Renewable Energy and Landscape Quality

Michael Roth
Sebastian Eiter
Sina Röhner
Alexandra Kruse
Serge Schmitz
Bohumil Frantál
Csaba Centeri
Marina Frolova
Matthias Buchecker
Dina Stober
Isidora Karan
Dan van der Horst
(eds.)

jovis

Content

PREFACE

Climate change was considered the biggest potential threat to the global economy in a survey of 750 experts at the World Economic Forum in 2016 (http://reports.weforum.org/global-risks-2016/). This risk is linked to other global risks such as social instability and large-scale involuntary migration (ibid.) which shows the interrelation between environmental, economic, and socio-cultural aspects at the global scale. Both the problems of climate change mitigation/renewable energy production and the loss of landscape/environmental quality have to be addressed at various scales from global policy down to local action.

On a regional and local level, Nuertingen-Geislingen University (NGU) as a university of applied sciences intensively pursues inter- and transdisciplinary research and teaching of economic, ecological, and societal aspects of sustainable development. The German name of the University—Hochschule für Wirtschaft und Umwelt or University for Economy and Environment—underlines this integrative approach. Also, on the research map of the German Rectors' Conference, NGU is included with two research priorities related to environment/landscape and energy/economy:

- Applied agricultural research, landscape development, environmental planning and nature conservation
- Sustainable management in the energy, automotive, and real estate industries

Against this background, the COST Action TU1401 'Renewable Energy and Landscape Quality' has been fully within the research scope of our university and contributed significantly to the international visibility of NGU as a research institution with a strong focus on transfer and application. Leading an international research network of this size with more than 200 participants from 37 countries in Europe and beyond would not be possible without both institutional support of the university as well as personal dedication and devotion of the faculty and staff involved.

With 97 contributing authors, the book *Renewable Energy and Landscape Quality* as a main product of the four-year COST Action shows the potential of international and interdisciplinary collaboration. I hope that this book finds a responsive audience, so that future policies, political decisions, and planning documents can contribute to optimise trade-offs between renewable energy systems and landscape quality protection by promoting an effective and efficient renewable energy policy without jeopardising the assigned values and inherent qualities of European landscapes.

Nuertingen, April 2018

Prof. Dr. Carola Pekrun
Vice-Rector for Research and Transfer at
Nuertingen-Geislingen University

0.1
INTRODUCTION

Michael Roth & Sebastian Eiter

In response to climate change, limited fossil fuels, and rising energy demand and prices, renewable energy is being heavily promoted throughout Europe. While objectives to boost renewable energy and trans-European energy networks are ambitious, it is increasingly understood that public acceptance becomes a constraining factor, and general support for green energy does not always translate into local support for specific projects. Perceived landscape change and loss of landscape quality have featured heavily in opposition campaigns in many countries, even though renewable energy can facilitate sustainable development, especially in disadvantaged regions rich in wind, water, biomass, geothermal, or solar energy.

Climate change mitigation and adaptation is a major societal challenge, and renewable energy is a core element in the transition to a low-carbon society. This will reshape our landscapes. It is unlikely that existing landscape management mechanisms will be effective in adapting to climate change and facilitating renewable energy development. New deliberative, interdisciplinary, and integrated approaches are needed to inform and guide the transformation process and to create a vision and coalition for reconciling renewable energy systems and landscape quality across public, stakeholders, and sectoral, administrative, and geographical boundaries.

Against this background, COST Action TU1401 'Renewable Energy and Landscape Quality (RELY)', running from 16 October 2014 to 15 October 2018 investigated the interrelationships between renewable energy production and landscape quality, and the role of public participation for the acceptance of renewable energy systems. Starting as a relatively small network with around 20 academics from 18 institutions in 13 European countries and Canada at the proposal stage, the partnership grew rapidly over the lifetime of the Action: more and more countries joined the Action and individual attention was raised through networking tools and events like training schools, special sessions and co-organisation of scientific conferences, and a traveling exhibition. In the final phase of the Action, the research network consisted of more than 200 individual members from nearly 100 institutions (academic, governmental, and non-governmental) in 35 European countries, Canada, and Israel. The disciplinary backgrounds of the members involved include social sciences, engineering, political sciences, and interdisciplinary fields like geography, landscape planning, and landscape architecture. With this wide coverage in terms of geographical scope and disciplinary background, the Action network formed an ideal basis to overcome fragmented national and sectoral research, language, and cultural barriers. Moreover, the Action consolidated existing research networks across the natural science/social science/engineering divide, thereby creating a network of networks:

- EEEL: Emerging Energies, Emerging Landscapes
- PECSRL: The Permanent European Conference for the Study of the Rural Landscape
- EUCALAND: European Culture expressed in Agricultural Landscapes
- RESERP: Spanish Renewable Energy and Landscape Network
- IALE-Europe: International Association for Landscape Ecology—European Chapter
- NLRN: Nordic Landscape Research Network
- NIES: Nordic Network for Interdisciplinary Environmental Studies

This book presents the results of almost four years of collaboration. The large network of the Action has made it possible to produce a pan-European synopsis of 32 contributing countries regarding their national situations concerning renewable energy and landscape quality (section 1).
The Action was organised in four working groups (WGs): WG 1 reviewed specific renewable energy production systems and their impacts on landscape character and quality in Europe from a past, present, and future perspective and produced a systematic review of the nexus between renewable energy systems and Europe's landscapes' qualities (section 2). WG 2 assessed landscape functions and qualities and their sensitivity to and potential for specific renewable energy production systems. These analyses were used to produce: (i) a typology of best practices of sustainable, landscape-compatible renewable energy production systems, (ii) guidance for assessing the potential of areas for specific renewable energy systems in terms of effects on landscape quality or character, (iii) a catalogue of relevant criteria, indicators, and respective GIS-available proxy-data for assessing the suitability of landscapes for renewable energy systems (section 3). WG 3 investigated socio-cultural aspects of sustainable renewable energy production and proposed modes and means of integrating specific aspects of renewable energy in participatory toolkits to increase public acceptance of renewable energy projects (section 4). WG 4 focused on the synthesis of findings, the dissemination of results towards different target groups, and the facilitation of collaboration across working groups by providing a multi-lingual glossary of terms (section 5).
COST stresses cooperation in science and technology by addressing academics, public and private (research) institutions, as well as non-governmental organisations (NGOs), in order to increase research impact on policy-makers, regulatory bodies, and national decision-makers as well as on the private sector. That emphasis is also reflected in this book: to supplement existing communication channels like scientific articles, conference presentations, and the Action's website (http://www.cost-rely.eu/), a book format and layout were chosen, which is intended to motivate potential readers to explore the multi-facetted aspects of renewable energy landscapes. At the same time, the book addresses policy-makers at EU and national levels as well as decision-makers in public agencies and business to encourage internationally accepted best practice. Following the general principle of the European Landscape Convention, and general provision of the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, that the public is entitled to environmental information, this book can also inform and empower citizens and NGOs to build on solid research results in participation and decision-making processes.
It is with great appreciation that we acknowledge the funding provided by the COST Association over the past four years as part of the EU Framework Programme Horizon 2020. Without that specific funding scheme that allows both cooperation and exchange, targeting a wide geographical scope across Europe and beyond, leveraging national research investments and building capacity by connecting high-quality scientific communities in Europe and worldwide, this book would not have been possible.

0.2

COST RELY FACTSHEET: A SUCCESS STORY

Sina Röhner & Alexandra Kruse

Participating countries in 2018	37
ITC countries	18
Individual participants	200
MC meetings, always combined with WG meetings	7
WG meetings	14
Core group meetings	4
Thematic meetings	2
Training schools	2 with 44 participants
Co-organisers of conferences	3
STSM (Short term scientific missions)	17
Exhibitions of the COST RELY Travelling Exhibition	15
Translation of the COST RELY Flyer	10
Publications (from 2014-2018 in April, around 10 to come)	37
Surveys	2
Case Studies collected	WG 2: 51 in 20 countries, WG 3: 25 in 12 countries
COST RELY Glossary	48 terms translated into 28 languages including Esperanto
Photo Database with special RE types, RE landscapes and RE and landscape quality	> 100 photos
Photo competitions	3

Table 0.2.1
COST RELY in figures

The main objective of the Action was to develop a better understanding of how European landscape quality and renewable energy deployment can be reconciled to make socio-environmental contributions to the sustainable transformation of energy systems. Four Working Groups put their focus on different aspects during the four-year lifetime of the Action:

1. Renewable energy production systems and impacts on landscape quality
2. Landscape sensitivity and potentials in terms of renewable energy production
3. Socio-cultural aspects of sustainable renewable energy production
4. Synthesis of findings and dissemination

The Core Group of the Action consisted of the Action Chair Michael Roth from Germany and Action Vice-Chair Sebastian Eiter from Norway, the working group chairs and vice-chairs as listed in Figure 0.2.1, and the STSM Coordinator, Serge Schmitz from Belgium. The position of WG4 vice-chair was transferred during the Action from Malgorzata Lachowska (Poland) to Isidora Karan.

In addition the activities of the working groups, the Action was quite active in dissemination activities and events. Figure 0.2.2 shows the time table of the work done during the four years of the Action.

The Action was submitted by academics from 13 European countries plus Canada. At the kick-off meeting in October 2014, the Action had already grown to members from 27 European countries plus Canada, and it kept growing to 200 participants from

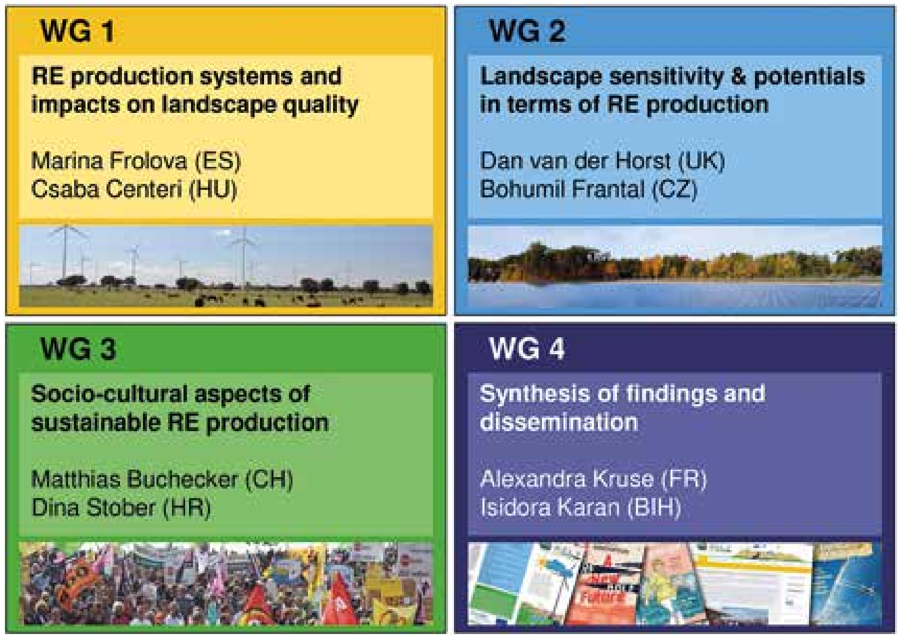


Figure 0.2.1
The four working groups of the COST Action RELY and their topics

Milestones and timetable

Duration: October 2014 - October 2018

Activity	Year 1		Year 2		Year 3		Year 4	
	1		2		3		4	
Kick-off phase	■							
Working Group 1: Systematic review, meta-analysis								
Working Group 2: Strategic case studies								
Working Group 3: Multidimensional scenarios								
Working Group 4: Synthesis, dissemination								
Milestones								
Meeting, incl. kick off meeting	X	X	X	X	X	X	X	X
Annual progress report		X		X		X		
Action conferences		X		X			X	
Training Schools with special focus on ECI				X		X		
Publication of a comprehensive Action book								X
Final Action report								X

Figure 0.2.2
Timetable of RELY

35 European countries as well as from Canada and Israel until the final conference in September 2018.

Besides Cyprus and Luxembourg **inclusiveness target countries** (ITC) were well represented in the Action. Almost 50 % of the participating countries and almost 40 % of participants belong to ITCs, as well as all four WG vice-chairs. The share of participants from IT countries at meetings was between 40 % (Lisbon, Portugal, 2015) and up to 67 % (Brno, Czech Republic, 2018). Nearly 65 % of the STSMs between 2015 and 2018 were carried out by members from ITCs and nearly half of the participants of the two training schools also came from ITCs. Meetings in ITCs were held in Bosnia & Herzegovina, Czech Republic, Croatia, Hungary, Portugal, and Slovenia.

Regarding **gender balance** COST RELY was doing fine: 47 % of all participants were female. In the Core Group, 50 % of the members were female. The share of female participants at meetings was between 37 % (kick-off Meeting) and 53 % (Lisbon, Portugal, 2015). Half of the STSMs were carried out by female participants and 59 % of the training school participants were also female.
The action chair and three out of four WG vice-chairs are **early career investigators** (ECI), who were also well represented within the whole Action.

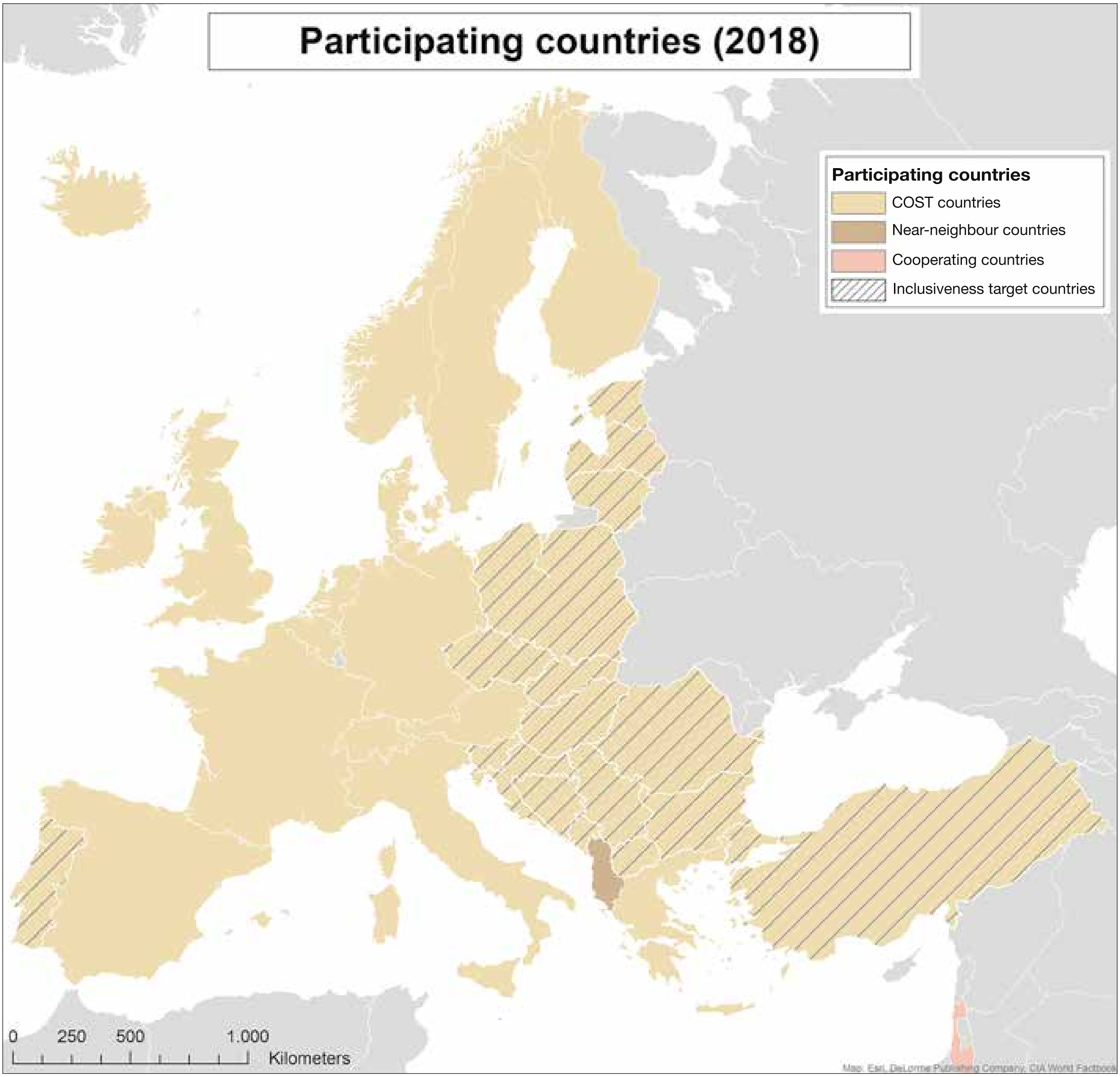


Figure 0.2.3
Countries participating in the COST Action RELY.
Author: Sina Röhner.

