PROSEU

Prosumers for the Energy Union: mainstreaming active participation of citizens in the energy transition

D3.2 Policy Brief: Strategies for Policy Coherence and Sustainability

Part 1: Relevance of EU policies and frameworks for prosumers

Horizon 2020 (H2020-LCE-2017)

Grant Agreement N°764056

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°764056. The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the funding authorities. The funding authorities are not responsible for any use that may be made of the information contained therein.

Lead partner for deliverable	ECO-UNION
Document type	Report
Due date of deliverable	31.05.2019
Actual submission date	31.05.2019
Dissemination level	Public (PU)
Authors (s)	Kristian Petrick, Jérémie Fosse, Salvador Klarwein, Mireia Reus (all ECO-UNION)
Reviewer (s)	Marta Toporek (CLIENT EARTH), Mark Davis (University of Leeds), Inês Campos and Esther Marín-González (FC.ID)

Cite as: Petrick, K., Fosse, J., Klarwein, S. (2019). Strategies for Policy Coherence and Sustainability – Relevance of EU policies and frameworks for prosumers. PROSEU - Prosumers for the Energy Union: Mainstreaming active participation of citizens in the energy transition (D3.2).

Summary of PROSEU

PROSEU aims to enable the mainstreaming of the renewable energy Prosumer phenomenon into the European Energy Union. Prosumers are active energy users who both consume and produce energy from renewable sources (RES). The growth of RES Prosumerism all over Europe challenges current energy market structures and institutions. PROSEU's research focuses on collectives of RES Prosumers and will investigate new business models, market regulations, infrastructural integration, technology scenarios and energy policies across Europe. The team will work together with RES Prosumer Initiatives (Living Labs), policymakers and other stakeholders from nine countries, following a quasi-experimental approach to learn how RES Prosumer communities, start-ups and businesses are dealing with their own challenges, and to determine what incentive structures will enable the mainstreaming of RES Prosumerism, while safeguarding citizen participation, inclusiveness and transparency. Moving beyond a case by case and fragmented body of research on RES Prosumers, PROSEU will build an integrated knowledge framework for a socio-political, socioeconomic, business and financial, technological, socio-technical and socio-cultural understanding of RES Prosumerism and coalesce in a comprehensive identification and assessment of incentive structures to enable the process of mainstreaming RES Prosumers in the context of the energy transition.

Summary of PROSEU's Objectives

Eight key objectives at the foundation of the project's vision and work plan:

- **Objective 1:** Document and analyse the current state of the art with respect to (150-200) RES Prosumer initiatives in Europe.
- **Objective 2:** Identify and analyse the regulatory frameworks and policy instruments relevant for RES Prosumer initiatives in nine participating Member States.
- **Objective 3:** Identify innovative financing schemes throughout the nine participating Member States and the barriers and opportunities for RES Prosumer business models.
- **Objective 4:** Develop scenarios for 2030 and 2050 based on in-depth analysis of technological solutions for RES Prosumers under different geographical, climatic and socio-political conditions.
- **Objective 5:** Discuss the research findings with 30 relevant stakeholders in a Participatory Integrated Assessment and produce a roadmap (until 2030 and 2050) for mainstreaming RE Prosumerism.
- **Objective 6:** Synthesise the lessons learned through experimentation and co-learning within and across Living Labs.
- **Objective 7:** Develop new methodological tools and draw lessons on how the PROSEU methodology, aimed at co-creation and learning, can itself serve as an experiment with institutional innovation.
- **Objective 8:** Create an RES Prosumer Community of Interest.

PROSEU Consortium Partners

Logo	Organisation	Type	Country
	FCIENCIAS.ID	Private non-profit association	Portugal
	UPORTO	University	Portugal
	ICLEI EURO	Small and medium-sized enterprise	Germany
	CLIENTEARTH	Non-governmental organisation	United Kingdom
	UNIVLEEDS	University	United Kingdom
	DRIFT	University	the Netherlands
	UNIZAG FSB	University	Croatia
	LEUPHANA	University	Germany
	ECO-UNION	Non-governmental organisation	Spain
	IÖW	Private non-profit limited company	Germany
	CE Delft	Small and medium-sized enterprise	the Netherlands

Table of contents

List of tables

List of Figures

Glossary

ASCM	Agreement on Subsidies and Countervailing Measures
CAP	Common Agricultural Policy
CETA	Comprehensive Economic and Trade Agreement
CHP	Combined heat and power
DPIA	Data Protection Impact Assessment
EAFRD	European Agricultural Fund for Rural Development
ECT	Energy Charter Treaty
EE	Energy Efficiency
EED	Energy Efficiency Directive
EES	European employment strategy
EIA	Environmental Impact Assessment
END	Environmental Noise Directive
ESD	Effort Sharing Decision
EV	Electric vehicle
EPBD	Energy Performance of Buildings Directive
EU	European Union

EU ETS	EU Emission Trading Scheme
FIP	Feed-in premiums
FIT	Feed-in tariffs
GATT	General Agreement on Tariffs and Trade
GCF	Green Climate Fund
GDPR	General Data Protection Regulation
GHG	Greenhouse gas
ICS	Investment Court System
IED	Industrial Emissions Directive
IRENA	International Renewable Energy Agency
ISDS	Investor-state dispute system
IPCC	Intergovernmental Panel on Climate Change
kW	Kilowatt
LCA	Life-cycle assessment
LCR	Local content requirement
MCP	Medium Combustion Plant (MCP)
MW	Megawatt
NECP	National Energy and Climate Plan
NDC	Nationally Determined Contributions
NZEB	Net Zero Energy Building
PV	Photovoltaic
RE	Renewable Energy
RES	Renewable Energy Sources
RED II	Renewable Energy Directive (Recast) from 2018
REFIT	Regulatory Fitness and Performance Programme
RDP	Rural Development Programmes
R&D	Research and Development
SEA	Strategic Environmental Assessment
SET	Social Energy Tariff
SET-Plan	Strategic Energy Technology Plan
SME	Small and medium enterprises
SO2	Sulphur dioxide
STEM	Science, technology, engineering, and mathematics
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value Added Tax
VPP	Virtual Power Plants
V2G	Vehicle-to-grid
WEEE	Waste electrical and electronic equipment
WFD	Water Framework Directive
WTO	World Trade Organisation

Executive Summary

This document represents Part 1 of the Deliverable D3.2 *"Strategies for Policy Coherence and Sustainability"* and discusses the relevance of EU policies and frameworks for prosumer. It contains a **Policy Brief** followed by a report which provides supporting background information.[1]

The document provides recommendations to policymakers at EU, national, and local level on how to support and mainstream renewable energy prosumerism. Where appropriate, guidance to prosumer initiatives is given on how to make the best use of the different frameworks.

The overall objective of the study leading this document was to identify regulatory frameworks, governance models and sectoral policies which may affect or are affected by renewable energy prosumers. The supporting background information provides reviews of mainly EU frameworks, as well as some relevant international agreements, on eight thematic policy areas: climate, environment, infrastructure and development, social affairs, data security, economic and fiscal policy, trade and international investment, and education.

The assessment of the impact of the reviewed policy areas on prosumerism clearly shows that the prosumer model is not yet embraced. In order to change this, policy makers should get more familiar with the opportunities that prosumers can offer and adopt their strategies, regulations and objectives accordingly. As policymakers in these non-energy areas are not usually concerned with energy issues, it is upon the policymakers in the energy sector and other stakeholders – like prosumer initiatives – to make non-energy policymakers aware of the necessary changes in their respective policy areas and regulatory frameworks.

[1] Part 2 of Deliverable 3.1 is about the relevance of EU policies and frameworks for prosumers. As the two aspects of task 3.2 which led to Deliverable 3.2 are quite different (policy coherence on the one side and sustainability issues on the other), it has been decided to submit two policy briefs, rather than one, each with a supporting background report.

Policy Brief

D3.2 Part 1: Strategies for Policy Coherence – Relevance of EU policies and frameworks for prosumers

Renewable energy prosumerism – self-production and consumption of green energy by active citizens – is still a relatively new concept in the energy sector. As a major milestone, the recast of the EU Renewable Energy Directive, adopted in December 2018, legally recognised the right of energy to produce, sell, store and self-consume energy in Europe. While prosumerism is now being recognised in the field of energy, prosumers are also affected by other sectoral policies, regulatory frameworks and governance models which are not always directly linked to energy. Moreover, prosumerism may also have impacts on these non-energy frameworks, requiring their evolution and adaptation to accommodate energy prosumers.

Eight major thematic policy areas – which do not primarily focus on energy – have been reviewed, focusing mainly on EU legislation, as well as some relevant international agreements: 1) climate; 2) environment, 3) infrastructure and territorial development; 4) social affairs; 5) data security and privacy; 6) economic and fiscal policies; 7) trade and international investment; and, 8) education. Where possible, recommendations to policymakers at EU, national, and local level on how to support and mainstream prosumerism were derived from this transversal analysis. The assessment of the different policy areas confirms that many legislative and regulatory frameworks have an impact on prosumerism. It also shows that the concept of prosumerism is still not being embraced in such a way to facilitate its mainstreaming within the EU.

The overall findings for each thematic policy area are the following:

1. Climate

The international agreements under the UNFCCC climate regime, do not recognise the importance of the prosumer model for increasing mitigation, nor establish concrete targets regarding renewable energy production. However, stringent international greenhouse gas (GHG) reduction commitments lead to RE deployment and, thus, can potentially result in the expansion of the prosumer model.[2] Furthermore, the positive impacts that prosumers can have on accelerating adaptation efforts through increased resilience to extreme weather events are also not sufficiently recognised.

The EU climate-related frameworks would have positive impacts on prosumerism if they adopted more ambitious climate and renewable energy targets, an effective carbon price (within and beyond the EU Emission Trading Scheme), higher energy efficiency requirements (through the Energy Efficiency Directive), and incentives for developing prosumer projects. Apart from the provisions of the Renewable Energy Directive, the Governance Regulation demands the inclusion of targets and measures related to self-consumption and energy communities in the Integrated National Energy and Climate Plans.

[2] The UNFCCC Secretariat does, however, recognise the importance of RE deployment for reducing greenhouse gases. See http://unfccc.int/resource/climateaction2020/tep/thematic-areas/renewable-energy/index.html

2. Environment

EU environmental frameworks like the Birds and Habitats Directives, the Environmental Noise Directive, the EU Eco-design and Energy Labelling regulation, Water Framework Directive (WFD), and the Waste Directive are relevant to ensure the environmental integrity of all energy facilities, yet they are not specific to prosumer projects. Nevertheless, it is essential that prosumer developers of large RE projects integrate the outcomes of Environmental Impact Assessments (EIAs) to comply with the environmental requirements of EU and national laws, in particular near and within fragile natural areas. This approach will contribute to ensure consistency with global and local environmental goals, mitigate negative externalities, and to overcome non-technical barriers to prosumer mainstreaming, such as low public acceptance levels of energy infrastructure (*not in my backyard* reaction). However small-scale prosumer projects in the built environment usually have few negative environmental impacts so they are expected to become easier to implement and disseminate compared to traditional energy facilities.

In conclusion, the EU environmental directives are relevant for prosumers initiatives. However, the level of significance varies according to the technology used, and the size and location of the project. Overall, biomass might be the technology mostly affected by the different environmental policies, followed by wind and small hydro installations.

3. Infrastructure and development policies

Prosumers are affected by infrastructure and development policies at the national and local level. In most countries, the legally binding legislation covers three planning levels: National planning, subnational/county planning, and local/regional planning. For **larger projects**, the **spatial planning** frameworks are most important. Frameworks that provide space for community owned RE facilities tend to gain public acceptance for these projects.

For **smaller projects** below the megawatt range, (national/local) **building codes, as well as urban plans, are crucial**. As prosumers lead to more demand for RE installations in buildings, this may need to be further considered in these codes and plans. National and local spatial planning processes should ensure community ownership of RE projects and enable the virtual sharing of prosumer energy. Furthermore, the different **European funding programmes** (European Regional Development Fund, Horizon 2020, Cohesion Fund, etc.) and national funds catalysing rural and territorial development should scale-up their support for prosumer initiatives, such as those involving land-sharing between RE farms and agriculture.

In the **transport sector**, the EU agreed in December 2018 that by 2030 new passenger vehicles must emit 37.5% less CO_2 compared to 2021. The EU and the Member States can further incentivise prosumerism by adopting stringent transport emission regulations to promote electric vehicles. This, in turn, can play a vital role in the expansion of the prosumer model not only through self-charging but also with the help of vehicle-to-grid services. If the emission targets for transportation are not sufficiently ambitious to trigger real change in the offerings of car manufacturers, prosumers may not find the electric vehicle models that match their requirements concerning performance and price, or the infrastructure may not be sufficiently developed.

Concerning policies targeting **industrial development**, the EU and its members can indirectly benefit prosumerism, especially industrial prosumerism, by tackling subsidies on carbon-intensive energy

products, and adopting an effective carbon pricing mechanism. In return, with the resulting higher price on non-renewable electricity consumption, manufacturers would be incentivised in investing in own renewable infrastructure and thus become industrial prosumers.

4. Social Affairs

EU policies concerning energy poverty, employment, and gender do not embrace prosumerism. While **energy poverty** is increasingly recognised as a widespread problem across Europe, there are no relevant policies supporting prosumerism to help alleviate energy poverty. In order to tackle this issue, the EU and its members should increase the ambition of their energy efficiency measures, and secondly, support the mainstreaming of the prosumer model, as it protects vulnerable households from fluctuating electricity prices. Moreover, the 2018 Energy Performance of Buildings Directive (EPBD) requires that there be a rapid upscaling of Nearly Zero Energy Buildings (NZEBs). However, while it is assumed that many NZEBs will have on-site RE production, the EPBD -nor any other regulation- requires on-site RE systems in NZEBs. Therefore, policies should require for on-site RE production, and the excess energy produced -for instance from public buildings- can be virtually shared to energy-poor households.

