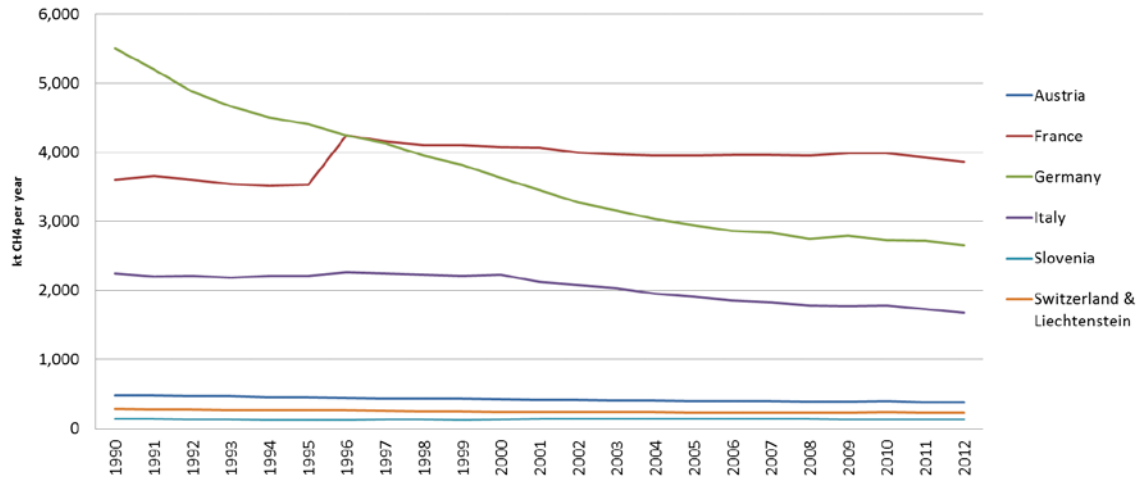


Figure 2.1.1-2 *CH_4 emissions (in kt per year) in Alpine countries including biofuel and biomass burning between 1990 and 2012 (Source: JRC 2014a, graph: ifuplan 2016). Liechtenstein data have been included in the Swiss data[16].*

Decoupling economic growth from fossil fuels

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

All in all, CO_2 emissions produced by the combustion of fossil fuels in the Alpine area have not changed significantly compared to past years (PSAC 2011, cf. Figure 2.1.1-1). Different sectors are responsible for CO_2 emissions, such as the transport, energy and heating industry as well as construction sector. On the consumer level, household heating, industrial motorised transport and the tourism sector are the main contributors to the high emissions. Against this background, these sectors play a key role in establishing a low-carbon economy in the AC area.

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

EU and international level

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

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

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

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

17. Further information: climateactiontracker.org/countries/eu.html.

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

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

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

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

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

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

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

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

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

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

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

Alpine level

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

Further information on national GHG emission targets as well as the expected national measures to achieve these goals can be found in the 'Situation in Alpine countries' section of this chapter.

Alpine relevance of carbon emissions

Sectors contributing to GHG emissions in the Alps

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

Alpine regions are taking part in the collective effort to reduce the impact of greenhouse gases by searching for adapted solutions particularly for the key sectors contributing to CO_2 emissions. These are transport, energy and heating, construction, tourism and private households.

On the consumer side, household heating accounts for the highest share in CO_2 emissions. Climatic circumstances, in particular extreme weather conditions in wintertime, have an important influence on emissions in the Alps.

Tourism and transport are further important contributors to GHG emissions in the Alps. Due to topographic features and limited accessibility of some regions in the Alps, high CO_2 emissions are caused by transport, especially by trucks. Motorised road traffic (individual and freight transport) bears the main responsibility for CO_2 emissions caused by transport (93%). The first Report on the State of the Alps (PSAC 2007) shows that 84% of all tourists travel to their destination in the Alps by car. Comparing the CO_2emissions caused by tourism with those from transport highlights a higher growth in transport related "well to wheels" than in passenger transport by car (PSAC 2013).

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

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

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

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

Further information: alpine.adelphi.de/de

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

The energy sector quite certainly is one of the most promising areas with a significant potential in terms of energy efficiency and use of local assets for RE production. The construction industry is a promising sector for achieving energy savings and GHG emission cuts, as many old buildings need renovation. Energy-efficient construction methods and examples of refurbishment and retrofitting projects in the Alps are described in chapter 2.3.1.

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

Climate protection and adaptation in the Alps

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

Climate-friendly innovations in the Alps could help to reduce CO_2 emissions, e.g. through climate-friendly local and regional transport, energy-efficient construction and refurbishment, sustainable food and energy production, regional cycles or climate-friendly tourism. Information on the status quo as well as suggestions on mitigation measures can be found in chapter 3.1.2.

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

In fact, early adaptation means lower costs to society and less residual damage. Economic assessments of the monetary benefits of adaptation vary across sectors and require a case-by-case approach. However, adaptation can provide immediate benefits where

it is applied (which is not the case with mitigation). That is also the reason why many adaptation measures have been introduced autonomously by individual stakeholders operating in different sectors in response to market or environmental changes (PSAC 2015b). If such measures are not properly taken, the costs of mitigation will be higher and the consequences of climate change will be more serious, before they can eventually be balanced out by the long-run effects of mitigation policies (Stern-Report 2007).

Technical and infrastructural adaptation measures are usually found in areas such as water and natural hazard management, and tourism. These sectors are particularly affected by climate change in terms of water availability, and the frequency and quantity of snow during the winter season. Alternative solutions are often possible, as there is a wide range of hard (technical) and soft (awareness raising) behavioural measures to choose from. An economic assessment of these measures and their cost-effectiveness might help both public bodies and companies to identify suitable local adaptation measures, cut adaptation costs (including planning, preparing for, facilitating, and implementing adaptation measures, and transition costs) and bring about substantial benefits, including economic ones (defined as: avoided damage costs or the accrued benefits following the adoption and implementation of adaptation measures). For instance, accurate assessment of public expenditures for new ski facilities in resorts threatened by reduced snowfall can help to avoid ineffective and unprofitable investment of public money (CIPRA 2011).

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

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

Situation in Alpine countries

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

AUSTRIA

For reaching the Kyoto target (13% below 1990), Austria has formulated a National Climate Strategy (Klimastrategie 2002; BMLFUW 2002) that was adopted in 2007 (BMLFUW 2007). In 2011, the Climate Protection Law (KSG 2011; BGBl. 2011I Nr. 106/2011) came into effect and was amended in 2013 (BGBl. 2011I Nr. 94/2013). It defines maximum amounts of GHG emissions until 2020 for each sector. By 2020, Austria needs to reduce its emissions not covered by the EU ETS (EU Emissions Trading Scheme) by 16% compared to 2005 in accordance with the Effort Sharing Decision (ESD) (Decision No 406/2009/EC).

Figure 2.1.1-3 shows that the average 2008–2011 emissions in Austria were 5.4% higher than the base-year level (1990) and thus significantly exceeded the burden-sharing target (Kyoto target; UN 1998) of -13% for the period 2008-2012. involved, including mountain municipalities.

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

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

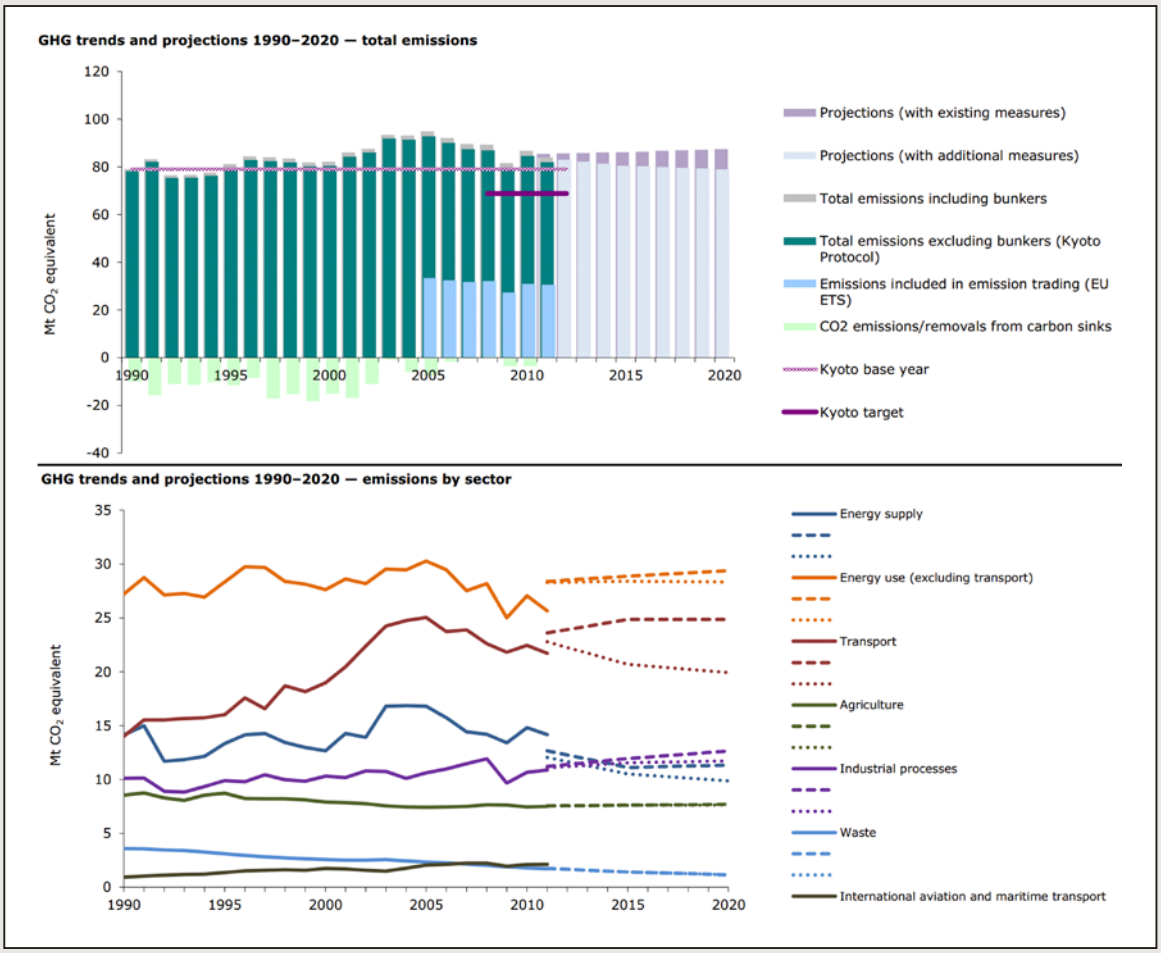


Figure 2.1.1-3 GHG trends and projections 1990-2020 – total emissions as well as emissions by sector in Austria (Source: EEA 2011a, p.2).

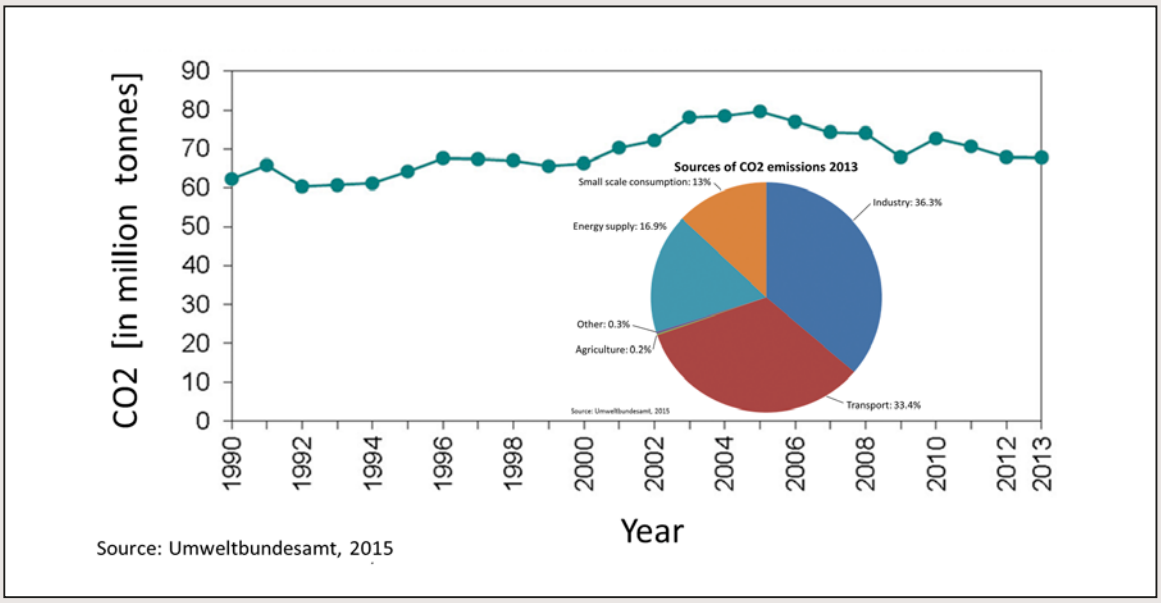


Figure 2.1.1-4 CO_2 emission trends (1990-2013) in Austria (Source: UBA Austria 2015a, p.57).

According to the statistical trends (see Figure 2.1.1-4) summarised by the Federal Environmental Agency of Austria (UBA Austria 2015a), CO_2 emissions in 2013 were 8.9% above the 1990 level. In this last documented year (2013), 67.8 million tons of CO_2 were emitted, that is 0.1% less than in the year before (2012). The distribution of CO_2 pollutants shows that emissions from industry (36.3%) and transportation (33.4%) make up the largest share. However, energy supply (16.9%) and small household consumption (13.0%) are relevant as well. Agriculture (0.2%) and other sectors like waste combustion (0.3%) only marginally contribute to CO_2 production (UBA Austria 2015a).

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

FRANCE

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

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

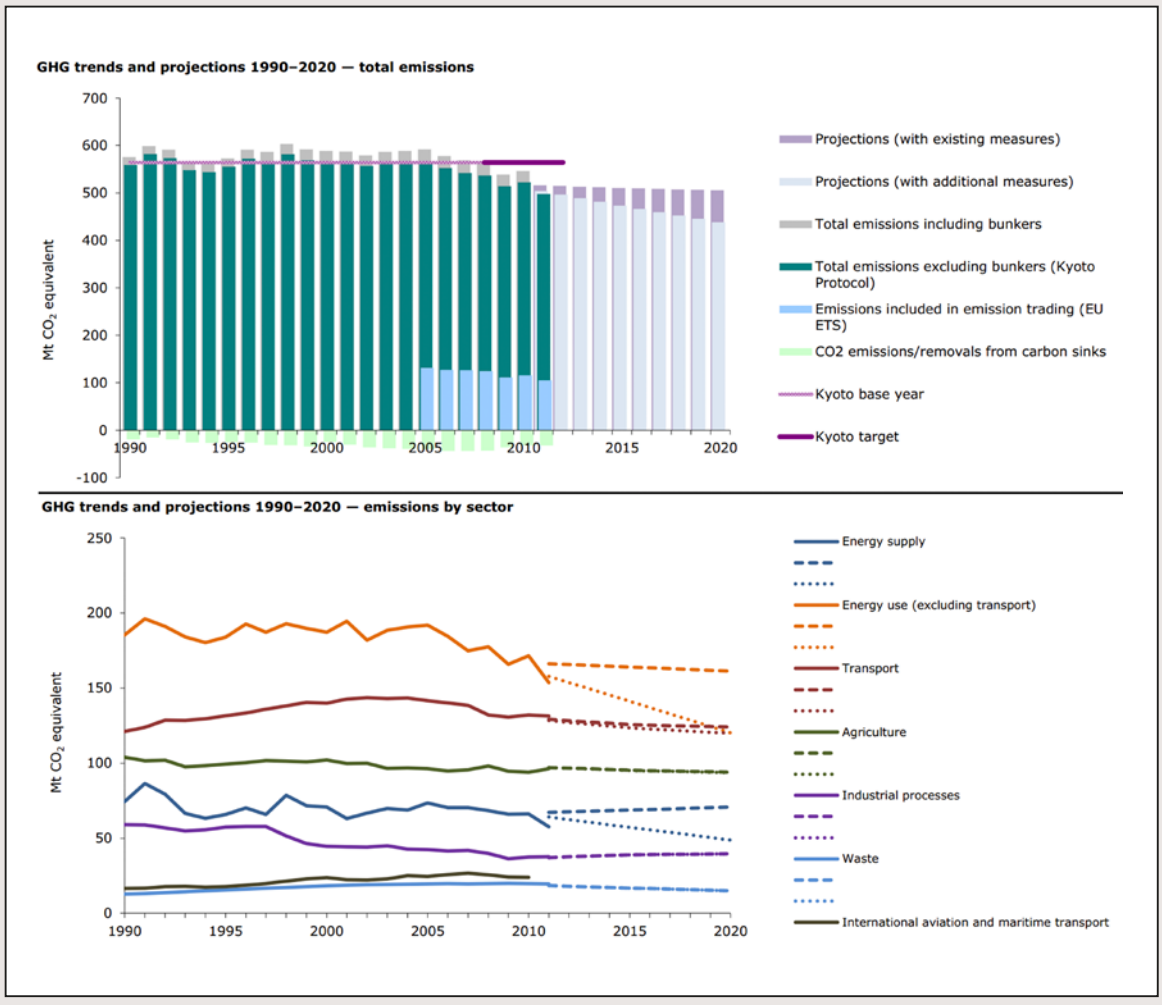


Figure 2.1.1-5 GHG trends and projections for 1990-2020 total emissions as well as emissions by sectors in France (Source: EEA 2011b, p.2).

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

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

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

GERMANY

Germany´s GHG emission reduction targets set by the German *Energiewende*[21] programme are summarised in Table 2.1.1-2.

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

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

Until 2014, a reduction of 27% (346 million tonnes CO_2 eq.) in CO_2 emissions was achieved, compared to 1990 levels. By 2008, Germany had more than fulfilled its greenhouse gas reduction targets under the Kyoto Protocol. However, the Federal Environment Agency (UBA), which collects Germany's official emissions data, estimated in March 2016 that emissions had increased again by 6 million tonnes or 0.7% from 2014 to 2015. Thus the total emissions amounted to 908 million tonnes in 2015 (cf. Figure 2.1.1 6).

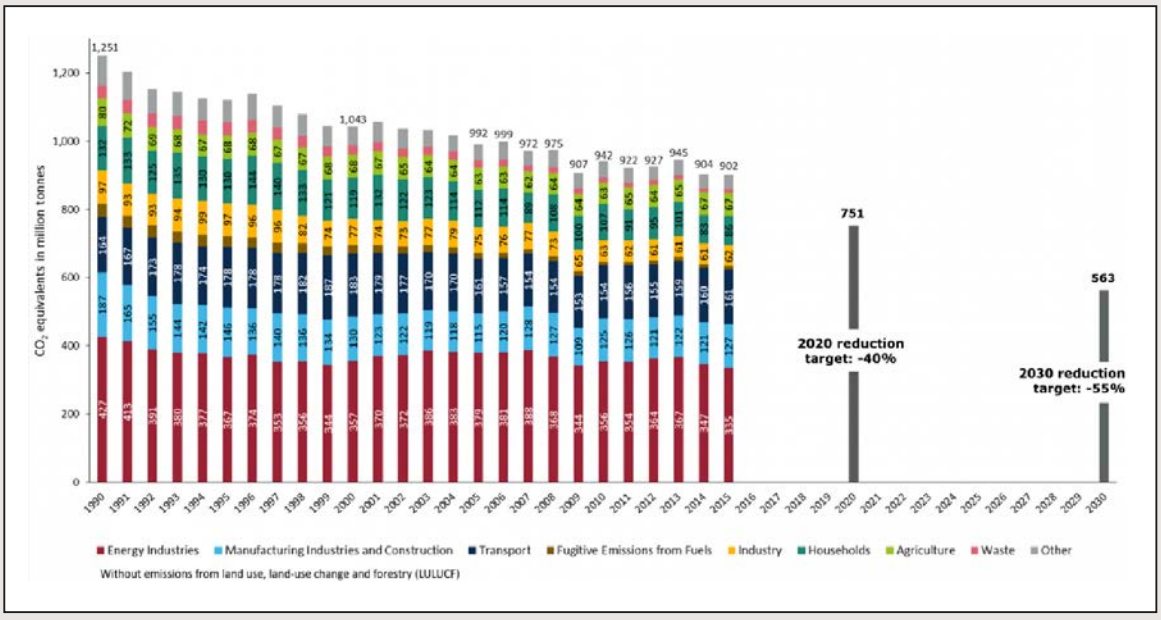


Figure 2.1.1-6 GHG emissions in Germany from 1990-2015 by sources and emission reduction targets to 2020 and 2030 (Source: UBA Germany 2016).

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

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

ITALY

Italy imports 86.4% of its consumed energy from abroad. The residential and public sector account for 36.3% of energy demand, the transportation sector for 32.5%, and industry for 23.4%. Total net production at the country level (269,147.9 GWh) is covered by traditional thermoelectric power plants (62%), hydropower (21%) and other sources. Italy does not produce any nuclear energy.

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

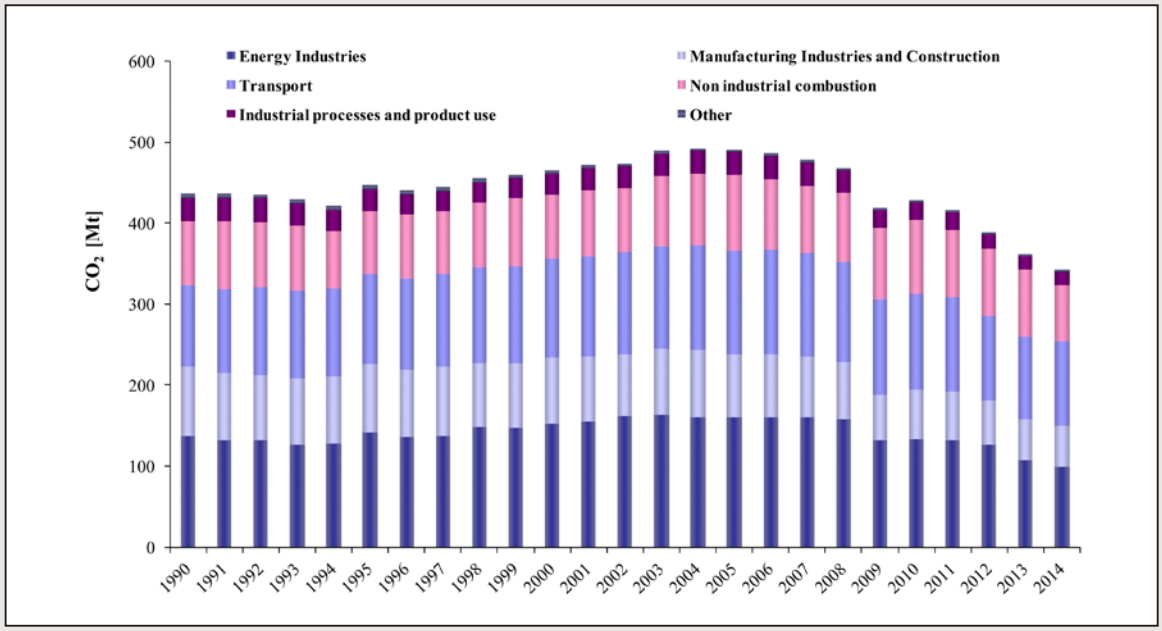


Figure 2.1.1-7 Italian national CO_2 emissions by sector from 1990 to 2014 in Mt (Source: ISPRA 2016, p.51).

In Italy, CO_2 emissions excluding land use, land use change and forestry have decreased by 27.24% from 1990 to 2014, ranging between 436.2 and 342.8 million tons. The most relevant emissions derive from transportation (30.25%) and energy industry (28.94%). Other sectors (20.34%), manufacturing and construction (14.81%) and industrial processes (4.57%) basically make up the remaining quota of CO_2 emissions. Looking more in depth at the main contributing sectors

(see Figure 2.1.1 7), it is worth noticing that over the 1990-2014 period, the energy industry's share has been decreasing by 39.22%, manufacturing and construction by 66.44%, and industrial processes by 86.63%. Only the transportation sector has seen a small increase of 2.31% (ISPRA 2016).

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

Some figures for the regional level are available for 2010 where trends in tons of CO_2 per capita are shown (cf. Table 2.1.1-3). At that time, the eastern Alpine regions showed an average value of 8.1 tons, the western ones 8.6. Both values are above the national average (7.4).

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

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

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

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

LIECHTENSTEIN

In the framework of the second commitment period of the Kyoto Protocol, Liechtenstein has introduced a legally binding emission reduction target of at least 20% from 1990 to 2020. Due to the 2 °C goal as well as the doubling of its climate goals, Liechtenstein is ready to reduce its emissions by 40% until 2030 (140 kt CO_2). For 2035, it aims at 3.7 tCO_2 per inhabitant and year, for 2050 at 1.7 t/cap/a. The 2012 nationwide emissions are equivalent to 1990 levels (225,000 tons CO_2 equ.) despite a significant economic and population growth of +25% (Franke 2015).

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

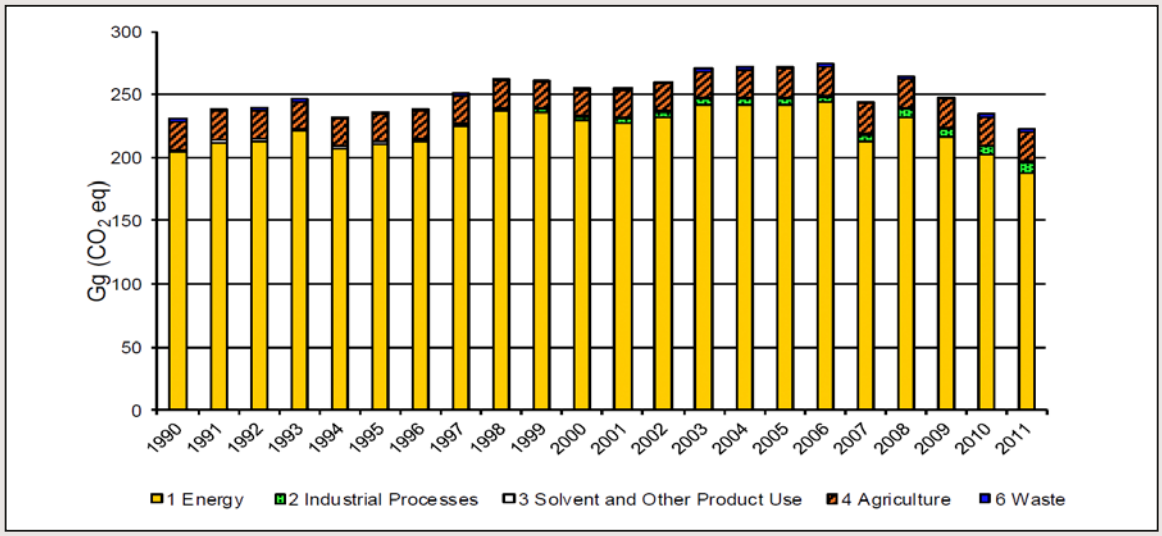


Figure 2.1.1-8 *Trend of Liechtenstein's greenhouse gas emissions by main source categories in CO_2 equivalent (Gg), 1990-2011, excl. net CO_2 from LULUCF (Source: Office of the Environment 2013, p.56).*

SLOVENIA

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

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

The most recent projections demonstrate that the binding national targets under ESD will be achieved and even exceeded throughout the period 2013-2020. The greatest uncertainties in the projection are related to the transport sector. A

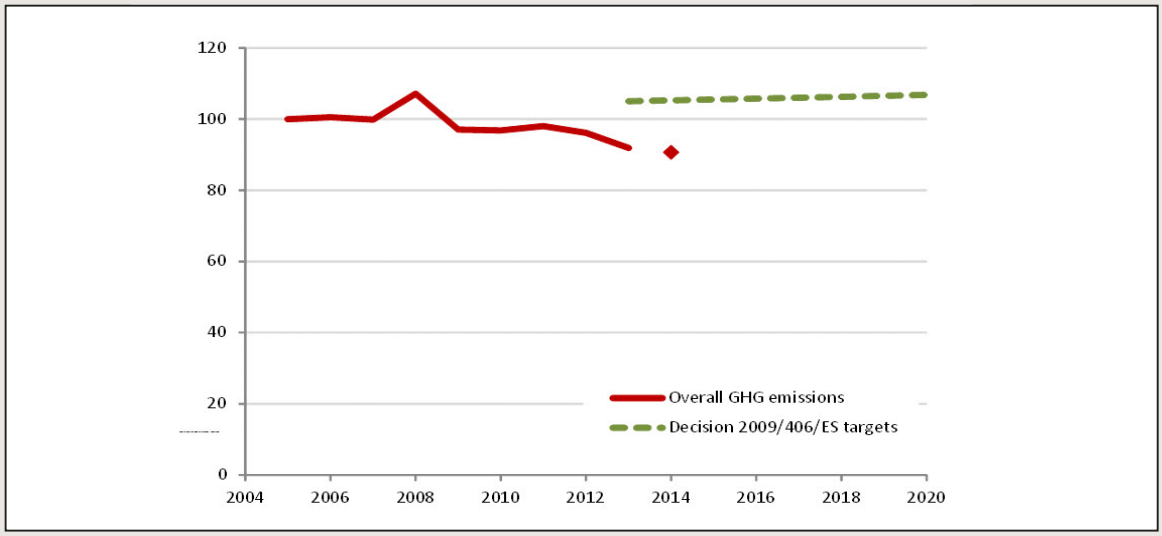


Figure 2.1.1-9 *Changes in ESD (Effort Sharing Decision) sector emissions in Slovenia in the period 2005-2014 compared with the 2013-2020 emission target trajectory calculated based on emissions in 2005 (2005=100) (Source: MOP 2016, p.4).*

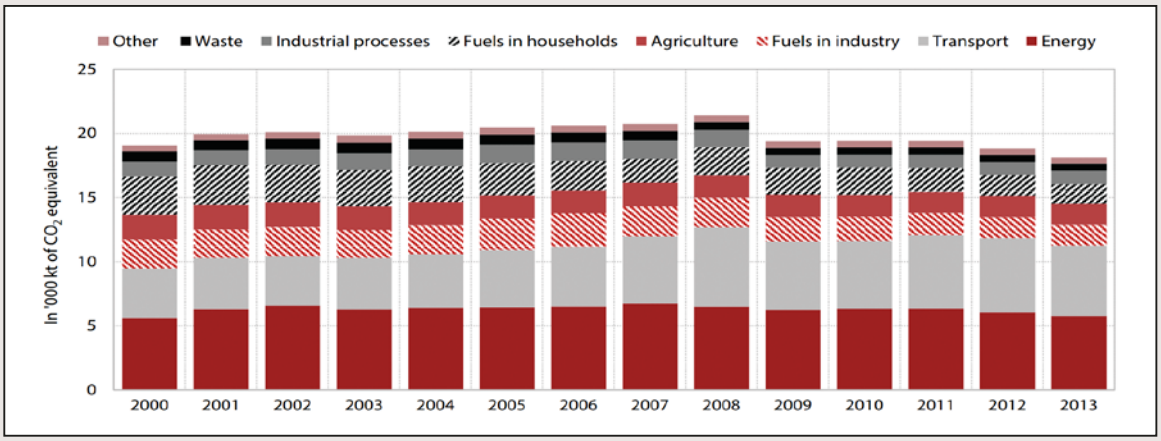


Figure 2.1.1-10 GHG emissions by sectors in Slovenia (Source: IMAD 2015).

sensitivity analysis of the impact of transit traffic in projections was made that compared scenarios of the implementation of measures in the transport sector. The range between the highest and lowest projections of GHG emissions in transport amounted to 37%. The worst-case scenario shows a stagnation of total GHG emissions in ESD sectors in the period 2012-2020, which is still sufficient to achieve the national targets for 2020 (see Figure 2.1.1-9).

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

SWITZERLAND

By signing the Kyoto Protocol, Switzerland committed itself to reducing its greenhouse gas emissions during the period 2008-2012 to 8% below the 1990 level. In order to achieve the Kyoto target, the Swiss government has adopted a specific CO_2 Act in 1999. Since 2013, a revised CO_2 Act is in force. It foresees that Switzerland reduces its greenhouse gas emissions by at least 20% by 2020 compared to the 1990 level[22]. For the UN climate conference in Paris (COP21),

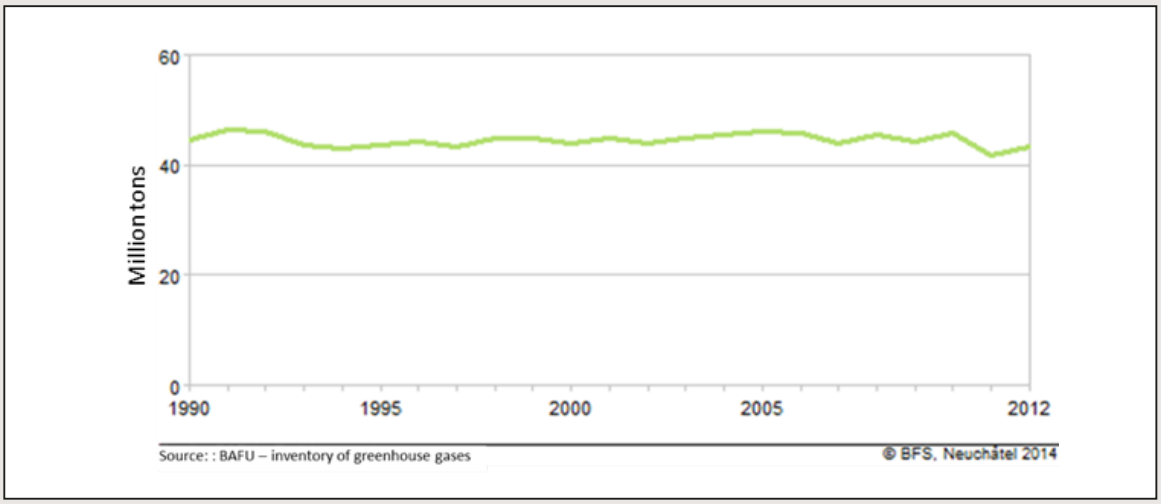


Figure 2.1.1-11 National CO_2 emissions of Switzerland according to the Greenhouse Gas Inventory in million tons, 1990-2012 (Source: Schweizerische Eidgenossenschaft 2014).

22. Further information: www.bfs.admin.ch/bfs/portal/de/index/themen/21/02/ind32.indicator.72205.3211.html.

Switzerland has submitted its GHG emission goals for 2030. Switzerland wants to achieve a 50% decrease compared to the 1990 value[23].

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

In 2013, around 31% of GHG emissions in Switzerland were caused by transport. Transport thus is the biggest contributor, followed by the industry sector (21%) and households (20%). With 7%, waste emissions have the smallest percentage (see Figure 2.1.1-12).

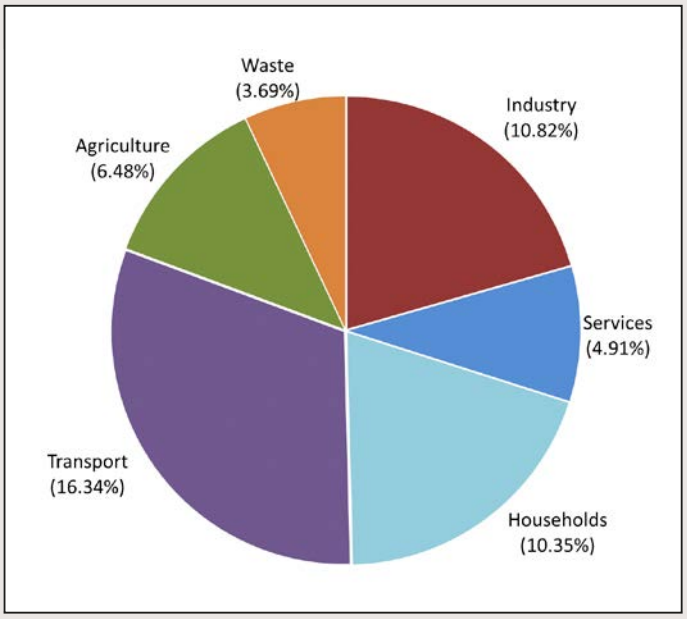


Figure 2.1.1-12 Swiss GHG emissions by sector (CO_2 equivalent) in 2013 (Source: BAFU 2015).

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

Good practice – klimaaktiv mobil, Austria

The initiative of the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) has significant effects on climate protection, environment and health, provides an essential impetus for the economy and for securing jobs, and supports the local development in rural areas and Alpine regions.

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

The klimaaktiv mobil investment funding programme for alternative vehicles and electro mobility, the expansion of the infrastructure for cycling as well as the promotion of mobility management are important contributions to meeting the requirements of the Austrian Climate Protection Act and the Federal Act on Energy Efficiency. They also create important stimuli for the economy. Therefore, klimaaktiv mobil also contributes to job security and to the creation of green jobs. At the same time, new opportunities for industries and businesses, cities and communities emerge.
Klimaaktiv mobil achievements 2007-2015:

- *6,600 climate-friendly mobility projects were implemented by 5,000 businesses, 700 towns, municipalities and regions, 650 providers of tourism services and 250 schools.*
- *These projects have achieved an annual reduction of 610,000 tons of CO_2 emissions.*

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

- *€79.6 million of public funding spent on these environmentally friendly mobility projects have led to a total investment volume of more than €500 million.*
- *Approximately 6,000 'green jobs' have been secured or created.*

Further Information: www.klimaaktivmobil.at

Good practice – '100% from the region for the region – Sustainable energy supply in Achental', Germany

The main goal of this programme was to create a model of sustainable energy supply and utilisation in the entire Achental through the creation of regional cycles, targeted sourcing, processing and supply of all bioenergy resources in the region, as well as optimised logistics and processing. At the same time, resulting CO_2 emissions were minimised, efficiently utilising resources through combined heat and power and small-scale district heating networks. The programme also curbed demand through savings in heat and power consumption. By 2020, the Achental strives to achieve self-sufficiency in terms of energy supply, with annual savings of 128,000 tons in CO_2 (reference year 2006).

Further Information: www.oekomodell.de

CO_2 reduction capacity of the Alps and mitigation opportunities

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

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

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

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

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

1) A high exploitation of reduction capacity and comparatively low CO_2 emissions (Austria: western and central part of Tyrol; Germany: Garmisch-Partenkirchen, Bad-Tölz, Wolfratshausen and Miesbach; Slovenia: Goriska and Gorenjska).
2) A high reduction capacity but also high CO_2 emissions (Austria: Tyrolean Oberland and Upper Austria; Italy: Trentino; Slovenia: Osrednjeslovenska).

The most challenging areas are the ones in beige and red, where CO_2 levels are still high.

Different pictures can be drawn on CO_2 reduction capacity of the Alpine countries. Liechtenstein has significant reduction capacities in the buildings sector as well as in the transport sector. With its energy transition (Energiewende), Germany is shifting to a power system based on renewable energies while phasing out nuclear power. Moreover, there is considerable reduction capacity within the transport sector (BMWi & IKA 2012). Austria has very good prerequisites for CO_2 reduction in terms of RE potential and good conditions for low-carbon and energy-efficient technologies. According to recent research analyses (e.g. Ajanovic & Haas 2014), the

CO_2 reduction capacity in Austria is 7 million ton CO_2 equivalent by 2050. The potential amount for each sector has been summarised in the report on GHG projections and the assessment of policies and measures by the Federal Ministry (UBA Austria 2013).

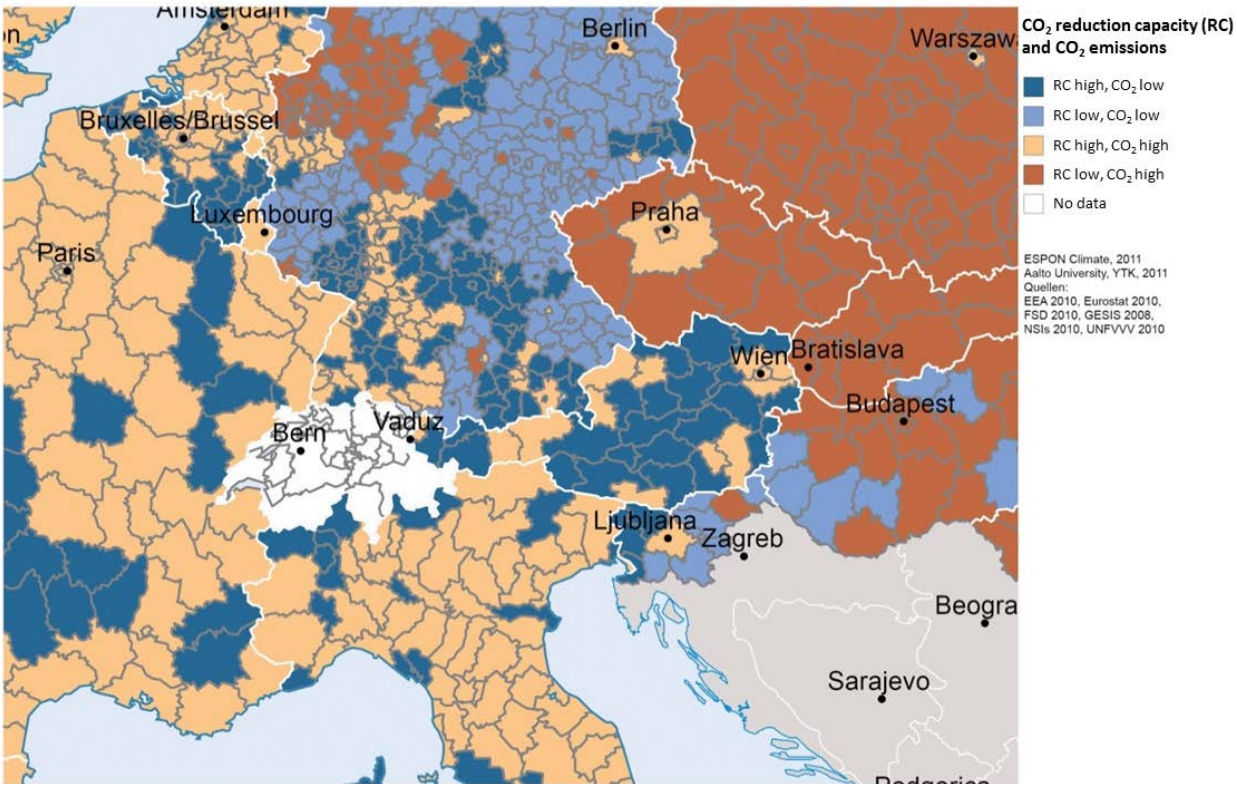


Figure 2.1.1-13 CO_2 reduction capacity (RC) vs. CO_2 emissions of the Alpine countries (Source: BBSR 2012, p.15).

Carbon sequestration potential of Alpine forests

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

Conclusions on opportunities and challenges

Status conclusions:

To sum up the above results, it can be concluded that progress to achieve the climate goals of the Paris agreement as well as the 2020 EU targets varies among the Alpine countries:

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

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

- Due to natural as well as anthropogenic circumstances (e.g. CO_2 emissions caused by the transport sector due to the topography and heating of households in wintertime), there is a responsibility of the Alpine area for climate protection.
- The national trends on GHG emissions show that efforts in GHG reduction are not sufficient in all Alpine countries.
- The continuous use of fossil fuels without taking into account externalities in the Alpine region hinders innovation in the energy sector and makes the Alpine area economically and environmentally vulnerable. There is a need for an absolute decoupling of the economy from fossil fuels.

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

- There is a need for adaptation due the economic and ecological vulnerability of the Alps.
- Adaptation to natural hazards, adaptation to changing water discharge (e.g. due to the fact that water will no longer be stored in snow and glaciers), and different production patterns for agriculture (e.g. due to changing harvest yields) are required.

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

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

Opportunities

- The Alpine region has a significant capacity for CO_2 reduction based on the potential for installing renewable energy power plants, increasing energy efficiency through innovative technologies, and promoting CO_2 sequestration in Alpine forests.
- Increasing the use of renewable energies and local energy sources and reducing the Alpine area's dependency on fossil fuels can be a triggering factor for an innovation towards a low-carbon economy that can and will bring benefits to the Alpine economy, environment and society.
- Initiatives by local, regional and non-state actors (e.g. municipalities, regional governments and businesses) are key factors to reduce greenhouse gases. Their efforts strongly contribute to achieving regional climate targets.

Challenges

- Among the biggest challenges on the path to a low-carbon economy are the urgently needed schedule for adaptation and the introduction of adequate policies in a timely manner.
- A further challenge will lie in accelerating the implementation of measures as well as in transferring innovative approaches of pilot regions to the whole Alpine area.

2.1.2 RENEWABLE ENERGY SOURCES

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

Background information on renewable energy sources

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

European level

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

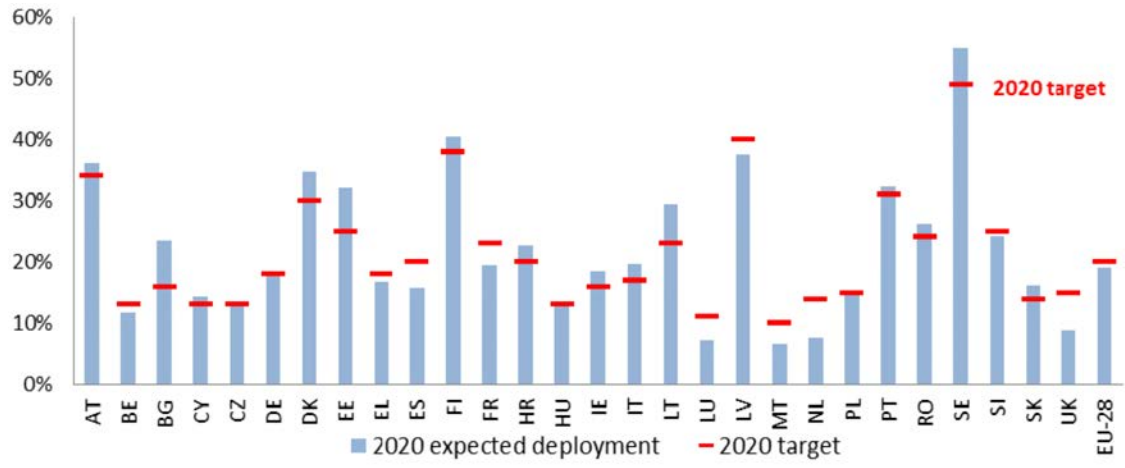


Figure 2.1.2-1 Expected RES development in EU Member States and 2020 RE targets in per cent. Countries belonging to the Alpine Convention are presented in green (Source: EEA 2015h, p.5. Note: Modelling is based on policy measures implemented only until 2013).

Figure 2.1.2-1 projects trajectories with current and planned policies until 2013 that have been described in the NREAPs, as well as the set RE targets until 2020. The target for the share of energy from RE sources in gross final energy consumption until 2020 is set at 34% in Austria, 23% in France, 18% in Germany, 17% in Italy, and 25% in Slovenia (Annex I of Directive 2009/28/EC). The goal in Switzerland is to increase the proportion of electricity produced from RE by at least 5400 GWh. Liechtenstein has no precise goals for 2020.

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

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

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

Alpine level

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

Furthermore, the Alpine Convention´s Water Management Platform has drafted guidelines for the use of small hydropower.

Figure 2.1.2-2 illustrates the shares of RE sources in total RE energy production per Alpine country in 2011. The biggest share of energy production from RE lies in biomass including waste, as well as hydropower (Swiss Confederation et al. 2015). It should be noted that since 2011 the composition of renewable energy sources in the Alpine countries has shifted in favour of wind power and solar energy.

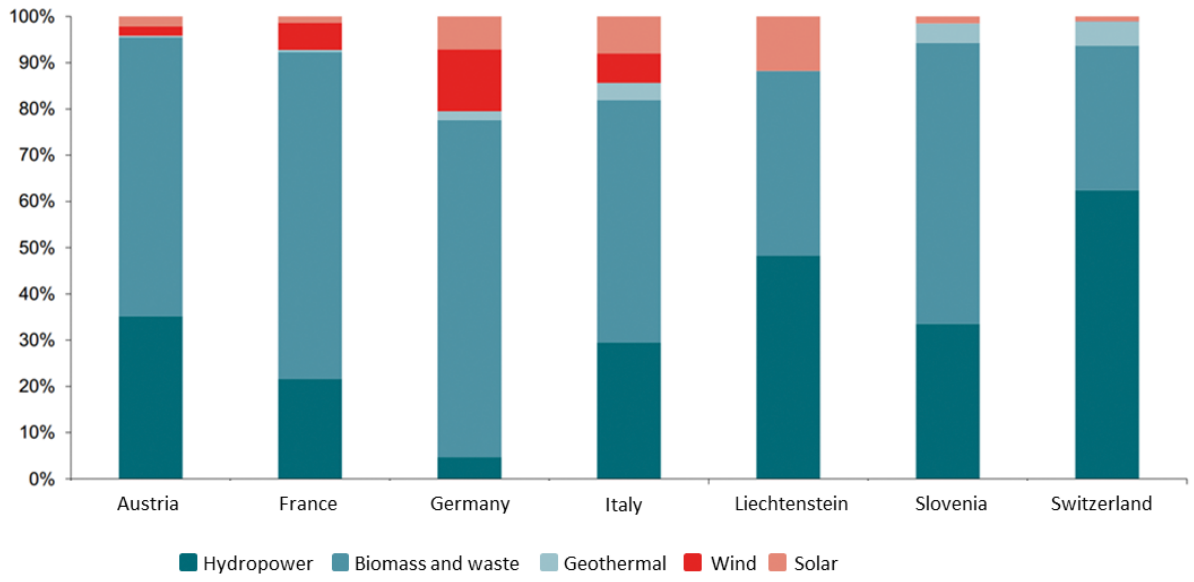


Figure 2.1.2-2 Share of hydropower, biomass including renewable waste, geothermal, wind and solar energy in RE production for each Alpine country in 2011 (Source: Swiss Confederation et al. 2015).

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

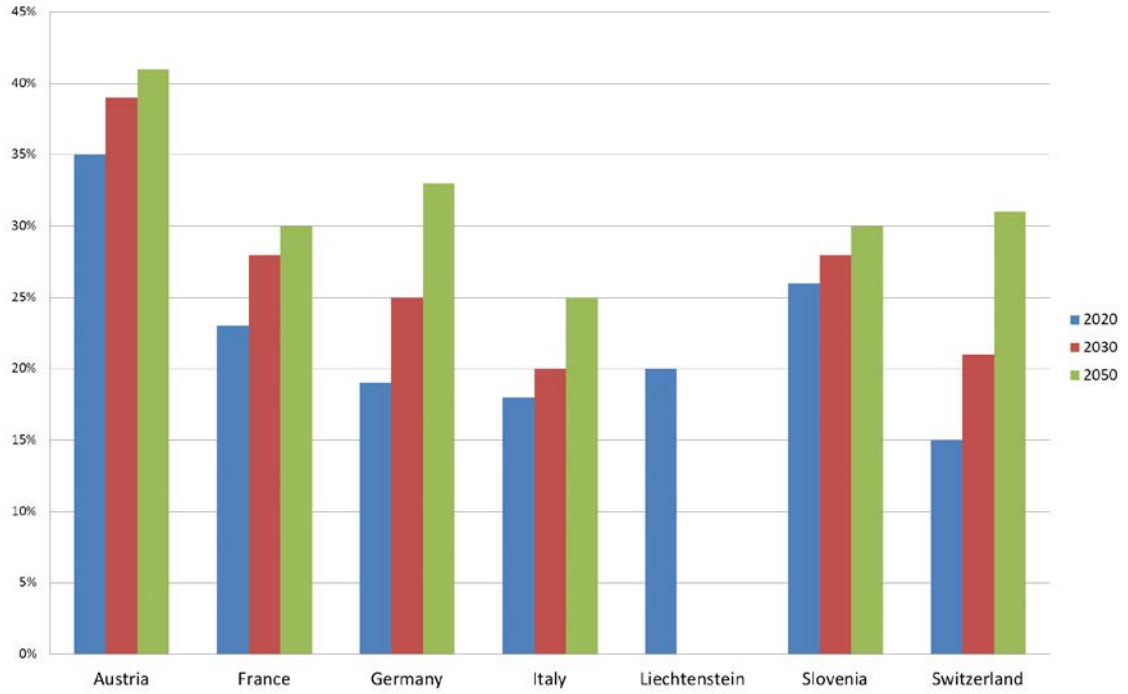


Figure 2.1.2-3 Projected share of RES in final energy demand (%) per year of the Alpine countries in 2020, 2030 and 2050 (Source: Swiss Confederation et al. 2015, p. 26, graph: ifuplan 2016).

Alpine relevance of renewable energy sources

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

In order to create an efficient and resilient system with a high share of renewable energies within the Alpine area, concrete measures are needed to promote an increased supply of RE, taking into account their social, ecological and economic implications. For future RE plans and the construction of RE facilities, as well as for the *Renewable Alps* vision (Schweizerische Eidgenossenschaft 2015), the carrying capacity of the ecosystems in the Alpine area will have to be taken into consideration.

The Alpine area is predestined for a multifaceted, decentralised generation of power from renewable energy sources. Many of these sources are intermittent, and power usage needs to better adapt to power generation. While demand-side management offers potential, intelligent storage technologies can provide for cost-effective buffering in metropolitan areas as well as in scattered habitats. The development of 'smart grids' – infrastructure based on modern information and communication technologies – seems to be essential for the Alpine area. Smart energy management and sustainable mobility solutions have been developed in the context of the AlpStore[24] project.

24. Further information: www.alpstore.info/ .

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

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

'How to balance nature conservation and avoid land use conflicts during the development and operation of energy projects' was the central question of a report commissioned by Germany following the 13th Alpine Conference. It was agreed that Germany would collect best practice examples of energy projects to demonstrate how the above-mentioned question can be best dealt with. For this best practice report, forward-looking, economically viable projects and especially efficient technological solutions that constitute effective solutions for nature conservation aspects and land use conflicts were collected. Moreover, procedural aspects of the projects, e.g. participation of stakeholders, information exchange and planning methods were evaluated. The report focuses on successfully implemented energy projects that produce, transmit or store energy rather than research projects. The final report was presented during the Alpweek in October 2016.

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

Situation in Alpine countries

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

Status on RE and installed capacity of the Alpine countries (Alpine and national level)

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

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

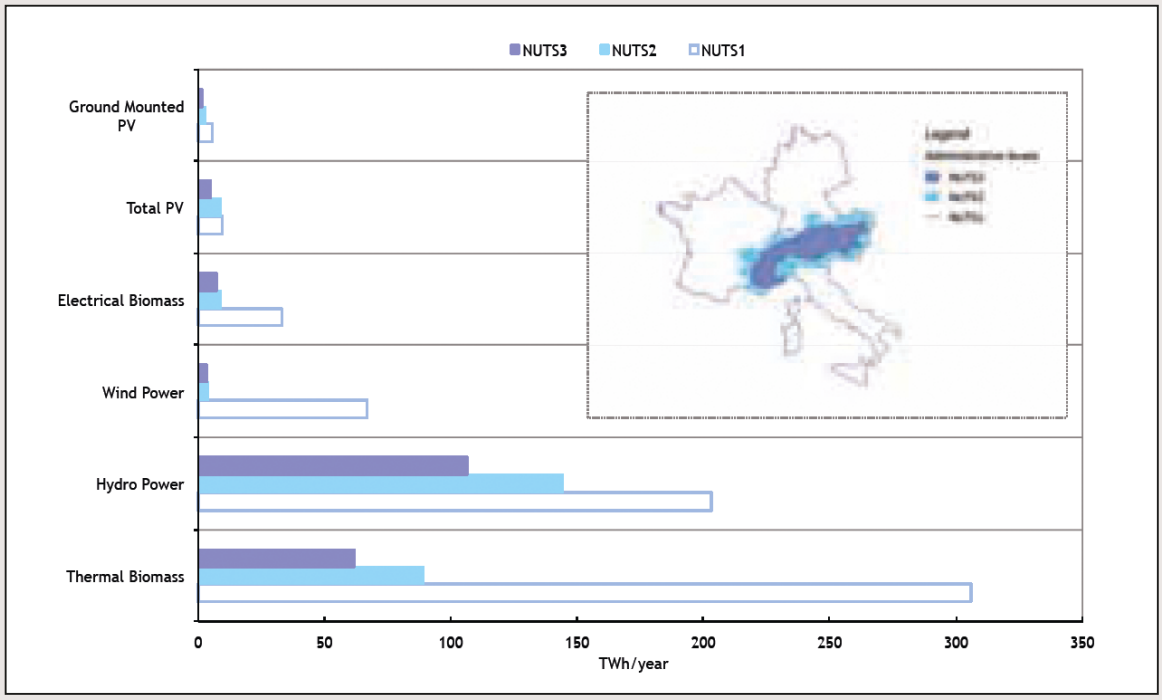


Figure 2.1.2-4 RE production in the Alpine countries (NUTS1) and in the total NUTS2 and NUTS3 unit (Source: Recharge Green 2015).

AUSTRIA

In Austria, the Green Electricity Act 2012 (BGBl.I Nr. 75/2011) has established goals to increase the installed capacities between 2010 and 2020 for the following RES:

- hydropower (1,000 MW)
- wind power (2,000 MW)
- biomass and biogas (200 MW)
- photovoltaics (1,200 MW).

According to the statistics of E-Control Austria[25] on RE installed capacity trends, the installation of wind power as well as biomass power plants stalled between 2006 and 2010 due to unfavourable conditions in the previous Green Electricity Act. Since 2010 we have seen significant increases for both types of power plants every year, which are expected to continue.

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

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

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

The spatial distribution of the individual sources of energy differs strongly. Whereas, for example, the utilisation of hydropower primarily takes place in the Alpine area (cf. Figure 2.1.2-6), wind energy plants can be found in the north

25. Further information: www.e-control.at/statistik/strom/bestandsstatistik.

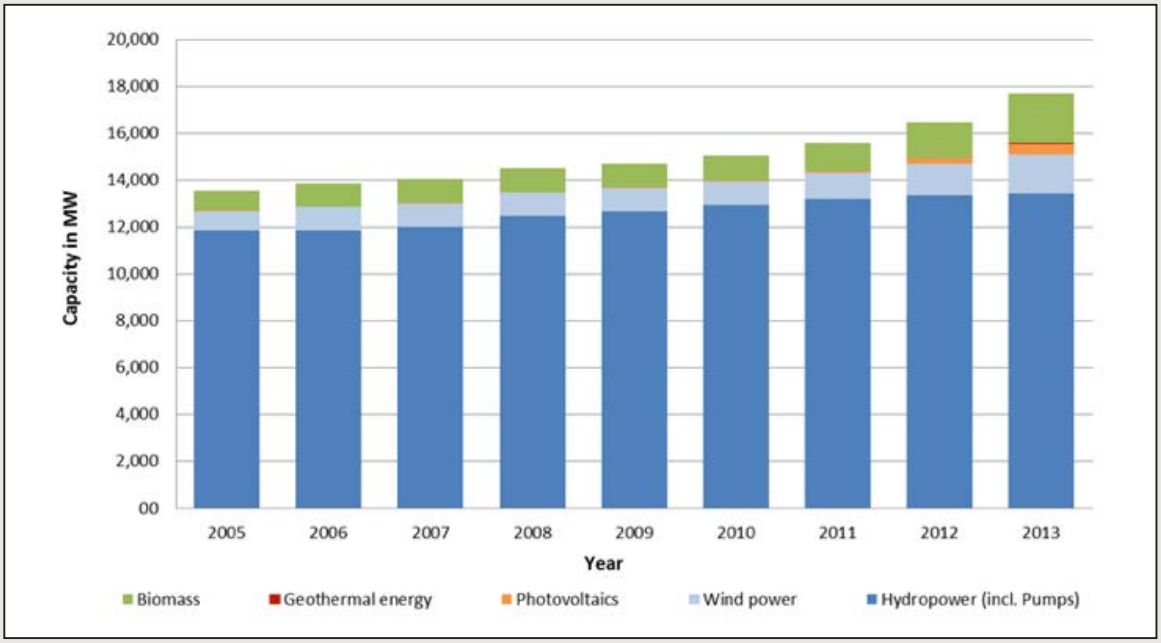


Figure 2.1.2-5 Installed capacity of RE sources in Austria from 2005-2013 (Source: Umweltbundesamt Austria 2015, graph: ifuplan 2016).

Source of energy	Installed capacity in MW	Feed-in volume in GWh	Number of plants	Fees in million €	Share of feed-in subsidies for eco-e-lectricity (% of total electricity supply)	Average fees in cent/kWh
Small-scale hydropower stations (subsidized)	342	1,371.3	1,801	66.6	2.40%	4.86
Other green electricity plants	2,306	5,769.2	16,681	680.4	10.10%	11.79
Wind power	1,555	2,970.0	295	247.6	5.20%	8.34
Biomass, solid	322	2,013.0	129	272.8	3.50%	13.55
Biomass, gaseous[26]	83	544.3	293	96.8	1.00%	17.79
Biomass, liquid	5.0	0.19	32	0.02	0.0003%	11.83
Photovoltaics	324	215.2	15,886	61.7	0.38%	28.67
Landfill gas and sewage treatment plant gas	15.8	26.0	44	1.4	0.05%	5.42
Geothermal energy	0.9	0.306	2	0.012	0.0005%	3.85
Total small-scale hydropower plants and other green electricity plants	2,648	7,140.5	18,482	747.1	12.50%	10.46

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

26. Including operating cost surcharges (for 2013 and second half of 2012) / raw material cost surcharges (for first half of 2012).

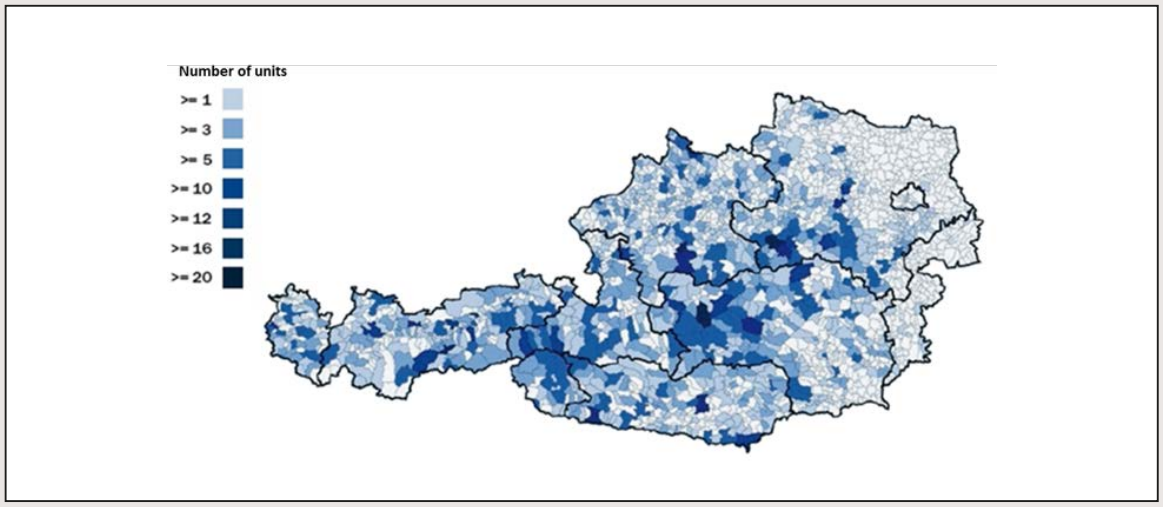


Figure 2.1.2-6 *Regional distribution of small-scale hydropower by number of plants in Austria, based on the green electricity report (Ökostrombericht) 2014 (Source: E-control Austria 2014 (Electricity Guarantee of Origin Database)[27].*

and in the east of Austria. Forests located in mid-mountain tourist resorts are increasingly in the focus of interest. Other sources of energy, such as biomass or biogas, show an almost homogeneous distribution, while the major part of photovoltaics plants is located outside the Alpine area.

According to the 2014 green electricity report, the share of green electricity (domestic production) in the consumption amounted to 70% in 2013, after having already amounted to 73% in 2012. The decline was due to a moderate increase in consumption and a reduction in hydropower.

Figure 2.1.2-7 shows the development of consumption in the public network including pumped storage, as well as the share of electricity from renewable sources of energy (subsidized green electricity and hydropower).

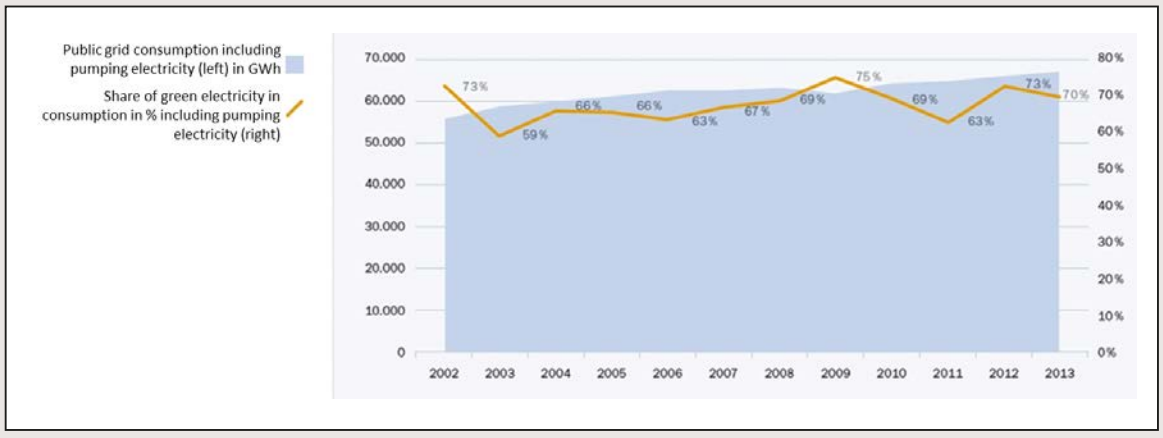


Figure 2.1.2-7 *Share of electricity from renewables from domestic production (in GWh) in the final consumption in Austria (Source: E-control Austria 2014).*

27. Further information: www.e-control.at/marktteilnehmer/strom/e-diskurs/e-diskurs-archiv/stromnachweisdatenbank.

GERMANY

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

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

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

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

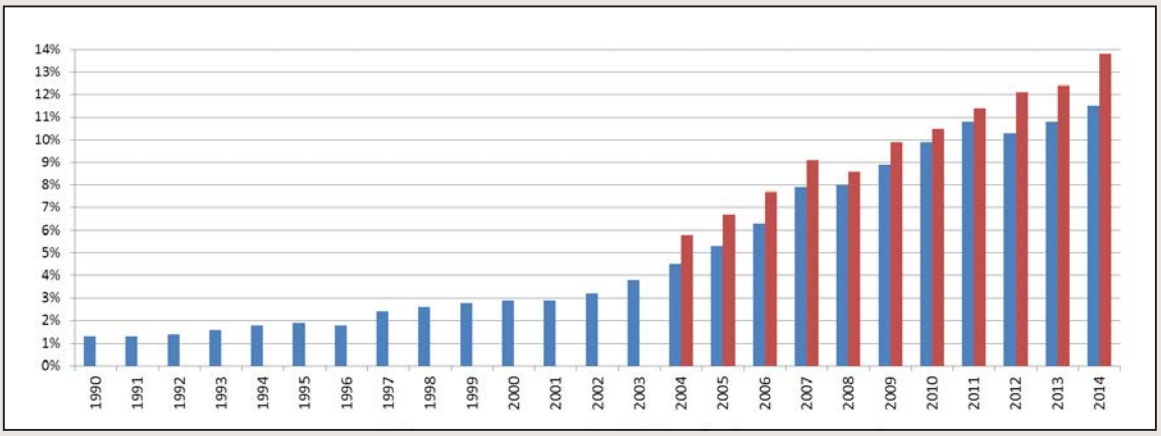


Figure 2.1.2-8 Share of RE in primary energy consumption (blue) and in total final energy consumption (red) in Germany, 1990-2014 (Source: BMWi 2016, graph: ifuplan 2016).

In 2013, total gross electricity generation in Germany was at 634 TWh. This was a result of a continuous increase from 1993. However, the economic crisis in 2008 caused a relevant decline. From 2003 onwards, total gross energy consumption has constantly been lower than gross electricity production.[28]

28. Further information: www.umweltbundesamt.de/daten/energiebereitstellung-verbrauch/stromerzeugung

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

The installed capacity of renewable power plants has increased very rapidly during the last years in Germany (see Figure 2.1.2-9). After 2000, wind power had the highest installed power capacity among renewables. Between 2012 and 2013 power from photovoltaic installations was in first place. In 2014, wind power regained its leading position due to changing promotional measures for photovoltaic systems. The installed power of biomass and hydropower systems on the national level is much lower than photovoltaics and onshore wind power capacity.

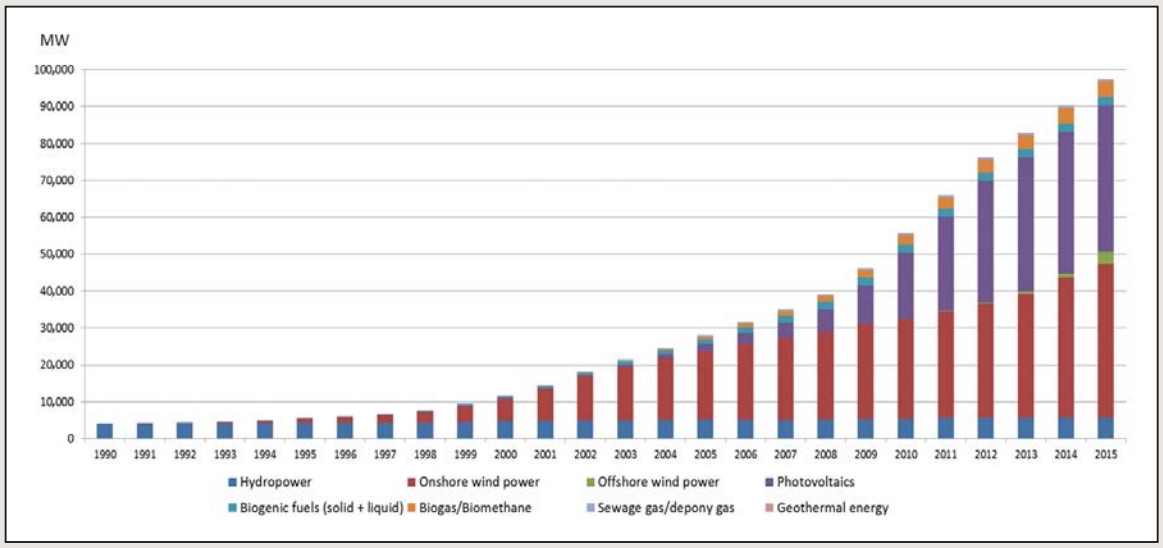


Figure 2.1.2-9 Renewable electricity installed capacity (MW) in Germany, 1990-2015 (Source: BMWi 2016, p.63, graph: ifuplan 2016).

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

German Alpine municipalities

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

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

The success of RE installations is going to be measured in the future with a view to the development of the market integration. With the reform of the Renewable Energy Law in 2014, the first steps in this direction have been undertaken[29].

