



GREENING THE ECONOMY IN THE ALPINE REGION

Report on the state of the Alps

ALPINE CONVENTION
Alpine Signals – Special Edition 6

EXECUTIVE SUMMARY

IMPRINT

Editor:

Permanent Secretariat of the Alpine Convention

www.alpconv.org

info@alpconv.org

Office:

Herzog-Friedrich-Straße 15

A-6020 Innsbruck

Austria

Branch office:

Viale Druso-Drususallee 1

I-39100 Bolzano/Bozen

Italy

Graphic design: De Poli & Cometto - Belluno - Italy

Printing: Stampatori della Marca - Castelfranco Veneto - Italy

Proofreading: A. Edwards, S. Manning-Baumgartner, Innsbruck Translation Centre – Austria

Cover Photo: Christine Wendl

© Permanent Secretariat of the Alpine Convention, 2017

ISBN 9788897500292



Carbon compensated
publication by buying credits
from biomass renewable energy
sources in Uttar Pradesh, India.

2016 | XXX-86-NJK



GREENING THE ECONOMY IN THE ALPINE REGION

REPORT ON THE STATE OF THE ALPS

ALPINE CONVENTION
ALPINE SIGNALS – SPECIAL EDITION 6

EXECUTIVE SUMMARY

This executive summary was approved by the Alpine Conference at its XIVth meeting in Grassau (Germany), held on 13 October 2016. It contains the main findings of the sixth Report on the State of the Alps (RSA), briefly illustrated by presenting key indicators.

The full English version of the sixth Report on the State of the Alps can be downloaded here: www.alpconv.org

The preparation of the sixth Report on the State of the Alps and of this Executive Summary 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.

Coordination of ad hoc expert group

Presidency

Hans-Joachim Hermann, Richard Landgraf (*Umweltbundesamt, Deutschland — Federal Environment Agency, Germany*)

Permanent Secretariat of the Alpine Convention

Marianna Elmi, Aureliano Piva, Simona Vrevc

Members of the ad hoc expert group

Austria

Josef Behofsics (*Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft — Federal Ministry of Agriculture, Forestry, Environment and Water Management*)

France

Richard Rouquet (*Ministère de l'Environnement, de l'Énergie et de la Mer — Ministry of the Environment, Energy and Sea*)

Germany

Andreas Burger (*Umweltbundesamt — Federal Environment Agency*)

Italy

Luca Cetara (*Italian Delegation to the Alpine Convention, Eurac Research, European School of Economics*)

Liechtenstein

Heike Summer, Helmut Kindle (*Amt für Umwelt — Office for the Environment*)

Slovenia

Urška Kušar (*Direkcija Republike Slovenije za vode — Slovenian Water Agency*)

Tatjana Orhini Valjavec (*Ministrstvo za okolje in prostor — Ministry of Environment and Spatial Planning*)

Switzerland

Silvia Jost (*Bundesamt für Raumentwicklung — Office Fédéral du Développement Territorial — Ufficio Federale dello Sviluppo Territoriale — Federal Office for Spatial Development*)

Observers of the ad hoc expert group

Andreas Pichler, Anita Konrad (*CIPRA International*)

Veronika Schulz, Liliana Dagostin (*Club Arc Alpin*)

Peter Winkler (*FIANET*)

Thomas Scheurer (*ISCAR*)

Consultants of the ad hoc expert group

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

Focal points of the Alpine Convention

Austria

Ewald Galle (*Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft — Federal Ministry of Agriculture, Forestry, Environment and Water Management*)

France

Isabelle Paillet (*Ministère de l'Environnement, de l'Énergie et de la Mer — Ministry of the Environment, Energy and Sea*)

Germany

Silvia Reppe (*Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit — Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety*)

Italy

Paolo Angelini (*Ministero dell'Ambiente e della Tutela del Territorio e del Mare — Ministry of the Environment and for the Protection of Land and Sea*)

Liechtenstein

Helmut Kindle (*Amt für Umwelt — Office for the Environment*)

Monaco

Céline Van Klaveren-Impagliazzo (*Gouvernement Princier, Principauté de Monaco — Government of the Principality of Monaco*)

Slovenia

Blanka Bartol (*Ministrstvo za okolje in prostor — Ministry of Environment and Spatial Planning*)

Switzerland

Silvia Jost (*Bundesamt für Raumentwicklung — Office Fédéral du Développement Territorial — Ufficio Federale dello Sviluppo Territoriale — Federal Office for Spatial Development*)

European Union

Giacomo Luciani (*European Commission, DG Environment*)

Further institutions and persons that contributed to the report

Berchtesgaden National Park
Michael Vogel

Bundesamt für Raumentwicklung, Schweiz — Office Fédéral du Développement Territorial, Suisse — Ufficio Federale dello Sviluppo Territoriale, Svizzera — Federal Office for Spatial Development, Switzerland
Martyna Derszniak-Noirjean, Maria Hopf

Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit, Deutschland — Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany
Anastasia Guretskaya

Ecological Network Platform of the Alpine Convention

Bettina Hedden-Dunkhorst (*Bundesamt für Naturschutz, Deutschland — Federal Agency for Nature Conservation, Germany*)

Marie-Odile Guth (*Ministère de l'Environnement, de l'Énergie et de la Mer, France — Ministry of the Environment, Energy and Sea, France*)

Aurelia Ullrich (*CIPRA International*)

Marianne Badura (*Staatsministerium für Umwelt und Verbraucherschutz, Bayern — State Ministry of the Environment and Consumer Protection, Bavaria*)

Yann Kohler, Dominik Cremer-Schulte (*ALPARC*)

European Topic Center on Urban, Land and Soil Systems of the European Environment Agency

Silvia Giuliotti (*European Environment Agency*)

Andreas Bartel, Andreas Littkopf (*Umweltbundesamt, Österreich — Federal Environment Agency, Austria*)

Emanuele Mancosu (*University of Malaga*)

Istituto Superiore per la Protezione e la Ricerca Ambientale, ISPRA Italia — National Institute for Environmental Protection and Research, Italy

Claudio Curcuruto, Riccardo De Lauretis

Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Italia — Ministry of the Environment and for the Protection of Land and Sea, Italy

Benedetta Dell'Anno

Mountain Agriculture Platform of the Alpine Convention

Ewald Galle, Ignaz Knöbl (*Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Österreich — Federal Ministry of Agriculture and Forestry, Environment and Water Management, Austria*)

Permanent Secretariat of the Alpine Convention

Vera Bornemann, Stefano Della Chiesa, Taja Ferjančič Lakota, Nathalie Morelle

Staatsministerium für Umwelt und Verbraucherschutz, Bayern — State Ministry of the Environment and Consumer Protection, Bavaria

Peter Eggensberger

Umweltbundesamt, Deutschland — Federal Environment Agency, Germany

Björn Bünger

Working Group Mountain Forests of the Alpine Convention

Francesco Dellagiacomma (*Provincia Autonoma di Trento, Italia — Autonomous Province of Trento, Italy*)

Working Group Sustainable Tourism of the Alpine Convention

Thomas Bausch, Stephan Meier (*Munich University of Applied Sciences*)

Marcella Morandini (*Foundation Dolomites UNESCO*)

Working Group Transport of the Alpine Convention

Thierry Louis, François Lamoise (*Ministère de l'Environnement, de l'Énergie et de la Mer, France — Ministry of the Environment, Energy and Sea, France*)

FOREWORDS

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
Presidency of the ad hoc expert group*

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

TABLE OF CONTENTS

Recommendations for a Green Economy in the Alps	9
1 Introduction	13
2 Energy-efficient and low-carbon economy	15
2.1 Carbon emissions	15
2.2 Renewable energy sources	18
2.3 Efficient use of energy	20
3 Resource-efficient economy	23
3.1 Efficient use of resources	23
3.2 Land use changes	24
3.3 Circular economy, recycling and waste management	27
4 Ecosystem services and natural capital-based economy	29
4.1 Natural capital and ecosystem services	29
4.2 Biodiversity	31
4.3 Valuation of ecosystem services	33
5 An economy supporting quality of life and well-being	35
5.1 Employment and education	35
5.2 Economic well-being and social inclusion	37
5.3 Sustainable consumer behaviour	38
5.4 Health and harmful emissions	39
6 Conclusions	41
7 Bibliography	45

LIST OF FIGURES

Figure 2.1 1	At national levels: CO ₂ emissions (in kt per year) in Alpine countries from fossil fuel use and industrial processes between 1990 and 2013.	15
Figure 2.2 1	Share of hydropower, biomass including renewable waste, geothermal, wind and solar energy in RE production for each Alpine country in 2011.	19
Figure 2.2 2	Projected share of RES in final energy demand (in %) per year of the Alpine countries in 2020, 2030 and 2050.	19
Figure 2.3-1:	Average annual change of energy intensity indicators from 2005-2013 in different sectors of the Alpine countries within the EU.	20
Figure 3.2 1	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.	25
Figure 3.2 2	Development (1984-2008; index base year 1984 = 100) and share (2008) of different land use classes in Liechtenstein.	26
Figure 3.2 3	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.	26
Figure 3.2 4	Development (1979-2009; index base year 1979/85 = 100) and share (2004-2009) of different land use classes in the Swiss part of the Alpine Convention area.	26
Figure 4.1 1	Annual forest increment and felling (m ³ /ha) in the Alpine countries.	30
Figure 4.2 1	Likelihood of HNV Farmland presence per 25 km ² in the Alpine Convention area based on CORINE land cover data.	32
Figure 5.1 1	Development of employment in the environmental goods and services sector in Germany, 2002-2012, in 1,000 persons.	36
Figure 5.2 1	Risk of poverty the Alpine Convention area.	37
Figure 5.4 1	Annual Average of Particulate Matter (PM2.5).	40

LIST OF TABLES

Table 2.1 1	EU Climate and Energy Package targets (2013-2020) as well as pledged targets under the UNFCCC.	16
Table 2.3 1	Current targets for energy consumption (2020) and predicted energy demand (2030, 2050) of the Alpine countries in Mtoe (Million tonnes of oil equivalent).	21
Table 3.1 1	Domestic material consumption in Alpine countries (in tonnes per capita), 2014.	23

ABBREVIATIONS

AEA:	Annual Emission Allocations
CHP:	Combined Heat and Power
DMC:	Domestic Material Consumption
EC:	European Commission
EEA:	European Environment Agency
EMAS:	Eco-Management and Audit Scheme
ESS:	Ecosystem Service
ETS:	Emissions Trading System
EU:	European Union
EUSALP:	European Union Strategy for the Alpine Region
GDP:	Gross Domestic Product
GHG:	Greenhouse Gas
HNV:	High Nature Value
IBAs:	Important Bird Areas
ISO:	International Organization for Standardization
IUCN:	International Union for Conservation of Nature
LCA:	Life Cycle Assessment
NEEAP:	National Energy Efficiency Action Plan
NGO:	Non-Governmental Organisation
OECD:	Organisation for Economic Cooperation and Development
PBAs:	Prime Butterfly Areas
PEF:	Product Environmental Footprint
PES:	Payments for Ecosystem Services
PM:	Particulate Matter
PPS:	Purchasing Power Standard
PSA:	Permanent Settlement Area
RE:	Renewable Energy
RES:	Renewable Energy Source
RMC:	Raw Material Consumption
RSA:	Report on the State of the Alps
SDG:	Sustainable Development Goal
SME:	Small and Medium-Sized Enterprise
SOIA:	System for the Observation and Information on the Alps
UAA:	Utilized Agricultural Area
UN:	United Nations
UNEP:	United Nations Environmental Programme
WG:	Working Group
WHO:	World Health Organization

RECOMMENDATIONS FOR A GREEN ECONOMY IN THE ALPS

The Alpine 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.

1. INTRODUCTION

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 area. In order to develop towards a Green Economy, the economic activities in the Alps need to respect the specific topography, the natural resources, the climate and the sensitive Alpine environment. The Alpine topography poses special challenges, such as 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 differ from those of 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, which predestines the Alps as a pilot area for a Green Economy approach.

A Green Economy may also 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 area

Even though the term 'Green Economy' is still not consistently defined, most organisations now have a shared understanding of the concept. As a common basis, the ad hoc expert group for the Elaboration of the sixth Report on the State of the Alps agreed to use for the purpose of this

report the UNEP definition of Green Economy as the most widely used and authoritative one. UNEP (2011b) defines Green Economy:

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

This implies four key topics of Green Economy, which are used to structure this Report on the State of the Alps (RSA):

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

Policy objectives

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

In its Europe 2020 strategy, the European Commission sets the conditions for a smart, sustainable and inclusive growth. Sustainable growth shall lead to a resource-efficient, green and more competitive low-carbon economy and shall fulfil the so-called 20-20-20 goals¹. 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.

Conventionally, the state of an economy is measured by using the Gross Domestic Product (GDP) or similar indicators

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.