Employment: EU labour law sets minimum standards for working and employment conditions and generally applies to all industries, and thus there are no specific labour policies regarding the RE industry. The growth of prosumerism is an opportunity for transferring the workforce from the fossil fuel sector to prosumer initiatives. Also, prosumerism is more beneficial to the local economy -and thus employment- than external large-power utilities, because with prosumerism, the energy expenditures stay within the local community. It should be considered that the workforce of prosumer projects is less organised than the conventional energy industry, and is, therefore, more vulnerable to any policies that can affect the sector. Hence, prosumer workers may unionise to have more visibility and ultimately protect their interests.

Gender: The EU Directive on "equal opportunities and equal treatment of men and women in matters of employment and occupation" includes objectives that the European labour market should set in terms of gender equality. As women are still underrepresented in the energy sector in general and in prosumer projects, the EU should require further regulations on targeting overall gender equality within science, technology, engineering, and mathematics (STEM). This needs to entail a mix of policies on education, media, industry, research and others.

5. Data Security and privacy

The European Charter of Fundamental Rights stipulates that EU citizens have the right to the protection of their personal data. The General Data Protection Regulation (GDPR) already contains the provision of a Data Protection Impact Assessment for smart grid and smart metering systems. As prosumers share data concerning real-time energy consumption and production, their RE systems can be exposed to data security and privacy issues. In all, there is a need for a more robust framework that ensures that prosumers can share their personal data with the support of smart meters and smart grids in a secure manner.

6. Economic and Fiscal policy

Economic and fiscal policies are not yet harmonised across the EU but coordination does increasingly take place between countries, and several frameworks do apply. Though the EU ensures the overall

consistency of the fiscal policy of its member states, tax regulation regarding energy, and certainly on prosumer initiatives, is left to the discretion of each country. This means that prosumers are affected by their respective national fiscal policies and permit/licence fees, which vary significantly from country to country. Nevertheless, the implementation of RED II will be a step forward to ensure the right to be a prosumer, as it will potentially abolish taxes for RE self-consumption, and it will enable the sale of excess energy to the grid. However, the EU should step up tax breaks and fiscal incentives to facilitate the prosumer model while at the same time increase taxes on non-renewable energy use.

Furthermore, it may also have to be assessed if parts of this new energy system could be financed through taxes and public budget assignation (such as other public infrastructures like roads and railways).

7. Trade and international investment

Concerning trade and international investment, the current international frameworks could potentially pose a threat to the expansion of prosumerism. In particular, the frameworks promoted by the **World Trade Organisation** (WTO), the **Energy Charter Treaty** (ECT), and other free trade and investment agreements, such as the **Comprehensive Economic and Trade Agreement** (CETA). The WTO and the different trade and investor agreements should be amended to tackle the unlevelled playing field in which fossil fuels have the upper hand over RE. These agreements should support the deployment of RE and the protection of prosumers, as an essential tool to democratise renewable energy, promote active participations of citizens, guarantee energy security and reduce carbon emissions of the energy sector.

8. Education

The EU has adopted a number of recommendations and actions aimed at increasing the number of jobs in science, technology, engineering, and mathematics (STEM). For instance, within the New Skills Agenda for Europe, the Commission has asked member states to develop national digital strategies to support the training, upskilling, and re-training in the workforce. The Strategic Energy Technology Plan (SET-Plan) has set a roadmap on education and training, which addresses the human resource challenge for the energy research and innovation sector.

To expand the development of prosumerism, the EU must develop robust policies that aim at improving the (green) energy literacy of all people throughout primary, secondary, tertiary education and vocational training. The energy transition needs an education strategy at all levels which promotes energy savings, the change of consumer habits, and the importance of prosumerism. Specifically, the EU should continue to promote STEM workers, and in particular technicians of renewable energy infrastructure. Furthermore, local governments and prosumer initiatives should collaborate in awareness campaigns and education programs to further engage local communities in the energy transition.

Conclusions

The overall assessment of the impact of the reviewed policy areas on prosumerism clearly shows that the prosumer model is not yet embraced. In order to change this, policy makers should get more familiar with the opportunities that prosumers can offer and adopt their strategies, regulations and objectives accordingly. As policymakers in these non-energy areas are not usually concerned with energy issues, it is upon the policymakers in the energy sector and other stakeholders – like prosumer initiatives – **to make non-energy policymakers aware of the necessary changes in their respective policy**

areas and regulatory frameworks. This requires cross-sectoral and "non-silo" thinking which can only be achieved if all policy areas have the common objective of achieving the goals of the Paris Agreement. As prosumerism can play a significant role in reaching these objectives and at the same time improve social, economic and environmental conditions of the energy sector, it is essential to **mainstream the awareness and knowledge about the opportunities that prosumerism can offer**.

The following table summarises the overall impact of EU policies on prosumerism.

Table 1: Overall impact of EU policies on prosumerism

Policy area	EU Framework	Current overall impact on prosumerism
Climate	RED II, EU ETS, EED, EPBD	positive
Environment	Habitats, Birds, Soil, Water, Noise, Air pollution, Waste	neutral
Development & Infrastructure	Rural development policy, Clean Energy Directive, European Fund for Strategic Investments (EFSI), Digital Single Market strategy, ESD	neutral
Social Affairs	Equal Treatment Directive (2006)	neutral
Data Security	The General Data Protection Regulation (GDPR)	positive
Economic and fiscal policy	RED II	positive
Trade and international investment	'Trade for All' (2015)	negative
Education	SET-Plan	neutral

(positive) means there is a positive impact, such as an increased adoption of prosumerism, (neutral) means no relevant impact, (negative) means there is a negative impact, such as a reduction of prosumerism

Background information report on

The relevance of EU policies and frameworks for prosumers

1. Introduction

1.1 Background and objectives

This document aims to define, structure and develop the content the first part of Task 3.2 "Strategies for enhancing policy coherence and sustainability". This task focuses on the prosumer relevance of EU policies and frameworks and is defined as follows in the PROSEU project: "*This task will focus on analysing conflicts and synergies between RES prosumer regulatory frameworks and governance models and policies in related sectors such as climate change policies; spatial planning; energy efficiency regulation and building codes; rural development policies, housing and social inclusion, nature and soil conservation policies, and other key policies and related issues to be co-identified during the project with Living Labs and other stakeholders*."

The overall objective is therefore to identify regulatory frameworks, governance models and sectoral policies which may affect or that are affected by renewable energy (RE) prosumers (hereinafter: prosumers). In addition, this document provides recommendations to policy-makers at EU, national, and local level to further support and mainstream renewable energy prosumerism (hereinafter prosumerism), as well as to recommend prosumers on how to best engage with the different frameworks. Prosumerism is the process in which energy consumers actively participate in the energy transition by both consuming energy and producing renewable energy. The main focus is on the European level - the geographic scale of the PROSEU project. Besides, some global and international frameworks have been reviewed to ensure completeness.

This document is related to the second part of Task 3.2 "Strategies for enhancing policy coherence and sustainability" which discusses sustainability guidelines for prosumers.

1.2 General approach

First, the areas, in which EU or global regulatory frameworks were likely to be directly or indirectly linked to prosumers, had to be identified. In order to ensure that no framework was overlooked, the current EU directorates were initially taken as a baseline (see Table 71 in the Annex). As certain policy themes such as "jobs, growth and investment" or "internal market" occur in several directorates, they were grouped into eight policy areas or themes:

- Climate
- Environment
- Infrastructure & Development (incl. spatial & urban planning, rural development, transport, Industrial development)
- Social affairs (incl. energy poverty, employment, women)
- Data security & privacy protection
- Economic & fiscal policies
- Trade & international investment
- Education

This document is thus organised in a way that issues which are most closely related to each other are discussed within the same chapter, even though some may be relevant in several sections (e.g. rural development is also linked to energy poverty). The legislative and regulatory framework concerning energy are not further discussed in this document as they fall under the scope of PROSEU Task 3.1.

Each identified policy is then briefly described and the positive, negative and neutral effects that these frameworks/policies may have on prosumers, and vice-versa, are later identified, discussed, and recommendations are derived. This resulted in the following three sub-sections for each policy framework:

a) Description of key legislation or regulation available at the European or the global level
b) Discussion of the relevance, synergies and conflicts with prosumers
c) Recommendations for policymakers

It should be noted that some of the issues that are discussed and some of the recommendations that are given overlap with the ones described in the Proseu Task 3.2B document on Sustainability Guidelines.

In general, any RE project needs to comply with the provisions made in EU legislation, independent of the fact of if they are prosumer projects or not. For the purpose of this report, prosumer projects can be divided into two groups:

- **Large prosumer projects:** These are RE plants that require a significant amount of ground space for PV, wind or bioenergy projects in the megawatt (MW) range. Large MW roof-top PV systems would also fall in this category.
- **Small prosumer projects:** These encompass RE plants for individual homes or buildings of up to several dozen kilowatts (kW), or –for larger roofs– a maximum of few hundred kW. Most small prosumer projects use PV installations, but also include small wind turbines, and small hydro, among others.

2. Climate policies

2.1 The UNFCCC Process

In 1992 the UN Framework Convention on Climate Change (UNFCCC), ratified by nearly all member countries, set forth the international climate change regime. The UNFCCC's goal is to stabilise greenhouse gases (GHGs) in a manner that enables economic development (UNFCCC, 1992). Article 3 states that the agreement abides by the principle that policies to combat climate change should be implemented at the lowest possible cost (UNFCCC, 1992). In 1997, most of the UNFCCC parties signed the **Kyoto Protocol.** The most significant contribution of the Kyoto Protocol is that it requires developed countries to reduce or limit their GHG emissions. However, with regards to RE, the Kyoto Protocol vaguely requires developed countries to implement national policies regarding the research and development of RE, as well as to phase out support-mechanisms to GHG emitting sectors that run counter to the objective of the convention (Kyoto Protocol, 1997). Nevertheless, the Kyoto Protocol commitments will end in 2020, whereas the Paris Agreement will continue on.

2.2 The Paris Agreement

In December 2015, almost all of the countries in the world signed the "Paris Agreement" committing themselves "to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius" (Paris Agreement, 2015).

All Parties are required to define their best efforts in nationally determined contributions (NDCs) and to further increase these efforts in the years ahead. In addition to the NDCs, the EU has agreed to govern the energy and climate commitments of its member states through the National Energy and Climate Plans (NECPs).[3]

[3] For details on the EU governance and NECPs please refer to the report on Task 3.1.

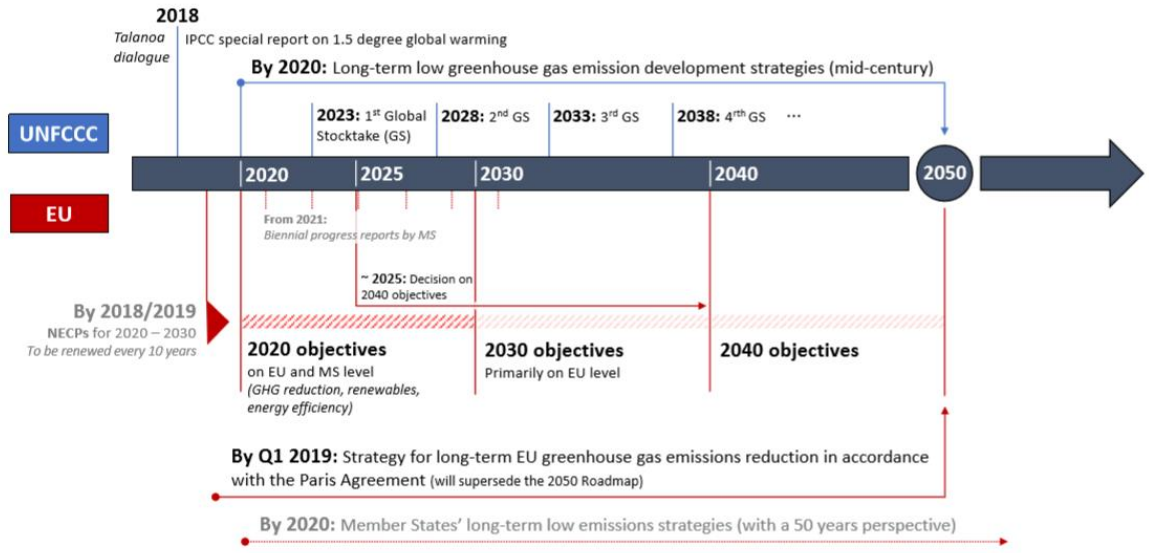


Figure 1: Climate Governance – UNFCCC and EU. Source: Bruegel 2018

2.3 Prosumers and the Paris Agreement

Although the Paris Agreement does not establish any binding targets regarding renewable energy production, the goal to limit global average temperature increase to 1.5ºC-2ºC directly influences national and regional RE deployment targets. However, it is up to the parties to decide if their respective mitigation commitments are supportive of the prosumer model or the conventional utility model.

The Paris Agreement also requires that states plan and implement **adaptation** measures (Article 7). Prosumers are relevant in this regard as well, as photovoltaics (PV) and other RE installations on buildings help their owners to increase their resilience to extreme weather events in cases where the central electricity supply fails. However, in order to work under non-grid connected conditions, specific features need to be installed such as batteries and stand-alone operation mode.