29. Further information: www.stmwi.bayern.de/energie-rohstoffe/erneuerbare-energien/.

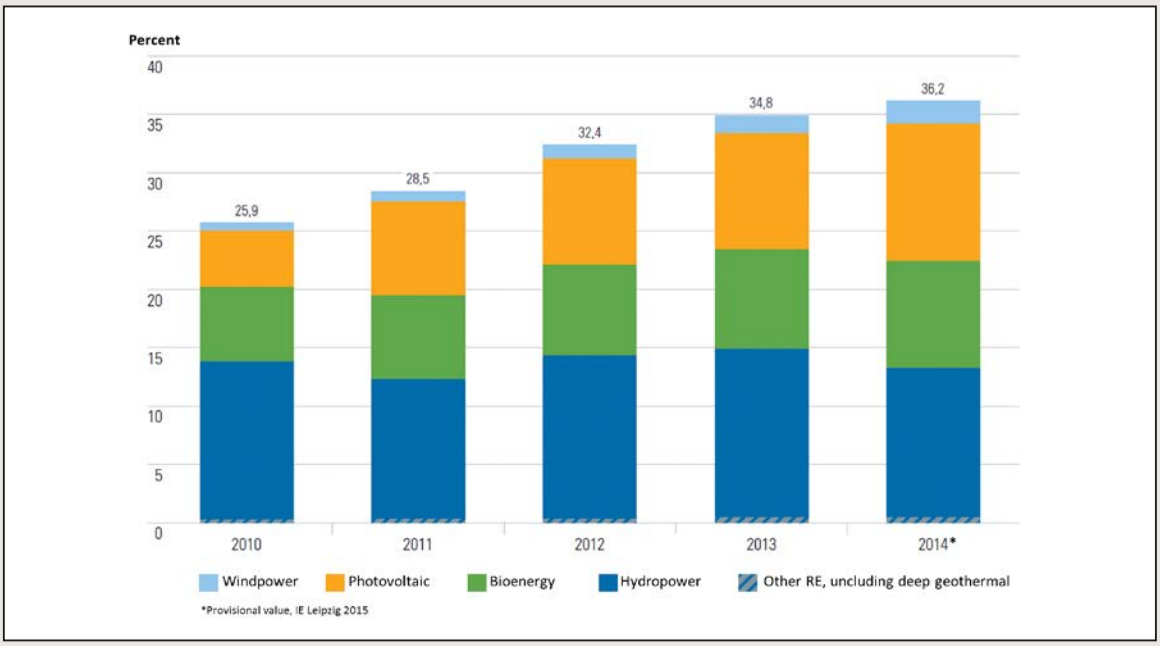


Figure 2.1.2-10 Share of RE in gross electricity generation in Bavaria (Source: StmWi 2015, p.7).

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

All in all, Germany – including the Alpine municipalities – is on its way to realistically achieve its RE targets set for 2020.

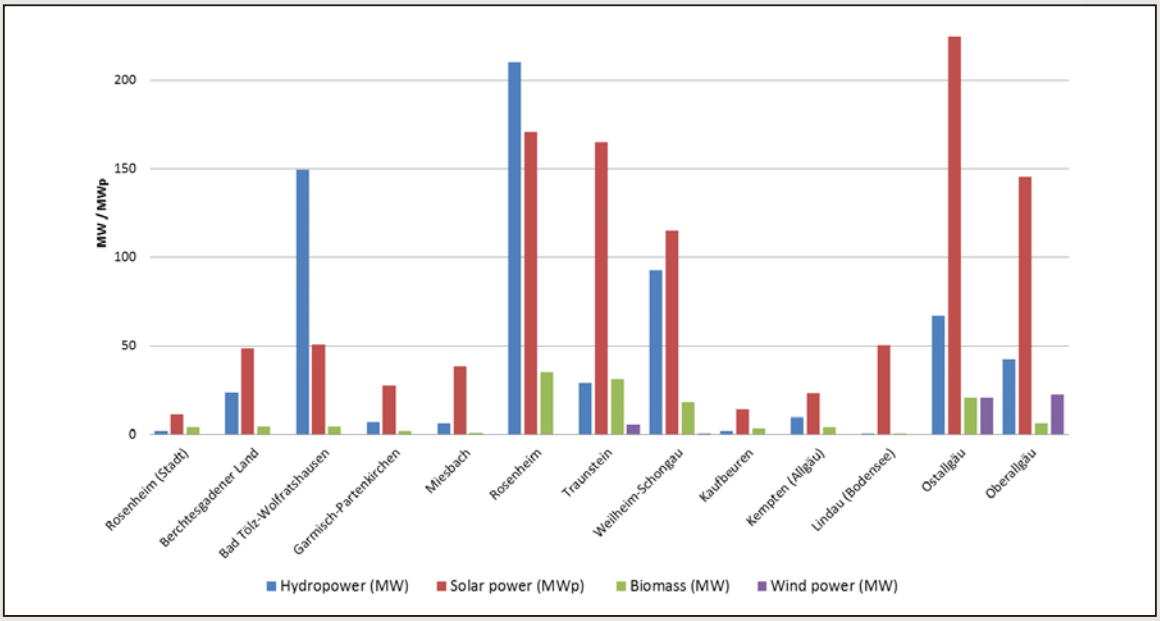


Figure 2.1.2-11 Installed RE capacity within the German Alpine area, 2013 (Source: Energieatlas 2016, graph: ifuplan. Note: Data only include RE power plants that receive feed-in tariffs according to the German Renewable Energy Law).

ITALY

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

Following the EU Directive 2009/28/EC, the plan defines strategies and actions to reach the national target of 17% of energy produced by renewable sources by 2020. In particular, renewable energy shares in transport, electricity, and heating and cooling should reach 6.38%, 28.97% and 15.83%, respectively. The plan aims to increase the use of hydro, wind, solar and geothermal power as well as biomass. It will also change the current incentive mechanisms.

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

Focusing on the Italian Alps, regional energy balance sheets vary across regions. In general, energy demand and production are relatively well balanced across the Italian Alpine regions with a deficit of 20%. The national average is at 13%. As a share of total production, hydropower is the most relevant source of energy available in the Italian Alps. The highest shares for this source have been registered in Valle d'Aosta (99%) and Trentino Alto Adige (88%). It significantly contributes to the positive energy balance of these two emblematic mountain regions. Moreover the Italian Alpine regions provide some 79.5% of hydropower, 36% of thermoelectric, 1% of wind and 29.3% of photovoltaic power of the national level (Terna 2014). These numbers echo both the economic history of some of these regions (Piemonte, Liguria and Lombardia having been major sites for industrial production that needed a relatively huge quantity of power supply) and the local availability of natural assets in mountain zones. Water, in particular, has been used for electricity production since the second half of the 19th century.

In terms of the number and power output of RES power plants in the Italian Alps, Lombardia is the Italian region with the highest concentration of installed RES capacity (36.7% of the capacity installed in the Italian Alpine regions and 15.9% of the nation-wide installed capacity in 2014). At a provincial level, Brescia qualifies as the province with the highest installed capacity in Italy (5.5%), but a high share can also be found in other provinces like Sondrio (4.6%). High levels of installed capacity can also be found in the Alpine provinces of Bolzano (3.9%), Trento (3.5%), Torino (3.2%) and Cuneo (2.4%). Lombardia, Piemonte and Trentino are the main producers (in MW) of renewable energy in the Italian Alps, ranking well also at the national level, being respectively 1st, 3rd and 4th absolute providers of electricity from RES (GSE 2015).

LIECHTENSTEIN

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

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

Heat production from local wood and biogas from the 1,794 solar thermal collector installations totalled 55,393 MWh. The two wood-fired power stations in Malbun and Balzers use mostly domestic wood for heat production. Compared to the previous year (2013), the self-sufficiency ratio fell from 9.8% to 7.6%. The self-sufficiency rate is the ratio of energy from indigenous sources of energy to total energy consumption or import. Domestic electricity was supplied to the national grid in 2014 by:

- Hydropower plants of Samina, Lawena, Schlosswald, Mühleholz, Letzana, Steia, Schaan, Stieg, Maree, Wasserkopf, Wissa, Stae and Meierhof.
- Natural gas-powered cogeneration plants in the municipalities of Triesen, Balzers, Schaan, Eschen, Mauren and Schellenberg.

- Biogas-powered combined heat and power (CHP) cogeneration plant of the Bendern wastewater treatment plant (WWTP).
- Solar power plants (photovoltaics): 1,343 plants with an installed capacity of 965 kWp fed energy into the national grid (compared to 1,224 plants with an installed capacity of 333 kWp in 2013).

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

SLOVENIA

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

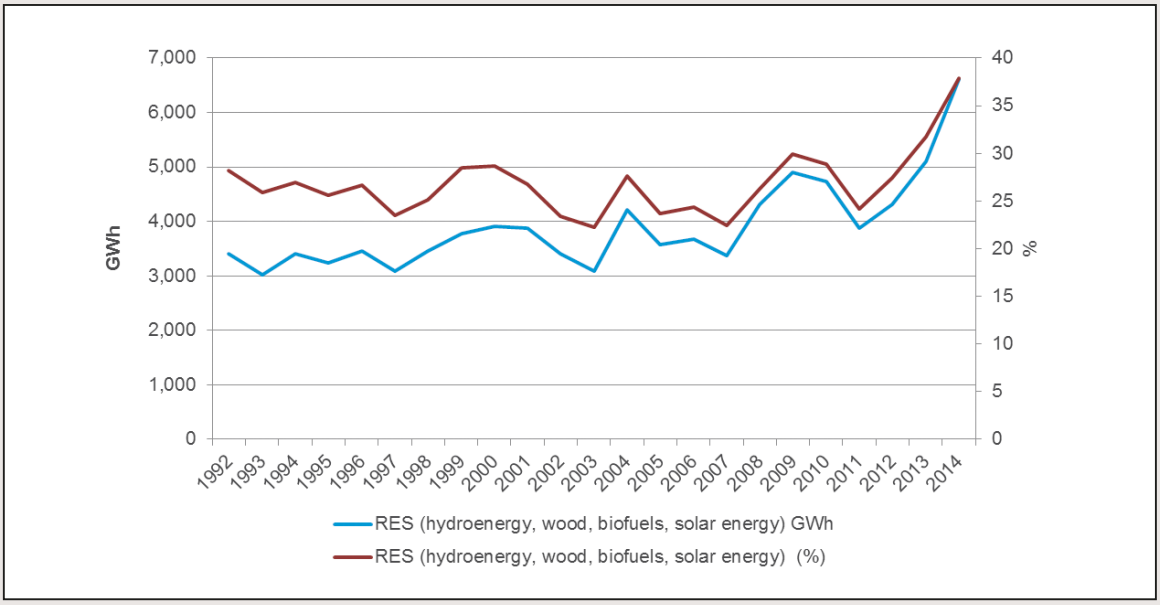


Figure 2.1.2-12 RE electricity production in Slovenia in GWh and % (Source: MOP et al. 2016).

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

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

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

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

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

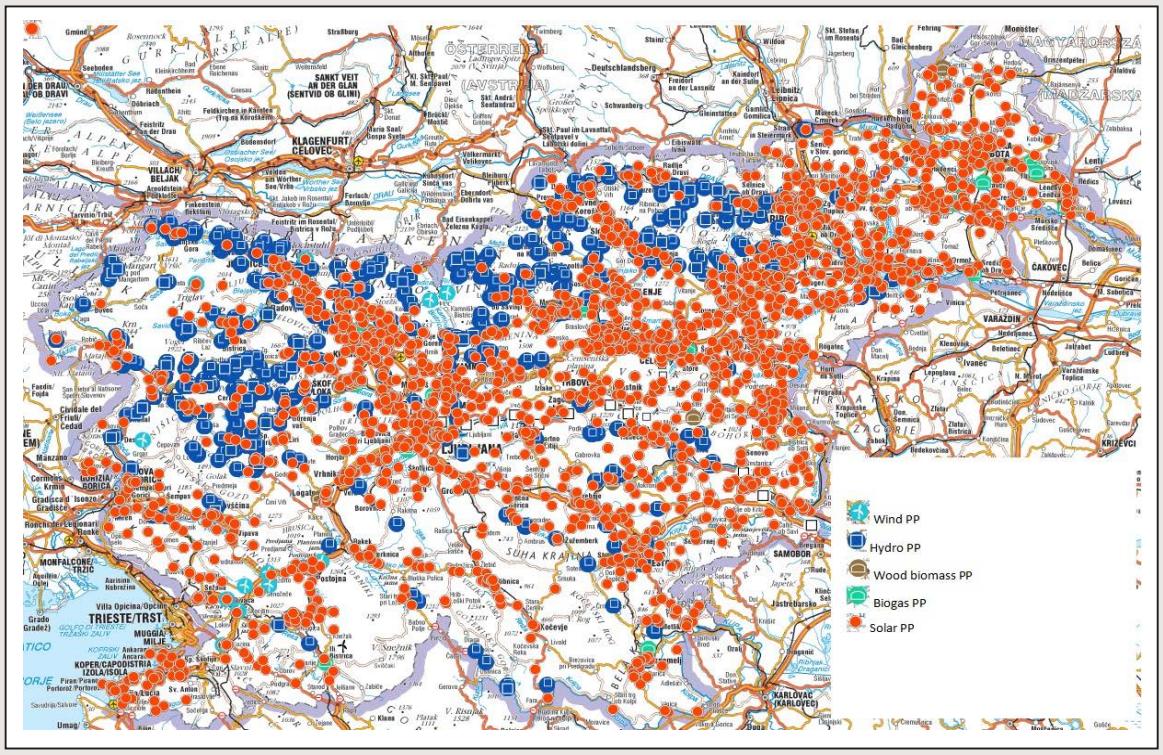


Figure 2.1.2-13 Installed RE power plants in Slovenia (Source: ENGIS 2016).

SWITZERLAND

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

Figure 2.1.2-14 shows energy production trends in Switzerland from 1990 to 2010.

In Switzerland around 20% of the consumed energy comes from renewable sources. This proportion has been continuously increasing since 1990 (Figure 2.1.2-15).

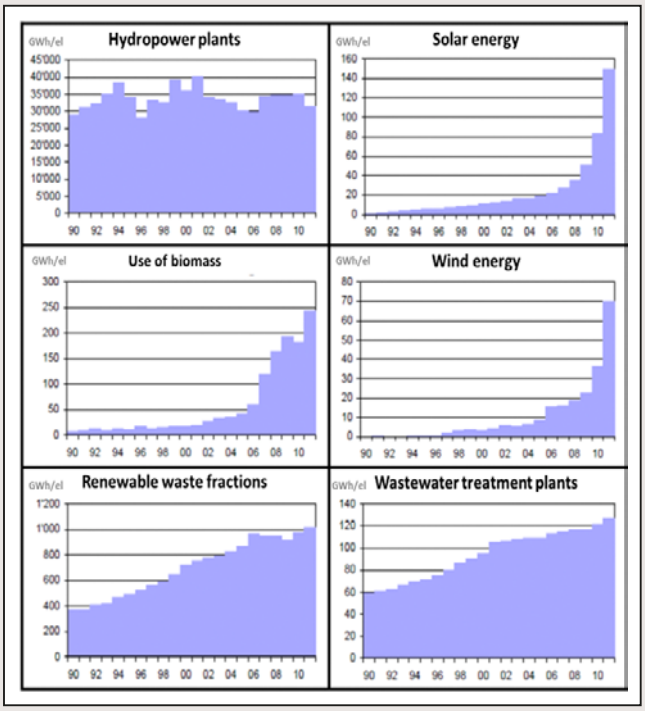


Figure 2.1.2-14 Swiss energy production since 1990 by technologies (Source: BFE 2012).

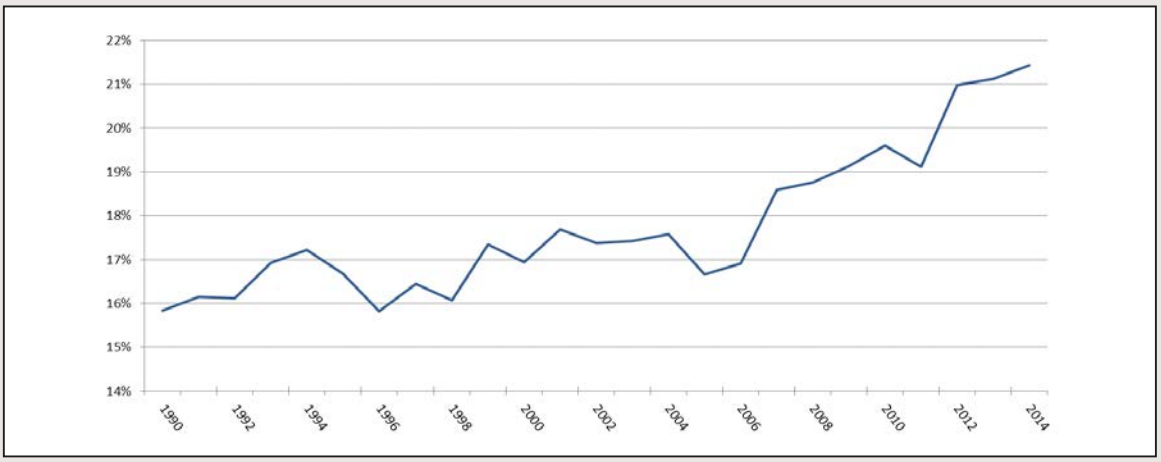


Figure 2.1.2-15 Share of RE in % in Switzerland on the national level, 1990-2014 (Source: BFS 2016e).

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

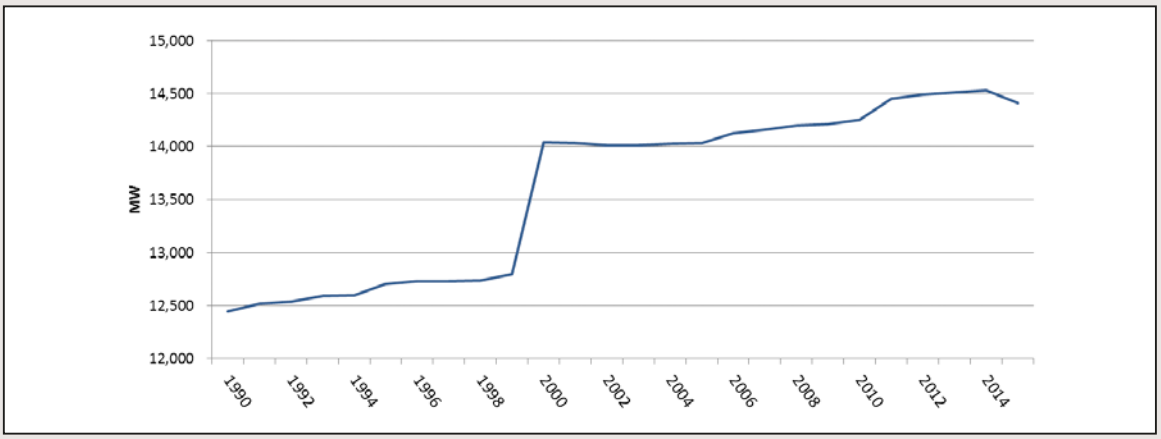


Figure 2.1.2-16 Installed hydropower calculated in capacity of turbines in megawatts, 1990-2014 (Source: BFS 2016f).

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

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

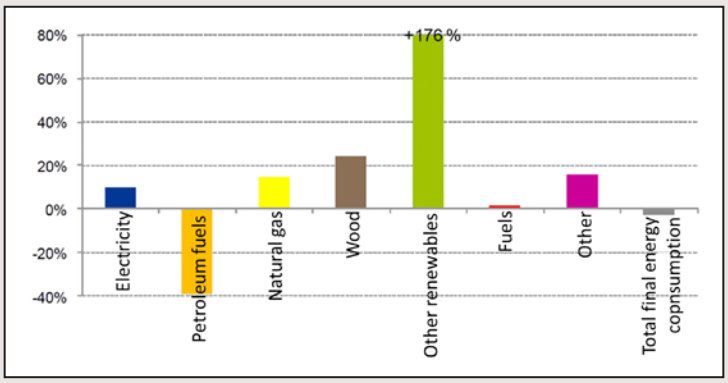


Figure 2.1.2-17 Percentage change in final energy consumption in Switzerland between 2000 and 2014 (Source: BFE 2015).

RE potential in the Alpine area

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

Hydropower

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

Taking into account the technical and economic potential of hydropower stations, an additional 10% of hydropower could be generated (Kraxner et al. 2015).

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

Wind power

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

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

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

Biomass

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

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

Geothermal energy

The best conditions for geothermal energy production can be found in the Molasse basin, a foreland basin north of the Alps. Geothermal projects in the central part of the Alps are very rare because of the heterogeneity and complexity of geological structures, which do not provide large geothermal fields that are easily detectable and accessible. The Alpine foreland, however,

hosts several large geothermal heat generation sites and electricity power plants. The rocks here are karstified so that hot water flow through the cleats is allowed.

In Germany, especially in the northern part of the Alpine Molasse Basin called Bavarian Molasse, several deep and hundreds of near-surface geothermal power plants are operated mostly for heat but also for electricity production. In Switzerland, the biggest geothermal potential is in the very north of the country in the Molasse basin and the Upper Rhine Graben. However, several deep geothermal production projects had to be stopped in Switzerland due to earthquakes triggered by drilling. Another popular way of geothermal heat production in Switzerland is using the heat from Switzerland's 700 road and railway tunnels (Philipp 2013). Most geothermal projects in the Alpine area are near-surface projects. However, in the Molasse basin, 20 deep geothermal projects are under construction.

Situation in Alpine countries

AUSTRIA

An evaluation of Austria's RES potential can be found in the final report of the *Future-proof energy supply for Austria* project (BMVIT 2011). Table 2.1.2-3 shows the RES potential in PJ (petajoule) for the year 2020 and 2050 and summarises the growth potential between 2020 and 2050. The highest RE growth potential between 2020 and 2050 lies in photovoltaics (+950%), in biomass from agricultural sources (+156%) and in solar thermal energy (+133%). The potential of hydropower plants is rather small (+5%). All in all, an RE potential of 510.3 PJ by 2020 and even of 932.8 PJ by 2050 would be possible.

Sources of energy	2020	2050	Growth potential (2020-2050)
Hydropower	144.2	152.3	8.1
Biomass from agriculture	80	205	125
Biomass from forestry	193.5	215.6	22.1
Wind energy	26	61	35
Photovoltaics	9	94.5	85.5
Solar thermal energy	27	90	63
Heat pump	26.5	95	68.5
Geothermal energy	0	7.4	7.4
Industrial waste heat	4.1	12	7.9
Total	510.3	932.8	422.5

Table 2.1.2-3 RES potential [PJ] in Austria in the years 2020 and 2050 (Source: BMVIT 2011).

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

The potential for solar energy is only limited by the area available for installations.

In a current study of the Federal Environment Agency various scenarios are compared with respect to their shares of RES (UBA Austria 2015b). In the year 2030 the highest RES share will be reached with 46.9% or 34.3%, respectively. In the year 2050 the value will fluctuate between 32.3% and 66.6%.

GERMANY

The Renewable Energy Roadmap 2030 (Remap 2030) report of Germany (IRENA 2015) aims to determine the potential of renewable energy deployment. According to the Remap analysis, Germany reaches a 27% renewable energy share in the total energy mix by 2030.

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

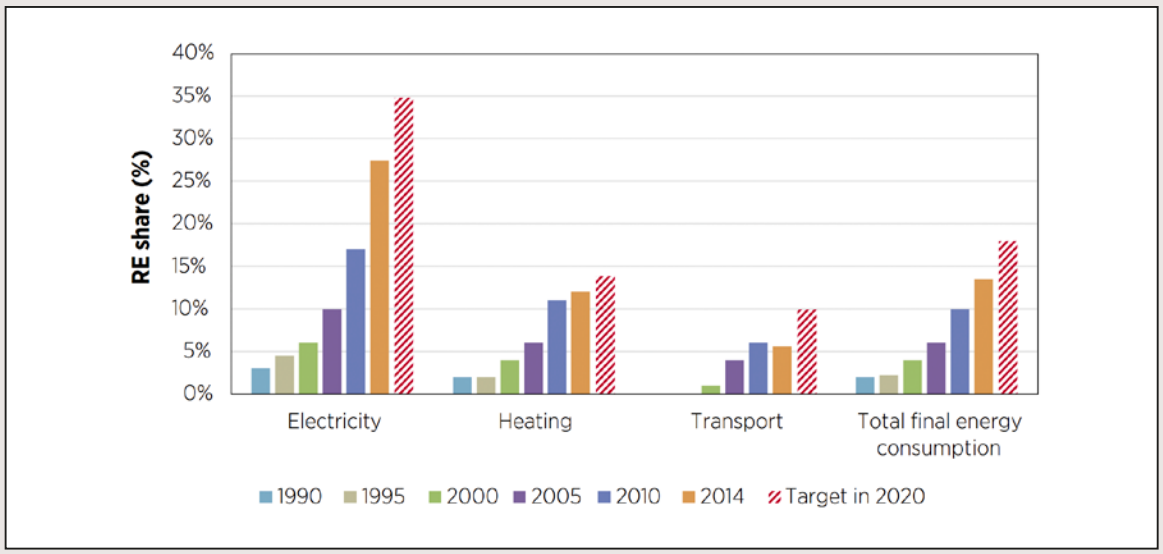


Figure 2.1.2-18 Renewable energy share in Germany's final energy consumption, 1990-2014 and targets for 2020 (Source: IRENA 2015, p.26).

CIPRA Germany has published a position paper on an environmentally sound implementation of the *Energiewende* in the Bavarian Alps (CIPRA Germany 2013). The paper identifies a great potential in retrofitting or repowering RE power plants.

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

Concerning wind energy, the Bavarian Wind Atlas includes maps that show the wind velocity and potential energy output of wind power plants at an elevation of 100 meters, 130 meters and 160 meters. The wind maps indicate wind velocity in typical hub heights of wind power plants. Furthermore, they provide information on wind power reference yields[30].

Figure 2.1.2-19 shows the full load hours (left) and the reference yields (right) at an elevation of 100 m.

30. Further information: www.energieatlas.bayern.de/thema_wind.html.

	New permissions		Follow-up permissions		Fish ladders
Administrative district	Number of power plants	Capacity (kW)	Number of power plants	Capacity (kW)	Number of power plants
Bad Tölz-Wolfratshausen	4	22	5	159	n.a.
Berchtesgadener Land	7	1,007	15	1,315	7
Garmisch-Partenkirchen	4	1,098	5	1,058	4
Kempten (municipality)	1	150	1	460	n.a.
Lindau	0	0	1	195	n.a.
Miesbach	0	0	5	1,006	7
Oberallgäu	6	1,272	17	2,608	19
Ostallgäu	2	491	13	1,805	4
Rosenheim	1	30	21	840	2
Traunstein	8	1,762	20	1,637	6
Weilheim-Schongau	1	2	2	9	n.a.

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

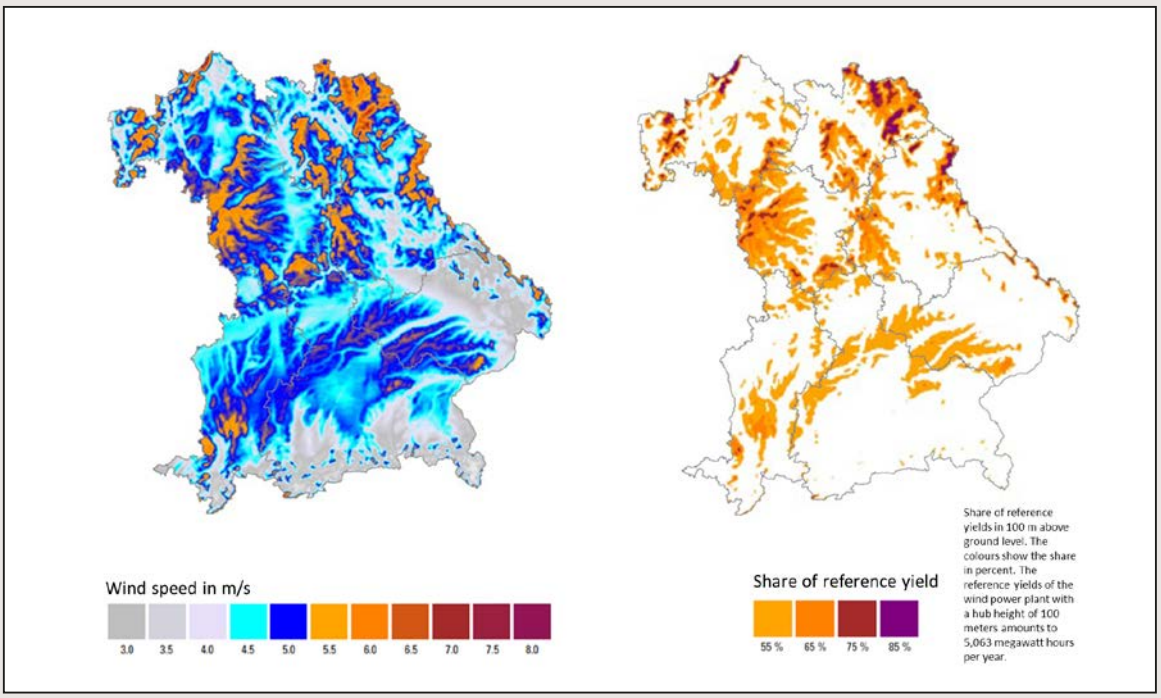


Figure 2.1.2-19 Wind conditions (left, m/s) and reference yields of windpower (right, %) at an elevation of 100 m in Bavaria (Source: StmWi 2014).

LIECHTENSTEIN

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

SLOVENIA

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

Another two hydropower plants in the chain of six on the Lower Sava River are in the planning. Further hydropower projects are in the pipeline, such as the hydropower plants on the Middle Sava River and on the Mura. An important factor for the installation of hydropower plants are the hydrologic conditions, which have generally shown a negative trend in the last years, possibly related to climate change.

SWITZERLAND

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

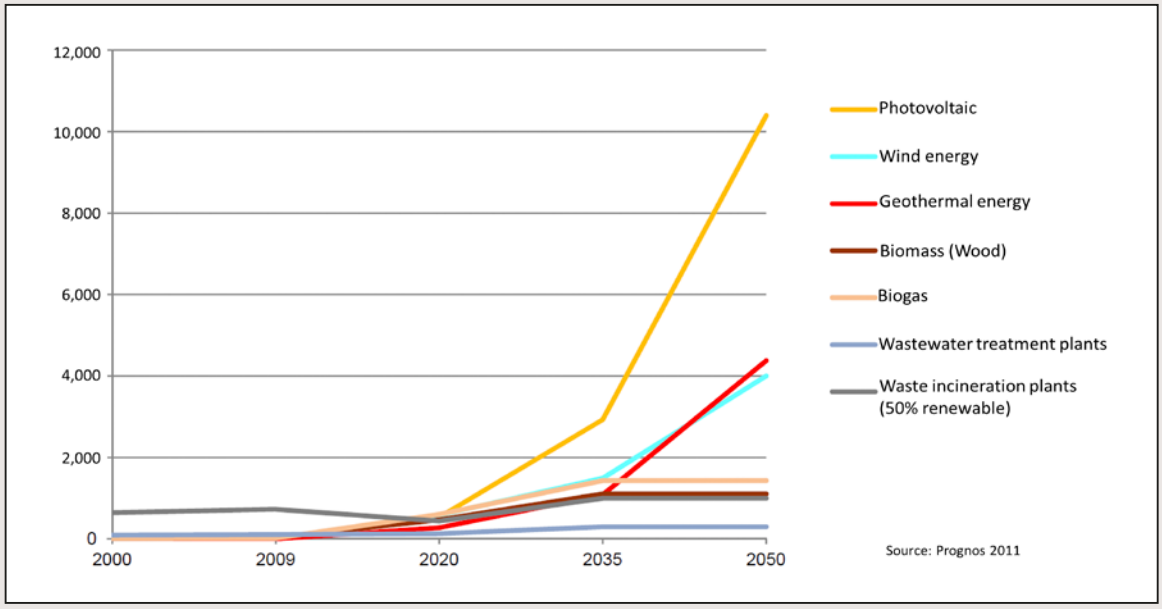


Figure 2.1.2-20 RE potential for electricity production in Switzerland (in GWh/el/a) (Source: BFE 2012, p.9).

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

Good practice – Toggenburg 'Energy Valley', Switzerland

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

Further Information: www.energietal-toggenburg.ch

Good practice – Frutingen Tropical House, Switzerland

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

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

Further information: www.tropenhaus-frutigen.ch

Good practice -Ecological hydropower, Au an der Iller, Germany

This first German ecological hydropower plant features a 'Very Low Head' Turbine (VLH) based on a combination of variable water level control with a water-filled rubber dam. Low head hydropower applications use tidal flows or rivers with a head of 20 metres (66 ft.) or less to produce energy. These applications may not need to dam or retain water to create hydraulic pressure. Fish can swim through the extremely slowly moving turbines down the river.

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

Further information: www.illerkraftwerk-au.de/content/technologie/

Conclusions, opportunities and challenges

Status conclusions:

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

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

Opportunities:

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

Challenges:

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

2.1.3 EFFICIENT USE OF ENERGY

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

Background on the efficient use of energy

Relation between energy efficiency and a Green Economy

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

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

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

Benefits of energy efficiency

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

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

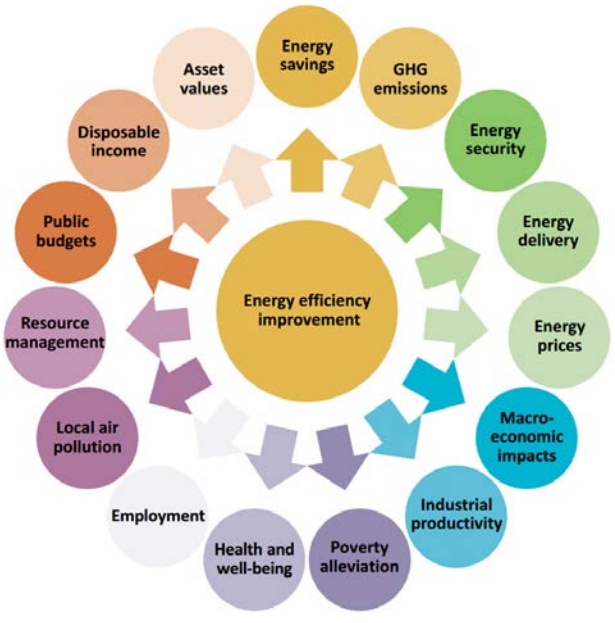


Figure 2.1.3-1 Key benefit areas derived from energy efficiency (Source: IEA 2014a, p.28).

The study also found that opportunities for new jobs are greatest in the building and transport sectors. The financial value of buildings with an energy-performance certificate is 10-16% higher than the value of non-certified ones.

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

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

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

European level

The EU *Energy Efficiency Directive* (EED) (2012/27/EU) of 4 December 2012 (EC 2012b) has replace both the Energy Service Directive (2006/32/EC) and the Combined Heat and Power (CHP) Directive (2004/8/EC). The EED establishes a common framework of measures for the promotion of energy efficiency within the European Union in order to ensure the achievement of the 2020 20% target on energy efficiency and to pave the way for further energy efficiency improvements beyond that date. In its energy efficiency target stipulating that energy consumption should not exceed 1,474 Mtoe of primary energy consumption or 1,078 Mtoe of final energy consumption by 2020, the EU equalises energy efficiency with a reduction of energy consumption.
The Alpine countries have set ambitious targets for the Europe 2020 strategy in their NEEAP 2014 *National Energy Efficiency Action Plans*.

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

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

*Table 2.1.3-1 Current targets for energy consumption (2020) as well as the predicted energy demand (2030 and 2050) of the Alpine countries in Mtoe (Source: [1]NEEAP 2014, [2]EC 2013c). *In Switzerland the Energy Strategy 2050 bill has not yet been passed by the National Council and the Council of the States. The sector-specific energy efficiency targets of Switzerland are described in 'Situation in Alpine countries'.*

Alpine level

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

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

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

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

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

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

- *net Zero Energy Buildings and Building Culture*
- *strategies for Climate-Responsive Neighbourhoods*
- *sustainable Building Refurbishment*
- *reinventing Alpine Communities*
- *holistic Building Design and Certification Systems.*

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

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

Alpine relevance of energy efficiency

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

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

Situation in Alpine countries

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

Energy efficiency trends

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

Energy efficiency can be measured through energy intensity, namely the ratio between unit of energy and unit of GDP. Figure 2.1.3-2 shows the average annual change of energy intensity between 2005 and 2013 in the following five sectors in the EU countries of the Alps:

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

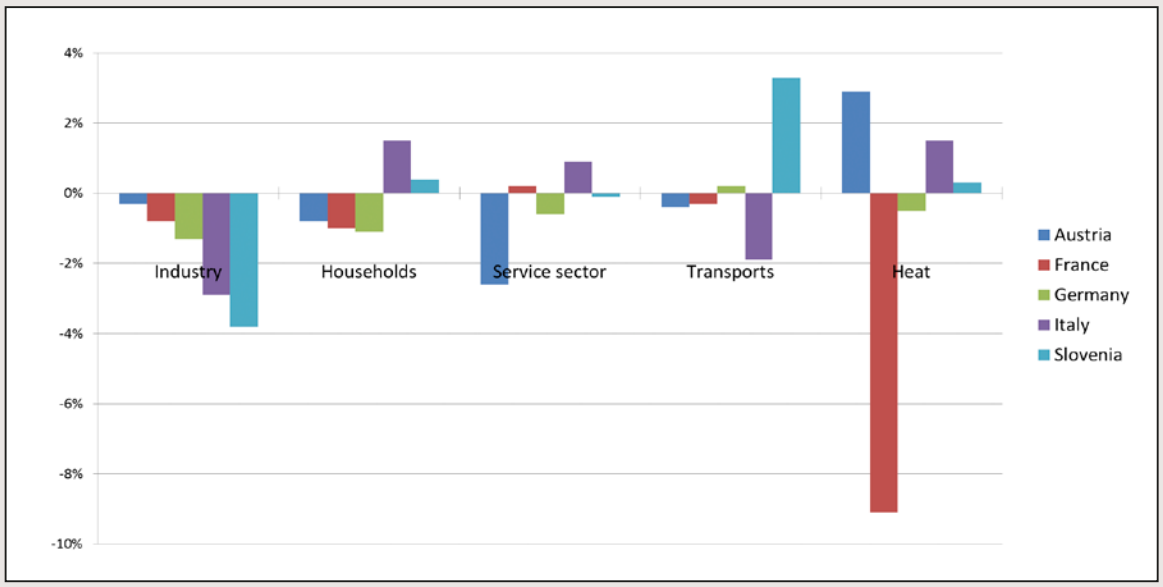


Figure 2.1.3-2 Average annual change of energy intensity indicators from 2005-2013 in different sectors of the Alpine countries within the EU (Data source: EC 2015e, graph: ifuplan 2016).

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

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

AUSTRIA

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

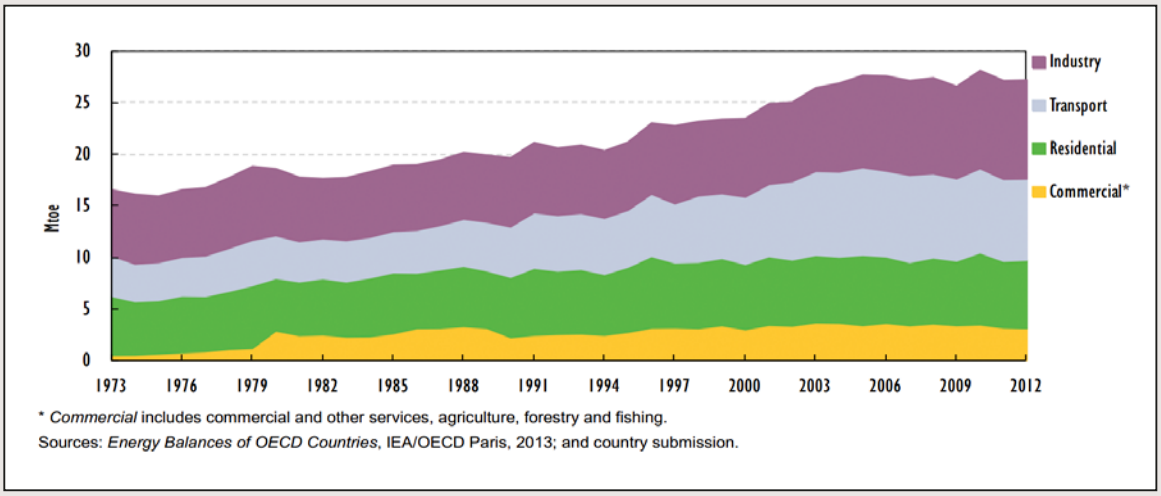


Figure 2.1.3-3 Final energy consumption trends in Austria, 1973-2012 (Source: IEA 2014b).

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

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

GERMANY

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

The process of reorganising the energy supply system needed to be accelerated by a comprehensive package of legislation, the energy package 2011, and the *Energiewende* resolution.

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

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

Year	Energy consumption and energy efficiency targets					
	Primary energy consumption[31] (vs. 2008)	Final energy productivity (2008-2050)	Gross electricity consumption[32] (vs. 2008)	Primary energy demand for buildings (vs. 2008)	Heat demand for buildings (vs. 2008)	Final energy consumption in transport[33] (vs. 2005)
2014 (Achieved)	-8.3%	+1.6% p.a. (2008-2014)	27.0	27.0	27.0	27.0
2020	-20%	↓ Increase by 2.1% p.a.	-10%	↓	-20%	-10%
2030	↓		↓			↓
2040						
2050	-50%		-25%	0.014		-40%

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

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

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

Figure 2.1.3-4 illustrates that Germany has made progress towards meeting the 2020 energy efficiency target but is currently slightly above the 2005-2020 primary energy linear target path.

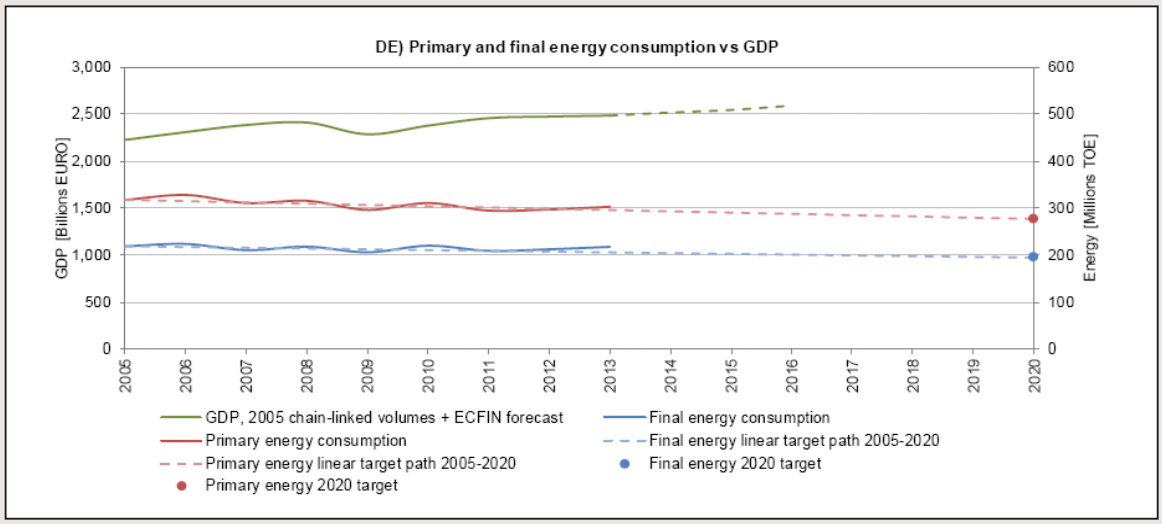


Figure 2.1.3-4 Primary and final energy consumption vs. GDP for Germany (Source: EC 2015b, p.53).

31. Further information: www.ag-energiebilanzen.de/7-0-Bilanzen-1990-2014.html.
32. Further information: www.ag-energiebilanzen.de/index.php?article_id=29&fileName=20160128_brd_stromerzeugung1990-2015.pdf.
33. Further information: www.ag-energiebilanzen.de/7-0-Bilanzen-1990-2014.html.

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

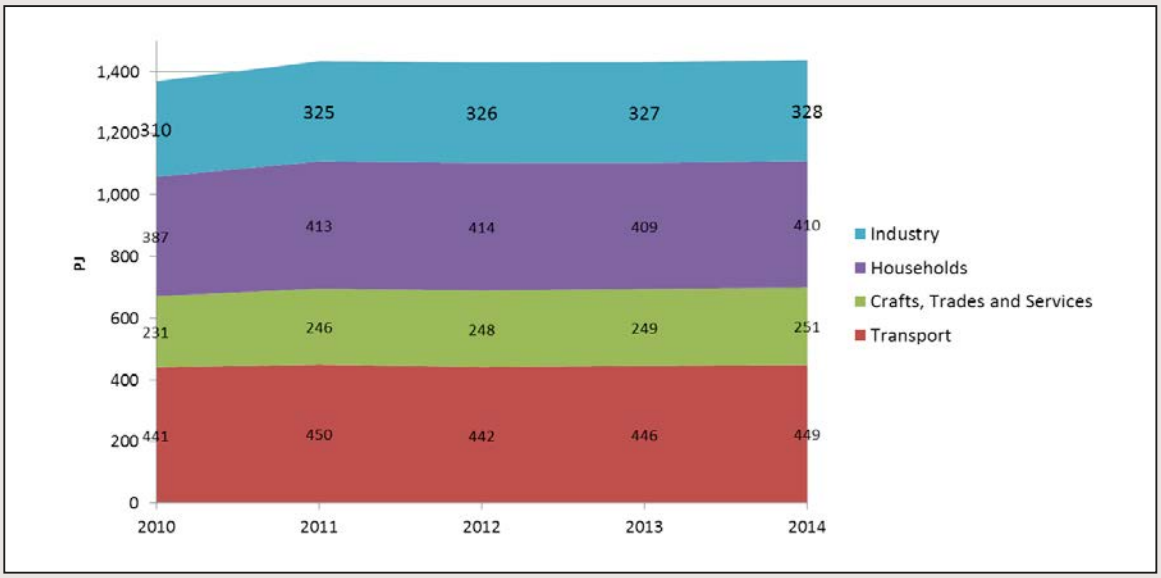


Figure 2.1.3-5 Final energy consumption in Bavaria 2010-2014 in PJ (Source: StmWi 2016, p.65, graph: ifuplan 2016).

ITALY

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

LIECHTENSTEIN

The EU formula of the Energy Strategy 2020 reads '20-20-20'. In line with this formula Liechtenstein wants to achieve the following targets by 2020:

- 20% increase in energy efficiency to stabilise consumption.
- 20% domestic, renewable energy.
- 20% fewer greenhouse gases compared to 1990 levels.

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

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

SLOVENIA

The Action Plan for Energy Efficiency for the period 2014-2020 (NEEAP 2020), adopted in May 2015 in accordance with the requirements of the Energy Efficiency Directive (2012/27/EU), raises the national objective of improving energy

efficiency by 20% by 2020. The absolute target is that primary energy consumption in 2020 will not exceed 7,125 Mtoe (82.86 TWh). Slovenia has not yet established a medium to long-term strategy for climate and energy covering the post-2020 period.

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

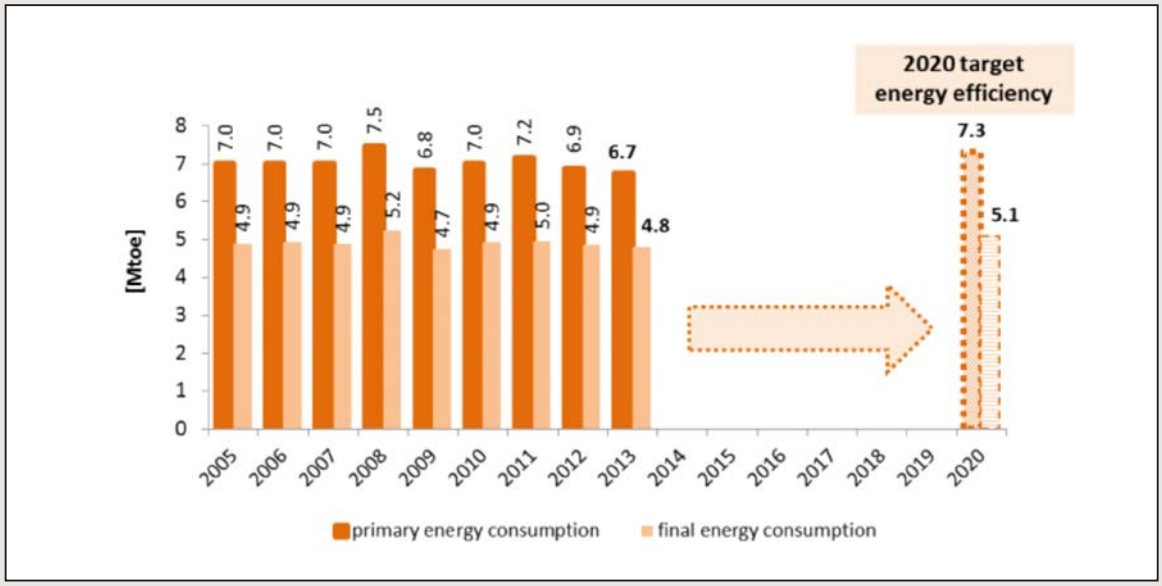


Figure 2.1.3-6 Primary and final energy consumption trends of Slovenia with its target until 2020 (Source: EC 2015c).

Slovenia is allowed to increase primary energy consumption by 4.5% relative to 2005, while in the EU overall primary energy consumption should be reduced by 13.2%. The majority of EU countries are on track to meet the 20% target, partly due to the economic slowdown. To reach the targeted savings, Slovenia should not increase primary energy consumption by more than 9.1% in 2014-2020, while the EU as a whole should reduce it by 5.3%. In the last few years, energy intensity in Slovenia deteriorated significantly compared with the EU average, as it was falling more slowly than in the EU. Approximately until 2005, energy intensity in Slovenia had converged towards the EU average, exceeding it only by 15%, while in the following years it was moving away from the EU average and exceeded it by 4 percentage points in 2013 (Table 2.1.3-3).

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

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

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

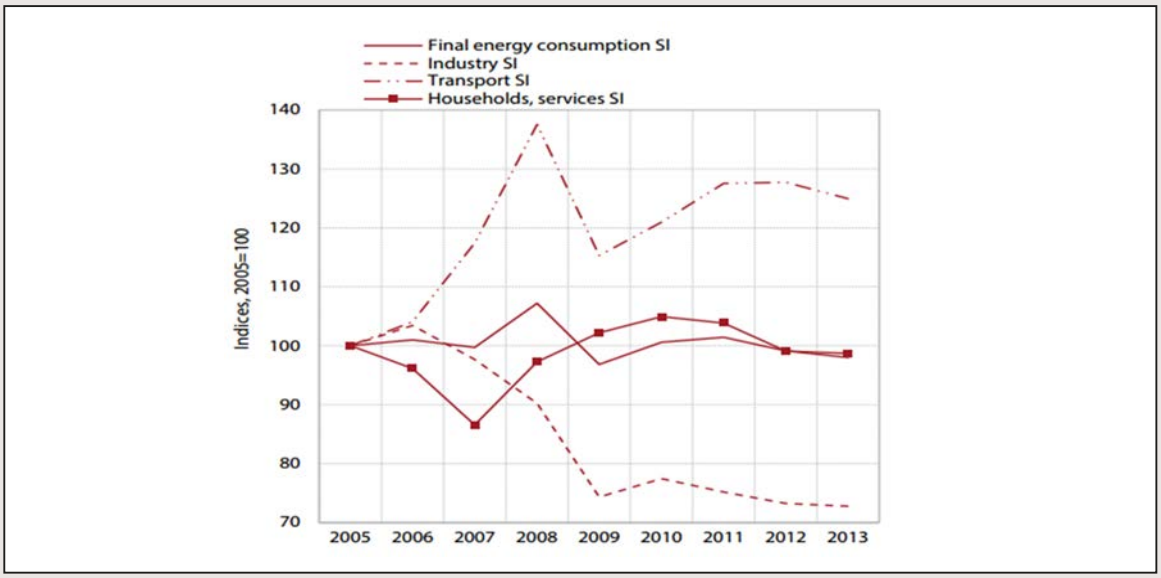


Figure 2.1.3-7 Final energy consumption by consumer sector in Slovenia (Source: EUROSTAT 2014, p.197; calculations Institute of the Macroeconomic Analysis and Development).

SWITZERLAND

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

- Reduction of fossil fuel energy by 20% between 2010 and 2020.
- A maximum 5% increase in electricity use between 2010 and 2020 and a continuous reduction from 2015 onwards.
- Following a *best practice strategy* for buildings, vehicles, devices and industrial processes. Appropriate investors, buyers and operators are to receive incentives to increase energy efficiency.

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

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

In the construction sector approximately 50% of Switzerland's primary energy consumption is attributable to buildings: 30% for heating, air-conditioning and hot water, 14% for electricity, and around 6% for construction and maintenance. Economically speaking, it is essential to exploit the relatively high remaining potential for further efficiency improvements in this area. Buildings are also a major consumer of material resources and generate high levels of waste and pollution.

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

	2000	2008	2009	2010	2011	2012	2013	2014	Δ'00-'14
Households	236.3	247.8	245.7	264.9	225.7	244.3	259.0	219.0	-7.3%
Industry	160.7	171.13	161.1	168.5	162.2	163.1	164.5	156.9	
Services	137.6	144.6	142.6	151.8	135.4	143.5	149.8	130.8	-4.9%
Transport	303.3	312.2	306.4	308.4	309.6	313.0	312.7	311.7	+2.8%
Statistical difference incl. agriculture	9.2	9.4	9.3	8.9	9.4	9.3	9.1	7.4	+19.5%
Total final consumption	847.0	885.2	865.0	902.5	842.3	873.2	894.9	825.8	-2.5%

Table 2.1.3-4 Fossil fuel consumption by sector in Switzerland from 2000-2014 (Source: BFE 2015).

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

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

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

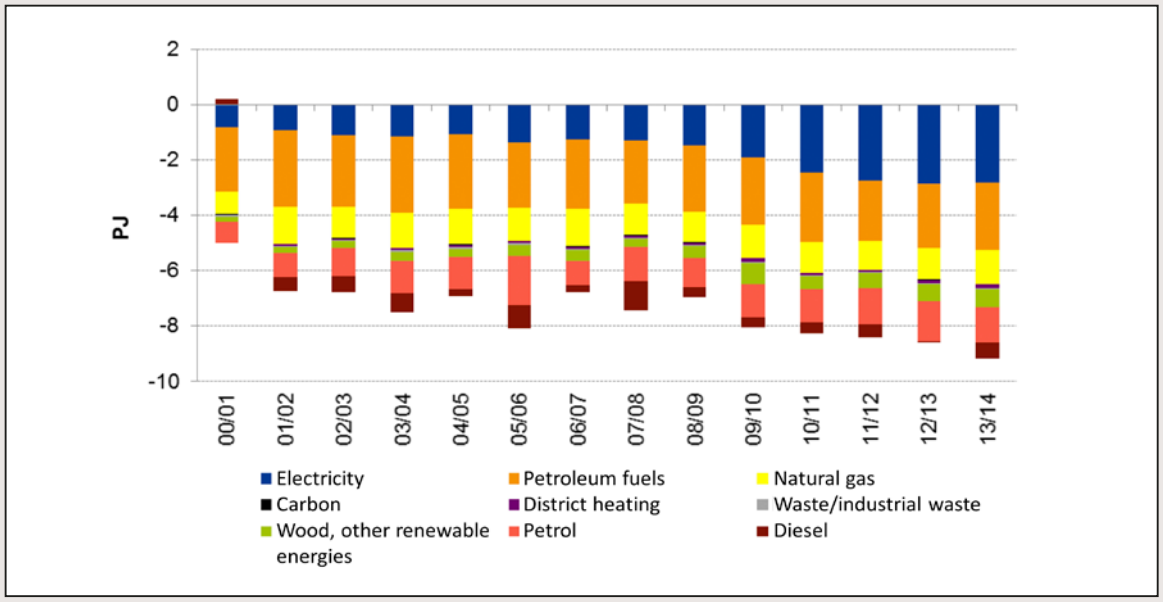


Figure 2.1.3-8 Yearly energy savings in Switzerland between 2000 and 2014 in PJ (Source: BFE 2015).

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

The BIOCASA project started in 2005 and aimed to build houses with a low energy impact (high efficiency), low carbon emissions and reduced energy costs. As a member of GBC Italia, an association introducing new sustainable building standards, the FILCA cooperative, which started BIOCASA, accepted Leadership in Energy and Environmental Design (LEED) certification standards and implemented them in new construction projects. The main features of a BIOCASA building are as follows: (1) Site sustainability, (2) Reduction of energy consumption, (3) Human well-being and safety, (4) Material and resource management, and (5) Assessment of the bioclimatic quality of buildings.

The main results of the projects are:

- *Reduction of energy consumption of around 70-80% in comparison with older buildings (before 2007-2008).*
- *An energy class A 'BIOCASA più' building with 90 square meters has annual heating costs of €300 to €350, compared to a €1,500/1,800 average cost for current housing sector energy standards.*
- *Expected real estate value increase of 16-22%.*
- *Establishment of certified quality labels: BIOCASA più Filca (energy class A buildings), BIOCASA Filca (class B) and BIOCASA A+ Filca Consumo Zero – Qualità Certificata e Assicurata.*

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

Conclusions on opportunities and challenges

Status conclusions:

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

Opportunities:

- Energy efficiency creates benefits such as a more sustainable energy system, a support for strategic objectives of economic and social development and the promotion of environmental goals, profitability and cost savings. Moreover, studies suggest a strong link between energy efficiency and employment.
- Higher energy efficiency increases competitiveness in various aspect:
  - Increased profitability due to cost savings.
  - Economic opportunities for countries to become leaders in energy efficiency and innovative solutions.

Challenges:

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

2.2 A RESOURCE-EFFICIENT ECONOMY

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

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

As described in the EU Factsheet 'Resource efficiency – a business imperative' (EC 2011c), a resource-efficient economy is a comprehensive concept: 'It is an overarching idea that applies to all natural resources from food, timber and biodiversity to metals, soil, water, minerals, the atmosphere and land.' It does not matter whether resources are used as a source for production and consumption or as a sink for pollution. This chapter will concentrate on the following aspects:
(1) efficient use of non-energy resources,
(2) land-use changes, and
(3) circular economy, recycling and waste management.

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

2.2.1 EFFICIENT USE OF NON-ENERGY RESOURCES

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

Background

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

One of the main benefits of resource-efficient measures for the private sector is to reduce costs and thus enhance the competitiveness of companies. Schmidt & Schneider (2010) carried out 569 analysis of energy efficiency measures in German companies and have identified average potential savings of 2.1% of turnover. According to this study, the highest saving potential

can be found in small companies, amounting to 5% of annual turnover. More than half of the proposed measures considered in this study could be realised with investments of less than €10.000 and with a payback period of less than six months. Even though this study only analysed the situation in a selected number of German companies, similar results could be expected for other Alpine countries.

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

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

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

*Table 2.2.1-1 Domestic material consumption in Alpine countries (in tonnes per capita), 2014 (Source: EUROSTAT 2015f, FSO 2016). *Latest data: 2012.*

Since DMC only includes physical imports and exports of materials, it lacks to account for the resources used to produce traded goods. Other approaches to measure resource productivity, such as raw material consumption (RMC), rely on footprint indicators: they work with raw material equivalents, estimating the amount of raw materials needed to produce a traded good. The Swiss Federal Statistical Office consistently works with these kind of indicators (FSO 2016), whereas for the other mentioned Alpine countries, RMC is only measured at the EU level. Moreover, the extraction and processing of raw materials also has an impact on the environment (e.g. CO_2 emissions). For an Alpine-specific analysis, more research on regional indicators is needed.

Situation in the Alps

Water

Water resources are vital for the Alpine region. The Alps are the 'water towers' of Europe, as they provide continuous runoff to the forelands. Alpine water resources are rivers, lakes, wetlands, groundwater bodies and glaciers as well as precipitation. Major European rivers such as the Danube, Rhine, Po and Rhone have their headwaters in the mountains and their discharge is transported via the river systems to lower-lying areas, serving as an essential freshwater resource. Therefore, Alpine water resources are used inside and outside the Alps for various purposes ranging from water supply for all economic sectors (including energy supply and agriculture) to public water supply. The following paragraph from the Report of the European Environment

Agency 'Regional climate change and adaptation – The Alps facing the challenge of changing water resources' explains how important water is as a resource in the Alpine region and beyond:

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

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

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

The Alpine Convention (PSAC 2010) covers water management in Article 2(2)e: '[t]he objective is to preserve or re-establish healthy water systems, in particular by keeping lakes and rivers free of pollution, by applying natural hydraulic engineering techniques and by using water power, which serves the interests of both the indigenous population and the environment alike.' For the continuous improvement and implementation of adequate water management systems in the Alpine region, the Water Management Platform of the Alpine Convention has been established.

Forests[34]

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

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

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

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

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

Sector-specific considerations

Relevant resource-intensive industry sectors in the Alpine region are the agricultural sector (including food processing), the tourism sector and the construction sector. The European Commission states that a '[b]etter construction and use of buildings in the EU would influence 42% of our final energy consumption, about 35% of our greenhouse gas emissions and more than 50% of all extracted materials' (EC 2011d). The following two good-practice examples provide a glimpse on the potential for resource efficiency in the construction and the food sector. The first shows how non-renewable construction materials can be substituted by wood and energy consumption can be reduced. The second example gives some insights into the Milky Way project, which aims to optimise milk use in the dairy production in Italy.

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

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

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

The project is based on four guiding principles, which are:
- *sustainable, CO_2-free energy, decentralized and self-sufficient supply*
- *innovative, low-energy timber construction*
- *living and working in the same location*
- *varying standards of modernisation as examples of housing industry requirements.*

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

Good practice – MILKY WAY: Eco-innovative real-milk classification technology for optimised milk use, Italy

The project aims at promoting a new environmentally friendly breakthrough contributing to the reduction of the environmental impact deriving from dairy production. In areas with a high concentration of milk production, as the Alpine region, there is a larger risk of nitrogen water pollution. The new solution is based on real-time classification of milk (without any type of manipulation). Main results:
- *Reduced amount of milk employed in the dairy production process.*
- *Milk efficiency improvement and high quality cheese with enhanced nutrient properties.*
- *Improvement of dairy production and yields (up to 15%).*
- *Optimised milk supply chain; important savings in operational costs for dairy farming; optimization and higher value for milk processors; and premium prices for farmers.*

Further information: www.milkyway.bio

Tourism[35]

The tourism sector is a good example of an industry that heavily depends on resources provided by the Alpine region. In many regions of the Alpine area, especially in the more central and mountainous areas, tourism is a key economic sector. The Alpine area is one of the main touristic hot spots worldwide. In many Alpine regions, tourism accounts for more than 20% of the regional domestic product. In some valleys, the share is even higher than 50%. Also in the surrounding foothill areas, there is a significant

35. Contribution from the Working Group Sustainable Tourism of the Alpine Convention: Analysis of the role of sustainable Alpine tourism in a Green Economy.

amount of tourism, especially in touristic municipalities, even tough on a regional level its importance is decreasing. Due to the importance of the tourism sector for the Alpine region, it can assume a key role for the development of a green Alpine economy.

The need of resources in the tourism economy can be analysed based on the process chain (see Table 2.2.1-2). We consider energy as a resource for the process chain, even if it is obvious that the actual natural resources used in the background (renewable or non-renewable energy sources) can vary. Waste is listed in the process chain because waste management needs resources but can also be part of a circular economy. Table 2.2.1-2 shows the most important resources for each step within the process chain.

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

Table 2.2.1-2 Alpine tourism process chain.

Resource-efficient tourism concepts therefore require:

1. Reduction of printed advertising material; use of a high share of recycled paper.
2. Energy-efficient and renewable energy-based transport to and from destination; better information on directions and local transportation.
3. Development of new and refurbished accommodation with a focus on re-use and improvement of existing structures and redensification of properties.
4. Energy, water and waste management as well as use of regional resources in accommodation, boarding and other large-scale indoor infrastructure.
5. Resource-efficient public transport within destinations as well as individual mobility concepts based on renewable energy; appropriate marketing to convince consumers to use them.
6. Improvement of outdoor facilities within existing infrastructure and areas focusing on quality as well as resource efficiency.
7. Regional circular economy for the tourism sector.

Some of the most important instruments for making Alpine tourism more resource-efficient can be structured by stakeholders and by the level they are acting on. First, the stakeholder group of the guests has to be considered. Even if an increasing part of guests is aware of the interdependencies of their behaviour and used resources, only competitive products meeting their needs and expectations are attractive to guests. Therefore, the challenge is to combine a comparative advantage such as excellent service or a unique experience with resource efficiency (as a basis for that advantage) generated by innovative products. However, innovation and improved resource efficiency take place on the level of the entrepreneurs. The economic benefits stemming from resource efficiency are the main arguments for turning their business into a more resource efficient one. Moreover, the rising demand for sustainable tourism has to be satisfied by supplying an increasing number of certified sustainable tourism businesses in the Alpine region. This underlines the role of umbrella associations for destination management, hotel and restaurant owners or ropeway companies. They can offer training, consultancy, labels or awards and take a leadership role in helping businesses to benefit from a Green Economy. Local authorities and regions can mainly contribute by providing better guidance in the field of

regional and settlement planning, strategic development plans, improving their waste management and public transport system as well as promoting pilot projects supporting a regional circular economy approach in tourism.

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

Conclusions on opportunities and challenges

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

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

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

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

2.2.2 LAND USE CHANGES

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

Further negative economic effects of land take are the costs needed to build and maintain the settlement, infrastructure and industrial and economic sites. These costs include the market price of land, construction and maintenance costs, e.g. for transport and technical infrastructure such as power supply lines, fresh water and wastewater, and digital infrastructure. However, they also include the social infrastructure, recreation areas and public transport services. The more the urban and suburban 'fabric' extends, the higher the service and infrastructure expenses. In regions with a population decline, the costs will have to be paid by fewer

people in the future, unless underused buildings, infrastructures or even settlements are reduced. The gap between maintenance costs and people obliged to pay for these will be widening, even in regions with a stagnating population, if land take continues. However, there are also positive economic effects of land take, such as employment opportunities, generation of income, and provision of expansion opportunities for local companies and organisations.

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

Background information

The main drivers for land take in the Alps are:

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

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

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

Good practice – SCOT Tarentaise – Development of new or renewed tourist accommodation, France

The scheme for territorial coherence (referred to as SCOT- Schéma de cohérence territoriale) is a strategic planning and urban development document. One of the most important challenges for the Tarentaise Valley is to define the development of Alpine ski tourism as well as the development of the valley's ski resorts (tourism beds, ski areas and leisure facilities). The Tarentaise SCOT is one of the first studies of this type on the real estate sector in Alpine ski resorts (taking into account commercial and private tourist beds, unoccupied beds and forecasting). For the Tarentaise Valley representatives, the priority lies in renovating existing buildings rather than encouraging new construction projects.

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

The municipal and intercommunal representatives are not alone in taking on this project. Ski lift companies have also got involved. For example, in order to combat low occupancy rates, the 3 Valley Company has introduced the Affiniski scheme. This concept supports property owners for their projects with assessment, renovation, financial planning, rentals, etc. Further information: www.affiniski.com/en/

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

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

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

Austria

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

Germany

The German government decided in 2002 in the framework of the National Sustainability Strategy (Die Bundesregierung Deutschland 2002) to reduce the increase of the settlement and transport area from 129 ha per day (as a moving average over 4 years from 1997 to 2000) to 30 ha per day until the year 2020. To reach the target value of 30 ha per day, the government has launched several programmes and projects to enforce inner-urban development (e.g. REFINA, MORO).
In Bavaria, the State Development Programme (BayStMF 2013) has established several principles and goals for inner-urban development, which should be respected in urban land use plans. One of them is the aim to prefer inner-urban development over greenfield development.

Italy

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

Alpine relevance

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

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

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

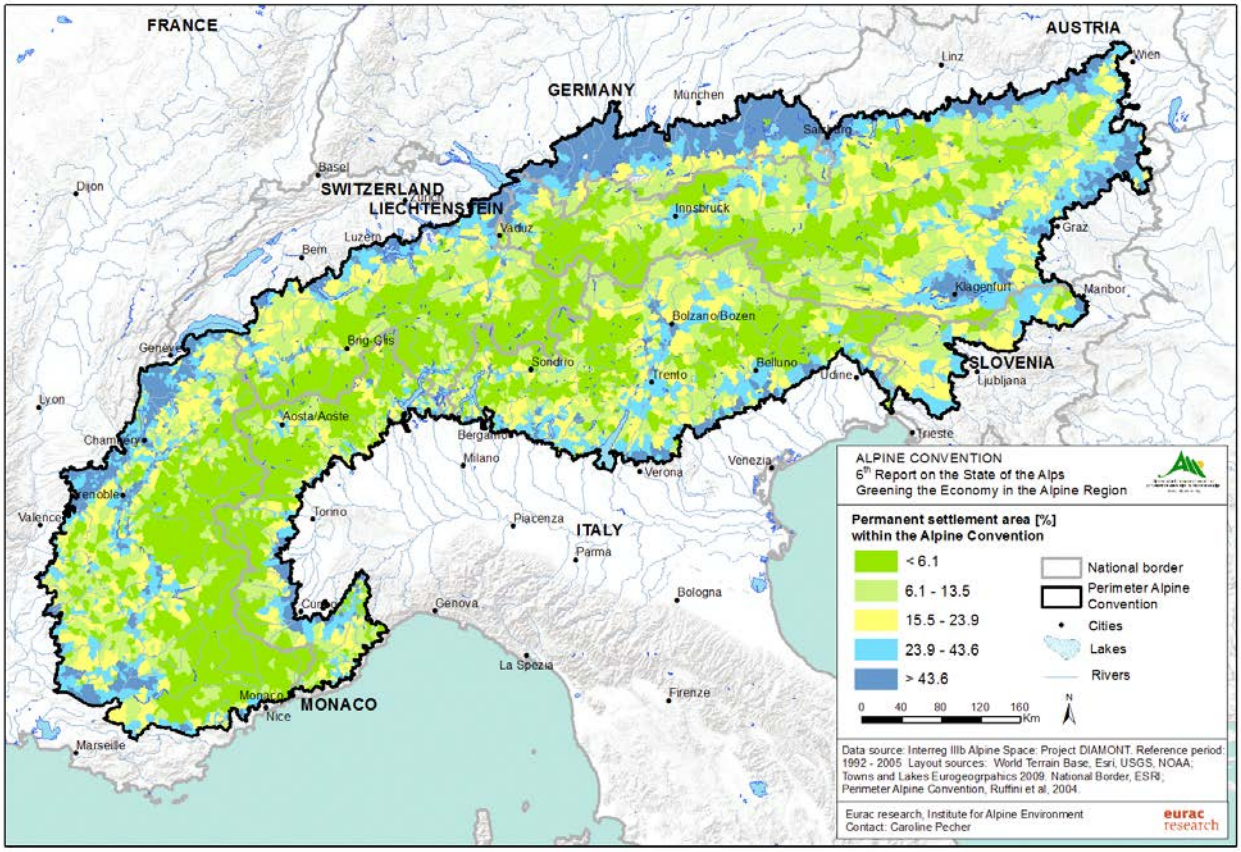


Figure 2.2.2-1 Share of permanent settlement area within the Alpine Convention area per municipal area (Source: EEA 2010c).

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

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

Situation in Alpine countries based on CORINE data

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

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

Situation in Alpine countries based on national statistical data[36]

AUSTRIA

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

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

GERMANY

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

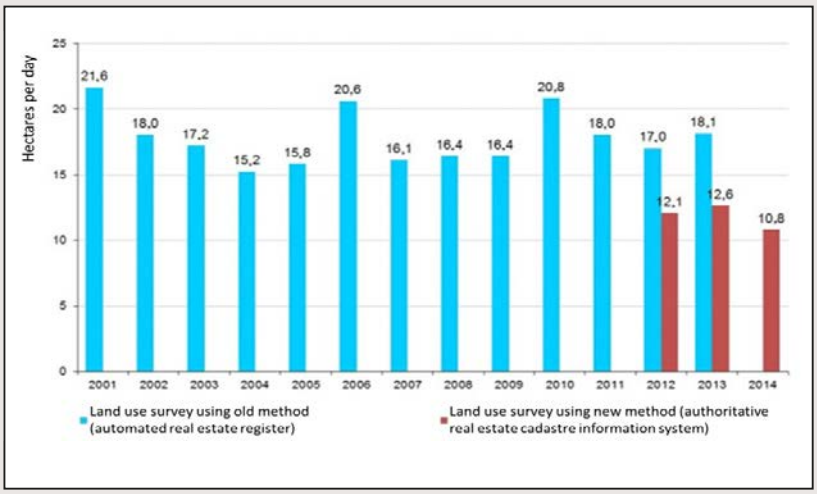


Figure 2.2.2-2 Land take in Bavaria between 2001 and 2014 (Source: LfU 2014).