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. Basically, national GDP is a measurement of a nation's overall economic activity. This is one of the main reasons why economies focus on economic growth.

There is a variety of criticisms against GDP as an indicator to measure economic and social well-being. Its shortcomings have been debated for decades. Numerous initiatives to assess well-being other than through GDP have appeared in recent years. Notable examples are the OECD Better Life Index, the Happy Planet Index or the Gallup-Healthways Well-Being Index². There is a debate about the need for a great transformation process, encompassing all kinds of economic activities from production to consumption, trade and services including the financial sector. As the global financial system has supported and invested in the 'brown economy'³, 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 Green Economy also raises controversial questions⁴ 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).

The full version of the Report on the State of the Alps, summarised in this document, describes the relevance of Green Economy in terms of the Alpine Convention, the general economic situation and the main players in the Alpine area.

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

3. A brown economy is one that relies heavily on fossil fuels, not considering the negative impacts that production and consumption can have on the environment.

4. Further information: whygreeneconomy.org/which-green-economy/.

2. ENERGY-EFFICIENT AND LOW-CARBON ECONOMY

A low-carbon economy is generally understood to be an economy based on low-carbon energy sources that produces minimal greenhouse gas emissions (GHG), in particular carbon-dioxide (CO₂). Typically, a low-carbon economy makes limited use of fossil fuels.

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

The Alpine area 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 CO₂ reduction and a higher share of renewable energy.

The European Union has recognised the importance of a low-carbon Alpine space by including the objective as priority axis to the Alpine Space Cooperation Programme (2014) and by stressing the strategic importance of the topic of energy

efficiency within the macro-regional strategy for the Alps (EUSALP) in particular in its Action 9, 'To make the territory a model region for energy efficiency and renewable energy'⁵. In this chapter, the focus is on three main topics of an energy-efficient and low-carbon economy in the Alps:

- (1) Carbon emissions, focusing on the status and trends of GHG emissions (especially CO₂) and their consequences, policy background and main targets for low-carbon economies in the Alpine countries, as well as potentials for reducing CO₂ in the Alpine area.
- (2) Renewable energy sources, highlighting the situation on installed renewable energy (RE) capacity of the Alpine countries as well as the potential use of RE within the Alpine area.
- (3) Efficient use of energy, in particular primary and final energy consumption in different Alpine countries as well as their status and goals for energy efficiency.

2.1 CARBON EMISSIONS

The combustion of fossil raw materials generating CO₂ has several consequences for the natural and human environment: global warming is causing extreme weather

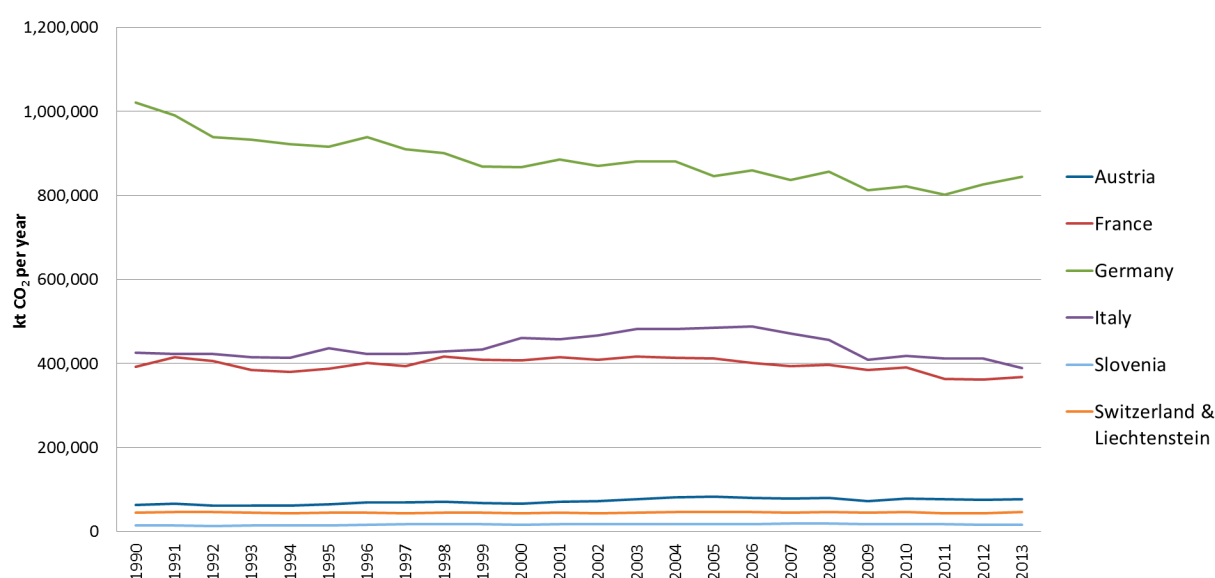


Figure 2.1 1 At national levels: CO₂ emissions (in kt per year) in Alpine countries from fossil fuel use and industrial processes between 1990 (base year) and 2013 (Data source: JRC 2014b; graph: ifuplan 2016). Liechtenstein data have been included in the data of Switzerland.⁶

5. Further information: ec.europa.eu/regional_policy/en/policy/cooperation/macro-regional-strategies/alpine/library/.

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

conditions, glacier melting, sea level rise, biodiversity loss (IPCC 2007 and 2013). These trends are likely to have serious consequences for the economy of the Alpine area, which call for further collective efforts towards a low-carbon economy on a supranational level aimed at avoiding such extremes.

Figure 2.1-1 shows the CO₂ emissions caused by fossil fuel use and industrial processes in the Alpine countries of Austria, France, Germany, Italy, Slovenia and Switzerland including Liechtenstein, at a national level between 1990 and 2013. The numbers include cement production, carbonate use of limestone and dolomite, non-energy use of fuels and other combustion. They do not include short-cycle biomass burning (such as agricultural waste burning) and large-scale biomass burning (such as forest fires).

The data show that until 2013 three Alpine countries have reduced their CO₂ emissions in comparison to the base year of 1990. Decreasing tendencies can be found in Germany (-17%), Italy (-8%) as well as France (-6%). In other Alpine countries increasing CO₂ tendencies have been reported such as Austria (+22%), Slovenia (+13%) and Switzerland including Liechtenstein (+4%).

On 12 December 2015, the 195 participating countries at 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.

For 2020, the EU has signed up for the second commitment period of the Kyoto Protocol. The annual targets – known as annual emission allocations (AEAs) – follow a logical line between a defined starting point in 2013 and the target for 2020. The EU or national targets for the Alpine countries for the time period between 2013 and 2020 are listed in Table 2.1-1.

Alpine Countries	GHG emission reduction targets ⁷
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%) ⁸ below 1990 level

Table 2.1-1 EU Climate and Energy Package targets (2013-2020) as well as pledged targets under the UNFCCC (Switzerland, Liechtenstein) (Source: EC 2009a).

Status and potential of carbon emissions reduction in the Alpine area

The progress of the various Alpine countries to achieve the climate goals of the Paris Agreement and the 2020 EU targets differs greatly from country to country:

- The Paris Agreement with its goal to keep the increase in global average temperature to 'well below' 2°C above pre-industrial levels and pursue efforts to limit it to 1.5°C sets ambitious targets for the Alpine countries. Strong political efforts are needed to achieve the 2°C and especially the 1.5°C targets.
- EU 2020 climate and energy targets: according to the progress reports on national GHG emissions,

most of the Alpine countries are on track to achieve their 20% GHG reduction goals (in comparison with 1990 level) with the measures in place until 2020. However, the binding reduction target of 40% until 2030 seems to be a significant challenge for all Alpine countries. Therefore, further efforts and actions in the field of mitigation as well as adaptation should be considered.

There is a high need for mitigation as the Alpine countries have decreasing but still high CO₂ emissions:

- Due to natural as well as anthropogenic circumstances (e.g. CO₂ emissions in transport sector due to the topography; heating of households in wintertime) there is a responsibility of the Alpine

7. EU Climate and Energy Package Effort Sharing targets for 2013-2020 (Austria, Germany, France, Italy, Slovenia) as well as pledged targets under the UNFCCC (Switzerland, Liechtenstein). 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 of 2013-2020.

8. 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.

area for climate protection.

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

However, adaptation in the Alpine area is especially relevant because of specific effects of climate change:

- There is a need for adaptation due to the economic and ecological vulnerability of the Alps.
- Adaptation to natural hazards, adaptation to changing water discharge (e.g. due to the fact that water is not going to be stored in snow and glaciers), and different production patterns for agriculture (e.g. due to changing harvest yields) are 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 CO₂ emissions derive from the fossil fuel combustion in transport, energy and heating industry, household heating, construction and tourism. These sectors play a key role in establishing a low-carbon economy within the Alpine area. Efforts in reducing

carbon emissions from the combustion of fossil fuels should not be thwarted by increased economic activities.

Opportunities:

- The Alpine area has multiple capacities for CO₂ reduction based on the potential for installing renewable energy power plants, the increase of energy efficiency through innovative technologies and CO₂ sequestration in Alpine forests.
- Increasing the use of renewable energies and local energy sources and reducing the dependency on fossil fuels of the Alpine area can be a triggering factor for an innovation towards a low-carbon economy that can and will also bring benefits to the Alpine economy, environment and society.
- Local, regional and non-state actors (e.g. municipalities, regional governments, businesses) need to support initiatives to reduce greenhouse gases, taking note of the significant potential of their efforts to achieve regional climate targets.

Challenges:

- One of the biggest challenges towards a low-carbon economy is the urgent need for adaptation as well as the short time remaining for policy action.
- A further challenge will lie in accelerating the implementation of measures as well as in transferring innovative approaches of pilot regions to the whole Alpine area.

2.2 RENEWABLE ENERGY SOURCES

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

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

share of energy production from renewable sources 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 2.2-2 shows the predicted future development of the share of RES in final energy demand of the Alpine countries for 2020, 2030 and 2050.

National renewable energy targets as a percentage of gross final energy consumption until 2020 are as follows: Austria (35%), France (23%), Germany (19%), Italy (18%), Liechtenstein (20%), Slovenia (26%) and Switzerland (15%).

Status and potential for renewable energy use in the Alpine area

- The Alps have a significant potential for the use of renewable energy, making a valuable contribution to reduce CO₂ emissions and consequently mitigate climate change.
- The biggest share of renewable energy production in all Alpine countries is held by biomass and hydropower.
- Renewable energy potential in the Alps: although there is a significant potential for hydroelectricity with pump-storage development, the potential is conditioned by requirements of nature protection, impacts on the landscape and other forms of land use. Solar and wind energy are recognized as high potential RES by the Alpine countries. Wind power potential might have to consider landscape effects e.g. visual and acoustic interventions as well as a lack of space; the utility of biomass for renewable energy needs to respect sustainable management. The generation of electricity from geothermal power is still in the development phase. Some projects have been launched in Austria, Germany as well as in Switzerland. All renewable energy plants have to consider the impact on flora and fauna.
- Most of the Alpine countries are on the way to achieve their ambitious 2020 targets set by the EU Renewable Energy Directive with existing as well as with planned measures.
- Cooperation between the Alpine countries might promote 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. It is important to establish joint policy frameworks, programmes, measures and guidelines and to implement joint projects.

Opportunities:

- Fostering the installation of sustainable facilities for potential renewable energy in the Alps offers a great opportunity for energy-independent, CO₂-neutral Alps.
- Existing infrastructure for renewable energy power plants (e.g. existing hydropower plants) can be used to feed the electricity grid system with other RES. Furthermore, older hydropower plants could be retrofitted for a more sustainable energy generation.
- The use of the endogenous energy potential of the Alps provides economic opportunities on the local and regional level including more jobs and higher incomes.