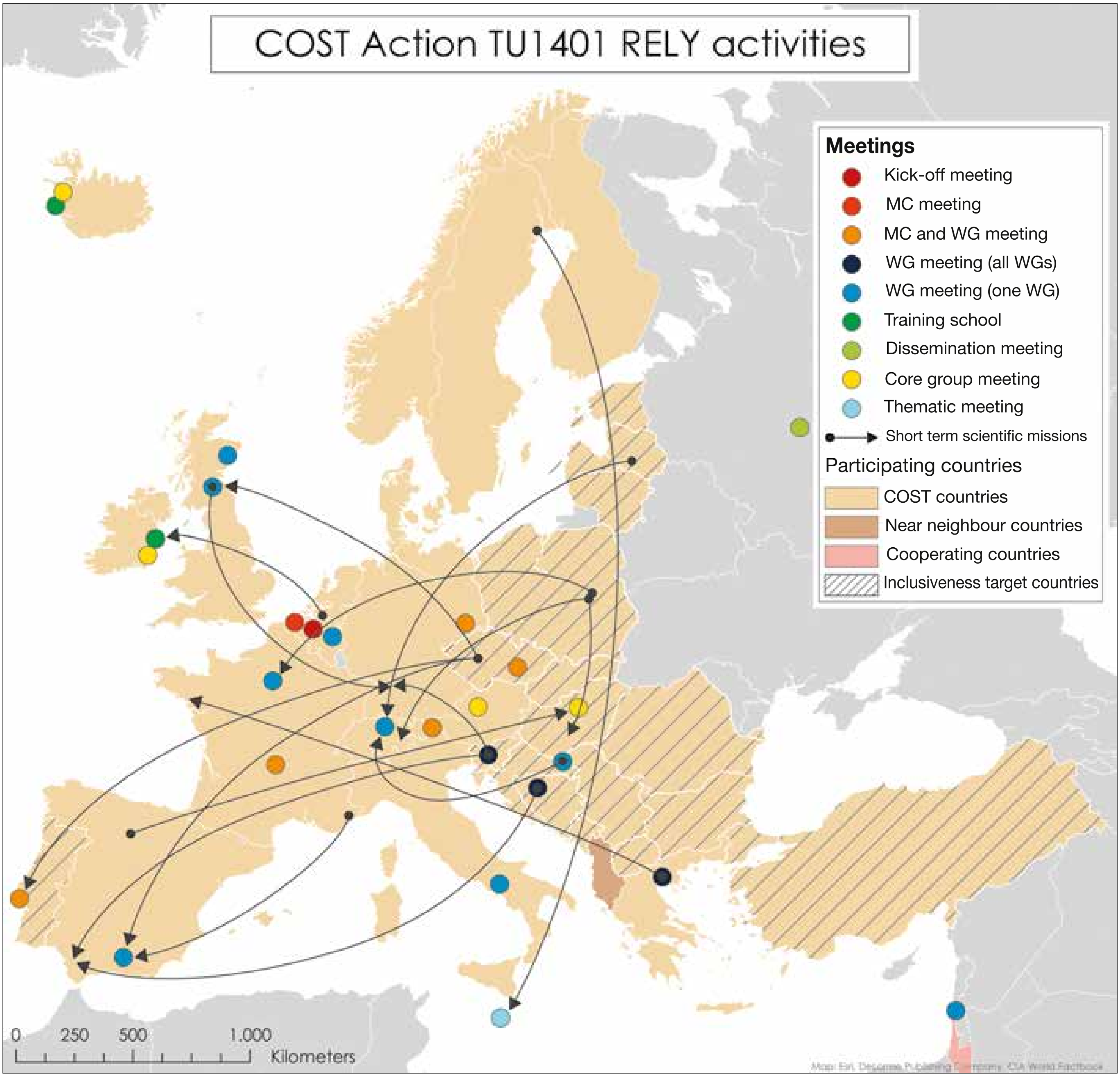


Figure 0.2.4
Meetings and STSMs of the COST Action RELY.
Author: Tadej Bevk.

1 NATIONAL OVERVIEWS

1.9
FRANCE

Bénédicte Gaillard & Alexandra Kruse

Situation of Renewable Energy

The French Landscape Law was passed in 1993, which aimed at protecting and developing landscapes across the breadth of contexts (natural, urban, or rural). Twenty years later the national debate about renewable energy commenced. Only now, after France hosted the COP21 in 2015 and in order to meet the enacted climate obligations, is RE increasing its share of energy production.

In 2015, RE represented 9.4 % of primary energy consumption. Except for hydropower, of which France is the third biggest producer in Europe after Norway and Sweden, the use of RE is at an early stage. Compared to other countries, there are relatively few wind turbines, solar thermal, or photovoltaic panels. Since December 2017, the national energy company EDF has been contacting private households to promote the installation of photovoltaic panels on their rooftops.

Data on Landscape Quality

A national policy to publish a landscape atlas has been supported at the regional level by the DIREN (Regional directorates for the environment) (Davodeau n.d.). Since 2009, the DIREN have been progressively replaced by the DREAL (Regional directorates for environment, planning, and housing). For more information and to view the landscape atlas, see www.statistiques.developpement-durable.gouv.fr/lessentiel/ar/279/1129/atlas- paysage.html.

Data on the environment are edited annually by the SOeS (Service for Observation and Statistics) and published by the Ministry of Ecological and Inclusive Transition. Environmental impact assessments are required in planning processes. The content of the assessment is described in article R.122.5 of the Environmental Code which refers to landscape but not to landscape quality.

Different types of protected areas exist in France, such as national parks, regional nature parks, and nature reserves. Although the legislation concerning the environment distributes the relevant authority to different levels of administration (state, regional, departmental, and municipal), the legislation concerning landscape gives an essential role to the national level, in terms of defining the legal framework for different policies for the management of natural areas.

Interaction between Renewable Energy and Landscape Quality

Environmental impact assessments have to be carried out when RE installations are planned. For example, the planning of offshore wind power plants requires an assessment that considers the landscape (Ministère de l'Environnement, de l'Energie et de la Mer 2017), as does the installation of onshore wind power and, on a case-by-case basis so do solar panels (Ministère de l'Environnement, de l'Energie et de la Mer 2017).

According to the Environmental Code, public participation has to be included into the decision-making process relating to projects, plans, and programmes. Public involvement has already led to several achievements, e.g. the Charte de pays (charter of pays, a strategic orientation paper resulting from the collaboration between elected officials and public and private stakeholders which provides a vision of territorial evolution for the next ten years and determines favoured development axes), a wind power charter, and directives and objectives for local development. The 'communauté de communes' was recognised as pioneering with the Ardenne metropole obtaining EU LEADER project funding. For citizens with a strong attachment to the landscape as a part of their heritage, landscape quality is a very sensitive issue with respect to the acceptance of renewable energy projects, mainly onshore and offshore wind farms.

Solar panels are more acceptable to citizens due to lower impacts on landscape quality. An impressive example are the on-ground solar panels at Les Mées, Alpes de Haute Provence. A construction of which faced a challenge of avoiding negative visual impacts for the village of Les Mées and Puimichel. The project required an investment of approximately 70 M euros between May 2010 and January 2011. The ground preparation and construction phase of the project employed 350 people. It is located on a 36 ha field, comprising 79,000 modules, with a total capacity of 18.2 MW. Annual production of the site is 26 GWh, providing electricity for approximately 9,000 families, and displacing the emission of more than 9,200 t CO_2 annually.

Table 1.9.1
Installed capacity and year of first installation of RE in France

RE type	Installed capacity (MW) 2015	Year of the first plant
Wind power onshore	10,013	2000
Wind power off-shore[1]		
Marine energy	241	2008
Small hydropower	2,000	1830
Large hydropower	25,400	1900
Solar PV	6,191	1990
Solar thermo-electric	1.01	
(only on pilot sites)	2010	
Geothermal	17.2	1985
Biomass	365	2003
Biogas	332	2000

1 In 2011/2012, four projects were attributed off Fécamp, Courseulles-sur-Mer, Saint-Brieuc and Saint-Nazaire, cumulating a power of 1928 MW
In 2013/2014, two projects were attributed off Tréport and the Yeu islands and Noirmoutier, accumulating a power of 992 MW
In 2016, two projects were announced in the frame of a third call for tender off Dunkerque and the Oléron Isla

1.16
ITALY

Michele Bottarelli, Raffaella Laviscio, Paolo Picchi, Alessandra Scognamiglio & Bruno Zanon

Situation of Renewable Energy

In Italy, the demand for energy over the last decades increased steadily until 2005, when it started to decrease due to an economic crisis (Italian National Energy Balance 2013). With regards to fossil sources, natural gas surpassed oil in electricity production in 2000; in 2016, coal covered 20 % and biofuels 10 % of the total production (199 TWh). In 2015, combined heat and power plants passed traditional power plants and covered 60 % of the production. Concerning electric energy, until the early 1960s hydroelectricity covered a good share of generation (82 %), but in the following decades there was a rapid increase of thermal generation.

In 2016 electricity demand reached 314 TWh, while the internal gross generation capacity reached 290 TWh. Production by renewables covers 108 TWh. Some technologies are rapidly evolving (SISTAN & Terna 2017), in particular photovoltaics and wind. Efficiency of hydroelectric plants have improved and especially small plants exploit the remaining bodies of water.

Italy implemented the EU Directive 2009/28 with a decree (DL 28/11) on the development of production and use of RE. It aims to reach 17 % of RE production in 2020 and integrates the diverse authorisation procedures by declaring that the assessment for the installation of renewable energy technologies (RET) must safeguard biodiversity, cultural heritage, and the rural landscape. Moreover, the derective delegates the responsibility for authorising the installation of RET to regions, which are obligated to draw up specific guidelines.

The Italian government issued a first action plan in 2012, and in 2017 a new strategy was approved (National Energy Strategy 2017). It affirms that by 2030 Italy must

- Reduce energy consumption from 1372 TWh (in 2015) to 1256 TWh
- Increase energy consumption from renewable sources from 17.5 % to 28 %, in particular 55 % in electricity (from 33.5 %), 30 % in thermal energy (from 19.2 %), and 21 % in transport (from 6.4 %)
- Decrease energy costs and reduce dependence from other countries
- Stop energy production from coal
- Improve the quality of the oil refinery chain
- Reduce CO_2 emissions of 39 % in 2030 and of 63 % in 2050
- Invest in research, sustainable mobility, and resilient energy provision and delivery networks and processes.

The planned investments to improve networks, RE production, and efficiency are 175 billion euros by 2030.

Data on Landscape Quality

In Italy landscape is protected by the Code of Cultural Heritage and Landscape of 2004 (modified in 2008), which updates

Italy—Electric Energy: Number of plants and gross generation capacity, 2016

	Number of plants	Gross generation capacity in GW	%	Production in TWh	%
Hydroelectric	3927	22.7	19.4	44	15.2
Thermo-electric	5285	64.9	55.4	199	68.6
Geothermal	34	0.8	0.7	6	2.1
Wind	3598	9.4	8.0	18	6.2
Photovoltaic	732053	19.3	16.5	23	14.1
Total	744897	117.1	100.0	290	100.0

Source: Sistan & Terna, 2017

Table 1.16.1
Renewable energy production in Italy

previous laws (1939, 1985), to reflect concepts and definitions of the ELC. A large part of the territory is protected, if considered appropriate, both for its outstanding values and intrinsic characters of places. Regions must take care of the protected landscapes by elaborating landscape or territorial plans. Such plans must 'analyse landscape characteristics, *created by nature and history*'. They must define detailed frameworks and identify 'the measures for the correct insertion … of territorial transformation projects'. Few regions approved an updated landscape plan, but all regions manage landscape assessment procedures.
Besides the protected landscapes, there are 871 natural parks and protected natural areas, which cover more than 10 % of the national area, and 51 UNESCO sites. Other sectoral provisions cover forests, historical heritage sites, hydro-geological fragile areas, etc.

Interaction between Renewable Energy and Landscape Quality

Diverse authorities are involved in the assessment and authorisation of RE plants, but a key role is played by regions. They are responsible for the authorisation of RE plants. At the national level a Ministerial Decree of 2010 defined 'Guidelines for the authorisation of RE plants'. This document sets out the criteria by which regions should identify measures for an appropriate landscape integration, identify unsuitable areas, and define compensatory measures. The Ministry of Culture proposed guidelines for wind energy plants to guarantee landscape design principles for RET by considering the characters of places (morphological, formal, historical, and perceptive factors). Currently, the regions are the main promoters of directives and guidelines; in general, these are heterogeneous documents that consider landscape aspects only partially, aiming at streamlining the process, developing an implementation tool according to the energy policies and, when present, the regional energy plan.
Guidelines elaborated within regional landscape plans are different. They provide rules and formulate criteria to support design activity with particular suggestions oriented toward the treatment of landscapes. Guidelines specifically address renewable energy plants. This is the case for Lombardy and Apulia, whose documents identify the most suitable areas for installation and suggest specific studies to evaluate landscape compatibility, while providing examples of good and bad practices. Veneto and Sardinia regions, as well as some provinces, have elaborated guidelines and documents for the assessment of PV plants.
The regional directives and guidelines for renewable energies are both tools for design support and decision making. In general, they are oriented to facilitate the construction of plants providing criteria and parameters for the assessment of environmental compatibility.

1.21
NETHERLANDS

Berthe Jongejan, Henk Baas, Sven Stremke & Cheryl de Boer

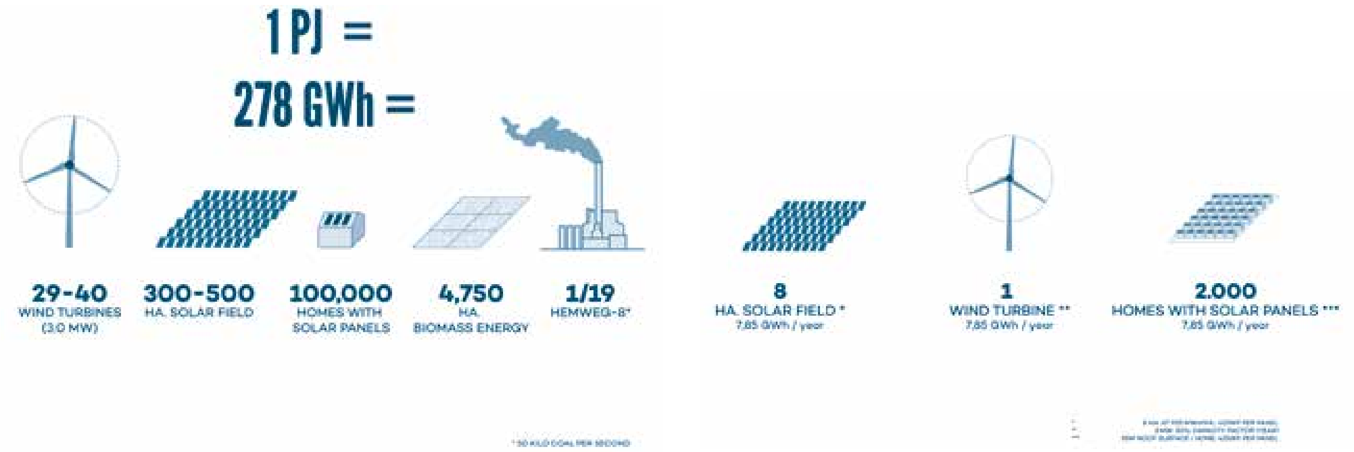


Figure 1.21.1
(Posad / Generation.Energy, 2018)

Situation of Renewable Energy

The Netherlands is facing a major challenge with regard to its energy supply. Fossil fuels will ultimately run out. Moreover, they increase greenhouse gasses. The Dutch National Energy Agreement therefore states that CO_2 emissions should be reduced by 80 to 95 % by 2050 and that RE should constitute 14 % of the total production in 2020 and 16 % in 2024. In 2016 the consumption of energy from renewable sources was 5.9 %. The total net electricity production in 2014 was 11039 GWh (Central Statistics Office, [CSO], 2018). The first wind turbines were installed in 1981 (0.25 MW) onshore and in 2007 (108 MW) offshore. In 2018, 2294 wind turbines had a total capacity of 4,2 GW (Bosch & van Rijn 2018).

Data on Landscape Quality

Dutch national law requires an environmental impact assessment. Strategic environmental assessments are also a tool which focuses on the consideration of environmental consequences in plans and programmes, with specific emphasis on the environment. The Netherlands' Commission for Environmental Assessment uses the Council of Europe's definition of landscape. As such, landscape can relate to both urban and rural settings, as well as to existing and new attributes. The Cultural Heritage Agency compiled descriptions of landscape character for 78 historic regions. These are intended to inspire municipalities and others to put current environmental changes in a broader time-depth perspective (Cultural Heritage Agency 2018).