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

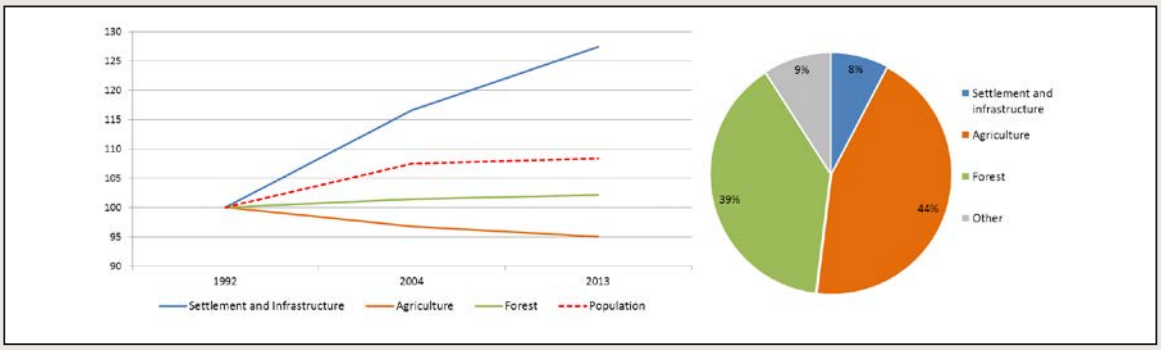


Figure 2.2.2-3 *Development (1992-2013; index base year 1992 = 100) and share (2013) of different land use classes in the German part of the Alpine Convention area. Due to changes in the land use statistics, the data from 2014 onwards are not directly comparable with data up to 2013 (Data source: Bayerisches Landesamt für Umwelt 2014; graph: ifuplan 2016).*

ITALY

In 2012 land take in the Italian Alpine territory (provinces, NUTS3) was still significant even though it is below the national average (weighed average 23.9 ha/day compared with a national average of 55 ha/day), with Piemonte, Lombardia and Veneto showing higher values (ISPRA 2015a). Estimates indicate an increasing land take at the regional level across all Italian Alpine provinces. The units with a higher share of mountains show lower absolute values for land take. Most of the land take seems to take place in the lowlands rather than at higher altitudes or where slopes are steeper. However, it has been shown that land take influences ecosystem services, in particular the climatic and hydrogeological regulation (ISPRA 2015a).

LIECHTENSTEIN

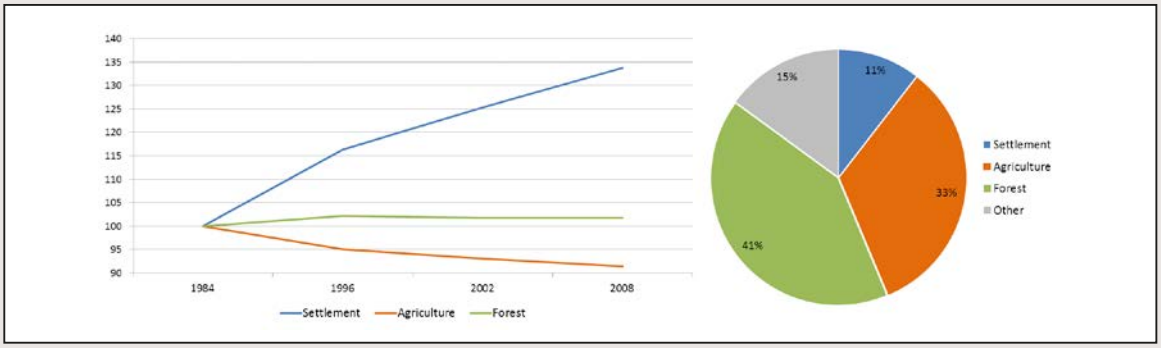


Figure 2.2.2-4 *Development (1984-2008; index base year 1984 = 100) and share (2008) of different land use classes in Liechtenstein (Data source: Schweizerische Eidgenossenschaft 2009; graph: ifuplan 2016).*

SLOVENIA

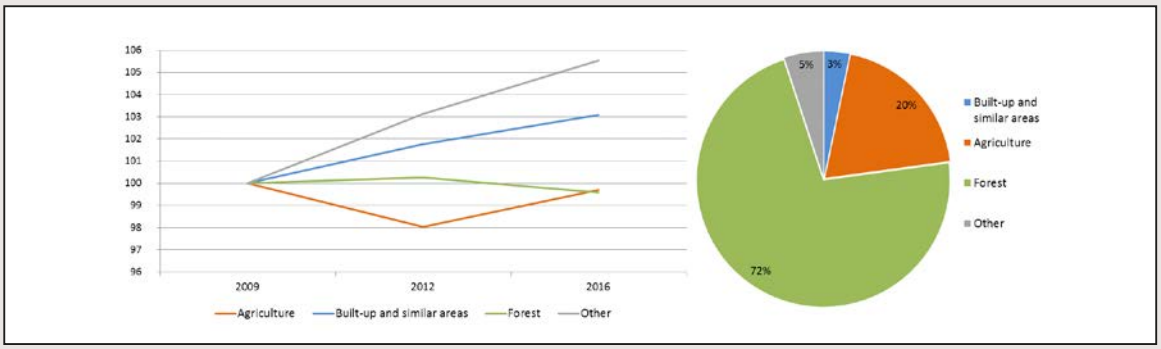


Figure 2.2.2-5 *Development (2009-2016; index base year 2009 = 100) and share (2016) of different land use classes in the Slovenian part of the Alpine Convention area (Data source: Slovenian Ministry of Agriculture, Forestry and Food 2016; graph: ifuplan 2016).*

SWITZERLAND

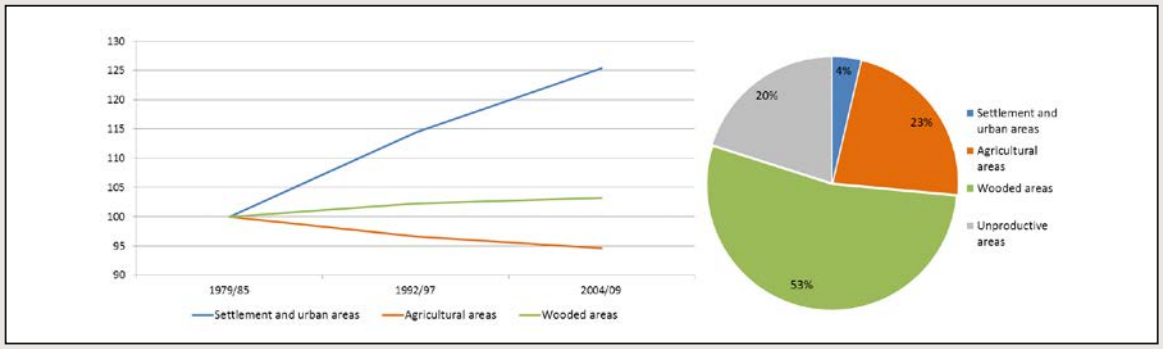


Figure 2.2.2-6 *Development (1979-2009; base year 1979/85 = 100) and share (2004-2009) of different land use classes in the Swiss part of the Alpine Convention area. Data were provided for Cantons. Four Cantons are only partly within the AC area but are included completely in the figures (Data source: BFS 2016b; graph: ifuplan 2016).*

Germany (cf. Figure 2.2.2-3), Liechtenstein (cf. Figure 2.2.2-4), Slovenia (cf. Figure 2.2.2-5) and Switzerland (Figure 2.2.2 6) show a continuous increase of settlement area over the last decades, with only minor decreases in growth rates during the recent period (DE: 2004-2013; FL: 2002-2008; SI: 2012-2016; CH: 1992/97-2004/09). The comparability with land use data based on cadastres (as for German data) or interpretation of aerial photography (as for Slovenian, Swiss and Liechtenstein data) is rather limited. The share of settlement and transport infrastructure area in Germany (8%) and Liechtenstein (10%) seems relatively high compared to other Alpine countries. However, as the classifications and sources differ from country to country, a direct comparison of numbers is possibly misleading.

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

The share of agricultural area declined in Germany (to 44% in 2013), in Liechtenstein (to 33% in 2008) and in Switzerland (to 23% in the timeframe 2004/2009) as this land use category is most frequently converted. In the Slovenian part of the Alps, the agricultural area stagnated at about 20% of the total area in 2016.
In Slovenia and Switzerland, more than half of the Alpine Convention area is forest or wooded area, in Switzerland these areas increased, in Slovenia they stagnated (SI: 2012-2016; CH: 1992/97-2004/09). Germany and Liechtenstein have a smaller share and a minor increase of forest area (DE: 2013; FL: 2008).

Conclusion on opportunities and challenges

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

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

Land take affects agricultural areas, which are frequently transformed into settlement, infrastructure and economic sites. This conversion of agricultural land affects mainly valley bottoms and gentle slopes in lower altitudes were soil productivity is – in most cases – higher than in higher altitudes and on steeper slopes. Therefore, agriculture has lost and is continuing to lose more and more land with a relatively high productivity and finds it increasingly difficult to compete with agriculture in the lowlands. The economic consequences cannot be described here comprehensively, but this process may potentially contribute to a further decline of agriculture in the Alps.

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

2.2.3 CIRCULAR ECONOMY, RECYCLING AND WASTE MANAGEMENT

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

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

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

Background

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

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

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

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

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

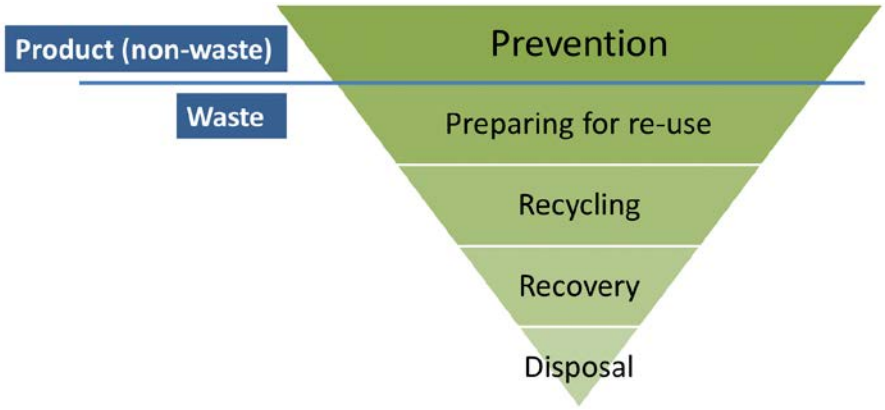


Figure 2.2.3-1 Waste hierarchy of the EU Waste Directive (Source: EC 2008; ri-elaboration: PSAC).

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

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

- recycling of 65% of municipal waste by 2030
- recycling of 75% packaging waste by 2030
- material-specific targets for different packaging materials
- a binding landfill reduction target of 10% by 2030.

Alpine relevance of a circular economy, recycling and waste management

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

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

Good practice – Eco Kamp Koren, Slovenia

Koren Camp – a sustainably managed campground – is organised in harmony with nature and ensures the protection and careful use of natural resources. It strives to offer many locally grown products in its store.

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

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

The environmental policy of the campground is based on several principles: (1) With regard to the legislative framework it relies on preventive action to ensure human health and a healthy environment; (2) the commitment of employees and visitors to protect the environment; and (3) continuous improvement of its environmental performance.

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

Situation in Alpine countries

GERMANY

Figure 2.2.3-2 shows the absolute amount of waste in Germany and the shares of different sources. The blue part shows the municipal waste, which has been more or less stable over the years, while the green part – waste from waste[37] – has decreased due to the reduction of coal exploitation. Waste from production and manufacturing – the dark red share of the column – fluctuate with business activity. The highest waste volumes originate from the construction and demolition sector (yellow), including road construction waste. It is four times higher than municipal waste and more than 50% of the total waste. Finally, waste from waste treatment plants (orange) is almost as much as municipal waste.

Municipal waste in Bavaria is collected and / or has to be brought to collection points. Every municipality has a different system. While residual waste and in most cases also paper and organic waste are collected (i.e. picked up), other recyclables such as textiles, glass, metals, packaging waste etc. have to be brought to collection points.

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

37. This is waste from exploration, mining, quarrying, and physical and chemical treatment of minerals.

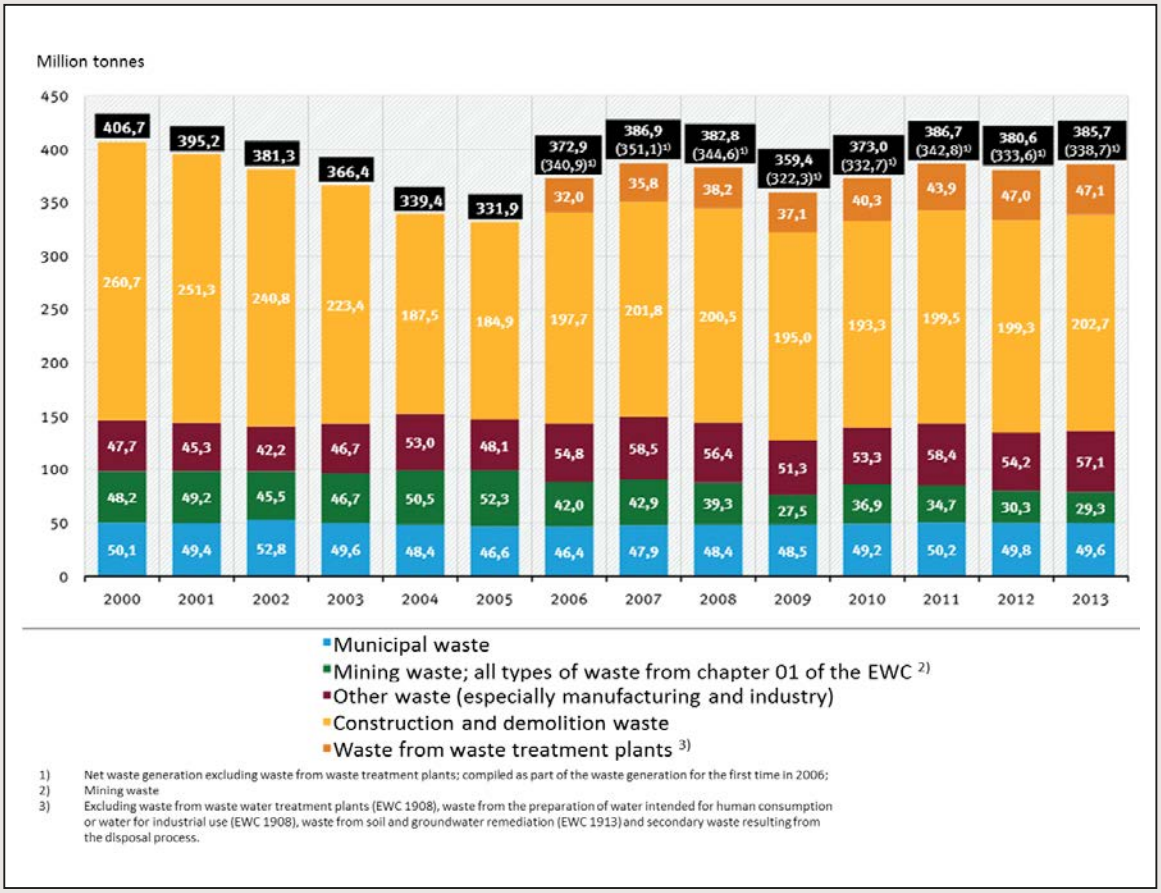


Figure 2.2.3-2 Total waste generation (including hazardous waste) in Germany (2000-2013) in million tons for different types of waste (Source: UBA 2015).

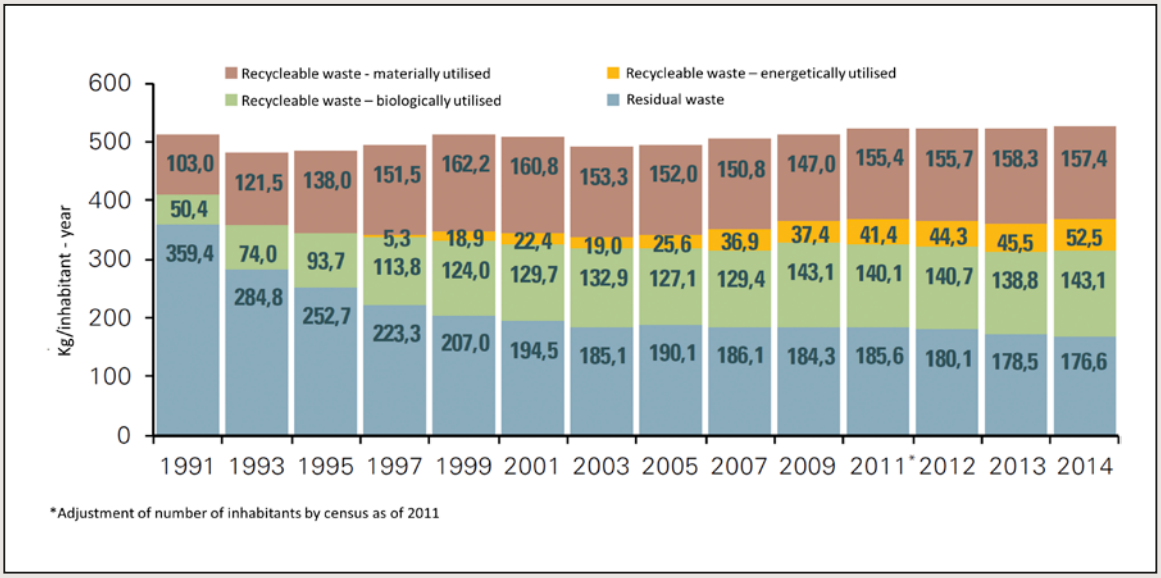


*Figure 2.2.3-3 Development and utilisation of municipal waste (kg per inhabitant) in Bavaria between 1991 and 2014 (Source: LfU 2015). *Adjustment of number of inhabitants in line with 2001 census.*

ITALY

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

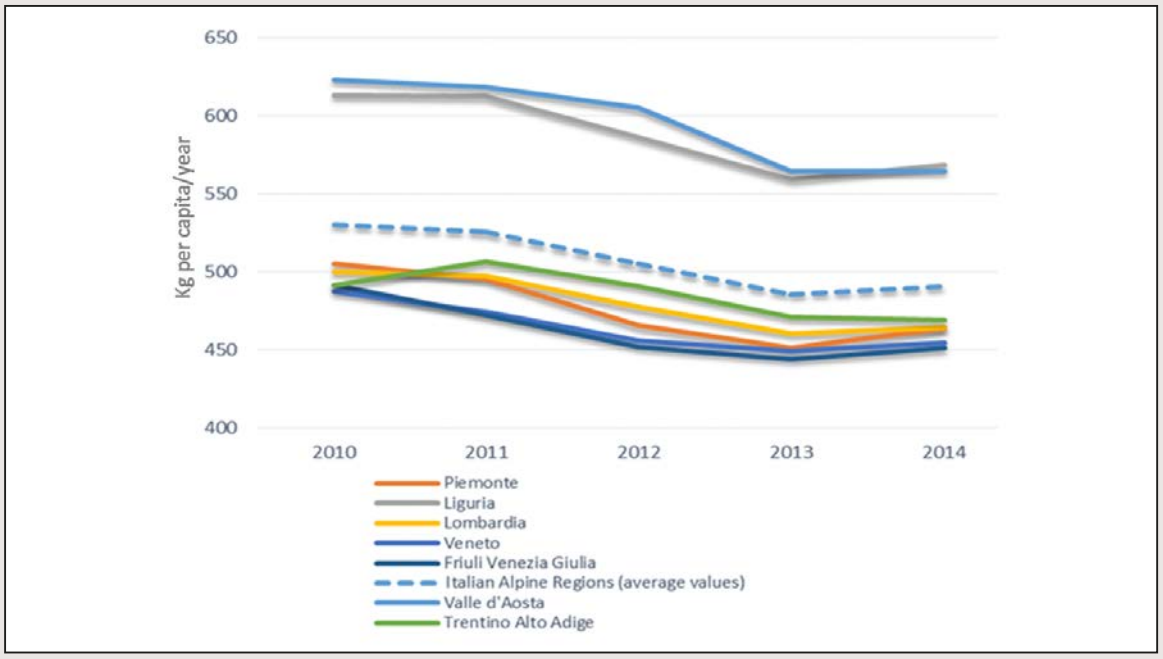


Figure 2.2.3-4 Annual urban waste p.c. in the Italian Alps, regional data (2010-2014) (Source: ISPRA 2015b).

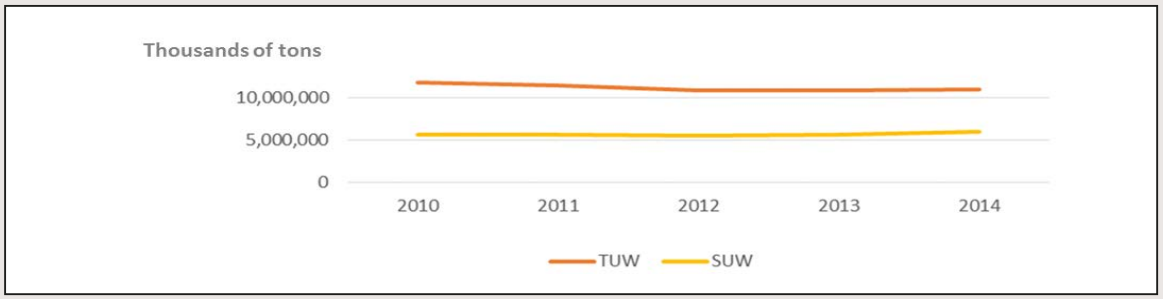


Figure 2.2.3-5 Total and sorted urban waste (TUW and SUW) in the Italian Alps (Source: ISPRA 2015b).

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

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

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

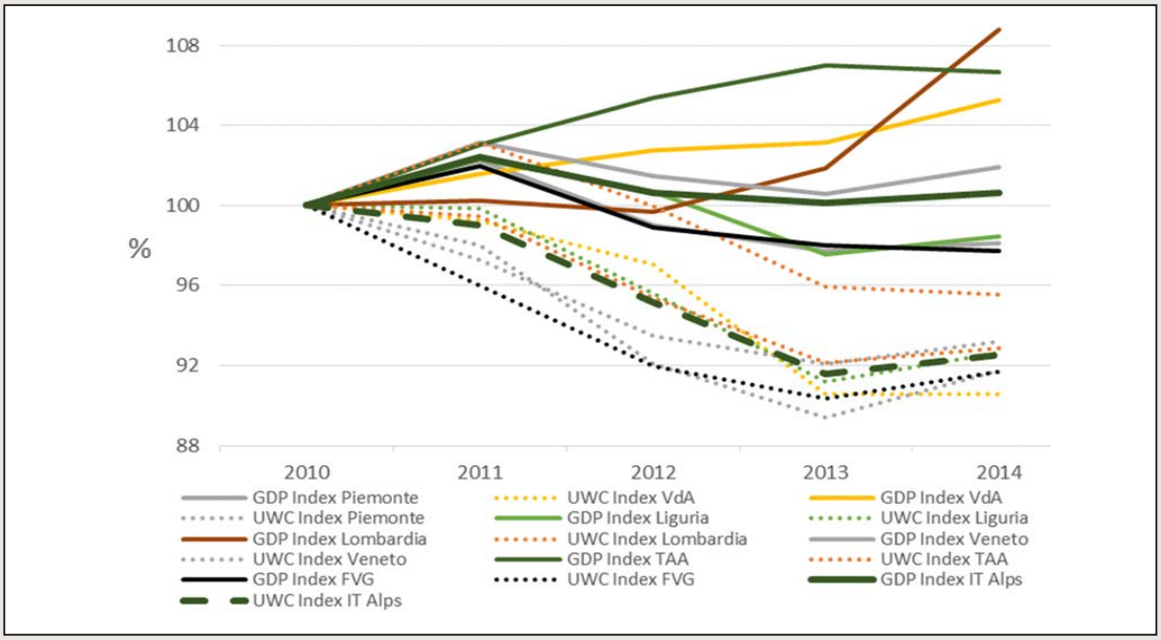


Figure 2.2.3-7 Trends of Urban Waste and GDP p.c. in the Italian Alpine regions, indices 2010-2014 (Source: ISPRA 2015b).

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

Regional figures are available concerning some economic aspects of waste management in the Alpine area. The average costs of waste disposal for unsorted, sorted and total waste collected for inhabitants have changed over the 2001-2014 period in the northern part of Italy: the growing rate of sorted waste and new innovative management techniques have caused an increase in total costs of 37.7%, driven by a significnat increase in the cost of sorted waste management (+139%). Some components have nevertheless decreased. Unsorted waste management costs, for instance, have decreased by 13.4%.

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

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

LIECHTENSTEIN

After the implementation of fees on municipal waste based on the polluter pays principle in 1994, the amount of waste clearly declined. In the following years, the amount developed in parallel to the population growth. The recycling rate was 60.3% in 2010.

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

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

SLOVENIA

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

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

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

Consumers and their lifestyles are one of the driving forces in the use of natural resources and the generation of waste. In 2014, 891,708 tonnes of municipal waste were generated (414 kg per capita). Thanks to separate waste collection and other legal measures, the quantity of landfilled municipal waste has declined (from 74% in 2008 to 23% in 2014). The exploitation of natural resources produced or abstracted in Slovenia after 2007 has been decreasing. In 2012, 22

million tons of which a maximum of mineral raw materials, primarily for construction, have been used. The efficient use of resources can be monitored by resource productivity, which has been rising since 2007, mostly due to reduced construction activity.

SWITZERLAND

The Federal Office for Environment (FOEN) is responsible for the national coordination of waste management. Statistical data on recycling (tons and per cent) are available for the years 1990 to 2014 (BFS 2016h).

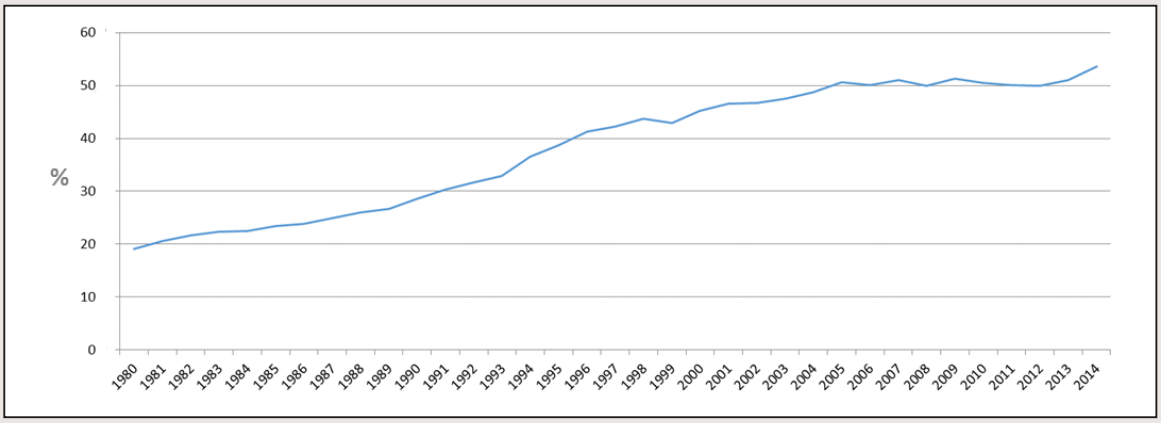


Figure 2.2.3-8 Separately collected waste as a percentage of total municipal waste in Switzerland (1980-2014) (Source: BFS 2016h).

The figures above show that the recycling rates have steadily risen since 1980. In 2014, the percentage reached 53.5%. In 2013, 51% of the total volume of solid municipal waste was recycled. In the same year, the proportion of municipal waste that cannot be recycled was successfully reduced to 344 kg per person from 433 kg per person in 1989. Recycling of the following waste yielded impressive results:

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

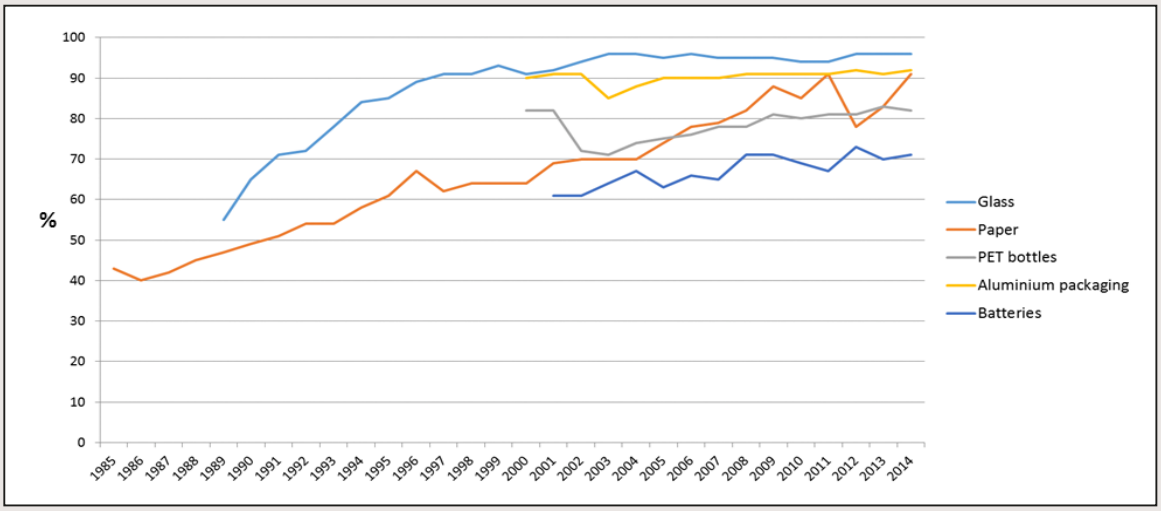


Figure 2.2.3-9 Recycling rates of various materials (1985-2014) in Switzerland (Source: BFS 2015a).

Organic waste is recycled as well. Around 1.3 million tonnes are composed in 235 organic waste plants and are processed in fermentation plants.

Conclusion on opportunities and challenges

Opportunities and challenges within the AC area in terms of a circular economy and waste management do not differ from those in the lowlands. The Circular Economy Package of the EU contains targets for waste management for 2030, which may be met in the AC countries considering on-going developments. Waste management in remote areas is a particular challenge. Expenditures for separated waste collection (organisational structures and transport) are rather high in relation to the lesser quantities of each fraction of waste generated in these areas.

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

In some border regions, a cross-border cooperation on waste management would be desirable.

2.3 ECOSYSTEM SERVICES AND A NATURAL CAPITAL-BASED ECONOMY

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

- Natural capital and ecosystem services (ESS) represent a capital besides human capital, manufactured capital, and social capital. In addition, the services nature provides are a foundation for human well-being.
- Biodiversity is a relevant factor for the provision of ESS and for building natural capital and represents a value in itself.
- The valuation of ESS has limitations and opportunities, in particular in terms of the economic valuation of natural capital and ecosystem services.

2.3.1 NATURAL CAPITAL AND ECOSYSTEM SERVICES

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

Economy, social services and human well-being in the Alps are based directly or indirectly on goods and services provided by nature. These kinds of goods and services are called ecosystem services (ESS). They build an indispensable foundation for our well-being and are of crucial economic relevance. However, the value of natural capital and ESS is often not taken into account in the national wealth accounting systems.

The degradation, overexploitation and destruction of natural capital and ESS could lead to an ecological 'bankruptcy'. This would bring tremendous disadvantages for our economy, culture and social life. Examples are the costs arising from flood damages related to degraded regulation service of riversides. Flood damages in Germany in the summer of 2013 amounted to about €11.7 billion (MunichRe 2014).

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

A mismanagement of natural capital often occurs because the full value of natural capital and ESS is not reflected in policy trade-offs and in economic choices. This lack in decision-making is prevalent on the local, regional and national level (EEA 2015d).

The maintenance of natural capital and provision of ESS is strongly linked to the economy because the economic valuation of ESS can support the identification and internalisation of environmental costs. In addition, the payment for ESS needs to reflect the multitude of ecosystem services. A missing internalisation of environmental costs delivers wrong signals for economic development. Almost all economic sectors have to integrate environmental costs and are, therefore, relevant for the transition to a Green Economy and the conservation, restoration and sustainable use of natural capital (Brink et al. 2012).

Background on the concept of natural capital and ecosystem services

How do economies benefit from nature? The concept of natural capital and ecosystem services puts biophysical structures, which enable ecological functions and services provided by ecosystems, in a context that also considers benefits for humans.

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

Interlinkages between natural capital and ecosystem services

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

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

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

Natural capital comprises two major components:

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

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

Common definitions and a valid measurement system for ESS are still under development, and a common understanding is on its way. The Alpine-wide evaluation of ESS is thus an enormous challenge. However, European approaches such as the Common International Classification of Ecosystem Services (CICES) and the Mapping and Assessment of Ecosystems and their Services

(MAES) framework do exist and may be a starting point for an assessment of ESS in the Alps. A first framework may be expected from the Alpine Space project *Alpine ecosystem services – mapping, maintenance and management* (AlpES). The overall objective of the project is to introduce ecosystem services as a regional and transnational environmental governance framework.

Types and structure of ecosystem services

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

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

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

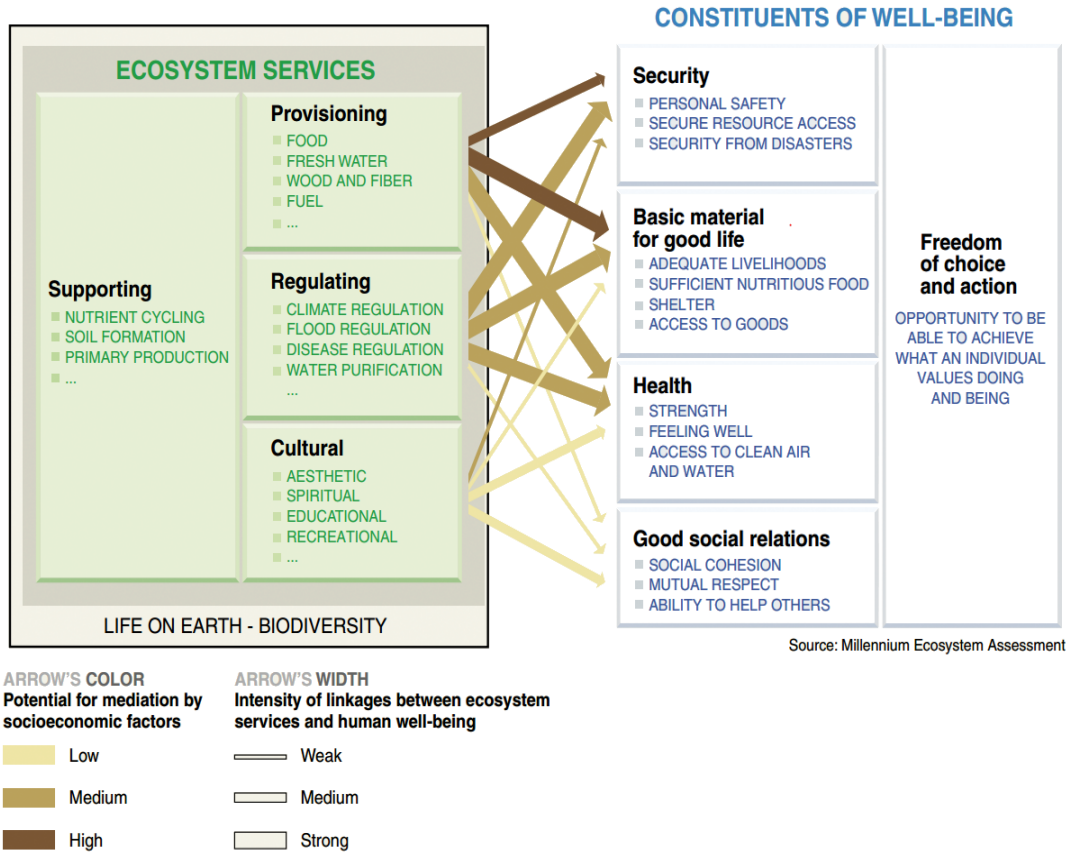


Figure 2.3.1-2 Categories of ecosystem services and their relation to human well-being (Source: MEA 2005).

Trade-offs between ecosystem services and other forms of land use

The application of the ecosystem service concept does not mean that there will be no conflicts. Rather, trade-offs between different ecosystem services will become more visible and benefits and disadvantages for human well-being will be easier to detect. This might be the case for intensive agricultural production in fruit orchards (provisioning service) versus groundwater protection as a regulating service. Even conflicts between the maintenance of ecosystem services and other forms of land use, in particular economic activities, are better to grasp because the focus is on the effect on well-being. An example might be the use of hydropower dams for electricity production versus cultural services such as landscape aesthetics.

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

- Biomass energy needs to consider the small scale of Alpine agriculture and has to adjust the biomass facility size.
- Hydropower should seek to find a balance between energy production and the preservation of particularly small pristine rivers with high ecological values.
- Wind energy should consider requirements of biodiversity protection and the compatibility of wind mills with Alpine landscapes.
- Photovoltaic systems should preferably be promoted on buildings and other sealed surfaces.

Ambiguity of evaluation

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

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

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

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

Status of ecosystem service analysis at European level

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

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

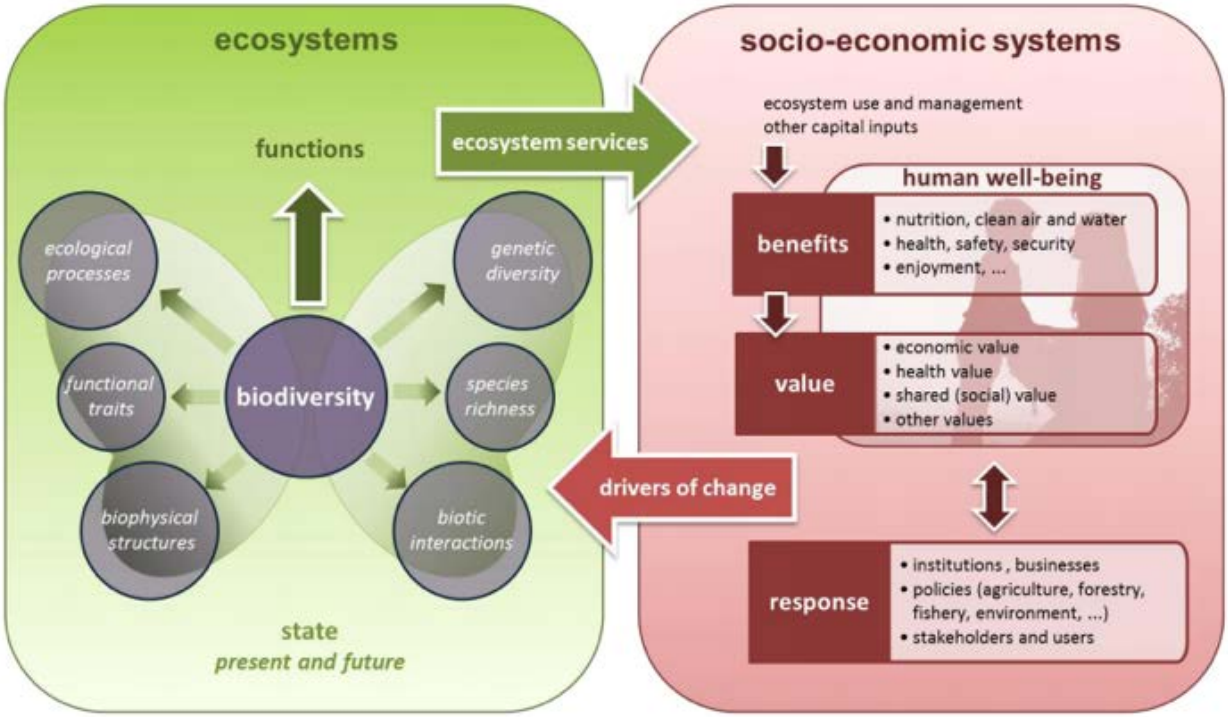


Figure 2.3.1-3 Conceptual framework for EU-wide ecosystem assessment (Source: Maes et al. 2016, p.16).

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

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

The recently started ESMERALDA project[38] is going to provide an overview of the state of assessments and mapping of ecosystem services in the EU Member States. In this study, different levels (tiers) of ecosystem service assessments will be considered, and data for map production and practical recommendations will be provided.

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

38. Enhancing ecoSysteM sERvices mApping for poLicy and Decision mAking (ESMERALDA). Further information: www.esmeralda-project.eu.

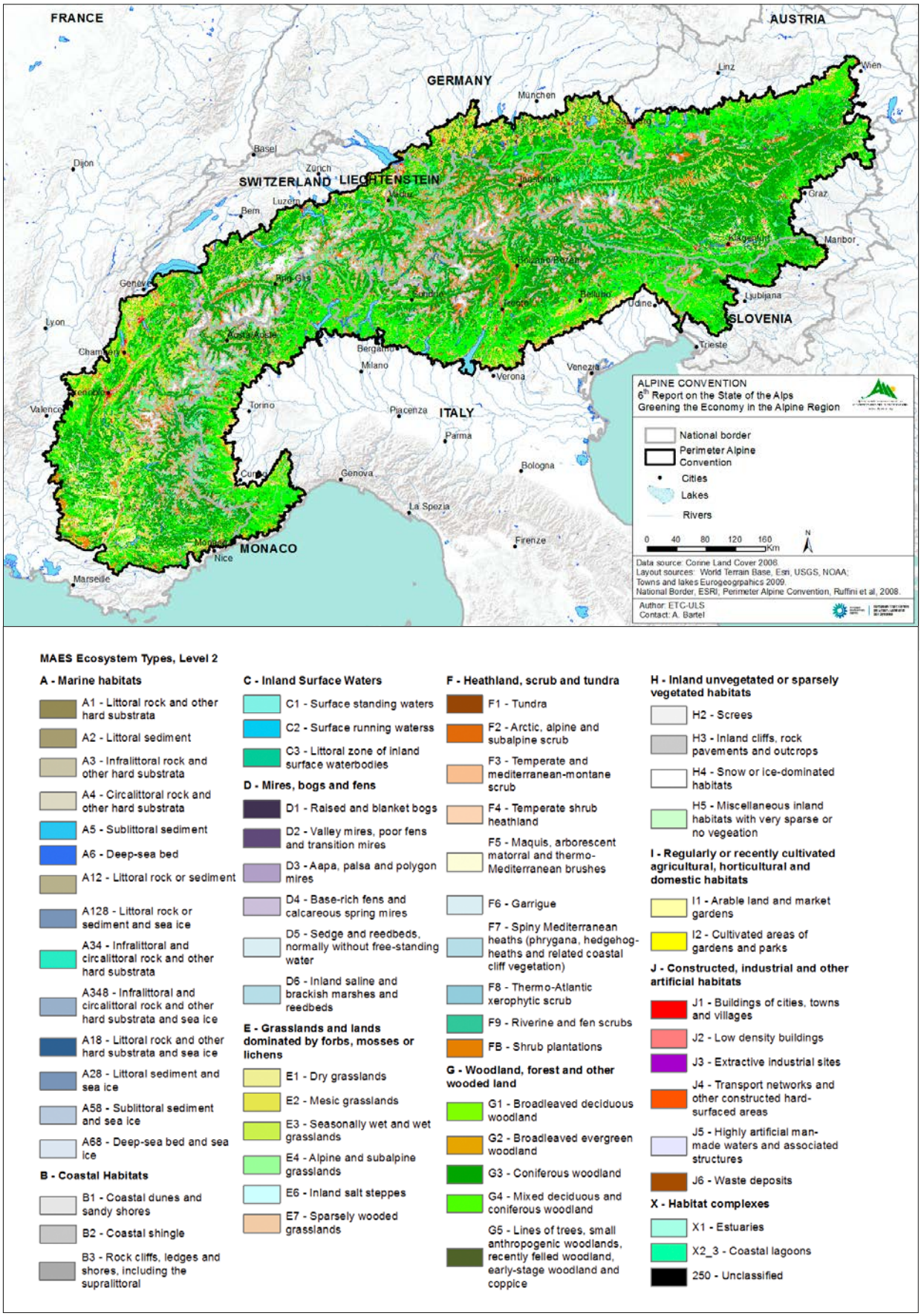


Figure 2.3.1-4 Ecosystem types based on CORINE Land Cover (CLC) data in the Alpine Convention perimeter (Source: ETC ULS 2016a).

Policy background on natural capital and ecosystem services

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

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

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

Alpine relevance of natural capital and ecosystem services

What are specific contributions of the Alps in terms of natural capital and delivering ecosystem services? It is difficult to answer this question, as no cross-country analysis of natural capital and ESS exists. However, based on other analyses, the following first examples of Alpine natural capital and ecosystem services can be highlighted:

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

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

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

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

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

Good practice - Sardona Active, Switzerland

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

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

Further Information: www.unesco-sardona.ch

Natural capital - the example of forests in the Alps

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

Ecosystem services – the example of hazard prevention

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

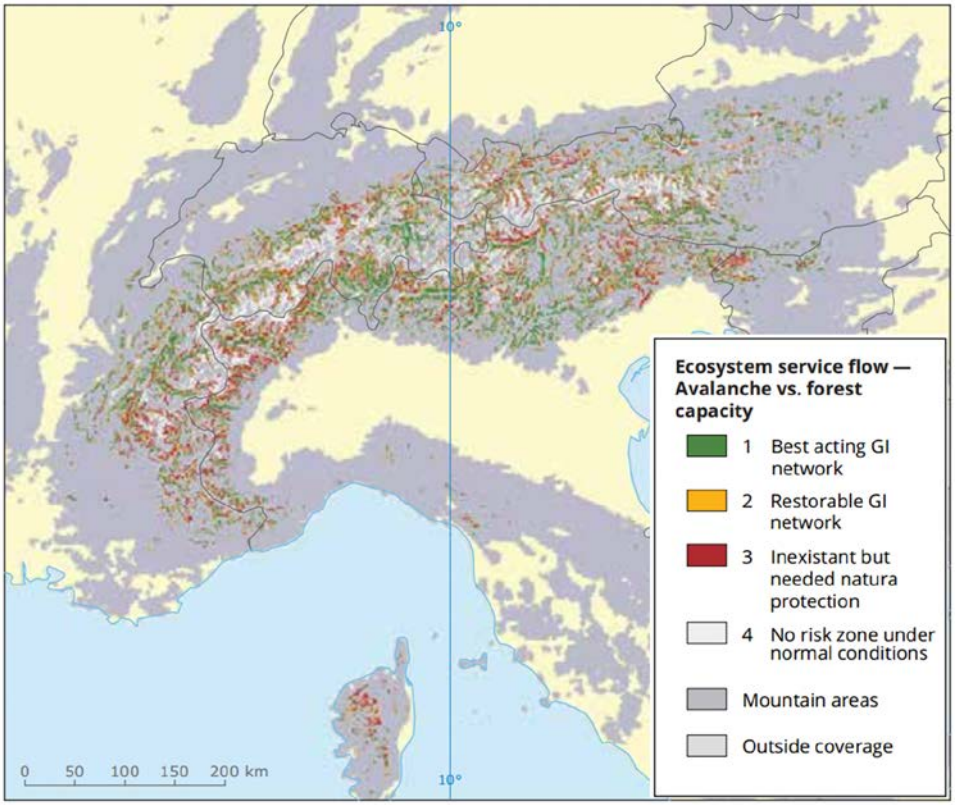


Figure 2.3.1-6 *Avalanches are a typical natural hazard in high mountain ranges like the Alps. The hazard potential is presented against the ecosystem service capacity of Green Infrastructures (GI) such as forests to mitigate avalanches. (Source: EEA 2015e).*

Situation in Alpine countries

Natural capital in the Alpine countries – Forest development

Wood is a renewable and climate-neutral resource, which serves as a key material for a Green Economy. For the purpose of this report, two indicators were selected to assess natural capital within the Alpine Convention area: net annual forest increment and annual felling (both measured in m³/ha).

The relation of these two indicators expresses the stress on forests caused by their exploitation in the Alpine area. The total wood volume of Alpine forests is 2,000 million m³, with an average of almost 240 m³/ha, much higher than the EU 28 average (146 m³/ha). The annual increment is 50 million m³, equal to 5.7 m³/ha, which is higher than the EU 28 average of 4.8 m³/ha. The annual cutting is 28.5 million m³ (Working Group Mountain Forests 2016). Figure 2.3.1-7 trends on the amount of annual growth compared to annual felling.

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

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

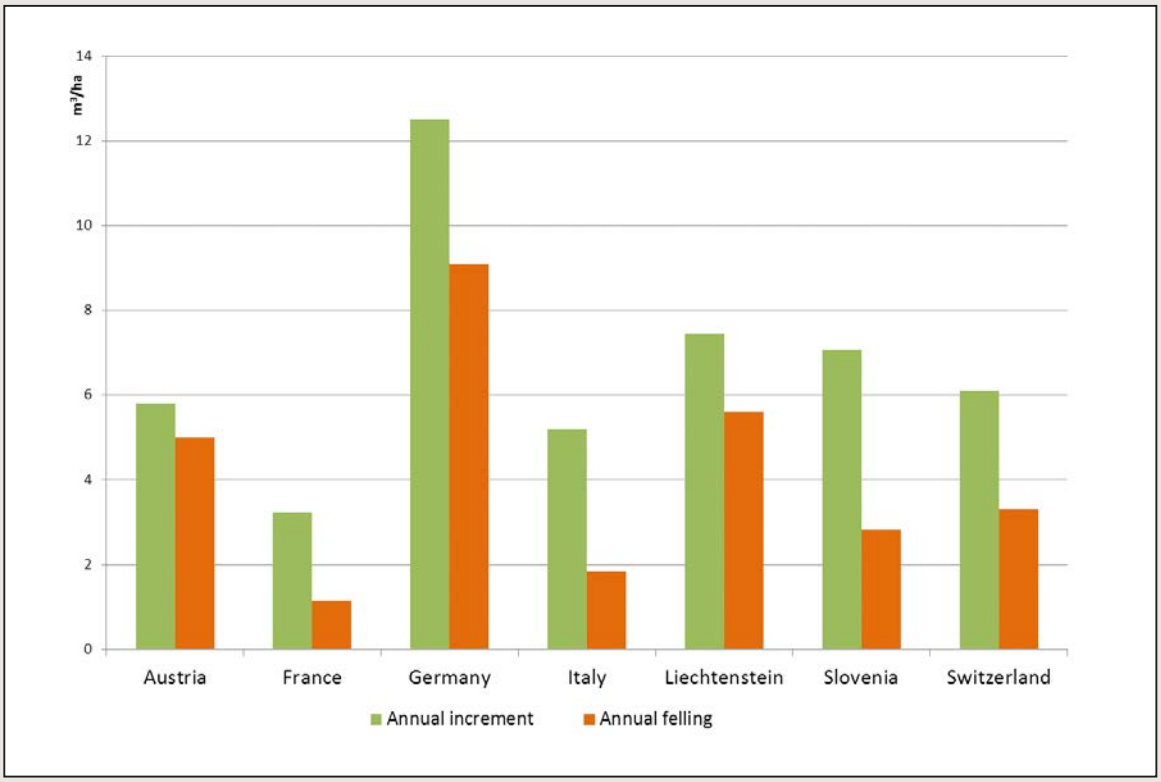


Figure 2.3.1-7 *Annual forest increment and felling (m³ per ha) in the Alpine countries (Source: Working Group Mountain Forests of the Alpine Convention 2014). In the south-western Alps, felling amounted to 35% of forest growth, while in the north-eastern Alpine area it was 75%.*

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

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

AUSTRIA

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

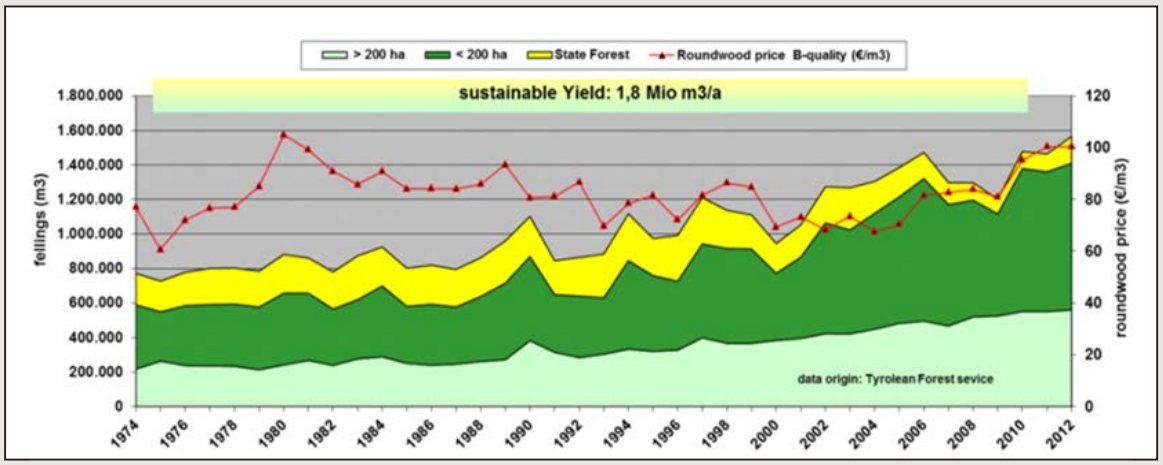


Figure 2.3.1-8 Felling in Tyrol from 1974-2012 in smaller and larger than 200 ha properties and state forests (Source: Working Group Mountain Forests of the Alpine Convention 2014).

GERMANY

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

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

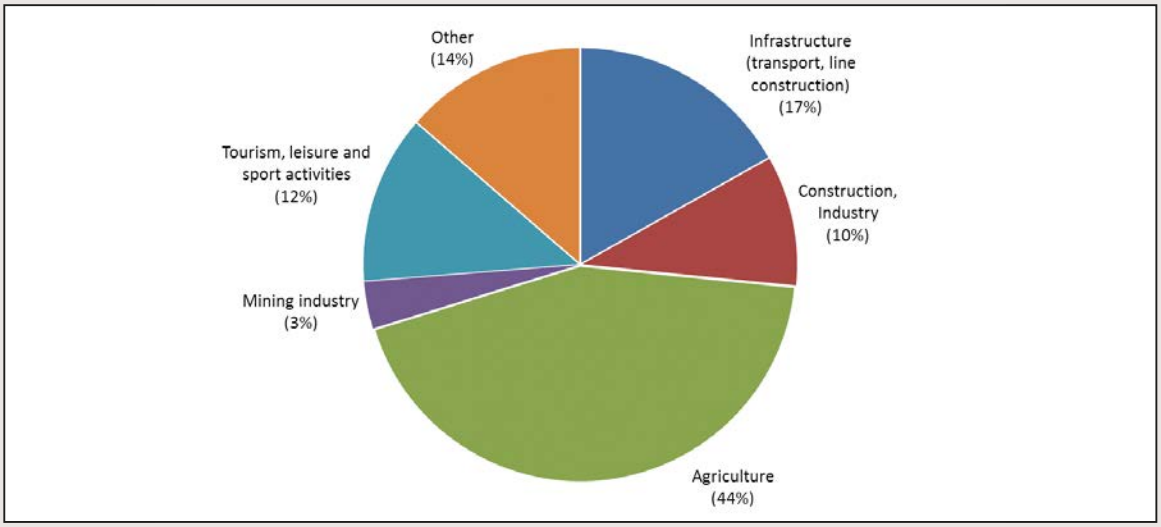


Figure 2.3.1-9 *Share of approved clearings of forests by sectors in the German Alpine Convention area from 2006 to 2012 in the districts of Bad Tölz, Berchtesgadener Land, Garmisch-Patenkirchen, Lindau, Miesbach, Oberallgäu, Ostallgäu, Rosenheim, Traunstein and Weilheim (Source: Bayerischer Landtag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

ITALY

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

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

Figures also show that the national annual increase of forests (+0.6%) is higher than in the Italian Alps (+0.4%).

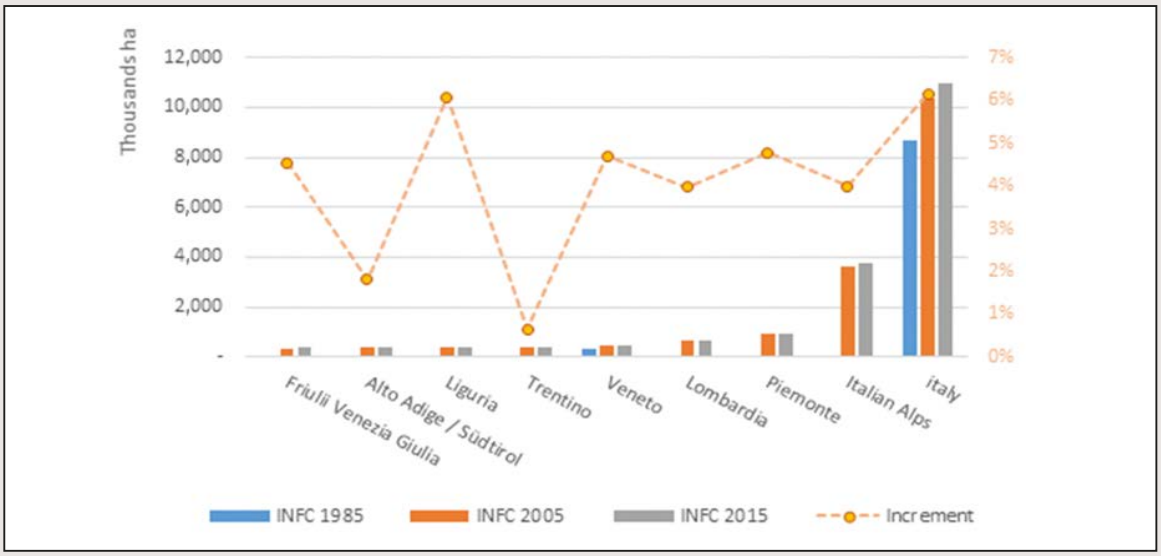


Figure 2.3.1-10 *Forest land cover and increment, Italian Alpine regions (2004- 2014) (Source: Corpo Forestale dello Stato & CRA 2015).*

LIECHTENSTEIN

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

Table 2.3.1-1 shows the distribution of logged wood across different usage categories. Around 70% of total felling in Liechtenstein are used for wood fuel. 33.3% are assigned for construction wood and only 0.5% are used for industrial purposes. Since 2014, energy wood obtained from branches and crown tops is documented separately and makes up 10% of the total energy part.

	Energy wood	Construction wood	Industrial wood	Remaining in forest	Total
Total logged, m³	14,401	7,407	109	342	22,259
Share	64.7%	33.3%	0.5%	1.5%	100%

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

SLOVENIA

Slovenia has a long tradition in sustainable forest management. The most typical feature of the Slovenian landscape is its forests, which cover 58.4% of the national territory. In terms of relative forest cover, Slovenia ranks third in the European Union, after Finland and Sweden.

The forest area in Slovenia is expanding through the natural reforestation of abandoned farmland, meadows and pastures. In many parts of the urban landscape, however, forests have to yield to the construction of infrastructure and housing. Forests are a valuable natural resource for Slovenia, containing close to 300 million cubic meters of wood. The proportion between deciduous and coniferous trees is 45.8 : 54.2. In the year 2013, the growing stock increased by 1.4% and amounted to 342,408,614 m³ or 289 m³/ha. The annual increment was 8,491,883 m³ with 3.7 million m³ coniferous trees and 4.8 million m³ deciduous trees.

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

SWITZERLAND

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

Switzerland	2005	2006	2007	2008	2009	2010	2012	2013
Forest area (ha)	1,242,510	1,244,681	1,247,856	1,254,144	1,255,141	1,255,274	1,258,658	1,258,210
Wood production (m³)	5,284,639	5,701,515	5,690,549	5,262,183	4,879,697	5,128,995	4,658,379	4,778,328
FSC certified wood production (m³)	3,552,518	3,895,054	3,809,913	3,494,644	3,443,713	3,456,408	3,176,516	3,194,409

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

Good practice – Sustainable forest management in Mezzano, Italy

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

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

Prescribed cutting was also increased from 3,750 to 5,500 cm/year, from 60% to 70% of the annual forest growth, despite the fact that the amount of actual felling was higher due to wind damages (53,000 cm, i.e. +22% in 50 years). In total, 300,000 cm of wood have been collected, mostly industrial wood but also firewood for the local population.

Fifty years later, the forests have good accessibility and infrastructure, with a house for the forest warden, a former agricultural building refurbished as a camp for school children, and an educational nature trail. Despite some relevant damages caused by windthrow and snowbreaks the forest has a very high growing stock and wood production. Wood is sold at a good price, there is a relevant presence of large fir trees, a rapidly growing beech percentage with positive effect on soil fertility, and part of the forest is within a Natura 2000 area.

Felling is done by local companies while many families still take wood fuel for their needs – which is a recognised right for the inhabitants of the municipality – as well as wood for building their homes).

Further Information: www.comune.mezzano.tn.it

Situation in Alpine countries

Status of ecosystem service analysis in the Alpine countries
Role of mountain forests for providing ecosystem services

Alpine forests stock big amounts of carbon, removing CO_2 from the atmosphere and transforming it into organic matter (mostly wood, which basically consists of carbon). Even when considering only the carbon in the above-ground mass (without roots, litter and soil, which represent 150 to 200% of it), the total amount is remarkable: 600 million t (i.e. 2,200 t of CO_2). Annual sequestration is also very relevant: 50 million t of wood growth corresponding to 55 million t of CO_2. 42% of it is stocked in the growth of forest stands (representing an accountable sequestration within the Kyoto agreement); the rest (non-accountable sequestration) is felled and used mostly in the building and furniture sectors (thus continuing sequestration for the time staying in the stock) and in part as firewood (returned to atmosphere but replacing fossil fuels). A 'cascade use' of wood (i.e. using raw material primarily for long-life products, while using industrial wood waste and end of life-products to generate bioenergy) extends the carbon sequestration process.

In mountain areas, forests play an essential role in providing soil cover and protection against natural hazards like avalanches, rockfall and erosion. Designed as protective forests, they are subject to stricter regulations regarding land use change and management. This function is particularly relevant in the Alps, which are characterised by steep slopes as well as dense population and infrastructure.

The storage of carbon in Alpine forests is a regulating service that has gained more attention due to the effects of climate change.

Another highly important aspect is the impact of the forest cover on the water cycle: forests provide for canopy and soil filters and store rainwater with a positive effect on water quality and on flood reduction. The natural risk-reduction function is even more important in the context of climate change. Extreme events are expected to occur more frequently, and the costs for soil and infrastructures protection are very high (Working Group Mountain Forests of the Alpine Convention 2016).

AUSTRIA

The Austrian Biodiversity Strategy 2020+ published in 2014 refers to ecosystems and their services. The introduction of a green GDP (*Umweltgesamtrechnung*) is discussed, and approaches for green accounting are tested, but methods and applications are still on the research agenda.

The MAES group[39] characterizes activities related to ecosystem services in Austria focusing on the development of biodiversity indicators: for this, several studies have been conducted by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, also dealing with ESS. The aim of a study in 2013 was to assess the condition and importance of biological diversity in Austria, to provide a comprehensive definition of ecosystem services and to depict possible conflicts, e. g. effects of soil sealing on various services.

Other activities were undertaken by the Environment Agency Austria, such as a nation-wide mapping of ecosystems based on the EUNIS classification (105 classes from level 2 to 4) with a spatial resolution of 10 x 10 metres. Mapping and assessing of a set of ecosystem services on a regional level was conducted within the MUFLAN project for two case studies in Römerland Carnuntum and Oststeirisches Kernland. A study published in 2011 presented an inventory of ESS in an agricultural context. An inventory of ecosystem services of forests followed in 2015. Another report published in 2015 examined potentials, requirements and risks of the economic valuation of ESS. Furthermore, contributions were made to the COIN – Cost of Inaction – project by examining the costs of climate change and its effects on two ecosystem services (pest control and pollination). On a European scale activities included the participation in MESEU as well as contributions, e.g. to the creation of the Map of European Ecosystem Types based on the EUNIS classification and ecosystem assessment as part of ETC-SIA.

In a case study in the Stubai Valley the ecosystem services of agricultural areas were analysed in terms of effects of global change by Schirpke et al. (2013). In addition, scenarios have been analysed how future land use patterns would develop under changing conditions and what this will mean for multiple ecosystem services. Results point out that a local economy concept may generate new markets for agricultural products. However, due to changing climate conditions, declining precipitation may limit farming opportunities. An increasing forest cover may provide additional ecosystem services but might reduce cultural services for tourism. It is recommended to consider multiple ecosystem services and their trade-offs in agricultural management and in land use policy.

FRANCE

According to the MAES group, scientific and technical committees as well as a steering committee involving stakeholders have been set up in France. There are working groups focusing on different ecosystems (current state in 2015: forest, wetlands, urban ecosystems, agro ecosystems, and marine ecosystems). A new working group on rocks and mountains was planned to be launched at the beginning of 2016. The output of the working groups is expected to include a map of wetlands, a report on what can be done in urban ecosystems and case studies, a map and assessment of some ecosystem services such as pollination). In terms of the economic assessment of ESS, the use of data was clarified at the *Hands On* workshop.

A process has been launched to look at values of ecosystem services that are not well considered in current work, which tends to focus more on economic assessment. Issues that will be explored concern less tangible cultural services with benefits such as spiritual and mental well-being. Experience has shown that it is difficult to communicate these issues, and one priority will be to provide indicators for the decision-making process.

39. More information: biodiversity.europa.eu/maes/maes_countries.

GERMANY

In Germany, ecosystem services are tackled mainly by the Federal Agency for Nature Conservation and the German Environment Agency at the federal level. Other public authorities e.g. from the agricultural sector have joined the discussion and development process. Many activities are carried out within the national TEEB process (The Economics of Ecosystems and Biodiversity), called *Naturkapital Deutschland* (Nature Capital Germany). The activities comprise:

- A national overview study on physical accounting for ecosystem services has been carried out including first mapping and assessment approaches on behalf of the Federal Agency for Nature Conservation (Marzelli et al. 2014). It includes the definition of ecosystem services, prioritization of services with special importance for Germany, exploration of available data, presentation/creation/discussion of alternative indicators for each service, reasoned proposal of one indicator for each service, mapping of indicator values based on available data and a scoping study on economic values for ecosystem services (meta-analysis). The study produced several maps of ESS at national level, which also cover the German Alpine Convention area (cf. Figure 2.3.1-11).
- Based on the above-mentioned overview study, a discussion paper summarises the development of national indicators for ecosystem services – Recommendations for Germany (Albert et al. 2016). In this paper, 23 indicators for ecosystem service supply, demand and use are proposed with some extensions and modifications regarding e.g. groundwater quality, fodder production, ecosystem services of natural and semi-natural ecosystems in agricultural landscapes.
- Within the Nature Capital Germany[40] TEEB process (2012-2017), two general and four topic-based reports presenting the economic arguments to support nature conservation are produced. The reports include an introductory brochure (TEEB Germany 2012) and a brochure for businesses (TEEB Germany 2013). The topic reports focus on the contribution of nature and nature conservation to climate change mitigation and adaptation (Marzelli et al. 2014), ecosystem services in rural areas (TEEB Germany 2016a), ecosystem services in cities (TEEB Germany 2016b) and a summary report on the integration of ESS into private and public decision making.
- Job (2015) has analysed the economic effects of tourism in the Nationalpark Berchtesgaden. He documented that in the year 2014 about 1.58 million people visited the park and generated a turnover of €93.8 million. Compared to his former analysis in the year 2002 (Metzler & Job 2003), visitors and turnover have significantly increased.

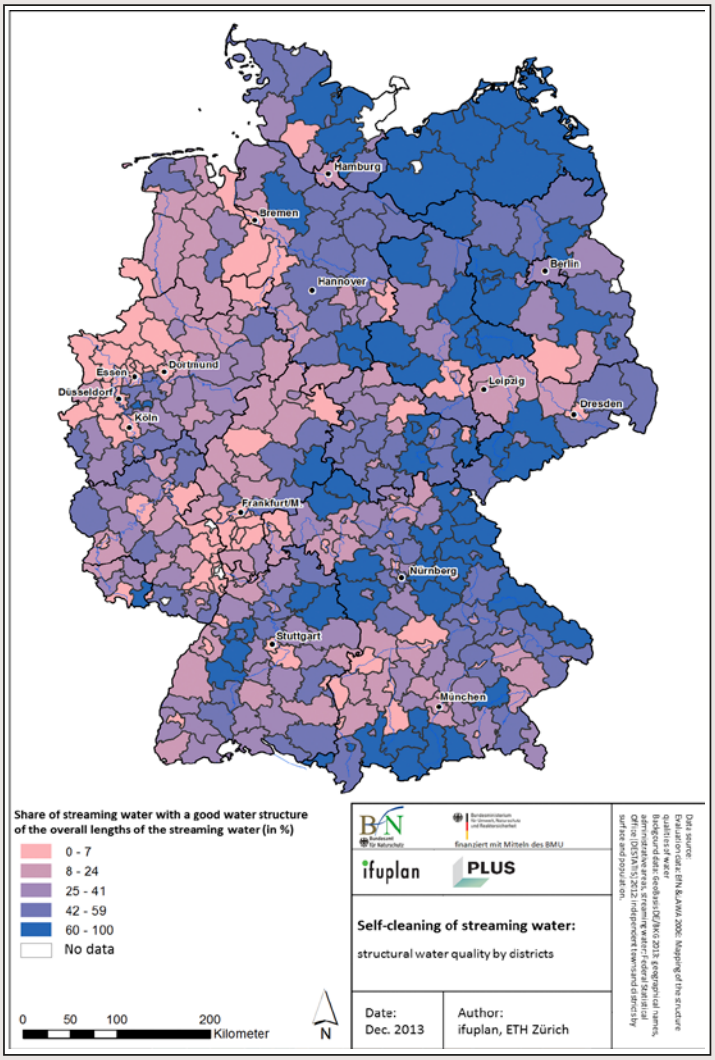


Figure 2.3.1-11
Share of streaming waters with a good water structure in percent of the overall lengths of the streaming water per county in Germany. The streaming water structure in the Alpine counties is better than in most counties north of the Alpine arc (Source: Marzelli et al. 2014).

40. Further information: www.naturkapital-teeb.de.

ITALY

Updated and detailed basic data have been collected at the national level, including eco-regions, land units, bioclimate, biogeography, potential natural vegetation and CORINE Land Cover at the fourth level. As a result, a map of national ecosystems at 1:100,000 based on CORINE Land Cover and potential natural vegetation, bioclimatic and biogeographical information has been delivered in which ecosystem types have been defined according to their biogeographic and bioclimatic setting, geographical location and vegetation physiognomy. Moreover, the conservation status of ecosystems and landscapes has been assessed based on a selected set of parameters. Ecosystem services have been inspected from a biophysical point of view for five pilot case studies focusing in particular on provisioning and regulating services. Moreover, some criteria to determine priorities for ecosystem restoration have also been proposed and applied based on the status of conservation of related habitats for community interest (ESMERALDA 2015).

From a policy point of view, ecosystem services have been receiving particular attention in the framework of the Italian National Biodiversity Strategy (MATTM 2010), especially the ones that derive from national, regional and other parks across the whole country (MATTM & Unioncamere 2015).

National parks in Italy are considered responsible for the implementation of the CBD Strategic Plan 2020 (Aichi Target 11) to conserve biodiversity and ecosystem services through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures.

The Italian National Biodiversity Strategy was approved in 2010 and considers biodiversity as natural capital due to both its intrinsic and tangible value and the ecosystem services that flow from it. These are essential to shape human well-being but also to sustain economic prosperity. The strategy starts with an investigation concerning natural capital (defined as *natural heritage*) that aims at accounting in physical terms the size of vegetal, wildlife and water heritage by providing homogenous metrics for all the national parks across the country.

Forest ecosystems received particular attention due to their significant presence in national parks. The role played by forests in stabilizing GHG concentrations in the atmosphere has increased the importance of the ecological role and the socio-economic function of forests as carbon sinks and stocks in line with climate change mitigation as a priority. The identified forest ecosystem services include the following ones:

- Water regulation and surface run-off reduction.
- Prevention of hydrogeological instability and limitation of natural hazards.
- Influence on global atmospheric circulation and its components (in particular through carbon sinks).