Challenges:

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

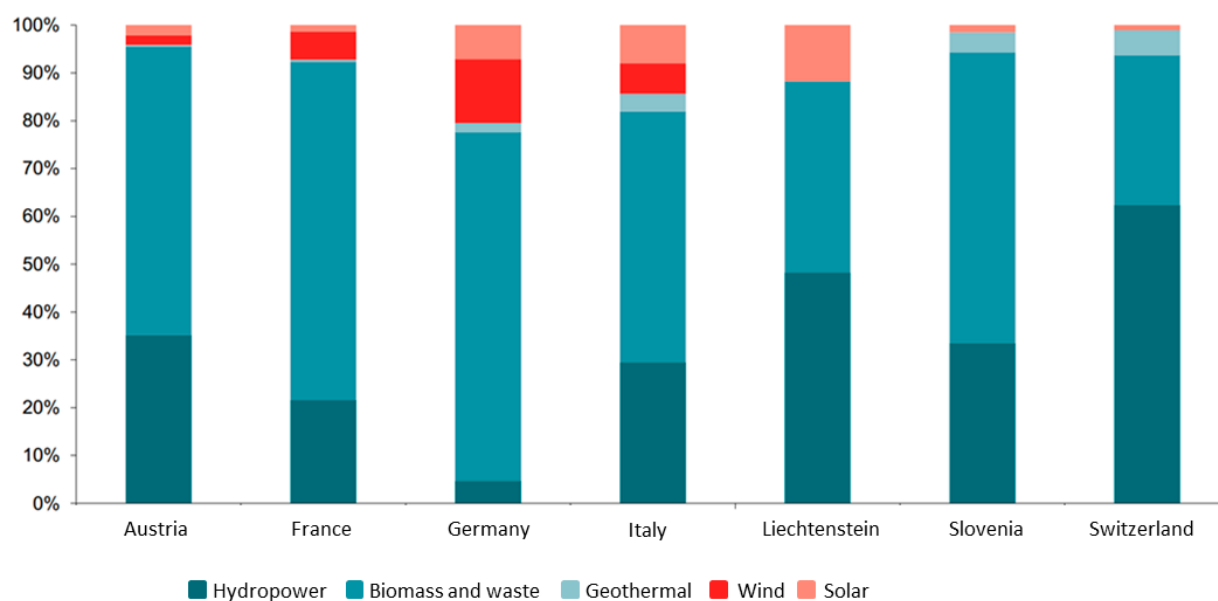


Figure 2.2-1 Share of hydropower, biomass including renewable waste, geothermal, wind and solar energy in RE production for each Alpine country in 2011 (Source: Swiss Confederation et al. 2015).

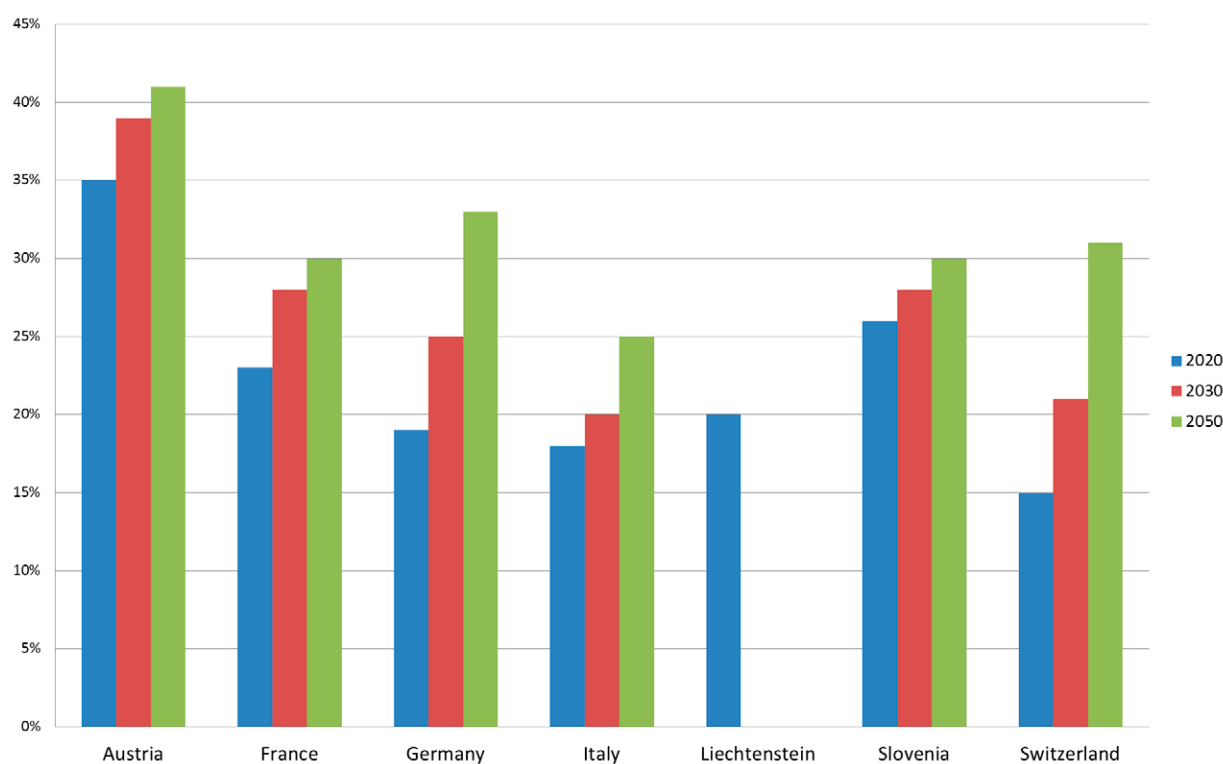


Figure 2.2-2 Projected share of RES in final energy demand (in %) per year of the Alpine countries in 2020, 2030 and 2050 (Source: Swiss Confederation et al. 2015, p. 26; graph: ifuplan 2016).

2.3 EFFICIENT USE OF ENERGY

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

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

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

Figure 2.3-1 shows the average annual change of energy intensity between 2005 and 2013 in the following five

sectors in the EU countries in the Alps:

- Industry: average 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).

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

The Alpine countries have set ambitious targets towards the Europe 2020 strategy in their National Energy Efficiency Action Plan (NEEAP 2014). Table 2.3-1 illustrates target levels for energy consumption in 2020 (Mtoe) as reported by Member States in 2013, in the NEEAP 2014 or in a separate notification to the European Commission in 2015 as well as the projected energy demand.



Figure 2.3-1: Average annual change of energy intensity indicators from 2005-2013 in different sectors of the Alpine countries within the EU (Data source: EC 2015d; graph: ifuplan 2016).

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 2.3 1 Current targets for energy consumption (2020) and predicted energy demand (2030, 2050) of the Alpine countries in Mtoe (Million tonnes of oil equivalent) (Source: 1 NEEAP 2014; 2 EC 2013c).

*In Switzerland the bill on Energy Strategy 2050 has not yet been passed by the National Council and the Council of the State. Sector-specific energy efficiency targets of Switzerland are described in Situation in Alpine countries.

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

- Targets towards energy efficiency: the target of a 20% increase in energy efficiency by 2020 set forth in the EU Energy Efficiency Directive is an ambitious goal for the Alpine countries.
- Efforts to boost energy efficiency in the Alpine countries have had a positive effect on reducing primary energy consumption. However, not all countries are meeting the current targets, and 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 decrease of energy consumption in relation to productivity. In addition, the reduction of CO₂ emissions is strongly connected to energy efficiency.
- Political approaches of the Alpine countries include the setting of targets to promote energy efficiency. The housing and transport sector but also production processes and the service sector are identified as action fields.

Opportunities:

- The benefits of energy efficiency include, among others, a more sustainable energy system, the

strategic support of economic and social development and the promotion of environmental goals, higher profitability and cost savings. Moreover, studies suggest a strong link between energy efficiency and the employment rate, which also brings economic benefits.

- Higher energy efficiency increases competitiveness in various aspects, including economic advantages due to cost savings and economic opportunity to become a leader in energy efficiency and innovative solutions.

Challenges:

- Improving energy efficiency may save less energy than expected due to changes of energy use consumption patterns. This so-called rebound effect has to be considered and addressed when talking about energy efficiency within the framework of a Green Economy.
- Efforts in reducing carbon emissions from the combustion of fossil fuels may be thwarted by increased economic activities. Carbon emissions targets should therefore be related to the productivity of economic sectors (CO₂ productivity). Furthermore, when replacing old technology with more efficient one, life-cycle issues such as upstream-downstream effects need to be considered (energy efficiency vs. resource efficiency).
- Ecological challenges: from the ecological point of view, there is a risk that the constant or growing energy consumption from renewable energies results in a higher and ecologically not desirable land take for power generation facilities. Consequently, efforts towards energy savings as well as energy efficiency

are essential within the framework of an energy transformation in the Alps and, therefore, have important implications for the future of our society.

- Despite successes in decoupling economic growth and energy consumption, additional efforts

are needed to reach ambitious primary energy demand reduction goals. Energy efficiency can contribute to sustainable development, particularly if it contributes to a reduction of the total energy demand.

3. RESOURCE-EFFICIENT ECONOMY

A resource-efficient economy is an essential element for the development of a Green Economy in the Alpine area. Using natural resources – renewable or non-renewable – is the basis for economic activities in all sectors, from agriculture and industry to the service sectors. 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. This does not automatically mean a decrease of the total resource input. On a global scale, the use of all natural resources – from biotic to non-biotic raw materials, water, air, soil, land and biosphere – has 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 scarcity of many non-renewable resources and overuse of some renewable resources. The Alpine economy is dependent on resource imports from other world regions, which shifts the environmental and social impacts of resource exploration and extraction to distant countries, which often bear more than their fair share of the burden. Increased resource efficiency and a circular economy will help to reduce environmental pressure not only in Europe and will lead to lowering material purchasing costs. It thus enhances competitiveness and offers opportunities to innovate.

From many points of view, especially in terms 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. The issue of sufficiency is therefore an important dimension.

As described in the EU Factsheet *Resource efficiency – A business imperative* (EC 2011c), a resource-efficient economy is based on a broad 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. As it is impossible to present all aspects, this chapter will concentrate on:

- (1) efficient use of non-energy resources
- (2) land use changes and
- (3) circular economy, recycling and waste management.

3.1 EFFICIENT USE OF RESOURCES

The transformation to a resource-efficient economy is generally characterised by an increase in resource productivity and an absolute reduction of material input. One of the approaches to measure resource productivity is the gross domestic product (GDP) divided by domestic material consumption (DMC)⁹. DMC measures the total amount of materials directly used by an economy. It is defined as the annual quantity of raw materials extracted from the domestic territory of the focal economy, plus all physical imports minus all physical exports (Eurostat 2010).

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

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

*Latest data 2012 (Source: Eurostat 2015e, FSO 2016).

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

Since these indicators are available on national level only, no statement on the Alpine area itself can be formulated.

DMC per capita in the Alpine countries varied from 8.8 to 21 tonnes in 2014. During 2005 and 2014 the absolute DMC 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 PPS¹⁰ per kg in 2014. In relation to these figures, Switzerland and Italy achieved the highest values for resource productivity among the Alpine

countries in 2014. However, a direct comparison is difficult, since the industry structures of the Alpine countries differ a lot. As a matter of fact, countries with a large service sector register higher resource productivities. Noteworthy, too, is the change of resource productivity in the last decade (2005-2014). All Alpine countries increased their resource productivity in this timeframe. Slovenia and Italy actually increased their resource productivity by more than 50%. Therefore, in all Alpine countries, material demand has been decoupled from economic growth during the period under consideration (cf. Table 3.1-1).

Status and potential for resource efficiency increase in the Alpine area

For a comprehensive picture, the data availability for resource efficiency on the regional level needs to be improved. Therefore, this chapter concentrates mainly on two specific Alpine 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 area is water. Climate change exacerbates existing water challenges due to more likely regional and seasonal water scarcity within the Alps and in the lowlands. This increases the need for a sustainable Alpine water management and climate change adaptation measures. Occasional local conflicts among water users and negative ecological challenges concern the full range of water uses – from irrigation, the production of artificial snow, and drinking water supply in times of touristic high seasons to natural low water availability in winter or periods of occasional droughts in summer. In the southern part of the Alps, this requires special attention, also because of climate change.

The second resource with special relevance for the Alpine area is wood. A more sustainable forest management can improve the production of wood based on a higher wood mobilisation and create increasing supply of other ecosystem services, such as CO₂ sequestration, soil protection, natural hazard protection, recreation, landscape and biodiversity. A potential for increased wood mobilisation has been identified especially in the southern part of the Alpine area. Moreover, wood can be used as an alternative renewable resource, e.g. in the construction sector.

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

3.2 LAND USE CHANGES

Across Europe, artificial surfaces¹¹, i.e. settlement and infrastructure areas, are growing steadily, mainly at the expense of agricultural areas and, to a lesser extent, of forests and other (semi) natural areas. This process is more or less irreversible. Developed areas are no longer available for agriculture, forestry and other non-urban land uses. The type of land use has fundamental consequences

for the environment, especially on landscape aesthetics, biodiversity, soils, hydrology and local climate. Artificial areas often cause further environmental impacts, predominantly additional emission of air pollution from transport, housing and production on these settlement and infrastructure surfaces, an increase of run-off of precipitation and a decline of infiltration to groundwater tables. These effects are economically relevant as they lead to external costs that are often not considered.

10. Purchasing Power Standard (PPS) is an artificial currency unit. It is used by Eurostat for the common currency in which national accounts aggregates are expressed when adjusted for price level differences.

11. Artificial surfaces include all land use classes within the 'artificial surfaces' category of the CORINE land cover classes.