Article 6 of the Paris Agreement invites parties to establish carbon markets. Carbon markets enable the transaction of emission allowances within a market. To date, there are 21 emission markets and dozens more that are under consideration (World Bank, 2018). Pricing emissions can incentivise companies that participate in a carbon market to develop large prosumer initiatives to reduce their emissions, and thus the economic burden of the carbon price.

The Paris Agreement can directly finance prosumer projects in developing countries through the Green Climate Fund (GCF). Developed countries initially pledged to donate to the GCF $100 billion per year by 2020, though the Paris Agreement extended this date to 2025. So far, the impact of the GCF remains limited as it has only received $10.3 billion.

2.4 EU Climate and Energy policy

The EU will ensure that its members sufficiently contribute to the overall 2030 targets by requiring them to define National Energy and Climate Plans (NECPs). The 2030 climate and energy targets that were adopted in November 2018 are (Psaledakis & Lough, 2018):

- 40% cut in greenhouse gas emissions compared to 1990 levels
- 32% share of renewable energy consumption
- 32.5% indicative target for an improvement in energy efficiency

The main policies aimed at achieving these targets are the Renewable Energy Directive (RED II), the EU Emissions Trading System (ETS), the Effort Sharing Regulation (ESR), and the Energy Efficiency Directive (EED).[4]

2.5 Prosumerism and EU climate and energy policy

The new **RED II** has set rules that will invigorate prosumer initiatives. RED II requires member states to ensure that consumers can become renewable self-consumers, who may: (i) generate and store RE, and sell excess RE production; (ii) not be subject to any charge or fee on self-consumed energy until 2026; and (iii) join RE communities that generate RE, store energy, and sell excess energy production[5].

The **EU-ETS** indirectly affects RE development by establishing a cap and a price on the emissions of 11,000 carbon-intensive installations from the power and manufacturing industry (representing close to 50 per cent of EU emissions). The intended design of the EU ETS was to create an emission price that would incentivise a fuel-switch to RE and/or the implementation of energy efficiency measures, and thereby reduce emissions. However, the EU-ETS has thus far been under a price that would incentivise RE deployment due to longstanding design issues, such as a high cap and the over-allocation of free allowances (Bel & Joseph, 2015), which have been inadequately addressed over the different trading phases of the EU ETS (Vailles et al. 2018; Perino & Willner, 2017).

Nevertheless, economic studies estimate that despite a rise in the carbon price in 2018 (which resulted from the adoption of essential reforms), the EU ETS will fail to reach a carbon price which incentivises RE development within the 2020-2030 period (Vailles et al. 2018, p.33). Hence, the EU ETS must be reformed further to effectively foster RE and indirectly benefit prosumer initiatives. An EU ETS with a price that leads to RE deployment potentially benefits prosumerism by incentivising manufacturers that participate in the EU ETS in developing their own prosumer projects, and by encouraging individuals in becoming prosumers due to higher energy bills.

In turn, the **Effort Sharing Regulation (ESR),** adopted in 2018, establishes emission targets for non-ETS sectors for the period 2021-2020.[6] Sectors covered include agriculture, transport (except aviation), housing, waste, and non-ETS industries. The ESR contributes to the EU-wide 2030 target of 40 per cent emissions reduction compared to 1990 with the objective to cut emissions from non-ETS sectors by 30 per cent compared to 2005. To achieve the EU-wide target, the ESR allocates state-level goals, which range between 40% reduction for countries with high GDP to 0% for the least wealthy states (EC, 2018). The ESR aims at achieving this goal by allocating annual emission allocations (AEAs) to each country, in the form of credits. Therefore, in principle, stringent emission targets within ESR sectors would lead to national measures aiming to reduce emissions in such industries, including higher RE targets that could indirectly incentivise the adoption of prosumerism. However, the ESR offers states several flexibilities to

[4] Details of the EU climate and energy directives are developed in Task 3.1.
[5] For details on RED II see task 3.1
[6] The ESR is the follow up of the Effort Sharing Decision (ESD) (406/2009/EC), which covers the period 2013-2020.

achieve their national targets, such as using EU ETS allowances; the transfer of surplus EUAs from country to another; the use of credits from land use, land-use change, and forestry (LULUCF); and the banking of surplus achievement emissions reduction targets of the 2013-2020 period (Effort Sharing Regulation 2018/842, Article 7 and 5). In consequence, the ESR, as it is currently designed, will not significantly result in a switch to RE (Vailles et al. 2018, p. 41-42; Ambel, 2018), and therefore will not indirectly incentivise prosumerism.

The 32.5% increase target on energy efficiency by 2030 in the revision of the Energy Efficiency Directive (EED), as well as the related long-term objective of the European Performance of Buildings Directive (EPBD) regarding the renovation of the entire EU building stock by 2050, indirectly affect the adoption and viability of prosumer projects. Energy efficient buildings incentivise the adoption of prosumer projects, because they maximise the excess of on-site electricity generation, and hence, the potential revenue from its sale. Furthermore, the Governance Regulation (EU) 2018/1999) demands targets and measures for self-consumption and energy communities; and the amended Electricity Directive, which was adopted in May 2019, and will be published in the summer of 2019, incentivises prosumerism by ensuring the right to participation in the electricity market and tackling obstacles to the free movement of electricity.

2.6 Conclusions and recommendations

Overall, although the GHG emission reduction commitments within the UNFCCC and EU directives relevant to climate governance are relevant to the deployment of RE technology, only RED II directly regulates prosumers. Following we present a couple of tables summarising the overall impact of the above-mentioned frameworks on prosumers.

Table 2: Impact of climate-related international and EU frameworks on prosumers

International / EU framework	impact on RE deployment	Impact on prosumers	Mentions RE/ prosumers	Comment
Paris Agreement	positive	neutral	no/no	Reaching the temperature goal requires RE deployment
RED II	positive	positive	yes/yes	Ensures the right to prosumerism
EU ETS	neutral	neutral	no/no	Has not incentivised switch to RE
ESR	neutral	neutral	yes/no	Has not significantly incentivised switch to RE; only mentions the need of RE in relation to transport
EED	positive	positive	no/no	Increased efficiency indirectly incentivises the adoption of RE systems
Governance Regulation	positive	positive	yes/yes	Incentivises self-consumption and RE communities
EPBD	positive	positive	no/no	Increased efficiency indirectly incentivises the adoption of RE systems

(positive) means there is a positive impact, such as increased deployment/adoption of RE and prosumerism, (neutral) means no relevant impact, (negative) means there is a negative impact, such as reduction/prevents RE and prosumerism.

The IPCC special report (2018) regarding limiting global warming to 1.5˚C has underpinned the point that a 1.5˚C warming scenario, and indeed a 2˚C scenario, is not safe. Hence, at the global level, states must be more ambitious than the current Paris Agreement targets and develop an urgent transition to a zero-emission economy, where prosumer initiatives can potentially play a crucial role. Furthermore, states should abandon their historical reluctance to agree on energy matters and, thus bind to a climate agreement that requires a fast transition to 100% RE and recognises the importance of the prosumer model. At the EU level, the EU should step up their current RE adoption level ambitions, which should include the financial support of the prosumer model.

Prosumers benefit from comprehensive and stringent climate policies. The positive impacts that prosumers have on mitigation and adaptation may not be sufficiently recognised yet. Many countries still pursue policies that assume that only large-scale, multi-Megawatt power plants - that are constructed and run by large conventional utilities - are able to cover our future energy needs. However, the speed with which an energy system can be changed through the appearance of prosumers and distributed generation has already been demonstrated, e.g. in Germany the final energy consumption from PVs grew from nearly 0% in 2007 to 7.2% in 2017 (Fraunhofer, 2018 p.8).

3. Environmental policies

3.1 Introduction

Despite its positive impact towards the mitigation of climate change, the deployment of renewable energy installations can be in conflict with the EU's general nature conservation objectives. For example, habitats may be lost or fragmented by hydropower installations or dams (Environment and Ecology, 2019), wind turbines can kill birds and bats (Hickman, 2012), and large-scale solar power plants can cause heat island effects which may affect local ecosystems (Binder, 2016; Barron-Gafford, 2016). It is therefore necessary to assess the impact that the EU's environmental directives have on RE facilities in general, and on prosumers' initiatives in particular.

Over the past decade, the EU has developed a comprehensive and ambitious set of environmental regulations that aim to protect biodiversity along with water, air and soil quality. These directives may vary in degree of relevance for prosumer initiatives, depending on the site, scale and technology used. The following section reviews the main EU environmental directives in order to understand how they interact with RE development in general, and prosumer activities in particular.

Most of the following provisions only apply to larger scale RE installations such as wind and solar farms in the MW range. While most prosumer projects are small-scale and hence have a low environmental impact, the following provisions are especially relevant for large-scale prosumer projects.

3.2 EU frameworks

3.2.1 Birds and Habitats Directives

The Birds and Habitats Directives form the foundation of Europe's nature protection policy. Adopted in 1979, the **Birds Directive** aims to protect wild birds and their most important habitats across the EU. The **Habitats Directive** (Council Directive 92/43/EEC), adopted in 1992, extends protection to rare, threatened or endemic species of wild animals and plants as well as rare habitat types (e.g. special types of forests, meadows, wetlands, etc.). Together, the two directives aim to establish a network of protected sites, **the Natura 2000 network**, and introduce a strict regime for protecting species covered by the two directives (EC, 2019a). The Natura 2000 Network currently contains over 27,000 sites across 28 EU Member States.[7] These sites cover around 18% of the land area in the EU-28 as well as significant marine areas (see Figure 2 below).

It is relevant to check the potential impact of this directive on prosumers, as some areas of Natural 2000 sites may be well suited for rural prosumer projects, due to the availability of land free of agriculture and other anthropogenic practices.

[7] Find all sites in: http://natura2000.eea.europa.eu/

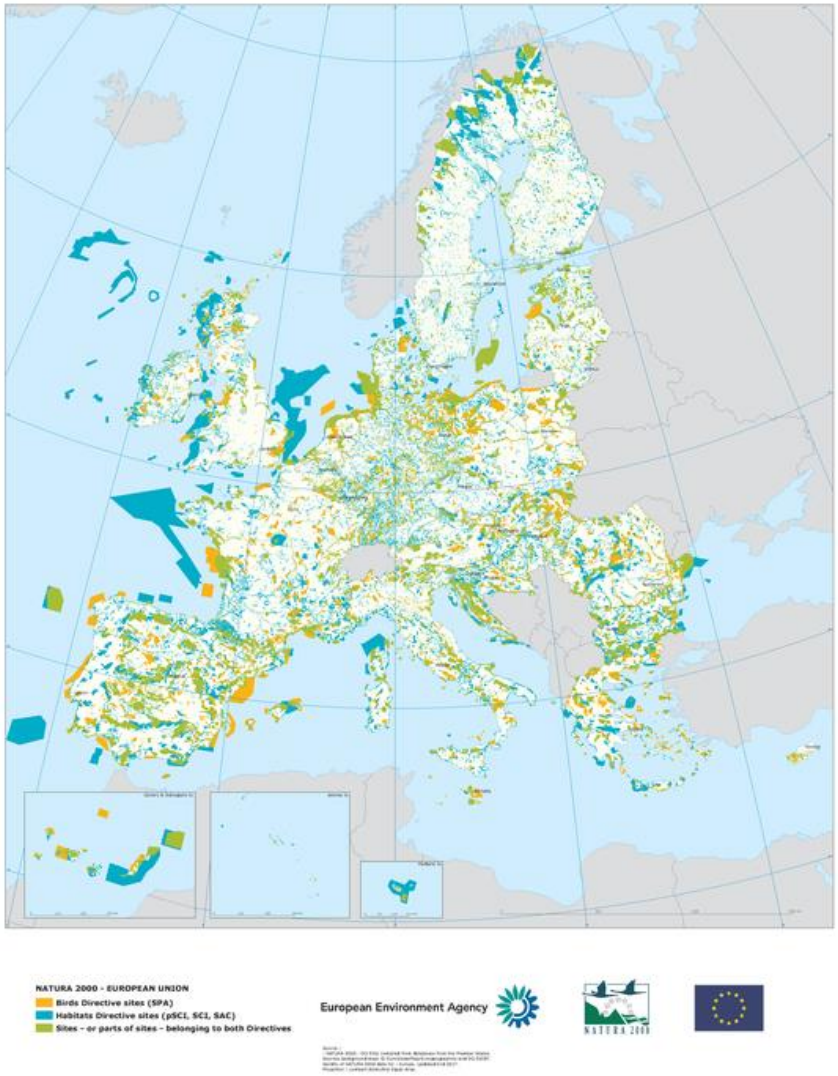


Figure 2: Natura 2000 network. Source: EEA, 2018.

Article 6 of the directive defines how Natura 2000 sites are managed and protected. In particular, **paragraphs 6(1) and 6(2)** require that, within Natura 2000, Member States must:

- Take appropriate conservation measures to maintain and restore the habitats and species for which the site has been designated to a favourable conservation status;
- Avoid damaging activities that could significantly disturb these species or deteriorate the habitats of the protected species or habitat types.

Paragraph 6(3) lays down the procedure to be followed when new developments might affect a Natura 2000 site:

- Any plan or project likely to have a significant effect on a Natura 2000 site, either individually or in combination with other plans or projects, shall undergo an "**Appropriate Assessment**" to determine its implications for the site. The competent authorities can only agree to the plan or project after having ascertained that it will not adversely affect the integrity of the site concerned (Article 6.3).