- Different landscape mapping projects by national and provincial governments provide various types of data. The most relevant and comprehensive sources are listed as web services (Dutch National Spatial Data Service 2018).
- The Netherlands have assessments considering landscape quality for planning processes for 3 windturbines/15 MW or more. To determine the information required in the environmental assessment, three steps are necessary: 1. Describe or determine the ambition; 2. Describe the landscape qualities; and 3. Determine a tailor-made approach. Every province has developed maps and reports on landscape quality, primarily with a heritage aspect (Cultural Heritage Agency, landschapinnederland.nl, bronnen en kaarten)
- Certain landscapes are protected as World Heritage Sites (Beemsterpolder, Dutch Defense Line), or as cultural monuments (over 450 villages & townscapes, partly agricultural landscapes as well). Furthermore, landscapes can be protected by environmental/spatial planning instruments through the adaptation of provincial efforts. There are 20 national parks as well, but there is no strict legal framework regulating or protecting them.

Interaction between Renewable Energy and Landscape Quality

The transition to alternative forms of energy will have a major impact on the environment. This however has also occurred in the past. Peat extraction left behind large artificial lakes as well

	2010	2015	Forecast 2020
Wind power onshore	3739 GWh	5880 GWh	6000 MW
Wind power offshore	467 GWh	1036 GWh	4450 MW
Photovoltaic power	333 GWh	1436 GWh	-

Table 1.21.1
Wind and solar energy consumption by source and production forecast

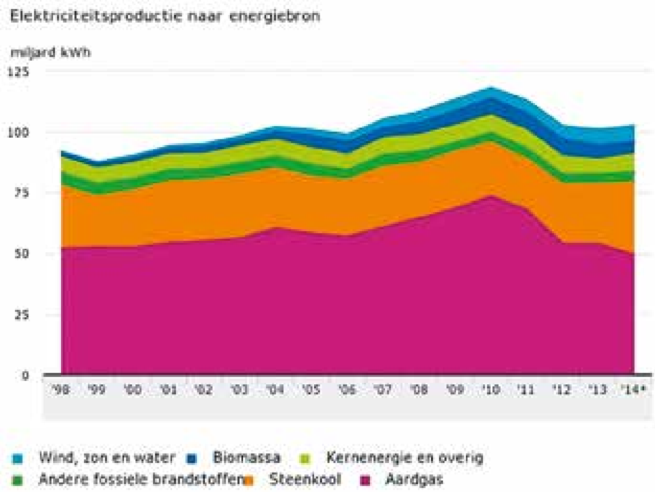


Figure 1.21.2
"Electricity production by energy source, CSO, 2018, wind, sun and water, biomass, nuclear energy, other fossil fuels, hard coal, natural gas"

as new settlements along the larger and smaller canals. Following the invention of the wind mill, thousands of new structures soon dotted the open landscape. What is different now is the tremendous speed at which the landscape is changing. This acceleration increases the challenge to complete the transition to a climate-neutral lifestyle solely based on sustainable energy within the next 35 years. Some new energy sources, such as geothermal energy or heat-cold storage, will more or less blend in with the landscape and raise little protest. New wind farms and solar plants, however, will profoundly alter the environment. Finally, we should remember that energy production has also generated a wide range of landscapes and features which today are highly appreciated, such as the Kinderdijk windmills.

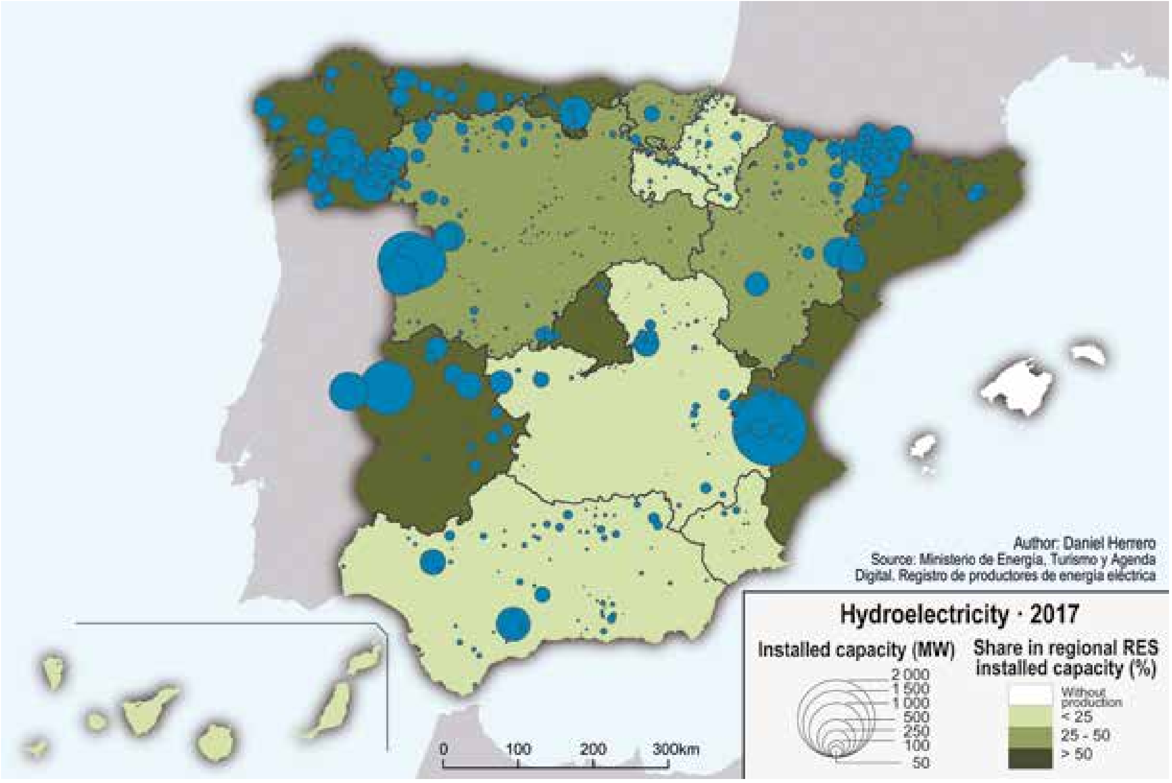
The national government is mostly involved in the development of large wind parks (> 100 MW). The national policy for onshore wind energy is focused on the nationally zoned areas for wind energy. Provinces are responsible for wind parks 10-100 MW. Each province has developed their own strategies and zoning categories. These actions are agreed upon through discussions with the national government.

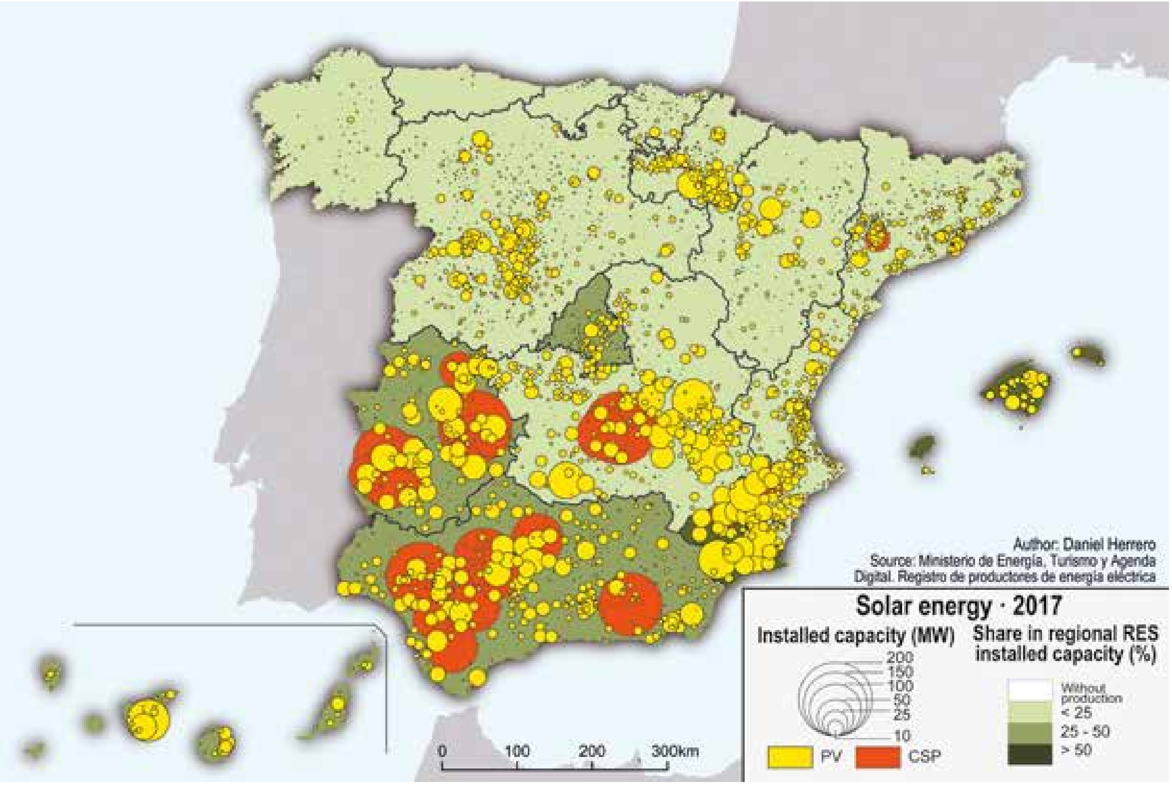
Municipalities are responsible for wind parks < 10 MW. Many municipalities already have developed or are developing policies for RE. Some municipalities, particularly the larger ones, have produced a specific wind vision or policy. In Amsterdam, wind turbines must be at least 2 km away from the world heritage site. An extensive cartographic overview of all existing wind turbines in the Netherlands can be found at Bosch & van Rijn (2018).

Concerning solar energy, there is no specific national policy related to the placement of solar farms in rural areas. Policies are made at the provincial level. Generally, provinces try to prevent agricultural land from being used for solar farms. Different policies apply to farms up to 5 ha and those larger than 5 ha. Many municipalities stimulate individuals and companies to place solar panels on existing surfaces. In Amsterdam there is about 11 km^2 of suitable rooftop space. The placement of solar panels is primarily influenced through adherence to local regulations related to building and neighbourhood aesthetics and further through rules related to protection of the character of villages and cities (Huub van de Ven 2014).

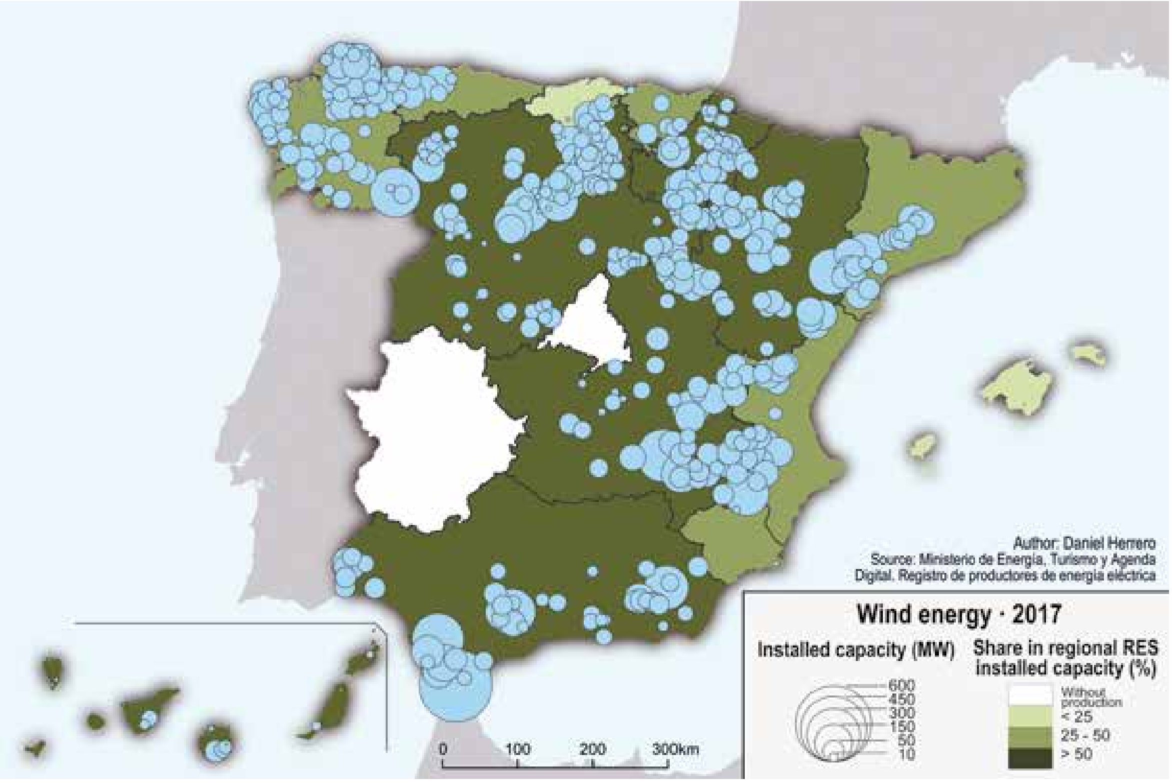
Many communities attach importance to considering landscape quality when developing projects and plans. Nevertheless, schemes or projects to improve spatial quality or to make existing landscape the primary concern when implementing plans often fail to hold their own in environmental assessments. There is no national consensus on a definition of landscape quality. This intricate situation has complicated the development of processes and evaluation frameworks for the country as a whole. Experts have begun to argue for the movement away from landscape quality to environmental quality ('leefomgeving') which, by default, comprises other parameters such as smell and sound but also, in parts, functionality and environmental performance of the country.

Figure 1.22.1
Large-scale hydropower stations in mountainous areas have always been the main source of electricity production in Norway. (Photo: Sebastian Eiter)





1.28.2
Renewable Energy Installed Capacity, 2017. Source: Registro de Productores de Energía Eléctrica (2017). Ministerio de Energía, Turismo y Agenda Digital. By Daniel Herrero-Luque


Author: Daniel Herrero
Source: Ministerio de Energía, Turismo y Agenda Digital. Registro de productores de energía eléctrica
Wind energy · 2017
Installed capacity (MW)
600
450
300
150
50
10
Share in regional RES installed capacity (%)
Without production
< 25
25 - 50
> 50
0
100
200
300km


Author: Daniel Herrero
Source: Ministerio de Energía, Turismo y Agenda Digital. Registro de productores de energía eléctrica
Biomass energy · 2017
Installed capacity (MW)
100
75
50
25
10
5
Share in regional RES installed capacity (%)
Without production
< 25
25 - 50
> 50
0
100
200
300km

1.32
UNITED KINGDOM

Gisele Alves, Sennan Mattar & David Miller

Situation of Renewable Energy

The UK Committee on Climate Change (CCC) is an independent statutory body. In 2014, it reported that the UK would meet its immediate emission reduction targets due to increased renewable electricity generation and a change from coal to gas power (CCC 2014). The Energy Act 2013 has a binding decarbonisation target which, developed from The Climate Change Act 2008, sets out to achieve an 80 % reduction in greenhouse gas emissions from 1990 levels by 2050. The focus on decarbonisation rather than RE generation was centred on the desire to promote gas power as a 'low carbon' alternative to coal (HM Government 2011).

By 2016, the gross final energy consumption from renewable sources in the UK was 8.2 %, up from 1.1 % in 2004 (Eurostat 2018). The contributions of different types of RE have changed significantly, with hydropower providing the greatest proportion in 2000, dropping to fifth largest by 2016 (Figure 1.32.1). Considerable emphasis is now being placed on marine renewables, particularly on tidal power, and expansion of offshore wind energy. The devolved administrations of Scotland, Wales, and Northern Ireland have established their own policies and targets.

Figure 2 illustrates the generation of RE. It shows an increase in the contribution of bioenergy, and seasonal differences with wind contributing more in winter (Q4 and Q1) and solar in summer (Q2 and Q3).