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

Situation in Alpine countries – Analysis of land use changes based on national statistical data¹²

Germany (cf. Figure 3.2-1), Liechtenstein (cf. Figure 3.2-2) Slovenia (cf. Figure 3.2-3) and Switzerland (cf. Figure 3.2-4) are the countries for which land use changes data are available. They show a continuous increase of settlement areas over the last decades, with only minor decreases in growth rates during the recent period. The comparability with land use data based on cadastres (as for the German data) or interpretation of aerial photography (as for the Slovenian, Swiss and Liechtenstein data) is rather limited. The share of settlement and transport infrastructure areas in Germany (8%) and Liechtenstein (10%) seems relatively high compared to other Alpine countries. But as the classifications and sources differ from country to country, a direct comparison of numbers is possibly misleading.

The development of the settlement area has to be considered in connection with the development of population. In the German Alps, data show that the increase of settlement area

is much higher than the population increase (cf. Figure 3.2-1). Agricultural areas have declined in Germany (to 44% in 2013), in Liechtenstein (to 33% in 2008) and in Switzerland (to 23% in the timeframe 2004/09). This is the land use category converted most frequently. 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 have increased, in Slovenia they have stagnated. Germany and Liechtenstein have a smaller share and a minor increase of forest area.

In Austria, the utilized agricultural area in all LAU2 units within the Austrian Alpine Convention area declined by 26% between 1999 and 2010, compared to 15% nationwide (data of the Farm Structure Surveys 1999 and 2000). This is mainly due to changed 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. In 2010 only the fodder area was recorded excluding stony patches and unproductive areas covered with shrubs or trees. The settlement and transport area of all LAU2 units within the Austrian Alpine Convention perimeter shows an increase of 9.8% from 2001 to 2012 (regional data derived from the Austrian Federal Weights and Measures Office real estate database).

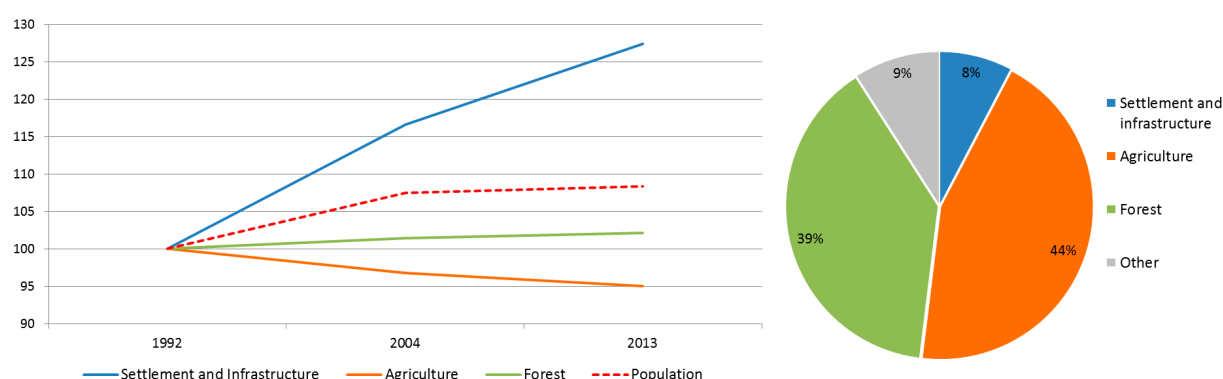


Figure 3.2.1 Development (1992-2013; index base year 1992 = 100) and share (2013) of different land use classes in the German part of the Alpine Convention area between 1992 and 2013. Due to changes in the land use statistics, the data from 2014 onwards are not directly comparable with data up to 2013. (Data source: Bayerisches Landesamt für Umwelt 2014; graph: ifuplan 2016).

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

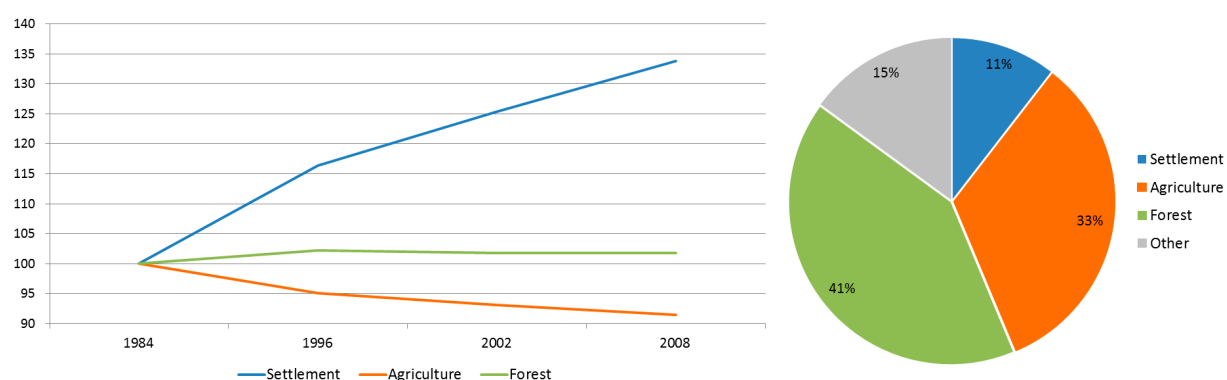


Figure 3.2.2 Development (1984-2008; index base year 1984 = 100) and share (2008) of different land use classes in Liechtenstein (Data source: Swiss Confederation 2009; graph: ifuplan 2016).

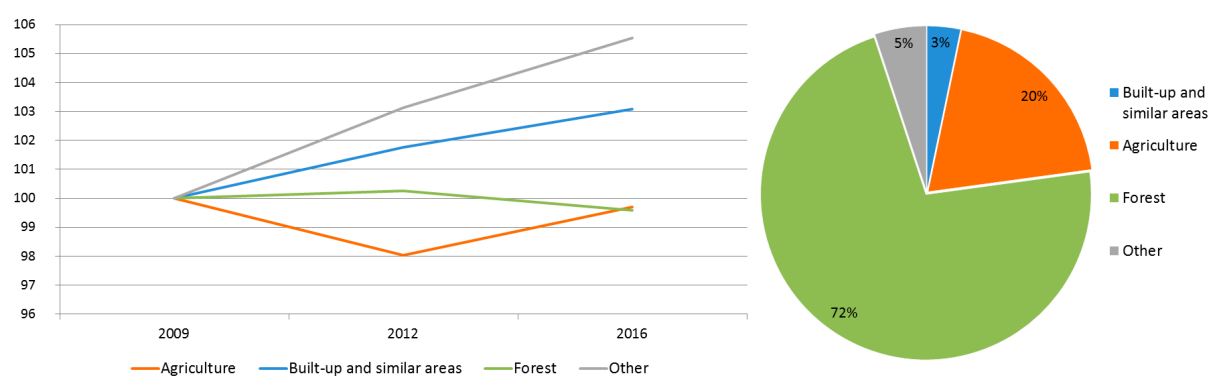


Figure 3.2.3 Development (2009-2016; index base year 2009 = 100) and share (2016) of different land use classes in the Slovenian part of the Alpine Convention area (Data source: Slovenian Ministry of Agriculture, Forestry and Food 2016; graph: ifuplan 2016).

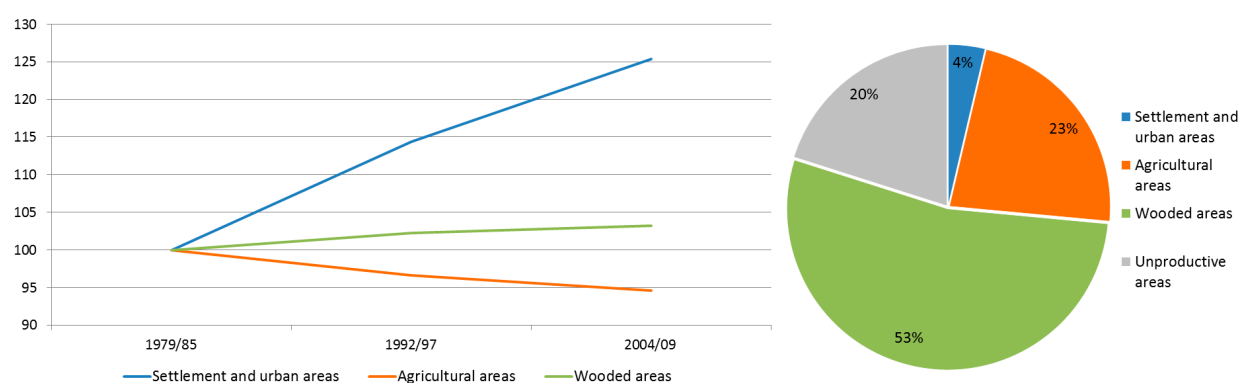


Figure 3.2.4 Development (1979-2009; index base year 1979/85 = 100) and share (2004-2009) of different land use classes in the Swiss part of the Alpine Convention area. Data were provided for Cantons. Four Cantons are only partly in the Alpine Convention area but included entirely in the figures. (Data source: Swiss Confederation 2016b; graph: ifuplan 2016).

Status and potential of land use changes in the Alpine area

Due to topographic and climate conditions, land suitable for settlement, transport and agriculture is more limited within the Alps than in the lowlands. A probable increase of natural hazards due to climate change may additionally endanger parts of the permanent settlement areas. As permanent settlement areas (PSA) 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 of agricultural land into settlement areas slowed down in most regions in the last decade, the current levels are not sustainable in a mid or long-term perspective. More efforts are needed to reach the target values. Taking into account the demographic changes, such as an ageing population in many Alpine regions, there is a need – but also the opportunity – to reduce and restructure settlement structures, stop net land take and develop a sustainable circular land use management.

Spatial planning plays a crucial role 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. The 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 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 reduces agricultural areas as settlement, infrastructure and economic sites are enlarged. This conversion of agricultural land affects mainly valley bottoms and gentle slopes in lower altitudes where soil productivity is – in most cases – higher than in higher altitudes and on steeper slopes. Therefore, agriculture has lost and is continuing to lose more and more land with a relatively high productivity and is finding 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, which can be used for various economic purposes.

3.3 CIRCULAR ECONOMY, RECYCLING AND WASTE MANAGEMENT

To keep resources within the economy after a product has reached the end of its life 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 to minimise, severe resource conflicts. Secondary raw materials can partly substitute primary raw materials. If products can be 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. The concept of a circular economy has to be respected already before and during product development and

requires a change of production patterns, e.g. by facilitating the possibilities to repair the product or exchange single components instead of replacing the whole product. Already during product development there is a need to consider recycling after the last use of the product to preserve the material or to replace non-recyclable materials by recyclable materials (e.g. plastics by regrowing or compostable alternatives or synthetics by natural materials). It also includes strategies such as reducing the quantity of raw material needed for a product (light weighting), increasing the durability of products, and the substitution of hazardous materials and materials difficult to recycle. In a nutshell, waste prevention means to act across the whole life cycle of products and not only at the end of their use.

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, six of which turn to waste. In 2010, only 36% of waste was

recycled, the rest was landfilled or incinerated¹³. This means there is still a high loss of potential secondary raw material, although some progress has been made.

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

However, tourism in some Alpine areas puts additional pressure on waste management, as more food and material may be wasted, and waste volumes fluctuate seasonally. This becomes 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.

Opportunities and challenges of a circular economy in the Alpine area

Opportunities and challenges within the Alpine Convention area in terms of a circular economy and waste management are not different from those in the lowlands. The circular economy package of the EU contains targets for waste management for 2030, which might be met considering on-going developments in these countries. Waste management in remote areas, where expenditures for separated waste collection (organisational structures and transport) are rather high in relation to the lesser quantities of each fraction of waste, may be a particular challenge.

Waste prevention, in general, and regional material

cycles are important aspects of the circular economy inside and outside the Alpine region. Regional material cycles can have additional positive environmental effects like a reduction of pollution and CO₂ emissions due to reduced transport needs. The management of waste and wastewater in Alpine huts without connection to municipal sewage and waste collection systems will have to be handled on a case-by-case basis as conditions vary.

A specific 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 and more economical.

13. Further information: ec.europa.eu/environment/waste/index.htm.

4. ECOSYSTEM SERVICES AND NATURAL CAPITAL-BASED ECONOMY

This chapter deals with the economic basis that 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 natural capital and services, which are often taken for granted and not considered and respected in our economic systems. Even if these suppositions are mostly in a conceptual state, they are very relevant for greening the economy and are introduced in this report:

- Natural resources and ecosystem services represent a capital, analogous to human capital, manufactured capital, financial capital and social capital. The services nature provides are also a foundation for the human well-being.
- Biodiversity is a relevant factor for the provision of ecosystem services and the building of natural capital and represents a value in itself.
- Finally, the valuation of ecosystem services introduces limitations as well as opportunities, in particular when it comes to the economic valuation of natural capital and ecosystem services.

4.1 NATURAL CAPITAL AND ECOSYSTEM SERVICES

Just like financial capital, 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. They build an indispensable foundation for our well-being and are of great economic relevance. However, the value of natural capital and ecosystem services is often not taken into account in the wealth accounting systems at a national level.