The performance of the Habitats and Nature directives have been scrutinised under a "fitness checked"[8] by the European Commission. The fitness check concluded that both directives, support correct (and efficient) implementation through a set of thematic guides applicable to Renewable Energy facilities (EC, 2017). These include:

- Guidance on hydropower and Natura 2000 (EC, 2018);
- Guidance on electricity transmission facilities and Natura 2000 (EC, 2018b);
- Updated guidance on wind energy and Natura 2000 (expected in 2019);

In the guidance on electricity transmission and Natura 2000 (EC, 2018b), potential risks caused by electricity facilities and mitigation measures for biodiversity preservation are highlighted:

- **Habitat loss, degradation or fragmentation**. Energy infrastructure projects may require the clearance of land and the removal of surface vegetation (direct land-take). Through this process existing habitats may be altered, damaged, fragmented or destroyed.
- **Disturbance and displacement**: Disturbance of species in their habitual breeding, feeding or resting sites, as well as along migration routes, can lead to displacement and exclusion, and hence loss of habitat use. The species may be displaced from areas within and around the project site due to increased traffic, the presence of people, a noise, dust, pollution, and artificial lighting or vibration caused during or after construction work.
- **Collision and electrocution risk**: Birds, and possibly bats, may collide with various parts of electricity overhead powerlines and other above-ground electrical facilities.
- **Barrier effects:** Large transmission, receiving and storage infrastructures may force species to bypass the area altogether, both during migrations and, more locally, during regular foraging activities. *It should be noted however that this risk seems to be limited for small-scale energy infrastructures.*
- **Potential cumulative effects:** The cumulative effects of projects may arise when a lot of energy infrastructure is present within an area or along a flyway corridor, or when an energy infrastructure project takes place in the same area as another type of project (e.g. other industrial developments). The cumulative effect is the combined effect of all these activities taken together. It may be that one energy infrastructure project, on its own, will not have a significant effect, but if its effects are added to those of other projects that are located in the area then their combined impacts could become significant.

Table 3: Summary of technologies covered in the review of scientific evidence and examples of impacts and mitigation/enhancement measures covered. Source: Meeting Europe's Renewable Energy Targets in Harmony with Nature, BirdLife, 2011

[8] For more on the fitness check assessment: https://ec.europa.eu/environment/efe/themes/nature-and-biodiversity/fitness-check-shows-eu-nature-laws-are-fit-purpose_en

TECHNOLOGY	MAIN CONSERVATION RISKS CONSIDERED	AVOIDING AND MITIGATING RISKS	ACHIEVING BENEFITS FOR WILDLIFE
Solar PV arrays	• Habitat loss • Direct impacts on birds, mammals and insects • Habitat fragmentation and/or modification.	• Avoid protected areas • Retain trees and hedges • Time construction and maintenance to avoid disturbance of birds and bats during breeding seasons.	• Manage vegetation around/beneath panels for wildlife • Use some revenues to support on-site conservation.
Onshore wind power	• Disturbance/ displacement • Barrier effects • Collision mortality • Habitat loss.	• Spatial planning (sensitivity mapping and location guidance) and site selection • Modelling collision risks and estimating displacement impacts • Improved tools and methodologies to assist pre- and post-construction monitoring and research • On- or off-site ecological enhancements.	• Positive land management changes • Create wildlife areas on- or off-site as part of community-benefit packages.
Offshore wind power	• Disturbance/ displacement • Collision risk • Habitat loss • Pollution.	• Spatial planning and site selection. • Baseline surveys and targeted pre-construction studies • Remote sensing techniques.	• Reef effects • No-take zones • Contributions to marine ecological data.
Tidal stream and wave power	• Collision risk • Entrapment • Disturbance/ displacement • Indirect effects.	• *None recommended due to early stage of development of wave and tidal technologies.*	• *None recommended due to early stage of development of wave and tidal technologies.*
Biomass for heat and power	• Pressure on existing habitats in forests and on farm land • Direct and indirect land-use change.	• Location guidance • Good practice guidelines • Sustainability standards and certification • Avoid using biomass from sources where sustainability cannot be guaranteed.	• Manage neglected forests for biodiversity gains and sustainable biomass production • Grow patches of wildlife-friendly energy crops, planned to improve habitat connectivity.
Power lines	• Electrocution • Collision risk • Habitat loss.	• Avoid sensitive locations • Retrofitting "killer poles" • Underground cables.	• Manage land beneath pylons as biodiversity "stepping stones" • Provide ecological enhancements to affected communities.

The Birds and Habitat directive is very relevant to mitigate the environmental impact of medium to large energy facilities, in particular related to electricity production and transmission in Natura 2000 sites. However, it seems less applicable to Prosumers initiatives that are mainly small to medium scale installations, especially if they are integrated into the built environment, such as rooftop wind turbines and PVs, as they do not compete for land with the natural environment.

3.2.2 The Medium Combustion Plant (MCP) Directive

The recent Medium Combustion Plant (MCP) Directive (2015) on the limitation of emissions of certain air pollutants, regulates polluting emissions from the combustion of fuels in plants with a rated thermal input equal to or greater than 1 thermal megawatt thermal (MWth) and less than 50 MWth. Medium combustion plants are used for electricity generation, domestic/residential heating and cooling, providing heat/steam for industrial processes, etc. They are an important source of emissions of sulphur dioxide (SO2), nitrogen oxides (NOx) and dust. The estimated number of MCPs in the EU is around 143,000.

This new directive fills the regulatory gap at the EU level that exists between large combustion plants (≥ 50 MWth) that are covered under the Industrial Emissions Directive (IED) (2010/75/EU), and smaller appliances (heaters and boilers <1 MWth) that are covered by the Ecodesign Directive (EC, 2018c). The emission limit values set in the MCP Directive will have to be applied from 20 December 2018 for new plants and by 2025 or 2030 for existing plants, depending on their size.

The new MCP directive has been criticized by some forest and biomass interest groups (in particular in Finland (Energia, 2015)) as, according to them, it would hamper investments in small and medium biomass facilities. However, the MCP directive seems necessary to ensure that MCPs do not harm public health and contribute to good air quality, as well as biodiversity protection, by preserving forests, agricultural fields and non-used land.

3.2.3 The Industrial Emissions Directive

The 2010 IED (2010/75/EU) covers a number of combustion plants but includes bioenergy installations above 50 MW, and therefore it is relevant for the development of industrial prosumers. The IED establishes limit values of emissions based on Best Available Techniques (BAT) decided between the Commission, industry, and environmental organisations. The current accepted BATs under the IED are currently being revised and should be updated by 2021 (Bioenergy Europe, 2019). However, industrial prosumer initiatives are currently the exception, and thus, the IED does not apply to most prosumers.

3.2.4 Environmental Noise Directive

The Environmental Noise Directive (END) (adopted in 2002) focuses on the assessment and management of environmental noise pollution and the ability to trigger necessary actions at both the Member State and the EU level. The Directive applies to noise to which humans are exposed, particularly in built-up areas, in public parks or in other quiet areas that are situated in an agglomeration or the open countryside, or that are located near schools, hospitals and other noise-sensitive buildings and areas. The Directive does not set limits or target values, nor does it prescribe measures to be included in action plans. Thus, it leaves these issues to the discretion of the competent Member State authorities.

Wind turbines: Noise and health effects

Noise is a factor that needs to be considered in order to ensure that there is social acceptance for planned wind turbine projects in Europe. Much of the sound that a wind turbine makes comes from the rotor blades passing through the air. This sound is usually perceived as a hissing or swishing sound. The sound can be described as a broadband noise, usually within the frequency range of 63–4,000 Hz (Natur

värds verket, 2018). The sound level decreases as the distance from the wind turbine increases. The weather, the type of soil, and the wind all affect how the sound propagates.

In most European countries, noise legislation is based on national regulations. Allowable environmental noise limits are categorised by area and time. Minimum and maximum levels usually vary between 40 to 55 dB during the day and are reduced by 5 to 10 dB during the night. Noise limits in recreational areas vary from 40 to 48 dB during the day and are reduced by approximately 5 dB during the night (Wind Europe, 2018).

In France the National Agency for Health, Environment and Security have studied the health effects related to low-frequency sounds (20 Hz to 200 Hz) and infrasound (below 20 Hz) emitted by wind farms. In its conclusions, the Agency underlines that there is no justification for changing the current exposure limit values or for extending the sound frequencies currently considered in the regulations. However, the Agency does recommend systematically measuring the noise emissions of wind turbines before and after they are brought into service as well as setting up continuous noise measurement systems around wind farms, for example based on current practices applied for airports. It also reiterates that the current regulations state that the minimum distance between a wind turbine and the first home should be evaluated on a case-by-case basis where the conditions of wind farms are taken into account. This distance, currently at 500 metres, may be increased further according to the results of an impact study, in order to comply with the limit values for noise exposure (Anses, 2013).

From the above analysis, it can be deducted that noise emissions from wind farms (and potentially bioenergy installations) remain a sensitive issue. However, community-led RE initiatives tend to foster greater social acceptance than commercial RE farms, in part due to the active dialogue between stakeholders often encouraged by community initiatives. Hence, community-owned wind farms are likelier to attend the concerns of local inhabitants (Nielsen, 2010). Beyond social acceptance fostered by dialogue between stakeholders, both mechanical and aerodynamic noise from wind farms can be reduced, for instance by vibration suppression techniques, and physical modifications of the wind turbine blade, respectively (Jianu, Rosen & Naterer, 2011). Therefore, technical upgrades are essential for solving noise pollution of wind farms, and thus, for the social acceptance of wind prosumer projects.

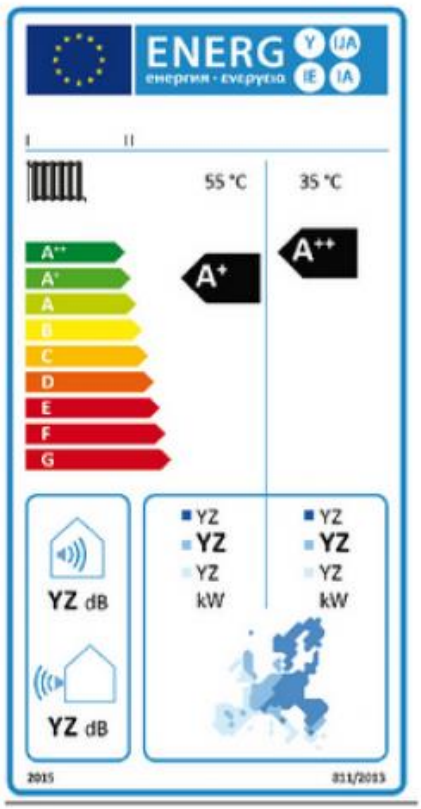
3.2.5 Energy labeling and ecodesign policies

Overall, the EU Ecodesign and Energy Labelling policies are aimed at reducing energy and resource consumption and greenhouse gas emissions. Specifically, ecodesign aims at increasing the environmental performance of products, while energy labels aim at ensuring that consumers can easily access understandable information about a product's performance. The group of products that the Ecodesign and Labelling policies cover that are relevant to prosumers are space heaters, heat pumps, solid fuel boilers, boilers, oil boilers, electric boilers, and cogeneration (CHP, combined heat and power) boilers.

Energy labels: New solid fuel boilers with a rated heat output of 70 kW or less are labelled on an energy efficiency scale ranging from A+++ (most efficient) to G (least efficient). Energy labelling rules also apply to packages that include a combination of a solid fuel boiler, supplementary heaters, temperature controls and solar devices (EU energy labelling regulation).

Ecodesign: Ecodesign requirements for solid fuel boilers with a rated heat output of 500 kW or less will be mandatory from 2020 onwards for all manufacturers and suppliers who wish to sell their products in the EU. These requirements are also applicable to boilers that are part of packages consisting of a solid fuel boiler, supplementary heaters, temperature controls and solar devices. The requirements cover energy efficiency and air polluting emissions (Ecodesign regulation for solid fuel boilers (Regulation (EU) 2015/1189, 2015) (EU).

Example of Energy label for heat pump



3.2.6 Waste Directives

The EU has been very active in regulating waste management in Europe through a number of legislations, most notably the Waste Framework Directive (WFD) (2008). The WFD and its amendments are a pillar of the 2015 Circular Economy package, which aims at increasing the lifecycle of products through greater re-use and recycling. The issue of waste management of RE goods is highly relevant as RE technology is mainly based on electronic components (e.g., PV, batteries, sensors, control devices, etc.), which are highly polluting if not correctly recycled. In this regard, small scale prosumers generally have far less experience in dealing with the full life-cycle of energy installations than large electric utilities which are periodically scrutinised under stringent EU law, such as the WFD. Hence, prosumers should offer special attention in complying with the different EU waste and recycling policies.

Apart from the WFD, prosumers must also comply with the Waste electrical and electronic equipment (WEEE) Directive (2012/19/EU), which is part of the 2015 Circular Economy package. The WEEE Directive sets criteria for the collection, treatment and recovery of waste electrical and electronic equipment. In

addition, prosumers should take into account the life-cycle assessment (LCA) as, for instance, the extraction of raw materials for RE technologies may lead to environmental impacts elsewhere.

3.2.7 Water Framework Directive

In the year 2000, European water policy underwent a major consolidation process which led to the adoption of the **Water Framework Directive (2000/60/EC)** (EC, 2016a). Its aim is to promote a more holistic approach to water policy, to streamline existing (fresh) water legislation and to adopt a River Basin Management approach (covering the ecological and chemical protection of surface waters and the chemical and quantitative status of groundwater).

The Water Framework Directive is particularly relevant for hydropower installations (potential prosumer initiatives) that are generally associated with severe environmental impacts as they reduce the backwater[9] proportion of rivers and create lake-like conditions that freshwater fish species do not find convenient. Backwater also influences downstream regions because it changes the physical and chemical conditions of the water. Another issue is the diverted reach that causes the river to dry out resulting in dramatic consequences for the fish. Even small run-of-river hydropower stations can provoke long term effects too, such as water level fluctuation, which creates an unstable habitat area that increases the mortality rate of juveniles. Moreover, fish migration is blocked by barriers, turbines and backwater, all decreasing the chances for fish survival (IUCN, 2012; Opperman, 2018).