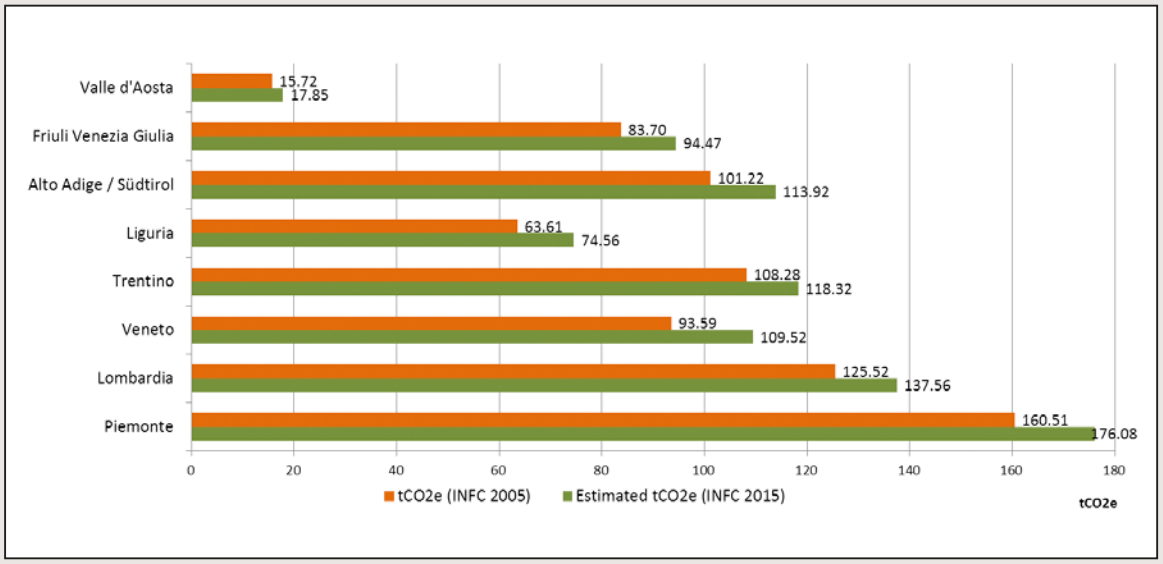


Figure 2.3.1-12 Forest carbon sinks in the Italian Alpine regions, 2005-2015. tCO2e figures for epigeous phytomass, Italian National Forest Inventory (INFC) 2005-2015 (Source: Corpo Forestale dello Stato & CRA 2015).

In line with the role of forests as carbon sinks, which contribute to CO_2 regulation, a national registry has been set up. This shows that the contribution of carbon sinks to meet the Kyoto Protocol targets is significant. The estimated biomass of Alpine forests in Italy (data for above-ground phytomass have been reported for 2005 and 2015) has been increasing, which resulted in an augmented CO_2 storage capacity on average by some 12% (own calculation) over the 2005-2015 period. The highest increase took place in Liguria and Valle d'Aosta, as shown in Figure 2.3.1-12 below.

Carbon sequestration as an ecosystem service provided by Alpine forests in Italy was valued in monetary terms at the average market price for CO_2 EU ETS allowances of 6.65 €/ton (over the period 2012-2016), at €5,002 to €5,601 million (for 2005 and 2015 respectively) (Corpo Forestale dello Stato & CRA 2015).

Increasing attention has been paid to the effect of alternative development paths and policies on natural and semi-natural ecosystems and the services they deliver. Concerning the latter, it is recognized that many ESS are supported by biodiversity, but only a share can be assessed qualitatively, an even smaller one quantitatively, and a very small share can be valued in monetary terms (MATTM 2013).

Companies located in protected areas appear to receive significant benefits from ESS whose provision they seem to care for, including drinking water provision and climate regulation services (MATTM & Unioncamere 2015). Some industries have been considered in a recent report as core *economic sectors* in national parks, being particularly linked to the natural capital stored in those protected areas. They are:

- Food & agriculture (farming and food industry).
- Forestry and the wood-value chain from raw timber (silviculture, wood industry, pulp, paper and cardboard).
- Agro food and wood trade.
- Tourism.
- Culture and recreation.

LIECHTENSTEIN

A national biodiversity strategy is available, but no practice examples or studies on benefits have been reported. Liechtenstein participates, together with partners from Austria, Germany, France, Italy and Slovenia, in the Alpine Space project AlpES, which addresses ecosystem services. In Liechtenstein, one or two pilot areas will be analysed.

SLOVENIA

Ecosystem services in Slovenia have not yet been systematically mapped and economically evaluated, but several studies dealing with particular areas have been carried out. Slovenia has participated in the TRAIN project, and several ESS have been analysed and drafted on the national level.

The most important ecosystem services in the Triglav National Park (TNP) have been identified within the Alpine space project greenAlps in which the TNP took part as a project pilot region. TNP provides a variety of ESS such as nature conservation, environmental and cultural heritage protection, recreation and tourism. In addition, agriculture and forestry can be recognized as important economic activities for local people. Within that project, the balancing of renewable energy production and nature conservation has been analysed.

Several studies also took place where ecosystem services were evaluated in small, protected areas. One example is the evaluation of ESS as a perquisite for sustainable development in 'The cases of Lovrenško barje meres and Škocjan caves' (Danez et al. 2014). The Institute of the Republic of Slovenia for Nature Conservation is a partner in the AlpES[41] project. In the course of this project, mapping and assessment of ecosystem services will be carried out not only for the Alpine Space but also for the entire country.

41. Further information: www.alpine-space.eu/projects/alpes/en/home.

SWITZERLAND

In 2012 Switzerland adopted a biodiversity strategy in which the assessment of ecosystem services was defined as one out of ten strategic objectives. The main goal is the long-term maintenance of ecosystem services. In the strategy, the Federal Office for Environment states that one of the ways to maintain ESS is to develop indicators that help assess them. To this end, the Confederation has developed a catalogue with the 23 most beneficial ecosystem services for society (Staub et al. 2011). The indicators to measure these ESS are already being developed. The results of this qualitative observation of ESS should help to deal with potential conflicts in applying the strategy.

There has also been an attempt for a national assessment of ecosystem services and a first screening of data for mapping ecosystem services in Switzerland. This recommended to apply a tier approach, assessing ecosystem services at different levels and with different intensity (Gret-Regamey et al. 2014).

The recognition of ecosystem services is at the heart of the Swiss Biodiversity Strategy and also a pillar of the Swiss strategy for the rural area and of the Swiss forest policy. In 2009 and 2011 the Swiss FOEN has published methodological studies for establishing (non-monetary) indicators for ecosystem services. A part of the studies' recommendations have been implemented; others (e.g. indicators on pollination) need further research. A feasibility study on mapping ecosystem services and a practical assessment of data availability for ESS (Gret-Regamey et al. 2014) was conducted.

Conclusions on opportunities and challenges

Natural capital and ecosystem services are new concepts that bear a high potential for greening the economy in the Alpine Convention area. They measure and analyse stocks and flows of natural resources and make them economically assessable.

The natural capital of forests is an important resource in a Green Economy due to its characteristics of being renewable, low-energy intensive and no-waste producing. From national data on forest growth and felling, it is evident that wood biomass is managed sustainably. The forest area has even increased. However, regional data for the Alpine Convention area have not been available for this report.

Opportunities of this locally and regionally available natural capital in the Alps are: the use of sustainably produced raw material as construction wood in an innovative building sector and the furniture industry as well as and energy wood as a renewable energy source. The consolidation and further development of sustainable forest management practices can support the efficient performance and supply of ecosystem services of forests to the local and regional communities.

For the assessment of ecosystem services, a variety of national approaches exists or is in preparation in the Alpine countries, and first case studies are available. In future, the concept of ecosystem services could serve as a tool and basis for the identification of trade-offs between different ESS and other forms of land use. Based on these trade-offs and their effects, environmental costs and benefits could be better considered in a Green Economy. Furthermore, the spatial disparities of ecosystem services and the above-mentioned analysis of trade-offs might also be a starting point for the development of compensation schemes for the provision and benefitting of ESS within and outside the Alps.

To date, a common classification or identification of ecosystem services for the Alps is missing, and data for assessing or mapping ESS are not ready for use.

2.3.2 BIODIVERSITY

Biodiversity is part of our natural capital and contributes to all ecosystem services used by our society. However, biodiversity is also a category in itself, as biodiversity is more than just the vast amount of biological functionalities of and between habitats, species and genes. Biodiversity influences our cultural habits such as cuisine (regional recipes) and clothing accessories for traditional costumes and enriches our personal outdoor experiences. More than this, biodiversity is also an important economic factor in marketing and tourism (e.g. eagle or Alpine ibex used in logos), a source for pharmaceutical products, biochemical products and cosmetics, and a master for bionic developments. The uncountable variations and millions of years of development time for biological solutions are also an important knowledge source for innovation. Often, this crucial role of biodiversity for society and economy is underestimated.

Background about biodiversity

Biological diversity is understood as (1) the diversity of ecosystems and habitats, (2) the diversity of species and (3) genetic diversity. Frequently, the protection of this diversity through nature conservation is perceived as contradicting economic prosperity, hindering the development of business and infrastructure. However, this viewpoint disregards the vital importance of biodiversity for an economy, particularly for a Green Economy.

The last decades have seen a dramatic decline of species worldwide. The Alpine biogeographic region exhibits an extreme fauna and flora and a high level of endemism. This creates essential and unique ecosystems with an extraordinary biological diversity that is particularly vulnerable. Anthropogenic impacts through transport, fragmentation of biotopes, changes in land use, and air pollution strongly affect mountain areas with negative effects on biodiversity. As an indirect impact, climate change continues to alter the distribution of species affecting the species composition in mountain ecosystems. Lowland species are expected to move upwards in altitude. Highland species may become extinct, as no high grounds will be available for escape (EEA 2002). Therefore, the EU Habitats Directive (EC 1992) lists a number of species in the Alpine biogeographic region that are under specific protection according to Annex II of the directive.

From an economic point of view, biodiversity loss causes significant costs for society (Svadlenak-Gomez et al. 2013). According to the study of the Nature Conservancy and the Corporate Eco Forum (Corporate Eco Forum & The Nature Conservancy 2012), each year our planet's complex land and water systems – a 'natural living infrastructure'- produce an estimated $72 trillion worth of 'free' goods and services essential for a well-functioning global economy. According to the UNEP report (2011c) the use of these natural resources is generating environmental and social costs of about $6.6 trillion per year. These costs could climb to $28 trillion per year by 2050 if we fail to take action. While reaping the benefits of nature, we are undermining its valuable inputs (Andersen 2015).

At the EU level, several policy instruments address the maintenance and conservation of biodiversity. The overarching EU Biodiversity Strategy for 2020 (EC 2011a) is a comprehensive strategic document with six operational targets and 20 associated actions that are closely modelled on the Aichi targets (CBD 2014) of the Convention on Biological Diversity (UN 1992).

Under the Habitats Directive, EU Member States propose areas to be protected for the preservation of biodiversity. Some 788 thousand km² of the EU 28's terrestrial area were proposed for protection under the Habitats Directive as of 2013, around 18% of the total land area (EUROSTAT 2015c).

The Green Infrastructure Strategy outlines that 'Green Infrastructure is specifically identified as one of the investment priorities. Green Infrastructure is recognised as contributing to regional policy and sustainable growth in Europe and facilitating smart and sustainable growth through smart specialisation' (EC 2013a).

Several projects in the Alpine Space Programme address the topic of biodiversity: the DynAlp nature programme, developed by the Alliance in the Alps, is designed to promote innovative model ideas targeted at habitat networking and at the creation and preservation of biodiversity. Relevant measures include the near-natural management of municipal green areas and open landscape management (project duration 2013-2016).

Alpine relevance of biodiversity

There is only scattered information on the Alpine-wide situation of biodiversity and its role for the economy. For the purpose of this report, the Alpine-wide status of biodiversity is described as follows: the contribution of biodiversity to Green Economy products; the status and role of protected areas, which represent important areas for biodiversity conservation; and the occurrence of high-nature value farmland, where even outside of protected areas a high level of biodiversity is likely to exist.

Biodiversity and Green Economy products

It is important to mention the role of biodiversity for human well-being, which is one major reason for greening the economy. In the Alpine area, biodiversity is one main asset for nature experience as a basis for ecotourism or close-to-ecotourism.

There is a growing offer of such products, and ecotourism is developing as a diversified branch of Alpine tourism. Herbal excursions, herb walks, herb cooking courses or hay baths offer special, biodiversity-based opportunities for the tourism sector in the Alps. The symbol of *Leontopodium alpinum* is often used in naming brands and products. Excursions, bird watching events and golden eagle shows (see good practice case) are other examples of successful tourist attractions. Several hotels in the Alpine area enhance their services by offering nature and biodiversity experiences.

Moreover, biodiversity serves as an essential resource for natural substances. For example, some special plant products come from or grow in the Alpine region (DAV 2015), such as *Angelica sylvestris, Peucedanum ostruthium, Arctostaphylos uva ursi, Vaccinium vitis idea, Gentiana lutea, healing herbs such as Arnica montana, Pimpinella anisum, Alchemilla officinalis, Pinus mugo, Pinus cembra, Rhododendron ferrugineum, Cetraria islandica and Taxus bacatta*. In addition, the Alpine fauna is a source for special pharmaceutical products like marmot oil.

Good practice – Protection of golden eagles in the Alps, Germany

The main objective of the Golden Eagle Project in the National Park Berchtesgaden was to identify areas most important to the Golden Eagle (Aquila chrysaetos) in the Alps for hunting. Recommendations including 11 guidelines were made concerning the protection of these habitats as well as the areas around occupied nests. Recommendations were communicated to the public through specific environmental education programs, more general public relations activities and through a cooperation with groups that utilize Golden Eagle areas (e.g. hunters, hikers, and paragliders).

Further information: www.dhv.de/web/en/sites-nature/nature-conservation/protection-of-golden-eagles/.

Status and role of protected areas in the Alpine Convention area

Type, number and extension of protected areas

Biodiversity cannot be maintained if restricted to protected areas only. The goal for biodiversity maintenance is to offer habitats, niches and green infrastructure also in landscapes with agricultural and forestry use, and even in settlement areas. Yet, protected areas, allowing natural dynamics, are an important backbone for a transnational green infrastructure in the Alpine area. According to the latest Alpine Protected Areas database (ALPARC 2016), the coverage of protected areas including nature reserves, national parks, regional parks, areas under particular protection, biosphere reserves, world heritage sites (> 100 ha) is 53,820 km^2. This means that 28.3% – a total number of 893 regions of the whole Alpine Convention area – are under protection. Table 2.3.2-1 and Figure 2.3.2-1 show the detailed number and location of protected areas in the Alpine Convention area. These protected areas already today generate significant added value. Although the number of areas might be impressive, one has to consider that protection rules and limitations of harmful land use differ significantly depending on the type of protected area.

Economic relevance of protected areas

Protected nature areas in the Alps make a relevant contribution to greening the Alpine economy. Their best-known missions are nature protection and biodiversity conservation. In the last two decades, they have also become important players in the

Number of Alpine Protected Areas* > 100 ha								
Type	Country							Total
	AT	CH	DE	FR	IT	LI	SI	
Nature reserve	78	53	37	25	55	1	11	260
National Park	3	1	1	3	4	-	1	13
Regional Park	30	9	1	9	45	-	2	96
Particular protection	52	298	76	53	8	-	20	507
Biosphere Reserve (UNESCO)	5	2	1	3	1	-	1	13
World Heritage Site (UNESCO)	-	3	-	-	1	-	-	4
Total	168	366	116	93	114	1	35	893

*Table 2.3.2-1 Number of Alpine protected areas > 100 ha. *Protected areas within the AC perimeter or outside but member of ALPARC (Source: ALPARC 2016. List may be incomplete).*

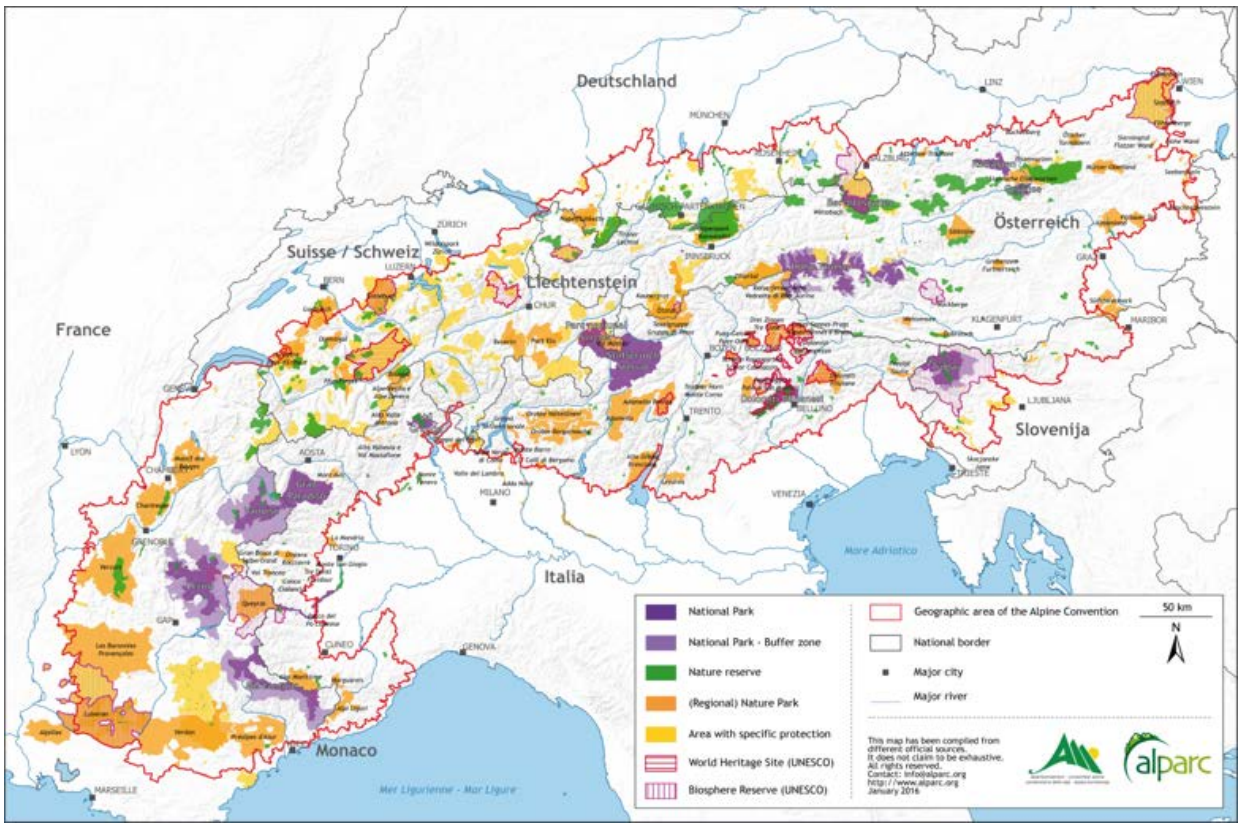


Figure 2.3.2-1 Large protected areas (> 100 ha) in the Alpine Convention area (Source: ALPARC 2016).

economy and in governance processes in many Alpine regions. A contemporary mission – especially for inhabited protected areas such as (regional) nature parks, biosphere reserves or national park buffer zones – is to promote an integrated economic development that uses natural resources sustainably and accounts for social needs in their regions. In order to accomplish this mission, stakeholders in nature parks and other label regions work together and develop strategies and projects that build upon their unique natural and cultural capital.

Already today, the 13 national parks, the 96 (regional) nature parks and the 13 biosphere reserves within the perimeter of the Alpine Convention generate significant value added. As examples, annual regional economic impacts for the following protected areas have been estimated:

- €17.9 million for the Swiss National Parks (overall impact, 2013).
- €2.9 million for the National Park Hohe Tauern (only direct impact, 2004).
- CHF 2.7 to 4.5 million for nature parks or biosphere reserves such as Entlebuch (overall, 2004), Val Mustair (overall, 2013), and Rieserfehrner-Ahrn (direct, 2004).
- €93.8 million (overall impact, 2014) and €47.5 million (direct impact, 2014) for the National Park Berchtesgaden (Job 2015, 2008).

To build on and to enhance their economic development, protected areas greatly depend on an effective valuation of their natural capital, such as biodiversity, specific natural and geological features, cultural landscapes, and traditional local knowledge. They value these resources primarily through the development of brands and labels for products and services, and through the promotion of sustainable tourism. The labels, often assigned by the national level, enable protected area regions and local producers to increase their visibility and recognized value, improve their marketing and strengthen regional identity. In addition, protected areas focus especially on nature tourism and related activities. Therefore, different local economic sectors can benefit as well (e.g. accommodation, catering and food, agriculture, crafts and transport). Ecotourism-related projects and development measures are relatively easy to implement financially and politically. In the last years, ecotourism has been booming as it meets current and future societal trends such as a continued rise in demand for nature-based tourism, outdoor activities, adventure, learning and innovative travel experiences. At the same time, the development of such forms of tourism is in line with sustainable development aims. It promotes responsible behaviour for the environment, considers local needs, involves local inhabitants and generates local income.

Protected areas as model regions

Beyond the direct and indirect effects of labelling policies and ecotourism, governments see and support inhabited protected areas as model regions of sustainable development. The term *model region* refers to the exploration of new ways of sustainable regional development, i.e. the generation of new ideas, the use of new technologies and the experimentation with new approaches in different sectors. Current efforts of protected areas focus e.g. on the commercialization of regional products and tourism offers, local production and consumption, the redevelopment of local value chains, co-working in remote regions and renewable energy. The term *model region* also refers to new forms of governance, collaboration, regional management and participation. In many protected areas, a multidisciplinary management team ensures networking, regional management and project coordination tasks. It gathers knowledge on the region, on funding possibilities and on key players, and therefore acts as a facilitator for regional development. Protected areas such as the Entlebuch Biosphere Reserve or the Nature Park Tiroler Lech are good practice examples that show how local stakeholders reorganize around a common development vision and integrate horizontally (cross-sectoral approach). The protected area is often a unifying element that strengthens a common regional identity among local stakeholders in these processes.

Within the wider context of spatial development, governments see inhabited protected areas also as a means to attenuate the negative effects of metropolisation, notably depopulation and increasing spatial disparities. Researchers and policy makers state that protected areas contribute to retaining the local population, especially the young, increase local incomes, create employment opportunities and attract new residents and businesses due to the high quality of life in these areas.

High Nature Value farmland

Also outside protected areas, biodiversity has to be maintained consistently. Therefore, appropriate habitats and less intensively used areas are important structures for flora and fauna in agricultural areas. High Nature Value farmland is used as an agri-environmental indicator in the EUROSTAT system and is defined as 'the percentage of utilized agricultural area (UAA) farmed to generate High Nature Value (HNV)' (EUROSTAT 2015a). Typical HNV areas are extensively grazed uplands, Alpine meadows as well as pasture lands with particular interests for nature conservation because of their high biodiversity (Paracchini et al. 2008). Based on the main characteristics of HNV, these authors categorised three types of HNV farmlands. Type 1: Farmland with a high proportion of semi-natural vegetation; Type 2: Farmland with a mosaic of low-intensity agriculture and natural and structural elements; Type 3: Farmland hosting rare species or supporting a high proportion of European or world populations (Desjeux et al. 2015). All three types can be found in the Alpine area.

In 2008, the JRC and the EEA have prepared the first EU 27 map of High Nature Value farmland (Paracchini et al. 2008) on the basis of land cover data from 2006. They refined and regionally differentiated selection criteria and additional biodiversity

datasets such as PBAs (Prime Butterfly Areas), IBAs (Important Bird Areas) and NATURA 2000 areas. Based on this methodology, Figure 2.3.2-2 presents the likelihood of HNV farmland presence in Europe, indicating that in most parts of the Alpine area the likelihood of HNV is high.

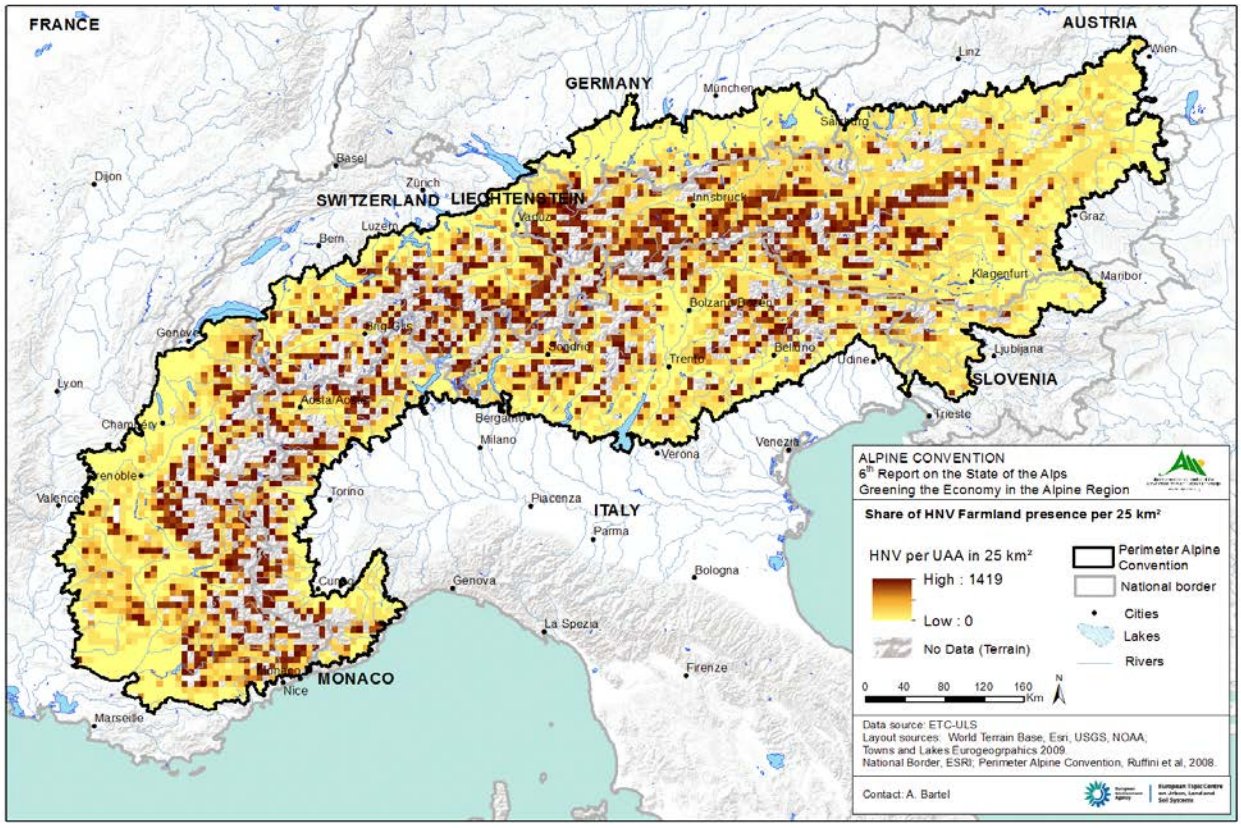


Figure 2.3.2-2 Share of HNV farmland presence per 25 km² in the Alpine Convention area based on CORINE land cover data (Source: ETC ULS 2016b).

Figure 2.3.2-3 presents the share of the estimated HNV farmland according to Paracchini (2008) in relation to utilized agricultural areas (UAA) according to CORINE Land Cover data (EEA 2006). It shows that the biggest share of HNV farmland in utilized agricultural area can be found in Slovenia (78.4%) as well as in Austria (68.4%). France and Italy have the biggest total volume of HNV farmland. In Germany, a share of 14.6% has been estimated for HNV. The analysis has not been conducted for Switzerland and Liechtenstein.

Figure 2.3.2-3 High Nature Value farmland areas and their percentage in relation to utilized agricultural area in the Alpine countries (Source: Paracchini et al. 2008, graph: ifuplan 2016).

Situation in Alpine countries

AUSTRIA

In Austria, the national biodiversity strategy was approved by the national government in 2014. The strategy comprises five action fields: recognition, sustainable use, reduction of impacts, maintenance and development, and global preservation of biodiversity.

The strategy has 12 objectives and more than 140 measures, which should inter alia contribute to an integration of biodiversity issues in all relevant sectors such as agriculture, forestry, tourism and transport. Quantitative and qualitative sub goals have been defined for these 12 objectives, which address the responsible actors and criteria for evaluation. The objectives are to be implemented until 2020.

Biodiversity is considered the main resource for a large share of the tourism industry in the Austrian Alps, at least in the summer season. Many activities support projects in agriculture for an economically and ecologically sustainable way of production. They are focused on management and production (e.g. sheep herding on the Hauser Kaibling skiing area), product development and marketing (e.g. the Tauernlamm brand) and on the traditional use of natural products (e.g. the Narzissen Fest in Bad Aussee). Supporting environmentally friendly agriculture means maintaining a traditional way of using the ecosystems, finding modern ways for marketing and selling its products and thus valorising their uniqueness. Active farming in the Alps means living off the cultural landscape, and this is the precondition for the rich and characteristic biodiversity in the Alps. This, in turn, is a basic need for the tourism industry.

Support for such projects often comes from rural development programmes (LEADER, investment support, diversification, etc.). Moreover, the agri-environmental programme in Austria is a major source of funding for sustainable agriculture, ranging from conservation measures and management of extensive meadows to organic farming.

Investments in the improvement of ecosystems also have effects on the local economy: jobs are created, at least for some time during the planning and construction phase. The LIFE+Nature programme is spending a total of about €170 million in Austria on 49 specific conservation projects from 1996 to 2020. It has become an important instrument for the implementation of the Natura 2000 directives. The majority (34) of the projects focus on the renaturation of rivers. About half of the projects are within the Alpine Convention area.

Biodiversity maintenance itself generates economic effects: the management of protected areas in Austrian national parks and Natura 2000 sites creates a number of skilled jobs, mostly based in remote areas. A lot of research, mapping and monitoring activities, communication needs (from leaflets to visitor centres) and technical maintenance requires staff or contracted people. Educational programmes are an economic factor, too: the University of Klagenfurt offers an international training programme for the management of protected areas.

GERMANY

Germany has adopted the Federal Nature Conservation Act (later amended in 2013, see Bundestag, Deutschland 2009), and biodiversity is a key focus in it. This is a uniform nationwide legal statutory basis for nature conservation, which is a major advance that facilitates the translation of EU directives into national laws, vis-à-vis other Alpine countries with decentralised nature conservation law systems. A biodiversity handbook for the private sector has also been published (EC 2012c).

The German National Strategy on Biological Diversity (BMU 2007a) includes 330 goals and 430 stakeholder-related biodiversity instruments aiming at the protection, sustainable use and social aspects of biodiversity preservation. The strategy also requires that forests with natural forest development have to reach 5% of the wooded area by 2020. This corresponds to about 1.6% of the country´s total area. The other essential goal of the strategy is to increase wilderness: 2% of Germany´s territory has to develop as an undisturbed ecosystem, to evolve as a wilderness area by 2020. By that same year, also a well-functioning management system for all large protected areas and Natura 2000 areas will have to be established.

The OECD policy recommendations for Germany include, inter alia, a suggestion to build upon the assessment of the economics of ecosystems and biodiversity (TEEB), to guide implementation of the National Strategy on Biological Diversity, and to strengthen inter-institutional cooperation in this area (OECD 2012a).

With focus on Bavaria, the following policy programmes are the most relevant concerning a Green Economy:
- The Biodiversity Programme of Bavaria 2030 (Bayerische Staatsregierung & StMUV 2014).
- Strategy for Maintaining of Biodiversity in Bavaria (BayStMUG 2009).
- Bavarian Compensation Regulation (BayKompV 2013).

ITALY

The Italian National Biodiversity Strategy (INBS) is the Italian national policy instrument aimed at the conservation of biodiversity and its integration with the national development goals (MATTM 2010).

Implementing INBS requires a strong cooperation among political and administrative bodies at all levels (particularly the central and regional ones) as well as the participation of stakeholder groups. INBS recognises the intrinsic value of biodiversity and its impact on human well-being. It aims at integrating the need for conservation and sustainable use of natural resources across national sectoral policies. It lists three strategic goals to be achieved by 2020, the third of which is particularly relevant from a Green Economy perspective:
1. Ensuring the conservation of biodiversity and the safeguarding and restoration of ecosystem services aiming at guaranteeing their key role for the life on earth and human well-being.
2. Substantially reducing the impact of climate change on biodiversity on the national territory by defining adaptation and mitigation measures and increasing resilience of natural and semi-natural ecosystems.
3. Integrating biodiversity conservation in economic and sectoral policies, also as an opportunity for new jobs and social development, by strengthening the understanding of the economic and societal benefits of ecosystem services and the awareness of the cost of their loss.

In order to achieve a satisfactory implementation of the strategy, improvements are needed for assuring a better coordination among national and regional bodies. These are jointly responsible for the strategy's implementation and for defining common criteria and methods for the identification, quantification and assessment of ecosystem services in natural areas and sites. The objectives are to improve the data collection and transferability; to facilitate the systematic implementation of common indicators on the national territory; and to contribute actively to the definition of sound shared criteria for natural capital accounting (NCA) at the regional and national level.

Protected areas are recognised as a fundamental and unavoidable tool to implement biodiversity conservation strategies. However, progress is still needed in the collection of natural, economic and social data as well as in the perception and awareness of the potential for human and economic development provided by natural capital.

Shared methodologies for assessing and evaluating natural resources and capital are required to ensure better management. Adequate financial and legal instruments for nature conservation need to be developed and made available at all levels for promoting consistent and efficient spending patterns.

Significant sources of income that could at least partly be invested in nature conservation actions might derive from a better integration of tourism and cultural heritage in natural sites with significant potential for sustainable growth.

Furthermore, a larger and deeper understanding of the different values (ecological, economic, social, cultural and ethical) of biodiversity by a large share of the population would be welcome, as well as a wider participation of stakeholders in development policies based on the potential of natural resources for value creation.

An interesting field of inquiry and action is the connection between biodiversity conservation and management and other sectorial policies. The INBS, in its section on 'strategic objectives', dedicates a specific work area to tourism.

The INBS recognises tourism as a sector that can strongly contribute to attaining sustainable development goals. For this to happen, there is a need to create conditions protecting the territory. Furthermore, awareness of the value of the biodiversity on the territory is necessary.

The main challenge in the sector is to properly manage tourist activities to ensure a sustainable use of limited natural resources, consistent with their capacity to regenerate and to generate income and profits for the industry. This objective especially requires monitoring of tourism impacts on biodiversity through a set of specific indicators that may support territorial planning and public and private decisions. Furthermore, the promotion of a protected areas network for sharing experiences and enhancing cooperation is necessary.

With the aim to achieve these objectives by 2020, INBS identifies the adoption of the European Charter for Sustainable and Responsible Tourism as one of the priority measures. The need to carry out actions aimed at promoting new business in the area of biodiversity enhancement is explicitly mentioned.

LIECHTENSTEIN

Liechtenstein is a Contracting Party to the Convention on Biological Diversity and has set the goal of stopping the loss of biodiversity by 2010. Liechtenstein has also signed other conventions relating to biodiversity such as the Ramsar Convention, the Bonn Convention and the Bern Convention. The process of developing a biodiversity strategy has begun, with the Fourth National Report on the Implementation of the Convention on Biological Diversity serving as the basis.

SLOVENIA

The adoption of the Nature Conservation Act in Slovenia provided a basis for the overall conservation of biodiversity and protection of valuable natural features as part of Slovenia's natural heritage. Around 10% of Slovenia's territory today falls within protected areas. 37.16% of the territory is protected under Natura 2000, and 14,901 elements of nature have been given the status of valuable natural features.

Slovenia fulfilled the obligation to draw up a Biodiversity Conservation Strategy by adopting a first strategy for the period 2002–2012. This document determined a set of specific objectives and guidelines for the coordinated implementation of measures facilitating the achievement of the three main CBD goals. An updated national biodiversity strategy and an action plan are currently being drawn up. Compared with the previous strategy, the targets proposed for the new strategy are focused more on the achievement of global (Aichi) goals. In Slovenia, biodiversity is included in basic national and various sectoral strategies, plans and programmes. The integration of environmental requirements in all policies and activities is essential for the enforcement and promotion of sustainable development.

Nature conservation planning in Slovenia is carried out through the National Nature Protection Programme. The National Nature Protection Programme defines operational programmes that contribute to the achievement of biodiversity conservation objectives, i.e. the Operational Programme for Biodiversity Conservation with the Natura 2000 Site Management Programme, the Strategy for the Management of Populations of Large Carnivores, and the Strategy for the Management of Non-native Invasive Species.

The Natura 2000 Site Management Programme is another key document for biodiversity conservation in Slovenia, owing to the large share of Natura 2000 sites (37.16% of Slovenia's territory). Slovenia's Development Strategy 2014-2020 is a fundamental national strategic document that states that all changes in the economy and society will be directed towards increasing the well-being of generations, taking into account environmental restrictions and human health considerations.

SWITZERLAND

Switzerland has a national Biodiversity Strategy to safeguard its natural capital. An action plan to implement the strategy is currently being developed. The Biodiversity Strategy for Switzerland was adopted by the Federal Council on April 25

2012. Ten strategic objectives describe the priorities and involve all actors in order to develop sufficient effects and to achieve clear results. The Federal Office of Environment is spearheading the development of the action plan.
The following topics are part of the strategic objectives (BFS 2016g):

- sustainable use of biodiversity
- creating an ecological infrastructure
- improving the state of national priority species
- preservation and promotion of genetic diversity
- verification of financial incentives
- detection of ecosystem services
- generation and distribution of knowledge
- promoting biodiversity in urban areas
- reinforcement of international engagement
- monitoring of changes in biodiversity.

The objectives are harmonised and influence each other in their implementation.

In Switzerland, two major monitoring systems exist for biodiversity: the Swiss Biodiversity Monitoring Programme (BDM) and the Swiss Landscape Monitoring Programme (LABES). Both aim at identifying the key biodiversity trends so that effective measures can be taken to conserve and promote biodiversity.

In addition, action plans for priority species and the federal inventories for protection of certain habitat types are the main pillars of the Swiss biodiversity policy, accompanied by conservation schemes such as the national agricultural subsidies programme, compensation measures for construction projects, regulation of the use of exotic organisms, etc.

Conclusions on opportunities and challenges

The Alpine Convention area has a remarkable share of different types of protected areas. However, considering the high abundance of rare, threatened and endemic species and specific Alpine habitats, efforts are necessary to maintain and develop this natural heritage and to stop a further loss of habitats and species.

It should be recognised and communicated that biodiversity generates economic benefits. These benefits originate directly in goods (such as plant-based pharmaceuticals) or services (such as wildlife and outdoor experiences) or in avoided costs (such as erosion prevention through native trees and grassland species). Biodiversity creates benefits also indirectly by contributing to the provision of ecosystem services supporting human well-being.

Therefore, an opportunity to improve biodiversity protection but also an economic opportunity lies in the development of markets for goods and services based on Alpine biodiversity[42]. Consequently, nature conservation should be viewed as an area of economic opportunity for a Green Economy and not as a constraint.

In particular protected areas can contribute to greening the Alpine economy by:

- Facilitating the development of activities and projects that reconcile economic development with nature conservation and social inclusion.
- Supporting social innovation in rural areas.
- Offering good practices and inspirations for biodiversity management and economic benefits also to other regions.

Biodiversity can also be maintained by preserving high-nature farmland. Sufficient and long-term financial compensation for the management of this low intensity farmland needs to be provided.

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

2.3.3 VALUATION OF ECOSYSTEM SERVICES

Natural capital, ecosystem services and biodiversity are – alongside ethical and cultural values - also valuable in economic terms. People and society in the Alps benefit economically from nature – and suffer from losses of natural goods.

Some examples may provide an impression of such monetary values. Globally about 400,000 tons of pharmaceutical plants valued at €54 to €72 billion are put on the market each year (Jessel et al. 2009). Global losses by natural hazards (Figure 2.3.3-1) average up to €164 billion per year in the last ten years. In 2013 alone the summer floods in southern and eastern Germany caused losses of about €13.6 billion (MunichRe 2014). Tourism is an important economic sector in the Alps and is based very often on natural assets and unspoiled landscapes. The GDP of tourism in Germany accounts for almost €100 billon and the this sector employed about 2.9 million people in the year 2010 (BMWi 2012). Therefore, economic values are additional arguments for the preservation of natural goods.

Figure 2.3.3-1 Damages caused by floods display impressively the economic value of the lack of flood retention by ecosystems (Image rights: Marzelli).

Background on the valuation of ecosystem services

Is it necessary to valorise ecosystem services and biodiversity? In principle, economics is about making choices and decisions while weighing the values of different alternatives. However, economists often equate *values* with *prices* (cf. paragraph on valorisation below). Therefore, the markets in place do not and cannot fully reflect all values of ecosystem services (ESS). Markets are structurally limited in their abilities to provide a comprehensive evaluation of all ESS and to offer support in decision-making (TEEB 2010, ch.5:8). Moreover, it will be very difficult to quantify ESS which also embrace services from human-made assets, such as input like labour and technology.

GDP measures the total value of all goods and services produced within the national territory within a specified period. However, GDP normally does not regard damages to the environment and to nature: paradoxically it considers the impacts on the environment as a positive contribution to public welfare. It does not take the loss of natural capital into account (e.g. clear cutting of a forest for a motorway), since at present there is no methodology implemented to measure it. On the contrary, the GDP counts the replacement of natural capital (e.g. motorway instead of forest) as productive and as a contribution to welfare. Even more, technical substitutes for natural services (e.g. noise protection embankments) are also considered as

production and additionally contribute to welfare. 'Ultimately, not recording the cost of reinvestments to sustain healthy ecosystems creates and conceals ecological liabilities. This distorts our perception of the future when restoring ecosystem services will demand that we repay the debts' (EEA 2013c).

One needs to be aware that the term *value* bears different meanings: value may mean to regard something as being of importance or worth. Value is also, sometimes used as a synonym for price or monetary value. The valuation of ESS means to recognize that first the importance and the value ESS provide for our daily lives. Furthermore, the value may also be expressed as an economic value of ESS, which are the preferences people attribute to ecosystem goods and services in monetary terms. For this, a variety of different qualitative and quantitative methodologies exists. On the one hand, economic values are often very difficult to assign to ESS, particularly for regulatory and cultural services. On the other hand, economic values play a major role in decision-making at all levels from strategic policy decisions up to private customer's decisions and are, consciously or not, applied to many public and private decisions. Thus, economic values are a very important link between the environmental and economic spheres. The TEEB foundation lists six main reasons for conducting a valuation of natural capital and ecosystem services (TEEB 2010, ch.5:9):

- Missing markets.
- Imperfect markets and market failures.
- For some biodiversity goods and services it is essential to understand and appreciate the alternatives and alternative uses.
- Uncertainty involving demand and supply of natural resources, especially in the future.
- Governments may like to use the valuation versus the restricted, administered or operating market prices for designing biodiversity/ecosystem conservation programmes.
- In order to arrive at natural resource accounting for methods such as net present value methods, valuation is essential.

It has to be underlined that economic valuation is never foreseen as a stand-alone solution, but needs to and will be embedded in legal, administrative and planning solutions.

What does valuation mean?

The valuation of ecosystem services and biodiversity requires several succeeding steps which include the identification of ESS, the physical measurement with help of indicators, data and analysis of data and finally the assessment of functions, services and use. The assessment may be in a qualitative manner or in an advanced state in a quantitative manner. Based on this, a monetary valuation of ESS can be carried out. Figure 2.3.3-2 shows the different levels of valuation of ecosystem services presented by ten Brink (2008).

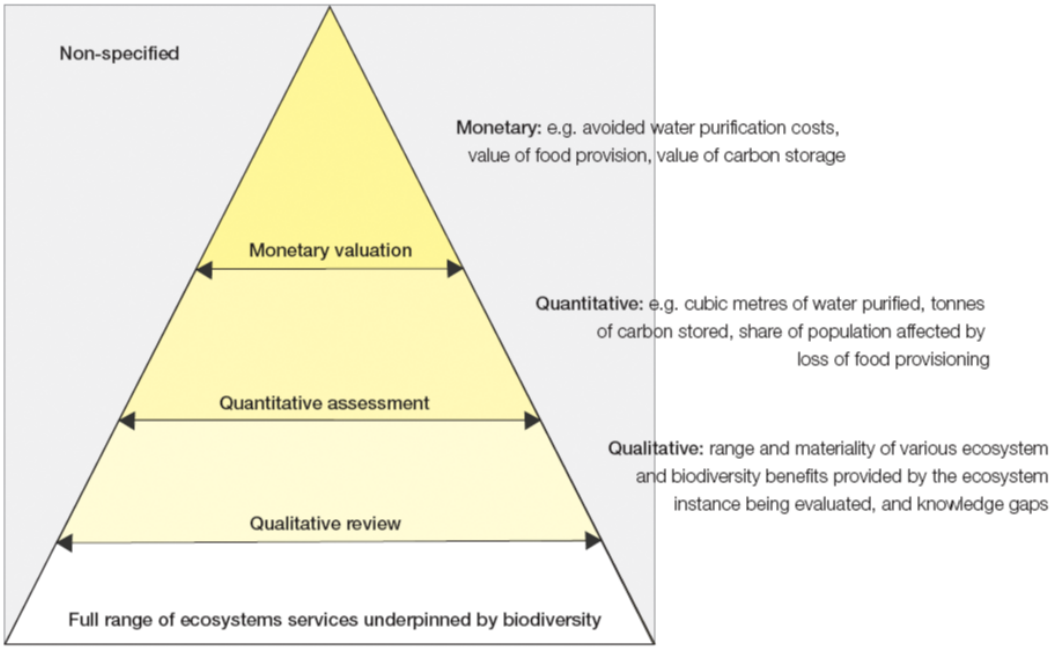


Figure 2.3.3-2 Different levels of valuation of ecosystem services (Source: ten Brink 2008).

To put a value on something indicates that we express how important something is for us or to our well-being. This value can be something immaterial such as to feel happy about the beauty of a landscape, to feel good when listening to music or to relax when walking through nature. Of course, there are also material values such as the market value, which is paid if things are sold on markets. However, it is quite important to distinguish between this market value and the value in use. A good example is that of water and diamonds already used by Adam Smith, the grandfather of economic science. Water has a very high use value, as it is the precondition for our life, but in general, there is a low exchange value put on it. Whereas diamonds have a pretty low use value, but are exchanged at a very high price.

Economists often use the term value synonymously with the market price. This would mean goods with a low exchange value also have a low price. This interpretation would mean all goods not traded on markets have no economic value. Often, no markets are available for public goods, which is the reason why they often have no market value. Nonetheless, they may have a high economic value for our well-being and our society. Natural capital, ecosystem services and biodiversity in most cases are public goods.

Different approaches of economic valuation

The main challenge for economic valuation is to decide which evaluation approach is appropriate to make an economic valuation of ecosystem services. The definition, but also the origin of the final ESS as well as the methodological differentiation – e.g. which part of the final product comes from natural contribution and which from financial, technical or human contributions - are challenges for using these values in a Green Economy.

There are different approaches on how to achieve economic values for environmental goods and services. In TEEB (2010), an overview on the different kind of values that may contribute to the theoretical Total Economic Value (TEV) is presented. Table 2.3.3-1 presents a typology of values of ecosystem services.

Value type	Value sub-type	Meaning
Use value	Direct use value	Results from direct human use of biodiversity (consumptive or non-consumptive).
	Indirect use value	Derived from the regulation services provided by species and ecosystems.
	Option value	Relates to the importance that people give to the future availability of ecosystem services for personal benefit (option value in a strict sense).
Non-use value	Bequest value	Value attached by individuals to the fact that future generations will also have access to the benefits from species and ecosystems (intergenerational equity concerns).
	Altruist value	Value attached by individuals to the fact that other people of the present generation have access to the benefits provided by species and ecosystems (intragenerational equity concerns).
	Existence value	Value related to the satisfaction that individuals derive from the mere knowledge that species and ecosystems continue to exist.

Table 2.3.3-1 Typology of values for ecosystem services (TEEB 2010).

There are different methodologies to assess such values. Often, the use values do not consider all components of a value or are not comprehensive. In addition, it is difficult to get non-use values for non-market goods. Some methodologies for assessing such prices are:

- Market value: if the ecosystem goods and services are the same or very similar to those that are traded on markets, the valuation uses market prices as values. For instance market prices for deer, fish or fruit can be used.
- Hedonic pricing: the use of ecosystem goods and services may be reflected in rental prices for housing. Housing in green areas is often more expensive as people prefer to live close to green spaces and accept to pay higher rents for that.
- Contingent valuation: in particular, for bequest values, existence values and option values it is almost impossible to gather real existing prices. Therefore, the *willingness-to-pay* or the *willingness-to-accept* of selected groups is analysed in questionnaires asking how much people would spend to maintain a rare species or an endangered habitat for instance or how much they would request for accepting a change. In multiple choice analyses also, different alternatives can be examined.
- Travelling price: peoples' preference to visit beautiful landscapes or recreation areas is also reflected in the prices and time they spend for travelling to these destinations.

National accounting

The valuation of ecosystem services is also a key to improve national accounting and by this to internalize external costs for strategic policy decisions. If the GDP were extended to integrate the cost of natural capital and environmental damages, it would reflect a bit more realistically how the national capital (human and natural capital) developed.

Ecosystem accounts are tools that can be used to describe the quantity and quality of ecosystems systematically, and show their change over time. They can help to understand the effects of such changes to people, either in quantitative units, in risk effects for health and life quality or in monetary terms. The accounts aim to reflect on critical stock and flows of natural capital (EIONET - European Topic Centre on Biological Diversity 2010).

However, this poses serious challenges to define, quantify and value the natural capital and ecosystem services. At the international level, the System of Environmental-Economic Accounting (SEEA) is a subsystem of the United Nations System of National Accounts (SNA). This is to collect information on three areas in the SEEA, flows of materials and energy, environmental economic statistics and stocks of natural resources[43]. In Europe, the European Environment Agency has started to develop an ecosystem accounting system, based on ecological indicators for landscape, ecosystem production, biodiversity, water, absorption of external inputs and capacity to support healthy populations (EEA 2013b). This Land and Ecosystem Accounting (LEAC) uses CORINE Land Cover data at the European level.

The EU environmental economic accounts were established in Regulation (EU) No 691/2011. This regulation provides a legal framework for a harmonised collection of comparable data from all EU Member States and EFTA countries. The statistical office of the EU, Eurostat, collects national data for environmental accounting in the following categories:

- air emissions accounts (AEA)
- economy-wide material flow accounts (EW-MFA)
- physical energy flow accounts (PEFA)
- environmental taxes
- environmental goods and services sector (EGSS) accounts
- environmental protection expenditure accounts (EPEA)
- forest accounts
- environmental subsidies and similar transfer accounts.

It is also planned to develop ecosystem accounts and water accounts. There is a multi-annual EU strategy for environmental accounts[44]. The environmental goods and services sector covers the output and export of produced products, the related gross value added and employment. These data will become mandatory in 2017.

Payment for ecosystem services

The payment for ecosystem services (PES) is a tool, which compensates to some extent the ESS provided by agriculture, horticulture, forestry or fisheries besides the provision of food and raw material. According to the UN (2014), the contribution of PES towards a Green Economy is to expand PES schemes and use them as a complement to regulations and other measures. The advantages of PES lie in:

- Boosting public relations for companies as PES contribute to positive company image (cf. Chapter 3.4). However, the reputation of the PES will to some extent depend on the reputation of the company.
- Making environmental protection schemes easy to understand, as PES simply link the use of an environmental service to the payment. Any system like this which can be easily grasped by the public, the media and opinion leaders can be immediately seen to be 'doing good' in environmental matters.
- Raising awareness for the multiplicity of ecosystem services is fostered by the easy-to-understand PES arrangements.

Alpine relevance of the valuation of ecosystem services

As in almost all areas in the world, the Alpine area provides ecosystem services (ESS), which are used by the residents of the area. The first concern is to maintain the provision of ESS for Alpine residents and their well-being. Furthermore, the Alpine

43. Further information: en.wikipedia.org/wiki/System_of_Integrated_Environmental_and_Economic_Accounting.
44. Further information: ec.europa.eu/eurostat/documents/1798247/6191525/ESSC-2014-21-EN-24-EuropeanStrategy-env.

area provides ESS, which are highly important services for areas outside the Alpine Convention area and for the well-being of far more residents than are living in the Alpine area. The provision for ESS in the Alpine area can only be illustrated by using some case studies, since there is no comprehensive overview of the overall contribution of Alpine ESS.

Protected areas and tourism

Tourism plays a significant role for the economy of the Alpine area. In a wider sense, many Alpine tourist destinations are chosen for their natural and cultural assets. Aesthetics, experience of nature or inspiration, which can all be considered as cultural ESS of Alpine landscapes.

In the protected areas of the Alps, tourism is most probably more focused on these nature-related motivations in a narrower sense, relying more concretely on natural amenities. Therefore, the economic effects of national parks, the most prominent category of protected areas, give some insight into the economic value of ESS for tourism. Following the IUCN guidelines (IUCN 2008), national parks should not only protect the ecological integrity of ecosystems but also offer opportunities for recreation and tourism as primary goals. Often, national parks are in remote areas. They can offer highly attractive destinations for tourism and 'can serve as engines for economic development in otherwise often weak regional economies' (Mayer et al. 2010).

In the year 2002, the national park Berchtesgaden in the German Alps affected the regional economy by having 1,129 million visitors with 1,442 million overnight stays producing a gross turnover of €49.1 million (Job et al. 2009). Based on the economic analysis of German national parks, ten proposals have been formulated by Job et al. (2009), of which four seem well transferable to the Alpine areas:

- Effects of national parks on regional economy are remarkable in structurally weak, peripheral areas, even if transferring structural programmes are not considered.
- State support in national parks has relevant economic effects: the average administration and investment expenses of national parks generated three times[45] higher income.
- Peripheral areas may take advantage of being branded as wilderness areas, however, the official labelling of national parks as a unique selling point is important. It is mandatory to offer additional regional tourism services, regional food or other products with a clear relation to nature and the protected area.
- It is recommended to make a qualified assessment of opportunity costs comparing different types of land use in national parks, particularly ecotourism and forestry.

Water discharge and water retention

The Alps receive much higher precipitation, have higher runoff than surrounding lowlands and therefore are considered the water towers of Europe. This becomes obvious when comparing the water balance of the Alps with the rest of Europe. The Alps provide almost three times higher runoff than the rest of Europe. The big river systems Danube, Rhine, Rhône and Po are fed by the discharge of their Alpine catchment areas. For the Rhine River, the Alpine region contributes about 34% of the total runoff in the Netherlands (Weingartner et al. 2009). The lowlands experience advantages from the Alpine region as the water discharge is maintained even in the dry seasons of spring and summer. In addition, snow and ice withhold water and thus act as regulating services for flood control in the lowlands.

However, climate change effects are threatening this sensitive and complex interaction between lowlands and Alps. 'In the future, the combined effects of droughts and increased water consumption in the Alps could cause water supply problems throughout Europe. Future climate change is projected to lead to a shift from summer precipitation to winter precipitation. Together with an earlier and reduced snow melt due to lower storage of winter precipitation as snow as well as less glacial melt water, this will lead to an essential decrease in summer run-off all over the Alps. A decrease in water availability has severe impacts on all sectors relying on water, amongst them agriculture (irrigation, particularly in the southern Alps), hydropower production, industry, households, winter tourism (for example snow-making) and river navigation' (EEA 2009, p 17).

Alpine waters also provide an excellent water quality in drinking water. Therefore, water is also a viable resource for the approximately 14 million inhabitants of the Alps and outside the Alps; many agglomerations close to the Alps such as Milan, Zurich, Vienna, Munich or Stuttgart derive their drinking water from the Alps (cf. good practice below). Just a very

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

rough estimation of drinking water consumption based on some basic data reveals the economic dimensions: the 14 million inhabitants of the Alps use about 1.7 million m³ drinking water daily which accounts for an economic value of more than €2.5 million[46].

Avalanche protection

Avalanches pose severe risks to Alpine residents, municipalities and infrastructures. They are a natural feature, influenced by natural conditions but also depend on effects of land use. Avalanche risks may increase or decrease through the change of land use. In a Swiss study carried out in Andermatt, benefits and costs of avalanche protection in case of changes in mountain forest cover have been analysed for a 300 year avalanche event (Olschewski et al. 2012). Results compare collective risk (based on loss of life, damages of buildings), willingness to pay for risk reduction, avoidance costs and alternative costs for mitigation measures. The results indicate that the residents' willingness to pay is about same amount as the costs of the collective risk (cf. Table 2.3.3-2). The avoidance costs through appropriate forest management offer the most cost-effective measures at about US $20 per household.

Valuation approach	Assumption/alternative	Lump sum (USD)	Annuity (USD)
Collective risk	300-years event	470	69
Willingness to pay	Risk reduction	390	56
Avoidance costs	Forest management	20	3
Alternative costs	Wooden logs	60	6
	Wooden grills	195	28
	Steel bridges/net	600	87

Table 2.3.3-2 Results of valuation approaches for avalanche protection in Andermatt in US dollars per household (Olschewski et al. 2012).

Within the framework of the Alpine Space project greenAlps, several experts from various sectors have been asked about ESS and their valuation. According to the survey, 80% of the interviewees said that the ESS concept could be helpful for ensuring the conservation of biodiversity and ecological connectivity and contributing to human well-being. However, there is still scepticism about economic valuation: about 39% of the interviewees thought that all ESS should be assigned a market value, but that general evaluation of all ESS tends to underestimate their real value. From the results of the interviews, it can be concluded that the ESS approach offers new impulses to make the value of nature conservation in Alpine ecosystems visible. However, the ESS approach has to be translated for the relevant stakeholders and show them the concrete benefits[47].

Economic role of mountain forests

The income of forest owners still comes largely from selling wood, despite the increasing importance of ESS and the growing interest in non-wood forest products and services (in particular mushroom licences and tourist services, as well as traditional hunting). The productivity of forest work has grown substantially in the last 25 years but management costs have risen more than revenues, and in the mountains profits from wood production are decreasing. Consequently, management is more extensive and costs can become higher than incomes, particularly where the network of forest roads has not been maintained.

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

46. Calculation based on an average consumption of 120 l/day/inhabitant and 1.50 Euro/m³.
47. Further information: www.greenalps-project.eu/download/.

Maintaining economic interest in forest management is important for the owners. This can be done through promoting the use of Alpine products, wood and non-wood. Conditions must be created to allow ESS provided by Alpine forests to be paid for. Some ESS can be marketed, e.g., water cycle regulation and recreation, directly or through cooperation with local water management and tourist institutions. For others, e.g., CO_2 sequestration and conserving biodiversity are some pre-conditions that must be created through the revision of property rights and new contractual agreements. For regulation services like soil and water protection, compensation can be created like in agriculture (rural development) (Contribution by the Working Group Mountain Forests).

Economic aspects of transport in the Alps

The objectives of article 14 of the transport protocol of the Alpine Convention include that Alpine countries agree to apply the 'polluter-pays' principle. Systems of pricing which allow the real costs to be covered in a fair way should gradually be introduced. This consists of the costs of infrastructure - linked to the construction and maintenance of that infrastructure - and external costs - corresponding to the nuisance suffered by all the other actors.

The Working Group Transport of the Alpine Convention was asked to carry out works on implementing such systems of pricing for heavy goods vehicles.

A first phase, dedicated to the analysis of the measures already adopted by Alpine countries, highlighted that systems of pricing for heavy goods vehicles exist on all main Alpine road axes. These take costs of infrastructure into account. Austria also added an additional amount to the price for heavy goods vehicles on the axis leading to the Brenner Pass, in accordance with an optional provision included in the EU Directive 2011/76/EU ('Eurovignette').

Prices vary from one infrastructure to another and are difficult to compare between countries, considering the conditions of realizing infrastructures, which differ according to geographical zones. Besides, price variations according to EURO standards have been implemented on all the Swiss, Austrian and German networks, as well as for the French-Italian road tunnels (Mont Blanc, Fréjus).

For several years, Switzerland has integrated external costs into the system of pricing. In its last version in 2011, the directive Eurovignette authorised certain external costs (air pollution and noise) to be considered for the countries of the European Union with the possibility to double the amount in mountainous zones. Since 1 January 2015, the external costs linked to atmospheric pollution have been included in the price collected in Germany (Lkw-Maut). Other countries are studying the possibility of implementing such measures or, when conditions allow, an additional amount such as that collected by Austria.

In 2015, the Working Group Transport of the Alpine Convention began, according to its mandate, the work of collecting existing studies on evaluating external costs, in particular in the Alps. This is to verify the appropriate and sufficient character, or not, of the terms of the directive Eurovignette with regard to the compliance with the real cost pricing foreseen in article 14 of the transport protocol. The objective is to estimate the amounts of each of the categories of pollution more accurately. If needed, follow-up studies will be considered (Contribution by Working Group Transport).

Situation in Alpine countries

AUSTRIA

There is no official assessment of ESS in Austria. However, a number of preparatory works and case studies have been carried out on the topic. Besides an overview through an inventory of ESS in agriculturally used land and in forests, a recent study (UBA Austria 2015c) tried to evaluate different approaches of economic valuation of ESS, and discussed the pros and cons.

Mountain farming and mountain forestry are particularly connected to ESS and includes many services, which are also largely used by the population outside the Alps (i.e. water supply, agricultural products). In addition, many regulating and supporting functions are based in Alpine agriculture, which in most cases works without using environmentally problematic substances. The Federal Institute for Mountain Farming has published a research report on this topic (Hoppichler 2013).

A case study on river ESS has been reported from Austria. About 290 kilometres (or about 60%) of the river Mur in Styria are within the AC perimeter. The study reports the value of ESS for the Styrian Mur between €93 and €132 million per year. The main component, as assessed by a public questionnaire, is considered to be in recreation services; the second, in maintaining biodiversity.

GERMANY

In Germany, different studies to evaluate ESS have been carried out. A compilation of 126 monetary values based on existing collections and additional research has been conducted in an overview study (Köllner et al. 2014). Only very few studies have been carried out in the Alpine areas, so not many figures are available. The analysis of the economic values calculated in the studies revealed that values differ significantly between different ESS, as well as within one ecosystem service. In particular, the values for regulating services of natural hazards remarkably exceed values of other services. However, it turned out that values calculated in the studies were strongly influenced by specific conditions. Therefore, the transfer of values from one study area to another appears difficult (cf. Figure 2.3.3-3).

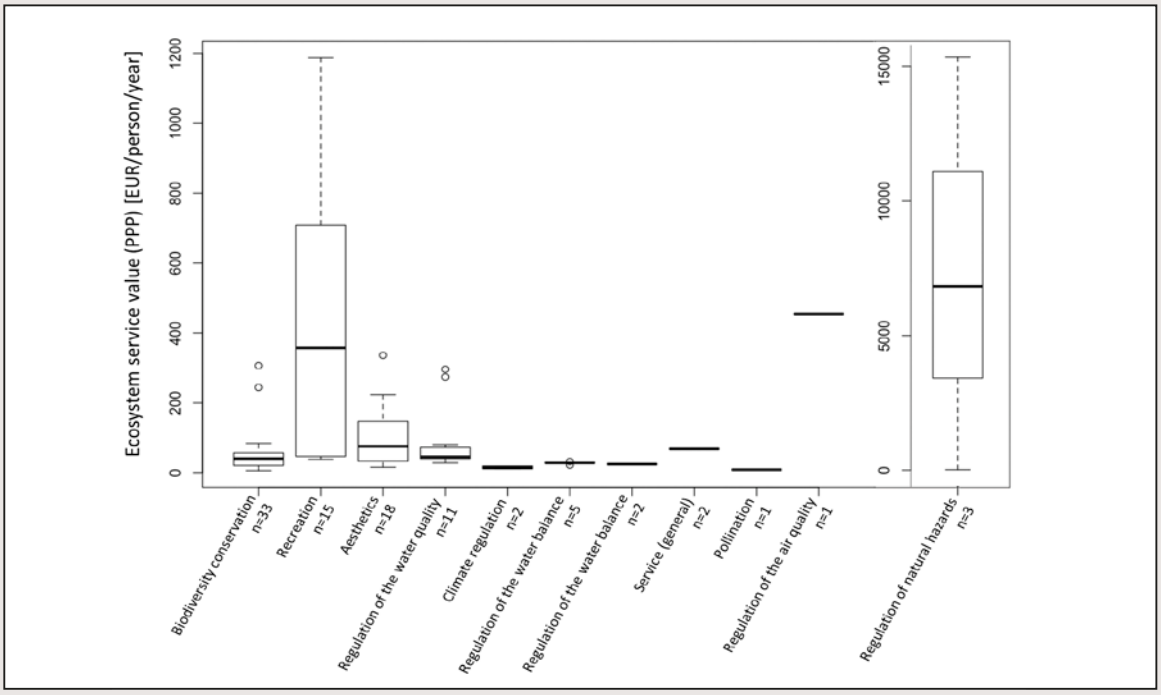


Figure 2.3.3-3 Ecosystem service values in euros/person/year in Germany (Source: Köllner et al. 2014).

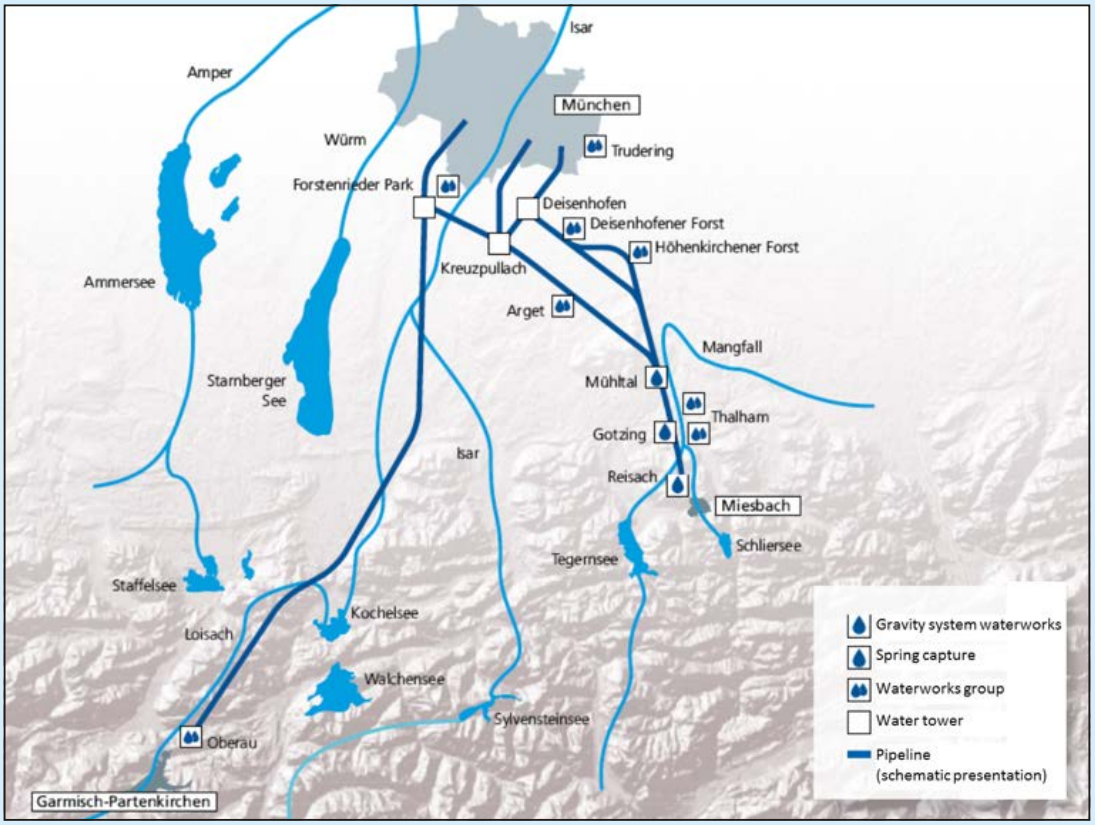
The economic value of mountain forests providing avalanche protection in the German Alpine Convention area is estimated to be about €5/m²/year which adds up to about €4 billion for German territory per year (BayStMUG 2013).

The economic value of clean water provided from Alpine valleys for the drinking water supply of Munich (about 300,000 m³/day) can be estimated to about €178.5 million[48] per year (SWM 2016; cf. good practice below).

In Germany, a first attempt was made in former years to develop environmental economics accounting (*Umweltökonomische Gesamtrechnung*). These consider flows of material and energy (in physical units), environmental measures (such as costs for environmental protection, environmental taxes and fees) and sustainability (indicators for sustainable development). The environmental accounting is a satellite system to the national accounting system.

Case study - Water supply for Munich, Germany

In the catchment areas of the Alpine rivers Loisach and Mangfall, the water supplier for Munich Stadtwerke München discharges water for the 1.4 million Munich citizens. The sources are monitored to ensure no environmental damages are caused in the catchment areas.



Since 1992, the water supplier has started the initiative 'eco-farmer', in support of organic farming in the catchment area in the Mangfall area. About 150 farmers have shifted their production from conventional to organic farming, together managing an area of about 3,500 hectares, which is one of the largest organic farming areas in Germany. The farmers are paid for organic farming by the water supplier and receive financial support for converting to organic farming. This financial support is only about 0.5 ct/m³ water for the consumer, which is a very small supplement to the water price of 1.63 Euro/m³ (SWM).

48. Calculation based on the average consumption of 120 l/day/inhabitant and €1.50/m³.

ITALY

A methodology for the classification, assessment and valuation of ESS based on MEA's approach and categories of ESS (2005) was prepared for the approval of the National Biodiversity Strategy in 2010. The methodology evolved from the classical 'command and control' approach to the relatively innovative approach of the new EU common agricultural policy (CAP) introducing incentives and compensations paid on a voluntary basis. The principle of *conditionality* of public aid was introduced eventually, subject to compliance with environmental standards of the actions implemented by beneficiaries.

Concerning mountain areas and namely the Alps, the methodology identified a set of ESS as is shown in Figure 2.3.3-4.

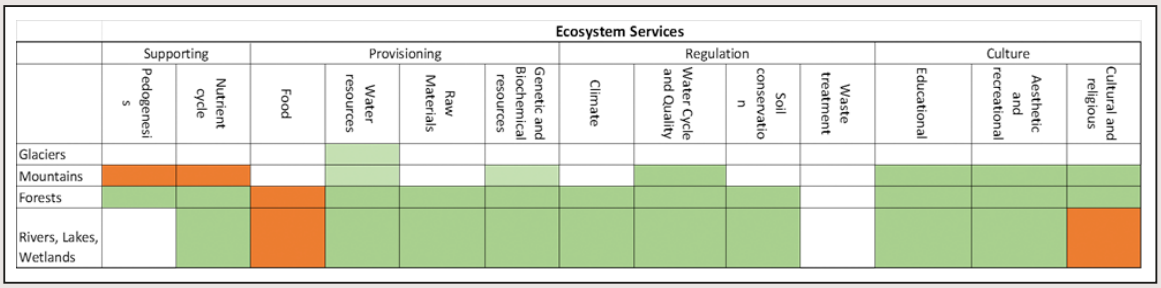


Figure 2.3.3-4 *Ecosystem services in mountainous areas (Note: the 'green cases' refer to ESS with a very significant presence in the Italian Alps, while the 'orange cases' refer to services only present in the Italian Alps) (Source: MATTM 2009).*

Possible approaches for ecosystem quantification and valuation at national level have been developed under both the ecological and economic points of view. Ecologically, a few case studies have been investigated for the purpose of providing information for mapping ESS at the EU level, as noted above (ESMERALDA 2015). Economically, local experiments have been conducted and a methodology aimed at defining payments for environmental services (PES) has been proposed to the INBS. Regional projects addressing the issue of valuation and legal instruments for proper implementation of PES exist across the Italian Alps, often involving natural parks and protected areas (*LIFE+ Making Good Natura - Making public good provision the core business of Natura 2000*), even though they did not translate into binding policies, measures or legal instruments.

In methodological terms, the following steps to be followed are suitable to set up a national harmonised approach to ESS assessment and valuation, and for setting up adequate PES schemes (MATTM 2009):

1. Identifying the ecosystems with higher environmental quality in relationship to local biodiversity.
2. Studying the behaviour and dynamics of the selected ecosystems.
3. Identifying the stakeholders playing a principal role in ecosystem management.
4. Developing assessment and economic valuation techniques for specific services and for the ecosystems that provide them (natural capital).

As a result, knowledge about ESS and managers of the territories from which they flow is considered as the necessary basis for planning measures, actions, payments and compensation involving private and public actors and the local communities.