A degradation, over-exploitation and destruction of natural capital and ecosystem services would lead to an ecological 'bankruptcy'. This would bring tremendous disadvantages for the economy, culture and social life of a society. Examples are the costs arising from flood damages, which are related to degraded regulating services of rivers. The flood damages in the summer of 2013 in Germany amounted to a total of approximately 11.7 billion Euro (MunichRE 2014).

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

What are specific contributions of the Alps in terms of natural capital and delivering ecosystem services? With no cross-country analysis of natural capital and ecosystem services ever conducted, it is difficult to answer this question. However, from other analysis, one might highlight some first examples of Alpine natural capital and ecosystem services:

- Water in high quantities and qualities is provided not only for the Alpine area but also 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 south-eastern, lower areas (up to 53% in Austria and 68% in Slovenia, data provided by the WG Mountain Forests).
- Large-scale semi-natural landscapes host a high diversity of plants and animals and are also a biotic resource for cultural services.
- Provisioning services are the basis for the production of fruits and vine grapes cultivated in many of the Alpine regions.
- Regulating services for natural hazards such as floods, avalanches and mud slides are provided by Alpine forests and through the maintenance of Alpine pastures.
- Cultural services like health, recreation and well-being are what people are seeking in remote valleys. Millions of tourists and residents experience the Alps as hikers, bikers, mountaineers or skiers or as people looking after their health through a stay in clean mountain air and climate. The Alpine landscapes also offer a vast amount of cultural services, which have inspired generations of artists.

Natural capital The example of forests in the Alps

For the purpose of this report, forests have been chosen as an indicator for natural capital. A sustainable management of forests requires that the amount of wood extracted from forests is equally compensated by forest growth.

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 (WG Mountain Forests 2016). Figure 4.1-1 presents 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 Alpine Convention area, due to the abandonment of marginal agricultural areas (meadows and pastures). The forest expansion reported in Europe is concentrated in mountainous 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 annual forest growth observed in last decades is likely due to the combination of several factors such as a larger growing stock, a reduction of grazing, the fertilisation effect caused by atmospheric

nitrogen deposition, the increase in atmospheric CO₂ content concentration and the rise in temperatures (Bellassen et al. 2011).

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 (WG Mountain Forests 2016).

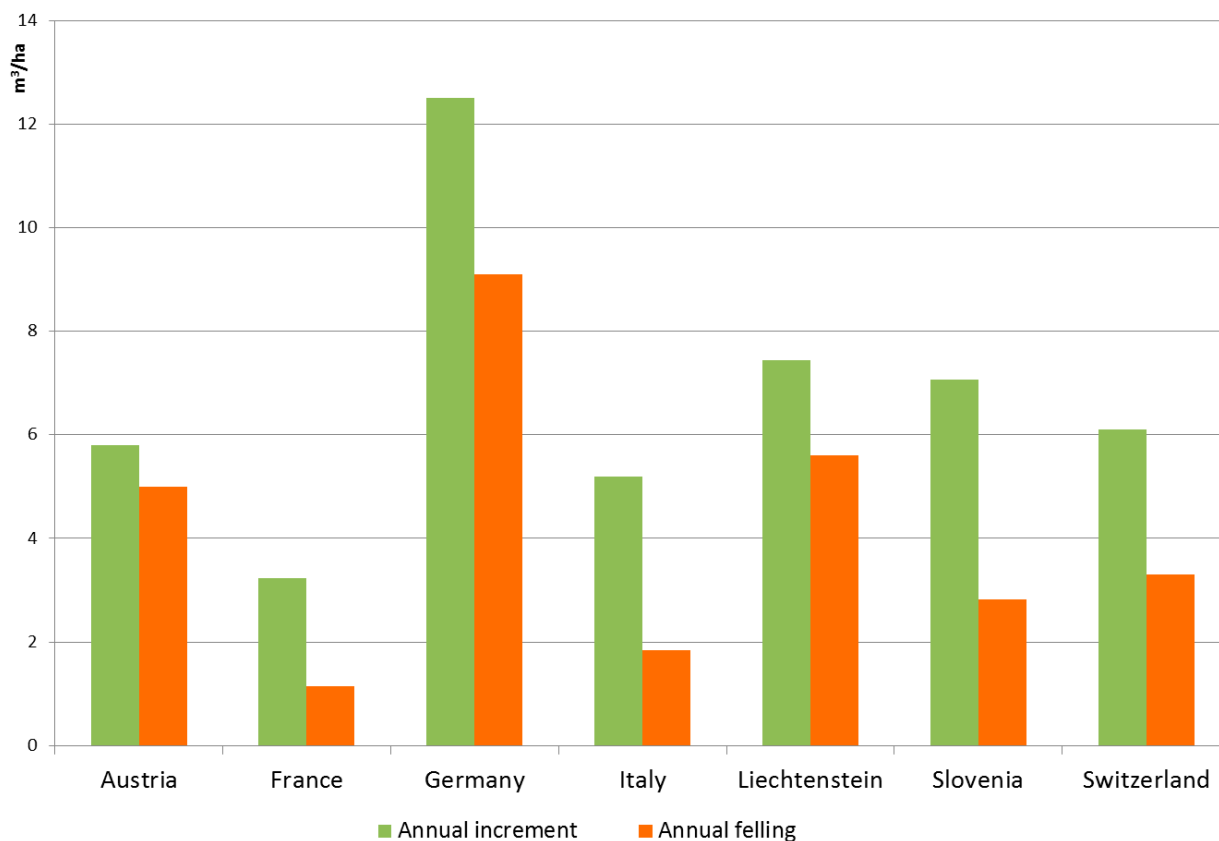


Figure 4.1 1 Annual forest increment and felling (m³/ha) in the Alpine countries (Source: Working Group Mountain Forests of the Alpine Convention 2014). In the south-western Alps, felling amounted to 35% of forest growth, while in the north-eastern Alpine area it was at 75%.

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

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 accessible for consideration in economic terms.

The natural capital of forests is an important resource in a Green Economy. Forests are renewable and low energy-intensive, and they do not produce waste. From national data on forest growth and felling, it is evident that wood biomass is managed sustainably in the Alpine area. The forest area has even increased. However, regional data for the Alpine Convention area have not been available for this report.

Opportunities of this local and regional natural capital in the Alps lie in the use of sustainably produced raw materials such as construction wood for innovative building and furniture 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.

A variety of national strategies to assess ecosystem services are available or in preparation in the Alpine countries. Initial case studies have been published. In future, the concept of ecosystem services could serve as a tool and basis for the identification of trade-offs between different ecosystem services and other land uses. Based on these trade-offs and their costs, environmental costs and benefits could be better considered in a Green Economy. Furthermore, the spatial disparities of ecosystem services and the 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.

So far, a common classification or identification of ecosystem services for the Alps is still missing, and data for assessing and mapping ecosystem services are not ready for use.

4.2 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 it 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 (e.g. regional recipes) or clothing accessories for traditional costumes and enriches our personal nature experiences. More than this, biodiversity is also an important economic factor. It is a marketing and image asset in tourism (such as the eagle or the Alpine ibex), input for pharmaceutical products, biochemical products or cosmetics, and a model for bionic developments. The uncountable variations and millions of years of development time for biological solutions serve as an important knowledge source for innovation. This crucial role of biodiversity for society and economy tends to be underestimated.

Biodiversity cannot be maintained by only creating protected areas. The rich biodiversity in the Alpine area makes protected areas an important backbone for a transnational green infrastructure. Protected areas cover almost 28% of the total Alpine Convention area. These protected areas are already generating significant added value.

Also outside protected areas, biodiversity has to be maintained consistently. 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 high nature value areas are extensively grazed uplands, alpine meadows and pasture lands with particular interests for nature conservation because of their high biodiversity (Paracchini et al. 2008). Based on the main characteristics, these authors categorised three types of high nature value farmland: 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 Joint Research Centre and the European Environment Agency prepared the first EU 27 map of high nature value farmland on the basis of land cover data from 2006, refined and regionally differentiated selection criteria and additional biodiversity datasets such as PBAs (Prime Butterfly Areas), IBAs (Important Bird Areas) and NATURA 2000 areas. Based on this methodology, Figure 4.2-1 presents the likelihood of HNV farmland presence in the Alpine area. In most parts of the Alpine area the likelihood of HNV lies within the interval high to very high.

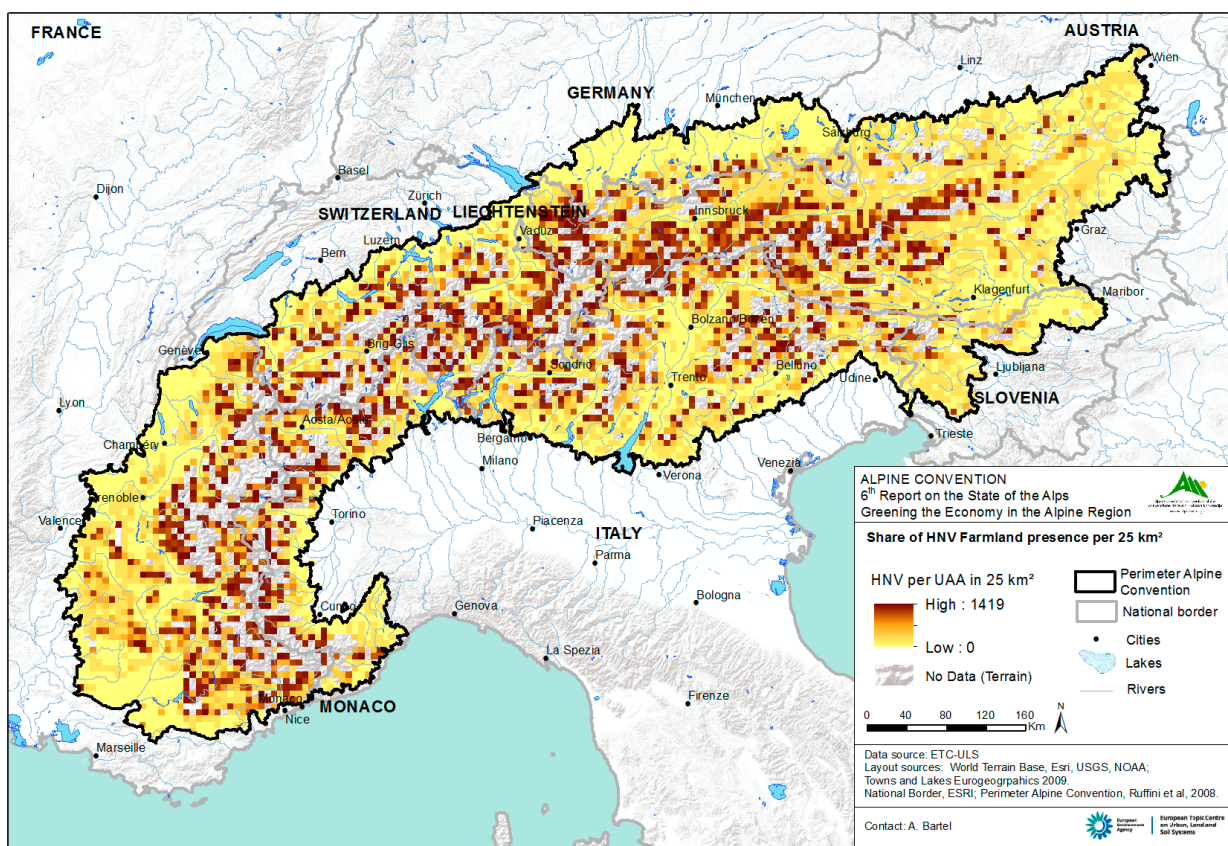


Figure 4.2-1 Likelihood of HNV Farmland presence based on CORINE land cover data (Source: ETC-ULS 2016b).

Opportunities and challenges of biodiversity in the Alps

The Alpine Convention area has a remarkable share of different types of protected areas. However, considering the 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 such as goods (like plant based pharmaceuticals) or services (such as wildlife experience) or costs avoided through biodiversity (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, the development of markets for goods and

services based on Alpine biodiversity¹⁴ provides an opportunity to improve biodiversity protection but also an economic opportunity. Nature conservation should thus be viewed as an area of economic opportunity for a Green Economy and not as a constraint.

In particular, protected areas can contribute to a greening of the Alpine economy by:

- Facilitating the development of activities and projects that reconcile economic development with nature conservation and social inclusion.
- Supporting social innovation in rural areas.
- Offering good practices and inspiration for biodiversity management and economic benefits also to other regions.

Biodiversity can also be maintained by preserving high nature value farmland while providing sufficient and long-term financial compensation for the management of this low intensity farmland.

14. Further information: cms.iucn.org/nl/node/26196.

4.3 VALUATION OF ECOSYSTEM SERVICES

Natural capital, ecosystem services and biodiversity – together with ethical and cultural values – are also valuable in economic terms. People and society in the Alps benefit economically from nature – and suffer from losses of natural goods.