For existing hydropower plants, the WFD demands that the plants achieve a Good Ecological Status (GES) and it requires them to implement an ecological restoration construction for existing infrastructures such as ecological flow and fish passages. The recommendations for new plants include the integration of water planning and an energy policy. Moreover, all cases in which article 4(7) exemptions are applied should include an appropriate and transparent justification of compliance with all conditions.

Again, as for other renewable technologies, most of the prosumer facilities will likely use small to medium-scale hydropower installations which should have a limited environmental impact.

3.2.8 Strategic & Environmental Impact Assessment Directives

An Environmental Impact Assessment (EIA) is a procedure that ensures that the environmental implications of projects are taken into account before the decisions are made and a project is started. On the basis of the Environmental Impact Assessment (EIA) Directive (2011/92/EU) an EIA can be undertaken for individual projects, such as dams, wind farms, and solar farms, or for other infrastructure projects such as roads or airports. EIA's are mandatory for all projects that "are likely to have significant effects on the environment" (Directive 2014/52/EU (amended version)). Hence, prosumers developing large RE projects -especially if near sensitive areas- must undertake an EIA. On the other hand, the Strategic Environmental Assessment (SEA) Directive (2001/42/EC) applies to public plans or programmes.

[9] **Backwater** is a part of a river in which there is little or no current.

The common principle of both Directives is to ensure that plans, programmes and projects that are likely to have significant effects on the environment are made subject to an environmental impact assessment prior to their approval or authorisation. Consultation with the public is a key feature of environmental impact assessment procedures. They do not create a legal requirement to actually avoid or reduce impacts nor do they compensate for residual impacts. An EIA's implementation details depend of national and local legislation. For instance, in Spain the limited use of effective environmental impact assessments has resulted in some severe impacts on bird populations as a result of the poor siting of wind farms (Bowyer, 2016).

There are also problems regarding the environmental impact assessments of **agricultural developments**, especially related to biofuel and biomass crops which both may potentially be used by Prosumer facilities. Rural Development Programmes (RDPs) (EC, 2018d) (see also section 4.2), the second pillar of the **Common Agricultural Policy (CAP)** (EC, 2018e), include measures that support bioenergy production (e.g. anaerobic digesters). Whilst the Rural Development Programmes must be subject to a SEA, it is difficult to assess the impacts of these renewable energy related measures because they are not precisely defined (Bowyer et al., 2015). It has been found that the frameworks and criteria for screening are poorly implemented and they use high thresholds. The result is that many agricultural improvements fall outside the scope of the legislation so that their potential impacts are often not assessed (COWI, 2009).

It should be noted that the SEA is under a revision process (EC, 2018f) and is currently at the consultation phase. This is part of the European Commission's Regulatory Fitness and Performance Programme (REFIT) which involves a comprehensive, evidence-based assessment of whether the current regulatory framework is proportionate and fit for purpose and delivering as expected.

3.2.9 Soil directive proposal

New directives that are currently in development, such as the Soil directive proposal, might be relevant for RE and prosumer initiatives (especially for biomass projects), although it is too early to take them into account. Limiting soil sealing needs to also be considered for large PV projects (modern projects usually use very little concrete for foundations).

In 2006 the Commission adopted a Soil Thematic Strategy (EC, 2016a) which included a proposal for a Soil Framework Directive (2004/35/EC), to ensure the sustainable use of soils and to protect their function in a comprehensive manner in a context of increasing pressure and soil degradation across the EU. Taking note of the fact that the proposal has been pending for almost eight years without a qualified majority in the Council in its favour, in 2014 the Commission decided to withdraw the proposal for a Soil Framework Directive, opening the way for an alternative initiative in the next mandate (EC, 2016a).

3.3 Conclusions and recommendations

In conclusion, the overall level of relevance of the EU environmental directives is high. However, the level of relevance varies according to the technology used, and the size and location of the project.

Overall, biomass is the technology mostly affected by the different policies, followed by wind and small hydro. Notably, all technologies require compliance with policies concerning waste. Following we

present a summary table concerning the general relevance of the EU environmental directives with the different RE technologies.

Table 4: Relations between EU directives/policies and RE technology

Directive/Policies	PV solar	Wind	Biomass	Small Hydro
Habitats	+/-	+	-	+
Birds	-	++	-	-
Soil	+/-	-	+/-	-
Water	-	-	+/-	+
Noise	-	(++) national	+	+/-
Air pollution	-	-	++	-
Waste	+++	++	+/-	+/-

(+) means it is relevant, (-) means no significant relation

In conclusion, in order to support prosumer initiatives, it is essential to carefully assess the environmental impacts of potential technologies and their compliance with EU (and national) environmental directives. This needs to be done to ensure consistency, mitigate negative externalities and unlock potential barriers to Prosumer mainstreaming.

4. Infrastructure and Development policies

4.1 Spatial and urban planning - building codes

4.1.1 Definitions and explanations

The European INSPIRE (Infrastructure for spatial information in Europe) knowledge database defines a spatial plan as "*a set of documents that indicates a strategic direction for the development of a given geographic area, states the policies, priorities, programmes and land allocations (…) and influences the distribution of people and activities in spaces of various scales. Spatial plans may be developed for urban planning, regional planning, environmental planning, landscape planning, national spatial plans, or spatial planning at the Union level.*" (EC, not dated a).

When it comes to the deployment of RE, it may help to understand two frameworks as being both separate but interlinked: a) the **spatial and urban planning** framework, and, b) the **building** framework. They can be organised by different ministries (in Germany the Ministry for Infrastructure, BMVI, and the Ministry for Buildings, BMUB).

In most countries, the legally binding legislation covers three government and planning levels:[10] National planning level, subnational/county planning level, and local/municipal planning level. Following, we use examples from Germany and Spain.

National level:

- National laws and ordinances are the basis for all subsequent plans and ordinances. The legislative competence of the national government can be concurrent with regional or local legislation. In Germany, this is defined in the Basic Law (i.e. the Constitution).
- In terms of spatial planning, the relevant federal law is the Federal Regional Planning Act (*Raumordnungsgesetz*, ROG) (BMVI, 2018).
- In terms of buildings, the national legislations in Germany, for instance, are the **Federal Building Code** (BauG) and the Federal Land Utilization Ordinance (Baunutzungsverordnung – BauNVO).

Sub-national/county level:

- The **regional development programmes** or plans that provide spatial planning for a country, state or region ("*Bundesland*" in Germany, "*comunidad autónoma*" in Spain, etc.).
- **Regional spatial development plans** take the regional programmes into consideration and work on plans across sub-regions and cities (e.g. one piece of land can have several competent regional spatial planning authorities).

Regional/municipal level:

- **Local or municipal land use plans** provide planning details on how to use land (e.g. agricultural use, residential areas, natural areas, industrial zones, type of businesses, etc.),

[10] See: http://www.special-eu.org/

that is, the general intention of the municipality. They can include, for example, provisions for the use of distributed energy generation from RE.

- **Local development plans or zoning plans** give very concrete and legally binding provisions on how certain areas are to be used. They are done under the competence of the local authority. The final orientation and dimensions of buildings should take into consideration the use of RE.

The following table gives an overview of selected spatial planning frameworks in a number of EU countries:

Table 5: Titles of the legal framework in selected European countries

Country	National level		County/Regional	
	Planning	**Energy**	**Planning**	**Energy**
Hungary	National Spatial Planning Act National Regulation Plan Act	Environmental Protection Act District Heating Service Act Renewable Energy Act	Local Building Order	Local Environmental Protection Programme
Great Britain	Planning Act Building Regulations	Energy Act		
Austria	National Spatial Planning Act	National Climate Protection Law	Styrian Spatial Planning Law Styrian Building Law	Styrian Climate Protection Act Energy Plan 2025
Germany	Federal Spatial Planning Act Building Code	Renewable Energy Law Energy Saving Law Combined Heat and Power Act	State Spatial Planning Act	
Greece	Spatial Planning and Environment Sustainable Urban Planning	Accelerating the Development of RES National Targets		
Italy	Building Code	Energy Saving Law Act on Energy Saving Buildings	Regional Spatial Planning Acts	
Sweden	National Planning and Building Act	Energy and Climate Guidance Act		
Ireland	Planning and Development Act	National Renewable Energy Action Plan National Energy Efficiency Action Plan	*An Board Pleanala*	

Source: Special-eu.org

In all of the above levels, the need for (renewable) energy-related infrastructure and installations is acknowledged. European directives like the Directive 2011/92/EU "on the assessment of the effects of certain public and private projects on the environment" have been transposed to national laws – e.g. the German Building Code (BauG) – that consider the impacts and needs of RE installations.

4.1.2 Relevance for large prosumer projects

When developing large prosumer projects, like community owned RE plants that produce 1 MW or more, **spatial planning frameworks** need to be considered. Regional and local plans have an updating cycle in the range of five to ten years. Therefore, prosumer initiatives can focus on developing RE projects according to current spatial plans that exist, or they can try to influence future plans by participating in stakeholder consultation processes.

On the other hand, when developing spatial plans, policy makers should allocate land for RE technology and they should consider how to foster large prosumer projects. One way to increase prosumer projects is by favouring local ownership. For example, in Demark, by the year 2000, cooperatives, individuals and farmers owned 80% of all wind turbines in the country. However, with the end of ownership restrictions the growth of prosumerism stalled because large energy companies were able to invest higher sums of money and could act faster than cooperatives could (Bauwens et al., 2016).

With an increasing number of people moving to cities, their energy demands will be increasing. When these energy demands are to be covered through renewable sources, this will lead to higher pressure on surrounding lands and possibly conflict with other land uses. It has been effective to address such conflicts (or avoid them altogether) by providing space for community-owned facilities that tend to have the support of the local population (Nielsen, 2010).

4.1.3 Relevance for smaller prosumer projects in the built environment

For smaller RE projects below the MW range, **building codes as well as urban plans are crucial**. Building codes are the rules that specify the standards for buildings or other constructed structures. Building developers, architects, constructors and engineers must adhere to the building codes in order to receive building permission. These are concerned with health and safety issues as well as environmental and energy requirements. As prosumers lead to more demand for RE installations in buildings, this may need to be further considered in these codes and plans.

4.1.3.1 Cities

Energy demand per capita is lower in dense (compact) cities or city centres then it is in less dense rural areas. This is usually due to there being less space per inhabitant, the use of public transport, cycling, walking, etc. In addition, multifunctional urban structures with mixed infrastructure (e.g. homes, work places, health care, child care, local amenities…), along with high density buildings can further reduce the need for mobility and energy. **In cities, any surplus energy produced from a RE installation would need to be used within the local distribution grid. The result of which is that that there are negative effects due to higher voltage levels**.[11]

On the other hand, the space for solar modules per inhabitant in dense cities with people living in multi-family houses or apartments in high-rise buildings is lower than it is in the countryside or in wide-spread residential areas with single-family homes. Cities also have more issues with shading and concurrent uses (e.g. roof-top terraces and gardens, technical equipment like air conditioning, etc.). Therefore, in

[11] IÖW 2017 Citizens Produce Energy Themselves and Benefit from It

dense city areas there may be **fewer opportunities for individual prosumerism**. Instead, prosumers these areas may act as part of a community, and consequently they can invest in joint projects like PV on large roof-tops or large-scale RE projects outside of cities.

Planners can influence the design of the built environment in a sustainable way by facilitating the integration of RE technology, and thus indirectly incentivising prosumer projects. At the urban or local planning level this includes (Special, not dated):

- Orientation of the building: e.g. facing south to exploit solar radiation, avoidance of shading.
- Design of the building: compactness, geometry, and its respective designated land area.
- Areas of use of RE installations or district heating/cooling systems.
- Local rules (by-laws) for a compulsory connection to a district heating/cooling system.
- Local contracts like urban development contracts with the local administration that could define rules on the use of RE which cannot be mandated through the Building Code.
- In terms of visual aesthetics, planners can provide best-practice ideas and local administrations can propose solutions on how to balance the interests of safeguarding historical buildings or traditional local building design aspects with the rights of prosumers to harness renewable energy. For example, in France, PV installations that are integrated into the building or roof receive higher Feed-in Tariffs than non-integrated ones.
- The heat island effect results in an energy demand for cooling particularly in cities. Good urban planning can reduce this demand (by providing blue and green spaces), thus potentially reducing the need to have increased energy production through prosumers.

An example is the **ECOCITY-project**[12] which aims to further the development of compact, space saving settlement structures that enable an environmentally compatible energy system combined with habitat structures that correspond to the overall objectives for sustainability (ECTP-CEU and TCPA, 2017).

4.1.3.2 Rural areas or city outskirts

In rural areas or residential areas in city outskirts more space is available for siting RE installations, as individuals often own individual houses or farms. This implies a higher energy consumption per capita due to there being more square meters per capita and an increased need for mobility due to limited access to transportation infrastructure to fulfil basic needs, such as public transport, for example. In these areas, more individual prosumers can be expected as they can try to optimize the energy use of their homes by using roof-top PV, self-consumption, batteries, electric vehicles, etc.

Municipal infrastructure planning in rural areas needs to consider potential RE developments. For instance, a common district heating system based on bioenergy may not be viable if the building density is not high enough and home owners can become self-sufficient prosumers. For certain remote villages, it may be cheaper to install autonomous RE-based energy systems that are not connected to the main grid if electric lines are costlier to be build and maintain.