In Scotland and Wales, in particular, there is encouragement for community-led RE development. This forms part of an increased emphasis of policy-makers on sustainable development

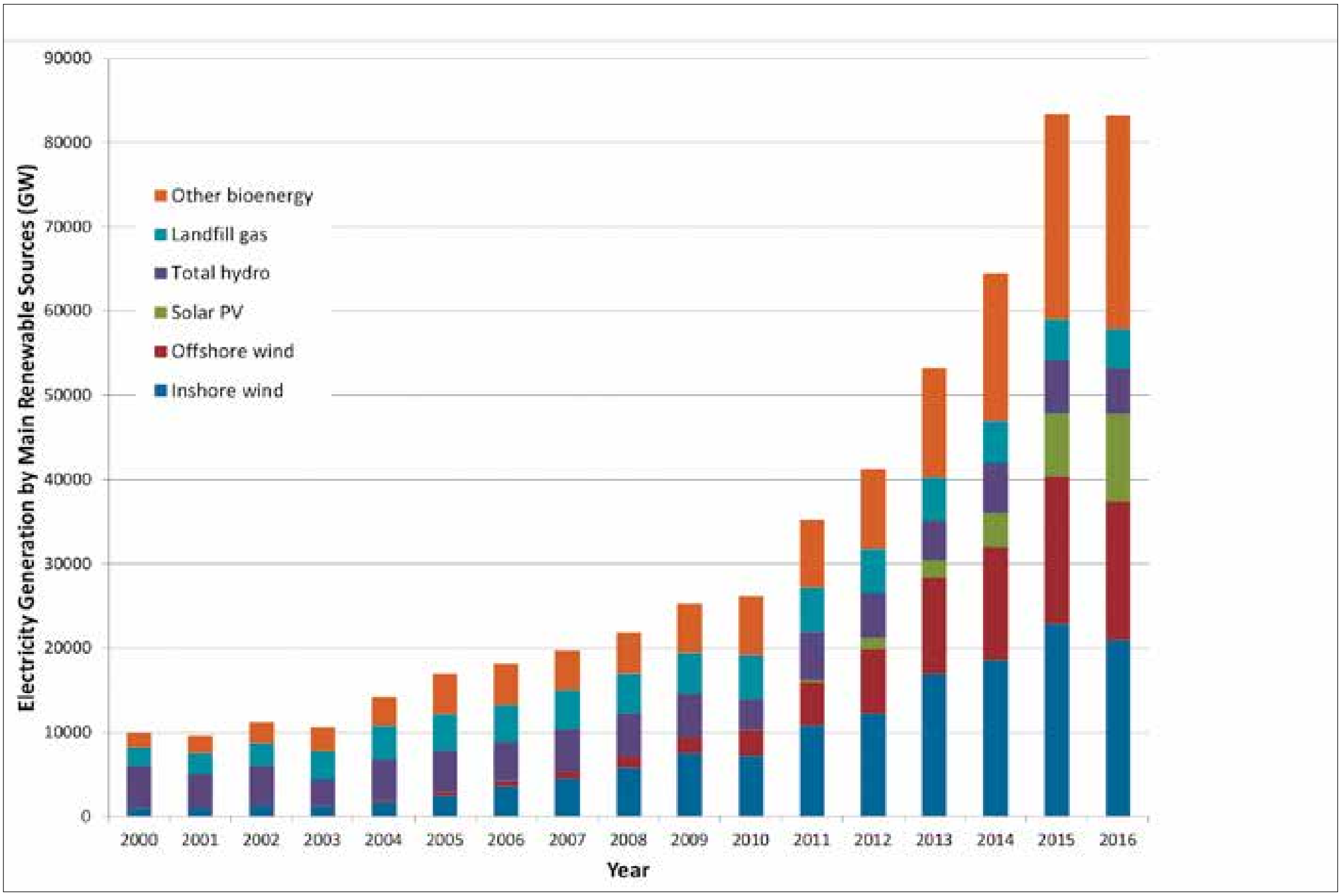


Figure 1.32.1
Electricity generation by main renewable sources (Source: Department for Business, Energy and Industrial Strategy 2017a, 158).

and diversification in rural areas, and social and environmental justice.

The types of RE generation varies across the UK reflecting the distribution of resources (Figure 1.32.3). In 2016, 66 % of renewable generation was from England, and 23 % from Scotland. The greatest amounts of RE were from onshore wind, principally from Scotland and England. Solar PV is becoming increasingly significant, increasing in England by 29 % and in Wales by 18 % between 2015 and 2016.

Data on Landscape Quality

At a UK level, there is neither single body responsible for landscape, nor a single dataset which represents its characteristics. Responsibility is divided across the devolved administrations for Scotland (Scottish Natural Heritage), Wales (Natural Resources Wales), and Northern Ireland (Northern Ireland Environment Agency), with the relevant UK government department having responsibility for England (Defra).

Several public policies make explicit reference to landscapes and their enhancement, protection, or management. Examples are the Northern Ireland Landscape Charter (Northern Ireland Environment Agency 2014) and the Scottish Land Use Strategy (Scottish Government 2016).

Across the UK, data on landscapes have been generated through the mapping of landscape character. This has followed the approach set out by The Countryside Agency and Scottish Natural Heritage (2002). The outputs are spatial datasets at national or local authority levels. This mapping has been undertaken by

2

INTRODUCTION: ENERGY LAND-SCAPE AND LANDSCAPE AND LANDSCAPE QUALITY

2.1

INTRODUCTION OF RE TYPES AND THEIR IMPACTS ON LANDSCAPE

Karl Benediktsson, Marina Frolova, Csaba Centeri & Benjamin Hennig

In this chapter, a broad overview is provided for describing the state of RE production and the share of RE in total energy consumption for all the countries that have participated in the COST Action RELY. It should be noted that, apart from the EU countries, these include several non-member states. The basis for the overview is data for 2015 from the Eurostat database. A series of cartograms for the main sources of RE as well as total RE production by country is provided in Figure 2.1.1

The cartograms were created using a density-equalising algorithm based on Gastner and Newman's (2004) approach. In the transformed maps, geometric accuracy is sacrificed, but the area of each country corresponds to the quantity being mapped while at the same time aiming to preserve each country's shape. This enables a quick grasp of the geographical distribution of the variable in question (Hennig 2013). The complementing pie chart provides guidance to each energy type's share in the overall RE production in Europe. Marine energy production was excluded from this map series due to its negligible overall share of significantly below 1 %.

The development of RE capacity has been influenced by a range of complex cultural, contextual, socioeconomic, political, and physical factors (Ellis et al. 2007), which have led to an uneven pace and extent of development. For the majority of the countries, RE production still accounts for less than 15 % of domestic energy consumption. The share of RE is lowest in Luxembourg, Malta, Bel-

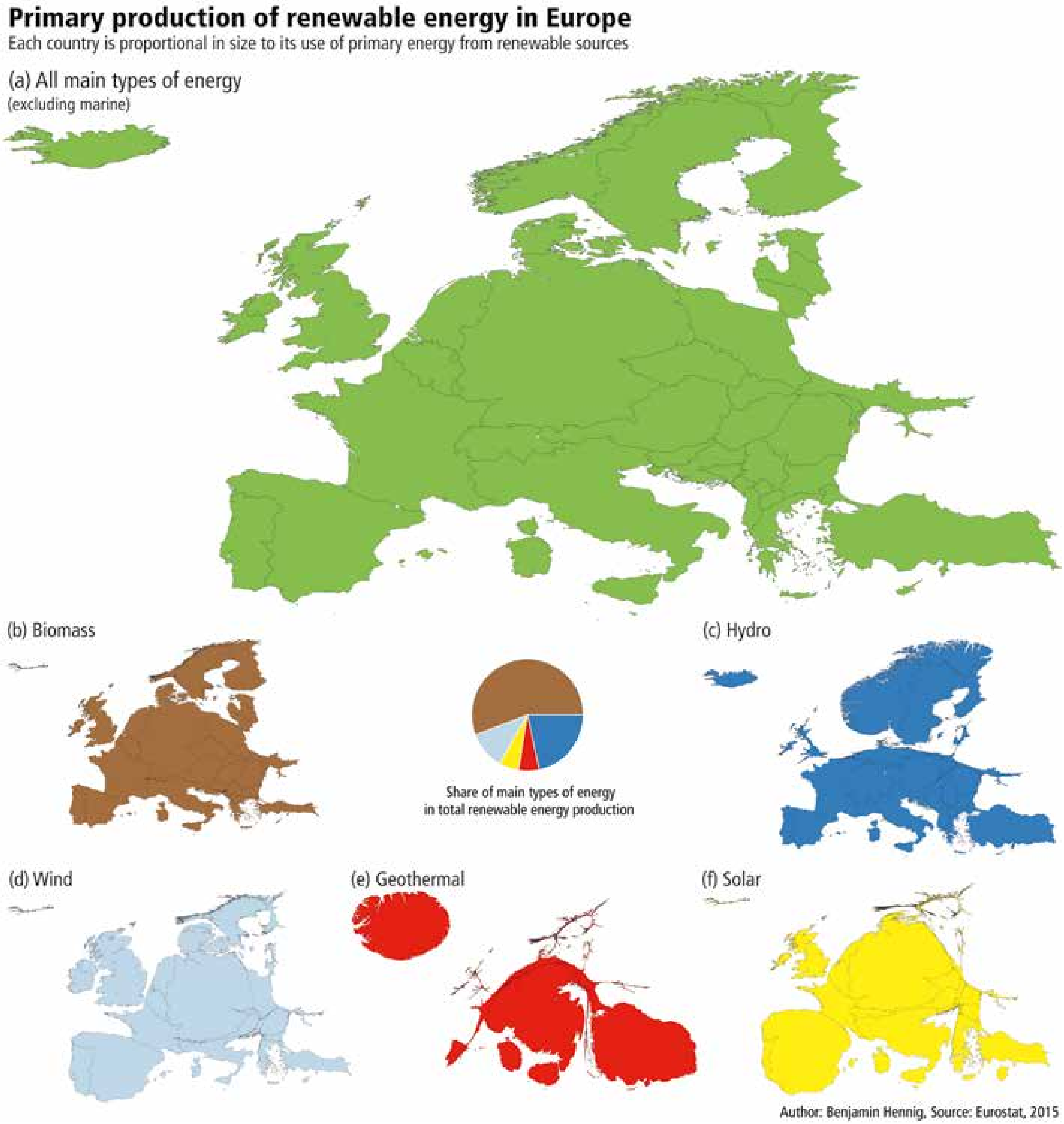


Figure 2.1.1
Cartograms showing total RE production (a) and of the five most important RE types (b-f) by country, 2015

plants could exceed that of one larger plant with equivalent output (Abbasi and Abbasi 2011, Koutsoyiannis 2011, Bakken et al. 2014). However, non-visible parts of hydropower landscapes are also very important. Ferario & Castiglioni (2017: 831) list numerous impacts of hydropower on landscapes that aren't immediately visible. For example underground pipes, turbines, pumps, but also surface water 'swallowed' by derivations and pipelines kilometres away and landscape elements eliminated by hydropower development, such as villages, mills and sawmills, meadows, pastures, huts, roads and trails, and entire valleys flooded by artificial lakes.

Indirect Landscape Impacts

As for indirect landscape effects, water diversion for electricity generation can lead to drying up of large watercourses, and the damming of lakes and rivers can lead to the erosion of the shoreline, thereby destroying soils and biota. Increased water discharge can cause riverbank erosion downstream of power plants (Rosenberg et al. 1995). Rapid flow variations due to hydropower plants can affect both physical and chemical qualities of water (Cushman 1985, Evans et al. 2009). These drastic changes in water-related ecosystems (Cushman 1985, Čada 2001, Evans et al. 2009) normally lead to unfavourable landscape quality changes.

Mitigation Strategies

As a study by Bottero (2013) illustrates, landscape impacts of hydropower projects largely determine public perception and evaluation of a project. In fact, depending on the landscape in question, damages to the landscape can account for a significant portion of a project's total costs. Thus, the key to increasing public acceptance of hydropower projects is the successful management of landscape impacts: dams, power stations, and transmission lines together with the accompanying infrastructure are usually considered disturbing (Hastik et al. 2015, Frolova 2017). Meanwhile, the perception of other visual elements may depend on the original state of the landscape and its cultural value. Frolova et al. (2015a) for example show that artificial lakes are often considered attractive,

many adverse impacts of hydropower plants can be mitigated: diverse solutions such as fish ladders help mitigate the impact on the species that would otherwise be threatened by the drastic changes to their ecosystems (Čada 2001). Power stations and power lines as well as the accompanying infrastructure are considered especially disturbing to the landscape (Hastik et al. 2015, Frolova et al. 2015a) and thus they should be placed underground to reduce their visibility whenever feasible. Utilising existing old infrastructure such as abandoned mills for the construction of small hydropower plants may help with both reducing the monetary cost of a project and reducing the impact on the landscape (Stevovic et al. 2016). Additionally, based on their comparative analysis of power plants in Norway, Bakken et al. (2014) show that landscape impacts of large hydropower plants may be reduced significantly, for example by establishing reservoirs from natural lakes, or by building large run-of-river plants which do not rely on reservoirs at all.

Potential Positive Impacts

Landscape impacts of hydropower plants need not necessarily be all negative. Large dams and artificial lakes can often become major regional attractions, boosting tourism and local income (Hastik et al. 2015, Frolova et al. 2015a). For example, hydropower infrastructure now plays a significant part in the local environment and became an important feature of the landscape in many European mountains (Frolova 2017).

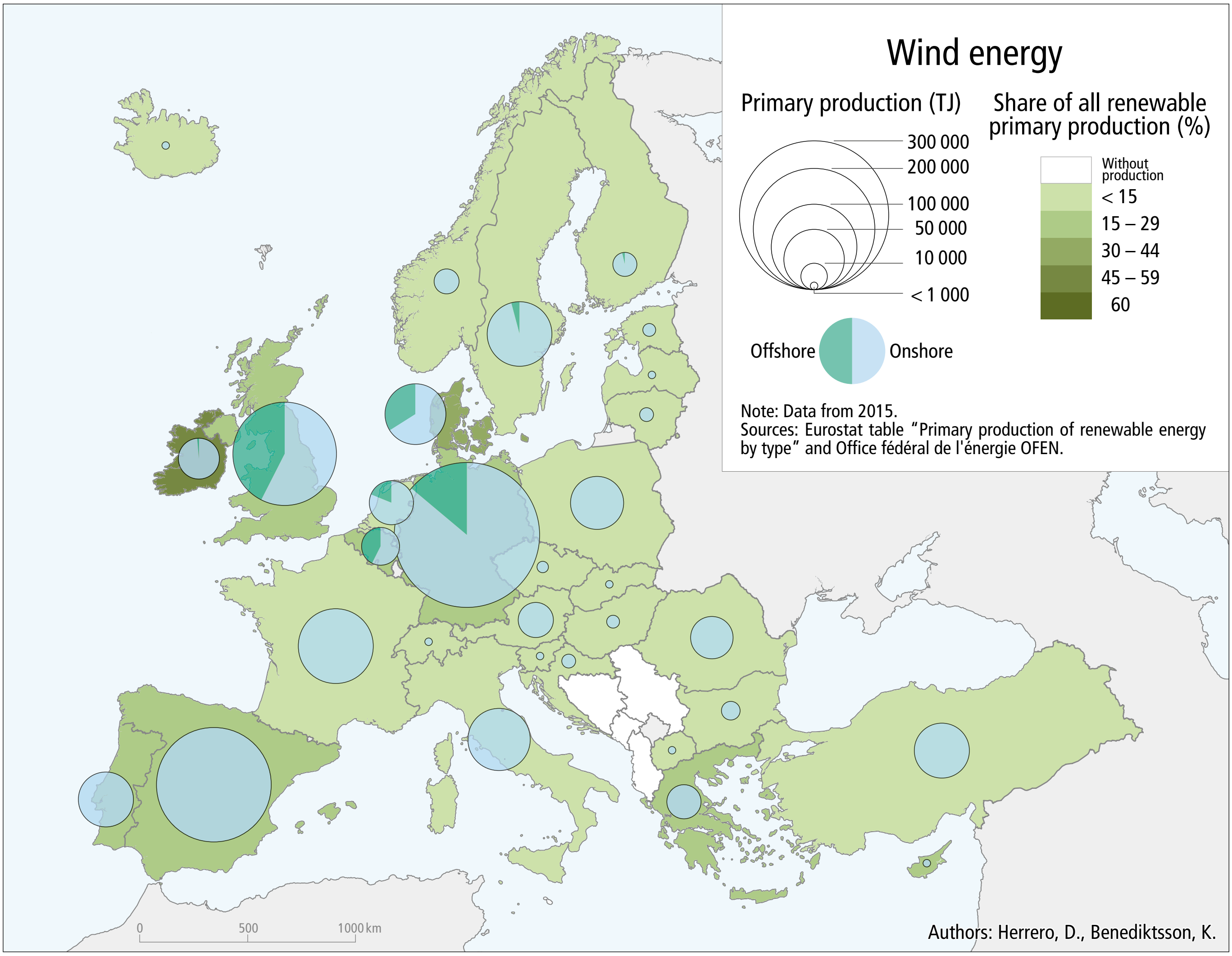


Figure 2.1.3.1
Wind energy production across European countries. Authors: Karl Benediktsson & Daniel Herrero-Luque.

2.1.3 Wind Energy

Marina Frolova & Georgia Sismani

General Overview

In 2015, the installed wind power capacity in the EU was 142 GW: 131 GW onshore and 11 GW offshore. Wind power was installed more than any other form of power generation (44.2 % of total capacity) (EWEA 2016). Germany has the largest installed capacity in the EU (45 GW), followed by Spain, the UK, and France. Sixteen EU countries have over 1 GW capacity installed, while nine of them have more than 5 GW (Figures 2.1.1 and 2.1.3.1).