Is it necessary to valorise ecosystem services and biodiversity? In principle, economics is about making choices and making decisions while evaluating various alternatives. However, economists often equate 'value' with 'price'. Therefore, the markets in place do not and cannot fully reflect the full value of ecosystem services. Markets are structurally limited in their abilities to provide a comprehensive evaluation of all ecosystem services and to act as a decision support (TEEB 2010, ch.: 5.8). Moreover, it will be very difficult to quantify ecosystem services that embrace also services from human-made assets, such as input from labour and technology.

GDP is widely used as a criterion to measure material welfare. GDP measures the total value of all goods and services produced within the national territory within a specified period of time. However, GDP normally does not regard damages to the environment and nature but paradoxically considers the impacts on the environment as a positive contribution to welfare. It does not take the loss of natural capital into account (e.g. clear cutting of a forest for a motorway) as at present there is no methodology implemented to measure it. On the contrary, the GDP counts the replacement of natural capital (e.g. motorway instead of forest) as production and thus a contribution to welfare. Even more so, technical substitutes for natural services (e.g. noise protection embankments) are also counted as production and an additional contribution to welfare. 'Ultimately, not recording the cost of reinvestments to sustain healthy ecosystems creates and conceals ecological liabilities. This distorts our perception of the future when restoring ecosystem services will demand that we repay the debts' (EEA 2013b).

It is important to be aware of the different meanings of the term 'value'. It may mean to regard something as being of importance or worth. Alternatively, value is used as a synonym for price or monetary value. The valuation of ecosystem services means first to recognize the importance and the value ecosystem services provide for our daily life. Furthermore, the value may also be expressed as an economic value, which is the monetary value people attribute to ecosystem goods and services. For this, a variety of different qualitative and quantitative methodologies exist. On the one hand, economic values are often very difficult to assign to ecosystem services, particularly for regulating and cultural services. On the other

hand, economic value plays a major role in decision making at all levels from strategic policy decisions up to private customers' decisions and is – consciously or subconsciously – applied to many public and private decisions. Thus, economic value is a very important link between the environmental and the economic sphere. The TEEB foundation lists six main reasons for conducting a valuation of natural capital and ecosystem services (TEEB 2010, ch.: 5.9):

- Missing markets.
- Imperfect markets and market failures.
- Importance of understanding and appreciating alternatives and alternative uses for some biodiversity goods and services.
- Uncertainty involving demand and supply of natural resources, especially in the future.
- Governments may use this monetary valuation to counterbalance the restricted, administered or operating market prices for designing biodiversity / ecosystem conservation programmes.
- Valuation methods such as Net Present Value are needed for effective natural resource accounting.

It has to be underlined that the economic valuation is never foreseen as a stand-alone solution, but needs to and will be embedded in legal, administrative and planning solutions.

Alpine relevance of the valuation of ecosystem services

Like most areas in the world, the Alpine area provides ecosystem services that are used by the residents of this area. Thus, the first concern is to maintain the provision of ecosystem services for Alpine residents and their well-being (such as the provision of wood, food, recreation and landscape amenities). Furthermore, the Alpine area provides ecosystem services that are highly important services for areas outside the Alpine Convention area (such as water provision and run-off regulation) and for the well-being of far more residents than those in the Alpine area. The ecosystem service provision in the Alpine area can only be illustrated by using some case studies since there is no comprehensive overview of the overall contribution of Alpine ecosystem services.

The example of protected areas and tourism

Alpine tourism plays a significant role for the economy of the Alpine area. In a wider sense, many Alpine tourist destinations are visited because of the local natural and cultural assets, such as Alpine landscapes' aesthetics, nature experience and inspiration, which can all be considered cultural ecosystem services.

In a narrower sense, more concretely relying on natural amenities, tourism in the protected areas of the Alps is most probably more focused on these nature-related motivations. Therefore, economic effects of national parks, as the most prominent category of protected areas, give some insight into the economic value of ecosystem services for tourism. Following the IUCN guidelines (IUCN 2008), national parks should not only protect the ecological integrity of ecosystems but also offer opportunities for recreation and tourism as primary goals. Often, national parks are situated in remote areas. They tend to be highly attractive destinations for tourism and 'can serve as engines for economic development in otherwise often weak regional economies' (Mayer et al. 2010).

The Berchtesgaden national park in the German Alps created regional economy effects in the year 2002 by attracting 1.129 million visitors with 1.442 million overnight stays resulting in a gross turnover of 49.1 million Euro (Job et al. 2009). Based on the economic analysis of German national

parks, ten theses have been formulated by Job et al. (2009), four of which seem well transferable to the Alpine area:

- Regional economy effects of national parks are remarkable in structurally weak, peripheral areas, even without taking into consideration transferring structural programmes.
- State support in national parks has relevant economic effects: average administration and investment expenses of national parks can generate a three times¹⁵ higher income.
- Peripheral areas may benefit from a branding as wilderness areas. However, an official labelling as a national park as unique selling point is important. It is mandatory to offer additional regional tourism services, regional food or other products with a clear relation to nature and the protected area.
- It is recommended to make a qualified assessment of opportunity costs¹⁶ comparing different types of land use in national parks, particularly ecotourism and forestry.

Opportunities and challenges of valuation of ecosystem services in the Alps

The limits of economic valuation of natural capital, ecosystem services and biodiversity are unquestionably due to different available methods and the various site-specific factors that have to be considered. But still, ecosystem services, natural capital and biodiversity represent significant economic assets that play an important role in the Alpine economy. At present, in some fields their value has already been assessed. But unfortunately in many fields, their value is still under-estimated or mostly questioned in political and economic decisions.

Many economic activities in the Alps depend directly on natural capital, ecosystem services or biodiversity or are supported by them. This is relevant in particular for mountain farming, mountain forestry, water management, tourism and recreation, and urban development.

The assessment and the valuation of natural capital and ecosystem services might become an important

complementary instrument for decision making in the future. However, most of the existing approaches are in their infancy and do not allow any benchmarking or provide any real support for decision-making. Therefore, a further development of the valuation of natural capital and ecosystem services may, together with the assessing and monitoring of ecosystem services, better highlight the economic relevance of natural Alpine features and support Green Economy approaches.

It is important to incorporate their value into decision-making to a larger extent through the internalisation of external costs and the application of better and long-term payment for ecosystem services (PES) schemes and thus make environmental and Green Economy policies more successful. This is a major challenge and will require a clear and comprehensive concept. Values of ecosystem services should be incorporated into decision-making also in cases where monetary valuation is difficult or controversial. This can be done in a qualitative manner.

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

16. An opportunity cost represents the benefits of an alternative given up when a decision is made.

5. AN ECONOMY SUPPORTING QUALITY OF LIFE AND WELL-BEING

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

This chapter deals with four different subtopics. First, it looks at the effects on employment and education of a Green Economy. Then, aspects related to economic well-being and social inclusion are examined. The third subchapter provides examples of sustainable consumer behaviour as a way to contribute to a more sustainable and inclusive economy and a fairer globalisation. Finally, health issues and harmful emissions resulting from economic activities are looked at.

5.1 EMPLOYMENT AND EDUCATION

A transition to a low-carbon and sustainable economy can provide opportunities for employment across many sectors of the economy and become a new engine of development. On the other hand, employment also plays an important role for the transition to a Green Economy. Appropriate training and education are necessary to satisfy the need of a Green Economy in terms of job qualification. The International Labour Organisation defines a green job as any decent job that contributes to preserving or restoring the quality of the environment whether it is in agriculture, industry, services or administration (UNEP 2008). Green jobs help to reduce negative environmental impacts leading to environmentally, economically and socially sustainable enterprises and economies. They reduce consumption of energy and raw materials, limit greenhouse gas emissions, minimise waste and pollution, and protect and restore ecosystems.

In 2008, 167,000 employees (full time equivalent) were working in the green sector in Austria. The number rose to 181,820 in 2014, equating to 4.9% of the total number of employees. Almost one job out of 20 in Austria is consequently a green job. Including public transportation, the number of green jobs in 2014 even reaches 209,864. Resource management activities encourage producers of technologies, goods and services to measure, control, restore, prevent, minimise, research and sensitise resource depletion. This results in resource-efficient technologies, goods and services that minimise the use of natural

resources. In Austria, the most important resource management activity by far is the management of energy resources.

Jobs in the environmental protection sector provide a good example of green jobs throughout the Alps. In Austria, the federal province of Salzburg has the highest amount of employees (8,633 persons) working on 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 in resource management can be found in Tyrol (7,903 employees), followed by Carinthia (6,285 employees), Salzburg (4,728 employees) and Styria (4,721 employees).

For Germany, a study estimated that in 2012, around 2.2 million people were employed in the field of environmental protection (Edler & Blazejczak 2016) – see Figure 5.1-1. This represents 5.2% of total employment and is thus an important sector for the labour market. Between 2010 and 2012, the number of people employed in environmental protection increased by 245,000. The estimate is based on 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 is a relatively low number, as several sectors such as ecological tourism, the ecologically-oriented insurance industry and product-integrated environmental protection were not included due to a lack of data.

Classical sectors include waste disposal, water protection, noise abatement and air pollution control. The production of goods necessary for the operation and maintenance of environmental protection facilities also contributes to the creation of jobs in the environmental sector. The environmental service sector accounts for 63% of all environmental jobs (1.38 million employees). 97,000 jobs can be attributed to the exportation of environmental goods. For employment in the renewable energies sector, the figures indicate 393,000 jobs in Germany in 2012 (cf. Figure 5.1-1).

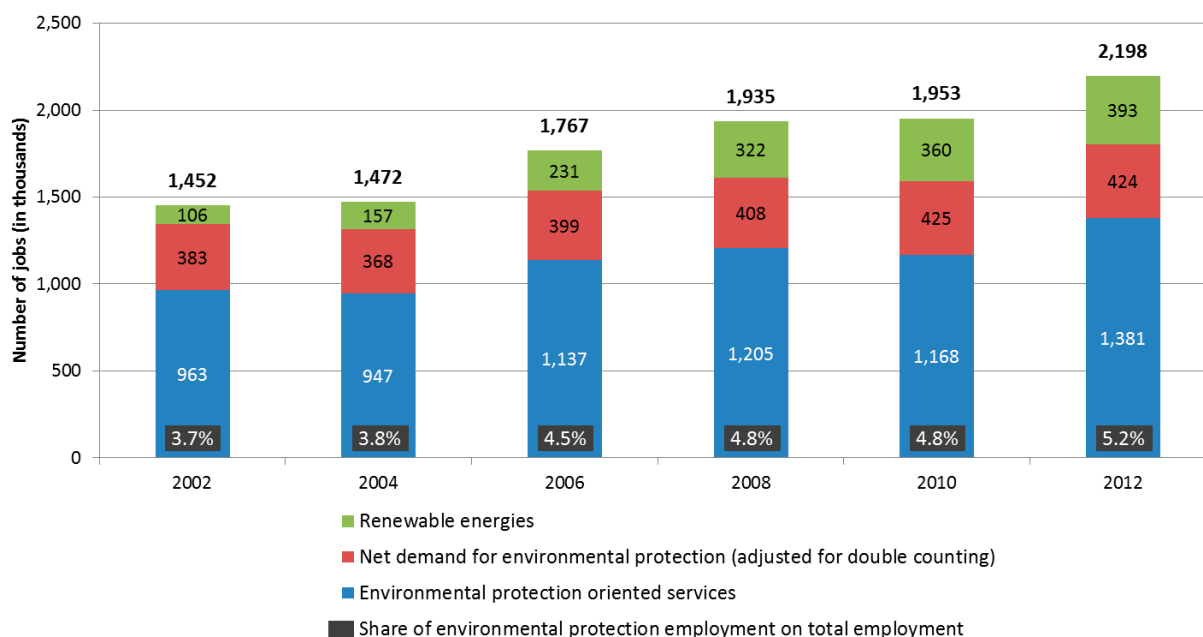


Figure 5.1 1 Development of employment in the environmental goods and services sector in Germany, 2002-2012, in 1,000 persons. The comparability of the estimation results between the review years is limited; a substantial part of the differences occur due to methodological and statistical reasons. Contains employment in energy-efficient building refurbishment (Source: Edler & Blazejczak 2016; calculations by DIW).

Opportunities and challenges of green employment and education in the Alps

Given that the Alpine area has a high innovation potential and numerous initiatives for renewable energies and energy efficiency, the area is predestined to create green jobs. Figures from Austria show that many of the Austrian green jobs are located in the Alpine Convention area. The creation of green workplaces can also offer an opportunity to keep qualified workers in the area.