[12] See http://www.ecocity-project.eu/

This means that through prosumerism – i.e. increased individual rights and responsibilities with regards to energy projects – additional options and alternatives for regional and local planning frameworks become available.

As with large prosumer projects, spatial planning can boost small-scale rural prosumer projects, such as on farms, by prioritising local ownership over commercial enterprises. Furthermore, support mechanisms could extend to off-the-grid prosumers. On the other hand, in cases where individuals lack the resources to become prosumers, spatial planning should facilitate the creation of cooperatives so that prosumers can confront economic barriers.

4.1.3.3 Relevant EU legislation

Article 2 of the amended Energy Performance of Buildings Directive (EPBD) requires the decarbonisation of the entire building stock by 2050, facilitating the transformation of existing buildings into nearly zero-energy buildings (NZEBs) (EPDB, 2018). This target is a step forward from the previous EPBD and the Energy Efficiency Directive (EED). The previous EPBD demanded NZEBs solely for new constructions, while the EED required a long-term renovation of government buildings. The renovation of all buildings into NZEBs provides the opportunity of mainstreaming prosumerism.

However, the EPBD does not directly address prosumers and it does not aim for a percentage of home-produced energy. On the other hand, the Renewable Energy Directive for the post-2020 period (RED II) requires Member States to ensure the right of consumers to become prosumers. Guaranteeing the right to be a prosumer may be a catalyst for the upscaling of prosumer individuals and collectives in urban and rural areas.

4.1.4 Recommendations

The EU should set a minimum requirement for on-site RE production for the entire building stock. Specifically, this should apply to rural areas. Also, policy-makers should foster prosumerism by ensuring a quota of local ownership of RE projects. In the urban environment, policies should ensure that the design of the infrastructure can adopt RE systems, as well as enable the virtual sharing of prosumer projects in order to make RE accessible for households without access to roof tops. On the other hand, prosumers should pay special attention to the respective spatial/urban plans and building codes that may regulate their RE installations.

4.2 Rural development policies

4.2.1 Frameworks

The EU's rural development policy 2014-2020, the so called second pillar of the Common Agricultural Policy (CAP), allocates a share of the €100 billion from the European Agricultural Fund for Rural Development (EAFRD) to each member state (EC, 2018). In addition, other EU, national, regional, and local funds provide the rural development programmes (RDPs) with another €61 billion. The rural development policy finances seven-year RDPs, at both the national and the regional level. The EAFRD, created by EU Regulation N°1305/2013, promotes resource efficiency and supports the shift towards a

low-carbon and climate-resilient economy as one of its six priorities. Thus, as confirmed in Article 20 of the EAFRD regulation, renewable energy projects are eligible for funding (EAFRD, 2013).

The EU is currently negotiating the CAP for the period 2021-2027. The Commission has proposed that at least 30% of each national rural development allocation will be dedicated to environment and climate measures and that 40% of the CAP's overall budget is expected to contribute to climate action. This will entail more opportunities for funding small-scale rural prosumer-led initiatives (EC, 2018a).

4.2.2 Prosumer and rural development

Solar PV, wind, and biomass projects on farms can lead to considerable RE production and can represent an additional income for farmers. Support for the development of RE systems based on prosumerism can also help to fight fuel poverty in remote rural areas and can stop them from becoming abandoned. In the Shetland Isles of Scotland, for instance, more than one-third (35%) of all households suffer from fuel poverty, but the development of off-grid renewable energy systems, especially for heating, have reduced the problem (OECD, not dated).

On the other hand, RE can also lead to competing land uses, e.g. farming vs. PV plants. In Puglia, Italy, for example, feed-in tariffs encouraged farmers to install PV panels on their agricultural land. A one-hectare photovoltaic field could generate up to €5,000 per year, resulting in a higher income than that which could be earned by farming the same area, and this could occur with less use of water and inputs (OECD, not dated). It should be noted, however, that generous Feed-in Tariffs are basically no longer available in Europe. New studies show that the most profitable option is to implement land-sharing of crops and solar PV panels. This has been illustrated in Germany, where a 194kW floating solar farm has been installed above the ground enabling sunlight to reach the crops and the agricultural machinery to pass below the solar panels. The result has been an increase in land use efficiency of 60% (Fraunhofer, 2017). Therefore, was this simple idea, farmers do not have to choose between planting crops or installing RE technology on arable land.

The rural development policy aims to invest €2.7 billion in renewable energy production between 2014-2020 (EC not dated b). This has so far led to the funding of over a dozen prosumer initiatives within agricultural projects.[13] One such example is that of an Estonian family-owned strawberry farm that received nearly €60,000 of EAFRD funding to develop a 160 kW solar farm in order to reduce their energy bill costs and increase their profits by selling excess solar energy to the grid. The result has been a 100% increase in company profits, the creation of one permanent job, growth in the number of annual visitors from 50 to 500, and the starting up of a consulting service to guide other farms in developing similar prosumer initiatives.[14]

Despite the risks that exist for a farmer that is adopting a RE installation, such a system can entail a significant source of income that enables a farm to be more competitive while at the time reducing GHG emissions. Although the EU rural development policy acknowledges the benefits of RE for agriculture, it falls short in promoting the added value of prosumer-led initiatives in rural areas.

[13] See funded projects at https://enrd.ec.europa.eu/projects-practice/
[14] See: https://enrd.ec.europa.eu/projects-practice/laastu-farm-generating-solar-power-strawberry-farm_en

Facilitating prosumer initiatives can be a key policy aim to reduce rural depopulation while achieving net zero emissions by 2050. Many rural areas in the EU have been experiencing depopulation since the second half of the 20th century. These lingering rural economies, which are often tourist-oriented, further incentivise the population exodus to urban areas. Hence, by 2050 the rural population is projected to decrease by 7.9 million people, while the urban population will increase by 24 million people compared to 2016 (Espon, 2017, p.2). Therefore, considering the urgent need of decarbonising the economy and the lack of space to install RE systems in cities, rural RE farms, and specifically, prosumer led initiatives, can offer new job opportunities in rural areas, can revitalise the economy, and hence can reduce rural depopulation while producing clean energy for cities. Prosumer led farm initiatives are potentially more effective in strengthening the rural economy than commercial RE farm initiatives, because the profits from prosumer projects—which are often led by local inhabitants—are likely to remain within the local community.

4.2.3 Recommendations

The rural development policy for 2021-2027 should specifically promote the adoption of the prosumer model in rural development, and it should recognise its paramount contribution in the transition to a low-carbon society, the growth of the rural economy, and in reducing the population flow towards urban areas.

In turn, prosumers that benefit from the rural development policy should share their experience and lead other agrarian projects into becoming prosumers and should do so with the support of the available funds if required. Sharing the experience of prosumer projects on farms, such as combining cropland with solar PV installations, can incentivise the expansion of the prosumer model within the agrarian landscape.

4.3 Transport policies

4.3.1 Potentially relevant frameworks

Transport policies are linked to prosumers through the possibility of combining power generation with charging private passenger electric vehicles (EVs), thus creating an additional incentive for consumers to become prosumers.

Reducing vehicle emissions is a key policy measure to tackle climate change and improve public health. For this purpose, Regulation (EC) No 443/2009 established substantial reduction targets concerning emission standards for new passenger vehicles (EC, not dated c). However, despite this vehicle manufacturers (i.e. The Volkswagen Group) conducted systemically flawed laboratory testing that resulted in a 40% gap between test results and the real emission performance of vehicles (Egenhofer et al., 2016, p.6). Nevertheless, the new regulation has established a new emissions test procedure and the EU in December 2018 agreed that by 2030 new passenger vehicles must emit 37.5% less CO_2 compared to 2021 (Reuters, 2018).

Concerning public procurement, the Clean Energy Directive (2009/33/EC) intends to support the sale of efficient vehicles by requiring public authorities, when purchasing vehicles, to take into account the lifetime environmental impacts of the vehicles. However, by focusing on energy savings, the directive

has failed to promote RE powered vehicles and instead has incentivised the purchase of diesel vehicles (Dance, 2018).

Furthermore, the 2009 Renewable Energy Directive (RED) requires that by 2020, 10% of transportation fuel is from renewable sources. The proposal for the post-2020 period (RED II) increases this target to at least 14% by 2030, mostly affecting the use of biofuels. However, to reduce the environmental impacts of biofuels, RED II increases the use of advanced biofuels and phases out crop-based biofuels.

4.3.2 Prosumers and transport

The legal framework regarding car emissions is important for prosumers in the sense that it will trigger investment decisions. If Electric Vehicles (EVs) become the first choice due to obligations, reduced costs or incentives, prosumers will then have additional options for their personal energy management. Prosumers may use their self-produced energy for their EVs, or use the car's battery to store electricity to use it later in their home or as a back-up energy supply. These possibilities, in turn, can lead to an increase in the demand for EVs and hence also more EV models to choose from. Additionally, the adoption of strict emission and air quality standards that incentivises the purchase of EVs can in turn foster EV owners to become prosumers so that they can power their vehicles without increasing their energy bills.

By contrast, if the emission targets for transportation are not sufficiently ambitious to trigger real change in the offerings of car manufacturers,[15] prosumers may not find the EV models that match their requirements concerning performance and price, or the infrastructure may not be sufficiently developed.

EV charging infrastructure may require distribution grid upgrades which should be combined/harmonized with the necessary updates that are needed for distributed generation. Shared car fleets in combination with distributed generation could be used in **Virtual Power Plants (VPPs)** as storage which may be owned or run by cooperatives. As vehicles are shared, this kind of business model may lead to an increase in demand for EVs, and it may lead to an overall reduction of individually owned vehicles – thus potentially the opposite effect to the one mentioned above. Prosumers may be more environmentally conscious and thus open for shared business models (especially if engaged in energy communities) but in cases where they have additional benefits from an individually owned EV (as described above), they could also be more reluctant to give away their personal car. This requires further investigation to determine the real effects. The changes that the automotive sector is facing are potentially so significant that it is extremely complicated to predict the markets a decade from now.

The development of autonomous vehicles may also lead to a very significant reduction in the total number of vehicles. This is as owning a car may no longer have advantages with respect to costs and convenience. Autonomous vehicles could be driving all of the time (except for when being charged). This would reduce the potential for **Vehicle-to-grid (V2G)** services as those can only be used when vehicles are not moving. However, the timing and length of charging times could be managed in such a way that charging only occurs at times when there is a lot of RE power available. V2G services may be

[15] The currently discussed 30% reduction target for 2030 below the 2020 values can be considered a weak compromise

provided when demand for mobility services is low or at times when the prices for V2G are higher than the prices for mobility services.

4.3.3 Conclusions and policy recommendations

Policymakers should phase out conventional transport fuels and incentivise EVs to couple the energy and transportation sector through prosumers. Considering the magnitude of emissions that come from cars, and the fact that EVs only comprise 1.4% of the EU fleet (EEA, 2018), the EU's new emission reduction target for 2030 of 37.5% compared to 2021 may still not be sufficiently ambitious enough. In addition, the EU should consider the adoption of further policies to increase the share of EVs, such as establishing mandatory quotas and ensuring strong consumer-based incentives.

The effective coupling of the prosumer model with EVs requires more investment in R&D to be able to maximise the role of cars in the energy management of households and neighbourhoods. Otherwise, prosumers may not have a sufficient choice of EV models or of available technological options to charge their vehicles efficiently and cost-effectively.

Finally, policy should foster the upscaling of V2G services as the possibility of selling excess electricity from cars to the national grid will incentivise both the prosumer model and the uptake of EVs. However, since V2G services can significantly shorten battery longevity, more investment is needed in upgrading the efficiency and reducing the environmental impact of batteries.

4.4 Industrial development

4.4.1 Frameworks

In 2018, the Commission proposed its Energy Union objective of achieving emission neutrality by 2050 (EC, not dated b). The **European Fund for Strategic Investments** (EFSI), one of the three pillars of the Investment Plan for Europe, is set to be key in financing the transition to a net zero economy. The EFSI aims to reserve at least 40% of its funded projects to contribute to the goals of the Paris Agreement. As of November 2018, EFSI has mobilised €15 billion in additional investments in the environment and resource efficiency sectors, while about €136 million of the European Structural and Investment (ESI) funds are to have been invested in the transition to a low-carbon economy in all sectors in the 2014-2020 period (EC, 2018a).

The **Digital Single Market strategy** aims to digitalise the everyday-life of consumers, including the consumption of household energy. Digital monitoring of energy consumption is relevant for prosumer models as it can inform both the prosumers and the grid operators on their respective day-to-day energy needs.

The **EU ETS** is relevant for industrial development as it intends to decarbonise the energy and manufacturing industry by placing a cap and a price on CO_2 emissions (see also section 2.4). The **Effort Sharing Decision** (ESD) aim to achieve a 10% GHG emission reduction from non-ETS industries by 2020 compared to 2005. The Effort Sharing legislation follows-up on the ESD by seeking a 30% emission reduction for the non-ETS industries. However, while reduction targets can incentivise RE uptake, these

emission targets are not ambitious enough to decarbonise the sectors, nor are they in line with the goal of achieving net zero emissions by 2050 (Ambel, 2018, p.23).

4.4.2 Prosumers and industrial development

The EU policy strategies relevant to industrial development aim to—among other actions—enable funds for the transition to a low-emission economy and thus they could potentially boost the prosumer model. However, there exists a lack of obligations or incentives for manufacturers to consume energy from renewable sources. One way in which countries aid industrial development, competitiveness and job creation is by enabling energy-tax exemptions on high-emitting companies. For instance, while the **European Energy Taxation Directive** requires minimum levels of taxation on fossil fuel-based energy products, carbon-intensive manufacturers in Germany can apply for tax-exemptions. The German state refunds eligible manufacturers up to 90% of the taxes they paid minus the amount of reduced employer contributions to the national retirement insurance system (The Institute for Industrial Productivity, not dated).