As for offshore wind energy, this is a relatively young but continuously growing industry. The result has been in large-scale deployment of offshore wind farms (OWFs) in many EU coastal countries, in particular in the UK, Germany, Denmark, Belgium, the Netherlands, and Sweden.

Direct Landscape Impacts

Wind energy landscapes are characterised by considerable height (up to 160 m) of wind turbines (WTs), making their visual or perceived impact on landscape very pronounced (Figure 2.1.3.2) (Hurtado et al. 2004, Wolsink 2007, Möller 2010, Torres-Sibille et al. 2009).

The most common classification of wind farms (WFs) is based on number of WTs and capacity:

OWFs' indirect negative effects are again related to impacts on local ecosystem (birds and marine life), noise (mostly during construction phase), and coastal erosion (due to change of local wave climate) (Bergström et al. 2014, Tougaard et al. 2008). Consequently, the impact of OWFs may differ according to the type of OWTs. As fixed bottom OWTs are usually chosen for shallow waters near the shore, their installation and operation may cause greater impact to the coast compared to floating OWTs, which are located at larger distance from the shore. In the case of floating OWTs, noise and visual impact are reduced even more and the local sediment transport patterns are less affected.

Mitigation Strategies

Landscapes that previously contained large technical installations (industrial activities, harbor areas, etc.) can more easily assimilate a WF, due to thematic association with industrial structures (Danish Energy Agency 2009). Similarly, WFs could be placed into other visually complex contexts, such as power lines and towers, agricultural buildings, houses, and roads (DEHLG 2006).

The colour of WTs is important for mitigation of their landscape impact. Numerous studies show that 'no single color of WT will consistently blend with its background and it is more important to choose a color that will relate positively to a range of backdrops seen within different views and in different weather conditions' (SNH 2009, 8).

Many landscape and visual impacts of WFs could be minimised by the appropriate selection of design, layout, and location (MEEDDM 2010), by avoiding their visibility from sensitive viewpoints (SNH 2009), and by technical monitoring and specific restoration actions (MEEDDM 2010).

In case of OWFs, some potential negative effects could be mitigated through strategic planning (Bergström et al. 2014) and appropriate site selection (Lindeboom et al. 2011). Landscape and seascape character types can provide a good basis for designing guidelines of WFs. All the associated elements, other than WTs, should also be located and designed to respect the character of surrounding landscape (WEDG 2006).

Potential Positive Impacts

Although landscape is often cited as an argument in the conflicts around WFs, instead of being considered as a problem for local inhabitants, WTs can even form a positive part of a local landscape and sense of place and affirm an identity in a given landscape (Frolova et al. 2015b). From the aesthetic point of view, WTs can be perceived as sculptural elements in the landscape, evoke positive association where related to modern structures, and be associated with technological efficiency, progress, environmental cleanliness, and utility (WEDG 2006).

As in case of onshore WFs, prior experience of the public with OWFs may significantly influence their perception towards them and thus, at some point they could be considered as part of the local landscape (Ladenburg 2009, Ladenburg and Dubgaard 2009). Many studies indicate that OWFs may also lead to ecosystem benefits, as consequence of reduced pressures from shipping, commercial trawling, and dredging in the area. This may enable the establishment of large areas of seabed, and consequently, creation of a new habitat (Gill 2005, Inger et al. 2009, Wilson and Elliott 2009). Thus, may also be a potential increase in local biodiversity (van der Molen et al. 2014).

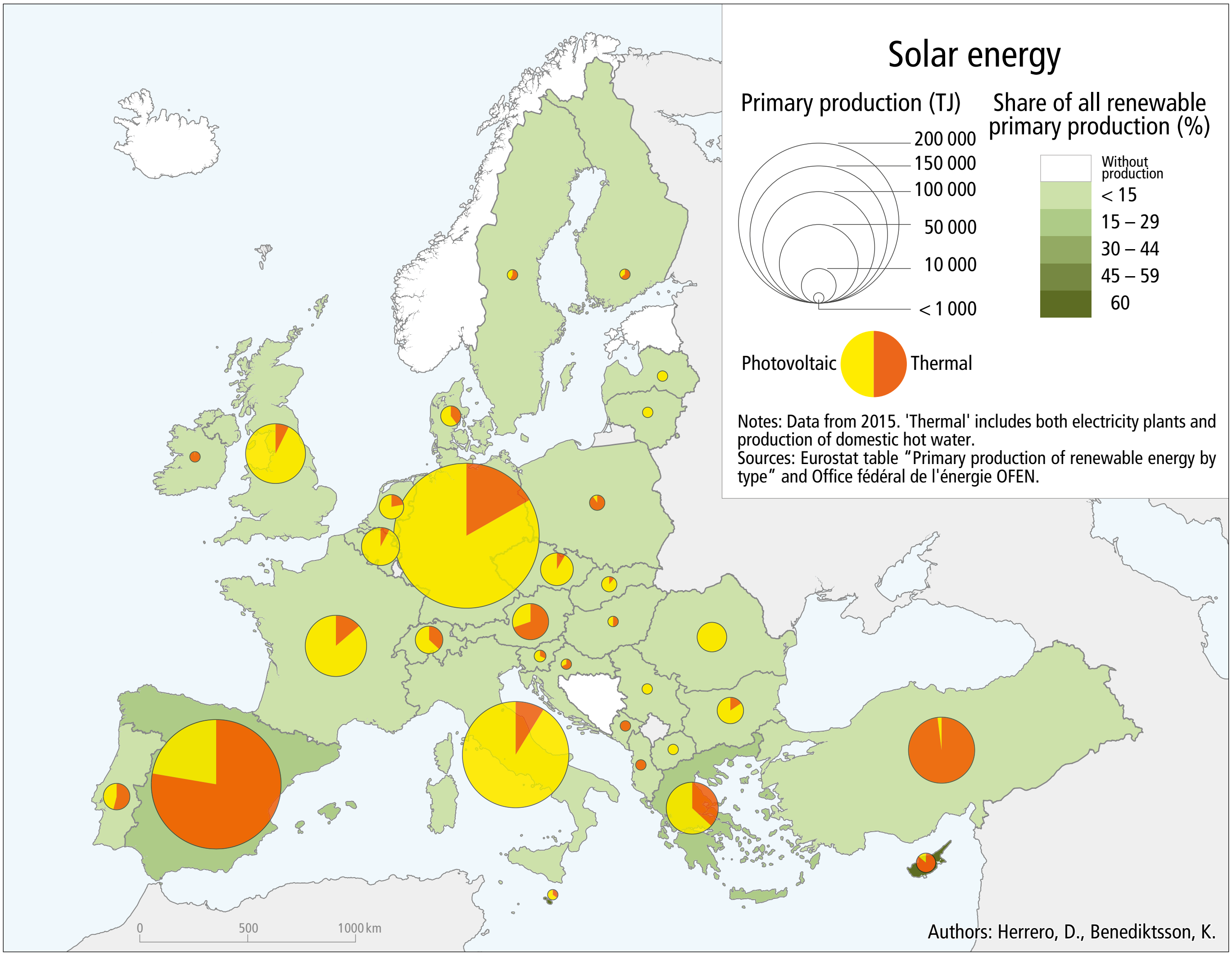


Figure 2.1.4.1
Solar energy production across European countries. Authors: Karl Benediktsson & Daniel Herrero-Luque.

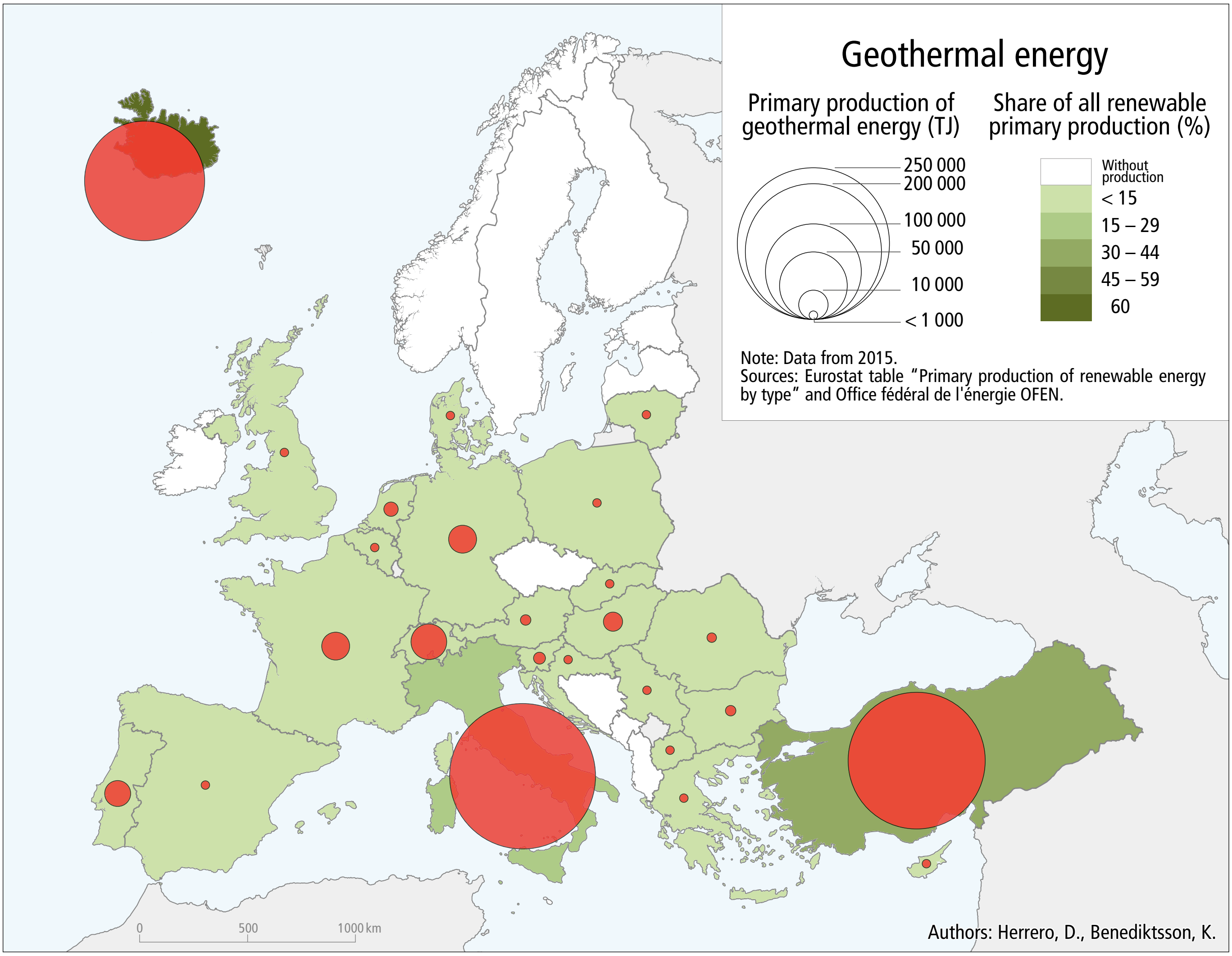
2.1.4 Solar Energy

Alessandra Scognamiglio,
Georgios Martinopoulos,
Emilio Muñóz-Cerón & Marina Frolova

General Overview

Solar energy systems compete with conventional fuels mainly in two applications: electricity and domestic heat generation (hot water and space heating). The most common solar system for electricity production (off and grid connected) is photovoltaics (PV) as solar thermal power (STP), also known as concentrated solar power (CSP) systems, are at an early deployment stage (Río et al. 2018). Solar thermal collectors are the systems most widely used for domestic heat generation.

At the end of 2016 the worldwide installed PV capacity was about 303 GW_p, with a market growth in 2016 of about 50 %, as 76 GW_p were added (IEA 2018). The leading country is China, followed by Japan and the USA (representing 26 %,14 %, and 13 % of the cumulative worldwide capacity, respectively); within the EU (20.5 %), Germany and Italy are leading with 14 % and 6 % respectively (Figures 2.1.1. and 2.1.4.1). The targets set by most EU countries for 2020 were vastly underestimated due to the decrease of PV prices coupled with the incentives provided during the previous years. Moreover, an increase of solar PV electricity



2.1.5 Geothermal Energy

Karl Benediktsson

General Characteristics

Geothermal resources are categorised as either low or high enthalpy, with temperature of 150 °C at surface pressure often used to separate the classes (Martín-Gamboa et al. 2015). They are either used directly, e.g. for space heating, or for the production of electricity. Geothermal energy contributed some 6% of all RE in Europe in 2015 (Eurostat 2015), but this is very geographically concentrated, with most of the production in only three countries: Italy, Turkey, and Iceland (Figures 2.1.1 and 2.1.5.1) albeit potentially available in many other parts of the continent. A high geothermal gradient (the rise in temperature with depth) is an indicator of geothermal potential. This characterises several regions in Europe (Hurter and Haenel 2002), especially in the three countries already mentioned, as well as parts of Greece and most of Hungary. Large areas of France, Spain, Serbia, Macedonia, and Romania also have rather high geothermal gradients.

Technical Characteristics

Geothermal fluids from high-enthalpy fields are suitable for electricity production. The first such power plants used dry steam (without a liquid component) taken straight out of the ground, but

Figure 2.1.5.1
Geothermal energy production across European countries. Authors: Karl Benediktsson & Daniel Herrero-Luque.

most newer installations use single flash or double flash technology, where the fluid is taken to the surface under pressure and then 'flashed' to steam (DiPippo 2015). The use of high-enthalpy fields for space heating and similar purposes requires the use of heat exchangers. Water from low-enthalpy geothermal fields is often suitable for direct use, e.g. for heating of buildings or bathing purposes. It can also be used for electricity generation, although mostly on a small scale using 'binary systems' with a secondary working fluid to drive turbines. This technology, which is still developing, could considerably enlarge the role of geothermal energy for electricity production in countries without high-enthalpy resources.

The true renewability of geothermal energy resources is open to question (Barbier 2002). Low-enthalpy systems based on naturally flowing hot water are indisputably renewable. However, if greater volumes of steam or fluids are extracted from a subsurface reservoir than are flowing into it, the situation is similar to mining (Arnórsson 2011). This is especially a concern in large projects making use of high-enthalpy fields to produce electricity. To ensure the long-term renewability of a geothermal project, the size of the reservoir thus needs to be very carefully assessed beforehand and closely monitored after use has commenced.

Figure 2.1.5.2
Geothermal pipelines at Nesjavellir, SE-Iceland. The power station is just to the left of the picture (Photo: Brynja Rán Egilsdóttir)

3

LANDSCAPE POTENTIAL AND VULNER-ABILITY TO RENEWABLE ENERGY DEVELOPMENT

3.4

THE POTENTIAL AND VULNERABILITY OF LANDSCAPES FOR SPECIFIC RENEWABLE ENERGY PRODUCTION SYSTEMS

Authors: Adolfo Mejia-Montero, Michael Roth & Bohumil Frantál

3.4.1 The Bond between Landscapes and Renewable Energy

Traditionally renewable energy production systems (REPS) have been spatially assessed solely on the basis of resource distribution. This positivist approach has systematically ignored the inherent geographic bond of REPS with social, environmental and cultural elements of pre-existent landscapes.

Multifunctional landscapes are able to provide a variety of functions, resources, and options over different land uses. However, most of the times land uses are interconnected, creating competitiveness among stakeholders (local residents, farmers, tourists, nature conservationists, etc.), or between certain landscape functions or features (such as e.g. cultural or aesthetic). Prone to conflict are, in this sense, primarily landscapes characterised by heterogeneity, fragmentation, dynamics, and competition of potential users for limited resources and space —typically peri-urban landscapes at the interface of urban and rural spaces (see e.g., von der Dunk et al. 2011).

Landscape changes are therefore, to a large extent, a by-product of market forces and sectorial policies (Mann & Jeanneaux 2009), whose impacts often have the form of unintended consequences (Röhring & Gailing 2005). However, while some landscape functions are regulated (e.g. laws on nature and landscape protection, laws on the protec-

Figure 3.4.2.1
Countries from COST action which participated in this pan-European assessment.

tion and exploitation of mineral resources, etc.), other landscape functions (aesthetic or cultural) usually lack standardisation and are controlled by informal institutions in the form of cultural traditions and norms (Mann & Jeanneaux 2009).

The multifunctionality and heterogeneity of landscapes makes it impossible to create a comprehensive institutional system to regulate all areas, or to reach general consensus on visual fit and compatibility between specific REPS with specific types of landscapes. This is also due to perceptions and evaluations varying in geographical, cultural, and socioeconomic contexts, traditions, and personal experiences.

This is why the present work comprises the first highly participative pan-European expert assessment (99 experts from 28 different European countries) looking at compatibility between different European landscapes, represented by 44 Corine Land Cover (CLC) classes, and different REPS. CLC was chosen as a proxy for landscapes due to its great resolution and the potential homogeneity to asses different European physical landscapes.