There is a need to put in place appropriate policies to achieve a successful and fair transition to a Green Economy and to create job opportunities. This includes qualification measures (education and vocational

training), supporting innovation in small and medium-sized businesses, creating networking structures among all stakeholders of a Green Economy, the promotion of sustainable investments and the setting of incentives to stimulate the demand for environmentally friendly products, technologies and services at the private and public level.

The innovation potential in the Alps and the existence of many RES companies show that green jobs are available. This needs to be supported by fostering green skills with further development of trainings and academic programmes. The Austrian example shows that, with the right policies in place, a Green Economy can have positive effects on the labour market and provides an opportunity for social inclusion.

5.2 ECONOMIC WELL-BEING AND SOCIAL INCLUSION

A sustainable economic system should generate sufficient income and wealth to allow people to satisfy their needs and pursue any other goal 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 with lots of working and organisational experience, people favouring part-time working due to private reasons or people with traditional working skills. Appropriate framework conditions have to be designed to allow marginalised groups to contribute to the economic system, including access to public transport for people living in remote areas.

The quality of life can differ significantly in the Alpine regions depending on where people live. Whereas in urban centres the quality is high, life can be rather difficult in remote areas where there is less access to public services and a higher risk of exclusion. However, especially in remote areas, there are people with traditional working

skills, such as dairy farmers on Alpine pastures, who are important for a more sustainable economy and who need to be integrated in the labour market for social as well as for economic reasons. If such ways of living shall be conserved and protected, it is important to assure a high quality of life in the whole Alpine area. Therefore, the topic is of particular importance for the Alps. Figure 5.2-1 shows the percentage of people at risk of poverty in the Alpine Convention area.

In the aim of creating an economy that increases 'the quality of life for all and not the wealth of a few', the initiative 'Economy for the Common Good'¹⁷ was born in 2010, launched by the Austrian writer and lecturer Christian Felber. The movement wants to promote the values of human rights and ecological responsibility in 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 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.

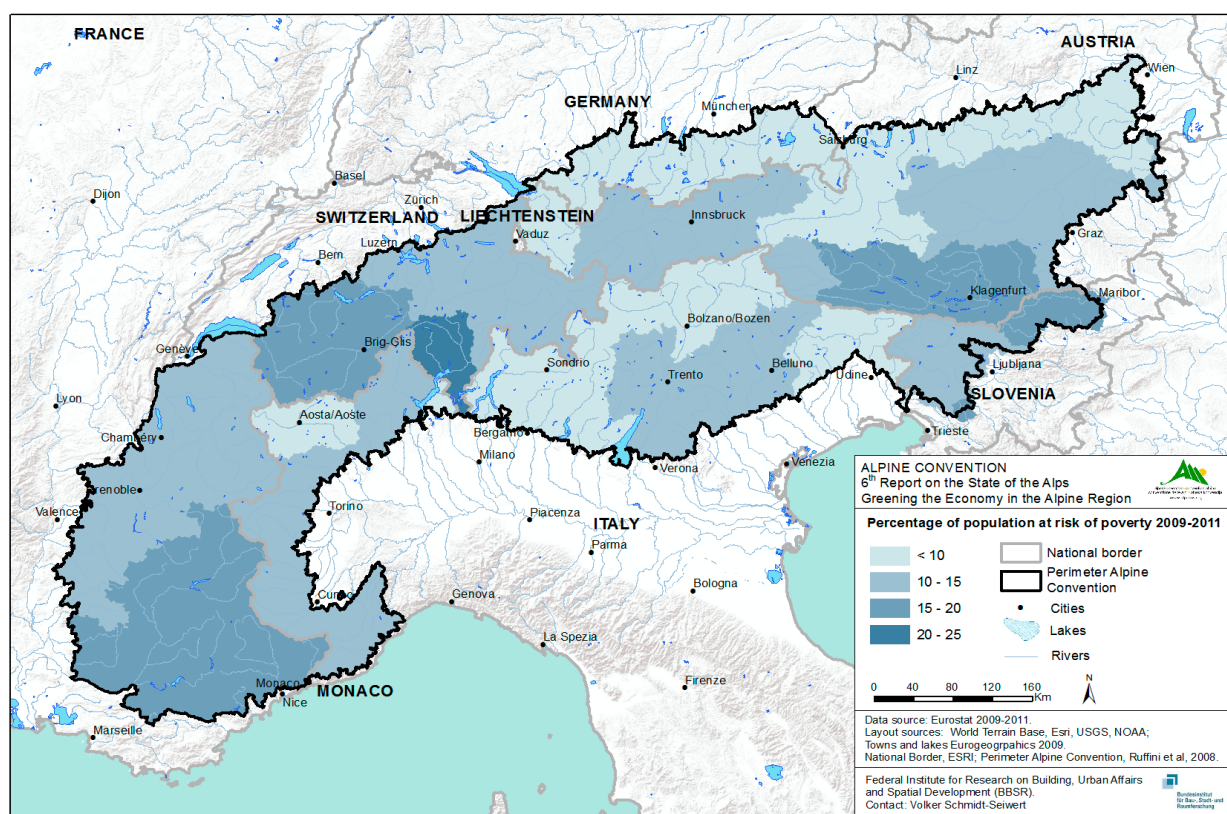


Figure 5.2 1 ESPON Atlas 2014: Risk of poverty in the Alpine Convention area (Source: ESPON & BBSR 2014; elaboration: Permanent Secretariat of the Alpine Convention).

17. Further information: www.ecogood.org/en.

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

In general, the quality of life is rather high in the Alpine area. The risk-of-poverty rate in the German Alpine area is lower than the Bavarian or the national average. In Slovenia, it is lower than at the European level.

The German Alpine area shows a higher employment and a lower unemployment rate than at the Bavarian or national level. For these two indicators, Slovenia performs better than the European average. In Switzerland, there is no noticeable difference in the unemployment rate between the national average and the Alpine area. The share of people with secondary

education is higher in the German Alpine areas than in the rest of the country. In Slovenia, the share of people with secondary education is higher than the European average. For tertiary education the figures come close to the European ones. In Italy, the Alpine areas 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 to social exclusion. It must be ensured that also in these regions, existing skills and workforces are integrated in the labour market. In terms of a Green Economy, this is especially true for people with traditional working skills.

5.3 SUSTAINABLE CONSUMER BEHAVIOUR

Sustainable consumer behaviour means incorporating social and environmental considerations into purchasing and consumption decisions, thereby triggering more sustainable production patterns. There is an increasing awareness among people for healthy and sustainable lifestyles and for the environmental and social performance of consumer goods and services. Numerous initiatives and campaigns run by public institutions and NGOs have raised awareness amongst consumers and empowered them 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.

Apart from private consumption, public procurement has a high potential to contribute to sustainable consumption and production patterns. European public authorities are major consumers with an approximate annual spending of two trillion Euro: this represents 19% of the EU's gross domestic product.¹⁸ 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 and health care). Sustainable procurement helps to achieve environmental targets that a public authority has set itself, can help to 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, showing the way to an alternative and more sustainable way of living and consuming.

An economic system consists not only of producers but also of consumers. In the context of a Green Economy, it is important to look at the economy as a whole, i.e. also taking the consumption side into account. Through conscious consumer behaviour, citizens can improve their quality of life and contribute to resource efficiency. Appropriate policies need to be put in place to set the right framework conditions for this to happen.

Opportunities and challenges of sustainable consumer behaviour in the Alps

Due to missing statistics on sustainable consumer behaviour, this topic is presented in the full English

version of the Report via case studies and good practices rather than comparing figures. It is, thus, difficult to provide an evaluation of the performance of the Alpine area in terms of sustainable behaviour. However, given the benefits of sustainable consumer behaviour (e.g.

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

contribution to energy savings, sustainable production patterns), the topic has a great potential to contribute to a Green Economy and should not be neglected in future strategies.

A topic of particular relevance for the Alpine area is the production, marketing and consumption of regional products. Regional labels and brands exist in several Alpine regions and have been highly successful. Fostering regional production and consumption and supporting regional marketing initiatives and instruments has the potential to make an important contribution to a Green Economy in the Alps. Local and regional authorities

have an important role to play in encouraging regional production cycles.

Furthermore, the introduction of regional currencies 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 areas that have introduced such currencies. As retaining added value within the Alps is an important objective for many stakeholders, the introduction of such an Alpine-wide currency seems a promising instrument towards a greener economy.

5.4 HEALTH AND HARMFUL EMISSIONS

Environmental quality always was and still is crucial to sustain human health in the sense of the WHO definition of health. Human health is affected by harmful emissions from man-made and natural sources. Almost all economic activities, from production processes in agriculture and industries to the transport of goods and persons, emit more or less harmful matters and/or noise. Many of these emissions lead to a degradation of the quality of all environmental media such as air, water and soil. Also, other natural assets such as biodiversity or the availability of silent places are affected.

The release of air pollution has a detrimental effect on public health (UNEP 2011b). Therefore, and in terms of a Green Economy the two main objectives for economic activities are to decrease harmful emissions (including those not directly affecting human health) as these cause environmental costs, and to decrease the exposure of people to environmental pollution, environmental risks and the related health costs. There are high indirect costs associated with the pollution arising from the combustion of fossil fuels and biomass (wood).

In the Alps, air quality and noise are in the foreground when harmful emissions come to attention. The harmful effects on human health of many air pollutants and noise emissions are widely described in publications of the WHO, the EEA and other international and national institutions. Although air quality has improved significantly in the last decades, ambient concentrations of some pollutants as nitrogen oxides or particulate matter (PM) below 10 µm are still too high, at least occasionally and in some regions. As this report cannot provide a complete overview over harmful emissions and the related health problems,

it concentrates on the status quo of two pollutants to illustrate the issue: ozone and particulate matter. Not within the scope of this report, but nonetheless relevant, are the negative impacts that air pollution and noise have on ecosystems, such as disturbances of habitats, eutrophication, acidification or leaf damages (also for crops) caused by ozone, nitrogen oxides, ammonium, sulphur oxides and other air pollutants.

While health effects of harmful emissions are a general issue, some aspects are specific to mountain regions concerning the behaviour of emissions. In a nutshell, the diffusion of air pollution as well as noise spreading is much different due to topography and related meteorological effects. The Alps rise 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). These can transport air pollutants uphill and into valleys far from the actual emission sources. Meteorological conditions such as inversion occur more often in the Alps than in the lowlands, and they lead to high pollutant concentrations as air becomes more stagnant and horizontal exchange of air is limited. Especially in the winter, inversion tends to be stable over several days, and air pollution increases from day to day during these periods (Heimann et al. 2007).

Figure 5.4-1 shows the interpolated annual average of PM_{2.5} in 2012. The target value of 25 µg/m³ is exceeded at several urban/suburban background stations in the Italian part of the Alpine Convention area. The interpolation shows also exceedances mainly at the southern borders. As the map shows interpolated data primarily from background stations, the picture may be different if industrial and traffic stations would be included. Due to the interpolation, local hot spots of particle pollution caused by domestic heating with wood are not shown but frequently occur in the Alpine area.

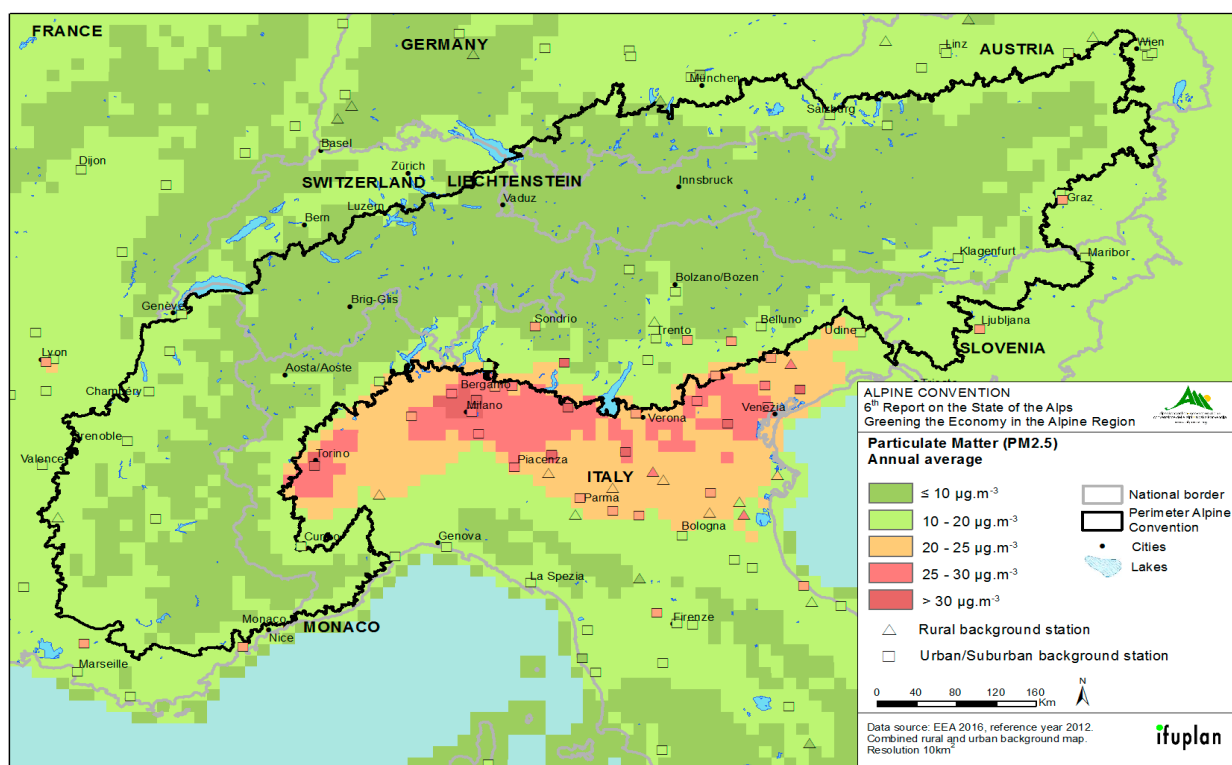


Figure 5.4 1 Annual Average of Particulate Matter (PM_{2.5}) (Source: EEA 2016).