As a result, households pay proportionally higher energy bills than high emitting companies. However, if manufacturers were equally billed, the energy cost for households would go down, and thus this would disincentivize consumers into becoming prosumers. Nevertheless, to reach a net zero economy by 2050 it is essential that all industrial sectors are fully powered by RE. Thus, EU countries must end tax-exemptions for fossil fuel energy consumption, establish ambitious minimum requirements on RE consumption per sector, and incentivise the prosumer model for manufacturers. The EU ETS price on carbon is an additional policy measure that intends to decarbonise part of the industrial sector. However, it's long-standing low price and its free allocation of allowances to prevent carbon leakage has resulted in it failing to trigger a fuel switch in carbon-intensive companies.

Ultimately, countries will choose between continuing the current big energy utility model or facilitating the growth of the collaborative prosumer model. States should effectively ensure "clean energy for all" – a right that is often violated within the utility model where big energy corporations have a crucial influence on the electricity bill. In fact, many EU member states continue to support carbon-intensive energy corporations with fossil fuel subsidies that are hidden within their industrial policies and thus they continue undermine the growth of prosumerism. In 2012, the European Commission estimated that the total subsidies provided to RE amounted to €41 billion (Alberici, 2014), while, fossil fuel subsidies within the EU countries are above €100 billion per year, and the EU itself has recently provided €4 billion per year. Between 2014 and 2016, EU countries have provided coal mines and coal-fired power plants with €3.3 billion and €2.2 billion per year respectively (Gençsü et al. 2017). Germany is the EU country with the largest subsidies to the coal industry. Though most coal mining subsidies are meant to create a smooth transition from mining activities, there is still substantial support for the continued operation of coal mines. For instance, Combined Aid in North Rhine Westphalia supports the sale of coal from hard coal mines to electricity and steel manufacturers. This subsidy amounted to €18.6 billion between 2005 and 2014 (Whitley et al. 2017).

Regarding support to oil and gas, between 2014 and 2016, EU countries have supported oil and gas production with €7.3 billion in public finance and fiscal aid, while energy-intensive companies benefited from €15 billion in budgetary support (Whitley, 2017).

Furthermore, between 2013 and 2017, the European Investment Bank directly disbursed €11.8 billion to fossil fuels, the majority for gas infrastructure. Besides, in 2018 the bank channelled more than €2.4 billion into the Southern Gas Corridor, despite many concerns over corruption, human rights abuses, and a significant climate impact (CEE, Bankwatch Network, 2018).

On the other hand, the RE market in the EU has historically increased due to support schemes, such as Feed-in tariffs. However, the European Commission wants to eliminate support measures to the RE industry because it considers that it is capable of competing within the free market (Talus et al., 2017). In consequence of the lingering support to RE sector compared to the fossil fuel energy sector, 98 per cent of the energy subsidies committed by EU countries between 1998 and 2040 are fossil fuel subsidies, while only 0,5 per cent are subsidies to the RE sector (Greenpeace Europe, 2018).

4.4.3 Recommendations

The EU should fully support the prosumer model within industries to effectively incentivise industries to invest in RE and EE. This implies that EU countries should not exempt industries from paying taxes on carbon-intensive energy and they should divert the financial support that is currently available for carbon-intensive energy production towards RE production and EE measures.

To indirectly benefit prosumers by supporting RE investment more broadly, policymakers should work on raising the carbon price – either through a significantly higher price within the EU-ETS, more ambitious emissions targets for non-EU ETS sectors, or through (additional) national carbon pricing. However, carbon pricing should be accompanied by trade measures, such as a border tax adjustment on emissions to avoid imports from countries with less stringent carbon regimes.

For energy-intensive industries that are located in countries with insufficient renewable resources, the costs for energy supply could increase. To prevent these energy-intensive companies from relocating to countries with less stringent climate policies ("**carbon leakage**"), these companies could be supported when they carry out additional investments in energy-efficient technology, own RE-based generation capacity for self-consumption, or purchase renewables in direct off-taking agreements. In the worst case, some companies may have to relocate to regions with abundant renewable resources, but so long as this relocation happens within Europe the overall socio-economic impacts should be manageable.

5. Social affairs

5.1 Energy Poverty

5.1.1 Definition and explanations

According to the **European Energy Poverty Observatory**, energy poverty is a distinct form of poverty where households experience inadequate levels of essential energy required for warmth, cooling, lighting and to power appliances "*due to a combination of high energy expenditure, low household incomes, inefficient buildings and appliances, and specific household energy needs*" (EPOV, 2018). An estimated 50 million households experience energy poverty in the EU (idem.).

Despite this, there is no EU-wide official indicator regarding energy poverty. There is, however, a broad consensus acknowledging energy poverty as a rapidly growing reality in the EU since the 2008 economic crisis. In Spain, about 29% of the population is at risk of energy poverty (ACA, 2018). In Portugal between 22% and 29% of the population is at risk of energy poverty (Simoes et al., 2016). In the mountainous areas of Greece, 90% of households are vulnerable to energy poverty (Katsoulakos, 2014). On the other hand, in Germany, in 2014, 4.2% of households were at risk of energy poverty (Morris, 2016).

The two main policy options to alleviate energy poverty are income assistance and improving the energy efficiency of households. The latter is more effective as it reduces energy consumption and it brings multiple benefits, including less money spent by governments on healthcare, reduced air pollution, better comfort and wellbeing, and improved household budgets.

5.1.2 Energy Efficiency Legislation and energy poverty

The main EU instruments currently affecting the energy efficiency of buildings are the 2018 **Energy Performance of Buildings Directive (EPBD)** and the 2012 **Energy Efficiency Directive (EED)** (EC, 2012/27/EU). Both of these legislations lack any binding obligations that require Member States to implement measures targeting energy-poor or low-income households (LIH).[16] In fact, only 7 out of 30 EU countries[17] have emplaced financial incentives for the adoption of EE measures in low-income households (Ordonez et al. 2017). The significance of this is that EU obligations regarding energy efficiency and the renovation of buildings do not take into special consideration the people who are most vulnerable to energy poverty.

However, Article 7 of the EED requires Member States to prioritise households that are affected by energy poverty when fulfilling their energy efficiency obligations. Hence, if the current proposal is adopted, EU countries will have to take into account energy-poor households when enforcing the EPBD target regarding the transformation of the building stock into NZEBs by 2050. Naturally, member states must also comply with their national obligations on energy poverty that may be more stringent than the EU obligations.

5.1.3 Prosumers & Energy Poverty

The growth of prosumerism without socially-inclusive measures can have a negative impact on energy-poor households. Without specific support measures in place, how income households cannot afford to invest in PV systems. Also, with the growth of prosumerism, LIHs may suffer higher energy bills as grid consumption declines while maintenance costs remain the same. Hence, public finance that is allocated to tackle energy poverty should prioritise energy efficiency.

However, in the medium and long-term, public financial support for prosumerism in LIHs can play a role in reducing energy poverty, and poverty in general. By becoming prosumers, the energy bills of families may be stabilized and they may be protected against increases in electricity rates. This is as self-produced electricity has become cheaper than buying electricity from the grid in many jurisdictions (Flaute et al. 2017). A high energy price is the principal issue regarding the rise of energy poverty. For instance, in

[16] LIH: earning less than 60 % of their respective national median equivalised disposable income
[17] Belgium, Germany, France, Ireland, Latvia, Slovenia, and the United Kingdom

Spain, since 2008 the energy bill has increased by 49% (Intereconomia, 2018), while the minimum wage has only increased by 22.65% (INE, 2019). In consequence, LIH show heating consumption levels much below the normal thresholds (Rodríguez, 2018).

The principal barriers preventing energy-poor families from becoming prosumers is their lack of economic capability to invest in RE systems and their lack of ownership of a roof-top. A collaborative solution around this obstacle is for prosumers to virtually-share their production to energy-poor households. Within this model, prosumer initiatives sell their excess energy to low-income households at a moderate price. In addition, governments can put in place RE systems in public buildings and they can provide excess energy from these systems to energy-poor households. In line with, Greenpeace Greece has proposed the EU government install roof-top solar PV systems on all of the public buildings of the EU member states, and that they allow the earnings gained from excess energy production to be used to reimburse hundreds of thousands of households that qualify for the **Social Energy Tariff** (SET). As a result, this project would be a relief to the public budget as it more efficiently tackles energy-poverty than the SET does (Pizzinato, 2018).

In all, supporting prosumer energy for energy-poor households can ameliorate public health as low-income families will have more resources available for healthcare, food, and education. However, despite these potential co-benefits, the current agreement for the upcoming RED II does not enable support schemes to go to prosumer initiatives for vulnerable families.

Nevertheless, as mentioned earlier, measures aimed at improving the energy efficiency of energy-poor households must be the first step taken before promoting prosumerism to tackle energy poverty.

5.1.4 Recommendations

Policy-makers must consider the potential distributive effect of EE and RE measures. If policies are not designed that prioritise energy-poor households, and supporting LIHs, they may not be effective in reducing energy poverty. Thus, EE measures and support schemes for prosumerism should be accompanied by measures ensuring affordable energy bills for all people.

Regarding prosumer initiatives, the negotiations on future policies should take into account the European Economic and Social Committee's opinion that "*the benefits of prosumer energy should be applied in an active policy of reducing energy poverty and protecting particularly socially vulnerable groups*." (European Economic and Social Committee, 2017 p.46). Following this line of thinking, states should facilitate the virtual sharing of prosumer energy for energy-poor households. By doing this, states engage in a win-win situation of tackling energy poverty while increasing the share of RE.

Furthermore, the 2018 EPBD requires that there be a rapid upscaling of NZEBs and that many public buildings will have on-site RE production. Governments should virtually donate the excess energy produced by these public buildings to energy-poor households.

5.2 Employment

5.2.1 Frameworks

EU labour law sets broad minimum standards for working and employment conditions and for informing and consulting workers. Member states have the competence of legislating on the different sectors, where they must at least meet the broad minimum EU labour law standards or set higher standards (EC, 2018). EU labour law generally applies to all industries, and thus there is no specific labour policies regarding the RE industry.

European Employment Strategy (EES) (EC, 2018a): The European Employment Strategy (EES) constitutes part of the Europe 2020 growth strategy. It is implemented through the European Semester, an annual process that promotes close policy coordination among EU Member States and EU Institutions. The EES employment target is for 75 per cent of people to be employed by 2020. The prosumer model supports the EU employment target as the structural change from carbon-intensive industries to RE ones are contributing to an overall growth of employment across the EU (Makandya, 2015).

5.2.2 Prosumers & Employment

According to a report of EurObserv'ER (2017) in 2016 the renewable energy sector employed over 1.4 million people across the EU.[18] Employment in the renewable energy sector is influenced by a large number of factors, including falling technology costs, changes in labour productivity, corporate strategies, industry restructuring, industrial policies to enhance domestic value creation, and market developments in renewable energy. Solar photovoltaics (PV) are the largest employer, primarily because installations of solar PV has dominated new renewable energy installations by a large margin. These PV jobs have been followed by jobs in biofuels, large-scale hydropower, wind energy, and solar thermal heating and cooling.[19]

The transition towards clean energy might leave some workers who have traditionally worked in the energy sector to become unemployed. The non-renewable energy sector and its workers might be negatively affected by the increase of renewable energy sector-related jobs. Prosumers, as well as the RE sector in general, contribute to the energy transition and thus also to the potential loss of jobs in the non-RE sectors.

On the other hand, this may not be the case if they are trained properly and companies adjust to renewable energy requirements. Training programs have a role to play in the transfer of the workforce from the conventional energy industry to the RE industry, as both industries often require similar skills. For instance, short-term programmes can effectively train electricians to become PV installers, while engineers may need a longer training period (ILO, 2017). It is also important that prosumer initiatives

[18] This figure includes energy from biogas, biofuels, and solid biomass. The report acknowledges a decrease of jobs in the solar sector; For global RE employment data see: Sawin J.L. et al. (2018).
[19] Solar photovoltaics (PV) was the largest employer, primarily because installations of solar PV dominated new renewable energy installations by a large margin. This was followed by jobs in biofuels, large-scale hydropower, wind energy, and solar thermal heating and cooling. Global employment in solar PV was estimated at 3.4 million jobs in 2017, 9% higher than in 2016. (REN21, 2018)

propose solutions on how the people who are losing jobs in non-RE sectors can find employment in the RE sector.

Prosumer projects of all sizes require skilled workers to install, operate, and maintain their RE technology. Hence, the growth of prosumerism is an opportunity for transferring the workforce from the fossil fuel sector to prosumer initiatives. In addition, prosumerism is more beneficial to the local economy—and thus employment—than external large-power utilities are, because with prosumerism the energy expenditures stay within the local community (Masera, 2015).

The workforce of the RE industry in general, and of prosumer projects in particular, is less organised or unionised then the conventional energy industry, something which leads to them having a lower visibility to governments and in the media. In the absence of an organised workforce, thousands of prosumer-jobs can silently disappear. For instance, some estimates indicate that after the 2008 crisis, the Spanish RE sector lost close to 20,000 direct jobs between 2007 and 2013 and did so without any consideration or coverage by the media (Bolaños, 2013). On the other hand, the workforce of the Spanish mining sector—currently at 6,700 jobs—have repeatedly organised and been effective in slowing the closing down of active mines (Planelles, 2018).

More broadly, the long-standing state-level subsidies to the fossil fuel industry (see section 4.4.2) undermines employment in the RE industry and thus also prosumer initiatives. Hence, if EU countries divert the current support to fossil fuels to the RE industry and prosumer initiatives, it would result in a considerable amount of long-term RE and prosumer-related jobs.