Some experiments, even if incomplete, exit in the field of water ecosystems and wetlands as well as in one of the forests in Italy. As foreseen by the national law on water management (Law Galli 36/1994), a share of the fee is earmarked to safeguard the basin area. However, in practice this quota is not used for silviculture, but rather for interventions and construction activities within the basins depending on regional regulations, guidelines and plans. Regione Piemonte foresees a variable quota of the fee (between 3 and 8%) to be earmarked for soil and mountain defence by means of a plan managed by mountain communities in the region.

Concerning forest management and water resources, a law on mountain rainfall basins (Law 959/1953) provided the possibility to make concessionaries pay an extra fee earmarked for mountain infrastructure and territorial enhancement and as compensation to mountain communities.

Another Alpine practice refers to non-wood forest products (NWFP) and in particular the permits required by many regional laws for collecting mushrooms. For instance, Regione Veneto has set up an 'implicit' PES scheme by introducing thresholds for collecting mushrooms that apply to two different stakeholder groups: the 'business users' collecting mushrooms to enhance their income, aiming at trade; and the 'recreational users' collecting mushrooms for direct consumption and pleasure. The second group of stakeholders needs to buy a permit with time-limitations (daily, weekly, monthly). The payments' beneficiaries are the forest and landowners. The trade refers to mushrooms and recreational services; the suppliers are tourists and occasional collectors; the intermediaries are the local mountain communities. There are conditions to the use of the revenues from the fee, namely that at least 70% of the revenues have to be spent on conservation and enhancement of the land where mushrooms can be collected and on educational initiatives (Veneto Regional Law 23/1996).

Adventure parks represent an interesting case of recreational service for the Italian Alps. Before 2008, there were more than 70 adventure parks in the Alps. Set-up costs for a large park (10,000 visits per year) can be recovered over 5 to 6 years. It has been estimated that the average individual is willing to pay €12.00 for a visit. These can be considered cases for PES, according to Wunder's definition (Wunder, 2008) as well as suitable alternatives to forestry. However, for both geographical (few suitable locations available) and market (limited segment/niche) reasons their role is likely to remain a minor one (MATTM 2009).

LIECHTENSTEIN

Within the new Alpine Space project AlpES, selected information on economic values of ESS in pilot areas in Liechtenstein are to be estimated.

SLOVENIA

In recent years, Slovenia has put some efforts into developing different modules of environmental accounts, both physical and monetary. The statistical office of the Republic of Slovenia (SURS) has already developed the methodology and introduced it into regular work of environmental accounts on air emissions accounts, material flow accounts and environmentally related taxes. These are the first parts of modules included in Regulation (EU) No 691/2011 of the European Parliament and of the Council on European environmental economic accounts.

The first obligatory reporting for these three modules took place in 2013. SURS has already successfully developed the methodology and introduced the second part of modules into regular work. This was included in Regulation (EU) No 691/2011 in 2014 with Regulation (EU) No 538/2014 of the European Parliament and of the Council amending Regulation (EU) No 691/2011 on European Environmental Economic Accounts.

This part includes accounting on environmental protection expenditure accounts, environmental goods, service sector accounts and physical energy flow accounts. The first obligatory reporting for these three modules will take place in 2017. The Institute of the Republic of Slovenia for Nature Conservation led the preparation of a study on evaluating ecosystem services for the small protected area on Pohorje under the transnational project NATREG. The total economic value was calculated for two scenarios: first with conservation and the second without conservation of Lovrenška jezera. Studies showed that conservation for the next 50 years is needed if we do not want to lose €151 million of the ecosystem services. In 2010, a review of the most frequently used methods for the economic valuation of ESS in protected natural areas was also carried out under the NATREG project.

In 2011, a comprehensive study was conducted of the valuation of ESS in the Škocjan Caves Park. The aim of the study was to determine the contribution of the park to the local, national and global economies and to gain local and political support for the conservation and sustainable use of the ESS of the regional park. The valuation of ESS provided comprehensive information on the impacts of particular measures on the environment and the people living there. The study is considered as a model case in Slovenia to prevent 'bad' decisions that could degrade the environment and thus worsen the living conditions of people. It was conducted under the project 'Protected Areas for the Planet of Life – Protected Areas in the Dinaric region'.

SWITZERLAND

The Swiss Federal Institute for Forest, Snow and Landscape Research, WSL, investigates different aspects of the valuation of the ESS. The following aspects are subject to scientific research:

- Economic valuation of ecosystem goods and services, provided to people by nature, forest and landscapes.
- Possibilities to realise the value of, as well as payments for these goods and services by private and public institutions.
- Calculation of the costs of maintaining these goods and services.
- Estimation of the financial effects of nature, forests and landscapes on regional economies.

Furthermore, several research activities are focusing on measures and strategies to realise the economic value of nature and landscapes, regional potential of sustainable agriculture and forestry on cultural heritage landscapes, economic valuation of cultural and environmental goods and services provided by nature, forests and (heritage) landscapes. Examples for ongoing research are the WSL projects in the framework of research in economic valuation of nature, forest and landscape:

(1) What are the determinants of local growth management regulations at the municipal level and how do they affect urban sprawl? A spatial econometric analysis.
(2) An economic analysis of Swiss wood markets.

The results of the two projects can serve as a basis for valuated ESS, however none of these projects explicitly aims to follow the ESS concept or PES.

A recent report by Hunnius (2015), highlights Switzerland's tourism capital of the landscape. The State Secretariat for Economic Affairs (*SECO*) has quantified the value of the landscape for tourism at around CHF 70 billion. It is intended to give fresh impulse to the sector through new initiatives so that the economy can benefit and boost the appreciation of nature and landscape. According to this study, mobility seems to be a major challenge towards establishing ecotourism in the Alps. Seventy per cent of tourists travel around Switzerland by car and with little awareness of the environment. Furthermore, in 2002 SECO calculated the annual willingness to pay of people who travel in the landscape. The researchers ultimately estimated the capitalised value of the Swiss landscape for tourism at between CHF 68 and 79 billion. They stress that this is a minimum value (Hunnius 2015).

Several monetary valuations have been conducted. However due to the context-dependency of monetary valuations, these projects have normally been on a case-per-case basis. Practical implementation of mapping and applied monetary valuations with regard to decisions of land use (e.g. in the context of touristic development) remain major challenges.

Conclusions on opportunities and challenges

The limits of economic valuation of natural capital, ecosystem services and biodiversity are unquestionable due to different methods available and site-specific factors, which have to be considered. However, ESS, natural capital and biodiversity represent significant economic values, which play an important role in the Alpine economy. At present, in some fields their values have already been calculated. However, unfortunately in many fields, their values are still under-estimated or mostly rebated by political and economic decisions.

Many economic activities in the Alps depend directly on natural capital, ESS or biodiversity or are supported by them. This is relevant in particular for mountain farming, mountain forestry, water management, tourism, recreation and urban development.

The assessment and the valuation of natural capital and ESS might become an important complementary instrument for decision-making in the future. However, most of the existing approaches are in early stages and do not allow benchmarking or real decision-making support. Therefore, further development of the valuation of natural capital and

ESS may, together with assessing or monitoring ESS, better highlight the economic relevance of natural Alpine features and support the Green Economy approaches. Values of ESS should be incorporated into decision-making also in cases where monetary valuation is difficult or controversial. This can be done in a qualitative manner.

It is important to incorporate the values into decision-making to a larger extent through the internalisation of external costs and the application of better and long term payment for ESS schemes and thus make environmental and the Green Economy policies more successful. This is a major challenge and requires a clear, comprehensive concept.

2.4 ECONOMY SUPPORTING QUALITY OF LIFE AND WELL-BEING

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

This chapter will deal with four different subtopics. First, it looks at effects on employment and education for a Green Economy. Then, aspects related to economic well-being and social inclusion are examined. The third subchapter provides examples of sustainable consumer behaviour as a way to contribute to a more sustainable and inclusive economy and fairer globalisation. Finally, health issues and harmful emissions resulting from economic activities are addressed.

2.4.1 EMPLOYMENT AND EDUCATION

On the one hand, a transition to a low-carbon and sustainable economy can provide opportunities for employment across many sectors of the economy and become a new engine of development. On the other hand, employment also has important impacts on the transition to a Green Economy. Appropriate training and education are necessary to satisfy the needs of a Green Economy in terms of job qualification. The International Labour Organisation defines a green job as any decent job that contributes to preserving or restoring the quality of the environment whether it is in agriculture, industry, services or administration (UNEP 2008). Green jobs help reduce negative environmental impact leading to environmentally, economically and socially sustainable enterprises and economies. They decrease consumption of energy and raw materials, limit greenhouse gas emissions, minimise waste and pollution, and protect and restore ecosystems.

Background on employment and education

The shift towards a Green Economy will have (and has already had) an influence on the world of work and on workers. In order to achieve a successful transition and create job opportunities, several challenges need to be met. Greening the economy will involve creating new types of jobs and transforming existing ones. Workers with specialised skills, knowledge and training are required. Additional employment potential can only be realised if appropriate skill training is provided, facilitating the reallocation of labour. In sectors such as renewable energy, energy and resource efficiency, buildings and construction, and environmental services, the insufficient availability of suitably trained workforce has already been recognised as being problematic.

There is also a need for a just and socially acceptable transition for those who now hold jobs in carbon-intensive and polluting industries. While many will benefit from the changes, others may face hardship because of declining industries and consequent job losses. Appropriate policies have to ensure that workers likely to be affected negatively are offered protection.

Despite an expected downsizing in emission-intensive economies, most scenarios predict a positive net effect on the labour market. There is a consensus that a Green Economy triggers employment across a range of sectors and has the potential to create millions of jobs. According to a report published in 2012 by the ILO (ILO 2012, p. 163), numerous country specific studies indicate a rise in employment of 0.5–2%, translating into 15–60 million additional jobs at the global level.

Chances and opportunities of a Green Economy for employment and the creation of jobs are increasingly recognised at the international, European and national levels. Numerous initiatives to support green jobs and corresponding skill development have seen the light of day in recent years.

In 2007, the United Nations Environment Programme (UNEP), the International Labour Organisation (ILO), the International Trade Union Confederation (ITUC) and the International Organisation of Employers (IOE) jointly launched the Green Jobs initiative. The aim of this initiative was to analyse and promote the creation of decent jobs in response to the policies needed to address the global environmental challenges. As part of this initiative, the first comprehensive and authoritative report gathering data on green jobs and providing recommendations for policy makers and business was produced in 2008 (UNEP et al. 2008). More recently, the above-mentioned study by the same initiative on opportunities for jobs and social inclusion of a Green Economy shows the potential of this concept to create decent jobs (ILO 2012).

The ILO Green Jobs programme was created in 2009 to support the creation of green jobs as a means of generating decent employment and income opportunities while at the same time responding to current environmental challenges such as climate change and resource scarcity. The programme aims at promoting coherence between economic, environmental and social policies at the international level. At the national level, the programme supports initiatives through capacity building and policy advice. Furthermore, it facilitates the exchange of knowledge, offers training and produces tools and general information material.

Within their Green Growth Strategy, the OECD undertakes several activities on green jobs and skills. A report published in 2012 on 'The Jobs Potential of a Shift towards a low-carbon Economy' (OECD 2012b), analyses in detail the influence of a transition towards a Green Economy on labour markets. Furthermore, it outlines the role that policies can play in maximising the benefits of economic greening for the labour world. Together with the European Centre for the Development of Vocational Training (CEDEFOP), the OECD organises the Green Skills Forum, an international conference for researchers, government advisers, employment and policy analysts and social partners. The forum aims to review and discuss research and policy approaches to foster a greener and inclusive economy. Furthermore, the OECD supports capacity building at the local level via the Climate Change, Employment and Local Development Project. The project aims to support national and local authorities to create good quality greener jobs.

At the EU level, the Employment Package adopted in 2012 identified the Green Economy as a key source of job creation in Europe. Estimates by the European Commission (EC 2012a, p.5) show that the implementation of energy-efficient measures could create or retain 2 million jobs by 2020 and the development of renewable energy sources could lead to 3 million jobs by 2020. In 2014, the European Commission adopted the Green Employment Initiative Communication (EC 2014a), addressing the employment challenges and opportunities of a transition towards a Green Economy. The communication sets out an integrated framework for employment policies to facilitate this transition.

Alpine relevance of employment and education

Polled experts from various regions in the Alps consider the Alpine region as being particularly innovative. There is a high number of businesses in the field of energy efficiency and renewable energies located within this region (see chapters 1.1.2 /1.1.3). Furthermore, the Alps seem to offer an ideal playground for the sustainable production of renewable energies, as the natural resources needed are available and all energy storage systems can be used. On these grounds, the Alpine region offers a particular potential and opportunities for green jobs.

Situation in Alpine countries

AUSTRIA

In Austria, a Masterplan green jobs was launched in 2010 to systematically stimulate and support the creation of employment in the environmental goods and services sector. In order to implement the Masterplan, six priority areas were identified where appropriate measures are to be taken:

- Ensuring a high level of qualification. To secure a highly qualified labour force in the green sector, innovative and tailor-made education and vocational training is needed in all economic sectors of a Green Economy.
- Continuous improvement and innovation are basic requirements for sustainably successful products, technologies and services and thus for creating jobs and maintaining employment.

- Networking and cooperation among all stakeholders of a Green Economy. Due to the size structure of the domestic businesses, the strengths of the Austrian green economic sectors and the related employment situation is dependent on targeted networking activities and intensive cooperation.
- Supporting and promoting internationalisation. Success on the international market is a condition for the growth of the domestic economy and thus for the creation of green jobs in Austria.
- Promoting sustainable investment and consumption patterns. Creating incentives for private consumption and public procurement to stimulate the demand for environmentally friendly products, technologies and services along the value chain and consequently to create a tangible effect on the labour market situation.
- Raising awareness has a major role to play in the transition towards a Green Economy. Values have an important influence on investment and consumption behaviour. Awareness raising is therefore a psychological key task for creating and maintaining green jobs.

Since the launch of the Masterplan in 2010, three evaluations of the measures have taken place. Even considering the delay in the availability of statistical data, a stimulating effect of a number of measures on the green economic sectors is noticeable. This is above all true for measures initiated before 2010, such as funding activities through the climate and energy fund.

Highlights include funding activities for thermal rehabilitation, educational measures of the climate protection initiative *klimaaktiv*, implementing the 2010 action plan for sustainable procurement and the ever increasing number of eco-labelled products and services.

In 2008, 167,000 employees (equivalent of full time) were working in the green sector. The number rose to 181,820 in 2014, thus 4.9% of the total number of employees. Consequently, almost one job out of 20 in Austria is a green job. The number of green jobs in 2014 even reached 209,864 including public transportation.

The economic activities belonging to the environmental goods and services sector as well as the products and services produced by these activities are allocated to two main categories, environmental protection activities and resource management activities.

Environmental protection activities are focused on producers of technologies, goods and services. They measure, control, restore, prevent, treat, minimise, research and sensitise environmental damages to air, water and soil as well as problems related to waste, noise, biodiversity and landscapes. This includes 'cleaner' technologies, goods and services that prevent or minimise pollution. In Austria, the most important environmental protection activities are waste management, wastewater management, protection and remediation of soil, groundwater and surface water as well as protection of ambient air and climate (according to the Classification of Environmental Protection Activities and Expenditure – CEPA; EUROSTAT 2000).

Resource management activities encompass producers of technologies, goods and services to measure, control, restore, prevent, minimise, research and sensitise resources depletion. This results mainly in resource-efficient technologies, goods and services that minimise the use of natural resources. In Austria, by far the most important resource management activity is the management of energy resources.

Maps 2.4.1-1 and 2.4.1-2 show the importance of these two kinds of activities for the area of the Alpine Convention in Austria, expressed in output and employment figures. Data are presented by federal provinces.

In terms of output, the federal province of Tyrol has the highest share among resource management activities (€2.3 billion), followed by Carinthia (€1.8 billion), Styria (€1.4 billion) and Salzburg (€1.2 billion). The differences between the provinces are smaller with regard to environmental protection activities. The federal province of Tyrol (€937 million) has the highest share, followed by Carinthia (€849 million), Salzburg (€804 million) and Vorarlberg (€717 million).

For most federal provinces, resource management activities are more important than environmental protection. In terms of employment, data tell a different story. In most federal provinces, employment is higher in environmental protection

activities than in resource management. One of the reasons is the strong influence of labour intensive agricultural activities (with low revenues compared to other economic activities) in environmental protection. In resource management however, there is a strong influence of activities with high output values per employee, like the production of renewable energies.

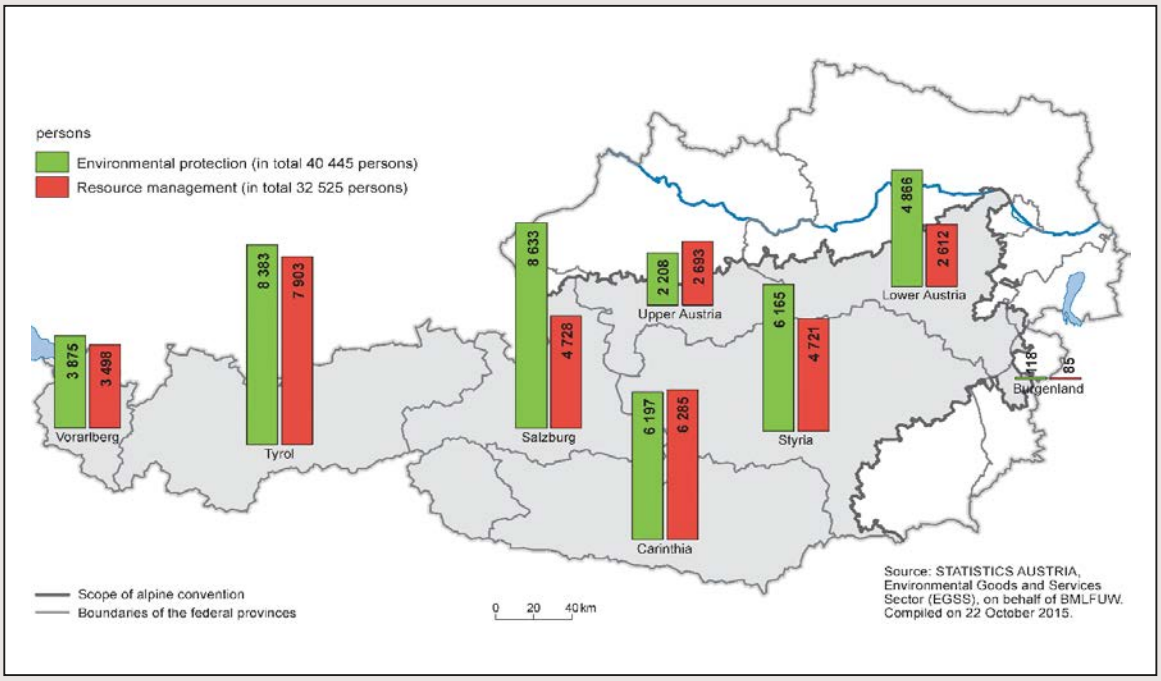


Figure 2.4.1-1 Employment in the environmental goods and service sector 2013, Austrian Alpine Convention area (Source: Statistics Austria 2015).

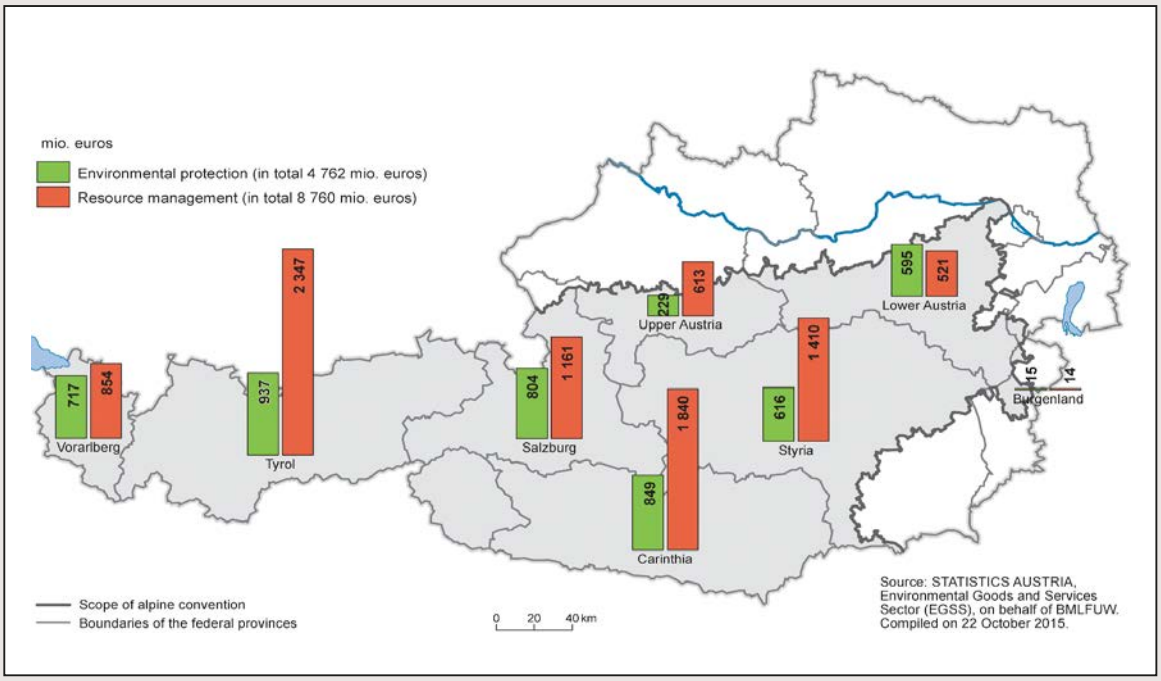


Figure 2.4.1-2 Turnover in the environmental goods and service sector 2013, Austrian Alpine Convention area (Source: Statistics Austria 2015).

Specifically, the federal province of Salzburg has the highest share of employees (8,633 persons) in environmental protection activities, followed by Tyrol (8,383 employees), Carinthia (6,197 employees) and Styria (6,165 employees). These are also the most important federal provinces in terms of resource management activities, albeit in a different order. Most of the employees can be found in Tyrol (7,903 employees), followed by Carinthia (6,285 employees), Salzburg (4,728 employees) as well as Styria (4,721 employees).

GERMANY

Germany does not have a specific programme for green jobs, notwithstanding the government's recognition of the potential of a Green Economy for job creation. There are, however, single initiatives in support of qualifying and training for employment in the environmental sector (see chapter 3.4.1).

Higher educational institutions have taken up the challenge of ensuring appropriate skills for a Green Economy. Within the German Alpine Convention area, the Kempten University of Applied Sciences offers a Bachelor in Energy and Environmental Engineering. At the University of Applied Sciences in Rosenheim, students can choose among various classes in the wood, energy & construction fields. These cover innovative wood and lightweight constructions, energy-efficient optimisation of building shells and renewable energies.

Bavaria has a leading position in terms of organic farming with more than 7,300 organic farms and an organic area of 230,000 hectares. Almost one-third of all German organic farms are situated in Bavaria. Even though there is no specialised apprenticeship for ecological farmers – education and vocational training for organic agriculture is integrated in the regular educational system for agricultural professions –there are two professional schools for farming specialising in organic agriculture in Bavaria. Within the Alpine Convention area, the Fachschule für Agrarwirtschaft, Fachrichtung Ökologischer Landbau, in Weilheim offers holistic training in organic farming after graduation through an apprenticeship. Successful students qualify as state-examined economist for organic agriculture.

A study estimated that in 2012, around 2.2 million people were employed in the field of environmental protection in Germany (Edler & Blazejczak 2016) – see Figure 2.4.1 3. This represents 5.2% of the total employment and is thus an important sector for the labour market. Between 2010 and 2012, the number of people employed in environmental

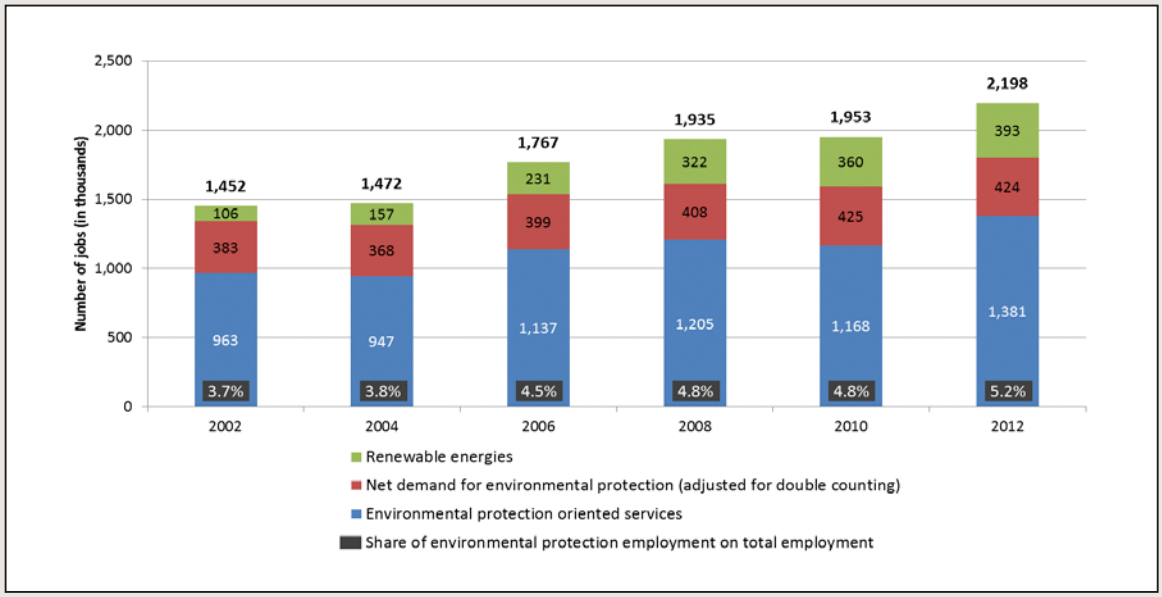


Figure 2.4.1-3 *Development of employment in the environmental goods and service sector in Germany, 2002 – 2012, per 1,000 persons. The comparability of the estimation results between the years under review is limited; a substantial part of the differences occurs due to methodological and statistical reasons. Contains employment in energy-efficient building refurbishment (Source: Edler & Blazejczak 2016; calculations by DIW).*

protection increased by 245,000. The estimated figure represents the number of people in the whole economy that use part of their working hours to perform environmental protection activities or whose jobs are indirectly induced in upstream industries by environmental protection activities. The estimated figure for 2012 depicts the lower limit of employment in environmental protection, as a number of sectors such as ecological tourism, ecologically oriented insurance industry and product-integrated environmental protection were not included due to lack of data.

Classical sectors include waste disposal, water protection, noise abatement, and air pollution control. The production of goods necessary for the operation and maintenance of environmental protection facilities also contributes to the creation of jobs in the environmental sector. The environmental service sector accounts for 63% of all environmental jobs (1.38 million employees). There are 97,000 jobs that can be attributed to the exportation of environmental goods. For employment in the renewable energies sector, the figures indicate 393,000 jobs in Germany in 2012.

ITALY

A formal collection of figures concerning green jobs at the national level has not been performed in Italy. However, estimates from studies (Fondazione Symbola & Unioncamere 2015) show a significant vitality in some Alpine provinces concerning the planned hiring decisions by companies. Data for 2015 indicate that a high share of locally created new jobs are green in the Alpine provinces of Monza and Brianza (20.2%), Bolzano (17.9%), Vicenza (15.2%), Trento (15.1%), Torino (14.8%) and Bergamo (14.3%).

A more in-depth analysis (Unioncamere et al. 2016) shows that the three business functions where green jobs tend to concentrate are R&D (66.8%), technical areas (45.3%) and marketing & communication (38.1%). This reflects the prominent role that eco-innovation plays in the Italian economy across different industries. This is due to the joint challenges of increasing the value added and investing in energy and environmental technologies, while maintaining competitiveness on the global markets. Furthermore, green jobs are usually characterised by a strong technical expertise. The greening of consumers' preferences has brought an increase in the demand for green expertise in marketing & communication to ensure better market performance.

In Italy, more new staff with previously unavailable skills (intended to occupy new posts) were hired in fields considered to be of green-type jobs over the 2009-2015 period, compared with the share of other non-green professionals hired in other fields (Unioncamere et al. 2016). This difference seems to point out that sustainability is a relatively new area for most businesses, with a limited number of employees still, where new skills are needed more often than in other business areas.

The Italian job market lacks green skills for companies, due to the absolute scarcity of professionals. However, since 2010 this situation has continuously improved, probably because of the introduction of appropriate educational initiatives and of the increased awareness of the young professionals on job opportunities in the green sector.

Sustainability both as a management practice and as a topic to be covered in university classes by means of specific courses or as a cross cutting issue has been addressed as a voluntary initiative by the Conference of Italian University Rectors (CRUI). CRUI has set up a 'Network of Universities for Sustainability' (CRUI 2015) aimed at spreading the culture and practice of environmental sustainability and social responsibility for the present and future generations. Among the 48 participating universities in 2015, many have seats within the Alpine Convention area (e.g. Bergamo, Bolzano, LIUC, Politecnico di Torino, Trento, Milano, Udine, Venezia, Verona, etc.). Those universities are committed both to run their campuses according to sustainability principles and often to use indicators that are regularly measured and checked. They aim at promoting high-level environmental education that contributes to the creation of a qualified green workforce.

The Italian Ministry of Education, University and Research (MIUR) promoted a formal agreement (implemented by the University of Milano, Unimont – University of the Mountains) aimed at creating a centre of excellence for university education on mountain topics (MIUR – Ministero dell'Istruzione Universitá e Ricerca 2011). The initiative includes a three-year course on mountain sciences run in the Italian Alps in Edolo. The course offers classes on topics relevant for the mountain economy (such as agro-forestry, environment, energy and tourism). It takes a multi-disciplinary and

inter-disciplinary approach and is run in cooperation with other universities holding specific competences and new learning approaches based on novel technologies (web, virtual classroom, blended learning). Moreover, networking among national and international research teams is promoted in the field of mountain studies.

A significant effort has also been put into primary and secondary education. The Italian Ministry for the Environment Land and Sea and the Ministry of Education, University and Research has issued several guidelines. These aim at making education for sustainable development a strategic target for the country by promoting environmental awareness across all cohorts of students and creating a generation of 'environmental natives'. This national initiative on environmental education includes a commitment to deliver specific skills to teachers on sustainable development and to students in the framework of the EU Strategy 2020 and EC COM 2008/868 on 'New skills for new jobs'. Moreover, it has set up eight educational courses to be taught at different educational levels (from primary to secondary education) on specific subjects including green economy, biodiversity, food, waste management and climate change (MATTM & MIUR 2014).

SLOVENIA

From 2011 to 2013 in Slovenia, the introduction of expertise for sustainable development was proposed and elaborated in the framework of the Institute of the Republic of Slovenia for Vocational Education and Training (CPI). It was based on the principle that all jobs in the country can be 'made green'. Therefore, it is important that proficiency for the management of sustainable development combining environmental, social and economic responsibility of organisations and individual jobs can be integrated into all forms of education and training. The expertise is being gradually introduced in the system of occupational standards.

In 2013 and 2014, NGO Umanotera implemented the project, Supporting Green Jobs, within the framework of the management partnership in EU affairs communication between the European Commission, the Slovenian Government and the European Parliament. The aim of the project was:

- To improve the understanding and knowledge of green jobs and to raise awareness of what green jobs are and what opportunities they bring.
- To provide a comprehensive presentation of green jobs in connection with the green economy.
- To promote the linking of different actors in the field of green jobs with the aim of promoting the creation of conditions for green jobs.

With support from the European structural funds, Slovenia is planning to finance measures for adapting workplaces. This includes the introduction and promotion of forms of work that are adapted to social and demographic challenges, including the greening of jobs.

The Ministry of Labour, in charge of the programme, is focusing on the following areas:

- Creation of new green jobs (e.g. sustainable local supply and forestry wood chain, waste recycling, water management, increase logging, new installations above pre-industrial wood processing, renewable energy production and food processing).
- Provision of high quality and healthy work environment.
- Social inclusion e.g. renovated brownfield recycling - now mainly within the framework of social enterprises.
- Education and training: the Ministry of Labour is partially responsible for providing training and adult education. A special focus will aim at unemployed and redundant workers. There is a need for education and vocational training to allow workers to acquire the knowledge and skills necessary for the transition to a Green Economy. In particular, the situation calls for a professionalisation of forest work, new technologies, and new skills in order to raise the value added by wood processing industries.

SWITZERLAND

Switzerland considers the cleantech sector to be very important to Swiss jobs and the economy and is constantly investing in its development.

The Swiss Cleantech Masterplan (UVEK & EVD 2011), next to other Green Economy action plans, was to be the motor of a greener economy with its main objective being supporting businesses in developing cleantech applications. The motivation behind this masterplan was to harmonise the development of the economy and the protection of the environment: these do not have to be mutually exclusive. With the right action and state support, they can work towards the same purpose of sustaining the environment without compromising, but rather boosting, the economy.

The federal government sees cleantech not only as an environmental necessity but also as an opportunity for the Swiss economy. Environmental problems prompt cleantech development, making it an international growth market with some sub-sectors expected to grow at a rate of 3-8%. From the perspective of the economy, the involvement of Swiss businesses means raising their competitiveness, contributing to economic growth and creating more green jobs. The innovative nature of cleantech is an especially relevant issue for Switzerland, given that innovation and technology is its economic backbone.

The Cleantech Masterplan with a series of objectives, measured and recommended areas of action, aims to create the right environment for boosting the development in the cleantech area by motivating various actors. The federal government`s vision was to make Switzerland a centre for cleantech innovation, to bring the use of resources to a sustainable level by setting an example in resource management and to increase resource efficiency. This was to be achieved by leading research on cleantech, progress in transfer of knowledge and technology, leadership in cleantech production and by Swiss quality in cleantech. The five strategic areas of action were research, knowledge and technology transfer; regulation and market based promotion programmes; international markets; cleantech innovation environment; skills and training. In each of these areas of action, the federal government undertook appropriate measures.

The masterplan provided groundwork for further development of policies and incentives in relevant areas. However, it also focused on encouraging dialogue between actors and shifting their view of the economy towards understanding that resource efficiency in the long term creates only winners and is beneficial for all: environment, economy and employment.

An important stakeholder of green training courses is *sanu future learning*. It is not only a leading provider of sustainable solutions but supports companies and public bodies as well. Furthermore, it provides a national platform and promotes all kind of courses in the environmental sector.

Conclusions on opportunities and challenges

Given that the Alpine region has a high innovation potential and that there are many activities in the field of renewable energies and energy efficiency, the region is predestined to create green jobs. Figures from Austria show that many of the green jobs in the country are located in the Alpine Convention area. The creation of green workplaces can also offer an opportunity to keep qualified workers in the region.

As laid down at the beginning of this chapter, there is a need to put in place appropriate policies to achieve a successful and just transition to a Green Economy and to create job opportunities. This includes qualification offers (education and vocational training), supporting innovation in small and medium-sized businesses, creating networking structures among all stakeholders of a Green Economy, promoting sustainable investments and setting incentives to stimulate the demand for environmentally friendly products, technologies and services at the private and public level.

The innovation potential in the Alps and the existence of many RES companies show that green jobs are available. This needs to be supported by fostering green skills with further development of training and academic studies. The Slovenian and Austrian examples show that with the right policies in place a Green Economy can have positive effects on the labour market and provide a chance for social inclusion.

2.5 ECONOMIC WELL-BEING AND SOCIAL INCLUSION

2.5.1 SOCIAL INCLUSION

According to the UNEP definition, a Green Economy improves human well-being and social equity. A sustainable economic system should generate sufficient income and wealth to allow people to satisfy their needs and pursue other goals that they deem important to their lives, while complying with ecological and social standards.

A Green Economy should also be inclusive, provide access to jobs, education and health care for all and integrate skills and needs of all groups of society into a sustainable economic system. This includes elderly people who have lots of working and organisational experience, people favouring part time work for private reasons or people having traditional working skills. Appropriate framework conditions have to be designed to allow marginalised groups to contribute to the economic system, including access for people living in remote areas to public transport.

Background to economic well-being and social inclusion

There have been increasing concerns in past years about the relevance of traditional indicators to measure national or societal well-being, namely the gross domestic product (GDP). Well-being does not depend only on the functioning of the economic system, but also on people's living conditions. Furthermore, GDP does not indicate how income and wealth are distributed among the people. It is now generally recognised that GDP is insufficient as a measure of prosperity and well-being and that there is a need for more comprehensive measures of human well-being. The OECD Better Life Initiative (OECD 2016) launched in 2011 to bring together internationally comparable measures of well-being aims at addressing these concerns.

There is no commonly agreed definition of well-being, however, the Better Life Initiative identifies three pillars for measuring people's well-being (cf. Figure 2.5.1-1):

- Material conditions or economic well-being, which determine people's consumption possibilities and their command of resources.
- Quality of life, which is defined as the set of individuals' non-monetary attributes that shape their opportunities and life chances, and have intrinsic value under different cultures and contexts.
- The sustainability of the socio-economic and natural systems where people live and work, which is important for well-being to last over time. Sustainability depends on how current human activities influences the stocks of different types of capital (natural, economic, human and social) that underpin well-being.

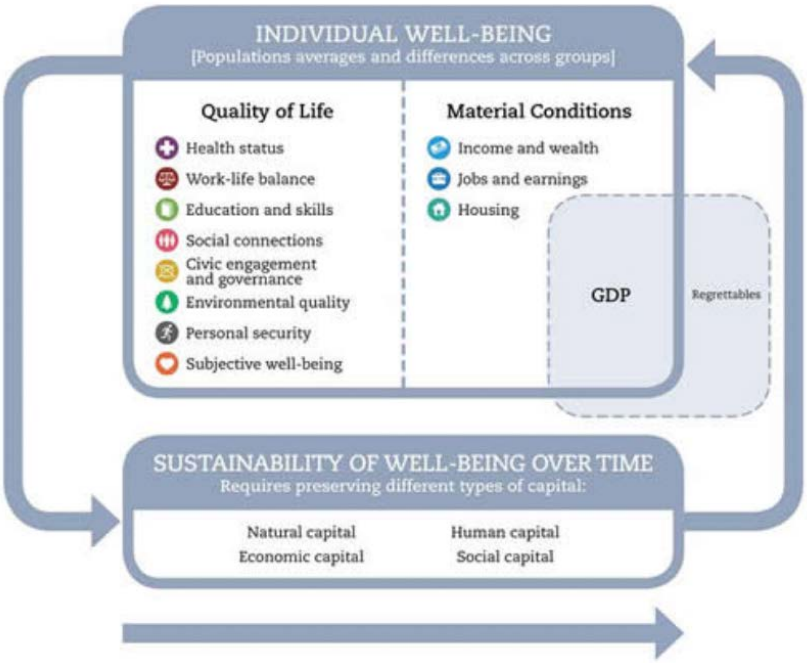
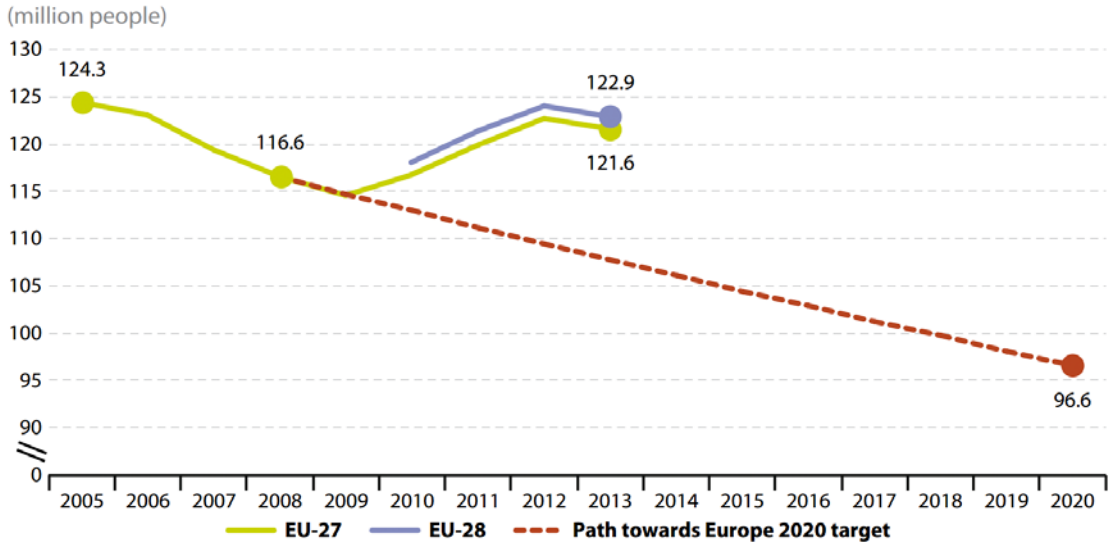


Figure 2.5.1-1 OECD Framework for measuring well-being and progress (Source: OECD 2013).

This chapter will focus mainly on the first pillar, economic well-being. Material living conditions and in particular income and wealth are important aspects of individual well-being. The importance of economic well-being to overall satisfaction has been recognised by numerous organisations dealing with measuring well-being (OECD 2013, p.29).

At the EU level, the Beyond GDP (EC 2016a) initiative of the European Commission aims at measuring the wealth and well-being of nations, also taking environmental and social aspects of progress into account. It develops appropriate indicators to address current challenges such as climate change, poverty, resource depletion, health and quality of life.

The 2015 monitoring report of the EU Sustainable Development Strategy provides a picture of progress towards the objectives of the strategy, covering a wide range of issues including social inclusion (EUROSTAT 2015i, pp.113). Whereas until 2009 the number of people in the EU at risk of poverty or social exclusion had been falling regularly, it started to rise again this year due to the economic crisis. Although the number reached its peak in 2012 with approximately 122.6 million people affected, in 2013 almost one in four persons was still at risk of poverty or social exclusion (121.6 million people in total or 24.5% of the EU population).



(1) 2005–2006 data are estimates. (2) The overall EU target is to lift at least 20 million people out of the risk of poverty or social exclusion by 2020. Due to the structure of the survey on which most of the key social data is based (the EU Statistics on Income and Living Conditions), a large part of the main social indicators available in 2010, when the Europe 2020 strategy was adopted, referred to 2008 data for the EU-27 as the most recent data available. This is why monitoring of progress towards the Europe 2020 strategy's poverty target takes EU-27 data from 2008 as a baseline year.

Figure 2.5.1-2 Development of people at risk of poverty or social exclusion in Europe (Source: EUROSTAT 2015i).

Poverty and social exclusion in Europe include monetary poverty, material deprivation or very low work intensity. In 2013, 16.6% of the total EU population was affected by monetary poverty whereas 9.6% (48.3 million people or every tenth person) was suffering from severe material deprivation. Material deprivation includes issues relating to economic strain, durable goods and housing. Affected people suffer from a lack of resources and are unable e.g. to pay rent or utility bills, heating, holidays or to cover unexpected expenses. Material deprivation measures poverty in absolute terms and thus complements (income-related) monetary poverty. Again in 2013, 10.8% (or 40.2 million) of the EU population aged 0 to 59 were living in households with very low work intensity, meaning the working age members of the household are working at less than 20% of their potential. The number of people affected by very low work intensity increased by 5.3% between 2010 and 2013. Economic inactivity substantially increases the risk of being poor. However, poverty and social exclusion do not only affect those who are economically inactive or unemployed. In 2013, 8.9% of employed people in the EU-28 were considered to be the working poor.

Long-term unemployment describes people aged 15 or older who have been unemployed for longer than one year. Normally it is more difficult for these people to obtain a job than for people who have been unemployed for shorter periods. Consequently, they face a higher risk of social exclusion. In 2014, the long-term unemployment rate was 5.1%.

There is a close link between income and education. Tertiary education and lifelong learning enable people to gain knowledge, skills and competences needed for employment in a changing world. Early school leavers and people with only basic education have a higher risk of experiencing very low work intensity or be among the working poor. Education also has a strong connection to social issues, such as participation and political interest. The ratio of early leavers from education and training has fallen steadily since 2003, reaching 11.1% in 2014. The portion of the population aged 30 to 34 years who attained tertiary education has been continuously increasing since 2002. Participation in lifelong learning increased by 27.4% between 2003 and 2014.

Alpine relevance of economic well-being and social inclusion

The quality of life in the Alpine region can differ significantly depending on where people live. Whereas urban centres offer high quality, life can be rather difficult in remote areas where public services are less accessible and there is a higher risk of exclusion. However, especially in remote areas, people with traditional working skills, such as dairy farmers on Alpine pastures, are important for a more sustainable economy and need to be integrated in the labour market for social and also for economic reasons. If such ways of living shall be conserved and protected, it is important to assure the quality of life in the whole Alpine region. Therefore, this topic is of particular importance for the Alps. Figure 2.5.1-3 shows the percentage of people at risk of poverty in the Alpine Convention area.

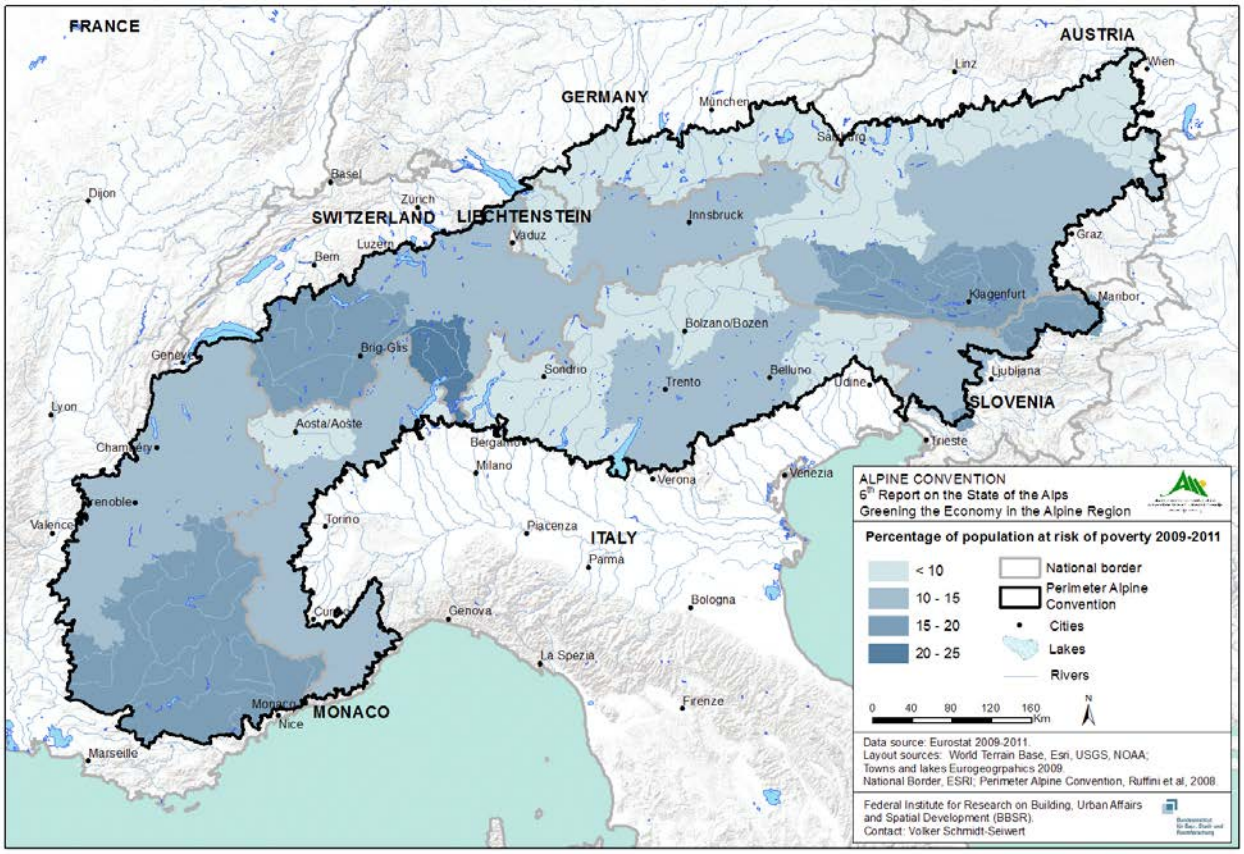


Figure 2.5.1-3 ESPON Atlas 2014: Risk of poverty in the Alpine Convention area (Source: ESPON & BBSR 2014, elaboration: Permanent Secretariat of the Alpine Convention).

In the aim of creating an economy that increases 'the quality of life for all and not the wealth of a few', the 'Economy for the Common Good'[49] was born in 2010, initiated by Austrian writer and lecturer, Christian Felber. The movement wants to promote the values of human rights and ecological responsibility into day-to-day business practice and works towards an economic system that places the common good at the centre of all economic activity. One of the central elements is the common good balance. Businesses can use the common good balance sheet as a tool to measure their contribution to the common good. By

49. Further information: www.ecogood.org/en/.

doing so, the companies are given an account of the degree to which they fulfil certain values, such as human dignity, solidarity, sustainability, justice and democracy.

Originally set up in Austria, the Economy for the Common Good quickly gained participants in Austria, Germany, Italy and later on in Switzerland before becoming an international movement. At present, several thousands of individuals, companies, local authorities and NGOs across the globe are actively involved in the initiative. The movement, however, has also been subject to criticism.

Still today, most of the initiatives and companies adhering to the movement of the Economy for the Common Good are situated in the Alpine region or close to the Alps. This is partly because the initiative was founded in Austria, and it seems to be of special interest to citizens and companies in this region. This be due to Alpine citizens' high level of identification with the region and thus increased preparedness of all actors to contribute to the common good. Next to companies, local authorities can also establish a common good balance sheet. The following good practice example describes the approach of the *Common Good Region Vinschgau*.

Good practice – Common Good Region Vinschgau, Italy

The Common Good Region Vinschgau started at the beginning of 2013 with the aim to contribute to a more sustainable shape of regional economic cycles. Four municipalities of the district community Vinschgau (Laas, Mals, Latsch and Schlanders) established their first common good balance sheet within the 'Economy for the Common Good' initiative. This is accompanied by two additional projects: the planned introduction of a regional currency to strengthen regional economic cycles and the development of a prosperity indicator for the Vinschgau region. The latter will measure the well-being in the valley according to their own criteria.

A number of regional companies have already established a common good balance sheet and the concept is becoming increasingly popular among business, municipalities, citizens and – in future - schools.

Further information: old.ecogood.org/allgemeine-infos/aktuelles/neuigkeiten/vinschger-pilotprojekt-zur-gemeinwohl-oekonomie

Situation in Alpine countries

AUSTRIA

In Austria, the Growth in Transition[50] initiative brings together transformation activists and decision-makers from politics, science, economy and civil society and promotes dialogue and exchange on growth, prosperity and quality of life. It provides an international platform for addressing questions of growth and an alternative, sustainable economy.

The initiative is organised by the Federal Ministry of Agriculture, Forestry, Environment and Water Management and supported by the Vienna University of Economics and Business and 25 other partner organisations, such as other Austrian federal ministries, NGOs, companies and academic institutions.

Recently, an international conference was held in Vienna. Up to 700 participants met at the Vienna University of Economics and Business, Europe's largest university of economics, to discuss the different aspects of economic and social change and its constraints. Apart from conferences, the initiative organised workshops in Brussels and Dubrovnik to connect decision makers at the European level.

50. Further information: www.growthintransition.eu.

Good practice – Green Care – where people can grow, Austria

The project 'Green Care - where people can grow' is a network of different actors in the agrarian, social and educational sectors and in the health care area, between whom there was previously no connection. The project's intention is to create structures and support in rural areas for a variety of target groups, from people with special needs and kindergarten children, to traumatised, unemployed or disabled and elderly people in need of care. Up to now, these kinds of projects have only been set up in urban areas. They are a collaborative effort between the agriculture and forestry sectors and social institutions.

Green Care in agriculture and forestry includes very different offers, such as:

- Educational activities (teaching on the farm) intended to provide children, young people and adults also with more understanding for nature and agriculture. Examples for this include kindergarten and day care centres on the farm, the project 'school on the farm' or forest-related education.
- Providing elderly and disabled people with a daily structure and thus increasing their quality of life by offering an environment close to nature. Existing care centres can be given a 'green component' using the agricultural sector's social competencies.

Further information: www.greencare.at/project/green-care-wo-menschen-aufbluehen/

GERMANY

Since 2001, the German government has published the "Report on Poverty and Wealth" (BMAS 2013) taking stock of the economic and social situation of German citizens. The report includes information on policies and measures taken by the government to improve the living conditions of disadvantaged people; it is published by the Federal Ministry of Labour and Social Affairs (BMAS) within each legislative period. An advisory board made up of representatives of the German Länder, local authorities, associations and NGOs support the government in drafting the reports. Furthermore, an expert committee contributes to the process by providing thematic studies and reports.

To date, four reports have been published, in 2001, 2005, 2008 and 2013. The fifth report is currently under preparation and will probably be released in 2016. These reports cover topics such as macro-economic conditions, income and wealth, education and employment, health, housing, political and civic participation, migration and people living under particularly difficult conditions. The last and fourth report on poverty and wealth, published in 2013, has a focus on social mobility, i.e. 'the change of living circumstances and the dynamics of social participation occurring within an individual's lifetime (intra-generational mobility)' (BMAS 2013). It covers the years 2007 – 2012. Labour market and distribution indicators show a rather positive development of the living standards in Germany.

According to the national statistical office in 2014, 20.6% of the German population was at risk of poverty or social exclusion, i.e. 16.5 million people. In 2013, 20.3% (16.2 million people) were considered at risk. The German figures are significantly lower than the EU average (24.4% in 2014 and 24.5% in 2013), (cf. 2.5.2-1).

	2011	2012	2013	2014
Germany	19.9%	19.6%	20.3%	20.6%
European Union	24.3%	24.7%	24.5%	24.4%

Table 2.5.1-1 People at risk of poverty and social exclusion in Germany and in the EU, 2011-2014 (DESTATIS 2016).

At the regional and local levels, figures are only available for monetary poverty (risk of poverty rates). In 2014, 15.4% of the population at the national level were at risk of poverty, 15.5% in 2013. The Bavarian values were considerably lower, corresponding to 11.5% in 2014 and 11.3% in 2013. Corresponding figures for the German Alpine districts are only

available at NUTS 2 level and show a value of 8.9% for Oberbayern and 12.1% for Schwaben for the year 2014, thus slightly lower than the Bavarian average (Statistische Ämter der Bundes und der Länder 2016).

Since 2005, the unemployment rate has fallen continually, reaching 6.8% in 2012 and 5.4% for young people (15-29 years), which is the lowest rate of youth unemployment in the European Union. In addition, the number of long-term unemployed, one of the major causes of poverty risk in Germany, has fallen considerably between 2007 and 2012 - from 1.73 million to 1.03 million (cf. Figure 2.5.1-4).

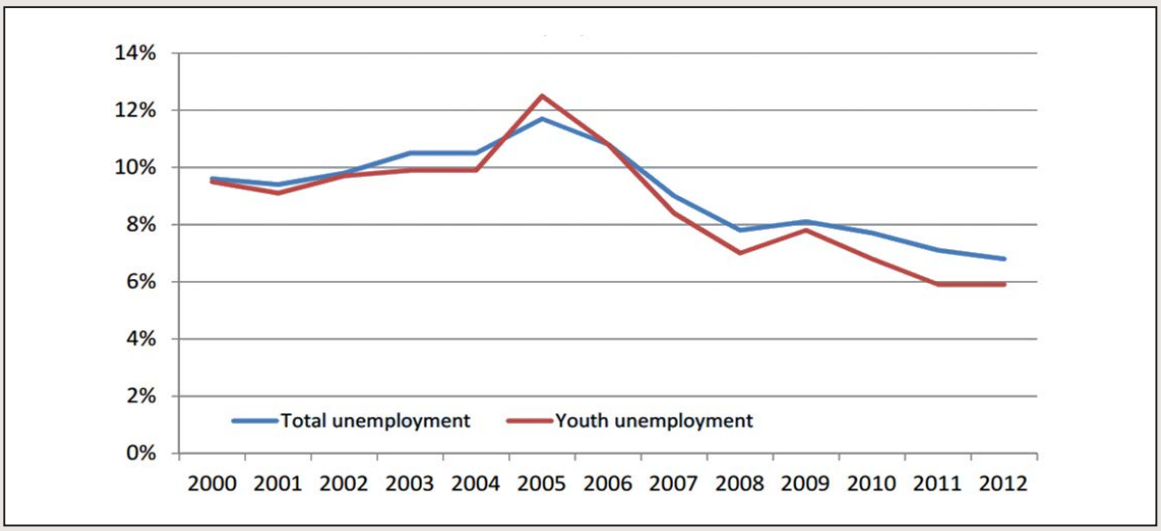


Figure 2.5.1-4 Development of the unemployment rate in Germany 2000 – 2012 (Bundesagentur für Arbeit 2016).

In the German Alpine region, the employment rate is in line or slightly higher than the Bavarian rate (78.6%) and higher than the German average (74.2%). As for the unemployment rate, the German Alpine districts have unemployment rates that are slightly lower than Bavarian average (3.6% compared to 3.8% in 2014) and lower than the German average (4.6% in 2015).

Young people leaving school without a certificate have fewer chances of playing their part in society. There is a decreasing number of students between the age of 15 and 17 leaving school without a certificate, falling from 8% in 2006 to 6.5% in 2010.

The rate of the German Alpine population who completed a higher secondary education degree range from 432 residents out of 1,000 residents in low performing areas to 531 in high performing areas. On average, this is higher than the Bavarian (459) and the German average (460). As for tertiary education, the rates of inhabitants of the German Alpine districts range from 105 to 168 and are lower than the Bavarian (147) and the German (150) average. The difference in performance between secondary and tertiary education levels may be due to the fact that many people with tertiary education have to move to bigger urban centres outside the mountain area, where they find better job opportunities for their respective education levels (PSAC 2015a, p.101).

ITALY

Since 2011, the National Institute of Statistics (ISTAT) and the National Council for Economics and Labour (CNEL) have been running an extensive programme that involves both the scientific community and civil society. This is aimed to identify a matrix for measuring 'equitable and sustainable well-being' across the Italian territory. Based on 134 indicators, scientific research combined with citizens' dialogue and the analysis of feedback identified 12 dimensions of well-being. A joint reading of the results of these indicators is expected to deliver information on the trend of well-being and inequality for each region in Italy (NUTS 2). Differences are categorized in the annual equitable and sustainable

well-being (Benessere Equo Sostenibile, BES) reports (CNEL & ISTAT 2014) according to gender, age and geographical origin. As a result, statistical information has been improved, some indicators have been refined, and others have been collected for the first time in years: the resulting combination yields a more comprehensive view of well-being in Italy.

The report delivers information on how the quality of life has changed for Italian citizens under twelve dimensions. The methodology has recently been tested also on the provincial level (NUTS 3) on a smaller sample (CNEL & ISTAT 2014).

In general terms, northern Italian regions score higher than the national average.

A focus on the BES dimensions named *economic well-being* and social relationships such as registered in the Alpine regions (CNEL & ISTAT 2014) and reveal the trends reported in the figures below. These dimensions rely upon a set of 10 or 11 indicators, of which some have a multiregional scope and others a regional one (NUTS 2).

Among the indicators covered, some particularly reflect aspects of employment, disposable income, financial security and exposure, social networks, no profit initiatives as well as community participation in political life.

An analysis of the indicators under the *economic well-being* dimension show a better performance of the Alpine regions compared to the national figures for all indicators. Furthermore, either a better performance or an alignment with the figure for northern Italy is the rule for most indicators. In particular the Alpine regions (NUTS 2) score significantly better than the national average concerning risk of poverty (-48%), people living in families with strong material deprivation[51] (-55%) or very low labour intensity (-52%).

Concerning the *social relationships* dimension, the Alpine regions tend to score better in particular in the domains of volunteering (+58%), social participation (+31%) and provision of private financial support to non-profit organisations (+49%) that are consistently more numerous (+65%). Trust in other people (+34%), in families (+18%) and friends (+20%) is significantly higher in the Alpine regions than elsewhere in the country.

From the point of view of labour, Alpine regions seem to be able to provide more secure and lasting jobs.

SLOVENIA

The Indicators of Well-being in Slovenia[52] have been published since 2013, produced by a consortium of governmental institutions: the Institute for Macroeconomic Development and Analysis, the Statistical Office of the Republic of Slovenia, the National Institute of Public Health and the Slovenian Environment Agency. Recognised relevant factors of well-being were divided into three areas – material, social and environmental - and presented by indicators.

According to the indicator report for 2015, material well-being of the people in Slovenia has been declining since 2008 due to the economic crisis. The *at risk of poverty* rate in Slovenia in 2013 increased to 14.5% of the population (EUROSTAT 2015b). In the 2009–2013 period, it went up by 3.2%, so that in 2013, an additional 50,000 people lived below the *at risk of poverty* threshold compared to 2008. Despite the increase, the rate is lower than the EU average, but the gap is rapidly closing, since the rate is declining in the EU. During this period, the *at risk of poverty* rate increased significantly for families with children. In Slovenia, above-average rates are recorded for single persons, particularly older women.

51. *Share of people living in families with at least 4 out of 9 problems / total number of residents. The problems taken into account are: (i) inability of supporting unexpected expenses higher than €800; (ii) inability to spend one week of holiday a year far from home; (iii) having arrears to pay for mortgages, rents, bills or other debts (e.g. instalment buying); (iv) inability to have a proper meal each two days, i.e. with meat or fish proteins (or vegetarian equivalent); (v) inability to adequately heat home; (vi) inability to pay for: a washing machine, (vii) a colour television, (viii) a phone, (ix) a motor car.*
52. *Institute for Macroeconomic Development and Analysis, the Statistical Office of the Republic of Slovenia, National Institute of Public Health and Slovenian Environment Agency, 2015: Indicators of well-being in Slovenia, www.kazalniki-blaginje.gov.si.*

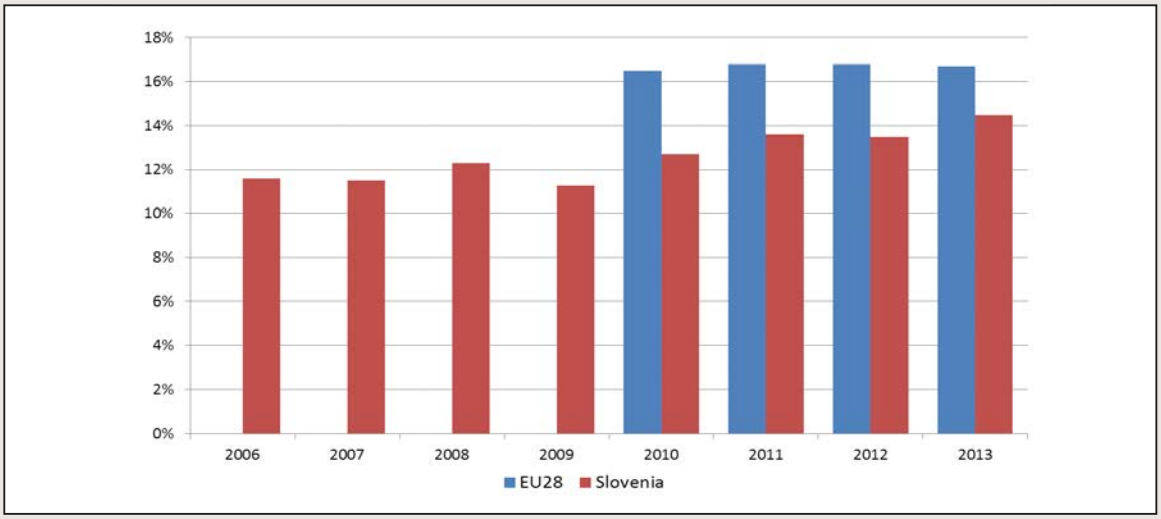


Figure 2.5.1-5 At risk of poverty rate, Slovenia and the EU, 2007–2013 (in %) (Source: EUROSTAT 2015b).

Because work is the main source of income for most individuals, the indicator employment rate for the population aged 20-64 years is a good indicator of the general material well-being of the population.
The indicator, as presented in the Indicators of Well-being in Slovenia, shows a decline since 2009, with economic recovery. In 2014 it increased by 0.6 percentage points to 67.8%, which is 5.2 percentage points less than in 2008.

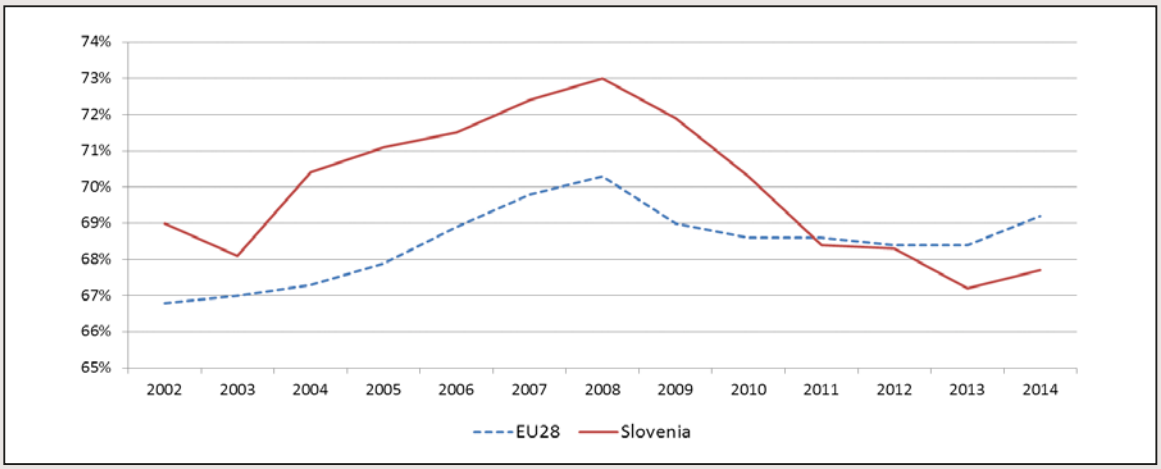


Figure 2.5.1-6 Employment rate for the population aged 20-64 years, Slovenia and the EU, 2002–2014 (in %), (Source: EUROSTAT 2015e)

In 2013, the employment rate of young persons (age group 20-24 years) was 39.7%. In 2014, it remained at a similar level. Since 2008, when it was the highest, it has dropped by as much as 15.9 percentage points. It fell below the EU average of 48.5% in 2009. The employment rate of older persons (age group 55-64 years) was 35.4% in 2014, thus considerably lower than the EU average overall (51.8%). The long-term unemployment rate in Slovenia was 5.3% in 2014, higher than the EU average (3%).

The indicator 'Portion of the population with at least secondary education' measures the educational levels of the adult population. This covers upper secondary and tertiary education and is important for well-being because people with at least secondary education are, on average, more likely to be employed and have a higher income and are less likely to be at risk of poverty and social exclusion. An increase in education levels has a positive impact on well-being.

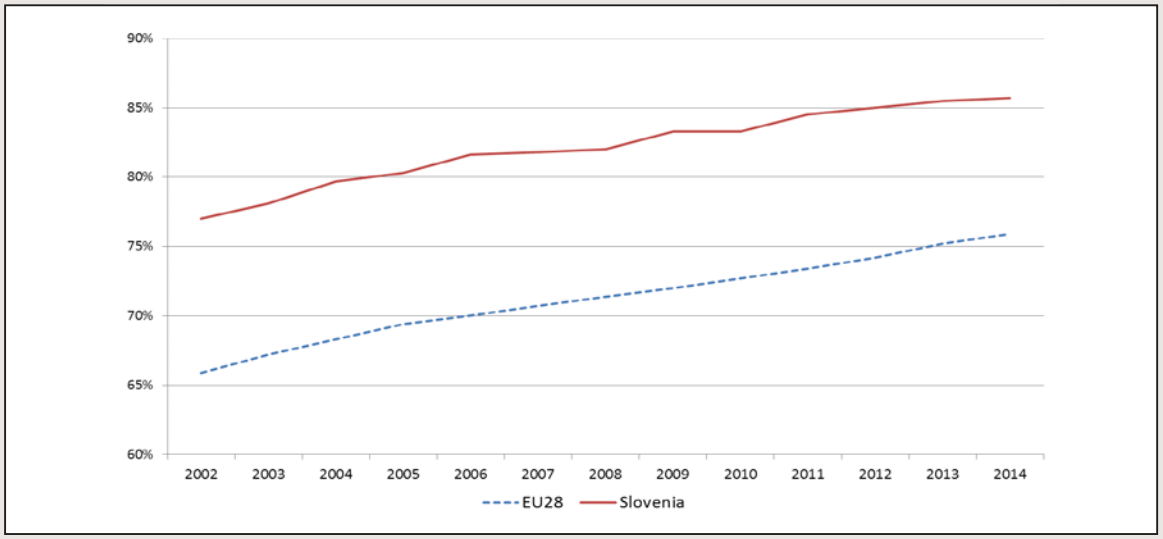


Figure 2.5.1-7 Portion of the population with at least secondary education, Slovenia and the EU, 2002–2014 (in %) (Source: SURS 2015 and EUROSTAT 2015h).

In 2014, 85.7% of the population in Slovenia aged 25-64 years completed at least secondary education. The proportion has been constantly increasing; from 2000-2014 it went up by 10.3%. Compared to the EU average (76% in 2014), the share in Slovenia is higher. The high share is mostly the result of a well-developed public education network, high participation of young people in education, low numbers of early school leavers and favourable financial possibilities for education. In addition, the share of the population aged 25-64 with tertiary education is growing rapidly. It has grown from 15.9% in 2000 to 28.6% in 2014 and is now very close to the EU average (29.3%). In the total number of tertiary education graduates in 2013, graduates of maths, science and technology represented 25.7%. Participation of adults in lifelong learning has been decreasing since 2010, when it was 16.2%. In 2014, it declined to 11.9% but it is still above the EU average (2014: 10.7%). The percentage of young people neither in employment nor in education was at 12.0% in 2014.

SWITZERLAND

In 2015, the average unemployment rate in Switzerland was 3.3%. Since 2011 (2.8% unemployment rate), this rate has been rising slightly. In the cantons which belong to the Alpine Convention (Appenzell Ausserrhoden, Appenzell Innerrhoden, Glarus, Graubünden, Nidwalden, Obwalden, Uri Schwyz, Tessin, Walllis), the unemployment rate was in the range of 0.9%-4.3% in 2015.

Various measures of the labour market aim at integrating unemployed persons into the labour market. This is done through improving placement ability as well as strengthening the skills of the unemployed to meet the needs of the labour market, through reducing the risk of long-term unemployment and allowing to gather work experience. Other measures include availability of courses and internships, temporary occupations in the secondary labour market, as well as, in special cases, taking over the housing costs during the months of unemployment. The graphs below show the percentage change of employed persons compared to the year before between 2009 and 2014 as well as the unemployment rate (according to ILO) among men and women between 2009 and 2014.

People affected by poverty i.e. people 'who do not have the financial means to acquire goods and services necessary to an integrated social life' live on the social existence minimum (BFS 2014). The poverty line is set at a fixed amount that covers living expenses, individual housing and additional expenses. Currently, poverty affects 7.7% of the society in Switzerland.