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

Air quality (measured for particulate matter and ozone) in the Alps is mainly within the EU thresholds or target values. Within the Alpine Convention area, threshold exceedances occur locally, such as along some main transit corridors and in towns or agglomerations. One reason for higher PM concentrations in towns and agglomerations is the commercial, institutional and household fuel combustion sector and the urban road traffic, which contribute significantly to the emissions of primary PM. The population living in towns, agglomerations and some transit routes is exposed to higher PM concentrations. There are no data available on how many people are exposed to threshold exceedances.

There are high ozone values in summers with high insolation. Ozone as a secondary pollutant cannot be directly addressed, but only its precursor gases. The exposure of people in rural areas may be higher compared to people living near the areas where the ozone is formed as certain air pollutants help to destruct ozone.

Greening transport and increasing the share of renewable energy for electric power generation for household and industrial consumption will further improve air quality

and can reduce external environmental and health costs. Even though a major goal of a Green Economy is to promote the sustainable use of wood and biomass, there might be a conflict regarding increased air pollution due to the combustion of wood and biomass. Promotion of installations with particle filters instead of inefficient household installations should be considered, taking into account the best available technologies.

The transport sector is still an important emitter of air pollution, even if the emissions of particulate matter have been decreasing. Transport 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 internalise 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.

An increased use of certification schemes and the deployment of eco-innovation by businesses across the region might help to reduce negative externalities from air pollution and their market and social cost for the Alpine economy.

6. CONCLUSIONS

The Alpine Convention area is characterised by the specific ecological conditions of a high mountain range. 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*, *CO₂-Neutral Alps*, *the 2000-Watt Society* or *Zero-Land-Take*. These could serve as examples for an Alpine development and feed into the development of a Green Alpine Economy.

Such a transformation of the economy will be relevant for all economic sectors, including agriculture, energy, transport, construction, tourism, industry and production and also private households.

Based on the conclusions of the 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 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 adaptation to unavoidable effects of climate change. Social innovation, technical innovation and innovative business models for production and transport means are needed for this reduction.

The use of regional renewable energies opens the door to reduce dependency on fossil fuels as it fosters innovation and reduces GHG emissions. The Alpine area offers a high potential for 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. For both, innovative approaches are needed. 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 subsequently 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.

Avoided costs are an economic benefit. If environmental damages, such as negative health effects through air pollution, damages by natural hazards and loss of productive soils through land take, can be prevented by precautionary action, society will save costs. In addition, the mitigation of GHG emissions and 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 in order 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 destinations 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, production of renewable insulation material, etc. But 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 capacities to bring innovative ideas to the markets.

Public authorities need to put in place appropriate policies and structures to pave the way for innovation, particularly for small and niche businesses. This could 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, it may also contribute to the well-being of residents.

Consumption of regional sustainable products or services establishes a relation 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.

The data provision and monitoring of relevant indicators is a task of regional authorities. They are the actors that need to collect and provide data or support the processing of existing data for a regional level.

Long-term goals and strategies for a Green Alpine Economy

Finally, the development of a Green Alpine Economy 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.

7. BIBLIOGRAPHY

AlpEnergy (2013): Final report on the project Virtual Power Systems as an Instrument to Promote Transnational Cooperation and Sustainable Energy Supply in the Alpine Space.

Bayerisches Landesamt für Umwelt (LfU) (2014): Entwicklung des Flächenverbrauchs für Siedlungen und Verkehr in Bayern seit 2001. Online: www.lfu.bayern.de/umweltqualitaet/umweltbewertung/ressourcen_effizienz/flaechenverbrauch/index.htm, last downloaded 16-08-2016.

Bellassen, V., Viomy, N., Luyssaert, S., Le Maire, G., Schelhaas M.-J. & Ciais, P. (2011): Reconstruction and attribution of the carbon sink of European forests between 1950 and 2000.

Desjeux, Y., Dupraz, P., Kuhlman, T., Paracchini, M. L., Michels, R., Maigné, E. & Reinhard, S. (2015): Evaluating the impact of rural development measures on nature value indicators at different spatial levels. Application to France and The Netherlands. *Ecological Indicators*. pp. 41-61.

Edler, D. & Blazejczak, J. (2016): Beschäftigungswirkungen des Umweltschutzes in Deutschland im Jahr 2012. Reihe Umwelt, Innovation, Beschäftigung 02/14. Dessau-Roßlau. Editor: Umweltbundesamt, Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit. Online: www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/uiB_01_2016_beschaeftigungswirkungen_des_umweltschutzes_in_deutschland_2012.pdf, last downloaded 29-07-2016.

European Commission (EC) (2009a): Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020. Effort Sharing Decision (ESD). Online: eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009D0406.

European Commission (EC) (2011c): Resource efficiency – a business imperative. Online: http://ec.europa.eu/environment/resource_efficiency/documents/factsheet_en.pdf. Last downloaded 07-2106.

European Commission (EC) (2012b): Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC, Text with EEA relevance. Energy Efficiency Directive.

European Commission (EC) (2013c): EU energy, transport and GHG emissions trends to 2050 - Reference scenario 2013. Online: ec.europa.eu/transport/sites/transport/files/media/publications/doc/trends-to-2050-update-2013.pdf.

European Commission (EC) (2015e): Report from the Commission to the European Parliament and the Council. Assessment of the progress made by Member States towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency.

European Environment Agency (EEA) (2013b): Common International Classification of Ecosystem Services (CICES): Consultation on Version 4, August-December 2012, last downloaded 21-07-2016.

European Environment Agency (EEA) (2015k): The European environment — state and outlook 2015. A comprehensive assessment of the European environment's state, trends and prospects, in a global context.

European Environment Agency (EEA) (2016): Interpolated air quality data. Online: www.eea.europa.eu/data-and-maps/data/interpolated-air-quality-data-2, last downloaded 02-08-2016.

European Observation Network for Territorial Development and Cohesion (ESPON) & Deutsches Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) (2014): ESPON Atlas. Mapping European Territorial Structures and Dynamics. European Topic Centre on Urban, Land and Soil systems (ETC ULS) (2016b): Likelihood of HNV Farmland presence based on CORINE land cover data.

EUROSTAT (2010): Environmental statistics and accounts in Europe. Luxembourg.

EUROSTAT (2015a): Agri-environmental indicator - High Nature Value farmland. Online: ec.europa.eu/eurostat/statistics-explained/index.php/Agri-environmental_indicator_-_High_Nature_Value_farmland, last downloaded 16-08-2016.

EUROSTAT (2015e): Employment and activity by sex and age - annual data. Online: appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfjsi_emp_a&lang=en, last downloaded 02-08-2016.

Heimann, D., Franceschi, M. de, Emeis, S., Lercher, P., Seibert, P. & ALPNAP Lenkungsgruppe (2007): Leben an der Transitroute. Luftverschmutzung Lärm und Gesundheit in den Alpen ALPNAP. In: Trento.

- Intergovernmental Panel on Climate Change (IPCC) (2007): Climate Change 2007. The Physical Science Basis.
- Intergovernmental Panel on Climate Change (IPCC) (2013): Climate Change 2013: The Physical Science Basis.
- International Union for Conservation of Nature (IUCN) (2008): Guidelines for applying protected area management categories. Ed. Dudley, Nigel. Gland.
- Job, H., Woltering, M. & Harrer, B. (2009): Regionalökonomische Effekte des Tourismus in deutschen Nationalparks.
- Joint Research Centre (JRC) (2014b): EDGAR database CO₂ time series 1990-2014 from fossil fuel use and cement production. Online: edgar.jrc.ec.europa.eu/overview.php?v=CO2ts1990-2013, last downloaded 02-08-2016.
- Mayer, M., Müller, M., Woltering, M., Arnegger, J. & Job, H. (2010): The economic impact of tourism in six German national parks. In: *Landscape and Urban Planning* 97 (2), pp. 73–82. DOI: 10.1016/j.landurbplan.2010.04.013.
- MunichRe (2014): Overall picture of natural catastrophes in 2013 dominated by weather extremes in Europe and Supertyphoon Haiyan. Munich. Online: www.preventionweb.net/news/view/36161, last downloaded 23-01-2016.
- National Energy Efficiency Action Plans (NEEAP) (2014): National Energy Efficiency Action Plans and Annual Reports of 2014 and 2016. Online: ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive/national-energy-efficiency-action-plans, last downloaded 22-07-2016.
- Paracchini, M. L., Petersen, J. E., Hoogeveen, Y., Bamps, C., Burfield, I. & van Swaay, C. (2008): High nature value farmland in Europe. An estimate of the distribution patterns on the basis of land cover and biodiversity data. JRC Scientific and Technical Reports EUR, 23480.
- Regions for Sustainable Change (2011): Handbook - Tackling climate change by shifting to a low-carbon economy. Online: www.rscproject.org/indicators/index.php?page=tackling-climate-change-by-shifting-to-a-low-carbon-economy, last downloaded 20-07-2016.
- Slovenian Ministry of Agriculture, Forestry and Food (2016): Own database, Dataset on the use of agricultural and forest areas (*Evidenca dejanske rabe kmetijskih in gozdnih zemljišč*). Online: <http://rkg.gov.si/GERKI/>, last downloaded: 07-2016.
- Swiss Confederation (2009): Arealstatistik Fürstentum Liechtenstein 1984 – 1996 – 2002 – 2008. Online: www.llv.li/files/abi/pdf-llv-slp-arealstatistik_fl_resultate_84_96_02_08.pdf, last downloaded 16-08-2016.
- Swiss Confederation (2016b): Arealstatistik der Schweiz. Online: www.bfs.admin.ch/bfs/portal/de/index/infothek/erhebungen__quellen/blank/blank/arealstatistik/02/04.html, last downloaded 16-08-2016.
- Swiss Confederation, Bundesamt für Raumentwicklung (ARE), Energy Platform Presidency & Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation (UVEK) (2015): Background report of the Alpine Convention Energy Platform.
- Swiss Federal Statistical Office (FSO) (2016): Sustainable Development - MONETDecoupling - Material consumption. Online: www.bfs.admin.ch/bfs/portal/en/index/themen/21/02/ind9.indicator.73017.906.html, last downloaded 31-05-2016.
- The Economics of Ecosystems and Biodiversity (TEEB) (2010): Ecological and Economic Foundations. Chapter 5: The economics of valuing ecosystem services and biodiversity.
- Umweltbundesamt Deutschland (UBA Germany) (2012): Glossar zum Ressourcenschutz.
- Umweltbundesamt Deutschland (UBA Germany) (2015a): Green Economy: an Engine for Development? (45/2015).
- United Nations Environmental Programme (UNEP) (2008): Green Jobs. Towards decent work in a sustainable, low-carbon world.
- United Nations Environment Programme (UNEP) (2011b): Towards a Green Economy. Pathways to Sustainable Development and Poverty Eradication.
- Working Group Mountain Forests of the Alpine Convention (2014): 1st Report 2013-2014 of the Working Group "Mountain Forests" of the Alpine Convention.
- Working Group Mountain Forests of the Alpine Convention (2016): Contribution of WG "Mountain Forests" to the RSA6.
- Please find the full English version of the sixth Report on the State of the Alps, as well as this summary in all Alpine languages at: www.alpconv.org**

www.alpconv.org

**Permanent Secretariat
of the Alpine Convention**

Herzog-Friedrich-Strasse 15
A-6020 Innsbruck
Tel. +43 (0) 512 588 589 12
Fax +43 (0) 512 588 589 20

Branch office in Bolzano/Bozen

Viale Druso-Drususallee 1
I-39100 Bolzano-Bozen
Tel. +39 0471 055 352
Fax +39 0471 055 359

info@alpconv.org



9788897500292