The results of this work will hopefully support downscaling to policy-making and guidelines at the national level in Europe, to assist the European energy transition without jeopardising its landscape quality, maximising the multifunctionality of synergies between landscapes and REPS, and improving the overall long-term quality of energy landscapes.

3.4.2 The How and Who of the Participative pan-European Expert Assessment

In order to assess the compatibility between CLC and REPS an assessment matrix and questionnaire were developed, with both categories displayed as rows and columns respectively, using as inspiration the work of Burkhard et al. (2009, 2012) assessing compatibility between Ecosystem Services (ESS) and CLC. This questionnaire was then shared with the RELY network of experts, for them to rank each combination of CLC and REPS depending on their professional perception of compatibility, including options for respondents who didn't feel confident enough to asses specific values (0 = Not relevant, 1 = Completely compatible, 2 = Rather compatible, 3 = Neutral, 4 = Rather conflicting, 5 = Absolutely conflicting, 9 = I don't know/can't judge).

In a parallel fashion and attached to this document, a second matrix to assess compatibility between Ecosystem Services (ESS) and REPS included.

To enrich the analysis of results each respondent was assigned a number, country of procedence, and area of knowledge: technology (engineers, physicist, etc.), people (sociologists, human geographers, etc.), landscape (landscape architects, landscape managers, etc.), and multi (geographers, energy planning, etc.). A total of 99 expert responses (64,251 data cells), from 28 European countries,

4

SOCIO-CULTURAL ASPECTS OF RENEWABLE ENERGY PRODUCTION

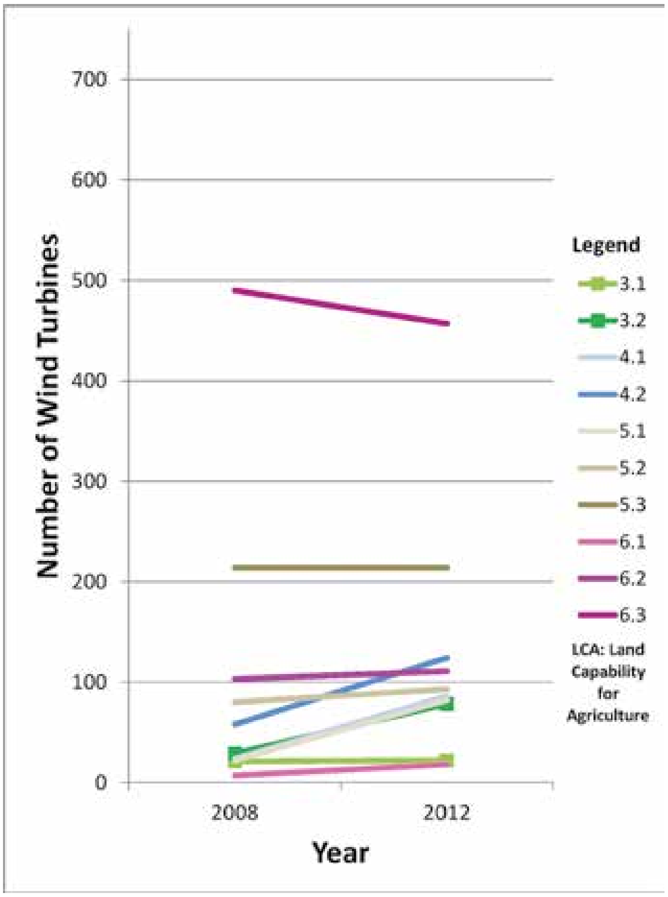
	Project name	County, country	T	I	L	Innovative aspect
AU	Energiekultur Kulmland	Oststeiermark, Austria	○	↔	👥	innovative actor—energy manager; innovative approach—building a regional energy vision, building trust
CH	Solar modules on avalanche barriers	St. Antönien, Grisons, Switzerland	🔧	↔	⊙	innovative approach—bottom up initiative, multiple use of resources
CH	Linthal 2015	Linthal, Grosstal, Canton of Glarus, Switzerland	🔧	↔	👥	innovative approach—well-designed involvement process, building trust and progress in level of participation
CH	Solarpark La Boverie	Payerne, Yverdon Switzerland	🔧	↔	👥	innovative approach—building vision on energy region, energy city, multiple use of resources
DE	Energy strategy/ policy Zellertal	Arnbruck and Drachselsried (county: Regen), Bavaria, Germany	🔧	↔	⊙	innovative visualisation techniques—scenario simulation, interactive mapping
DE	GIS-based and participative visual landscape assessment	Mecklenburg-Western Pomerania, Germany	🔧	↔	⊙	innovative visualisation techniques—GIS, 3D analysis
DE	Interactive visual landscape assessment as a basis for the geodesign of wind parks	Saarland, Germany	🔧	↔	⊙	innovative visualisation techniques—GIS, scenario simulation
DE	Dezent Zivil	Schopfheim, Baden-Wuerttemberg, Germany	🔧	↔	👥	innovative visualisation techniques 3D simulations, innovative approach—bottom up and high proactive initiative
DE	Energy village Wildpoldsried	Wildpoldsried, Bavaria, southern Germany	○	↔	⚇	progress in participation level, innovative approach—building a local energy vision
NL	Energiewerkplaats Fryslân The Energy Atelier Friesland	Province of Friesland, Netherlands	○	↔	⚇	innovative approach—locally tailored approach, innovative techniques—interactive mapping, 3D scenarios, new actors—local energy cooperation
BIH	Micro hydropower plant Čajdraš	Cajdras, Zenica, Bosnia and Herzegovina	⚖	↔	⊙	innovative approach—multiple use of resources as a goal
BIH	Solar power plant Kalesija	Kalesija, Bosnia and Herzegovina	⚖	↔	👤	innovative actor—financial private participation
CZ	Biogas station in Pustějov	Pustejov, Moravian Silesian Region, Czech Republic	🔧	↔	👤	innovative technique—study trip

Table 4.2.5.1
Assessment results of the case studies on innovative participation practices

	Project name	County, country	T	I	L	Innovative aspect
HR	Island Krk—Energy Independent Island	Island Krk, Primorsko—Goranska County, Croatia	instrumental	broad	involvement	progress in participation level; innovative approach—financial participation by inhabitants and learning by established models
HR	Biogas Gundinci	Municipality of Gundinci, Brod-Posavina County, Croatia	instrumental	narrow	consultation	progress in in participation level; innovative actor—UNDP innovative approach—multiple use of resources
HU	Coach-BioEnergy	Szada, Hungary	normative	broad	consultation	innovative approach—multiple use of resources; innovative techniques for information—letters, posters, bringing together—forums and study trips
HU	Csaba Vaszkó—bioenergy feed stock production	Tiszatarjan, Borsod-Abauj-Zemplen County, Hungary	substantive	narrow	collaboration	innovative approach—integration of local symbols, meanings and economy context
SR	Energy efficient Kindergartens in Belgrade	Beograd	instrumental	broad	consultation	progress of the participation level—broad public information and call for consultation
SR	Small biomass power plant	Dragacica	instrumental	narrow	involvement	innovative approach—financial participation by farmers
SR	Ecoremediation of degraded areas by energy crops production	Sadzak, Municipality Sremska Mitrovica	instrumental	broad	consultation	innovative approach—financial participation by farmers multiple use of resources
FR	Ailes des Crêtes wind farm	Chagny and Bouvellemont, Ardennes, France	substantive	broad	collaboration	innovative approach—shared benefits and learning by established models
FR	Energ'Ethique 04	Digne-les-Bains, Alpes de Haute Provence, France	substantive	broad	empowerment	progress in participation level—democratic governance, innovative approach—building regional vision, innovative actor—energy social enterprise
IT	L'Aquila Progetto C.A.S.E.	L'Aquila, Abruzzo, Italy	legalistic	narrow	information	innovative approach—multiple use of resources
PT	Barragem de Alqueva	Alqueva, parish of Alqueva, municipality of Portel, Portugal.	instrumental	broad	consultation	progress in participation level—high inclusiveness and multidisciplinary approach in early stage of project
PT	Central Solar da Amareleja	Amareleja	normative	broad	consultation	progress in participation level but without external obligation; innovative approach—building trust

TYPOLOGY	legalistic	normative	instrumental	substantive	
INCLUSIVENESS	narrow	broad			
LEVEL	information	consultation	involvement	collaboration	empowerment

5 OUTREACH OF COST RELY AND REFLECTION ON FUTURE STRATEGIES

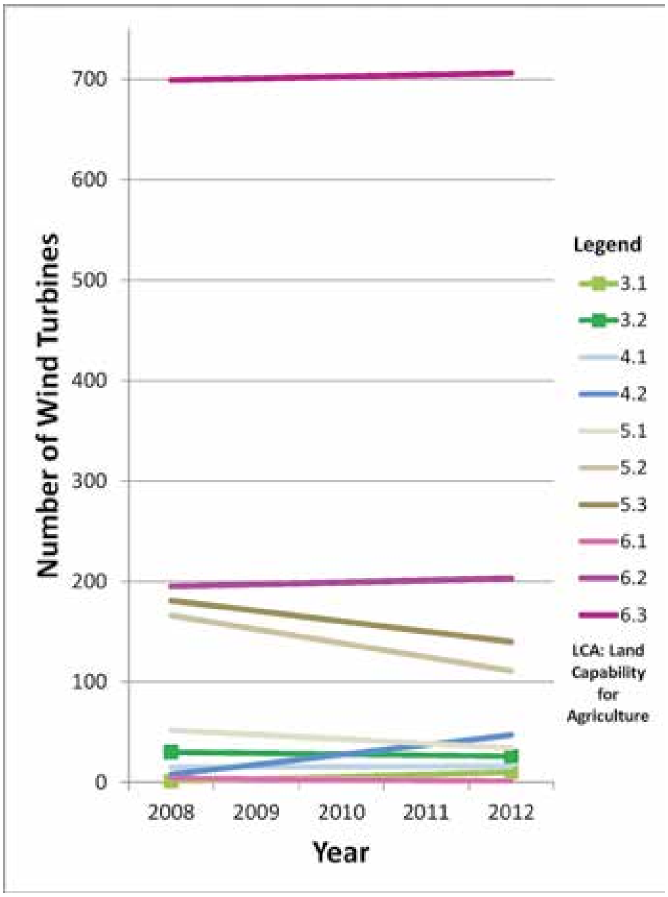


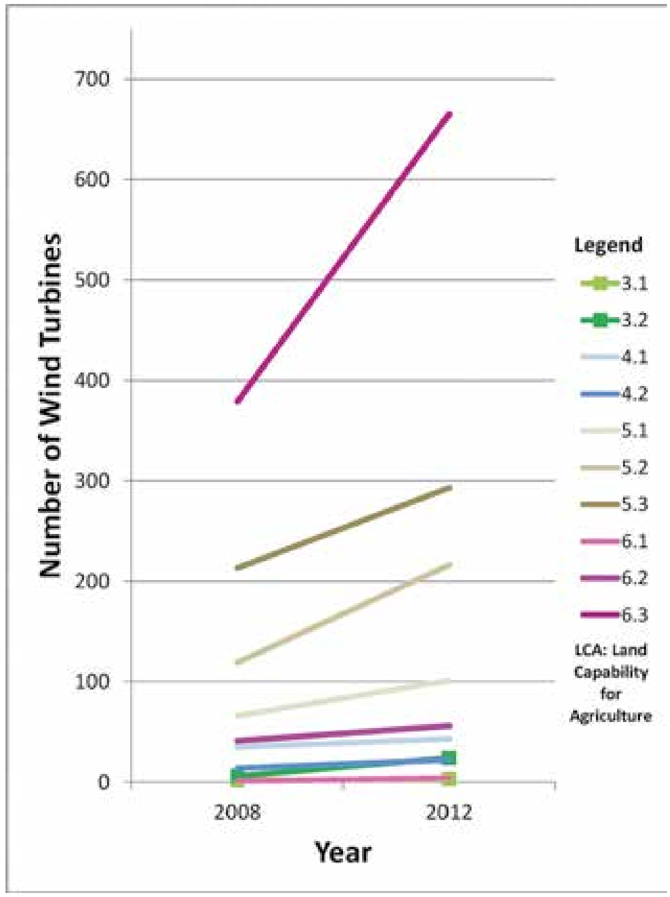
Applications for Wind Turbines
Figure 5.2.2.1
Applications for planning permission for wind turbines, by Land Capability for Agriculture Class, Scotland, 2008 to 2012.

management decisions and actions (e.g. expansion or decommissioning of a development).

An example of such adaptive management strategies in relation to renewable energies (and indirectly the landscape change induced by them) is the so-called 'floating cap' for the new installations of wind turbines in Germany. The 'floating cap' was introduced as a reaction to the fact that, in 2014 and 2015, more wind turbines had been built than planned. These wind turbines could not all be connected to the electricity grid and/or, the energy transmission system in general could not accommodate all of the energy they produced. With the reform of the Renewable Energy Sources Act in 2017 in Germany, a flexible instrument of reducing feed-in tariffs was introduced, mainly to control the economic efficiency of the system. Although principally an economically motivated adaptive management strategy, this is an illustration of how, even with national policy, flexible approaches are possible.

Fazey et al. (2009, 416) argue that many adaptation strategies focus on improvising short-term capacity to deal with environmental change, but can increase vulnerability to unforeseen changes in the future. Landscapes in which renewable energy systems are being introduced often have characteristics of providing capacity (renewable energy) in response to environmental change (climate change), and in some cases are exposed to risks that are new to an area. For example, the conversion of land use to the production of woodland biomass energy





Wind Turbines Approved
Figure 5.2.2.2
Applications for wind turbines approved, by Land Capability for Agriculture Class, Scotland, 2008 to 2012

Wind Turbines Installed
Figure 5.2.2.3
Wind turbines installed, by Land Capability for Agriculture Class, Scotland, 2008 to 2012

has an associated increase in the risk of forest fire. The magnitude of the risk may remain small, but the exposure and vulnerability may be significant. Therefore, over a long term the potential for 'disruptive' events increases.

Human responses to drivers for renewable energy or territorial-related policies and socio-economic conditions include investments in financial and social capital. Actors responding to opportunities for the development of renewable energy are taking advantage of technologies which are new, or as they emerge in different places at different times. The consequences for landscapes have been changes in their characteristics, the types and rates of which varies across Europe reflecting differences in biophysical, economic, and social opportunities for such change.