The Confederation undertakes various measures in order to fight this problem. There is a 2013 national program for preventing and combating poverty. It has four action fields: educational chances for children, teens and adults; social and occupational inclusion; monitoring living conditions and measuring the effects. Hence it aims at increasing educational possibilities for persons affected with or in danger of poverty, supporting persons with weaker chances' integration

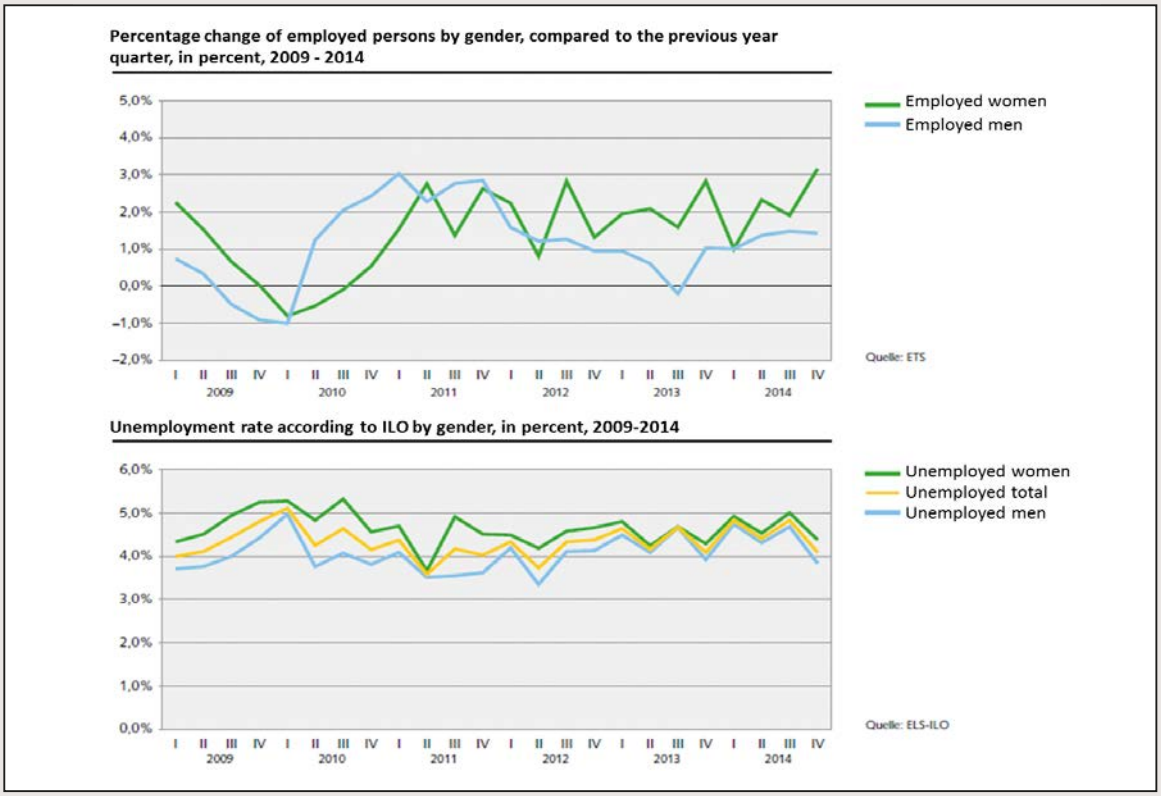


Figure 2.5.1-8 Percentage change of employed persons compared to the previous year between 2009 and 2014 and unemployment rate (according to ILO) among men and women between 2009 and 2014 in Switzerland (Sources: BFS 2016a).

into labour market, improving their living situation, access to information, as well as the situation of their families and monitoring the measures undertaken in order to fight poverty.

The implementation of these measures is realised in three different ways: elaboration of foundations and good practices, testing of new approaches and working on better-informed and networked actors. The Confederation, the cantons and the municipalities work together towards those goals.

Conclusions on opportunities and challenges

In general, the quality of life is rather high in the Alpine areas. The risk of poverty rate in the German Alpine area is lower than the Bavarian or the national average. In Slovenia, it is lower than the European level. The German Alpine area shows a higher employment and a lower unemployment rate than at the Bavarian or national level. For these two indicators, Slovenia performs better than the EU average. In Switzerland, there is no noticeable difference in the unemployment rate between the national average and the Alpine area. The number of people with secondary education is higher in the German Alpine areas than in the rest of the country. In Slovenia, the proportion of people with secondary education is higher than the EU average, for tertiary education the figures come close to the EU ones. In Italy, the Alpine regions show a better performance in terms of economic well-being compared to the country as a whole.

However, the possibility for people living in remote areas to participate in the labour market is limited, which may lead to a lower quality of life and social exclusion. It must be ensured that existing skills and workforces are integrated in the labour market also in these regions. In terms of a Green Economy, this is especially true for people with traditional working skills.

2.5.2 SUSTAINABLE CONSUMER BEHAVIOUR

Sustainable consumer behaviour means incorporating social and environmental considerations into purchasing and consumption decisions, thereby triggering more sustainable production patterns. There is increasing awareness among people of healthy and sustainable lifestyles and the environmental and social performance of consumer goods and services. Numerous initiatives and campaigns run by public institutions and NGOs have sensitized and empowered consumers to make use of their purchasing power and influence the market by consuming goods and services with less environmental and social impact than conventional products. The increasing existence of social and environmental labels and certificates has certainly also supported consumers in their efforts to live more sustainably.

Next to private consumption, public procurement has a high potential to contribute to sustainable consumption and production patterns. European public authorities are major consumers with an approximate annual spending of €1.8 trillion; this represents 14% of the EU's gross domestic product.[53] By using their purchasing power to buy goods and services with lower environmental and social impacts, public authorities can make an important contribution to sustainability objectives. They can also provide incentives to the industry to develop more sustainable products and thereby influence the market, especially in fields where they command a large share of the market (building and construction, public transport, health care). Sustainable procurement helps us to achieve environmental targets that public authority has set itself, can help reduce costs through a life cycle approach, sets an example to citizens as private consumers and has the potential to raise awareness of environmental and social issues. Furthermore, it provides strong incentives to enterprises to improve their environmental performance and triggers economies of scale.

In addition to purchasing and procurement initiatives, there is an increasing number of consumer initiatives such as sharing and exchange initiatives, regional production, repair cafés and local currencies, leading the way to an alternative and more sustainable way of living and consuming.

An economic system consists not only of producers but also of consumers. In the context of a Green Economy, it is important to look at the economy as a whole, i.e. also considering the consumption side. Through conscious consumer behaviour, citizens can improve their quality of life and contribute to resource efficiency. Appropriate policies need to be in place to set the right framework conditions for this to happen.

This chapter will provide an overview of existing approaches for sustainable consumer behaviour, including public procurement, private consumption and consumer initiatives in the Alpine regions and the potential they have to influence the market and the economic system.

Background on sustainable consumer behaviour

EU Level

At the European level, the importance of sustainable consumption (and production) patterns for sustainable development has been recognised for many years and has found its way into important policy documents such as the Sustainable Development Strategy and the Europe 2020 strategy. The 2008 Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) action plan includes measures aimed at improving the environmental performance of products and increasing the demand for more sustainable products. It complements further policy instruments in support of sustainable production and consumer awareness. The European Union sees its role in setting up and encouraging tools and frameworks to provide consumers with the product information needed to make conscious choices. The most important are presented briefly in the following.

One of the most important product groups in terms of environmental relief potential and human well-being is food. Food is the biggest single cause of climate change, and one of the biggest causes of other environmental damage. Food is the biggest single cause of health – or ill health. One-third of the food produced for humans is never eaten, but thrown away (FAO 2011). Furthermore, of all the hungry people in the world, more than half are farmers or farm workers[54]. Adopting a more sustainable approach to food can thus contribute significantly to environmental protection, health and social equity. Next to avoiding food

53. Further information: ec.europa.eu/environment/gpp/what_en.htm.
54. Further information on World Food Programme: www.wfp.org/hunger/who-are.

waste and buying regionally produced or fair-traded products, consuming organically grown food is a way for consumers to protect biodiversity and to contribute to the preservation of natural resources.

More and more consumers in Europe opt for organic food. Over the past decade, land used for organic farming increased by half a million hectares yearly. To date, there are more than 186,000 farms cultivating organic farmland across the EU (EC 2015a).

To achieve more transparency on the market, the EU created a European-wide label. Since 2012, the use of the EU organic logo is obligatory on all organic pre-packaged food produced within the European Union. It guarantees compliance with the conditions and regulations for the organic farming sector established by the European Union. The compulsory use of the logo make organic products easier to identify by the consumers and thus supports sustainable consumption.

The European Commission launched the EU Ecolabel in 1992. The aim was to develop a European-wide eco-labelling scheme that consumers could trust. The label helps to identify goods and services that have a reduced environmental impact throughout their life cycle. Scientists, NGOs and businesses have developed the underlying criteria in a multi-stakeholder approach. In September 2015, 44,711 products and services in Europe were certified with the EU Ecolabel. The largest number of EU Ecolabel licences was awarded in France (27%), Italy (18%), and Germany (12%).

Finally, the Green public procurement initiative of the European Commission supports public authorities in their efforts to reduce environmental impact through their purchasing practices by providing legal advice, green procurement criteria, good practice examples and tools for life cycle and cost analysis. Member States are encouraged to create national action plans for Green Public Procurement. As of November 2014, all Alpine countries, which are EU members adopted an action plan or an equivalent document.

Alpine relevance of sustainable consumer behaviour

Even though there are no specific opportunities for sustainable consumer behaviour in the Alpine regions, the topic is important for a Green Economy as in all other regions. One important aspect to be considered when setting up future strategies is that many Alpine regions produce high quality, sustainable and regional food products, using also traditional agricultural practices (such as Alpine farming). The consumption of regionally produced products is, therefore, an important aspect of sustainable consumer behaviour in the Alpine region.

Good Practice – Project 100max, Alpine-wide

100max is an Alpine-wide household programme for climate protection. The Alps are a sensitive living environment and especially vulnerable to climate change. Inhabitants can contribute to climate protection through their behaviour. Local authorities from seven Alpine countries are taking on this challenge and encouraging their citizens to take part in the '100max – the Alpine game for climate protection'. 100max empowers households to reduce energy consumption.

Twice a year during a given week, participating households convert their daily behaviour (including clothing, consumption of goods and services, mobility) into CO_2 points. A website (www.eingutertag.org) allows them to calculate and upload their points and to compare themselves with around 70 other households currently. Participants encourage and empower each other to save points. Additional ideas are provided by the website. After the end of the first reporting week, participating households have a few months to reflect upon potential improvements of their lifestyles with respect to climate protection and if the reduction of CO_2 points really leads to a reduced quality of life.

The 100max project is coordinated by the International Commission for the Protection of the Alps (CIPRA).

Further information: 100max.org/ueber-100max/

Situation in Alpine countries

AUSTRIA

In Austria, a regional brand for organic food products from Tyrolean mountain farmers, called '*Bio vom Berg*' has been created. It is based on a cooperative of about 600 farmers now, who still control the management and administration. Founded in 2002, the cooperative comprises farmers, cheese and meat manufacturers, and is the only producer-owned trademark in Central Europe. About 80 different products are being offered on the market. Customers are Tyrolean food retailers as well as producers of specialities, who recognize and honour the special qualities of the '*Bio vom Berg*' products.

Good practice – feld association for using the unused, Austria

Feld is an association - founded 2014 in Innsbruck - with the aim of using aftercrop that will not be harvested automatically as well as vegetables that will not fit into the 'normal markets' and to contribute those victuals to the food retail sector. To reach this goal, the club members meet to harvest crops - in agreement with the local farmers - nearby Innsbruck, use those formerly unused resources to produce long lasting food (e.g. jam, pickle) and to launch the products on well-chosen food markets in Innsbruck (e.g. food sharing spots, food coops).

The association is open for everyone who wants to contribute to the project goals and to take action against food waste.

Further information: www.facebook.com/feldverein

GERMANY

In Germany, a high number of sustainability labels are on the market. Platforms such as Siegelklarheit[55], label-online[56] and Kompass Nachhaltigkeit[57] provide some orientation by presenting and evaluating all or at least most of the existing labels.

The environmental label *Blue Angel*, owned by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, certifies environmentally friendly goods and services in different categories -resource efficiency, recycled material, water protection etc. Standards set are continuously adapted to technical progress. Currently, more than 12,000 products and services have been awarded the *Blue Angel*.

In 2001, a national label for products from organic agriculture was created. Like the above-mentioned EU organic label, products have to be produced with respect to the EU regulations for organic farming. It can be used additionally to the compulsory EU label. Next to this public label, there are private labels from organic farming associations, applying stricter standards than the EU regulations. The most important ones, at least for Bavaria and thus the German Alpine areas, are the *Bioland*, the *Naturland* and the *Demeter* labels. At the Bavarian state level, the Bavarian State Ministry for Food Agriculture and Forestry launched a new organic label for regional products in late 2015. The objective of the new label was to combine organic production of regional Bavarian origin. Criteria follow the quality standards of the Bavarian organic farming associations and are thus stricter than the official regulations. The first certified products have been available since December 2015.

In the Alpine region Allgäu, the company Feneberg Lebensmittel GmbH created a regional organic brand called *VonHier* in 1998. The brand is given to organically grown food that is being produced within a maximum distance of 100 km from

55. *Further information: www.siegelklarheit.de/home.*
56. *Further information: label-online.de/.*
57. *Further information: www.kompass-nachhaltigkeit.de/.*

Kempten, where Feneberg is situated. To date, more than 400 products including fruit and vegetables, dairy products, meat, cheese and pastries have been branded. The brand has been well accepted by consumers and has proved highly successful.

In terms of sustainable procurement, the German government supports the concept through various measures. The 'Integrated energy and climate protection programme'[58] of the government includes a measure for the procurement of energy-efficient products and services. The general administrative provision for the procurement of energy-efficient products and services[59] sets a mandatory target for all authorities at the federal level, to use life cycle costs in their procurement procedures to ensure energy-efficient and environment-friendly public procurement. The government provides advice to public authorities through a newly created competence centre for sustainable procurement.[60] Furthermore, procurement criteria for a high number of product groups and further support for public purchasers are available from the German Environment Agency.

In Bavaria, guidelines on the integration of environmental aspects in public procurement procedures[61] provide information and guidance on green procurement for governmental agencies. Apart from the obligation to procure wood products from sustainable forest management, there are no compulsory provisions for the procurement of environmentally sound goods and services.

The Bavarian Parliament was the first in Germany to take the decision to exclude products from exploitative child labour from public procurement of the government and state owned companies. Local authorities are encouraged to act accordingly. Around 70 local authorities in Bavaria have adopted similar council decisions, nine of them in the Alpine Convention area.

ITALY

Different voluntary initiatives have been undertaken by businesses of different sizes and industries aimed to capture consumer preferences for greener products and services in the Alpine region.

One of the most interesting aspects is the one of tourist infrastructures and facilities adopting the EU Ecolabel in the Alpine parks in Italy. The development of other park labels is according to a provision of the Italian law on protected areas (National Law n. 394/1991). The latter allows for the release of a park trademark on specific products with a particular link to the territory of the protected area as a way of enhancing the value of the park.

The EU Ecolabel scheme is particularly prominent in Italy. In the case of hotels and particularly relevant for the Alps, adopting the EU Ecolabel contributes to reducing the use of home care products and samples and saves water and energy thus providing tangible economic and environmental benefits. Italy is a champion in terms of EU Ecolabel products available to customers, totalling 16,815 of them; 337 licenses have been issued (following 486 in France).

Figures for the Italian Alpine Regions are reported in Figure 2.5.2-1.

The EU Ecolabel in the field of tourism (EC 2016b) has also been adopted by tourist facilities located in many parks across the Italian Alps. These are often associated with other certifications or voluntary rules that apply to parks themselves (e.g. EU Charter of Sustainable Tourism and their own park label). There are 5 in the autonomous province of Trento, 8 in Piemonte, 1 in Veneto and 1 each in Friuli, Venezia and Giulia (Federparchi 2016).

Many other voluntary schemes exist across the Alps, aimed at supporting sustainable consumer behaviour and marketing the nature and landscape value of mountain products (to a large extent in the food category). Figures at the regional level show that some 20% of quality products in the Italian parks concentrate in the Alpine regions, as shown in Figure 2.5.2-2.

58. Further information: www.bmwi.de/DE/Service/gesetze,did=254040.html.
59. Further information: www.verwaltungsvorschriften-im-internet.de/bsvwvbund_13022013_B1581643321841199.htm.
60. Further information: www.nachhaltige-beschaffung.info/DE/Home/home_node.html.
61. Further information: www.lfu.bayern.de/abfall/recycling_neue_produkte/doc/umweltgesichtspunkte.pdf.

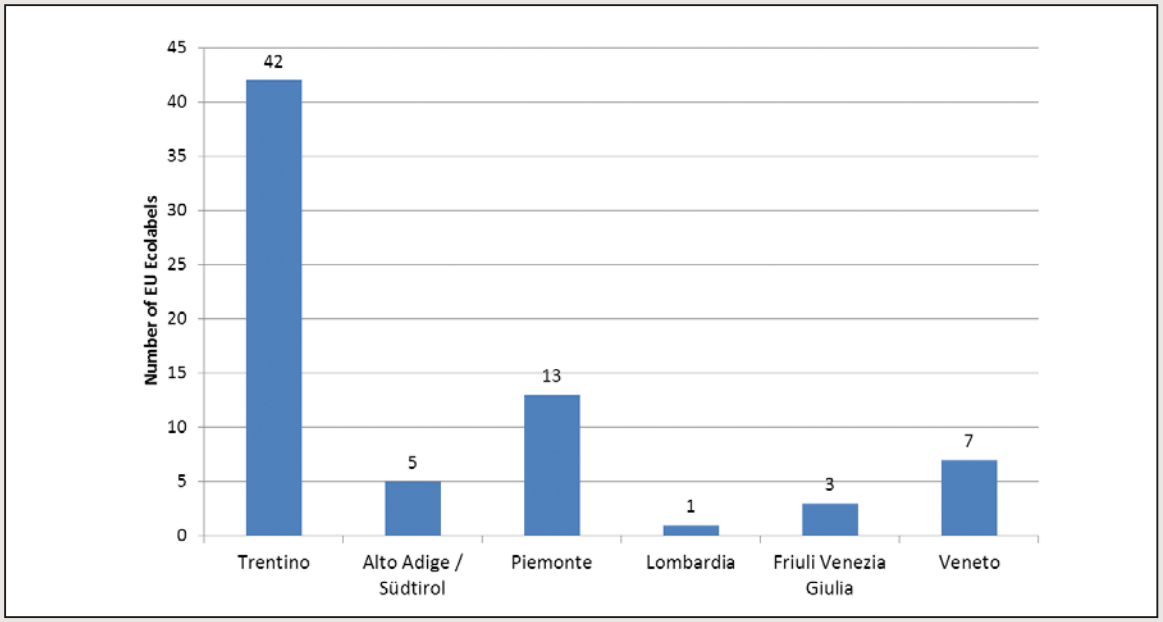


Figure 2.5.2-1 Number of EU Ecolabel in tourist facilities across the Italian Alpine regions (EU Ecolabel 2016) (EC 2016b).

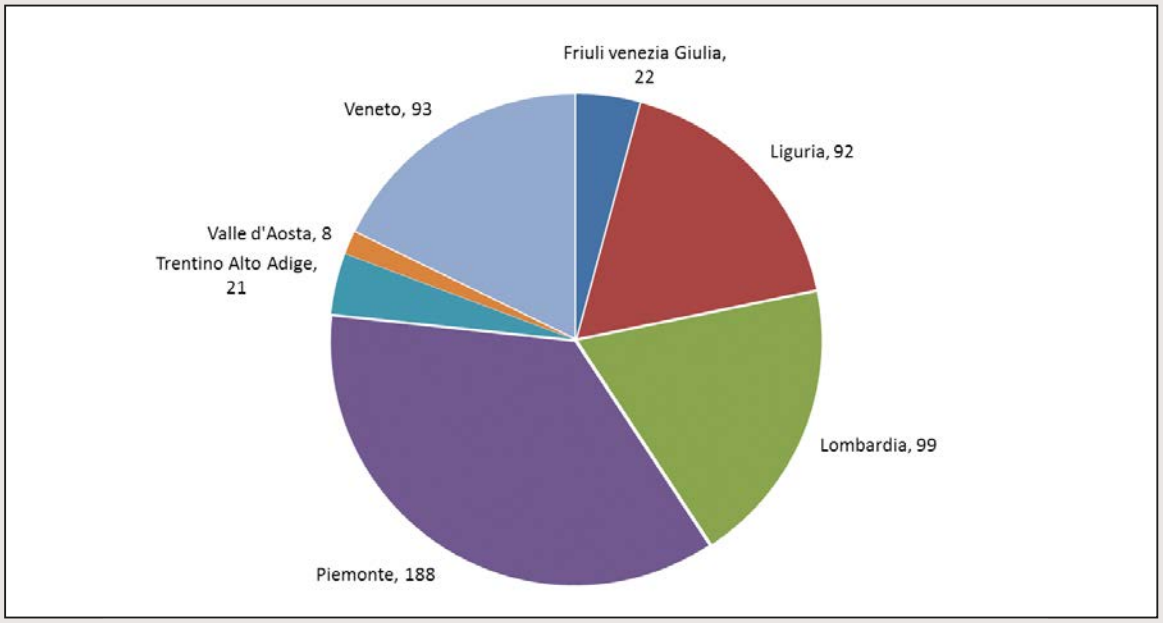


Figure 2.5.2-2 Number of food quality products from parks in the Italian Alpine regions (Federparchi 2016). Quality labels considered in the analysis include: PDO, PGI, TSG, PAT, DOCG, DOC, IGT, BIO, Slow Food Presidia.

Furthermore, a voluntary programme on the environmental footprint of goods, services and organizations has been running since 2011 at the initiative of the Italian Ministry for the Environment. In connection with the ongoing discussions in Europe on the EU PEF (Product Environmental Footprint) scheme, the programme represents a good practice of public-private cooperation, with the involvement of more than 200 participants. These include companies, municipalities and universities, some of which are located in the Alps. The project's aims are to identify companies' procedures of carbon management, support the use of low-carbon content technologies and good practices in the manufacturing processes. The initiative aims at promoting the companies' voluntary commitment to evaluate environmental performances and to

reduce the GHG emissions, as a tool to enhance the measures of the Kyoto Protocol, the European 'Climate and Energy package', and the EU Circular Economy package (MATTM 2011-2015).

The formal introduction of a voluntary certification scheme based on ISO 14040:2006 on LCA – Life Cycle Assessment, called 'Made in Green Italy' is very recent. It dates at the end of 2015 (Legge n. 221/2015 Collegato Ambiente) and will be operational in 2016. This certification is based on a multi-criteria assessment of environmental performance of a product or service, along its full life cycle. It is based on the product's environmental methodology to identify the environmental footprints of products and services, as defined by EC Recommendation 2013/179/EU. Its main aim is to reduce the environmental impacts of the goods or service from the extraction of raw materials at their disposal. The scheme is currently under development. It also aims at reinforcing the competitiveness of the Italian industrial system on national and global markets, taking note of the increasing demand for products of high environmental quality and exploiting the significant consumers' awareness of the 'Made in Italy' label.

LIECHTENSTEIN

In Liechtenstein, various projects and initiatives support consumer engagement and offer a platform for those willing to contribute to a more sustainable economy and way of living.

The association 'Symbiose' addresses people willing to contribute to a sustainable society. Projects include a co-working space, a repair café, a vegan and organic lunch lounge, and the future workshop. This 'Zukunftswerkstatt' is a joint project between the symbiotic community, Vaduz and the follow-up project of the former association 'Zeitlos' with its project 'Tuschzit', which are funded by the Youth in Action Programme.

The workshop was launched with the aim of promoting and shaping a sustainable and positive future. Through exchanges and cooperation, people aim to meet current challenges. The future workshop is a place that brings people together who want to contribute to a happy and sustainable society. An online platform and events support the development and discussion of pioneer projects and provide the opportunity to get involved with the community. Every person can present ideas and projects to those interested and seek cooperation to implement them.

The regional brand *vo do* is run by the Stiftung Agrarmarketing. By marketing regional products, it aims at providing fresh products with short transportation distances, increasing the regional value, preserving regional structures and traditions, protecting cultural and recreational areas, and protecting biodiversity by promoting the diversity of varieties at the regional level.

SLOVENIA

In Slovenia, green public procurement for certain products and services has been mandatory since 2012 (on 8 December 2011, the decree on Green Public procurement was promulgated). The decree is binding for public purchasers. It includes core environmental targets for a number of products groups, including buildings, electricity, electronic devices, food and paper.

To help consumers choose green products, some local eco labels have been created like Biodar. This is a collective trademark for organic food, grown and processed according to the standards of the union of Slovenian organic farmers association. Biodar guarantees that the product is of organic origin and controlled from the field or barn to the shelves.

Supervision of compliance with standards for the use of the brand Biodar, as well as basic control over the production and processing of organic agricultural products is implemented by three control organizations. Farmers are checked at least once a year. Namely, compliance with rules for organic production and processing are verified, and the conditions that the food labelled 'organic' meets the standards. The association's standards are more stringent in some cases than the regulations on organic production and processing of agricultural products and foodstuffs covered by Slovenian and EU legislation, which makes farmers subject to high requirements of organic production and processing.

Good practice – Carpooling Prevoz, Slovenia

In Slovenia, a web application to support carpooling has been developed. As Slovenia is predominantly a rural country, mobility is an issue. Having a car is considered to increase the quality of life due to restricted available public transport in some parts of the country. The number of journeys made by car, a largely unsustainable transport mode, has been growing.

Graduate students created an open source application allowing drivers with spare seats to enter their journey details (origin and final destination, date and time) along with the price they want to charge for a seat. Prospective passengers then contact the driver to arrange the ride.

The project proved to be very successful, showing that such solutions are very well accepted in the society. In combination with further projects on urban mobility and public transport, commuters in Slovenia will be able to choose among multiple cost-effective, efficient and environmentally friendly transportation options.

Further information: prevoz.org/about/

SWITZERLAND

The WWF in Switzerland evaluated 32 main labels in the Swiss food market to show how environment-friendly and sustainable they were[62]. Labels were evaluated in the following areas:

- environment (water, soil, biodiversity, climate, fishing and fisheries management)
- animal welfare
- social aspects
- risks for consumers and third parties
- credibility (independence, control, scope, transparency and viability).

One of the best known certifying organisations is Bio Suisse, a federation of Swiss organic farmers with over 6,000 members. More than 800 processing and trade companies have a licence contract with Bio Suisse to use the Bio Bud label.

Special food labels within the Alpine area are:

- Pro Montagna[63] which fosters products from the Alps distributed by the supermarket chain coop.
- Heidi[64], a label for products from the Swiss mountains, distributed by the supermarket chain Migros.

Swiss products and services enjoy an excellent reputation both domestically and abroad, which is why Swiss indications of source are being used with increasing popularity. Unfortunately, they are also being abused. The new 'Swissness' legislation strengthens protection for the 'Made in Switzerland' designation and the Swiss cross[65].

An existing sharing initiative within the Alps is the Alpentaxi[66]. The aim of the Alpentaxi is to take passengers travelling without a car from the last public transport stop closer to the mountains - and back again. Local taxi services as well as *call-a-bus* service are available. A rearrangement from motorized transport to public transport is being promoted, as well as a step taken towards sustainable tourism. Passengers such as hikers, mountaineers, climbers and ski tourers are able to enjoy their leisure time in a more environmentally friendly way. It provides not only benefit for tourists, but also for the local population and nature. The Alpentaxi is organised by different companies, not every taxi driver is a full-time employee.

62. Further information: www.wwf.ch/de/aktiv/besser_leben/ratgeber/lebensmittellabels.
63. Further information: www.coop.ch/de/labels/pro-montagna.html.
64. Further information: heidi.migros.ch/de.html?_ga=1.56760042.1775146862.1452707751.
65. Further information: www.ige.ch/de/herkunftsangaben/swissness.html
66. Further information: www.alpentaxi.ch

Good practice – Eco-village Čadrg, Slovenia

Village Čadrg is also called eco-village by its residents, since four of the five farms are organic. They offer organic milk and dairy products (cheese, cottage cheese and whey) and have their own brand, 'Tolminc' cheese produced in the village dairy. Reconstruction of the dairy was co-financed by the municipality of Tolmin, support was also offered by the agricultural advisory service.

The transition from conventional to organic farming was almost self-evident for Čadrg. Even before opting for organic farming, the breeding of cattle was based on traditional practices, which also applies to the supply of pasture and fodder production for livestock. Even cheese and cottage cheese are produced according to traditional procedures.

Thus for the transition to organic farming, they only needed to adapt stables, because animals require more space and light, but otherwise grazing and feed production continued without major changes. The local pastures provide high-quality forage. In winter, the cattle are fed with grass silage, which forms more than half of all feed and hay.

To date, four farms are certified eco-farms, representing almost the entire village.

The use of local and natural animal feed has resulted in achieving significant reduction in emissions. The transition to organic agriculture and related tourist activities has also improved the economic situation of the local residents, increased the quality of life and helped preserve the mountain countryside.

Further information: www.arhiv.slovenija-co2.si/index.php/dobre-prakse/trajnostni-razvoj-podeelja/dobre-prakse-2012/31.html.

Conclusions on opportunities and challenges

Due to the lack of statistics on sustainable consumer behaviour, this topic has been presented via case studies and good practices rather than comparative figures. Thus, it is difficult to provide an evaluation of the performance of the Alpine region in terms of sustainable behaviour. However, given the benefits, e.g. contribution to saving energy and sustainable production patterns, the topic has great potential to contribute to a Green Economy and should not be neglected in future strategies.

A topic of particular relevance for the Alpine region seems to be the production, marketing and consumption of regional products. In several Alpine areas regional labels and brands exist and have been highly successful. Fostering regional production and consumption and supporting regional marketing initiatives and instruments can potentially make an important contribution to a Green Economy in the Alps. Local authorities have an important role to play in encouraging regional production cycles.

Furthermore, the introduction of regional currencies also promotes regional environmentally-friendly products and services and reduces the necessity of Alpine transport. It is considered to be a successful practice to keep value within the region by those Alpine regions that have introduced such currencies. The introduction of such an Alpine-wide currency seems a promising instrument towards a greener economy since keeping added value within the Alps is an important objective for many stakeholders.

2.5.3 HEALTH AND HARMFUL EMISSIONS

Environmental quality always was and still is crucial to sustain human health in the sense of the WHO definition of health. Human health is affected by harmful emissions from manufactured and from natural sources. Almost all economic activities from production processes in agriculture and from industries that transport goods and persons emit more or less harmful matters and/or noise. Many of these emissions lead to a decrease in the quality of all environmental elements such as air, water and soil. In addition, other natural assets such as biodiversity or silent places are affected.

Air pollution has a detrimental effect on public health (UNEP 2011b). Therefore, and in terms of a Green Economy the two main objectives for economic activities are (i) to decrease harmful emissions, including those not directly affecting human health, such as those that cause environmental damage and (ii) to decrease the exposure of people to environmental pollution, environmental risks and the related health costs. There are high indirect costs associated with the pollution arising from the combustion of fossil fuels and biomass (wood).

In the Alps, air quality and noise are in the foreground when harmful emissions are brought to our attention. The harmful effects on human health of many air pollutants and noise emissions are widely described in WHO publications, the EEA and other international and national institutions. Although air quality has improved significantly in the last decades, ambient concentrations of some pollutants such as nitrogen oxides or particulate matter below 10 µm are still too high, at least occasionally and in some regions. As this report cannot provide a complete overview of harmful emissions and the related health problems, it concentrates on the status quo of two pollutants to represent the topic: ozone and particulate matter. The negative effects of these on human health will not be presented in detail here either, but only mentioned briefly. The negative impacts of air pollution and noise on ecosystems, such as e.g. disturbance of habitats, eutrophication, acidification or leaf damages (also for crops) caused by ozone, nitrogene oxides, ammonium, sulphur oxides and other air pollutants are also excluded from the scope of this report, but nonetheless relevant.

Background

Health impacts

The effects of air pollution on human health are well known. Depending on the pollutant, they range from diseases of the respiratory system to cardiovascular diseases and include even prenatal problems, e.g. premature births, reduced lung function and compromised immune system in newborns (EEA 2014a).

Particulate matter (PM) is dust suspended in air, which is categorised according to the size of particles below 10 µm (PM10) or below 2.5 µm (PM2.5). The particles originate from different natural and artificial sources. Depending on the sources, they are composed of different components, such as elemental carbon, heavy metals, polynuclear aromatic hydrocarbons, sulphate, ammonia, nitrate and many others. Due to their size, they stay in the atmosphere for a certain time instead of sinking immediately to the ground. PM enters the human body mainly via respiration. Depending on their size, the particles make their way through the body in different depths. Greater particles rest in the upper part of the respiratory system, but ultrafine particles can even enter the bloodstream and pass to inner organs. The particles are very different in their chemistry and can even contain heavy metals and cancer-causing substances. The most important health effects of PM are on the respiratory and cardiovascular systems, an increase of cardiac infarction and inflammatory reactions (EEA 2013a).

While ozone in the high atmosphere protects the earth from ultraviolet radiation, ground level ozone affects human health and plants. The main effects on humans are pulmonary system effects such as e.g. reduced pulmonary function and pulmonary inflammation and effects on the cardiovascular system (WHO 2008). Sensitive persons can suffer headaches, watering eyes and a decrease of physical performance.

Economic effects of air pollution

A new WHO/OECD study (WHO & OECD 2015) estimated the economic costs of the public health effects of ambient and household air pollution in the 53 countries of the WHO European region. There is still no standard and agreed-upon method available by which to measure the cost of morbidity. Table 2.5.3-1 shows that the costs remained static or decreased slightly over the last decade, while the number of premature deaths decreased in all Alpine countries. As data are only available on a national scale, their significance for the Alps is rather restricted as most national 'hot spots' of air pollution lie outside the Alps (cf. Figure 2.5.3-4 for PM10).

Country	Premature deaths		Economic cost of premature deaths from APMP [US$ millions]	
Year	2005	2010	2005	2010
Austria	3,642	3,122	34,511	32,447
France	17,916	16,892	53,031	53,295
Germany	50,051	41,582	154,382	144,715
Italy	34,511	32,447	98,612	97,193
Slovenia	1,011	876	2,489	2,539
Switzerland	2,978	2,656	10,471	10,225

Table 2.5.3-1 National levels of premature deaths from ambient particulate matter pollution (APMP) and their estimated economic costs in 2005 and 2010 (Source: WHO & OECD 2015, pp. 8-9 and 24-25).

Alpine relevance of air pollution

While health effects from harmful emissions are an issue everywhere, there are some special features in mountain regions such as the Alps concerning the behaviour of emissions. Briefly, the diffusion of air pollution as well as noise pollution is much different due to topography and related meteorological effects. The Alps reach high into the atmosphere and form a barrier to the horizontal exchange of air by wind. Additionally, they have special wind systems (valley winds and slope winds), which transport air pollutants uphill and into valleys distant from emission sources. Meteorological conditions such as inversions occur more often in the Alps compared to the lowlands and lead to high pollutant concentrations; the air becomes more stagnant and horizontal exchange of air is limited. Especially in the winter half year, inversions tend to be stable over several days causing air pollution increases from day to day (Heimann et al. 2007).

Policy targets and thresholds

Clean air has been an important policy target for years. The European Union has developed a thematic strategy on air pollution with the aim of decreasing the negative impacts and risks of air pollution to human health and the environment. The EU framework directive on ambient air quality and cleaner air for Europe 2008/50/EC (EU 2008) describes basic principles concerning the assessment and management of air quality and sets pollutant concentration thresholds. The directive merges most of the existing legislation such as Directive 96/62/EC and a number of subdirectives into a single one and sets new quality objectives for PM2.5. The EU directive sets thresholds, binding for the EU Member States, but e.g. Austria applies a stricter limit value for specific pollutants (e.g. PM10 daily mean – number of exceedances). The thresholds for Liechtenstein and Switzerland are defined in the Ordinance on Air Pollution Control (OAPC, SR 814.318.142.1) and differ partially from EU standards. Figure 2.5.3-1 shows the air quality thresholds for PM10 in the Alpine countries (EnvAlp WG 2014). It has to be mentioned that the thresholds cannot

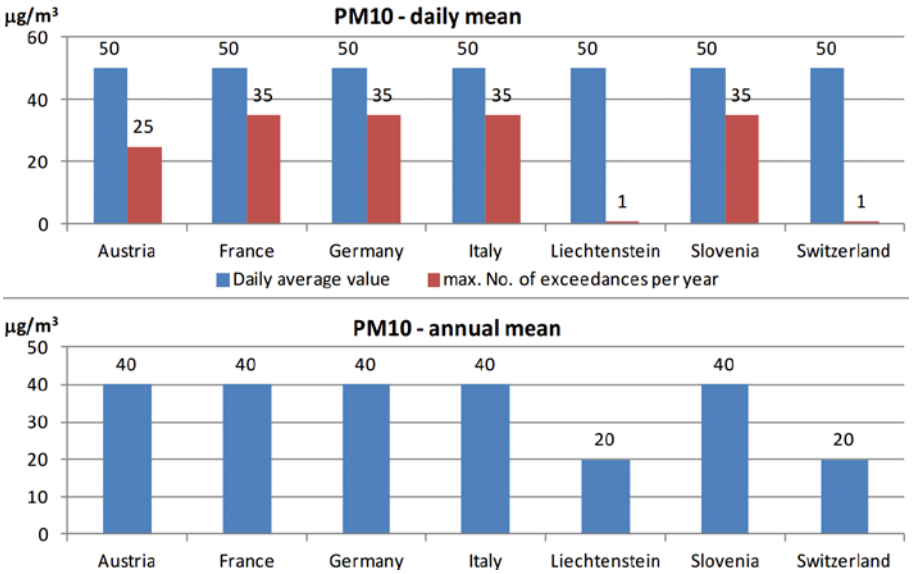


Figure 2.5.3-1 Comparison of air quality standards for PM10 in the Alpine countries (WG EnvAlp 2014).

be interpreted in the sense that values below them do not harm human health. Any concentration of PM is harmful to human health, less PM is less harmful to health and the smaller the particles, the more harmful they might be. The EEA has stated that PM's mortality effects are clearly associated with the PM2.5 fraction (EEA 2013a).

The annual target value for PM2.5, which is defined in the EU air quality directive is 25 µg/m³, but at the moment there is no target or threshold value for averaged 24 hours.

The thresholds implemented for the protection of human health from ozone emission are listed in Table 2.5.3-2.

Emission threshold	Statistical definition
European Union	
120 µg/m³ (25 days per year)	8 h- average value (highest of the day); target
120 µg/m³	8 h- average value (highest of the day); long-term target value
180 µg/m³	1 h- average value; information threshold
240 µg/m³	1 h- average value; alert threshold
Switzerland	
100 µg/m³	98% 1/2 h average value ≤ 100 µg/m³
120 µg/m³	1 h- average value may be exceeded only once/year

Table 2.5.3-2 Thresholds for the protection of human health from ozone emission from EU Ambient Air Quality Directive 2008/50/EC.

Situation in Alpine countries

Harmonised air pollution data are available for member countries of the EEA; they cover the whole Alpine region and can be used to assess air quality in the Alps.

Ozone

In the lower part of the atmosphere, ozone is a molecule that causes damage to human health and to vegetation. Ground level ozone is not directly emitted, but is a secondary pollutant mainly formed by complex chemical reactions of precursor gases like e.g. nitrogen oxide and the oxygen in the air under intense insolation. For this reason, ozone values show a characteristic course during the year and during the day with high values in periods of high insolation (summer, noon and afternoon) and lower values in wintertime. There is a clear connection between meteorological conditions and ozone formation leading to higher ozone levels in sunny periods and regions with high insolation, such as in the southern part of Europe. Precursor gases play not only a crucial role in the genesis of ozone, but also in the destruction of it. Therefore, ozone is more quickly destructed in areas with higher concentrations of precursor gases, and exists longer if transported to areas with lower concentrations of them. This is why regions with fewer pollutants often show higher ozone concentrations.

Figure 2.5.3-2 shows the values of SOMO35 (sum of ozone means over 35 parts per billion), which is the new indicator recommended by the WHO for health impact assessment. The Alps have some regions with rather high SOMO35 values. The triangles represent rural background stations, they often show higher ozone values than the urban/suburban background stations, which are represented on the map as squares.

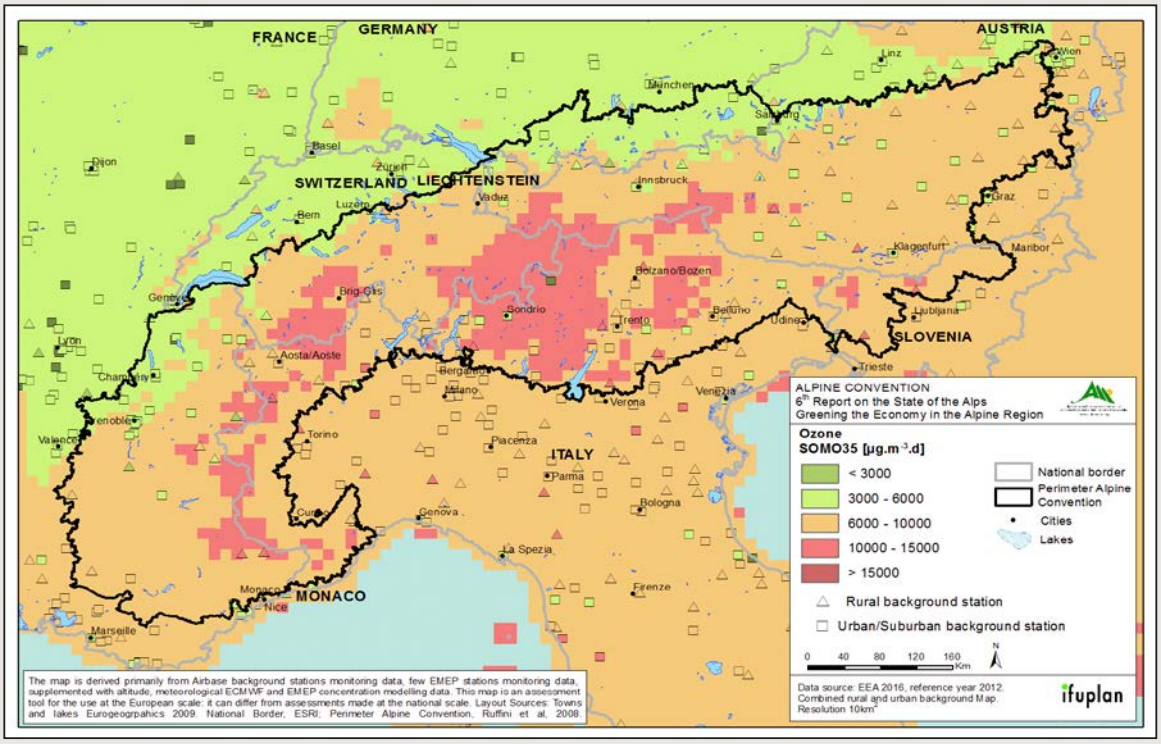


Figure 2.5.3-2 Sum of ozone means over 35ppb (2012) (Source: EEA 2016).

Particulate Matter – main source sectors

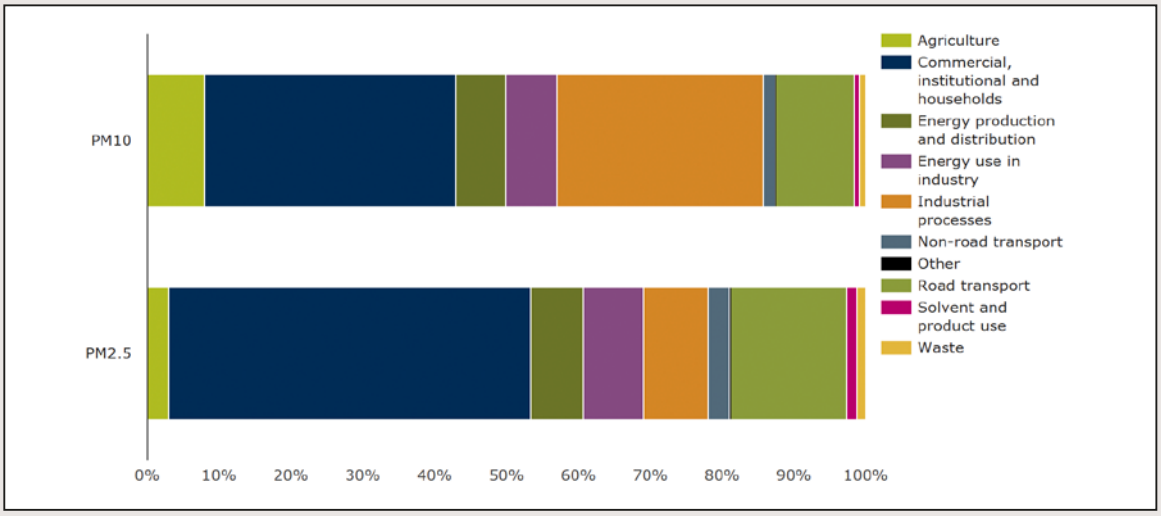


Figure 2.5.3-3 Sector share of emissions of primary PM2.5 and PM10 in the EU (Source: EEA 2014b).

Figure 2.5.3-3 shows the sources of primary PM in Europe. The highest shares of PM2.5 and PM10 are emitted from the commercial, institutional and household sectors, road transport and industrial processes. An explanation may be that the combustion of fossil fuels – no matter for which purpose (heating, transport or industrial processes) contributes significantly to PM emissions. Consequently, replacing fossil fuels by renewable energy sources and decreasing the demand by increasing energy efficiency is necessary also from the perspective of human health.

The newest EEA report on air quality in Europe (EEA 2015a) analysed the contribution of different sectors to emissions of several air pollutants. Even if the data do not differentiate between different regions or countries, some of the findings are interesting also for the Alps. The report states that all primary and precursor emissions contributing to ambient air concentrations of PM, O_3 and NO_2 have decreased over the past decade (2004–2013) as a whole in the EU-28. The smallest reduction was for NH_3 – a precursor gas of PM10 – and the largest was for SO_x (EEA 2015a, p. 15). The main sectors emitting air pollutants are transport, energy, the commercial, institutional and households sectors, agriculture and waste.

The commercial, institutional and household fuel combustion sectors dominate the emissions of primary PM2.5 (58% of total primary PM2.5) and PM10 (43% of total primary of PM2.5). This sector increased its emissions of PM between 2004 and 2013. One reason is the increasing use of wood and biomass combustion for heating, as it is perceived as a more climate friendly option compared to fossil fuels (EEA 2015a).

Industry is still the second largest source of primary PM, contributing to 22% of PM10 and 16% of PM2.5 in the EU-28. This may be different in the Alps, where large industrial plants are rare, but there is no data available for the Alpine area (EEA 2015a).

In the EU-28, emissions were cut in energy production and distribution for all pollutants with the exception of primary PM10 (EEA 2015a) between 2004 and 2013.

Agriculture is the sector with the least decrease of air pollutants, especially of ammonia (NH_3 –), which is a precursor gas of secondary PM[67]. It is now the third most important source of PM10 primary emissions in the EU-28 (EEA 2015a).

The transport sector has reduced its emissions considerably over the last decade, but is still the largest contributor to NOx emissions (46% of total EU-28 emissions) and remains a very important emitter of GHGs. It contributes to 13% of total PM10 and 15% of total PM2.5 primary emissions. Non-exhaust emissions (e.g. abrasion of brakes and tires) are estimated to have a noteworthy share of PM10 (about 50%) and PM2.5 (about 22%). Therefore, traffic will continue to contribute to PM emissions even with zero tail-pipe emissions (EEA 2015a).

Exceeding the EU daily limit value (cf. Figure 2.5.3-4: red and dark red dots) occurred primarily in urban or suburban areas in EU-28 (92% of cases), mainly in Eastern Europe and Italy, but also in the big agglomerations in other countries, e.g. in Munich (DE), which are mainly outside the Alps. The map shows that within the area of the Alpine Convention most monitoring stations are within the allowed exceedance of the daily limit value. Some exceptions are urban agglomerations such as e.g. Grenoble and some stations in Italy.

Figure 2.5.3-5 shows the interpolated annual average of PM10 in the Alps in 2012. The EU annual threshold for PM10 of 40 µg/m³ was not exceeded in the Alpine Convention area. Close to the Alps, several stations in northern Italy featured exceedance of threshold. Figure 2.5.3-6 shows the interpolated annual average of PM2.5 in 2012. The target value of 25 µg/m³ was exceeded at several urban/suburban background station in the Italian part of the Alpine Convention area. The interpolation also shows – as for PM10 - exceedances mainly at the southern borders. As both maps show interpolated data primarily from background stations, the picture may be different if industrial and traffic stations were included. Due to the interpolation, local hot spots of particle pollution caused by domestic heating with wood are not shown but frequently occur in the Alpine region.

67. NH_3 reacts with NO_2 or SO_x to ammonium nitrate or ammonium sulphate.

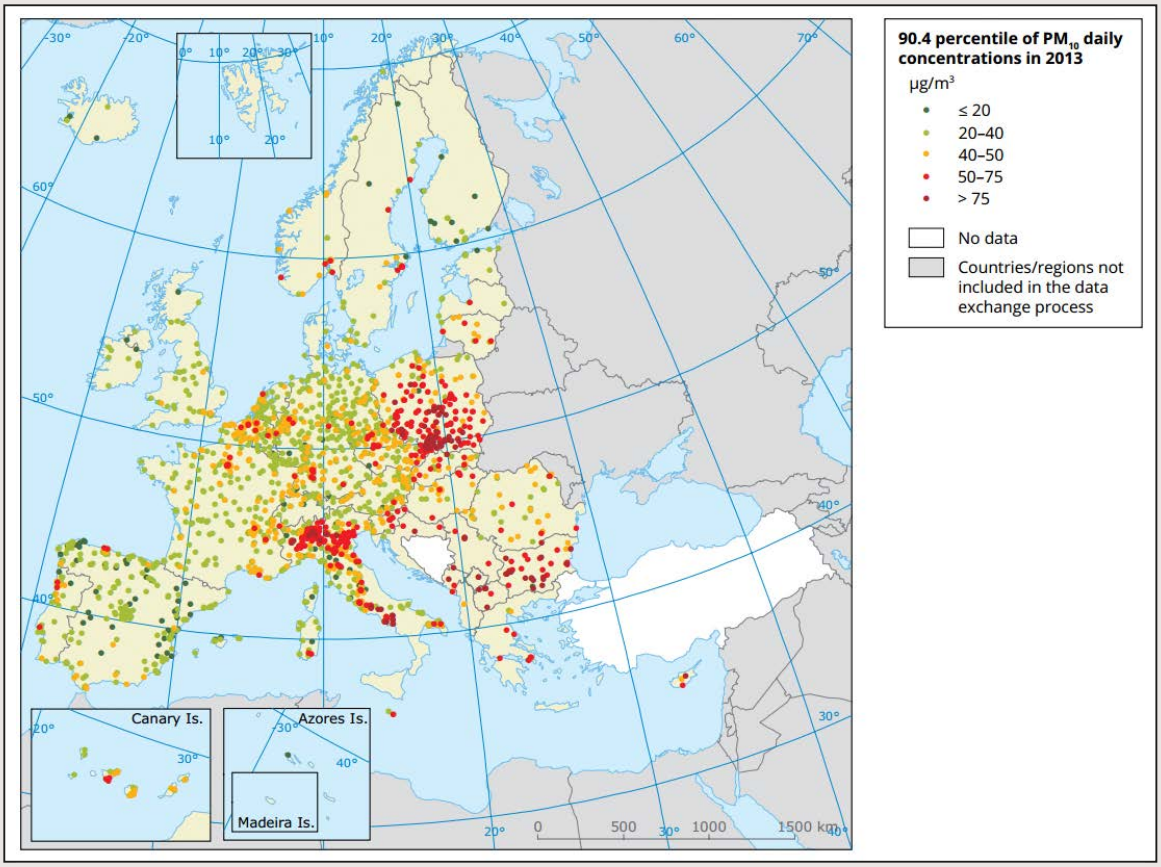


Figure 2.5.3-4 Concentrations of PM10 in 2013 in the EU (Source: EEA 2015a, p. 21).

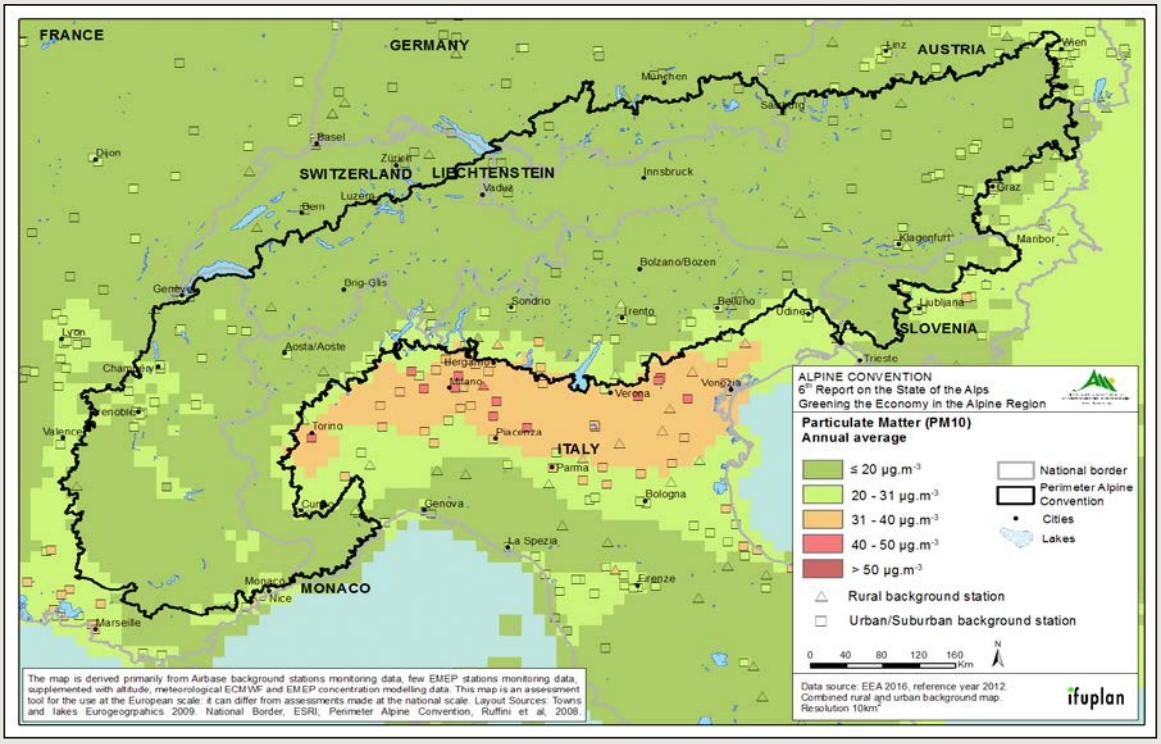


Figure 2.5.3-5 Interpolated annual average of particulate matter (PM10) in 2012 (Source: EEA 2016).

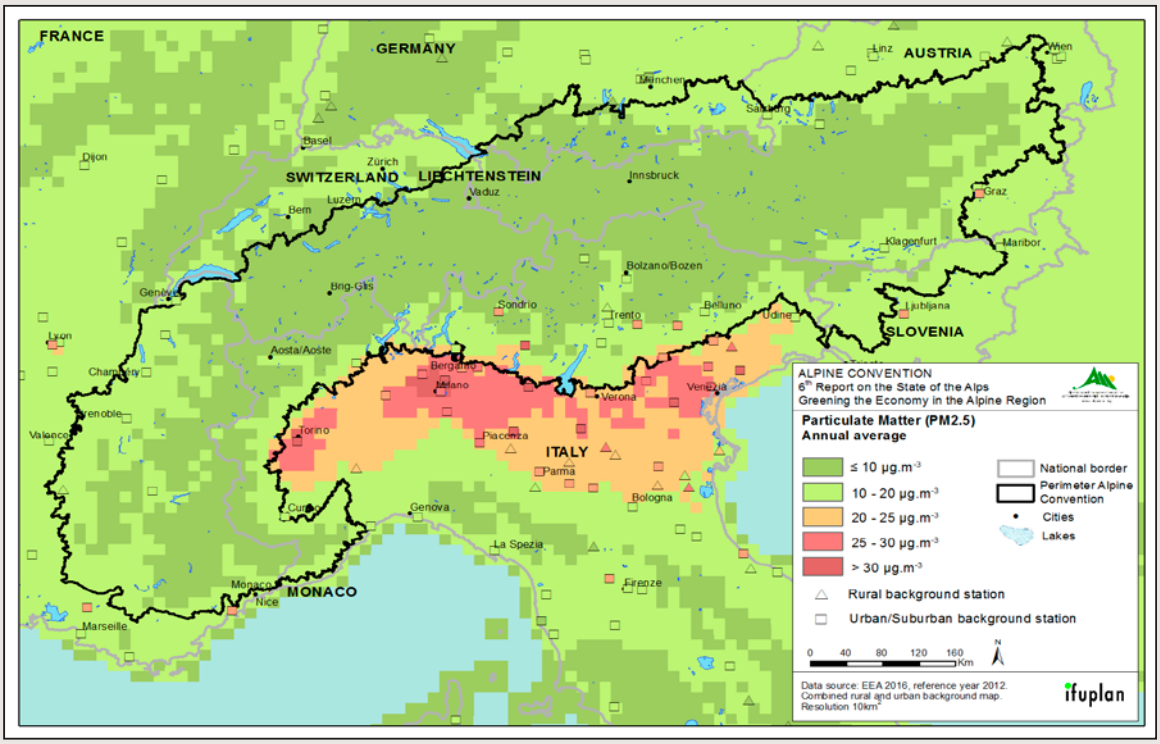


Figure 2.5.3-6 Annual average of particulate matter (PM2.5) in 2012 (Source: EEA 2016).

Transport sector – Case study MONITRAF and iMONITRAF!

As transport is an important sector causing air pollution in the Alps, some facts from the project MONITRAF/iMONITRAF! are of interest. From 2005 onwards, the project partners installed a monitoring system along five main transport corridors in the Alps.

Figure 2.5.3-7 shows a decreasing trend of PM10 concentrations along the iMonitraf corridors with the exception of Avio (Brenner corridor) and Entreves (Mont Blanc). Concentrations do not spread over a wide range. The highest values in 2014 were measured in Avio (22 µg/m³) and Vallée de la Maurienne (20 µg/m³, Fréjus corridor). 'A diachronic analysis reveals that after a significant decrease between 2005 and 2007, the concentrations remain overall more or less constant until 2010. An increasing trend is visible in 2011, followed by three years of significant decrease. As for NO_2, a main reason for the decreasing trend is the improvement of the emission factors of diesel vehicles. It is caused technically by the increasing number of vehicles equipped with particle filter systems, which are mandatory for the latest Euro classes. Year-to-year fluctuations are also driven by meteorology. An example is the station Erstfeld (Gotthard), where the wavy pattern happens simultaneously for PM10 and NO_2.

Some caveats are necessary: PM10 concentrations are influenced also by other sources than transport, such as wood heating installations, and by secondary PM10 built from gaseous precursor pollutants like NO_x, SO_2, NH_3, VOC, which may have been emitted long distances away from the iMONITRAF! Corridors. Secondary PM10 can contribute to half of the concentration measured. Therefore, the fluctuations identified in Figure 2.5.3-7 may be explained not only by the development of the road transport emissions.

The EU limit value for the annual average (40 µg/m³) was not exceeded at any station; the limit value of Austria and Switzerland (20 µg/m³) was not attained at any Austrian or Swiss station' (Lueckge et al. 2016, p. 22).

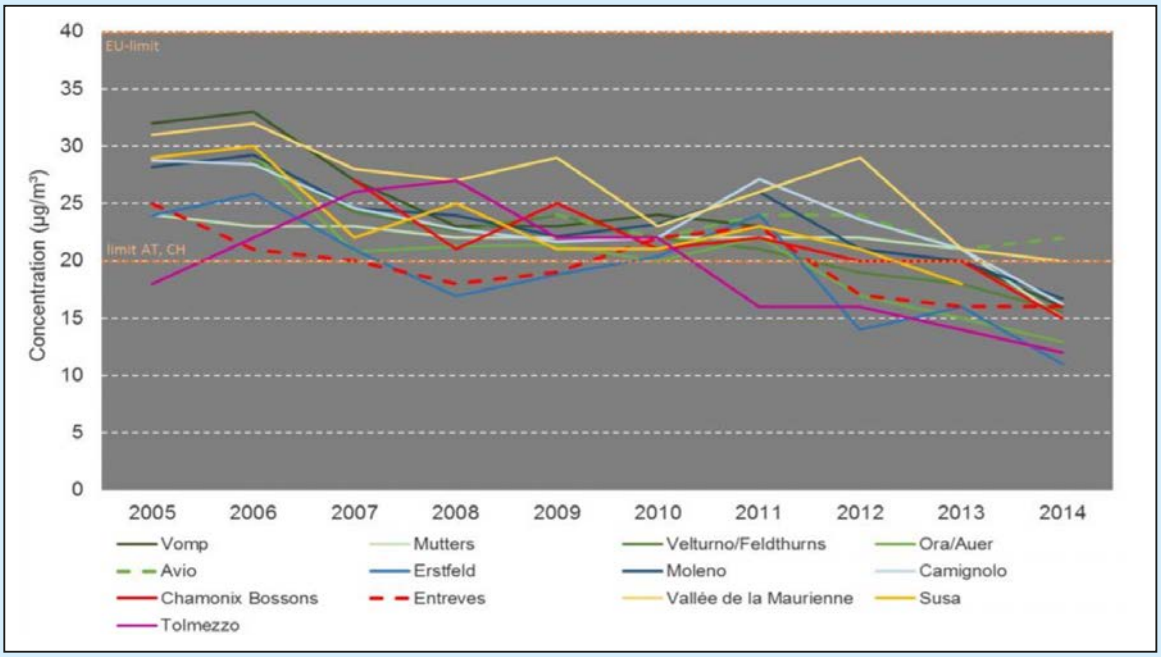


Figure 2.5.3-7 PM10 trend in annual average concentrations (2005-2014)[68] (Source: Lueckge et al. 2016, p. 22).

Case study Italy – Air pollution in the Italian Alps

It is possible to correlate the concentration of a polluting substance to an increase in the mortality rate within a geographic region based on the identification of concentration-response functions for a group of polluting substances and for each cause of mortality from pollution, which results in a 'relative risk level'. This type of assessment has been run across Italy on emissions from road traffic (NO_x) and biomass combustion in heating (PM2.5), and is a relevant policy issue. NOx is also among the main precursors of air particulates and, together with VOCs, of ozone. For three pollutants (PM2.5, NO_2, O_3) an estimate has been made of the ground concentrations for 2005, 2010 and 2020 over three different scenarios, providing for the adoption of policies to reduce atmospheric pollution.

In the Italian Alpine provinces (NUTS 3), estimates on mortality from PM2.5 for 2005, 2010 and 2020 show relatively low values if compared with other territories in Italy, however in the provinces of Torino, Bergamo and Varese the values are relatively higher, also due to the vicinity and influence of large urban centres. In addition, for NO_2 Bergamo and Varese appear to be the most exposed provinces, however all the scenarios for 2020 foresee important reductions of this pollutant. In the case of O_3, quite a sharp reduction is foreseen in all Italian Alpine provinces, with significant shifts in Veneto and Piemonte (VIIAS 2015).

68. The value for Vallee de la Maurienne in 2011 represents the average of the years 2010 and 2012.

Conclusions on opportunities and challenges

In the Alps air quality - measured for particulate matter and ozone - is mainly within the EU thresholds or target values. Within the Alpine Convention area, threshold exceedances occur locally, such as along some main transit corridors and in towns or urban agglomerations. The reasons for higher PM concentrations in towns and agglomerations are the commercial, institutional and household fuel combustion sectors and urban road traffic, which contribute significantly to the emissions of primary PM. The population living in towns, agglomerations and some transit routes is exposed to higher PM concentrations. There are no data available how many people are exposed to threshold exceedances.

There are high ozone values during summers with high insolation. Ozone as a secondary pollutant cannot be addressed directly, only its precursor gases can. The exposure of people in rural areas may be higher compared to people living near the areas where the ozone is formed, as certain air pollutants help to destruct ozone.

Greening transport and increasing the share of renewable energy for generating electric power for household and industrial consumption will further improve air quality and can reduce external environmental and health costs. Even though the major goal of a Green Economy is to promote the sustainable use of wood and biomass, there might be a conflict regarding increased air pollution due to the combustion of wood and biomass. Instead of inefficient household installations, those with particle filters should be promoted, taking best available technologies into account.

The transport sector is still an important emitter of air pollution, even if the emissions of PM were and are decreasing. It is responsible for a relevant share of emissions of nitrogen oxides, which are inter alia ozone precursor gases. A mountain-specific and well-adapted system of tolls may internalize external costs of freight and passenger transport within and across the Alps and improve air quality along transit routes.

Agriculture contributes significantly to ozone and PM precursor gases emissions, especially by emitting ammonia and nitrogen oxides. Greening agriculture would help to decrease these emissions.

The increased use of certification schemes and the deployment of eco-innovation by businesses across the region might help to reduce negative externalities from air pollution that have resulted in market and social costs for the Alpine economy.

3. INSTRUMENTS AND MEASURES FOR A GREEN ECONOMY

Different instruments and measures can be applied to achieve a Green Economy. In this chapter, the report outlines the many options that might be implemented to attain a Green Economy or that are already in place in the Alpine Convention area.

As a first orientation, the main types of instruments are introduced below. Then they are presented according to the four main topics chosen for a Green Economy in the subchapters 3.1 to 3.4, and within these subchapters according to the types of instruments.

Sometimes, it remains difficult to recognize which types of instruments exist as often they may carry different characteristics or overlap.

Policies and regulations

Policies define the framework for the implementation in form of strategies, actions plans and so on. Regulations then set the frame in a legal and more detailed scale, such as to achieve a certain level of environmental protection, e.g., air pollution, wastewater treatment or noise-level; then they are to be managed by a responsible body. There is a wide range of regulations, from the EU, national, regional and local levels. Within the EU, EU regulations are binding legislative acts that must be applied in their entirety across the EU.

Financial instruments and market developments

Financial instruments and market developments include environmental taxes & fees to internalise environmental or social costs, subsidies supporting market entries of green products and services, tradeable permits, deposit refund systems, reduction of market barriers for green products and the phasing out of harmful subsidies.

Green technology and innovation

Green technology and innovation can include support for research and development related to a Green Economy, the protection of intellectual property rights and support for environmentally related innovation (patents, scholarships, prizes, consulting, and networking) as well as the support and implementation of green business models.

Labels, certifications and awards

Products and services can be earmarked with labels and certifications to inform customers about the quality, external effects and product chains. Awards are also given to highlight remarkable efforts or success stories of projects but also of single persons.

Sustainable public procurement

Governments can focus on how their existing funds are being spent and foster sustainable public procurement. By this, they also act as role models for citizens and the private economy encouraging a shift to sustainable consumption patterns.

Education, training and developing skills

Transforming an economy into one that is resource-efficient and that produces optimal socio-economic results requires targeted educational measures at public institutions (universities, schools), NGOs, public and private media as well as to individual citizens. For individuals, these would include targeting their ability to be employed productively and meaningfully in the economy and to adopt environmentally friendly behaviour in their daily lives.

Corporate accountability and Corporate Social Responsibility (CSR)

Corporate accountability and social responsibility can be reasons for private and public entities to implement and continuously improve environmental and social standards along the supply chain. This includes environmental management, sustainable procurement, extended producer responsibility, sustainable supply chain management and participatory processes/employee engagement.

Civic engagement and participation

Civic engagement and participation is encouraging the public to become involved in the political process and the issues that

affect them. The term includes a series of private initiatives and supporting actions, e.g. sustainable consumption and labels that support the change of consumption as well as public referenda and energy cooperatives.

Financial flows/investment
Public and private investment in green economic sectors and infrastructures are needed to implement the Green Economy policies.

3.1 AN ENERGY-EFFICIENT AND LOW-CARBON ECONOMY

3.1.1 OVERVIEW OF POLICIES FOR AN ENERGY-EFFICIENT AND LOW-CARBON ECONOMY

Instruments and measures supporting an energy-efficient and low-carbon economy are difficult to oversee and even more difficult to structure. Depending on the national structure, the type of instruments often overlap or different types of instruments are combined within a regulation, funding scheme or strategy. Therefore, instruments and measures mentioned here can only give an impression of the ongoing process but will remain somewhat incomprehensive.

Table 3.1.1-1 lists existing political strategies, action plans and regulations in the field of energy efficiency and low carbon economy. Given the high number policies in the energy field, only the most recent and important initiatives at the EU, Alpine and national levels relevant for a Green Economy are listed.

Level	Energy-efficient economy & Renewable energy	Low carbon economy
EU	Renewable Energy Directive (2009/28/EC) Energy Efficiency Plan (2011/109/EC) Energy Efficiency Directive (2012/27/EU) Energy Labelling Directive (2010/30/EU)	EU strategy on adaptation to climate change (2013) 2020 Climate and energy package Emissions Trading Directive (2003/87/EC) Green Paper on a 2030 framework for climate and energy (2013/169/EC) Thematic Strategy on air pollution (COM/2005/446) Ambient Air Quality Directive (2008/50/EC) Roadmap to a low-carbon economy (EC, 2011)
Alpine Convention/ Alpine Space	Protocol on Energy of the Alpine Convention (2005) Vision Renewable Energies (2015)	Alpbach Declaration on Climate Change (2006) Action Plan on Climate Change in the Alps (KLIMALAND) (2009) Guidelines on local adaptation to Climate Change for Water Management and Natural Hazards in the Alps (2014) Guidelines for Climate Change Adaptation at the Local Level in the Alps (2013-2014)
Austria	Austrian Energy Efficiency Law (2014) Austrian Energy Strategy (2010) National Energy Efficiency Action Plan (2014)	Klimaaktiv: Climate Strategy 2008 – 2012 (2002)
France	National Energy Efficiency Action Plan (2014) Energy efficiency target declared by France under the EU Directive (2013) Energy Efficiency Performance Labels for Buildings (2003) National Renewable Energy Action Plan (NREAP) (2010) RT 2012 thermal regulations (2010)	National Low-Carbon Strategy (SNBC) (in preparation) National Adaptation Plan (2011) National Adaptation Strategy (2006)

Germany	Renewable Energy Sources Act 2014 (EEG 2014) 3rd National Action Plan on Energy Efficiency (2014) Energy Concept (2010) KfW Energy-efficient Construction (2009) Renewable Energies Heat Act (EEWärmeG) (2009)	German Strategy for Adaptation to Climate Change (2008) The German Integrated Energy and Climate Package (2008) Adaptation Action Plan (APA) (2011) Energy and Climate (EKF) Act, (2010) National Climate Protection Programme (2005) Adaptation Action Plan II (APA II) (2015)
Italy	National Energy Efficiency Action Plan (2007) Transposition of the Directive on Energy Efficiency (2014) National Intelligent Transport System (ITS) Action Plan (2014) National Renewable Energy Action Plan (NREAP)	National Action Plan (2003-2010) (2002) National Adaptation Strategy (has been approved) Sectoral Adaptation Plans are being developed 2050 South-Tyrol Energy Climate Strategy (2011)
Liechtenstein	Energy Strategy 2020 (2012) Energy Ordinance of the respective Building Act (2008) Energy Efficiency Act (2008)	Climate Protection Strategy (2007) Action Plan Air (2007) Environmental Protection Act (2008) Emissions Trading Act (2012) CO_2 Act (2008) CO_2-Law (2009) The climate cent (2005)
Slovenia	Action Plan for Energy Efficiency 2014-2020 (2015) Long-term strategy for promotion of investment in energy renovation of buildings (2015) Action plan for the nearly zero-energy buildings for the period up to 2020 (2015)	National Adaptation Strategy (being developed) Draft Strategy for the Transition of Slovenia to a Low-Carbon Society by 2050 (2012) Adaptation of Slovenian Agriculture and Forestry to Climate Change (2008) Action plan for 2010 and 2011 Climate Change Act (started in 2010)
Switzerland	Energy Efficiency Action Plan (2008) Swiss Energy Programme (2011-2020) Electricity Supply Act Sustainable Development Strategy 2016-2019; Green Economy Action Plan Energy Strategy 2050 (2011) Building Refurbishment Programme	3.1.1.2 CO_2 Act (2000, revised in 2013) Swiss National Adaptation Strategy (2012)

Table 3.1.1-1 Overview of the policies and regulations concerning low carbon and energy-efficient economy including the year of adaptation. Note: The list includes only the most relevant strategies, action plans and regulations concerning a Green Economy (Source: IEA 2016; NEEAP 2014; PSAC 2011).

3.1.2 INSTRUMENTS AND MEASURES FOR A LOW-CARBON ECONOMY

At the strategic level, the EU policy sets out a broad framework specifically for low carbon policy, including a variety of long-term objectives. As an example, the Roadmap to a low-carbon economy (EC 2011d) stipulates that, by 2050, the EU should cut its emissions to 80% below 1990 levels through domestic reductions. Differentiated adaptation and more mitigation strategies and measures are needed to reach this ambitious goal.