Landscapes can be managed to adapt to climate change, led by changing societal priorities. Such societal priorities are amongst the driving forces that continuously modify the 'state' of a landscape, making it neither steady nor constant. They may undergo a process of development that can be chaotic and autonomous (Antrop 2005, 31), with more intense dynamics of change leading to it being faster and more extensive (Antrop and Van Eetvelde (2017, 142), i.e. cumulatively large-scale. Precisely which processes of landscape change are dominant, and the consequences of these changes, can vary under different geographic and climatic conditions. Such influences are exerted mainly through the policy-induced acceleration of processes of intensification and extensification, and

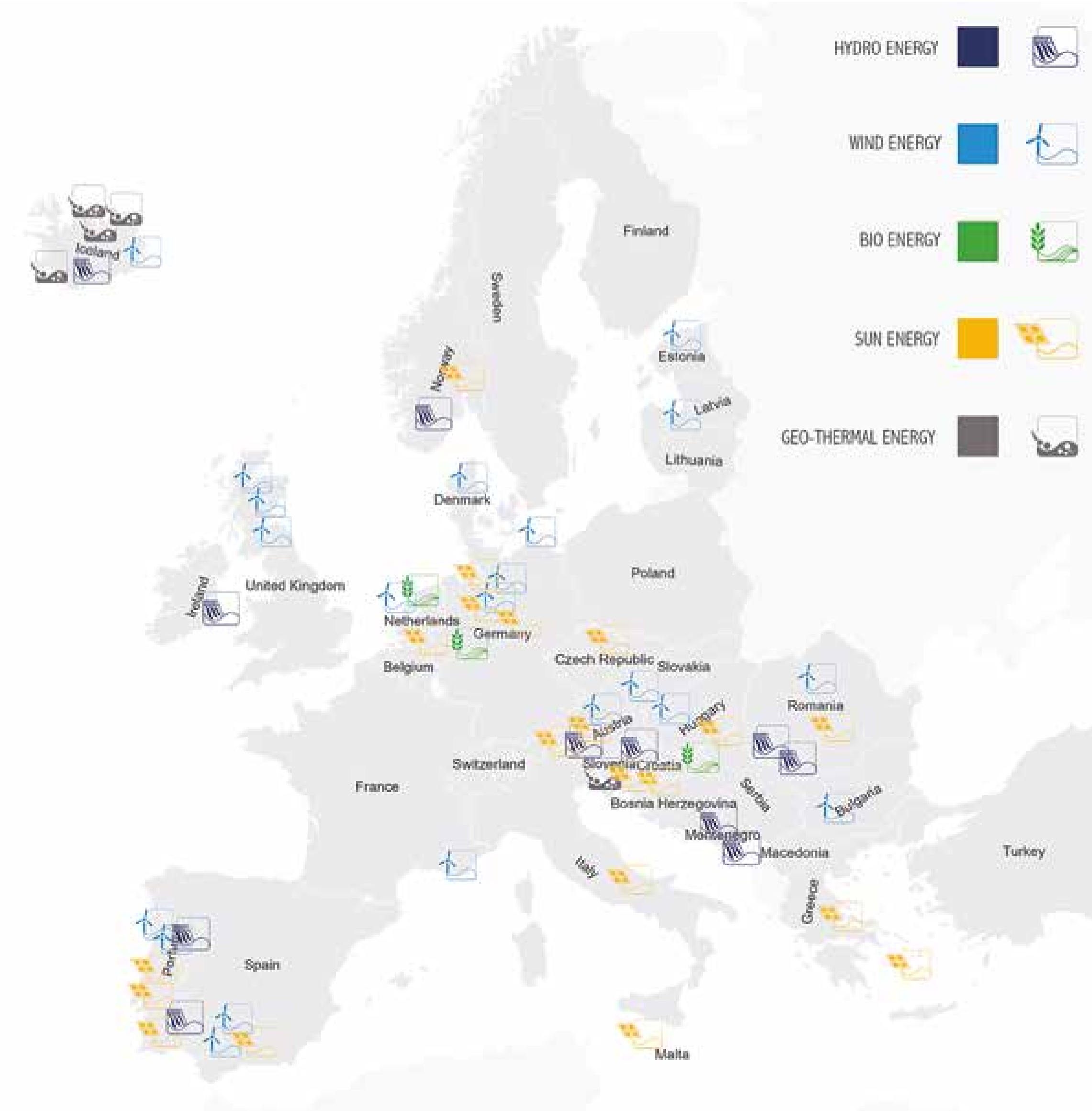


Figure 5.3.2.1
COST RELY Photograph Database Map. The map shows a predominance of wind and solar farms, both of which are usually associated with scenic landscapes (Source: J.J. González 2017, developed for COST RELY)

Figure 5.3.2.2
COST RELY Photograph Database Chart. The chart shows a preference for both wind and solar farms scenarios—overcoming regional differences. (N. Mestre 2018, developed for COST RELY)

forms and scales were recorded (Figure 5.3.2.2). The sources of renewable power resources illustrated in the photographs are biological, geo-thermal heat, sun; water, and wind. The dominant rural land use for land-based installations is agriculture and forestry. Installations are omnipresent and can even be found in remote, mountain areas, where photographs show the presence not only of hydroelectric power stations, but also of roof and ground-mounted photovoltaic systems. Finally, the database also includes examples of power infrastructure, renewable resources, new siting practices and lastly, but no less importantly, renewable energy landscape bad practices.

5.3.2 Mapping the RELY Photographs

The photo database includes photographs submitted by members from countries ranging from Portugal to Romania and from Greece to Iceland. The map of the photo database sets out renewable energy landscape practices in twenty-one European countries with ample regional representation (Figure 5.3.2.1). Energy systems are well represented by a wider set of resource and installation typologies defined in the COST RELY Glossary (http://cost-rely.eu/resources/glossary). As the map shows and the table proves, solar landscapes are the most common, followed by wind landscapes. Examples of the latter were submitted from thirteen coun-

TYPE	SUB-TYPE	COUNTRY	AUTHORS
hydro energy	*large*	*Austria*	*Csaba Centeri, María- José Prados*
	small	*Bosnia Herzegovina*	*Igor Kuvač*
	large	*Iceland*	*Csaba Centeri*
	large	*Norway*	*Sebastian Eiter*
	large	*Portugal*	*Naja Marot, Csaba Centeri, Maria Bostenaru*
	micro	*Romania*	*Maria Bostenaru*
	large	*Slovenia*	*Csaba Centeri, María- José Prados*
wind energy	*on-shore*	*Austria*	*Marton Havas, Rebecca Krieger*
	on-shore	*Bulgaria*	*Georgi Hinkov*
	on-shore	*Denmark*	*Naja Marot*
	old mill	*Denmark*	*Naja Marot*
	on-shore	*Francia*	*Naja Marot*
	on-shore	*Germany*	*Olaf Schroth, Jochen Muelder*
	off-shore	*Germany*	*Olaf Schroth*
	small	*Germany*	*Jochen Muelder, Andre Berger*
	on-shore	*Hungary*	*Marton Havas*
	on-shore	*Iceland*	*Csaba Centeri*
	on-shore	*Latvia*	*K. Reinis*
	on-shore	*Netherlands*	*Berthe Jongegan*
	on-shore	*Portugal*	*Filipa Soares, Maria JoaoNunes, Naja Marot, Csaba Centeri*
	on-shore	*Romania*	*M. Sbarcea*
	off-shore	*United Kingdom*	*Olaf Schroth*
	on-shore	*United Kingdom*	*Olaf Schroth, Naja Marot*
	on-shore	*Iceland*	*Csaba Centeri*
	on-shore	*Spain*	*María- José Prados, Juan José González*
bio	*bio-mass*	*Germany*	*Alexandra Kruse*
	bio-gas	*Croatia*	*Romulic & Stojcic studio*
	bio-mass	*Netherlands*	*Berthe Jongegan*
solar energy	*PV on-Roof*	*Austria*	*Marton Havas, Christina Nöbauer*
	PV-on ground	*Austria*	*Sebastian Eiter, Csaba Centeri, María- José Prados*
		Austria	*Gerald Leindecker*
		Czech Republic	*Bohumil Frantál.*
		Croatia	*Romulic & Stojcic studio*
	Pv on groud	*Germany*	*Sebastian Eiter, Olaf Schroth*
	PV on-Roof	*Germany*	*Jochen Muelder*
	PV on-Roof	*Greece*	*Nikos Papamanolis*
	Pv on groud	*Greece*	*Alexandra Kruse*
		Hungary	*Robert Kabai*
	Pv on ground	*Hungary*	*Balint Kiss*
	on-roof	*Netherlands*	*Berthe Jongegan*
	on- Ground	*Norway*	*Sebastian Eiter*
	on-roof	*Slovenia*	*Csaba Centeri*
	on-ground	*Slovenia*	*Naja Marot, Csaba Centeri, María- José Prados*
		Spain	*Manuel Perujo*
	PV on-Roof	*Italy*	*Maria Bostenaru*
	Pv on ground	*Portugal*	*Luis Junqueira, Luis Silva, Naja Marot, Csaba Centeri*
	PV on-Roof	*Romania*	*Maria Bostenaru*
	Thermo Solar	*Spaim*	*María- José Prados, Juan José González*
	PV on ground	*Spain*	*Juan José González*
geo-thermal	*power plant*	*Iceland*	*Csaba Centeri, David Ostman*
	natural	*Iceland*	*Csaba Centeri*
	greenhouse	*Iceland*	*Csaba Centeri*
	greenhouse	*Slovenia*	*Csaba Centeri, Naja Marot*

5.6
IMPACT THROUGH EDUCATION

Isidora Karan

Figure 5.6.1
Participants of the COST RELY training school in Dublin, Ireland, 2016. Photo: Michael & Sandra Roth.

5.6.1 Awareness-raising

Renewable energy is widely considered a desirable way of production energy in the context of sustainable and environmentally responsible development, even though there is community resistance towards renewable energy systems construction. This is mostly related to transformation of recognisable landscape characteristics, but also to negative perceptions of energy landscapes in general (Kontogianni et al. 2014, Silva, and Delicado 2017, see 4.1.). Energy landscape potentials and qualities are not recognised as such and a better understanding of how renewable energy deployment can be reconciled to contribute to the sustainable transformation of energy landscapes. Recent researcher has indicated that there is a yawning gap which needs to be addressed in the area of energy education and awareness on different levels. There is also a lack of expertise when it comes to comprising combinations of technical and natural sources of energy within a landscape (Sodha 2014). In order to further improve renewable energy development, the awareness of the two-way interaction between renewable energy systems and landscape quality should be increased. That implies an extra effort that should be added to the education of both experts and general public. It is important to recognised that awareness-raising cannot be a purely top-down process but needs to be seen as a 'multi-directional transfer of knowledge' and 'co-creation of meaning' (Council of Europe 2002).

5.6.2 RELY Education

In the framework of the RELY (Renewable Energy and Landscape Quality) COST Action, various educational activities have been undertaken in order to increase awareness of positive relationships between renewable energy and landscape quality. Those activities were orientated towards the education of the general public in different European countries (e.g. traveling exhibition, flyers, etc.; see 5.5), but the main focus was placed on the education of young scientists and future experts from all around Europe. Different types of educational activities have been realised, such as e-lectures or series of online sessions for all RELY Action participants and other interested parties, short-term scientific missions that allow knowledge transfer between individual researchers and scientific institutions, and training schools for students and early stage researchers coming from different European countries.

STSM

Short-term scientific missions (STSM) are aimed at supporting individual mobility and professional growth and at strengthening existing networks and fostering collaborations, allowing scientists to visit an institution in another participating COST RELY country. In the period 2015–2018, 17 STSMs were realised within the COST Action RELY (five in 2015, five in 2016, four in 2017, and three in 2018). The early stage researchers came from nine European countries and were hosted at universities and institutes in ten European countries; 50 % were female; 60 % came from inclusiveness target countries. The exchange visits lasted from two weeks up to three months. Young researchers tutored by experienced researchers from host institutions were working on important issues related to renewable energy and landscape quality (e.g. methods for assessing the suitability of landscapes for renewable energy systems, smart practices to smart visibility of renewable energy, survey on participatory RE planning in the European countries and subjective aspects of participation, etc.). Early stage researchers, such as Georgia Sismani from Greece, were particularly invited to participate.

The greatest benefit of attending an STSM is the chance to work in person with other experts of your field and thus gain valuable knowledge and experience. … It offers an opportunity to see how the host institution works, to come in contact with new methodologies and software and to exchange knowledge between the two institutions. This may lead to further research ideas and publications. … The most important points I kept from this experience are the contacts I made with the host institution and the valuable experience I gained for future research. Overall, an STSM establishes the opportunity to foster the collaboration between the two institutions. Georgia Sismani, Aristotle University of Thessaloniki

Outcomes of the STSMs were published in international scientific papers and/or presented at academic conferences, some were also disseminated to a wider audience (e.g. articles translated in national languages and published in national magazines). This in turn contributed to further dissemination of the RELY results and to raising awareness among societies.

Training Schools

Training schools provide intensive training in emerging research topics, but in the same time also cover appropriate retraining as part of life-long learning. Furthermore they serve to create networks for future cooperation. Training schools were addressed mainly at early stage researchers, but also at PhD students and MSc students. The two training schools organised within the COST Action RELY gathered more than 40 participants: young researchers and practitioners from diverse disciplines and from many parts of Europe. The first training school on Renewable Energy and Landscape quality: Techniques, Communities and Planning, was

Editor Profiles

alphabetical order

Buchecker, Matthias
Swiss Federal Research Institute WSL, Research Unit Economics and Social Sciences, Zürcherstrasse 111, CH-8903 Birmensdorf
Phone: +41 44 739 23 60
Email: matthias.buchecker@wsl.ch
Homepage: https://www.wsl.ch/en/employees/buchecke.html

Matthias Buchecker is senior researcher at the research unit Economics and Social Sciences of the Swiss Federal Institute WSL. He studied geography at the university of Berne and completed a doctoral thesis on participatory landscape development. Since 1999, he has directed projects at WSL on people-environment-interactions in the research fields landscape development, recreation, river management, natural hazards, and most recently also renewable energies.

2009–2012: Leader of WP 'Risk communication' in the EU-7th Framework Project „Social Capacity building for Natural Hazards" (Cap-Haz Net).
2011-2013 Leader of WSL project within the EU-7th Framework Project 'Building a Culture of risk prevention in Europe' (KULTURisk).
2012–2013: Leader of the project 'Social Acceptance of photovoltaic panel sites in a Alpine tourism region' in collaboration with the Energy Region Obergoms.
2013: Leader of the project 'Wahrnehmung des Thema Flussrevitalisierungen in den lokalen und regionalen Medien im Berner Oberland. Medienanalyse der Periode von 1999–2012.' Renaturierungsfonds des Kantons Bern, BAFU.
2013–2018: Leader of the PhD-project 'Analyzing the contribution of deliberative planning in risk management to social learning.' Swiss National Found
2016–2019: Leader of the PhD project 'Mapping meaningful places as a tool for participatory planning of renewable energy projects'. SBFI, COST Action TU1401

Centeri, Csaba
Szent István University, Inst. of Nature Conservation and Landscape Management, 2100-Gödöllő, Páter K. u. 1., Hungary
Email: Centeri.Csaba@mkk.szie.hu
Phone: +36 302027336

Csaba Centeri is an associate professor at the Szent István University. His main research interest is nature conservation and land use change related issues, especially in connection with soil and soil erosion, and wildlife impact. He also started working with agricultural landscapes, landscape protection, and renewable energy production, where soil and nature conservation play an important role.

Fekete István Programme (mapping the possible areas for producing renewable energy from biomass in a Trans-Danubian region, Hungary)
EUCALAND Network
COST-RELY
Bio-Bio, Indicators for biodiversity in organic and low-input farming systems (FP7)
EU-FP7 ENVIEVAL, Development and application of new methodological frameworks for the evaluation of environmental impacts of rural development programmes in the EU (Grant Agreement No. 312071)

Eiter, Sebastian
NIBIO—
Norwegian Institute of Bioeconomy Research
PO Box 115
1431 Ås
NORWAY
Phone: +47 6497 1044
Email: sebastian.eiter@nibio.no

Dr Sebastian Eiter is a geographer and landscape ecologist. He is employed as a research scientist in the Department of Landscape Monitoring at NIBIO, the Norwegian Institute of Bioeconomy Research. His recent research topics include causes and consequences of agricultural landscape change, cultural heritage, biodiversity, public participation, and urban agriculture.

Edible Cities Network: Integrating Edible City Solutions for Socially Resilient and Sustainably Productive Cities (EU H2020) 2018–2023.
Agricultural Landscapes in Norway: Occurrence, Sustainability, Characteristics, and Local Variations and Values (Research Council of Norway) 2015–2017.
Urban Agriculture Europe (EU COST) 2012–2016.
Monitoring cultural heritage environments protected by law—development of a method (Norwegian Directorate for Cultural Heritage) 2011–2016.
Monitoring the Norwegian mountain dairy farm landscape (Norwegian Forest and Landscape Institute) 2009–2014.
Landscape change (Research Council of Norway) 2008–2014.
Agricultural buildings and the cultural landscape (Norwegian Ministry of Agriculture and Food) 2009–2012.
Indicators for biodiversity in organic and low-input farming systems (EU FP7) 2009–2012
Land use changes in urban pressure areas—threats to food production and landscape qualities (Research Council of Norway) 2009–2012.

Frantál, Bohumil
Department of Environmental Geography, Institute of Geonics, The Czech Academy of Sciences, Drobneho 28, 602OO Brno, Czech Republic
Email: frantal@geonika.cz
Phone: +420 545 422 720

RNDr. Bohumil Frantál, PhD is a leading senior scientist at the Department of Environmental Geography, Institute of Geonics, Czech Academy of Sciences. In his research he focuses on social-spatial contexts of ongoing energy transition, particularly renewable energy development and related land use conflicts, environmental risk perceptions, urban renewal, and spatial models of behaviour. His principal publications address the issues of social acceptance of renewables, nuclear power, and coal mining. He also works as a lecturer at Palacký University in Olomouc.

Recent research projects:
2016–2018: 'Exploring social-spatial diffusion of renewable energy projects in the Czech Republic: lessons for adaptive governance of energy transition' (Czech Science Foundation No. 16-04483S)—Co-investigator
2014–2018: Integrated Spatial Planning, Land Use and Soil Management Research Action (INSPIRATION), (Horizon 2020, Grant No. 681256)—Member of research team
2011–2014: 'Energy Landscapes: innovation, development and internationalization of research' (ENGELA) (CZ.1.07/2.3.00/20.0025)—Project leader
2010–2013: 'Tailored Improvement of Brownfield Regeneration in Europe (TIMBRE)' (EU´s 7th Framework Programme, No. ENV.2010.3.1.5-2)—Member of research team
2009–2011: 'Spatial models of behavior in the changing urban space from the point of view of time geography' (Czech Science Foundation No. 403/09/0885)—Co-investigator
2008–2010: 'The use of wind energy: evaluation of spatial relations, environmental aspects and social context by the means of GIS' (Grant Agency of the Czech Academy of Sciences No. KJB700860801)—Member of research team

Frolova, Marina
Institute for Regional Development, University of Granada, c/Rector López Argueta s/n, 18071 Granada, Spain
Email: mfrolova@ugr.es
Phone: +34 958 24 10 00 Ext. 20218

Marina Frolova is professor at the Department for Regional and Physical Geography, and the Institute for Regional Development, University of Granada. She is an experienced contributor to and leader of multi-disciplinary research projects. Her research interests include landscape analysis, landscape and renewable energy policies, and their relevance for the social acceptance of energy technologies. She has published and edited several books, book chapters and articles on landscape—especially energy-related—issues.