Two hundred ninety-nine innovative adaptation and mitigation instruments and measures in place in the Alpine region have been evaluated in terms of the topical project of cc.Alps from 2010. According to the evaluation, there are more mitigation measures (88%) than adaptation strategies (12%) in place (CIPRA International 2010). Good practice examples for mitigation measures have been also collected on the regional and local levels.[69]

69. Further information: www.cipra.org/de/cipra/international/projekte/abgeschlossen/cc-alps/good-practice.

Policies and regulations

Policies on carbon emissions act particularly at the national level. However, policy implementations as well as supporting strategies are acting more at the regional and local levels. The approach to low carbon economy is closely interlinked with energy saving, efficiency and renewable energies.

Detailed information on national policies can be found in chapter 6.2.1.

Different regulations concerning carbon emissions and GHG emissions are in place in the Alpine Convention states. They focus on limiting emissions, sometimes including also those harmful for human health and the environment.

Financial instruments and market development

International level

One of the key objectives of the 7th Environment Action Programme (EAP) which entered into force in 2014 is to turn the European Union into a resource-efficient, green, and competitive low-carbon economy. The programme supports the phasing out of environmentally harmful subsidies (EHS) using 'an action-based approach, inter alia via the European Semester, and considering fiscal measures in support of sustainable resource use such as shifting taxation away from labour towards pollution' (EC 2011d).

Beside adaptation and mitigation strategies, green taxation as well as a reform of environmentally harmful subsidies are important measures for a low-carbon economy. Green Budget Europe (GBE), a Brussels-based non-profit expert platform on Environmental Fiscal Reform (EFR), promotes bringing tax and spending into line with environmental goals. By means of green taxes, emissions trading, reform of harmful subsidies, green public procurement, border tax adjustments, deposit-refund schemes and promotion of renewable energy, GBE aims to increase the price of pollution and environmental damage and to correct market distortions.

According to the Report on Vivid Economics, carbon fiscal measures are crucial and cost-effective instruments to reduce Europe´s GHG emissions. Carbon fiscal measures, having great potential role in fiscal policy 'may raise significant revenues while having a less detrimental macro-economic impact than other tax options' (Jacobs & Bassi 2012).

Concrete and broader mitigation measures in the Alpine countries are essential for achieving the 2-degree (1.5-degree) goal set by the Paris Agreement, as well as for effective reduction of GHG emissions. Particularly within the transport sector, CIPRA (2010) lists several opportunities in this context such as:

- To increase the price of mineral oil and stop the so-called 'fuel tourism'.
- To strengthen a circular economy based on regional products.
- To introduce a road pricing systems for trucks, using rolling highways more frequently - as a form of combined transport involving the conveying of road trucks by rail.
- To introduce a speed limit for passenger cars.
- To aim for more e-cars fuelled by photovoltaic systems and fewer cars fuelled by biofuel.
- To introduce soft mobility programmes.

Good practice – Alpine Crossing Exchange – An instrument within the transport sector

The Alpine Crossing Exchange is an instrument proposed by the Alpine Initiative that wants to transfer transalpine freight traffic from road to rail by issuing transit rights for truck trips. The transit rights issued can be traded on the market. As with other limited goods, demand fixes the price. It works based on the following 3 principles:

- *Cap: a political decision limits the number of transalpine truck crossings to an environmentally acceptable level by issuing a limited/fixed amount of transit rights. The upper limit can be reduced progressively from today's figure to the desired level. All trucks with a gross vehicle weight rating of more than 3.5 tonnes need a transit right if they want to cross the Alps.*

- *Allocate: the Alpine transit rights will either be allocated as a free bonus to freight companies who voluntarily use rail (1 transit unit for the road for every X units by rail), or sold to the highest bidders.*
- *Trade: Alpine transit rights can either be used by their owners or be freely traded. An information system supplies reference prices for rail transport.*

Further information: www.cipra.org/en/media-releases/an-alpine-crossing-exchange-is-legally-feasible

National instruments

Liechtenstein's financially most relevant and, for projections, most reliably quantifiable measures currently in place focus on the refurbishment of old buildings, on solar collector systems and on substitutions towards heat pumps and wood heaters induced under the Energy ordinance (EEG). Their effects are visible in a reduction in the consumption of heating fuels and finally in the reduction of emissions in the sectors industry and *others*. The municipalities individually supplement the national subsidies with additional funds. Other measures, such as savings through more efficient, new private heaters or recovery of steam in industry, are independent of the EEG but relevant for emission reduction.

In Switzerland, the CO_2 levy is a key instrument to achieve statutory CO_2 emission targets. This steering levy on combustible fossil fuels, such as heating oil and natural gas, was introduced in 2008. In making fossil fuels more expensive, it creates an incentive to use them more economically and choose more carbon-neutral or low carbon energy sources. Two-thirds of the revenue from the levy is redistributed annually to the public and the economy independently of consumption. One-third (max. CHF300 million) is invested in the buildings programme to promote CO_2 reduction measures such as, e.g., energy-efficient renovations or renewable energies. Another CHF25 million is provided to the technology fund. Energy-intensive companies can be exempted from the CO_2levy if they commit to reducing emissions in return. No levy is imposed on wood and biomass because these energy sources are CO_2 neutral: the amount of CO_2 released during combustion is equal to the CO_2 absorbed during their growth or formation.

Green technology and innovation

Several projects in the Alpine Convention area are matching concrete measures within the field of energy efficiency and RE in the Alps (see chapter 3.1).

The development of smart grids in the Alpine area, focusing on energy management and sustainable mobility solutions is one example, which was analysed in the AlpStore project.

Shaft power plants are going to be tested as a kind of hydropower plant, which offers higher energy efficiency, combined with less or almost no harmful impact to surface waters while improving the ecological connectivity of rivers.

Labels, certifications and awards

European level

International and national awards can be essential motivational instruments towards a Green Economy. Prizes such as the European Energy Award, Smart Cities, Environmental Innovation Award, EU Sustainable Energy Awards, and the European Solar Prize Award are good examples for this at the European level.

At the organizational level, environmental management systems such as EMAS or ISO 14001 provide incentives for businesses and administrations to improve their environmental performance continuously and reduce energy and resource consumption. The same holds true for energy management systems.

The Energy Platform of the Alpine Convention suggested that "Alpine-specific" energy awards might be a good approach to motivate people and organizations to support e.g. energy-efficient buildings and to improve the visibility of lighthouse projects. Networking and exchange of experience were also assumed to be important factors for innovation and successful implementation

of measures/actions towards an energy-efficient and sustainable Alpine region (Swiss Confederation et al. 2015). For example, the municipalities of 10 Alpine member regions have supported the ArgeAlp award (2011) as a prize for renewable energies.

National instruments:

In Germany the Fuel Efficiency Labelling of Passenger Cars Regulations (known as Pkw-EnVKV), which went into effect on 1 December 2011, requires new cars to be equipped with fuel economy labels that describe the vehicle's CO_2 emissions for consumers.

Since March 2003 in Switzerland, passenger cars must clearly display an energy label on each new car offered for sale, classifying the energy efficiency in seven levels including information such as fuel consumption or CO_2 emissions. The energy label is updated yearly to the latest technology[70].

Education, training and developing skills

European level

It is important to mention the role of the European Climate Foundation (ECF), one of the most influential climate NGOs in Europe, whose aim is to collaborate among stakeholders in ensuring the necessary transformation from a high-carbon to a low-carbon economy. This shapes the European context for ambitious and effective policies. One of the main issues of the ECF is to support a low carbon society and play an even stronger international leadership role to mitigate climate change. The ECF has launched the *Industrial Innovation for Competitiveness* (i24c) initiative, whose mission is to enhance understanding and confidence in how Europe's industry can successfully compete and drive prosperity thanks to a systemic industrial policy focused on innovation. The i24c bases its activities on research, multi stakeholder dialogue and high-level engagement[71].

National instruments

Slovenia has collected good practices for educational purposes and as incentive for further practical solutions to mitigate climate change effects (see box).

Good practice – Slovenia is Reducing CO_2: good practices

The project Slovenia is Reducing CO_2: good practices provides for the promotion of good practice, the dissemination of knowledge and encouragement to change. Success stories inspire! They demonstrate that the dramatic changes on the way to a low-carbon society are not only possible, but also bring a series of synergistic effects: they create savings and new green jobs, offer innovative solutions and development opportunities, protect the environment and human health, bring chances to reduce government costs and increase revenue and increase quality of life and inspiration.

In the years 2011 – 2015, Umanotera (Slovenska fundacija za trajnostni razvoj, ustanova), a Slovenian foundation focusing on sustainable development, selected and publicly presented 92 good practice awards that were selected under the project Slovenia reduces CO_2: good practice. They encouraged green jobs and were compliance policies - a precondition for achieving the objectives of international development co-operation. They presented in catalogues (Catalogue 2012 Catalogue, 2013 Catalogue, 2014 Catalogue 2015), on websites www.slovenija-co2.si and www.zelenadelovnamesta.si and in short animated films. Based on the presentations, recommendations were also offered to decision makers for further dissemination and application of good practices.

The project continued in the years 2015 – 2016 and will deliver a holistic recording of existing good practices in Slovenia. We are looking for good practices in the following priority areas: (1) energy efficiency, renewable energy and energy renovation of buildings, (2) sustainable management of forests, wood processing craft trade and industry, wood as a construction material and supply of wood-based fuels (3) organic farming, (4) sustainable rural development, sustainable community (5) sustainable mobility, (6) sustainable production and consumption and (7) adaptation to climate change.

Further information: www.slovenija-co2.si; www.zelenadelovnamesta.si

70. Further information: www.bfe.admin.ch/themen/00507/index.html?lang=de.
71. Further information: europeanclimate.org/initiatives/cross-cutting/innovation/.

3.1.3 INSTRUMENTS AND MEASURES FOR AN ENERGY-EFFICIENT ECONOMY

As mentioned in chapter 2.1.3 the Energy Protocol of the Alpine Convention sets essential targets for energy efficiency in the Alpine Convention area. In the first mandate phase 2013-2014 of the Energy Platform of the Alpine Convention, the following three main domains were identified: 1) energy usage, 2) energy production and 3) energy distribution and storage systems. Within this framework, several workshops were organized to establish an exchange within the most relevant stakeholders of these three topics. The aim of these meetings was to strengthen the Renewable Alps vision showing that Alpine regions and municipalities have gathered a vast pool of energy knowledge and innovation potential (Swiss Confederation et al. 2015).

Besides the fact that the Alps have a big potential on installing RE power plants, there is a big need to analyse the existing RE constructions on their environmental compatibility. Thus, instruments for repowering hydropower and wind power plants are an essential issue to achieve higher energy efficiency in the Alps.

Regulations and policies

Roadmaps and regulations for the development and fostering of energy efficiency embrace action plans and strategies at the national level, sometimes also specifically for some sectors such as the building or mobility sectors.

The Italian Law No 99/2009 provided for the publication of an Extraordinary Plan for Energy Saving and Efficiency. The plan envisages improved coordination among central and local administrations, promotion of sustainable construction and refurbishment of buildings, provisions for stimulating the supply of energy services, incentives for micro and small co-generation systems, mechanisms apt to boost the demand of white and green certificates, encouraging auto production of energy in SMEs. Detailed information on national policies can be found in chapter 6.2.2.

Financial instruments and market development

The internalisation of external energy costs is a well-introduced topic in mobility costs. Therefore, the Working Group Transport of the Alpine Convention is engaged to analyse different costs for freight transport, different national approaches and toll systems in the Alpine Convention area.

In addition, the ALBATRAS study on behalf of the Zurich group of the transport ministries of the parties in the Alpine Convention has deeply analysed different economic effects of different toll systems for freight transport.

As a first major step towards reducing consumption, Germany implemented the ecological tax reform on fossil fuels and electricity consumption in 1999. Thus, energy consumption and GHG emissions, most notably in the transport sector, were reduced.

Table 3.1.3-1 summarizes the financial instruments and measures in Germany towards energy efficiency. The data have been collected from the IEA energy efficiency database by selecting the most important economic instruments such as funds, direct investments, R&D, labels, standards or fiscal and financial incentives including taxes and loans in force and relevant for a Green Economy.

Funds, Direct investments
Energy Efficiency Fund (2011)
Directive for the promotion of energy-efficient and climate-friendly production processes
Financial support for investments in cross sectional technology (last amended 2015)
Energy Efficiency Initiative (2002)
Grants for consulting on Energy Performance Contracts
Urban Lighting (2011)

Fiscal financial incentives, taxes, loans
Heavy goods vehicle toll (2005)
Fiscal consideration of commuting expenses (2001)
KfW Energy-efficient Construction (2009)
Future Investments Act (ZuInvG) (2009)
IKK - Energy-Efficient Urban Refurbishment - Energy-efficient Redevelopment (2009)
National Innovation Programme for Hydrogen and Fuel Cell Technology (2008)
Third-Party Financing for Public Buildings
Energy Provisioning (2012)
Clean Truck Procurement Subsidies (2007)
KfW-Programme Energy-Efficient Restoration (Energieeffizient Sanieren) (2009)
Tax cap (*Spitzenausgleich*)
Energy Taxes: Coal, Biodiesel, Natural Gas (2006)
New vehicle car tax system (2009)

Table 3.1.3-1 Financial instruments and measures in force towards energy efficiency in Germany (Source: IEA 2016).

In Italy, measures provided in Budget Law 2007 regarding the household and building sector include a tax deduction worth 55% of the total amount of expenditures sustained to enhance the energy efficiency of buildings. This is relevant to the energy saving potential, available to both domestic and commercial consumers of energy. Eligible expenditures include those aimed at reducing thermal losses, the installation of solar collectors for hot water production, the installation of condensing boilers and the construction of high efficiency buildings. Budget Law 2008 confirmed fiscal incentives and added further measures including extending the 55% tax deduction to 2010. This rebate is fully monitored by ENEA, so that results are documented in terms of costs, energy saving, number and variety of measures.

Furthermore, the 2008 Financial Act grants tax deduction to Fair Purchasing Groups (Gruppi di Acquisto Solidali - GAS). These groups, fostering the seasonal products consumption, contribute to the reduction of the environmental impact due to transport of goods over long distances.

Good practice – effeLED, Switzerland

effeLED is a funding programme with the goal to achieve an energy saving of light of at least 54 million kWh of electricity. The national programme effeLED promotes energy-efficient lighting solutions with innovative LED technology in commercial buildings. It supports new construction and renovation projects that are realized in the years 2014-2016 in Switzerland. effeLED is based on an initiative of the Swiss Association of Lighting Industry (FVB) and is promoted as part of the Federal Office of Energy. The basic idea of the funding is to support the planner and mechanics in implementing energy-efficient lighting solutions and to cover the overhead cost of planning.

Further information: www.effeled.ch/nutzen/

Green technology and innovation

A selection of German research and funding activities for development of energy efficiency technologies and for e-mobility is listed below:

- Funding Programme for Electromobility Pilot Regions (2009)
- Government Electromobility Programme (2009)
- E-Energy – ICT-based energy system of the future (2007)
- Environment Innovation Programme
- KfW Special Fund for Energy Efficiency in SMEs (2013)
- 6th Energy Research Programme 'Research for an environmentally sound, reliable and affordable energy supply' (2011)
- R&D programme for battery electric mobility 'Show Cases Electric Mobility' (2012).

In Switzerland, the Swiss Federal Office of Energy (SFOE) fosters various energy efficiency technologies. To name a few examples (BFS 2016c), it supports or promotes research on:

- Fuel cells, which are capable of directly converting chemical energy into electricity.
- Cogeneration, a form of heating that at the same time produces electricity, and the other way around.
- District heating, an idea where heat is produced in a central facility such as thermal power plant or a wood-chip combustion plant, and then delivered via pipelines to consumers.
- Electricity technologies and application research programme which aims to optimize use of electricity from production until the end of consumption.

Good practice – LEEN-Learning Energy Efficiency Networks, Germany

LEEN offers a management-system – originally coming from Switzerland – aiming to set up and run energy efficiency networks among participating companies to reduce their energy demand. This is supported by exchanges of experience among the companies as well as the provision of professional assistance and advice. The Networks are based on the principle of self-help as companies explore their energy efficiency potential assisted by professionals.

The LEEN – System includes a variety of computer based calculation tools (e.g. pumps, electrical drives, compressed air, lighting systems) as wells as management guidelines. The German Environmental Ministry (BMUB) is currently supporting the launch of the LEEN-System.

Further information: leen.de/en/

Good practice – Energy autonomy Vorarlberg - 101 measures suited to grandchildren, Austria

The federal government of Vorarlberg initiated The Programme Energy Autonomy in Vorarlberg. In 2009, the provincial parliament made the unanimous decision that Vorarlberg would be energy autonomous by 2050. The activities towards achieving this vision are connected to the project called '101 Enkeltaugliche Maßnahmen'. A group of experts divided in 4 groups according to the topics on 1) renewable energies, 2) industry and trade, 3) construction as well as 4) mobility and spatial planning has worked out a set of concrete measures to achieve the EU energy efficiency targets until 2020.

Further information: www.energieautonomie-vorarlberg.at/de/schritt-fuer-schritt-ans-ziel

Labels, certifications and awards

The Austrian National award for environment and energy technology (a resource efficiency start-up) is another example for suitable awards in this sector. Austria is one of the leading countries especially in researching efficient building solutions. The federal government's programme is committed to promoting low energy and passive house standards by implementing strict energy efficiency regulations. Building related targets from the programme are that 50% of new buildings should meet the *klimaaktiv* standard. The standard defines criteria for energy-efficiency, the quality of the planning and execution, the building material and construction quality as well as the comfort and ambient air quality. These are assessed neutrally and need to be fulfilled in order to achieve the standard. The *klimaaktiv* building standard exists for residential and office buildings, for new buildings and also for renovations. From 2015 on, only those residential buildings meeting the standard receive government financial support for their construction (Swiss Confederation et al. 2015).

Germany supports the identification of energy-efficient products with different guidelines and labelling activities, such as:

- Directive for the promotion of energy management systems (2013)
- Compulsory energy efficiency audits in large companies (2015)
- Mandatory Fuel Efficiency Labelling for Passenger Cars (2004)
- Energy Consumption Labelling Ordinance (EnVKV)
- Blue Angel Ecolabel example: Hot Water Tank (2006)
- Passenger Vehicle Energy Consumption Labelling Ordinance (Pkw-EnVKV) (2004).

In Italy, the main measures for energy efficiency are as follows: white certificates, fiscal measures to encourage energy efficiency of buildings, transport, biofuels, domestic electrical appliances, lighting, industrial motors.

The Italian white certificate scheme was introduced in 2005. The obligations are intended for distributors of electricity and gas with more than 100,000 clients, who carry out energy efficiency projects for their clients (households and all kinds of industries). In Italy at least 50% of the energy savings have to be achieved through direct energy savings of electricity or gas. Up to 50% of energy savings may be realised through changes in fuels.

Green certifications such as Energy City (*Energiestadt*) in Liechtenstein and Switzerland are important measures on the way to energy efficiency.

The Swiss Federal Energy Ordinance sets out labels for electricity efficiency of various products such as household appliances, electric lamps, TV sets, motor vehicles, tyres as well as bathroom products[72].

Sustainable public procurement

The Italian National Action Plan on Green Public Procurement, invites public purchasers to use the 'best offer' system to award tenders, instead of the 'minimum price' system. They are also invited to use environmental technical specifications in the calls for bids, both as minima (core) criteria and award criteria. The Ministry of the Environment (by the way of the NAP GPP Committee) define core and award environmental criteria and formally adopt it by a ministerial decree. Criteria for some product groups have been formally issued: IT (computers, printers, copiers, and multifunction equipment), paper, and soil amending. Others have been submitted to the NAP GPP Committee for approval: construction materials, energy services, food and catering, furniture, textiles. The national target is set to 30% of all the public purchases with environmental criteria by the end of 2010. The monitoring will be made with the collaboration of ISPRA (the National Institute for Environmental Protection and Research), and will use the amount of green public purchase (in euro) / total public purchase as indicator for every product group.

Education, training and developing skills

Financial, technical and regulative measures will be not sufficient alone as the main influence on energy consumption comes from the way people are using energy and their awareness about it.

72. Further information: www.bfe.admin.ch/energieetikette/index.html?lang=de

The Alpine Space project THE4BEES (Transnational Holistic Ecosystem 4 Better Energy Efficiency through Social innovation) is a good example for this and builds on the hypothesis: energy is consumed by people rather than by buildings. Although most of the strategies to achieve energy efficiency in buildings focus on technical mitigation measures, both structural and soft approaches shall be considered complementarily across the Alpine Space to reach the ambitious goals on low carbon set by EU and the Alpine Strategy (EUSALP). THE4BEES project[73] focuses on the behavioural changes of users in public buildings needed to reduce energy consumption. Using innovative ICT applications developed by a transnational system will trigger such changes. The target groups in the demonstration sites (schools, houses, factories) will use those applications to encourage behavioural changes for energy efficiency and carbon footprint reduction.

The Swiss Federal Office of Energy SFOE established a platform, EnergieSchweiz to inform and raise awareness of various actors, such as cantons, municipalities, private sector, about energy efficiency; they also offer advice, education and quality assurance. This also acts as a place for networking and coordinates various measures undertaken on the subject of energy efficiency. As such, it is actively engaged in fostering energy efficiency in five different areas: buildings, electronic devices, industry and services, mobility, as well as renewable energy[74].

3.2 A RESOURCE-EFFICIENT ECONOMY

3.2.1 POLICIES, INSTRUMENTS AND MEASURES FOR RESOURCE EFFICIENCY OVERVIEW OF POLICIES

Overview of policies

Resource efficiency is an important economic and environmental topic of the policy discourse. As such, it is a priority of the Europe 2020 Strategy as well as of the sustainability strategies in the Alpine countries. In 2011, the Roadmap for a Resource-Efficient Europe was adopted, defining roughly a hundred individual actions to be taken by the European Commission and the Member States. Moreover, to turn the EU into a resource-efficient, green and competitive low-carbon economy is a priority objective of the 7th Environment Action Programme (EEA 2015i).

The Alpine countries implemented a diverse set of policies and measures to improve the resource efficiency of their economies. Table 3.2.1-1 gives an overview on relevant strategies and policies.

Level	Relevant Strategies and Policies
EU	• EU 2020 Strategy • Roadmap for Resource Efficiency (2011) • 7th Environment Action Programme • EU Eco Design Directive • European Eco-Management and Audit Scheme (EMAS)
Austria	• Austrian Resource Efficiency Action Plan (REAP)
Germany	• German National Sustainable Development Strategy • Bavarian Sustainable Development Strategy • German Resource Efficiency Programme (ProgRess) • Environment Agreement for Bavaria 2010-2015
Italy	• Environmental Action Strategy for Sustainable Development (2002)

73. Further information: www.irees.de/irees-en/inhalte/projekte/laufend/sowi/The4Bees.php.
74. Further information: www.energieschweiz.ch/home.aspx.

Liechtenstein	• Participation in Swiss Initiative Reffnet
Slovenia	• Operational programme for the implementation of EU Cohesion Policy 2014 – 2020 • Slovenian Industrial Policy, 2013 • Action plan: Wood is beautiful • Smart Specialisation Strategy
Switzerland	• Sustainable Development Strategy (2016-2019) • Action Plan Green Economy (since 2013) • Masterplan Cleantech (2011-2015) • Reffnet initiative (since 2014)

Table 3.2.1-1 Overview of selected policies on resource efficiency.

Green technology and innovation

To foster innovation in resource efficiency, several Alpine states support their private sector with consultancy measures, e.g. via the establishment of **resource efficiency agencies** or the assistance of **resource efficiency networks**.

A German success story is the implementation of regional resource efficiency agencies. A prototype is the Effizienz Agentur NRW[75], which was established by the state of North Rhine-Westphalia to provide industrial companies and tradesman with concrete support in the identification and implementation of efficiency potential. On the national level, the VDI resource efficiency competence[76] centre follows a similar approach. The Bavarian Infozentrum UmweltWirtschaft (izu) has been established and offers web-based general and sector-specific information on resource efficiency, which is especially relevant for the German Alpine region. Moreover, the Bavarian Environmental Consultancy and Audit Programme (BUBAP) assists industrial companies with resource efficiency improvements. Until December 2015, they consulted more than 6,500 companies in Bavaria including more than 1,000 in the Alpine region of Bavaria. Furthermore, the Bavarian Working Group on Raw Material Strategy (with members from administration, science and business) give policy advice on topics such as securing raw materials, material efficiency and material substitutes, recycling, and knowledge transfer (BMUB 2015).

For the further development of innovative national policies and measures on resource efficiency, path-breaking studies give guidance to Alpine states. For instance, in 2014, a Slovenian study (MKGP 2014) on approaches to address resource efficiency and waste prevention was prepared with the aim to present several concrete suggestions on the topics and to recommend the preparation of an action plan on resource efficiency in Slovenia. The Slovenian Operational Programme for the implementation of EU Cohesion Policy 2014–2020, supports measures on material resource efficiency for enterprises and uses the opportunities from domestic and foreign markets of green products. The Slovenian Operational Programme for the implementation of EU Cohesion Policy 2014 – 2020 supports measures on material resource efficiency for enterprises and uses the opportunities from domestic and foreign markets for green products. These measures focus on (1) research, development and innovation, (2) small and medium-sized enterprises and (3) eco-innovations (Energetika Portal 2015).

Switzerland recognizes the problem of scarce natural resources and aims to find its way around it by introducing various measures in order to maximise resource efficiency. In order to assess the impact of Switzerland on the planet`s capacities, including the impact of the Swiss consumption on the planet`s natural resources, the Swiss Federal Office for the Environment (FOEN) has launched a pilot study which helped to develop the concept of *Planetary Boundaries*. The goal of this study is to develop recommendations for a set of footprint limits for a Green Economy, by translating the environmental limits of our planet (Planetary Boundaries) to the context of Swiss demand (i.e. consumption). The proposed limit values serve as a rough orientation on the sustainable level of resource consumption from a scientific point of view (UNEP 2015).

With the target of increasing resource efficiency, the Swiss Federal Office for Environment has decided to focus specifically on Swiss enterprises and their handling of the problem. In 2014, Reffnet.ch opened a network for efficient resource use. Reffnet.ch supports recognition of potentials and planning, and offers support with the application of various projects and for the

75. Further information: www.ressourceneffizienz.de/ressourceneffizienz/startpage-en.html .
76. Further information: www.ressource-deutschland.de.

measurement of results. The Network`s website informs about good practice examples, knowledge, contacts, tools for self-control, as well as engagement in various measures; it also organises events. Resource efficiency may be difficult to achieve, hence appropriate guidance, which Reffnet.ch offers, is very much needed. Liechtenstein participates in the Swiss Initiative Reffnet. The LIFE climate foundation Liechtenstein sponsors up to 50% of the consultation fees for seven consultation services for the next two years.

A major project of the Swiss Confederation was the Masterplan Cleantech. It focused on creating a good environment for companies that specialise in clean technologies, thereby increasing their competitiveness and environmental benefits simultaneously. Resource efficiency is an important element of the Cleantech technologies. A report about the implementation for the years from 2011 to 2014 has recently been published. The Masterplan functioned as such until 2015. The Swiss government then mandated the Federal Department of Environment, Transport, Energy and Communications (DETEC) in collaboration with the Federal Department of Economic Affairs, Education and Research (WBF) to investigate further measures and steps. In the period of 2016-2019, it continues as a coordination instrument. However, similar measures as in the Masterplan are now implemented in the Green Economy Action Plan.

Labels, certifications and awards

The certification of environmental management systems (EMS) is a successful instrument to encourage the implementation of such tools in private as well as public organisations. EMS coordinates and controls environmental relevant activities in an organisation, reduces the environmental impact of a company and therefore, guarantees the long-term success of an organisation. One important aspect of this tool is the efficient use of resources. EMS structures responsibilities, practices, processes, and legal requirements for the implementation of environmental policies of an organisation. The two most commonly applied EMS in the Alpine countries are the European Eco-Management and Audit Scheme (EMAS) and the international environmental standard ISO 14001 (Eco Innovation Observatory 2016).

Table 3.2.1-2 shows the development of the number of organisations with EMAS and ISO 14001 certification in the Alpine countries. The number of ISO 14001 certificates is significantly higher than the number of EMAS organisations. The number of EMAS organisations was constant in Austria, France and Slovenia in 2014 compared to 2005. In Germany the number decreased by ¼ and in Italy it increased almost by a factor of four. Germany has the highest number of EMAS certified organizations with 1,229 in 2014. The number of ISO 14001 certificates has been slightly rising in Lichtenstein and Slovenia. Contrarily, in Austria, France and Italy the number more than doubled. Italy has the highest amount of ISO 14001 certificates with 19,705. For Slovenia and Switzerland, the number of ISO 14001 certificates in the Alpine area is available. In Slovenia, there are 169 within the Alpine region and in Switzerland, 644.

Country	Number of EMAS organizations in 2005	Number of EMAS organizations in 2014	Number of ISO 14001 cert. in 2005	Number of ISO 14001 cert. in 2012
Austria	253	249	481	1,084
France	20	19	3,289	7,975
Germany	1,619	1,229	4,440	7,034
Italy	258	1,017	7,080	19,705
Liechtenstein	-	-	19	21
Slovenia	1	1	417	420
Switzerland	-	-	1,561	2,762

Table 3.2.1-2 Number of organisations with EMAS and ISO 14001 certification in Alpine countries (Source: EUROSTAT 2015g, Eco Innovation Observatory 2016).

The higher number of ISO 14001 certificates is not surprising, since the requirements for an EMAS certification are more demanding than for ISO 14001. Exemplary, EMAS organisations are required to improve continuously their environmental performance above the legal requirements. Companies have to state clearly how their strategies incorporate social and environmental aspects. Moreover, strategic processes have to include the involvement of stakeholders and monitoring with specified indicators, which evaluate environmental progress.

Good practice - From EMS towards Sustainable Management Systems, Germany

A cooperation project of chambers of industry and commerce, chambers of crafts and the Bavarian State Ministry of the Environment and Consumer Protection has collected a series of good practices in medium sized enterprises that are testing the enhancement of EMAS/ ISO14001 towards sustainability management. In total nine companies, including one from the Alpine administrative district Lindau (Bodensee), have participated in this project.

Further information: www.stmuv.bayern.de/themen/wirtschaft/umweltpakt/nachhaltigkeitsmanagement/index.htm.

3.2.2 POLICIES, INSTRUMENTS AND MEASURES FOR LAND USE CHANGES

Overview on policies

At the political level the need to reduce the steady increase of settlement and infrastructure areas is acknowledged. A visible sign is that some countries have target values to reduce land take e.g. in their sustainability strategies.

Country	Document	Target
Europe / EU	Road Map for Resource-Efficient Europe	No net land take until 2050
Austria	Sustainability Strategy	Reduce land take urban areas and transport infrastructure to 2.5 ha per day
Germany	Sustainability Strategy	Reduce increase of settlement and transport area to 30 ha per day until the year 2020
Slovenia	Spatial Planning Act	Limitation of using agricultural land for urbanisation and promotion of inner-urban development
Switzerland	Spatial Concept Switzerland (Raumkonzept Schweiz) Revision of the Spatial Planning Act (RPG) - Stage 1	Limitation of land use and promotion of inner-urban development Obligatory revision of land use planning documents in the following 9 years in order to reduce the size of the building zones and in favour of a more sustainable spatial development.

Table 3.2.2-1 Overview on land use policies.

More information about land use policies in the Alpine countries is given in Annex 6.2. The most important instruments for responsible land use are spatial planning, urban planning, agricultural and subsidy policies. While agricultural and subsidy policies can be influenced for EU Member States by institutions and regulations on the EU level, spatial and urban planning is made on regional and local levels and the influence of international and even national policies is limited. Instruments and measures to reduce land take need to be applied on the regional and local levels. An Alpine-wide overview of such instruments capable to manage land take has been compiled in the Alpine Space project DIAMONT in its instruments database[77]. A wide range of single measures is taken and cannot be presented in total, but only exemplarily in the Annex.

77. Further information: diamont.alpconv.org/sites/ALpenDB_instrument_index.html.

Good practice – Spatial densification in Brig-Glis, Switzerland

The project on spatial densification in Brig-Glis is an example of inward development in order to avoid more land consumption. It aims to provide solutions that do not pose problems for landowners. The project focuses on producing an urban development model, which will be used in future development plans of the area. There are three main strategies: densify the city, protect the surrounding landscape and smart use of traffic systems.

The aims are to be achieved by finding areas that could be downgraded from construction zones, areas that could be re-zoned and densified as well as developing instruments that help identify areas suitable for those processes. Moreover, the project encourages affected parties to be involved, aims to raise awareness about living quality in the area, thereby involving the society, and promotes development inwards instead of further land take. As such, it also contributes to a shift in thinking about spatial development and spatial planning in urban areas.

The Municipality of Brig-Glis is carrying out the project and it receives financial support from the Confederation within the funding programme 'pilot projects for sustainable spatial development'; other involved actors are the Canton of Vallis and the Agglomeration Brig-Visp-Naters.

Further information: www.are.admin.ch/themen/raumplanung/modellvorhaben/2014-2018/05002/index.html?lang=de

3.2.3 POLICIES, INSTRUMENTS AND MEASURES FOR A CIRCULAR ECONOMY, RECYCLING AND WASTE

Overview of policies

Level	Documents and measures
EU	• EU Action Plan for the Circular Economy. The Action Plan (EC 2015d) • Circular Economy Package (EEB 2015): Funding 650 million from Horizon 2020 and 5.5 billion from structural funds for waste management and investments in the circular economy at national level • EU Directive 2008/98/EC on Waste (Waste Framework Directive) (EC 2008) • European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste • Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE) • Directive 1999/31/EC on the landfill of waste • European Parliament resolution on the Commission Green Paper on integrated product policy (COM(2001) 68 - C5-0259/2001 - 2001/2117(COS))
Austria	• Waste Management Act • Austrian Waste Management Plan
Germany	• Law on Circular economy (Kreislaufwirtschaftsgesetz) • Waste management plan of Bavaria (Abfallwirtschaftsplan Bayern)
Italy	• Environmental Action Strategy for Sustainable Development
Liechtenstein	• Environmental Protection Act (RDR 2008& Ministero Dell´Ambiente & Fondatione per lo Sviluppo Sostenible 2015)
Slovenia	• Waste Management Programme • Framework Programme for Transition to a Green Economy

Switzerland	• Regulation on avoidance and disposition of waste (Abfallverordnung) • Ordinance on Movements of Waste • DETEC Ordinance on Lists relating to Movements of Waste • Ordinance on beverage Containers • Ordinance on the Return, Take-back and Disposal of Electrical and Electronic Equipment • Ordinance on the prepaid disposal contribution for glass beverage containers • Ordinance on the prepaid disposal fee for batteries and accumulators

Table 3.2.3-1 Overview of selected policies on circular economy, recycling and waste.

More detailed information about policies and regulations is given in Annex 6.2.

Financial instruments and market development

Regional currencies may strengthen the regional economy and local supply chains and can contribute to circular economy not only by short transport ways, but also by rising awareness for sustainability in general and by offering sustainable products (cp. GP example Chiemgauer).

Good practice – The Chiemgauer – a successful regional currency, Germany

The Chiemgauer as a regional currency started in 2003 on a small scale as a company of a private school. It grew fast and has about 600 enterprises in the counties of Rosenheim and Traunstein in Germany accepting payment with Chiemgauer as banknotes or by a special Regiocard. The regional currency sees itself as a regional supplement to the Euro and has some innovative elements such as that 3% of the purchase is given by the enterprise to a social institution or association. The buyer chooses the purpose. The Chiemgauer aims at keeping the benefits in the region, to help to keep the city and village centres alive with shops and to promote togetherness by supporting non-profit associations. An important part is the stimulus for circulation of the Chiemgauer: the consumers have to upvalue the banknotes every 6 months by 3% with adhesive stamps, if she keeps them instead of purchasing goods. This way the Chiemgauer circulates faster and supports business activities. Speculation is prevented in this manner. One Chiemgauer has the value of one Euro and is covered by this. The exchange of Chiemgauer with a Regiocard is free, but the respective person has to be a member of the non-profit association. In addition, the membership at the Chiemgauer e.V. is free, requiring only a signature.

In 2015 more than 200 social institutions or non-profit associations got over €65,000 by the 3% which were given for each payment with Chiemgauer. Since 2003 more than €450,000 were handed over to 270 non-profit associations.

Further information: www.chiemgauer.info

Concerning waste management, Italy has a special landfill toll and a provincial environmental protection toll.

In Switzerland, old electrical and electronic equipment can be returned free of charge for recycling due to a recycling fee paid when purchasing the new product. SENS eRecycling, Light Recycling Foundation Switzerland and SWICO Recycling organise and manage the recycling of electronics through collection schemes. The institutionalized redemption of electronic waste was launched at the beginning of the 1990s as an industry solution, before 1998 when take-back and recycling obligation became law. Switzerland is not only a pioneer, but also one of the world champions in recycling electronic products with much higher response rates than the rest of Europe. A reason for the high return rate could be the extremely dense collection network with more than 6000 collection points, the involvement of all market players as well as high social acceptance (Swiss Recycling 2016).

Labels, certifications and awards

People, organizations and successful communication affect recycling. The Swiss recycling award should be an incentive for the recycling industry as well as for consumers. Furthermore, it underlines the importance of recycling. The winners of the Swiss Recycling Awards 2014 have been honoured for their exceptional performance: the three winners Migros, Maag Recycling AG and the Montreux Jazz Festival have all contributed in different areas and played a valuable role for recycling in Switzerland (Swiss Recycling 2016).

Education, training and developing skills

PUSCH is one organization that offers education for schools as well as municipalities in Switzerland. It was established in 2000 by Schweizerische Vereinigung für Gewässerschutz und Lufthygene VGL as well as Siga/ASS. It is a politically independent and a non-profit organization. PUSCH organizes meetings, seminars, courses, environmental education classes that target both school children as well as adults, for whom environmental education and education on waste management is relevant in some way. Annually, it benefits 60,000 students and a few thousand adults. In addition, it also offers publications, as well as exhibitions, campaigns, and runs a website Labelinfo.ch that provides information on environmental labels. Education on environment and waste management is a strategy for raising awareness on environmental protection. It is especially important for children who learn the habits of separating waste and recycling very early.[78]

Civic engagement and participation

Consumers and their behaviour play an important role in waste generation and consequently there are many initiatives to reduce waste presented by the civil society and NGOs in Germany. Food waste especially attracts the attention of many people. As it is impossible to present all initiatives, some examples are given here:

- Food-sharing initiatives offer platforms to give quantities of superfluous food to others and save waste (example www.foodsharing.de).
- Use of agricultural products which cannot be sold because of their unconventional forms and would therefore be thrown away (example: www.etepetete-bio.de).
- Internet information about how to save food from being wasted: www.zugutfuerdietonne.de.
- Initiative by the Center of Excellence for Nutrition of the Bavarian Ministry for Nutrition, Agriculture and Forestry (www.kern.bayern.de/en/index.php). Example project: innkeeper seeks farmer (*Wirt sucht Bauer*) with the aim of establishing a regional economic circle in terms of food: internet platform.
- Repair-cafés offer repair jobs on a voluntary, unsalaried basis and give instructions how to repair things instead of throwing them away.
- Internet platform to trade old construction elements such as stairs, windows or doors which can be reused[79].

Slovenia has started some promotional and educational activities towards circular economy:

- Cooperation with Ellen MacArthur Foundation, activities for membership in the program of CE 100 Regions with the goal to raise the capacity of key players (public administration, economics) understand and use the concept of the circular economy.
- Co-organization of a conference on the circular economy in November 2015 (ebm.si/p/circonf/). Goals: raising the skills of the participants, identifying opportunities for industry and young people, networking among participants.
- Pilot project: to promote circular economy among businesses in the Slovenian economy, to focus on small and medium-sized enterprises and local communities and to enhance interest in sustainable, energy, and material-efficient operations of Slovenian companies together with understanding the basic principles of circular economy in a selected public.

In Switzerland, the campaign 'Ich trenne' has achieved a high level of acceptance. Thirteen prominent persons from sports, music, politics, etc. talk about their own recycling. This is a valuable contribution to raise further the awareness of the Swiss population for recycling and separating waste.[80]

78. Further information: www.pusch.ch/.
79. Further information: www.bauteilnetz.de/ (Börse für wiederverwendbare Bauteile).
80. Further information: www.ich-trenne.ch/.

Good practice – Clean Alps, Austria

Littering is a global problem and a significant amount of potential secondary raw material gets lost through improper disposal of waste. Littering also poses serious environmental, economic and aesthetic problems with negative effects on humans and wildlife both, especially in the Alps as an ecologically very sensitive region. Once waste has been disposed of inappropriately, clean-up costs are very high.

For more than 40 years, the Austrian Alpine Club organises an annual clean up event, called Clean Alps, which is funded by the Austrian Provincial Alpine Governments and the Federal Ministry of Agriculture, Forestry, Environment and Water Management as well as several private bodies. The aim of this nationwide campaign is not only combing through areas of the Alps and picking up litter but also generally raising of awareness in the population and of recreation seekers for waste and littering problems in the Alps. Littered waste is gathered, collected and fed into recycling channels, substituting and preserving natural resources in the course of this initiative. Additional focus is put on collecting disposed waste around mountain huts.

Further information: www.alpenschutzverband.at/portfolio/aktion-saubere-alpen/

Corporate accountability and CSR

In Germany, about half of the waste originates from the construction, deconstruction and demolition branches. The recycling quotes are rather high (more than 90%). The initiative for circular economy in the building sector (Initiative Kreislaufwirtschaft Bau), a business association, reports every two years about the reuse and recycling in its branch. Measures to reach these high quotes were taken by the branch on the basis of voluntary commitments.

3.3 ECOSYSTEM SERVICES AND A NATURAL CAPITAL-BASED ECONOMY

3.3.1 OVERVIEW OF POLICIES ON BIODIVERSITY AND NATURE CONSERVATION

In recent years, EU environmental policies such as the 7th Environment Action Programme (7th EAP) and the Biodiversity Strategy to 2020 have pushed perception towards a more systemic perspective on managing the environment, explicitly addressing natural capital. For example, a priority objective of the 7th EAP is 'to protect, conserve and enhance the Union's natural capital'. There are many synergies and co-benefits of a more integrated management approach. Implementation of ecosystem-based management approaches that consider the entire ecosystem, including humans, offers much potential. Adopting this approach in the management of human activities in the aquatic environment and in developing green infrastructure development will provide important evidence and learning (EEA 2015j).

A wide range of policy instruments (conventions, regulations, directives, strategies and policies) directly or indirectly provide recommendations for the goals of conserving biodiversity, maintaining ecological connectivity and preserving ecosystem services. These are summarised in Table 3.3.1-1.

Topic	Strategies and Directives
Biodiversity	• EU Biodiversity Strategy to 2020 (COM(2011)244 final) • Birds Directive (2009/147/EC) • Habitats Directive (1992/43/EC) • Invasive Alien Species Regulation (1143/2014) • Communication on Green Infrastructure (GI) – Enhancing Europe´s Natural Capital (COM(2013) 249 final) • Common Strategic Framework (CSF) Cohesion Policy 2014-2020

Environment (in general)	• 7th Environment Action Programme (1386/2013/EU) • Strategic Environmental Assessment Directive (2001/42/EC (2001) • Environmental Impact Assessment EIA Directive (2011/92/EU)
Water	• Water Framework Directive (EC 2000) • Flood Risk Directive (2007/60/EC) • Urban Waste Water Treatment Directive (91/271/EEC) • Priority Substances Directive (COM (2011)876) • Drinking Water Directive (98/83/EC) • Groundwater Directive (2006/118/EC) • Nitrates Directive (91/676/EEC) • Blueprint to Safeguard Europe's Water Resources
Land and soil	• Thematic Strategy on Soil (COM/2006/0231) • Roadmap to a Resource-Efficient Europe (COM(2011) 571) • New EU Forest Strategy (2013) • Common Agricultural Policy (CAP) reform (2013)
Air	• Thematic Strategy on air pollution (COM(2005) 446) • Ambient Air Quality Directive (2008/50/EC) • National Emission Ceilings Directive (2001/81/EC)
Climate	• Biomass Action Plan (COM(2005) 628) • Renewable Energy Directive (2009b) • Energy Efficiency Directive (EC) (2012/27/EU) • Europe 2020 Strategy for Smart Sustainable and Inclusive Growth

Table 3.3.1 1 Overview of selected EU policies concerning biodiversity, ecosystem services and a Green Economy (Source: EEA 2015d; greenAlps 2014b).

3.3.2 INSTRUMENTS AND MEASURES FOR BIODIVERSITY PRESERVATION

Financial instruments and market development

EU level

The enhancement of direct payments for public goods is in the EU Common Agricultural Policy, within the above-mentioned EU Biodiversity Strategy as action 8. The delivery of environmental public goods is going further than cross-compliance measures. For forests, the Commission wishes to protect and enhance forest biodiversity (and ecosystem services) through forest management plans (in Action 11) and to integrate biodiversity measures in these plans (Action 12).

One of the most prominent promotion instruments for nature protection is **LIFE-Nature**. With this programme, the EU supports measures for conservation or restoration of threatened habitats. LIFE-Nature helps implement the Habitat and Birds directives as well as creating the Natura 2000 European network of protected sites. As an important LIFE financial instrument, the **Natural Capital Financing Facility (NCFF)** has to be mentioned. It supports projects working on payment of ecosystem services, green infrastructure, innovative pro-biodiversity and adaptation investments, and biodiversity offsets.

The EU supports measures for the protection of nature by means of considerable funds also through the European Development Programme for Rural Areas (ELER).

National level

The Austrian subsidies for less favoured areas (Ausgleichszulage) support the maintenance of farming in mountain areas, and to cultivate cultural landscapes highly important for biodiversity. The subsidies are limited to farms with less than 100 hectares[81].

In the German Alpine area, the Nature Conservation Contract Programme (*Bayerisches Vertragsnaturschutzprogramm*) supports financial measures for biodiversity particularly for the network Natura 2000 and the Bavarian habitat network Bayernnetznatur.

81. Further information: www.agraroekonomik.at/fileadmin/download/AB39_Volltext.pdf.

Farmers are supported for extensive farming of highly valuable nature farmland areas; county authorities control the implementation of the measures. Measures embrace conversion of cropland to green land, extensive use of meadows, extensive pasturing and renouncing mineral fertilizer.

The Bavarian Fund for Nature Conservation (Bayerischer Naturschutzfond) is one of the biggest nature conservation foundations in Germany with a stock of almost €56 million. The foundation is using revenues from the Glücksspirale lottery. It is supporting nature conservation measures such as safeguarding biodiversity, protecting endangered species and habitats, developing a habitat network, supporting natural dynamics in surface waters and forests and maintaining cultural landscapes (Bayerische Naturschutzfonds 2016).

The habitat network in Bavaria (*Biotopverbund BayernNetzNatur*) is the umbrella structure for a state wide network of natural and semi-natural habitats. The government launched the network development and takes part in nature conservation legislation. Since the start in 1998, about 399 biodiversity projects have been launched and implemented in the country. Core areas are nature protected areas, floodplains, the edges of mountain ranges and habitat stepping-stones.

The programme chance.natur is a common support activity of the federal ministry for food and agriculture and the federal agency to protect nature. It is awarded to selected projects that combine nature conservation and rural development activities. Up to now, more than 70 projects have received aid of more than €390 million and currently around €14 million per year is available for this programme. In the Alpine area, the *Allgäuer Moorallianz* project (alliance to protect bogs in the Allgäu region) is supported with about €7.9 million and the *Murnauer Moos* project (the largest bog complex of Alpine bogs in middle Europe) has received about €17.8 million.

A new instrument in Germany is MoorFutures, a system of integrating additional ecosystem services into carbon credits. As drained peatlands are the largest source of total agricultural emissions and a rewetting of peatlands reduces GHG emissions, appropriate measures are an important contribution to protecting climate, biodiversity and habitat. The MoorFutures are the first carbon credits from peatland rewetting on the voluntary market in the world (Joosten et al. 2015).

In Italy, ecosystem services were managed by means of classical 'command & control' regulatory instruments (constraints, emission standards, non-tradable permits, etc.) or economic instruments (taxes, fees, etc.) until the 1980s. Since the 1990s, when agro-environmental and forestry measures were introduced in the EU Common Agricultural Policy (CAP) in 1992, voluntary incentives and compensations have complemented the instruments which were formerly adopted.

After introducing the concept of *decoupling* in Italy, i.e. separating the support of agricultural production measures from the income support at the end of 1990s and the success of conditionality of public aid to respect minimum environmental protection standards, new criteria have been introduced also for managing ESS. The Natura 2000 network creation and the offer of compensations to protected sites' managers contributes to enhancing the diversification of ESS protection instruments. More recently newer economic instruments such as environmental payments and payments for ecosystem services schemes (PES) received increasing attention by the policymakers community (MATTM 2009).

At a practical level, Liechtenstein is offering financial incentives. Thus, ordinances are used to create or expand the preconditions for paying financial compensation for services relating to the protection or sustainable use of biological resources, e.g. payments for ecological services in agriculture, which promote sustainable management via the criteria of the Proof of Ecological Performance (PEP) and organic farming. The PEP is the precondition for entitlement to direct agricultural payments and requires inter alia a balance of nutrients, regular crop rotations and compliance with water protection requirements. The goal of having all farms throughout the entire territory operating in accordance with the PEP has already very nearly been achieved, with the PEP actually implemented on 98% of farmland. The number of organic farms increased dramatically in the 1990s. Today, 28% of farms meet the criteria not only of the PEP but also of organic farming (EEA 2015b).

In Slovenia, nature protection is, as a rule, mainly a non-profit activity that must be provided by the state and local communities in accordance with their responsibilities. The funding thereof is generally carried out through the state budget. The state provides the funds for measures aimed at biodiversity conservation and the protection of natural assets, for the public service providing nature conservation and for compensation. Local communities provide funds for measures aimed at protecting natural assets, for the public service providing nature conservation and for compensation when related to the protection of natural assets. The legislation also provides for other sources to finance the public service providing nature conservation. They are regulated through funding institutes as entities that perform a public service. This includes payments for services performed, grants, donations

and other sources allowed by law. In addition to the system of public, direct and purpose-based financing of nature protection, financing by means of funds from other sources, in particular international financial sources, foreign and domestic donations, and sponsorships, is of equal importance. Public institutions, local communities, non-governmental organisations, companies or individuals can use these funds. Important sources are the European Regional Development Fund, the European Agricultural Guarantee Fund, the Rural Development Programme, the LIFE programme, the Cohesion Fund, the EEA, the Norwegian Financial Mechanisms and the Swiss contribution.

As one of its 10 targets, the Swiss Action Plan for Biodiversity includes the review of financial stipulations. The idea is to investigate if taxes and subventions are working in a damaging way concerning actions that support biodiversity. Based on this review, damaging instruments should be adjusted in order to support targets of the Action Plan. This work is already in progress in many areas (agricultural and forest policy). A good example for such mechanisms comes from the agriculture policy 2014-2017, which introduces an incentive to have more animals per area. It is considered vital to check and develop new financial incentives in areas where market failure is probable (BFS 2016g).

Good practice – Allgäuer Moorallianz, Germany

The chance.natur programme of BMU/BfN finances the project Allgäuer Moorallianz. The aim of the project is to maintain sustainably the biological, landscape diversity of the hydrologically intact moor ecosystems in the pre-alpine hills and marshlands of Oberallgäu and Ostallgäu. Furthermore, it aims to match nature conservation with regional development in this area. The project has already developed (2009-2012) its management plans and is in the implementation phase of the defined measures from 2012-2020.

Further information: www.moorallianz.de/index.php?id=109

Green technology and innovation

The online application Jecami allows the analysis of ecological connectivity in Alpine regions based on indicators. This tool is an outcome of the Alpine-wide Econnect project. The application uses the Continuum Suitability Index to analyse structural landscape connectivity and landscape permeability. It also offers a tool to identify favourable areas for certain large mammals[82].

The recently approved INTERREG project called AlpES with the participation of Austria, France, Germany, Italy, Slovenia, Liechtenstein and Switzerland is going to analyse possible instruments and measures that foster and develop ESS of the Alpine area.

The German R&D project Greenconnect identifies and analyses measures of ecological connectivity based on a catalogue of measures to improve ecological connectivity in the Alps.

In Germany, the Bavarian Action programme 2020plus is dedicated to the improvement of flood protection through fostering the infiltration of soils, renaturalisation of rivers, reactivation of natural retention areas, improving the interaction of river and floodplains. Up till now, more than 8,000 km streaming waters development concepts have been elaborated and about 25 million m^3 of retention volume has been reactivated (LfU 2016).

Gaps caused by the existing road networks have been identified in the habitat network and migration corridors of big mammals in Germany, in a rule based methodology using a geographic information system. Based on these results, the German Defragmentation Programme was developed which locates priority sites for measures to overcome road-related barriers.

Innovative, practical and widely usable nature conservation concepts are tested in Germany as part of trial and development (T+D) projects. The Federal Ministry for Environment provide scientific back up for these projects, which focus on nature conservation, regional development, ecological urban development, climate change adaptation and awareness raising models. The projects have to test or develop innovative approaches, must have a regional impact and should have model character. Since the start in 1987 around €120 million has been provided for more than 90 projects and currently the T+D programme has an annual budget of around €3 million (EEA 2015e).

82. Further information: www.jecami.eu.

A Swiss example for the implementation of nature conservation is the Centre for Sustainable Use of Biomass in the UNESCO Biosphere Entlebuch. The project develops a binding, regional biomass strategy, creating a centre for the sustainable use of biomass in the UNESCO Biosphere Entlebuch. The regional biomass flows are recorded and visualized. These data are used not only as a basis to solve conflicts of interest, but also to simulate and illustrate different processing techniques. There are pilot plants like a biochar reactor, educational opportunities and an exhibition to make the experience gained in the long term available to the public and to a professional audience. The regional biomass strategy should also be integrated into the regional structure plan.[83]

A tentative tool to analyse effects on ecosystem services systematically, addressed to planners, has been developed by the University of Zurich (ETHZ).[84] Although universities have carried out substantial work towards improving land use decisions (e.g. PALM potential analysis for sustainable land management[85]), the practical implementation of mapping ecosystem services for land use decision makers (e.g. in the context of touristic development) remains a challenge.

Labels, certifications and awards

The platform ecological Network of the Alpine Convention has developed a concept for the nomination of pilot regions in the Alps has been developed. Since 2011 eight pilot regions have been identified in a nomination concept. The experiences and lessons learnt from this process are summarised in the 'Implementation Recommendations'.[86]

In the German Alpine Convention area, the Bayerischer Biodiversitätspreis award is given to associations, municipalities and their institutions, schools, churches whose activities support the public perception of nature conservation and environmental protection, in particular the diversity of species and habitats. Every two years, the €15,000 award is granted for implementation projects and biodiversity survey activities.

In Bavaria, the Enterprise Nature[87] study has examined the options for the engagement of enterprises for biodiversity: there are many options how the area and buildings of companies can be redesigned to offer secondary habitats, save resources such as groundwater, soil and also may serve as green corridors and green spaces. The blueprint for this approach are the activities of the Swiss foundation Nature & Economy[88] which has already certified more than 300 companies in the country for the nature-friendly design of their areas.

In Switzerland federal instruments such as the park label, product label and global financial aid for parks are supporting parks:

- Park and product labels: a park project becomes a park of national importance as soon as it has been awarded a park label by the federal authorities. From the time the park is labelled, the authority is also allowed to award a product label for businesses and individuals for certain goods or services.
- Park label - For the operation phase, park projects whose long-term future is assured and which meet the requirements specified by the federal authorities are awarded the park label by the FOEN. Parks in the development phase can use the candidate label.
- Product label - The park authority can award the product label to individuals or businesses if the products fulfil the specified sustainability criteria and are manufactured in the park area. The product label is designed to promote traditional skills/crafts of the region (BFS 2015b).

Civic engagement and participation

The Natural Capital Coalition as a global, multi-stakeholder, open source platform brings together the many different initiatives and organizations working in natural capital under a common vision. Its aim is to achieve a shift in corporate behaviour to preserve and enhance, rather than deplete the earth's natural capital. It is made up of early adopters from the business, policy, accounting and NGO communities.[89]

83. Further information: www.are.admin.ch/themen/raumplanung/modellvorhaben/05237/index.html?lang=de.
84. Further information: oesl-check.ethz.ch/.
85. Further information: www.nsl.ethz.ch/index.php/Projekte/Projekte-der-einzelnen-Professuren/Prof.-Dr.-Adrienne-Gret-Regamey/Projekte-Prof.-Regamey/PALM-Gemeindeuebergreifende-PotentialAnalyse-der-Ressource-Boden-fuer-nachhaltiges-LandManagement.
86. Further information: www.alpine-ecological-network.org/the-alpine-ecological-network/pilot-regions.
87. Further information on Unternehmen Natur: unternehmen-natur.de/.
88. Further information: www.naturundwirtschaft.ch/.
89. Further information: www.naturalcapitalcoalition.org.

3.4 ECONOMY SUPPORTING QUALITY OF LIFE AND WELL-BEING

3.4.1 POLICIES RELATED TO GREEN JOBS, ECONOMIC WELL-BEING AND CONSUMER BEHAVIOUR

Level	Documents and measures
EU	• *Green Employment Initiative*: Communication by the European Commission addressing the employment challenges and opportunities of a transition towards a Green Economy. The communication sets out an integrated framework for employment policies to facilitate this transition. (COM (2014) 446 final) • *Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) Action Plan*[90] : by the European Commission to further strengthen green public procurement (GPP). • *Public procurement for a better environment* [91]: Communication by the European Commission to provide guidance on how to reduce the environmental impact caused by public sector consumption and how to use green public procurement to stimulate innovation in environmental technologies, products and services.
Austria	• *Masterplan Green Jobs* [92] : stimulate and support the creation of employment in the environmental goods and services sector. It identifies six priority areas where a high number of measures are identified to implement the Masterplan. The objective of achieving 200,000 green jobs by 2018 shall be realised through e.g. investment in thermal isolation, the increase of renewable energies, the improvement of public transport and the development of eco-tourism. • *Action Plan for sustainable procurement* [93] : adopted in 2010 and consisting of two parts. The first part includes the objectives and measures as well as the practical implementation of the action plan; the second part includes procurement criteria for 16 product groups.
France	• *National plan for green occupation and jobs* : the objectives are to: - identify and monitor green-related occupations; - integrate green-related skills into the initial and vocational education systems, through the adaptation of existing curricula, the creation of specific formations and the related modification of diploma systems and certificate systems; - integrate green occupations into active labour market policies such as apprenticeship contracts or subsidised jobs for disadvantaged workers.
Germany	• *National Programme for Sustainable Consumption 2016* [94] : contains ideas on sustainable consumption policies, including concrete measures.
Italy	• *National Action Plan for green public procurement* [95] : the Ministry for the Environment provides a general framework for green public procurement, sets national objectives and identifies priority product groups to realise the environmental relief potential of this instrument and defines minimum green criteria.
Slovenia	• *Decree on Green Public procurement 2011*: sets core environmental targets to be integrated in all public procurement procedures for 11 different product groups.
Switzerland	• *Sustainable Development Strategy 2016-2019* [96] : aims at promoting full and productive employment as well as decent work. The strategy also focuses on sustainable and inclusive economic growth as well as inclusive societies, institutions, gender equality as well as promoting well-being at all ages.

90. Further information: eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52008DC0397.
91. Further information: COM (2008) 400, published on 16 July 2008: eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52008DC0400.
92. Further information: www.bmlfuw.gv.at/greentec/green-jobs/masterplan/masterplan_greenjobs.html.
93. Further information: www.nachhaltigebeschaffung.at/.
94. Further information: www.bmub.bund.de/fileadmin/Daten_BMU/Download_PDF/Produkte_und_Umwelt/nat_programm_konsum_bf.pdf.
95. Further information: www.minambiente.it/pagina/il-piano-dazione-nazionale-il-gpp-pan-gpp.
96. Further information: www.are.admin.ch/themen/nachhaltig/00262/00528/index.html?lang=en.

3.4.2 INSTRUMENTS AND MEASURES RELATED TO GREEN JOBS, ECONOMIC WELL-BEING AND CONSUMER BEHAVIOUR

Labels, certifications and awards

Environmental, energy and social labels help to create green jobs by triggering the demand for more sustainable products and services. They are an important instrument for sustainable consumer behaviour, allowing consumers to make conscious choices.

The number of labels available at the European and national level is by far too high to permit us to provide a comprehensive picture here. The following links provide overviews on the national label landscape of the Alpine countries:

The EU Ecolabel[97] was launched by the European Commission in 1992. The aim was to develop a European-wide eco-labelling scheme that consumers could trust. The label helps to identify goods and services that have a reduced environmental impact throughout their life cycle. The underlying criteria have been developed in a multi-stakeholder approach by scientists, NGOs and businesses. In September 2015, 44,711 products and services in Europe were certified with the EU Ecolabel. The largest numbers of EU Ecolabel licences were awarded in France (27%), Italy (18%), and Germany (12%).[98]

The EU organic farming logo[99] is obligatory for all organic pre-packaged food produced within the European Union.

In Germany, the website label online[100] provides a comprehensive overview on existing labels on the German market, including an evaluation. In addition, the website Kompass Nachhaltigkeit[101], initiated by the Federal Ministry for Economic Cooperation and Development, provides an overview on sustainability labels and standards for public and corporate procurers. Here as well, a critical evaluation of the standard in question allows a better orientation.

The *Kompass Nachhaltigkeit* exists also for the Swiss market[102]. Since 2001, the *Labelinfo*[103] website, run by the Pusch foundation and addressing private consumers and companies, informs about environmental and social labels and standards. Currently, information about 135 labels is provided in German and French.

As described in chapter 2.4.3, some Alpine regions have introduced ***regional brands*** to support the regional economy and reduce negative environmental impacts through transportation. This covers mainly the production and marketing of regional foodstuffs. Examples include:

In Austria, the *Genuss Region Österreich*[104] is a protected trademark owned by the Austria Marketing GesmbH and the Federal Ministry of Agriculture, Forestry, Environment and Water Management. The aim is to make the regional agricultural products and specialities visible. Consumers and tourists receive information about the offers in the specific Austrian regions, allowing them to make conscious choices. As already described in Chapter 2.4.3, the regional brand for organic food products from Tyrolean mountain farmers, *Bio vom Berg*[105], offers about 80 different regional and high quality products.

In the German Alpine region Allgäu, the regional organic brand *Von Hier*[106] labels organically grown food that is produced within a maximum distance of 100 km from the city of Kempten, where the company that owns the brand is situated.

In Switzerland, similar initiatives exist, such as a label created by the Swiss supermarket cooperative Migros called *Aus der Region. Für die Region*[107]. The label was created as a reaction to the various food scandals in the late 1990's and is now

97. *Further information: www.ecolabel.eu.*
98. *ec.europa.eu/environment/ecolabel/facts-and-figures.html.*
99. *Further information: ec.europa.eu/agriculture/organic/.*
100. *Further information: www.label-online.de.*
101. *Further information: www.kompass-nachhaltigkeit.de.*
102. *Further information: www.kompass-nachhaltigkeit.ch/.*
103. *Further information: www.labelinfo.ch.*
104. *Further information: www.genuss-region.at.*
105. *Further information: www.biovomberg.at.*
106. *Further information: www.feneberg.de/marken/vonhier/.*
107. *Further information: aus-der-region.migros.ch/aus-der-region/de.html.*

one of the most popular and well-known labels in Switzerland. Coop, the second biggest supermarket has created a similar label called *ProMontagna*[108]. ProMontagna labels high quality food products stemming from mountainous areas, conserving workplaces in the mountains. The Alpinavera[109] association markets Alpine, mountain and regional food products in the cantons Graubünden, Uri, Glarus and Tessin. A minimum of 80% of the ingredients must come from the region for the product to receive the label.

For a few years, local authorities in Austria, Germany, France, Italy and Switzerland have had the possibility to apply for certification as a ***Fair Trade Town***[110]. Fair Trade Town is any community in which people and organisations use their everyday choices to increase sales of Fair Trade products and bring about positive change for farmers and workers in countries of the global south.

Sustainable Procurement

The enormous purchasing power of public authorities makes sustainable public procurement a powerful instrument for creating green jobs and for sustainable production and consumption patterns. To achieve sustainable procurement, local authorities should strive to get the necessary political support from local bodies, develop a strategy or action plan containing priority action fields and set targets for sustainable procurement.

Supporting instruments include:

- The Green Public Procurement Initiative of the European Commission supports public authorities in their efforts to reduce environmental impact through their purchasing practices by providing legal advice, green procurement criteria, good practice examples and tools for life cycle and cost analyses. Member States are encouraged to create National Action Plans for Green Public Procurement.[111] As of November 2014, all Alpine countries who are EU members adopted such an Action Plan or an equivalent document.[112]
- At the transnational level, ICLEI's ***Sustainable Procurement Campaign Procura+***[113] provides a frame to sustainable procurement activities at the local level, including procurement criteria on the most relevant product groups. Within the Alpine Convention area, only the city of Zurich is a member of Procura+.

There are also national initiatives in the Alpine countries to encourage and support sustainable procurement. In Austria, the website of the national action plan for sustainable procurement[114] provides advice, good practice examples and procurement criteria for a number of product groups. In Germany, the competence centre for sustainable procurement (Kompetenzstelle für nachhaltige Beschaffung[115], run by the Procurement Agency of the Federal Ministry of the Interior provides support for local authorities and other public procurers to integrate sustainability aspects into public purchasing processes.

Corporate accountability and CSR

The Economy for the Common Good movement was presented in chapter 2.4.2. The ***Common Good Balance Sheet*** is a central tool of the Economy for the Common Good (ECG) to measure the contribution of a company to the common good of a democratic society. It gives an account of the degree to which the company fulfils the five most important constitutional values of democratic states: human dignity, solidarity, sustainability, justice and democracy.

Education, training and developing skills

The Austrian climate protection initiative *klimaaktiv* sets quality standards for education and vocational training in the fields of renewable energies, energy efficiency, construction and renovation and sustainable mobility.

108. Further information: www.coop.ch/de/labels/pro-montagna.html.
109. Further information: www.alpinavera.ch.
110. Further information: www.fairtradetowns.org.
111. See Communication on Integrated Product Policy 2003: ec.europa.eu/environment/ipp/ippcommunication.htm.
112. Further information: ec.europa.eu/environment/gpp/action_plan_en.htm.
113. Further information: www.procuraplus.org/en/.
114. Further information: www.nachhaltigebeschaffung.at/.
115. Further information: www.nachhaltige-beschaffung.info.

In 2015, a European Social Fund (ESF) programme was initiated in Germany, entitled 'Promote vocational training for sustainable development – green key competences for climate-friendly and resource-efficient action on the job' (Europäische Sozialfonds für Deutschland 2016). For this first ESF programme in Germany with an explicit focus on environment and climate, the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety and the European Union will provide €35 million until 2020. The programme shall secure qualifications for green jobs and counter the shortage of skilled labour. There are two priority action fields, 'multidiscipline qualification for the energy-efficient refurbishment of buildings' and the 'greening of jobs'. The latter aims to provide information on green jobs and production methods by supporting work camps and road shows.

Since 2012, a Green Day[116] for environmental jobs takes place once a year on 12 September in Germany. Businesses, universities and research institutions open their doors to students from 13 to 19 years old. Since the first Green Day, more than 10,000 students have gained insight into study opportunities in protecting the environment and climate. The Federal Ministry for Environment supports the Green Day with funds from the national climate protection initiative and is implemented by the Zeitbild Foundation.

Furthermore, the Education for Resource Protection and Resource Efficiency (BilRess)[117] network was established in 2014 with support from the Federal Ministry for the Environment and the Federal Environment Agency. Founding members came from all education and training areas and include the Federal Institute for Vocational Education and Training (BIBB), the Federal Agency for Civic Education (BPB) and the German Federal Foundation for the Environment (DBU). The BilRess Network created a Roadmap resource education in cooperation with the key players in the education sector to prospectively integrate the curriculum on resource efficiency and resource conservation in all essential educational contexts. An online communication platform was established and a number of events have taken place already.

Civic engagement and participation

Sustainable consumer behaviour obviously lives from civic engagement. The ever-growing number of sharing and 'use the unused' initiatives, repair cafés and swap parties show an increasing awareness and engagement of civil society. Examples of such initiatives are also given in chapter 3.2.3. Some concrete instruments in place in the Alpine Convention area are:

- Food sharing in Kempten, Germany: food savers in the city of Kempten collect leftover food from participating shops and restaurants and distribute it to a central point for the local population, who is informed via a platform. The initiative is part of the national movement of food sharing[118].
- Application for carpooling in Slovenia: an open source application allowing drivers with spare seats to enter their journey details (origin and final destination, date and time) along with the price they want to charge for a seat. Prospective passengers then contact the driver to arrange the ride[119].

3.4.3 INSTRUMENTS AND MEASURES RELATED TO HEALTH AND HARMFUL EMISSIONS

Policies on air quality

An overview of the most relevant policies and regulations concerning ambient air quality is given in Table 3.4.3-1.

Financial instruments and market development

The new Directive 2011/76/EU (Eurovignette Directive) implements the *polluter pays* principle at least partly by possibly including external costs of air pollution of freight transport into the national toll systems. Annex IIIb Table 1 determines the maximum

116. Further information: www.greendaydeutschland.de.
117. Further information: www.bilress.de/.
118. Further information: foodsharing.de.
119. Further information: prevoz.org/about/.

Level	Policies and regulations
EU	• Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants • Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe • Directive 2011/76/EU (Eurovignette Directive) • European Union emission regulations for light-duty vehicles (Directive 98/70/EC) and for heavy-duty vehicles (Directive 2005/55/EC) • 7th Environment Action Programme of the EU 2014-2020 (EU 2013)
Germany	• Federal law on emissions (Bundesimmissionsschutzgesetz) and its regulations (1. BImSchV: Ordinance on small combustion installations, 28th BImSchV: Ordinance on emission limits for combustion engines; 39th BImSchV: Ordinance on air quality standards and emission limits) • Bavarian law on emissions (Bayerisches Immissionsschutzgesetz) • Measures are defined on local level in the framework of clean air plans, where excesses occurred
Switzerland	• Legislation on federal level which regulates harmful emissions from heating systems, industrial installations, motor vehicles, construction machines, boats and trains, quality of combustibles and heating fuels

Table 3.4.3-1 Most relevant policies and regulations on ambient air quality.

chargeable air pollution costs differentiated by EURO classes and suburban roads or interurban roads. 'The values may be multiplied by a factor of up to 2 in mountain areas to the extent that it is justified by the gradient of roads, altitude and/or temperature inversions' (2011/76/EU Annex IIIb).

However, there are also other Alpine–wide instruments under discussion, including the Alpine Crossing Exchange, the Alpine Emission trading system and Toll+. The Working Group Transport of the Alpine Convention and the Zurich Process contribute steadily to the process of a greener transport in and through the Alps.

In Germany a toll is levied on the freight transport sector for the use of federal highways and federal roads; the use of all other roads, including urban roads is free of toll. Emission classes differentiate the toll, so that external emission costs are included. There is no supplement for mountain areas. Busses and vehicles with maximum gross vehicle weight of less than 7.5 tonnes use all public roads free.

Solar and geothermal energy as renewable energy sources can play an important role to decrease the emissions of buildings. However, as the housing in many regions features relatively low energy standards compared to new buildings, a high potential to save emissions lies in modernisation and especially in heat insulation. In Germany several subsidy programmes for private and public buildings regarding heat insulation, solar or geothermal heating etc. were set up over the last years. Besides national programmes, regional or even local subsidies are also available.

Switzerland has introduced taxes: mileage-related heavy vehicle tax and the incentive tax on volatile organic compounds; moreover, the content of various types of fuel is regulated.

Swiss federal authorities have also been fostering low-emission methods in livestock farming. The Agricultural Policy for 2014-2017 includes relevant incentives, which should culminate in reducing ammonia levels.

Green technology and innovation

As the transport sector contributes significantly to air pollution, many measures target a decrease in emissions. Not only technical solutions are in demand - they have been taken for years, as the emission standards of vehicles have decreased continuously - but also infrastructural (e.g. tunnels) and organisational measures are on track. Initiatives to shift freight transport from road to rail are widespread in the Alps and some projects of the Alpine Space programme were dedicated to that issue (e.g. AlpFrail, Transitecs).

Civic engagement and participation

Reducing the use of private cars will decrease air pollution from the transport sector. Such measures are often initiated by civil society (e.g. car sharing and citizen-buses) or by regional authorities responsible for public transport (e.g. on-demand services or shuttles for special user groups such as hikers). In every Alpine country, various options exist for car sharing and car-pooling.

One example is *Mobility Carsharing* in Switzerland, founded in 1997. *Mobility Carsharing* provides its 120,300 customers with some 2,700 vehicles in nine different vehicle categories at 1,400 stations throughout Switzerland round-the-clock. The main customer argument in favour of using the Mobility fleet is the convenient self-service, the central and non-central stations, the efficiency of multi-modal mobility and the option to use the vehicles round-the-clock at short notice and for short periods. During the last years, *Mobility* has steadily grown in its number of locations, vehicles and customers. The cooperative's financial situation is both solid and positive.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

The Alpine Convention area is characterised by the specific ecological conditions of a high mountain range. This means that its climate conditions, soil, water, household, biodiversity and space availability make this area more vulnerable than lowland areas. Stakeholders and decision makers as well as communities hold a responsibility to preserve the Alpine area in terms of its high biodiversity, natural and cultural landscapes, and delivery of ecosystem services as well as a living space for its residents and an economic region.

The area covered by the Alpine Convention is exposed to global challenges such as climate change, demographic change, loss of biodiversity or global economic competition. These challenges cannot be answered sustainably by single solutions but require a great transformation of the patterns of production and consumption within the regional carrying capacity and planetary boundaries, while considering human well-being, social inclusion and economic welfare.

In this report, a Green Economy is described as low-carbon, energy and resource-efficient, considering natural capital and ecosystem services and supporting quality of life and human well-being. Some visions for such a future development in the Alps already exist, as presented in initiatives such as *Renewable Alps*, *CO_2-Neutral Alps*, the *2000-Watt Society* or *Zero-Land-Take*. These could serve as examples for an Alpine development and feed into the development of a Green Alpine Economy.
Such a transformation of the economy will be relevant for all economic sectors, including agriculture, energy, transport, construction, tourism, industry and production and also private households.

Based on the conclusions of the individual chapters of this report, the following overall conclusions on the development of a Green Economy in the Alps are synthesised. They follow a horizontal viewpoint and are structured in line with their relevance for greening the economy.

Regional economic development

Regional economic cycles are an important contribution to and offer opportunities for a Green Economy. The sustainable production of regional products can take advantage of endogenous natural capital. Examples for regional capital are wood from mountain forests, dairy products from Alpine pastures but also sites of natural beauty and landscape amenities. Using this regional capital appropriately requires taking stock of sustainably usable natural capital and ecosystem services at the regional level. For the time being, a systematic assessment of the stock has not yet been carried out in the Alpine area. The production of regional goods and services can take advantage of regional traditional skills, valuing them at the same time. The use of regional currencies may support the development of regional economic cycles. Regional products are appreciated by consumers, and there is a strong identification of the Alpine population with their region.

Relevant actors for a development of regional economies are regional and local authorities supporting the economic interrelations, local and regional businesses investing in their region, and residents, tourists and other consumers consciously selecting regional products for their consumption. Moreover, external investment may also support regional economic development in the Alps on a sustainable basis.

Innovation as an economic trigger and a key to more sustainability

Present and future challenges, particularly climate change, the transition to renewable energy sources, demographic change and growing mobility needs, put pressure on the economy. At the same time, they are opportunities for change and innovation.

There is a clear need for further reduction of greenhouse gas emissions and for adaptation to the unavoidable effects of climate change. Social innovation, technical innovation and innovative business models for production and transport means are required to bring about this reduction.

The use of regional renewable energies opens the door to reducing dependency on fossil fuels as it fosters innovation and reduces GHG emissions. The Alpine area offers a high potential of regional renewable energies, in particular energy from a sustainable and environmentally friendly use of biomass and hydropower. Moreover, there is a high potential for other renewable energy technologies such as solar and wind.

Storage of renewable energies but also the restructuring and upgrading of power grids can help to integrate decentralized renewable energy production and to allow a flexible reaction to energy demand and supply. Innovative approaches are needed for both. They are important for developing an energy supply based on renewable energies. Additionally, to create an innovative energy grid, existing energy infrastructure such as power or hydropower plants can be used or retrofitted.

Such innovative solutions not only support environmental goals such as emission reduction and decoupling but also contribute significantly to the competitiveness and sustainability of enterprises and regions and foster regional economies.

Cost-effective and efficient economy

In terms of water use, land take, and loss of productive soils, the current practice in the Alpine area needs to significantly improve to ensure an efficient use of resources.

There are numerous opportunities to increase energy and resource efficiency in the Alps and to generate both economic and ecological benefits. Resource and energy efficiency do not only reduce material and energy input – they also save costs in the long run, increasing the competitiveness of enterprises, municipalities and regions. For example, sustainable production with a lower resource and energy input with subsequent lower waste production, creates cost benefits for enterprises. The use of regionally sourced material instead of imports can save costs while supporting the regional economy. Wood, as a renewable resource available in many parts of the Alps, can substitute other, more energy-consuming and non-renewable materials for construction. It also offers opportunities for innovative products and regional economic development.

Costs avoided are an economic benefit. Society will save costs if environmental damages, such as negative health effects through air pollution, damages by natural hazards and loss of productive soils through land take, can be prevented by precautionary action. In addition, the mitigation of GHG emissions and the adaptation to climate change can prevent costs which otherwise may arise through future climate change impacts.

A truly cost-effective economy will have to change to a holistic approach to include external and often hidden costs, such as health impacts, loss of landscape amenities and ecosystem services. Instruments are also required to stimulate economic activities with positive externalities such as payments for ecosystem services. Moreover, the phasing out of environmentally harmful subsidies is indispensable to avoid detrimental effects on the environment. The savings from the reduction of environmentally harmful subsidies can be used to promote green investments. Where necessary, supporting measures to reduce negative social impacts by the phasing out should also be financed by savings from subsidy cuts.

Competitiveness of a Green Economy

Cost-effective and innovative enterprises are increasing their competitiveness by producing at lower costs and offering better products and services. Responding to future challenges and adopting more sustainable production patterns can thus represent an economic opportunity for them.

The use of the natural endogenous potential of regions such as the natural capital, available knowledge and skills of the residents may also increase the competitive edge of enterprises and regions.

Benefits from a Green Economy also include the improvement of enterprises' sustainability performance and image when reducing environmental impacts. Certifications of environmental management systems such as EMAS or ISO 14001 are a suitable instrument for communicating engagement. Different labels for agricultural, forestry and food products can make the green transformation visible and can be used for marketing purposes. This is a relevant issue particularly for farms, food and tourism enterprises and tourism municipalities in order to meet the expectations of their customers and consumers.

Positive employment effects through green jobs

A Green Economy has positive effects on the job market and can offer a wide variety of new jobs or reshape existing jobs. Potentials for such jobs lie in particular in the construction, energy, transport, tourism, forestry, agriculture and industrial sectors. Tasks comprise the design and planning of energy-efficient new buildings, power plants and grids, machinery, renovation of existing buildings, and exchange of heating systems, repowering of existing infrastructures and production of renewable insulation material, etc. Also nature-related jobs can be developed within integrative green and regional economic concepts such as management, customer and park service or monitoring jobs in national parks and other protected areas. As a third field, traditional skills might be used for the development of innovative products.

When using regional resources these jobs will be created at the regional level and strengthen the regional economy. In some cases, qualification measures will be needed to ease and support the transition from conventional to green jobs.

Cooperation for an Alpine Green Economy

The development of a Green Economy requires an overarching cooperation between the different actors in the Alpine Convention area. Enterprises and entrepreneurs are the main actors to initiate new types of businesses and implement ideas. However, they need support. SMEs in particular often do not have the capacity to bring innovative ideas to the markets.

Public authorities need to put in place appropriate policies and structures to pave the way for innovation, particularly for small and niche businesses. This could be done by lowering administrative burdens, by financially supporting promising ideas and by raising awareness among consumers. There is also a strong need for continuity in framework conditions (e.g. green stimulus packages), which offer enterprises a reliable and long-term foundation for their development and investments.

Furthermore, new forms of cooperation among citizens, public authorities and regional enterprises can support new sustainable initiatives to enter green markets. Civic engagement is reactivating community life and can promote the regional economy and governance.

Well-being of residents

A Green Economy also contributes to the well-being of the residents in various ways. For example, innovation and efficiency effects in agriculture, transport, energy or industry can further reduce harmful emissions such as PM10 and ozone and thus increase the health and well-being of residents.

Residents benefit from more efficient technologies through cost savings for energy and resources, which contribute to their personal economic welfare.

The development of new green jobs creates employment and offers sustainable and often stable opportunities for personal income. As mentioned in the section on green jobs, job development may also contribute to the well-being of residents.

Consumption of regional sustainable products or services establishes a relationship to the home region and offers an opportunity for personal interrelations between producers, service providers, sales people and consumers.

Data and monitoring of an Alpine economy

For the Alpine Convention area, only little data are at hand to describe the present status and the transformation towards a Green Economy. However, steering and reshaping the economy in the Alps requires taking stock of existing structures and reporting on progress towards new objectives.

In particular, data for the Alpine Convention area and regional data are not available for many aspects of a Green Economy such as resource efficiency, waste management, natural capital and ecosystem services.

Data provision and monitoring of relevant indicators is a task for regional authorities. They are the actors that need to collect and provide data or support the processing of existing data on a regional level.

Long-term goals and strategies for a Green Alpine Economy

Finally, the development of a Green Alpine Economy requires long-term goals, clear objectives and scenarios of how such a sustainable economy could be implemented in the different branches and sectors. For these long-term goals, new concepts such as those of natural capital, and ecosystem services can deliver adequate approaches and methodologies.

Based on these objectives, approaches and methodologies, concrete regional long-term strategies for an economic transition can be developed. This includes establishing governance strategies, addressing actors and stakeholders, selecting supporting instruments and measures, and taking appropriate action.

4.2 RECOMMENDATIONS FOR A GREEN ECONOMY IN THE ALPS

The Alpine area is a unique territory with outstanding nature and landscapes and impressive cultural diversity. The sixth Report on the State of the Alps (RSA) describes the status of Green Economy approaches by presenting selected topics and indicators. Several opportunities for the development of a Green Economy in the Alpine area have been identified based on this analysis. Despite some progress, there is a strong need to strengthen the efforts to fully integrate environmental and social aspects into economic policies.

The sustainable development of the Alpine Convention area depends on the implementation of comprehensive measures on an EU, national, regional and local level. To promote a Green Economy, a further evolution of the existing regulatory and economic framework is needed. The coherent objective is to avoid environmental damage by internalising external costs of environmental pollution, phasing out environmentally harmful subsidies, ensuring sustainable resource consumption and conserving the natural capital. Where necessary, supporting measures to reduce negative social impacts of the phasing-out and internalisation should be implemented. They could be financed e.g. by saved subsidies. To constantly improve the quality of life and health as well as to enhance social inclusion, policies and instruments need to strongly encourage sustainable production and consumption patterns.

In a nutshell, the long-term goal for the Alpine Convention area is a shift towards a Green Economy, which considers and respects the environmental limits of the Alpine area, takes into account global challenges like climate change and limited natural resources, and supports the quality of life and well-being of its residents. This Green Economy needs to be specified by objectives on greenhouse gas reduction. It requires the adoption of an integrated approach that tackles the mitigation of and adaptation to climate change, ensures energy and resource efficiency and preserves and continuously improves natural capital, ecosystem services and biodiversity. These objectives need to be transferred into long-term economic strategies to establish a framework for a Green Economy.

The following recommendations are based on the conclusions of the sixth Report on the State of the Alps "Greening the economy in the Alpine region":

1. *Use Green Economy as an engine for regional development.*
   - The Alpine Convention area is rich in natural and cultural resources and energy sources. They offer the economic basis for regional economic development. For a sustainable management of these resources, the region's natural and cultural capital has to be assessed and taken into account.
   - Green innovative businesses and start-ups need to be promoted on a regional level to facilitate eco-innovation for technological and non-technological solutions.
   - The Green Economy approach should be integrated into regional strategies, e.g. by developing concepts for sustainable agriculture, forestry, energy, tourism or transport.

2. *Use climate and energy challenges to trigger eco-innovation.*
   - Increasing efforts of the Alpine countries for greenhouse gases mitigation measures and a decoupling of GHG emission and production are needed. Energy saving, the development of low emission production, transport and energy are core components of a Green Economy. The Alpine region should aim towards an ideal goal of overall climate neutrality.
   - The expansion of renewable energy production capacities, especially – where appropriate – the sustainable and environmentally friendly use of biomass and hydropower and high potential technologies such as solar and wind energy should be encouraged in accordance with nature conservation concerns and sustainable land use. Encouragement and innovation is needed also for the development of energy storage and smart power grids.
   - Consistent implementation of innovative, low-carbon and energy-efficient technologies, in particular in the sectors of transport, energy generation, construction industry, tourism and agriculture, is needed.

3. *Consider ecosystems and biodiversity as an economic asset in the Alpine area.*
   - Policies and programmes should respect and incorporate the value of landscapes, natural capital, ecosystem services and biodiversity, also in an economic sense. This is of particular importance as the Alpine area is a European hotspot for habitat and species diversity.
   - The benefits of innovative concepts such as natural and cultural capital and ecosystem services need to be introduced and explained to decision makers. Research must be supported and a common approach on how to assess, monitor and value Alpine ecosystem services must be developed.
   - External costs need to be incorporated into the market prices using innovative concepts and instruments. Examples are green accounting on a national, regional and local level or schemes for payments for ecosystem services. The latter could for example include services produced by agriculture and forestry businesses for society as a whole.

4. *Take steps to turn the Alpine area into a resource-efficient, circular and cost-effective economy.*
   - Resource efficiency needs to be improved, particularly in terms of water use, energy, material, land take and loss of productive soils. Moreover, possible measures and instruments in these fields should be promoted. These include smart energy-efficiency networks, consulting programmes and voluntary schemes for enterprises. Policies and programmes on resource efficiency should stress that efforts in this field lead to cost savings and thus create economic benefits.
   - In terms of efficiency, the use of regionally available, renewable resources such as wood should be considered to substitute non-renewable resources.
   - Land take decisions should be based upon an integrated consideration of land use objectives and the protection of environmental and cultural heritage steered by existing and innovative spatial planning and land management instruments. Spatial planning and urban planning should reduce land take and loss of soils by applying efficient land management focusing on inner urban development, reusing brownfields, performing cost benefit and environmental impact assessments and reassuring that there is an actual demand before developing the land. The regional responsibility and co-operation across the boundaries of local communities for resource-conserving land management is to be strengthened.

5. *Use Green Economy to support the competitiveness of the Alpine Convention area.*
   - Anticipating future challenges and developing a Green Economy represent an economic opportunity for enterprises and regions.
   - Enterprises should be encouraged to use a comprehensive environmental management instrument that includes all environmental aspects, such as EMAS and ISO 14001. Energy efficiency aspects may also be addressed by applying energy management systems like ISO 50001. In addition, the use of instruments such as credible sustainability labels should be encouraged. Furthermore, consolidated methodologies such as Life Cycle Assessment (LCA) should be promoted by taking into consideration the on-going efforts on an EU level (Product Environmental Footprint - PEF).

6. *Use opportunities for the creation of green jobs.*
   - The transition to a Green Economy offers a wide range of opportunities for positive employment effects in the Alpine area by creating new green jobs and strengthening regional development. This should be supported by appropriate policies.
   - Such policies should include the support of innovation in small and medium-sized businesses, the creation of networking structures among all stakeholders of a Green Economy, the promotion of sustainable investments and the setting of incentives to stimulate the demand for environmentally friendly products, technologies and services at the private and public level.

- Appropriate training and education measures for the present and future workforce should be implemented to develop the green skills that are needed for future jobs and to satisfy the needs of a Green Economy in terms of job qualifications.
- Potentials for green jobs and employment lie in particular in the construction, energy, transport, tourism, industrial and service sectors. Therefore, sector-specific strategies should be developed to tap into these potentials.

7. *Improve the quality of life and well-being of Alpine residents through a Green Economy.*
   - Through innovation and efficiency gains in agriculture, transport, energy and industry, harmful emissions should be further reduced and the health and well-being of residents improved. Subsequently, the negative economic impacts of emissions can be reduced.
   - Progress in energy and resource efficiency should also result in cost benefits for residents.
   - The evolution of the job market towards green jobs should offer new opportunities of economic well-being and trigger a more socially inclusive development.
   - The promotion of regional sustainable products should be fostered. Their consumption can contribute to the well-being of residents while supporting regional producers and economies.

8. *Improve data availability and monitoring.*
   - The data and good practice examples collected in the framework of the Report on the State of the Alps will be accessible to interested stakeholders.
   - Relevant and comparable data and indicators for measuring Green Economy will have to be made increasingly available and regularly updated at a regional level in synergy with the System for the Observation and Information on the Alps (SOIA) of the Alpine Convention and existing international indicators. In particular, this is needed to evaluate achievements in terms of carbon reduction, installed capacity of renewable energy, improvements of energy and resource efficiency, regional green jobs as well as new indicators beyond GDP.
   - A knowledge pool for a Green Economy in the Alpine area should be created and maintained, as this is an essential step for the promotion of this concept. In this respect, the Permanent Secretariat of the Alpine Convention plays a key role.

9. *Prepare a comprehensive and ambitious Action Programme for a Green Economy in the Alpine area by 2018.*
   - This action programme should further elaborate the above recommendations and identify specific fields of actions and the relevant actors.
   - The development of such an action programme should involve all relevant stakeholders in the Alpine Convention area, particularly businesses, municipalities and towns, NGOs and the civil society.

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6. ANNEX

6.1 GLOSSARY

Adaptation
Adaptation are those objectives and measures directed at anticipating the adverse effects of climate change and preventing or minimizing the damage they cause (PSAC 2011, p. 32-33).

Annual felling
These are the average standing volume of all trees, living or dead, measured over bark to minimum diameter of 0 cm (diameter at breast height) that are felled during the given reference period, including the volume of trees or parts of trees that are not removed from the forest, other wooded land or other felling site. This includes silvicultural and pre-commercial thinnings and cleanings left in the forest; and natural losses that are recovered (harvested) (EEA 2010b).

Artificial surfaces
All land use classes within "artificial surfaces" in the CORINE land cover nomenclature.

Background station
'Station to monitor background concentration levels of air polluting substances that are significant for a given region or for the globe as a whole. Regional stations are located far enough away from industry and urban areas in order not to pick up day-by-day fluctuations in pollution levels. The purpose is to measure long-term changes in the composition of the atmosphere' (EEA undated). For more information about types of stations, cf. 2001/752/EC Annex II.

Biodiversity products
In the Alpine space, biodiversity is one main reason for nature experience as a basis for ecotourism. With biodiversity products, we refer to specific products or services that are support ecotourism.

Biological diversity
Biological diversity (biodiversity) means the multiplicity of life on earth. It ensures the variety of living organisms drawn from ecological complexes and includes the following three levels: (1) the diversity of ecosystems as well as cohabitations, habitats and landscapes (2) the diversity of species as well as (3) the genetic diversity within the different species. This is different from ecosystem services, which are generated with the help of biodiversity (cf. Chapter 2.3.2).

Carbon fiscal measures
Carbon fiscal measures are instruments such as tax instruments and subsidies levied on goods directly or indirectly linked to polluting activities (Kosonen & Nicodème 2009).

Decoupling
Decoupling can take several forms:
- Relative decoupling is achieved when an environmental pressure (e.g. resource use or emissions) grows more slowly than the related economic activity (e.g. sectoral gross value added (GVA) or national GDP).
- Absolute decoupling is achieved when an environmental pressure remains stable or decreases while economic activity increases.
- Impact decoupling is achieved when environmental impacts decline relative to resource use and economic activity (EEA, 2015b, p. 2).

Domestic Material Consumption (DMC)
'DMC measures the total amount of materials (in tonnes) used by an economy. It is defined as the annual quantity of raw materials extracted from the domestic territory, plus all physical imports and minus all physical exports. The DMC indicator assesses the absolute level of the use of resources. It allows differentiating consumption driven by domestic demand from that driven by the export market. DMC does not include upstream 'hidden' flows related to imports and exports of raw materials and products' (Eurostat, 2015a).

'Domestic material consumption (DMC) is often used as a proxy for the environmental pressures of resource use. DMC measures resources directly consumed within a national economy, with an understanding that eventually each tonne of material entering an economy will come out as waste or emissions. However, such a mass-based approach does not address the large differences in environmental impacts between different materials' (EEA 2010d, p.79).

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

Ecotourism
Ecotourism is defined as responsible travel to natural areas that conserves the environment and improves the well-being of local people. It is practised in relatively undisturbed natural areas, for the main purpose of admiring and learning more about them (BfN 2015). It is a sustainable form of tourism in sensitive areas that also contributes to financing nature conservation (GTZ 2001).

Emissions Trading Scheme
In the EU Emissions Trading Scheme, the sectors considered are heavy energy-consuming installations in power generation, manufacturing industry and aircraft operators performing aviation activities.

Finite resources
A resource that does not renew itself at a sufficient rate for sustainable economic extraction in human time frames.

Hemeroby
The degree of human influence on the natural environment.

Land take
Defined here as the area of land that is converted into settlements, economic sites and transport infrastructures. The EEA defines land take as 'The area of land that is 'taken' by infrastructure itself and other facilities that necessarily go along with the infrastructure, such as filling stations on roads and railway stations' (EEA, undated).

Mitigation
Mitigation refers to measures that seek to avoid, reduce or delay global warming by reducing GHG emissions (PSAC 2011, p. 32-33).

Natural capital
According to the EEA (2015f) a nation´s wealth is grounded in four core stocks of capital: manufactured capital (e.g. machines and buildings), human capital (e.g. people, their skills and knowledge), social capital (e.g. trust, norms and institutions) and natural capital. Natural capital is the most fundamental of the forms of capital since it provides the basic conditions for the other kinds of capital and enables human existence, delivering food, clean water and air, and essential resources. It sets the ecological limits for our socioeconomic systems, which require continuous flows of material inputs and ecosystem services.

The OECD (2001) defines natural capital as the world's stocks of natural assets which include geology, soil, air, water and all living things (World Forum on Natural Capital), providing natural resource inputs and environmental services for economic production. Natural capital is generally considered to comprise three principal categories: natural resource stocks, land and ecosystems. All are essential to the long-term sustainability of development of the economy. They provide 'functions' to the economy, as well as to mankind outside the economy and to other living beings.

Natural capital comprises two major components: 1) abiotic natural capital including subsoil assets (e.g. fossil fuels, minerals, metals) and abiotic flows such as wind and solar energy as well as 2) biotic natural capital of ecosystem capital that consists of ecosystems delivering a wide range of valuable services essential for human well-being.

Nature tourism
Nature tourism simply describes travel to natural places. Nature tourism uses nature as background scenery for multiple activities, especially sports e.g. diving, climbing, air sports, survival, expedition and adventure tourism. The goal of protecting or maintaining nature is not necessarily implied. This is why there is severe criticism to this form of tourism as commercialisation of nature (BfN 2015).

Net annual increment of forests
This indicates the average annual volume over a given reference period of gross increment minus that of natural losses on all trees to a minimum diameter of 0 cm (diameter at breast height) (EEA 2010b).

NUTS
Abbreviation for 'Nomenclature des unités territoriales statistiques'. A single, coherent system for dividing up the EU's territory in order to produce regional statistics for the Community (EUROSTAT 2016c).

Opportunity cost
An opportunity cost represents the benefits of an alternative given up when a decision is made.

Permanent Settlement Area (PSA)
The term refers to the area suitable for permanent settlement and agricultural use in the Alps. This area is limited mainly due to topographic and climate conditions, but different definitions exist in Alpine countries. An Alpine-wide standardised calculation was carried out by Tappeiner et al. (2008) considering settlement areas plus intensively used agricultural areas. Based on this about 17.3% of the total area is available for permanent settlement.

Primary PM
Primary particulate matter (PM) is directly emitted into the atmosphere, while secondary PM results from precursors that are transformed into particles by chemical reactions.

Primary raw materials
A primary raw material is a natural inorganic or organic substance, such as metallic ores, industrial minerals, construction materials or energy fuels, used for the first time. This may include previously unexploited raw materials from formerly abandoned mines. The scope of this work excludes agriculturally derived substances and energy reserves and resources. (Definition adapted from the INSPIRE Directive (EC 2007).

Purchasing Power Standard (PPS)
Purchasing Power Standard (PPS) is an artificial currency unit. Eurostat uses it as the common currency to express which national account aggregates are adjusted for price level differences.

Raw material consumption (RMC)
'RMC is defined as the annual quantity of raw materials extracted from domestic territory, plus all physical imports and minus all physical exports (both expressed as raw material equivalents)' (EUROSTAT 2016b).

Resource efficiency
Resource efficiency is a more holistic concept, aimed at the 'increase (of) prosperity without increasing resource use and environmental impacts' (EEA 2013d). Prosperity includes economic prosperity, but also social factors such as health, education, welfare as well as ecological factors. While resources in the concept of *resource productivity* are only materials in a stricter sense, resources in this concept include fertile soils, biodiversity, clean air and other ecosystem services, which contribute to human well-being.

Resource productivity
'Resource productivity relates domestic material consumption to economic activity (GDP). It provides insights into whether decoupling between the use of natural resources and economic growth is taking place. Resource productivity (GDP/DMC) is an EU sustainable development indicator for policy evaluation.

The simple weight of traded goods fails to take account of the raw materials used to produce those goods. To obtain a more comprehensive picture of the 'material footprints', traded goods can be converted into their raw material equivalents (RME), i.e. amounts of domestic extraction required to provide the traded goods concerned' (EUROSTAT 2016d).

Secondary raw material
'Waste materials that have been identified for their potential for recycling or reprocessing to generate raw materials (potentially displacing the use of primary materials), for example: mining wastes, manufacturing and processing waste, including scrap, and contents of landfill.

For the purposes of this work, only the long-lived, accumulated and hence permanently geo-located sources have been considered, namely mining and landfill wastes' (EC 2016d).

Social Innovation
Social innovations are novel concepts, practices and ideas that are developed and implemented to meet needs in different aspects of society. They support and strengthen civil society and provide value to society rather than to private individuals. Social innovations are often linked to interaction of people. Examples of social innovations are sharing initiatives, microcredits or fair trade.

SOMO35
SOMO35 is the Sum of Ozone Means over 35 ppb and the new indicator for health impact assessment recommended by WHO. It is defined as the yearly sum of the daily maximum of 8-hour running average over 35 ppb. For each day, the maximum of the running 8-hours average for O_3 is selected and the values over 35 ppb are summed over the whole year (EMEP 2016).

Sustainable land use
The term means to use the resource land for human interests, but in a way, which ensures the maintenance of ecological and socio-economic functions for now and all future generations. Sustainable land use is a holistic concept including all aspects, such as maintaining structural diversity of land, sustainable agricultural practices excluding soil degradation, avoiding land take etc.

Water abstraction
Water removed from any fresh water source, either permanently or temporarily. Mine water and drainage water as well as water abstractions from precipitation are included, whereas water used for hydroelectricity generation (in situ use) is excluded.

Water exploitation index (WEI)
The WEI is the mean annual total demand for freshwater in a country divided by the long-term average freshwater resources. 'Water abstraction as a percentage of the freshwater resource provides a good picture, at the national level, of the pressures on resources in a simple manner that is easy to understand, and shows trends over time. […] The warning threshold, which distinguishes a non-stressed from a water scarce region, is around 20%, with severe scarcity occurring where the WEI exceeds 40%' (EEA 2010d, p. 82).

Well-to-wheel
Well-to-wheel is the specific life cycle assessment used for transport fuels and vehicles.

6.2 FURTHER POLICIES AND REGULATIONS

6.2.1 CARBON EMISSIONS

Austria
Austria has implemented environmental policy instruments and measures such as laws, subsidies and initiatives for reducing energy-related emissions. Since Austria joined the European Union in 1995, the country's energy efficiency policy is based primarily on EU policy. The Austrian government is supporting efficiency improvements through research and funding programs in all sectors of the economy.

France
The SNBC will help to raise both public and private funding for the energy transition. An 'energy transition for climate' label will help identify investment funds that are funding the Green Economy, promote the creation of new green funds and encourage businesses to highlight the green aspects of their operations. The SNBC targets for the following sectors are:

- In the **transport** sector, the SNBC aims to achieve a 29% reduction in emissions over the 2015-2028 period, notably by improving the energy efficiency of vehicles consuming 2 litres per 100 km and developing clean vehicles (electric cars, biofuels, etc.).
- In **construction**, the SNBC aims to achieve an emissions reduction of nearly 54%, by rolling out ultra-low energy and energy-plus buildings, accelerating energy renovation work, implementing the concept of eco-design and using smart meters to manage consumption.

- In **agriculture**, the SNBC aims to achieve a 12% reduction in emissions through implementing the agroecology project. This will involve methanation, which means the synthesis of CH4 (Manahan 2006), ground cover, maintaining pastureland, developing the agroforestry sector and optimising the use of inputs.
- In the **industrial** sector, the SNBC aims to achieve a 24% emissions reduction, notably by improving energy efficiency, which is also a source of competitiveness, enlarging the circular economy (reuse, recycling, energy recovery, etc.) and replacing fossil fuels with renewable energy sources.
- In the **waste management** sector, the SNBC aims to achieve a 33% reduction in emissions, by reducing food waste, developing the concept of eco-design, fighting planned obsolescence, promoting reuse and improving waste recovery efforts (Gouvernement France 2015).

Germany

The German Integrated Energy and Climate Package (IECP) (BMU 2007b) has defined measures for a low-carbon economy. The Energy Concept (2010) presents a strategy towards 2050 including targeting the reduction of GHG, the increase in renewable energies and energy efficiency. The IECP and the Energy Concept describes (1) legally binding frame for a clear perspective and conditions for reaching the targets, (2) funding schemes, (3) feed-in tariffs, (4) information on creating savings and win-win situations, as well as (5) monitoring of implementation.

Liechtenstein

Liechtenstein's main legislative and administrative arrangements towards low carbon economy are to be found in the Emissions Trading Act, the CO_2 Act and the Environmental Protection Act (RDR 2008).

The Emissions Trading Act (EHG) (RDR 2012) sets up the general framework to fulfil Liechtenstein's reduction obligations originating from the respective ratifications of the Kyoto Protocol. The CO_2 Act – in force since 2008 – introduces a levy on the consumption of fossil fuel. It is part of 'The Bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on Environmental Levies within the Principality of Liechtenstein'. Due to the CO_2 Act, from 2014 on Liechtenstein will levy CHF 60 per ton CO_2, which corresponds to around Rp 16 per litre heating oil (until 2013 it was CHF 36 per ton CO_2, which corresponded to around Rp 10 per litre oil). Approximately 2/3 of the total CO_2 levy revenues from 2014 are earmarked for environmental purposes, thus strengthening the financial capabilities of the Government with respect to future measures within the national climate change framework.

The *Environmental Protection Act* (2008) summarized a set of individual legislative measures in order to streamline procedures within environmental law. With respect to climate and air quality related measures (see Air Quality Ordinance, Luftreinhalteverordnung) the Act builds the legal basis for emission limits, for example combustion installation within industry and households. It also provides the legal basis for the 'Air Action Plan' a measure effective since 2007 to reduce all kinds of emissions. The Air Action Plan itself, however, is not legally binding but provides proposals that have to be considered for future decisions by the government.

Liechtenstein's *Climate Strategy* will be revised in the course of 2015/2016. It requires an interdisciplinary coordination of the targeted areas. The focus will be on the coordination of climate relevant measures within Liechtenstein´s energy policy, transport policy, environmental policy, agricultural and forestry policy. In addition, the relevant CO_2 Act will be revised in the course of 2016/2017 to reflect the targets for 2030 (40% of GHG reduction compared to 1990 levels).

The bilateral Agreement between the Principality of Liechtenstein and the Swiss Confederation on Environmental Levies within the Principality of Liechtenstein was concluded in 2010. The agreement enables Liechtenstein to implement several environmental Swiss levies into national law while using the existing infrastructure of the Swiss authorities to execute the respective national laws. The environmental levies are:

- Act on tax for the rehabilitating contaminated sites (ASAG).
- Act on incentive tax on petrol and diesel oil with a sulphur content of more than 0.001 percent (BDSG).
- Act on incentive tax on extra light heating oil with a sulphur content of more than 0.1 percent (HELG).
- Act on incentive tax on volatile organic compounds (VOCG).
- CO_2 Act.

Environmental levies on pollutants serve to internalise external costs and to reduce the costs of pollution to society by increasing the proportion paid by polluters themselves.

In accordance with the new centralised allocation of the revised EU ETS scheme, Liechtenstein submitted its *National Implementation Measures* (NIM) in 2011.[120] The EFTA Surveillance Authority accepted Liechtenstein's NIMs in July 2013. Due to the new regulations, only one of the two installations covered by the EU ETS will receive free European Union Allowances (EUA) until 2020.

Slovenia

The *Operational Programme for Reducing GHG emissions* by 2020 with a view to 2030 (OP GHG 2020), adopted by the Slovenian government in December 2014, is a plan of action to implement legally binding targets. These are to reduce GHG emissions by 2020 from the climate and energy package under Decision 406/2009/EC and a key part of the programme to transform Slovenia into a resource-efficient, greener and more competitive low-carbon economy.

Switzerland

Switzerland understands a Green Economy as one that takes into account the scarcity of limited natural resources and the regeneration capacity of renewable resources, enhances resource efficiency, and hence boosts the overall performance of the economy and quality of life[121] .

The Federal Act on the Reduction of CO_2 Emissions was introduced on 23 December 2011. It deals with technical measures to reduce CO_2 emissions in buildings and passenger cars and compensations in case of fossil fuel thermal power plants and motor fuels; it establishes Emissions Trading Scheme (ETS), as well as sets CO_2 levies.

With 1 July 2012, Switzerland introduced regulations for CO_2 emissions for cars. According to these regulations, a penalty applies to imported cars which emit more than 130 grams of CO_2 per kilometre (BFS 2011).

6.2.2 EFFICIENT USE OF ENERGY

Austria

On 9 July 2014, the Austrian Energy Efficiency Act was adopted by the National Council with the necessary constitutional majority and published in the Federal Law Gazette on 11 August 2014. The Act aims at improving energy efficiency by 20% by 2020 and thus at improving at the same time the security of supply, increasing the share of renewable sources of energy in the energy mix, as well as achieving a reduction of greenhouse gas emissions. Moreover, it provides a positive impetus for the economy – thus a gross domestic product that is €550 million higher and 6,400 new jobs in the field of energy efficiency. This Act implements the EU Directive 2012/27/EU on energy efficiency and the promotion of energy efficiency measures, closely related to it.

Key subject areas of the Austrian Energy Efficiency Act are listed here:
Energy efficiency could be increased in the course of the past few decades and the energy consumption development be decoupled from the economic development due to such measures as the Federal Energy Efficiency Act. This development is supported by the figures of the Federal Ministry of Science, Research and Economy.[122]

Italy

The 2007 Finance Act launched the Industria 2015 programme concerning energy efficiency, promoted by the Ministry of Economic Development with the aim of increasing national companies' competitiveness e.g. in the energy efficiency and renewable markets. To this end, the programme foresees new instruments such as the 'Industrial Innovation Projects' (Progetti di Innovazione Industriale – PII). The first tender was launched in March 2008 in the field of energy efficiency and has financed 30 projects in the fields of photovoltaic, bioenergy, wind, high efficiency building materials and advanced industrial technologies. The total amount of incentives is €200 million, 54% of which is to be awarded to SMEs.

120. Further information: ec.europa.eu/clima/policies/ets/allowances/index_en.htm.
121. www.bafu.admin.ch/wirtschaft/15556/15557/15558/index.html?lang=en.
122. Further information: www.bmwfw.gv.at/EnergieUndBergbau/Energieeffizienz/Documents/Kerninhalte%20des%20EEFFG%20barrierefrei.pdf.

Slovenia

In Slovenia, the following plans and strategies are the most topical concerning energy efficiency:

- Action Plan for Energy Efficiency for the period 2014–2020, adopted by the government on 21/5/2015 in accordance with the requirements of the Energy Efficiency Directive (2012/27/EU). This raises the national objective of improving the efficiency of energy use by 20% by 2020. The target is that primary energy consumption in 2020 will not exceed 7,125 million tons (82.86 TWh). This means that compared to 2012 it will not increase by more than 2%.
- Long-term strategy to promote investment in energy renovation of buildings, adopted by the government on 29/10/2015.
- Action plan for the nearly zero-energy buildings for the period up to 2020, adopted by the government on 22/4/2015.

Slovenia has not yet established a medium to long-term strategy for climate and energy covering the post-2020 period. In December 2014, the government adopted an operational programme for reducing GHG emissions by 2020, with an outlook to 2030. The 2014 Energy Act provides a legal basis for the adoption of national strategic documents that will determine the long-term trend in energy supply and use. Following the adoption of the act, an energy concept (to be adopted in 2016), and a national energy plan will be developed, to guide major investments in energy infrastructure in the future.

The measures in the action plan NEEAP 2020 are aimed at the household sector, the public sector, the economy and transport. Most of the measures constitute existing measures that are being implemented and of which the interim objectives have already been achieved. The new action plan brings to the public sector some of the new measures, since it is necessary to fulfil the obligation to renovate 3% of government buildings annually. The aim of the state is to ensure that all new buildings, which are owned and occupied by public authorities, consume almost zero energy from 2018 onwards, in other sectors from 2020. Additional measures are planned in the economy, because energy efficiency is an increasingly important factor for improving the competitiveness of the economy.

The stock of existing buildings represents the sector with the greatest potential to achieve energy savings. To achieve the objective, it will be necessary to restore a quarter of the energy by 2020, which represents around 22 million m^2 of building land. This will decrease energy use in buildings by almost 10%. Furthermore, these measures will also speed up economic growth, because they are generating investments of €500 million per year. The effects of these investments are in addition to high savings in energy costs, a consequent reduction in energy imports in the workplace and approximately 10,000 jobs.
The necessary funds are to be provided to implement existing and new measures efficiently; namely, funds programmed for the efficient use of energy resources, investment priorities in cohesion funds and climate funds.

Switzerland

The Swiss Federal Office of Energy (SFOE) is responsible for several ongoing strategies and projects regarding energy efficiency. This is one of the most important actions to reduce energy consumption without incurring losses in terms of quality and comfort. A higher level of energy efficiency means consuming less energy while maintaining the benefits we are used to (e.g. availability of lighting, heating, electric motors). Increased energy efficiency not only uses fewer resources but also leads to a reduction of greenhouse gas emissions associated with energy consumption.

In terms of an energy-efficient economy, the following two national programmes are the most relevant.

1. The Swiss Federal Office of Energy has set up a programme named EnergieSchweiz which is active in the domains of energy efficiency and renewable energies. EnergieSchweiz is an information platform as well as a funding programme.
2. The Swiss Federal Office of Energy created the Energy in Buildings research programme in order to identify ways in which to achieve the reduction of energy consumption in buildings by 50% and eliminate the consumption of fossil fuels in building heating systems.

Introduced in 1998, the Energy Act contains two articles, Articles 8 and 9, which address economical and rational use of energy in production of devices, equipment and vehicles as well as in buildings.

The articles mention their aim at testing and clearly describing products' energy-efficiency, as well as introducing market-oriented instruments. Concerning energy efficiency in buildings, article 9 urges cantons to produce appropriate regulations in this area.

The action plan consists of 15 measures that consist of various incentives, support measures, rules, minimum standards, as well as measures in research and education. These measures are a product of a consultation phase, and were met with considerable appreciation. It is also emphasised that in the middle and long term they are also attractive from an economical point of view as the costs invested in innovation are compensated by lower energy costs.[123,124]

123. Further information: www.admin.ch/opc/de/classified-compilation/19983485/index.html#a8.
124. Further information: www.bfe.admin.ch/themen/00526/02577/index.html?lang=en&dossier_id=02578.

6.2.3 RESOURCE EFFICIENCY

Austria

The Austrian Resource Efficiency Action Plan (REAP) aims to increase resource efficiency by 50% until 2020 compared to 2008 levels (BMLFUW 2012).

Germany

The German National Sustainable Development Strategy aims to double resource efficiency until 2020 compared to 1994 (Die Bundesregierung Deutschland 2002). The most prominent instrument to enforce this target is the German Resource Efficiency Programme (ProgRess). The ProgRess programme (BMUB 2012) is based on a proposal from the German environment agency. It identifies 20 strategic approaches, which are underpinned with specific measures (e.g. market incentives, expert advice, education and research). Moreover, adopting ProgRess, Germany decided to report on the development of resource efficiency every four years, to assess progress and to continue to update the Resource Efficiency Programme accordingly.

Italy

The driving element for the environmental action strategy for sustainable development (EASSD) and for the definition of targets is essentially a decoupling between economic growth and pressure on the use of natural resources and on the environment, especially in agriculture, power and transport sectors. The specific indicators for use of material, soil, energy, water, resources and waste production per units of economic wealth, added value or per capita, must decrease relative to economic growth (partial decoupling) and finally stabilise or decrease in absolute terms (absolute decoupling).

Italy has recognised the need to diversify its energy portfolio to reduce the strong dependence on imports of fossil fuels and electricity and to reduce emission levels. In July 2009, the government announced a law to recommence the country's nuclear power programme and to start building a new nuclear power plant by 2013. A one-year moratorium on the work was adopted in March 2011, after the accident at the Fukushima nuclear plant. So far, there is no national strategy explicitly devoted to resource efficiency, but its underlying aspects are integrated in the following document:

Environmental Action Strategy for Sustainable Development (2002)
The Italian Environmental Action Strategy for Sustainable Development (EASSD) (MATTM 2002) was approved by the inter-ministerial committee for economic planning (CIPE) on 2 August 2002 and is currently in its implementation phase. CIPE is organised into six commissions, one of which is devoted to sustainable development.

The Italian EASSD contains four broad priority themes:
1. Climate change and stratospheric ozone.
2. Protection and sustainable valorisation of nature and biodiversity.
3. Quality of the environment and quality of life in urban areas.
4. Exploitation of resources and waste generation.

Priorities addressed in this last section are the use of natural resources, production-consumption cycles, water resources and waste.

The CIPE identifies the structures and bodies to ensure monitoring of the implementation and to see that the objectives are fulfilled by means of a technical board to the CIPE commission for sustainable development. Representatives of the Ministry of Economy, the regions and other ministry representatives competent on the subject at hand form the board.[125]

Targets:
- Reduce Italian total material requirements by -25% by 2010, -75% by 2030 and by -90% by 2050.
- Within public administrations, by the end of 2009.
- At least 30% of public purchases shall match ecological requirements. The monitoring will be done with the collaboration of ISPRA and will use the amount of green public purchases (in euro) per total public purchase for each product group as indicator.
- 30-40% of durable goods with reduced energy consumption.

125. *www.minambiente.it/index.php?id_sezione=396 in Italian only. An unofficial translation in English is available at: www.un.org/esa/agenda21/natlinfo/countr/italy/Italian%20NSDS.pdf.*

In relation to water resources, the overall objectives are to preserve and restore water resources, improve the quality of water resources and sustainable management of water resources' production/consumption systems.

Liechtenstein

Liechtenstein participates in the Swiss initiative Reffnet. This consultation service for companies allows them to find resource-efficient solutions. The LIFE climate foundation Liechtenstein sponsors up to 50% of the consultation fees for seven consultation services for the next two years.

Slovenia

Slovenia does not have a national resource efficiency strategy or action plan. Some other political policies that do address material efficiency are as follows:

- Slovenian Industrial Policy 2013, recognises material resource efficiency as a challenge for sustainable construction and in processing sectors (wood, metals) (MGRT 2012).
- Action plan: 'Wood is beautiful' contains measures which should lead towards better utilisation of wood, still plentiful in Slovenia, as a resource. However, the value added remains relatively low, which means that the productivity resources in this sector remain rather low (MGRT 2012).
- Smart Specialisation Strategy which includes one of the areas related to the smart use of resources (SVRK 2015).
- In 2014, the study on approaches addressing resource efficiency and waste prevention in Member States was prepared with the aim of presenting several concrete suggestions on the topics and recommending the preparation of an action plan on resource efficiency in Slovenia (MKGP 2014).

Switzerland

Introduced in 2013, the action plan Green Economy focuses on this problem in two of its four topics: production and consumption as well as waste and resources. The action plan brings attention to food waste, which at the same time means resource waste and aims to tackle this problem. It also greatly invests in the circular economy, which uses waste instead of further resources and increases efficiency by improving recycling systems, as well as introducing limitations on the use of new resources in the field of construction. In April 2016, the federal council approved the report 'Green Economy – Federal measures for a resource-conserving, future proof Switzerland' where past Green Economy actions were assessed and further measures outlined for the 2016-2019 period. Moreover, the Action Plan Wood focuses specifically on sustainable use of wood and supports projects that address this problem. The action plan includes six priorities; it was developed constantly further during its years of functioning from 2009-2016 and has yielded many various projects. The Spatial Concept Switzerland, elaborated by the Swiss Federal Office for Spatial Development ARE, also includes the securing of natural resources as one of its five targets. Last, but not least, a major Swiss strategy, which fosters sustainability in many aspects, including a focus on resources as Action Area 4, is the most recent sustainable development strategy 2016-2019. The strategy includes five goals that aim at achieving the long-term vision of respecting the qualitative and quantitative capacity and usage limits of the planet's natural resources. The goals focus on preserving ecological infrastructure of reserves and habitat networks, soil function, forests and landscapes as well as making the food industry environmentally friendly.

Additionally, FOEN has launched various studies that aim to deepen the understanding of material flows from ecological, economic and social points of view. The focus is on its research on materials which through extraction, processing, use and disposal cause considerable pollution, materials difficult to procure in the future, as well as materials which may have a better recycling potential. In addition, two other studies concerning material flows have been completed.

6.2.4 LAND USE CHANGES

Germany

In Germany, the Federal Building Code (Baugesetzbuch) and the Federal Spatial Planning Act (Raumordnungsgesetz, ROG) form the legal framework for spatial planning documents. Both documents call for sparing and careful use of natural resources, particularly water and soil. The specific instruments to deal with these regulations on the regional level are laid down in spatial development plans or programmes of the federal states. They are the main instruments of regional planning. At the federal level, the Federal Building Code has been amended several times in the past decade to promote inner-urban development and to protect open landscape. The code now sets a clear priority for the reduction of new land take and for inner urban development instead of developing agricultural areas or forests: Article 1 asks for justification if agricultural land or forests are planned to

be converted into urban land. This justification must include an assessment of the possibilities for inner urban development in particular including brownfields, building vacancy, vacant lots and other possibilities for redensification. However, due to the planning authorities at the local levels, greenfield land development is still widely practiced.

For the German Alpine area, defined as the morphological mountain area, the Bavarian State Development Plan has contained the so-called *Alpenplan* since 1972. It regulates the development of infrastructures (transport and ski lifts) by dividing the whole region into three zones (cf. Figure 6.2.4-1):

- Zone A (about 35% of the German Alps) comprises all settlements and most parts with already existing substantial forms of land use (such as tourism sites and valley floors). Apart from the usual restrictions, no additional criteria have to be met for new infrastructure.
- Zone B (about 22% of the German Alps) is a neutral zone or buffer zone in which projects can be allowed after detailed ecological examinations. New infrastructures require individual evaluation and are mostly permissible if needed for agriculture or forestry.
- Zone C (almost 43% of the German Alps) was designated as a protected zone, where all transport projects except necessary measures for traditional agriculture and forestry are inadmissible. The zone comprises the higher mountainous regions, protected areas and almost all mountain ridges on the German-Austrian border.

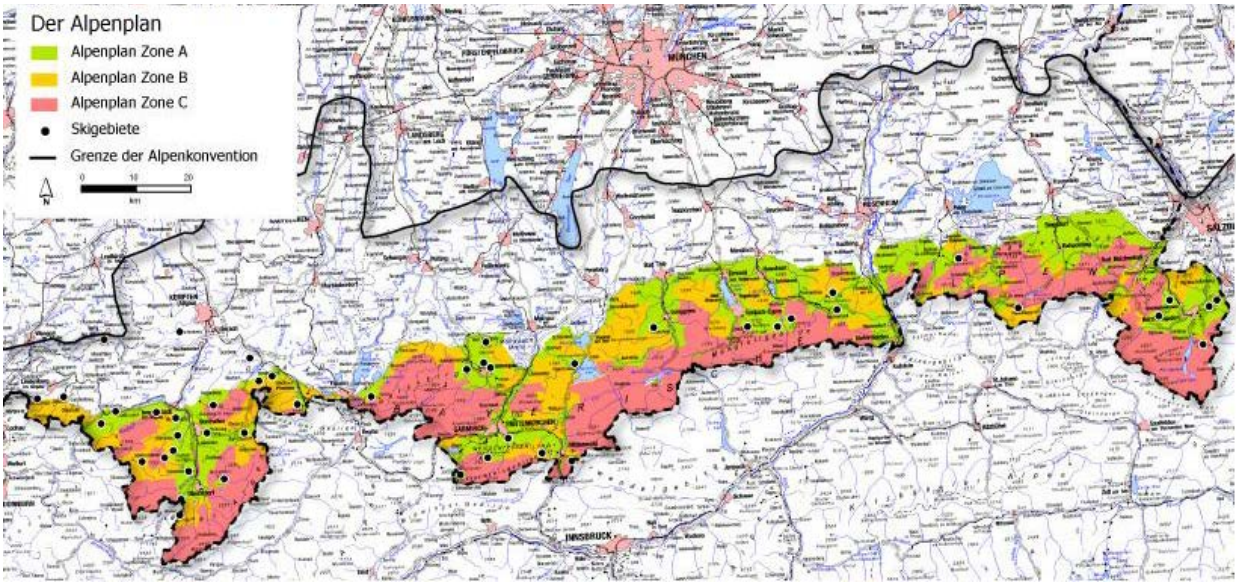

Figure 6.2.4-1 Zones in the Alpenplan (Source: DAV 2016).

Several policy initiatives in Bavaria support municipal efforts on land take and promote inner urban development. In 2003, an alliance for reducing land take (*Bündnis zum Flächensparen*) was founded. In this alliance, ministries and authorities, associations of municipalities, NGOs and private enterprises work together, share their ideas and exchange their experiences on inner-urban development. Besides a common declaration, all partners have committed to reduce land take. Participating ministries have developed several tools to support municipalities or inter-municipal alliances. The instruments are e.g. an easy-to-use free database for systematic registration of inner-urban development potentials, a computer based free tool to compare the cost for land development at different locations (inner-urban compared to greenfield development) and a collection of good practice examples. Regular meetings are organised with a biannual public conference to exchange experiences and promote the issue. A mobile exhibition for the public has been designed and is available for lending in order to present it to the broad public and raise awareness on the issue.

Italy

Regions are the competent level for spatial planning in Italy. They are responsible for legal provisions and instruments, including spatial and territorial plans for the Alpine areas; a few open issues and barriers towards harmonised Alpine-wide approaches still exist at the country level (e.g. exchange of data, territorial mapping systems and governance issues).

However, a consultation process among the six Italian Alpine regions and two autonomous provinces is ongoing as a shared initiative of the governments responsible. Another initiative that deserves mention is cooperation among protected areas and

sites of particular natural interest across the Italian Alps, where spatial planning and ecological continuum are at the centre of the debate.

Slovenia

The Slovenian Spatial Planning Act regulates land use management and planning. The Ministry of the Environment and Spatial Planning assumes this responsibility. The National Assembly or the government of the Republic of Slovenia (RS) adopts state-prepared laws and national policies and other instruments, according to the law. They define the spatial planning system and provide strategic spatial development objectives, guidelines and measures. In addition to the spatial development laws and strategic documents, the state also has the authority to perform measures concerning spatial arrangements for infrastructure of national importance. It issues construction permits for structures of national significance.

There is no regional administrative level; the planning authorities at the lower level are municipalities. Each municipality has to prepare a spatial plan with a strategic and an implementation part. The latter is the basis for issuing the construction permits at local level. Operating at regional levels, the state administrative units issue them.

The state uses laws and other strategic documents (such as the National Spatial Development Strategy and Spatial Order of Slovenia) to provide frameworks for spatial planning at regional and local levels. The state has the authority to monitor the lawfulness of spatial planning at lower levels. In case a local community adopts a local plan against the advice issued for a single spatial development plan, the state institutions can bring that case to constitutional court.

In relation to land use management, the Spatial Planning Act sets some basic principles, among them the principle of using underused or degraded land for spatial development prior to planning Greenfield developments. This principle was emphasised during consultations between the national sector responsible and the municipalities. The National Spatial Development Strategy, according to which spatial development is performed in urban centres of certain significance (i.e. central places with certain range of functions) and not in rural settlements, gives the second important guideline. These are specifically mentioned in the document as the key nodes of a polycentric urban system. Issued in May 2015 for the first time, an important instrument is the State of Spatial Development Report, showing the implementation of the national strategy objectives and priorities in the field of spatial development.

Switzerland

In Switzerland, there is a national framework legislation and some strategic documents at the national level regarding land use planning. The Federal Act on Spatial Planning (RPG) entered into force in 1980. It lays down the aims and principles of spatial planning for the whole of Switzerland. Based on the mandate anchored in the Swiss Constitution, it calls for careful management of land use in Switzerland. The federal law only lays down the principles but does not constitute a set of rules to answer all-important questions. Cantonal spatial planning and building regulations often contain road construction and land rationalisation.

The Confederation promotes and co-ordinates cantonal spatial planning and takes into consideration the demands of spatial planning in its own activities. The limited legislative responsibility of the Confederation leads to a variety of spatial planning concepts and instruments. In fact, the Confederation, cantons and communes are jointly responsible for ensuring economical land use. They do this by harmonising their activities, which have spatial impact.

However, the main land use planning documents and strategies are issued at regional and local levels. There are two important strategies at national level regarding careful land use management:

1) The Spatial Concept of Switzerland (Raumkonzept Schweiz) is a strategic framework for the future of spatial development. It was elaborated by representatives of the national, regional and local levels and should help authorities on those three levels to plan settlements, transport and energy infrastructures, or to deal with activities which have an impact on landscape or land use.
2) Revision of the Spatial Planning Act (RPG) - Stage 1.
   In Switzerland, it is only allowed to build new buildings within areas that have been flagged as building zones by the authorities in the land use planning documents. In various cantons and municipalities, building zones are oversized, potentially leading to urban sprawl, loss of agricultural lands and degradation of landscapes. In order to prevent this, the national Spatial Planning Act was revised. All eight cantons and many municipalities will have to revise their land use planning documents in the following nine years in order to reduce the size of the building zones in favour of a more sustainable spatial development. The Federal Council decided to put the partially revised Spatial Planning Act and the revised Spatial Planning Regulation into force on 1 May 2014. The revision provides for measures against urban sprawl and facilitates conditions for the construction of solar plants.

6.2.5 CIRCULAR ECONOMY, RECYCLING AND WASTE MANAGEMENT

In 2015, the EU adopted a Circular Economy Package, which includes legislative proposals on waste and an EU Action Plan for the Circular Economy. The Action Plan (EC 2015d) includes suggestions regarding production, consumption, waste management, the secondary raw material market and highlights the following priority areas:

- Plastics: less than 25% of collected plastic waste is recycled, therefore an increase of plastic recycling is needed.
- Food waste: along the whole food chain from the farmer to the consumer much food is lost, in the EU about 100 million tons annually; about 40% of food loss occurs at retail and consumer levels.
- Critical raw materials: materials of high economic importance and vulnerable to supply disruption, which are often present in electronic devices, are currently recycled at very low rates.
- Construction and demolition waste: it accounts for approximately 20-25% of all waste in Europe, many of the materials are reusable or recyclable, but the recycling rates vary significantly from country to country.
- Biomass and bio-based products: these products can contribute to the circular economy, as they are renewable, biodegradable or compostable, paying attention to environmental impacts and pressure on land use.

Austria

At the national level, there is the Waste Management Act (Abfallwirtschaftsgesetz AWG 2020. Federal Law Gazette I No 102/2002 as amended) implements the provisions of the Waste Framework Directive. In the Waste Prevention Programme of the Federal Waste Management Plan 2011 (BMLFUW 2011), the objectives of waste prevention were put into concrete terms as follows:

- Decoupling of economic growth from the life-cycle environmental effects of wastes.
- Reduction of emissions.
- Minimisation of the dissipation of pollutants.
- Reduction of pollutants.
- Saving of resources.

For biogenic wastes, the national Biowaste Strategy (UBA Austria 2014) demonstrates the most appropriate possibilities of treatment.

Germany

The Federal Law on Circular Economy (Kreislaufwirtschaftsgesetz, 2012) aims at fostering the circular economy to reduce resource input and to protect the population and the environment. The central principle of this law is a five-step hierarchy for waste: (1) avoid waste (2) prepare waste for reuse (3) recycle waste (4) utilise waste otherwise (5) remove waste.

It promotes circular economy and environmentally sensitive waste management and was adopted to implement the European Waste Directive. It forms the central part of waste regulations and is supplemented by regulations concerning special types of wastes such as e.g. old vehicles, batteries and electronics. One aim is a 65% minimum reuse/recycling rate for municipal waste effective from 2020 onwards (§14 (2)) and a 70% rate for construction and demolition waste by weight.

Each Federal State transposes Federal law into state law; for the German Alpine Convention area this is done by the Bavarian Waste Management Act (Bayerisches Abfallwirtschaftsgesetz). The counties and county free-towns in Bavaria are responsible for waste removal, but they may delegate it to others (public or private companies and cooperation); municipalities are obliged to support them by e.g. offering places and staff for the collection of recyclable material. As foreseen in the relevant EU Directive and the respective federal law, a waste management plan was deployed.

Italy

Regarding waste, the general objective is a reduction of production, recovery of materials and energy from waste.
Specific objectives (and related indicators) are:

- reduction of urban waste production
- reduction of special waste production
- reduction of dangerous waste
- recovery of materials and recycling of urban waste
- recovery of energy from waste.

Liechtenstein

In Liechtenstein, the Ministry of Environment together with the Office of Environment is responsible for developing legislation and policies to ensure the recovery and environmentally sound disposal of waste, coordinating the planning of waste disposal facilities and for implementing the policy framework in close collaboration with the eleven communes. The basis for waste legislation in Liechtenstein is the Environmental Protection Act (RDR 2008).

Because of the customs union treaty with Switzerland, the Swiss waste law also applies to Liechtenstein and there is no customs control between Liechtenstein and Switzerland. Swiss authorities control the borders. The Swiss Federal Office for the Environment (FOEN) monitors the import, export and transit of wastes and hazardous wastes for Liechtenstein. Switzerland is a member of the OECD and the Basel Convention and, therefore, carries out these controls according to their decisions. The authorities of Liechtenstein are informed in every case, and can refuse unwanted exports, imports and transits of wastes under their control. Moreover, the ordinance on the reduction of risks relating to the use of certain particularly dangerous substances, preparations and articles (Chemical Risk Reduction Ordinance, ORR-Chem) contains special regulations in terms of restrictions and bans for handling chemicals of all sorts. It substitutes the old ordinance on dangerous substances. Pursuant to the Customs Treaty, these new provisions are again also applicable to Liechtenstein.

Limited landfill space and existing difficulties to deposit new landfill sites, as well as changing conditions in neighbouring countries necessitated a revision of waste planning. Therefore, FOEN was commissioned by the government to create a new waste plan, together with the Liechtenstein municipalities, which will ensure safe disposal of waste in Liechtenstein in the future. Waste management planning is carried out within the framework of a strategic environmental assessment (SEA).

With regard to waste planning by 2070, all of the town's further stakeholders and the general public have been included for each group of waste:

- The actual state has been surveyed.
- The short, medium or long-term demands have been analysed.
- The fields of action have been defined.
- Alternatives were assessed and possible solutions presented.
- In an initial workshop, landfill and organic waste recovery planning were defined as key areas of action. From those results, the alternatives developed for the fields of action will be assessed and possible solutions and their effects highlighted. Waste management planning should be completed by 2016.

Slovenia

The waste management programme (in preparation) will be an umbrella strategic document in accordance with the Framework Directive (2008/98/EC) and will introduce a new approach in the treatment of waste. Waste is a valuable source and in planning policy and law making the five-step waste hierarchy should be taken into account.

Switzerland

Switzerland is highly committed to waste reduction and recycling. Its impressively high return rate makes it a pioneer and a world champion in recycling electronic products; however, it is also very successful in recycling other materials. This situation is the product of an efficient infrastructure, high standards, clear legislative stipulations and the involvement of both public and private stakeholders.

Regulations on avoidance and disposal of waste (Abfallverordnung) set general standards for planning, reporting, reducing, utilizing and deposing of waste, though the cantons are free to choose specific measures. There are other ordinances concerning movements of waste, beverage containers, returns and disposals of electrical and electronic equipment, prepaid contribution for glass beverage containers as well as fees for batteries and accumulators.

Various measures are put forward by the Swiss Federal Office for the Environment (FOEN), as well as cantons and municipalities. Waste management is an important element of environmental education. Information and awareness are presented in schools: cantons and municipalities conduct their own projects and initiatives. On the federal level, there is a fund for school projects in environmental education, which is administered by the foundation éducation21. This fund supports specific work in environmental education during obligatory school. The organization *Kommunale Infrastruktur* organizes a course on waste management which takes place every 2 or 3 years in cities and municipalities and consists of four modules. Beginners in the field, as well as specialists from private and public sectors can benefit from it. In addition, there is an annual course on the *Environmental Protection Act* organized by the *Vereinigung für Umweltrecht*. In addition, the FOEN also has a comprehensive list of various organizations that arrange events, workshops and trips on this topic and offers links to education material.

FOEN`s Action Plan Green Economy also focuses to a large extent on waste management: it is one of its four priority areas. The aims are to raise the effectiveness of waste plants, as well as production facilities; raising demands for building materials and construction methods as well as improving recycling of rarely used technical materials. Moreover, it seems important to boost the use of other raw materials in order to secure the ones used more frequently. The function of the concept on securing raw materials, which is currently being developed, is to create a basis for action. In addition, there are also comprehensive regulations on transboundary movements of waste. The federal government also supports investigation, monitoring and financial remediation of contaminated sites; for this purpose, it has set up the OCRCS Contamination Fund.[126,127]

6.2.6 NATURAL CAPITAL AND ECOSYSTEM SERVICES

Natural capital has not yet been formally accepted in national accounting systems. However, the national (and regional) statistical offices regularly collect data and participate in measuring the natural capital stored across the country. National programmes have been launched to attempt informal assessments of the value of nature and its services in Italy.

According to CNEL & ISTAT (2014), in order to ensure real well-being for all members of a society, the environment has to be vital and resilient, i.e. hosting natural capital able to sustain health with human social and economic activities. This means that environmental resources such as water, air and food should be safe and of good quality. Natural heritage should then be given a central position in the economy, able to provide for goods and services and be essential to ensure human well-being (Millennium Ecosystem Assessment, www.maweb.org and The Economics of Ecosystems and Biodiversity, www.teebweb.org). Valorising our environmental resources allows all members of society to enjoy tangible and intangible assets, contributing to the reduction of inequality.

The following list of indicators has been assembled within the framework of a successful pilot project named Equitable and Sustainable Well Being (BES), as an appropriate matrix for natural capital.

Dimension of well-being	Description
Water quality	Impact on human well-being and health.
Air quality	Impact on environmental and human health thus on human well-being.
Soil and quality of terrain	Soil has an impact on the water cycle, water quality, floods and landslides. Soil use and resulting consumption have an impact on the well-being of people living in a territory.
Biodiversity	Loss of biodiversity puts ecosystems at risk and their services on which human well-being and economic activities rely. Biodiversity conservation equals natural capital conservation.
Subjective valuation of the quality of natural environment	Individual and citizens' perception on the overall quality of the environment in which they live affects their well-being.
Matter, energy and climate change	Material consumption, energy use and climate change have an impact on development and its sustainability, through emissions and dramatic reduction of assets on which human well-being is based.

Table 6.2.6-1 Dimensions of well-being included in the pilot project Equitable and Sustainable Well-Being. A set of indicators for the above-mentioned dimensions of well-being is available (BES 2016).

Another indirect attempt to identify the value of natural capital stored in protected Italian areas - including the Alpine ones - has been made in a report on national parks, where 56,000 animal species have been counted (the highest figure in the EU). Important forest resources contribute to CO_2 storage, which has a role in halting land consumption (urbanisation in national parks covers 4.5% of total surface). Twenty-three areas have been analysed with regard to plants, animals, ecosystems and landscapes as a contribution to the National Biodiversity Strategy 2011-2020 (Ministero dell´Ambiente 2013).

126. Further information: www.bafu.admin.ch/abfall/14015/15232/index.html?lang=de.
127. Further information: www.bafu.admin.ch/abfall/index.html?lang=en.

The unique characteristics of maintaining cultural heritage and landscapes that is common to many protected Italian areas has also found formal recognition in the Charter of Rome on Natural and Cultural Capital in the subsequent report. Distinctive Alpine specificities have been highlighted for the national parks included in the Alpine area: Parco Nazionale della Val Grande, Parco Nazionale delle Dolomiti Bellunesi, Parco Nazionale dello Stelvio, Parco Nazionale del Gran Paradiso (Ministero Dell´Ambiente & Fondatione per lo Sviluppo Sostenible 2015).

6.2.7 BIODIVERSITY

Biodiversity targets in Germany	
Protecting biodiversity	
Population size	Species for which Germany has a particular conservation responsibility should achieve viable population sizes. By 2020, the threatened status of the majority of species on the Red List should have improved by one level.
Wilderness	Nature should be able to develop undisturbed and according to its own laws across 2% of Germany, and areas of wilderness should be growing.
Forests	Forests that have developed naturally should account for 5% of woodlands.
Water	Watercourses and their water meadows should be protected, so that their typical diversity as a natural area is guaranteed; river flood plains should be extended by at least 10% by 2020.
Water	The water regime in intact peatlands should be protected and regenerable peatlands permanently restored.
Biodiversity sustainability	
Renewable Energies	The production and use of renewable energies should not come at the expense of biodiversity.
Land use	Additional land taken for human settlement and transport should be no more than 30 ha/day.
Transport	The current proportion of unfragmented low-traffic areas > 100 km^2 should be maintained.
Transport	Existing transport routes should no longer cause major adverse effects for the network of linked biotopes. Fragmented areas should be ecologically passable.
Environmental influences	
	Cultivation-related discharges of substances into soil used in agriculture and forestry will be reduced.

Table 6.2.7-1 Biodiversity targets in Germany according to the National Strategy on Biological Diversity (2007) (Source: EEA, 2015).

Slovenia

The National Reform Programme (NRP) is the government's medium-term plan of priority measures and projects focused on achieving the objectives of the Europe 2020 strategy. It states that the preservation of a high level of biodiversity and vital ecosystems would be ensured through effective management of existing protected areas and accelerated implementation of measures intended to maintain the Natura 2000 network. Among its fundamental goals, the 2007–2013 National Development Programme lists the conservation and sustainable use of biodiversity.

The Rural Development Programme is a strategic document under which agri-environmental measures are implemented. The objectives are to establish the concept of sustainable agriculture and preserve natural resources and biodiversity. As stated in the strategy for implementing the resolution on the Slovenian agriculture and food industry strategic guidelines up to 2020, the green component is implemented with direct payments under the reformed *Common Agricultural Policy*. This includes obligatory agricultural practices with a favourable impact on climate and the environment. In the operational programme to implement the *EU Cohesion Policy* 2014–2020, a special priority investment is dedicated to the protection and restoration of biodiversity and

soil and the promotion of ESS. In 2004, Slovenia established the network of *Natura 2000* sites, which following a slight increase in 2013, and now covers 37% of the country's territory. This is an important achievement in nature conservation and contributed to the greater inclusion of nature protection considerations in spatial planning and planning the use of natural resources.

6.2.8 VALUATION OF ECOSYSTEM SERVICES

Germany

- Landscape planning is the key precautionary instrument for conservation and landscape management in Germany at different spatial levels such as state, regional and local. It is necessary to identify, define and establish conservation and landscape management objectives in landscape programmes, framework landscape plans and plan landscapes. In combination with the development plans, it is the main legally binding planning instrument to bring together and coordinate the conservation of nature, landscapes, ecosystems and biodiversity. The role of protected habitats, *Natura 2000* sites, and the connectivity of habitats or precautionary planning for recreation sites must be considered. Landscape planning also provides conservation principles and standards for management of sustainable land use.
- To conserve biodiversity, the German impact mitigation regulation (*Ausgleichsregelung*) has to be mentioned as one of the most important tools. The aim of this nationwide regulation is to prioritise the prevention of major damage to the natural balance, landscape and biodiversity. Where this is not possible, priority must be given to natural mitigation and replacement measures to offset the damage. In national terms, the regulation has been applied successfully for more than 30 years as an instrument of nature conservation.
- At the state level in Germany the *Bavarian Biodiversity Programme* (described in chapter 2.3.3) is the umbrella for several nature conservation instruments and measures. With the new Bavaria 2030 biodiversity programme, the state is investing €3 million in a new resource foundation to research potential for the sustainable protection of valuable resources and thereby press ahead with Bavarian energy transition.

Switzerland

In Switzerland, different national policies relevant for the valuation of ecosystem services are in place:

- Biodiversity Strategy
- Swiss Biodiversity Action Plan
- Federal Act on the Protection of Waters
- Federal Act on Forest
- Federal Act on the Protection of Nature and Cultural Heritage
- Ordinance on the Protection of Nature and Cultural Heritage
- Federal Act on Hunting and the Protection of Wild Mammals and Birds
- Ordinance on Hunting and the Protection of Wild Mammals and Birds
- Federal Act on Fisheries.

The *Biodiversity Strategy Switzerland* was passed in 2012. The main target is to preserve biodiversity and ecosystem services (ESS) in a way that makes them capable to respond to changes. Ten targets serve the following purpose:

1. sustainable use of biodiversity
2. developing ecological infrastructure
3. improving the situation of national priority species
4. preserving and supporting genetic diversity
5. reviewing financial stipulations
6. registering ESS
7. generating and disseminating knowledge
8. fostering biodiversity in settlements
9. strengthening international engagement
10. monitoring changes in biodiversity.

The action plan aims to facilitate implementation of the strategy. It is led by FOEN, however, its elaboration is a product of cooperation with various stakeholders, as well as with other federal offices. In 2014, FOEN developed stages of implementation for the plan and announced the need for further resources and legal adjustments. The basic framework of the action plan was implemented in the context of a participatory process, including federal offices but also various stakeholders from cantons and

municipalities as well as from NGOs, the economy, policies, science or interest groups. For example, on 19 November 2014 a meeting on ecological infrastructure was organised where stakeholders had a chance to discuss the measures provided by the action plan.

Natural reserves and national parks are established in order to protect biodiversity in specific areas. Certain mire landscapes and their preservation are also under protection as regulated by the ordinance on mire landscapes (Moorlandschaftsverordnung). Moreover, *Swiss Nationalpark*, as well as *Biosfera Val Müstair* belong to the UNESCO Programme *Man and Biosphere*[128].

Furthermore, fostering natural parks is another important nucleus of a Green Economy and ecosystem services in the Alpine area. The federal authorities support regional initiatives to establish and operate parks of national importance by providing financial aid and awarding the park label. The aim is to promote regions characterised by high natural and landscape values, which are pursuing sustainable development and meet the specified criteria. The legislation enabling the creation of parks of national importance was put into force on 1 December 2007.

The federal policy on parks is based on the following principles[129]:

- The establishment of a park of national importance is voluntary.
- A park of national importance arises from a broad-based participatory and democratic (bottom-up) process in a region.
- The development of parks does not involve the introduction of any new protection regulations, except in the core zones of national parks and nature discovery parks.
- High natural and landscape values are the fundamental requirement for the region of the park to be recognized as one of national importance.
- In parks of national importance, the natural and landscape values are to be preserved and enhanced and natural resources are to be used sustainably.
- Instruments for supporting parks of national importance must be maintained.

128. Further information: www.bafu.admin.ch/biodiversitaet/13721/14385/15120/index.html?lang=de.
129. Further information: www.bafu.admin.ch/landschaft/14534/15821/15839/index.html?lang=de.

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