Title: ADAPTation to sustainable energy transition in Europe: environmental, socio-economic and cultural aspects CSO2017-86975-R, funded by Spain's Ministry of Economy, Industry and Competitivity, 2018–2021 (chair);
Title: Energía eólica y paisaje: Evaluación del paisaje terrestre y maritimo para una ordenación sostenible, CSO2011-23670, funded by Spain's Ministry of Science and Innovation, 2012-2015 (chair);
Title: Ressources paysagères et ressources énergétiques dans les montagnes sud-européennes: Histoire, comparaison, expérimentation, fonded by Ministère de la Culture et de la Communication de France, Direction générale des patrimoines de France, Bureau de la recherche architecturale, urbaine et paysagère de France, Ministère de l'Écologie, du Développement durable, des Transports et du Logement de France, Direction de la recherche et de l'innovation de France y Atelier international du Grand Paris (AIGP) (Chair of WG)

Karan, Isidora
Center for Spatial Research
Slobodana Dubocanina 1, 78 000 Banjaluka, Bosnia and Herzegovina
Email: isidora_karan@yahoo.com
Phone: +387 65819623

Isidora Karan is an architect and urban designer. She was awarded a PhD in architecture (2015) from the University of Granada and pursued postdoctoral research at the National Autonomous University of Mexico in (2016). She has worked in practice on the projects of urban planning and design (2009–2011, 2016). She is a partner in the Center for Spatial Research (NGO) and teaching assistant (University of Banjaluka).

Projects:
Plan of detailed regulation for the area under the influence of Highway M-16.1., Bosnia and Herzegovina, 2009
General Urban Plan for Vlasenica Municipality, Bosnia and Herzegovina, 2016 (First prize at 26th International Urban Planners Exhibition in Serbia)
Small-scale urban intervention in Banjaluka, Bosnia and Herzegovina (2017–ongoing)

International competitions:

Recognition for project for The Sustainable Theatre, World Stage Design, Cardiff, 2013 (exposition and award)
First prize for the Urban Design of Memorial Zone DONJA GRADINA in Bosanska Dubica, Banja Luka, Bosnia and Herzegovina, 2009 (exposition and award)
First prize for the Urban Design of Old Market Veselin Maslesa in Banja Luka, Bosnia and Herzegovina, 2009

Kruse, Alexandra
Institute for Research on European Agricultural Landscapes e.V. (EUCALAND) institute World Heritage Consulting
10bis, rue du Haras – 78530 Buc/France –
Email: kruse@eucalandnetwork.eu
Phone: +33 6 28138569

Dr. Alexandra Kruse is an expert in UNESCO World Heritage and cultural landscapes. She is director of insitu World Heritage (whconsult.eu). In addition, she is an expert in natural heritage and nature sites, and project management. She has long experience in documentation. She is initiator and secretary general of the international network 'Institute for

Research on European Agricultural Landscapes (EUCALAND) e.V.' (eucaland.net). Since 2006 this network has been working on classifying and raising the awareness of the importance of European agricultural landscapes, their values for cultural heritage, and biodiversity. Projects:“ Erasmus - FEAL: Multifunctional farming and agricultural landscapes (feal-future.org), UNESCO nomination dossier 'Großglockner High Alpine Road', Republic of Austria, Altes Land, Germany: Holler Route (cycling route within the framework of EC program of European Cultural Routes) and preparation of a UNESCO World Heritage nomination, COMUS—Community-Led Urban Strategies in Historic Towns—by the Council of Europe, assigned as expert for Armenia including Eco-tourism concepts (http://pjp-eu.coe.int/en/web/comus)

Röhner, Sina
Nürtingen-Geislingen University
Institute for Landscape and Environment
Schelmenwasen 4–8
72622 Nürtingen
Phone.: +49(0)7022 / 201-192
Email: sina.roehner@hfwu.de

Sina Röhner studied landscape planning at Nürtingen-Geislingen University and geographical information science at Salzburg University. Since 2015, she has been employed as research associate at the Institute of Landscape and Environment of Nürtingen-Geislingen University where she is involved in research projects on landscape quality, renewable energy, and grid expansion and in lectures on GIS and landscape related topics.

Projects: 2015–2018: COST Action TU1401 'Renewable Energy and Landscape QualitY (RELY)'
2015–2017: Nationwide scenic quality assessment for Germany as a basis for high voltage grid expansion
2015: Dezent Zivil—Decisions on decentral energy production in civil society
2015: Development and application of methods for interactive visualisation of different building alternatives for the 'Hölderlinhaus' in Nürtingen
2015: Visual landscape assessment in Germany—State of Research and Practice

Roth, Michael
Nürtingen-Geislingen University
School of Landscape Architecture, Environmental and Urban Planning
Schelmenwasen 4-8
72622 Nürtingen
Germany
Tel: +49 7022 201-181
Fax: +49 7022 201-166
E-Mail: michael.roth@hfwu.de
WWW: http://www.hfwu.de/michaelroth

Prof. Dr. Michael Roth studied landscape architecture and landscape planning in Dresden. He obtained his PhD at the School of Spatial Planning, Dortmund University of Technology. He held research and teaching positions at TU Berlin (2002–2006), TU Dortmund (2006–2013), Michigan State University (2011–2012), University of British Columbia (2013), and University of Natural Resources and Life Sciences in Vienna (2016). Since 2013 he has been professor for landscape planning and landscape informatics at Nürtingen-Geislingen University (Germany).

Projects: 'Visual landscape assessment as a basis for the impact mitigation regulation' funded by the Thuringian Agency for Environment and Geology (2018)
COST Action TU1401 RELY 'Renewable Energy and Landscape Quality' funded by the EU COST framework with funds from the EU framework programme Horizon 2020 (2014–2018)
'Nationwide scenic quality assessment for Germany as a basis for high voltage grid expansion' funded by the Federal Agency for Nature Conservation (2015–2017)
'Decisions on decentral energy production in civil society' funded by the Federal Ministry of Education and Research (2015)
'Visual landscape assessment in Germany: State of Research and Practice' funded by the Federal Agency for Nature Conservation (2015)

Schmitz, Serge
University of Liege, Clos Mercator, 3, 4000 Liege (Belgium)
Email: S.Schmitz@uliege.be
Phone: +32 43665629

Serge Schmitz is professor of human geography at the University of Liege where he teaches courses in rural geography, tourism, and landscape analysis. In 2007, he created the Laboratory for the Analysis of Places, Landscape, and European Countryside (www.laplec.ulg.ac.be). Since 2016, he has co-chaired the Commission on the Sustainability of Rural Systems of the International Geographical Union.

Selected publications:
Dubois C., Firmino A., Kim D. C., Schmitz S. (eds.), 2017. Balancing Heritage and Innovation: Pathways towards the Sustainability of Rural Systems. BSGLg, 69, 94 p.
Ciervo M., Schmitz S., 2017. Sustainable biofuel: a question of scale and aims, Moravian Geographical Reports, 25/4, 220–233.
Schmitz S., Vanderheyden V., 2016, Reflexive Loops on Scaling issues in Landscape Quality Assessment, Land Use Policy, 53, 3–7.
Schmitz S., Vanderheyden V., Vanden Broucke S., Loopmans M., 2012, The Shaping of Social Attitudes toward Energy-Parks in the Belgian Countryside, Horizons in geography, 81, 83–93.
Van Hecke E., Antrop M., Schmitz S., Van Eetvelde V., Sevenant M., 2010, Paysages, Monde rural et agriculture, Atlas de Belgique, vol. 2, Academia Press, Gent, 74

Stober, Dina
Faculty of Civil Engineering Osijek
Josip Juraj Strossmayer University of Osijek
Vladimira Preloga 3
HR-31000 Osijek
Croatia
dstober@gfos.hr

Dina Stober has studied architecture and urban planning at the Faculty of Architecture, University of Zagreb, Croatia. She was awarded a PhD in spatial and urban planning (2013) from the University of Ljubljana, Slovenia. She is Assistant Professor at the Faculty of Civil Engineering Osijek, University of Osijek where she teaches courses in rural planning, urban planning and design of industrial buildings. Her interest is in digital heritage. She is active memeber of Association od Architects Osijek. She has published papers on rural settlement, urban public spaces and place attachment topics.

COST Action TU1401 RELY 'Renewable Energy and Landscape Quality' funded by the EU COST framework with funds from the EU framework programme Horizon 2020 (2014–2018)
UNIREG IMPULSE Regional Universities as initiators of transnational region of knowledge, funded by IPA Cross-border Co-operation Programme 2011 (2011–2013)
CARDS 2003 Sustainable development of small family farms in Baranja (2005–2006)

Van der Horst, Dan
Geography Building
University of Edinburgh,
Drummond Street,
EH 89XP, Edinburgh
United Kingdom
Email: Dan.vanderHorst@ed.ac.uk

Dan van der Horst is a reader in energy, environment, and society at the School of Geosciences, University of Edinburgh. His research queries in particular the role of geography and the potential fate of our landscapes in the aspired transition towards a society that is less environmentally unsustainable and less socially unfair. His publications examine amongst others the spatially unequal impacts of energy policy, the characteristics and politics of ('local') resistance to renewable energy projects and the ethics of visual aesthetics in relation to landscape change.

Projects: 'Landscapes of Energies', funded by the European Science Foundation.
'Energyscapes and Ecosystem Services', funded by the UK research councils.
'Seanergy 2020'; best practice in marine spatial planning for renewables, funded by the EU.
'Energy Landscapes: Innovation, development & internationalization of research', with Geonika (Czech Republic), funded by the European Social Fund.
'TEDDINET; Transforming Energy Demand in Buildings through Digital Innovation', research network funded by the UK research councils.
'Review of biomass energy technologies for sub Saharan Africa', funded by the UK Department for International Development.
'Renewable energy & adaptive governance in rural policy', funded by the Czech Council of Research.
'Forest 2020'; Political economy of forest monitoring & protection, funded by the UK Space Agency.

List of Authors

First name	Last name	Institution	Country
Rachelle	Alterman	Technion - Israel Institute of Technology, Center for Urban and Regional Planning, Haifa	Israel
Gisele	Alves	Glasgow Caledonian University (GCU), School of Engineering and Built Environment	United Kingdom
Kathrin	Ammermann	Federal Agency for Nature Conservation (BfN), Leipzig	Germany
Dragi	Antonijevic	Innovation Center, Faculty of Mechanical Engineering, University of Belgrade, Belgrade	Serbia
Brian	Azzopardi	Institute of Electrical and Electronic Engineering - Malta College of Arts, Science and Technology (MCAST), Paola	Malta
Henk	Baas	Cultural Heritage Agency of the Netherlands (RCE)	The Netherlands
Emel	Baylan	Department of Landscape Architecture, Faculty of Architecture and Design, University of Yuzuncu Yil, Van	Turkey
Karl	Benediktsson	Faculty of Life and Environmental Sciences, University of Iceland - School of Engineering and Natural Sciences, Reykjavik	Iceland
Tadej	Bevk	Department of Landscape Architecture, Biotechnical Faculty, University of Ljubljana	Slovenia
Maria	Boștenaru Dan	Department of Urban and Landscape Design, Faculty of Urban Planning, Ion Mincu University of Architecture and Urban Planning, Bucharest	Romania
Michele	Bottarelli	University of Ferrara	Italy
Ken	Boyle	Department of Environment and Planning, Dublin Institute of Technology - School of Planning and Transport Engineering	Ireland
Pat	Brereton	Dublin City University - School of Communications	Ireland
Paulo	Brito	Instituto Politécnico de Portalegre	Portugal
Matthias	Buchecker	Swiss Federa	Research Institute WSL, Economics and Social Sciences, Birmensdorf	Switzerland
Csaba	Centeri	Department of Nature Conservation and Landscape Ecology, Szent István University, Gödöllö	Hungary
Csaba	Csontos	Eötvös Loránd University, Budapest	Hungary
Cheryl	De Boer	University of Twente	The Netherlands
Aleksandra	Dedinec	Faculty of Computer Science and Engineering, "Ss. Cyril and Methodius" University, Skopje	Republic of Macedonia
Blanca	Del Espino	Department of Urban and Land Planning, University of Seville	Spain
Sokol	Dervishi	Department of Architecture, Epoka University, Tirana	Albania
Zlata	Dolacek-Alduk	University of Josip Juraj Strossmayer Osijek, Faculty of Civil Engineering, Department for Organisation, Technology and Management	Croatia
Sebastian	Eiter	Department of Landscape Monitoring, NIBIO – Norwegian Institute of Bioeconomy Research, Ås	Norway
Wendy	Fjellstad	Department of Landscape Monitoring, NIBIO – Norwegian Institute of Bioeconomy Research, Ås	Norway

Bohumil	Frantál	Department of Environmental Geography, Institute of Geonics, Czech Academy of Sciences, Brno	Czech Republic
Marina	Frolova	Institute of Regional Development, University of Granada	Spain
Bénédicte	Gaillard	Consulting in World Heritage Conflict Management, Les Issambres	France
Giedrė	Godienė	Institute of Geosciences, Vilnius University	Lithuania
Mojca	Golobič	Department of Landscape Architecture, Biotechnical Faculty, University of Ljubljana	Slovenia
Mihaela	Hărmănescu	Faculty of Architecture, Ion Mincu University of Architecture and Urbanism, Bucharest	Romania
Marton	Havas	Eotvos Lorand University, Budapest	Hungary
Benjamin	Hennig	Faculty of Life and Environmental Sciences, University of Iceland	Iceland
Verónica	Hernán- dez-Jiménez	Research Group of Ecology and Landscape in the Polytechnis Univesity of Madrid, Observatory for a culture of the territory	Spain
Daniel	Herrero	Dpto. Geografía, Facultad Filosofia y Letras, Universidad de Valladolid	Spain
Richard	Hewitt	Research Group of Ecology and Landscape in the Polytechnis Univesity of Madrid, Observatory for a culture of the territory	Spain
Marcel	Hunziker	Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf	Switzerland
Artan	Hysa	Department of Architecture, Epoka University, Tirana	Albania
Nela	Jantol	OIKON Ltd. – Institute of Applied Ecology, Zagreb	Croatia
Berthe	Jongejan	Cultural Heritage Agency of the Netherlands (RCE)	The Netherlands
Jovana	Jovanovic	Faculty of Managenemt Herceg Novi	Montenegro
Robert	Kabai	Hunscapes Co. Ltd., Budapest	Hungary
Vania	Kachova	Forest Research Institute, Bulgarian academy of Sciences, Sofia	Bulgaria
Matea	Kalcicek	Ekoinvest – Consulting Ltd., Zagreb	Croatia
Isidora	Karan	Center for Spatial Research, Banjaluka	Bosnia and Herzegovina
Mirko	Komatina	Faculty of Mechanical Engineering, University of Belgrade	Serbia
Alexandra	Kruse	Institute for Research on European Agricultural Landscapes (EUCALAND) e.V., Buc	France
Ain	Kull	Department of Geography, University of Tartu	Estonia
Mart	Külvik	Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences, Tartu	Estonia
Igor	Kuvac	Center for Spatial Research, Banjaluka	Bosnia and Herzegovina
Marija	Lalosevic	Urban Planning Institute of Belgrade	Serbia
Raffaella	Laviscio	Department of architecture, built environment and construction engineering A.B.C., Polytecnico die Milano	Italy
Gerald	Leindecker	Hochschule Oberösterreich, Linz	Austria
Naja	Marot	Department of Landscape Architecture, Biotechnical Faculty, University of Ljubljana	Slovenia
Stanislav	Martinát	Department of Environmental Geography, Institute of Geonics, Czech Academy of Sciences, Brno	Czech Republic
Georgios	Martinopoulos	International Hellenic University - School of Science and Technology, Thessaloniki	Greece
Sennan	Mattar	Glasgow Caledonian University (GCU), School of Engineering and Built Environment	United Kingdom
Adolfo	Mejia Montero	University of Edinburgh	United Kingdom
Daniel	Micallef	Faculty of the Built Environment, Department of Environmental Design, University of Malta, Valletta	Malta
Renata	Mikalauskiene	Malta College of Arts, Science and Technology (MCAST), Paola	Malta
David	Miller	James Hutton Institute, Aberdeen	United Kingdom
Stefanie	Müller	Swiss Federal Institute of Forest, Snow and Landscape (WSL), Birmensdorf	Switzerland