5.2.3 Recommendations

At the policy level, as there is no EU sector-specific labour law, the EU and its members can implement actions that indirectly increase employment in the RE industry and prosumer initiatives. The EU and its members must phase-out fossil fuel production sites while ensuring that the energy industry collectively supports the transition of its workforce to the RE industry, including to prosumer RE sites. Re-training programmes supported by the government are essential for implementing this task. As many fossil fuel companies might inevitably close, the EU, national authorities, the RE industry, and prosumer initiatives, should collaborate with the communities affected by the energy transition to ensure a sustainable future for such communities.

While decision 2010/787/UE, meant to drive the phasing-out of fossil fuels, conditioned subsidies for the closing of mines by the end of 2018, it also entailed the extension of mining activity. Hence, the EU and its members should ensure that any remaining subsidies to the fossil fuel industry are solely for the phase-out of fossil fuels, most importantly, the transfer of the workforce to the RE or other sustainable sectors.[20]

At the same time, prosumer initiatives should organise themselves and constitute a joint force that effectively protects the renewable industry and its jobs. National and European associations of renewable energy cooperatives, such as REScoop are thus important stakeholders to counter possible backlashes of the energy transition.

[20] More on social inclusion: http://ec.europa.eu/social/main.jsp?langId=en&catId=1

5.3 Women & Energy

5.3.1 Frameworks

Strategic engagement for gender equality 2016-2019 (Whitley et al. 2017): The European Commission published this strategy in 2016, building on the Commission's 2010-2015 strategy for equality between women and men, in which it focused on the following 5 priority areas:

- increasing female labour market participation and the economic independence of women and men
- reducing the gender pay, earnings and pension gaps and thus fighting poverty amongst women
- promoting equality between women and men in decision-making
- combating gender-based violence and protecting and supporting victims
- promoting gender equality and women's rights across the world

In particular, "Integration of a gender equality perspective into all EU activities and policies" includes the preparation, design, implementation, monitoring and evaluation of policies, legal measures and spending programmes, i.e. gender mainstreaming. This means assessing the impact of EU actions on both women and men and taking responsibility for any readjustment necessary, so that women and men benefit equally and that inequality is not perpetuated. Energy is mentioned as one of the sectors were gender equality should be present.

Gender equality in the labour market: The Directive "Implementation of the principle of equal opportunities and equal treatment of men and women in matters of employment and occupation" (Directive 2006/54/EC) includes objectives that the European labour market should set in terms of gender equality. Some of the topics mentioned in the Directive are "Equal treatment in occupational social security schemes" (Chapter 2) such as "Prohibition of discrimination" (Art. 5), "Flexible pensionable age" (Art. 13), "Equal treatment as regards [to] access to employment, vocational training and promotion and working conditions" (Chapter 3) or "Gender mainstreaming" for which "Member States shall actively take into account the objective of equality between men and women when formulating and implementing laws, regulations, administrative provisions, policies and activities in the areas referred to in this Directive" (Art. 29).

5.3.2 Prosumers & Women

According to the International Center for Research on Women, economic empowerment is when a woman "*has both the ability to succeed and advance economically and the power to make and act on economic decisions*" (Golla et al., 2011, p.4) Therefore, dimensions of employment that signify value and advancement, such as earned income, hours worked, class of work, job security, working conditions, and opportunity for advancement are to be taken into consideration (O'Dell, Peters, Wharton, 2014).

The International Energy Agency claims that the energy sector remains one of the least gender diverse sectors and that closing this gender gap will be vital as women are key drivers of innovative and inclusive solutions (Tam, 2018). According to the IEA Technology Collaboration Programme on Clean Energy and

Empowerment (C3E) (International Energy Agency, 2018), without engaging women, countries are leaving half of the potential energy workforce out of the talent pool.

Enable.eu[21] conducted a non-statistical qualitative study that explored the social, cultural, and gender aspects of households' energy choices in relation to becoming prosumers in Italy, Norway, Serbia, The UK, and Ukraine. The research found that in all these countries, men were the ones with the initiative in becoming prosumers. In general, men took responsibility for the whole process concerning the installation and maintenance of the RE system. A recurrent finding within the study that helps explain the male-dominant role in residential prosumerism is that men show more interest in the technical aspects of RE technology. The study found only a couple of exceptions where women, that worked in the energy sector, took the initiative to become prosumers (Standal et al., 2018).

The International Renewable Energy Agency (IRENA) estimates that women only comprise about 35% of the workforce in the RE sector. Nevertheless, the female workforce in the RE sector is significantly higher than in the conventional energy sector, where only 20-25% of all employees are women (Standal et al., 2018). Furthermore, the study finds that the media feeds the perception of PV systems area masculine technology by unequally representing genders participating with PV technology. The study also highlights that the average prosumer is an educated 40-year-old male with high to middle income. The fact that women have less financial autonomy than men due to lower wages is another obstacle for women to lead the initiative to becoming a prosumer household.

Hence, despite the lack of robust statistical data, the qualitative evidence shows that the longstanding male dominance within sectors concerning science, technology, engineering, and mathematics (STEM) has also led residential prosumerism to be dominated by men.

5.3.3 Recommendations

Policies aimed at eliminating the gender salary gap facilitate women to participate in prosumer initiatives. Support-schemes, such as FITs and tax-breaks, are also important to support women and low-income households to become prosumers. Countries should further strengthen policies aimed at increasing the presence of women within STEM sectors in order to allow women to take the initiative to become prosumers.

The energy industry and governmental authorities should promote RE technology and prosumerism in a manner that represents women engaging with RE technology. Furthermore, promotional campaigns should insist on the wide-range of benefits in becoming a prosumer to catch the attention of all genders. Prosumer initiatives can also adopt quota schemes to ensure a certain level of gender-parity within their workforces.

[21] Enable.eu is an EU funded project.

6. Data Security and Protection

6.1 Definition and explanation

The **European Charter of Fundamental Rights** stipulates that EU citizens have the right to protection of their personal data. According to the European Commission, personal data is any information that relates to an identified or identifiable living individual. Different pieces of information, which collected together can lead to the identification of a particular person, also constitute personal data (EC, not dated). Personal data that has been de-identified or encrypted but that can still be used to re-identify a person, remains personal data and falls within the scope of the law. Personal data that has been rendered anonymous in such a way that the individual is not identifiable is no longer considered personal data. For data to be truly anonymised, the anonymisation must be irreversible.

General Data Protection Regulation (GDPR): The General Data Protection Regulation (GDPR) (REGULATION (EU) 2016/679) protects personal data regardless of the technology used for processing that data. It is technology neutral and applies to both automated and manual processing, provided the data is organised in accordance with pre-defined criteria (for example alphabetical order). This Regulation aims at the protection of natural persons in relation to the processing of personal data and the free movement of such data. It came into force on 24 May 2016 and has applied since May 2018. This Directive is based on the Directive on the protection of personal data (Directive 95/46/EC), and it currently constitutes the core legislation governing the processing of personal data.

Data subject rights included in the Regulation that could be interesting for prosumers include the right of access, the right to erasure ('right to be forgotten'), the right to data portability to another controller, data protection by design or by default, breach notification and the appointment of Data Protection Officers (DPOs) for those controllers and processors whose core activities consist of processing operations which require regular and systematic monitoring of data subjects on a large scale (which would be the case for many prosumer applications).

Smart grids: Smart grids are energy networks that can automatically monitor energy flows and that can adjust to changes in energy supply and demand accordingly.[22] When coupled with smart metering systems, smart grids reach consumers and suppliers by providing information on real-time consumption. With smart meters, consumers can adapt – in time and volume- their energy usage to different energy prices throughout the day, thereby saving money on their energy bills by consuming more energy in low price periods. Smart grids can also help to better integrate renewable energy. Combining information on energy demand with weather forecasts can allow grid operators to better plan the integration of renewable energy into the grid and balance their networks. Smart grids also open up the possibility for prosumers to respond to prices and to sell excess energy to the grid.

The General Data Protection Regulation (GDPR) contains the provision of a Data Protection Impact Assessment (DPIA) (REGULATION (EU) 2016/679) Article 35) for smart grid and smart metering systems. This, written by the main stakeholders of the smart grid sector, has been created by taking into account the opinions of data protection authorities and energy regulators. It is aimed at those investing in smart

[22] See https://ec.europa.eu/energy/en/topics/markets-and-consumers/smart-grids-and-meters

grids so that they can identify and anticipate risks to data protection, privacy and security. It also recommends safeguards in proportion to these risks.

Smart Grid Task Force: The Smart Grid Task Force was set up by the European Commission to give advice on issues related to smart grid deployment and development.[23] It launched a sub-group called "My Energy Data" in 2016 (European Smart Grids Task Force, 2016). "My Energy Data" is the term that has been adopted as a generic description of services to offer customers the possibility of downloading their energy consumption information and to grant third parties access to that information to enable service providers to offer analytical and other services to customers. It aims to get an overview of some of the existing initiatives on data access and data management in the field of energy distribution, to identify possible obstacles for controlled data access and data management, and to explore the potential for and scope of a possible industrial initiative on a common format for energy data interchange at the EU level.

With smart meters being deployed across Europe, data on energy consumption is becoming increasingly available. The development of devices that deploy additional sensors (Internet of Things) will potentially lead to an exponential increase in the possibility to gather data. To fully reap the potential benefits for the energy market and consumers in general, it must be ensured that trusted mechanisms are in place for consumers to access and manage their data.

6.2 Prosumers and data security

As prosumers share data concerning real-time energy consumption and production, their RE systems can be hacked, and thus, naturally exposed to data security issues.

In addition, utility companies must abide by data protection laws to not invade the privacy of prosumers when monitoring the data regarding their energy consumption and production.

However, there is a need of a more robust frameworks that ensures the data security of prosumers that is shared with the support of smart meters and smart grids.

6.3 Recommendations

Developing legal and regulatory regimes that respect consumer privacy in cooperation with the data protection authorities, in particular with the European Data Protection Supervisor, and facilitating consumers access and control over their energy data processed by third parties is essential for the broad acceptance of Smart Grids by prosumers and consumers. Any exchange must also protect the sensitive

The Commission has also produced guidance on data protection and privacy for data controllers and investors in smart grids (Data Protection Impact Assessment Template supported by Commission Recommendation 2014/724/EU. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2014.300.01.0063.01.ENG (accessed 9 January 2019).

business data of grid operators and other players, and enable companies to share smart grids data securely.[24]

An EU common data format and model could allow unified hardware procurement, better alignment and co-operation with foreign partners and with international markets, and facilitate service interoperability: a service developed in one national market could easily be sold in other markets. However, such an approach would require further efforts to establish a joint understanding within the EU in order to protect prosumers.

7. Economic and fiscal policy

7.1 Frameworks

Economic and fiscal policies are not yet harmonised across the EU but coordination does take place and a number of rules do apply[25]. These are crucial for legislative frameworks, especially for the countries that use the Euro as a common currency. Though the EU ensures the coordination of the fiscal policy of its member states, fiscal policy regarding energy, and certainly on prosumer initiatives, is left to the discretion of each country. As a consequence, national fiscal policies on prosumer RE installations, energy storage, grid use, and incentive measures vary significantly across the EU. In addition, municipal taxes, such as taxes applied to businesses and for land transactions are also relevant to large prosumer initiatives.

Nevertheless, RED II ensures that prosumers receive remuneration for the self-generated renewable electricity that they feed into the grid, and that they are generally not subject to any charge for self-consumed energy. Hence, several states that currently do not offer remuneration for excess energy that is fed into the grid will have to update their policies (Chaitan, Huluban & Fortuna, 2018).

7.2 Prosumers and fiscal policy

7.2.1 Taxation

The European Court of Justice ruled that receiving compensation for feeding excess energy production into the grid entails an economic activity, and thus, it is subject to the **Value Added Tax (VAT)** system. Countries have dealt with this issue differently. For instance, Poland and Hungary implemented national laws that generally exempt small-scale prosumers from VAT obligations. In other countries, such as France, Italy, and the UK, RE plants and prosumers are subject to a reduced VAT rate (GfK Belgium consortium, 2015).

VAT normally applies to electricity that is fed into the grid. Between the different regulatory frameworks regulating the sale of excess electricity, net-metering leads to lower VAT costs for the prosumer, as the onsite electricity that is generated is valued equally to that of the grid electricity. Furthermore, net-

[24] Interesting informal overview of the data protection and smart meters: http://eulawanalysis.blogspot.com/2018/03/data-protection-and-smart-meters-gdpr.html (accessed 7 January 2019)
[25] See https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination_en

metering exempts the prosumer from paying volumetric grid taxes and levies for the entire distributed generation production. Thus, with net-metering, non-prosumers pay higher grid costs (Energy Community Secretariat, 2018).

The implementation of the RED II should abolish any discriminatory energy-production taxes on prosumers that are charged by public authorities (RED, 2018/2001/EU, Art. 21 and 22). Energy-production and storage taxes are enforced under the argument of compensating for the decline of revenues from energy taxes due to the expansion of self-consumption. However, such taxes can be a substantial impediment for prosumer initiatives. A seminal case is the abolished Spanish Royal Decree 900/2015, also known as the 'sun-tax.' The so-called 'sun tax' had to be paid on self-consumed electricity (for installations above 10 kW), and hence made prosumerism uneconomical. In addition, small-scale prosumers were confronted with complicated administrative procedures and were not receiving any compensation for the electricity they fed into the grid. Consequently, over the past few years there has been relatively little prosumer development in Spain (Roberts, 2016).

7.2.2 Fiscal incentives

Support schemes, subsidies and tax-breaks have been a seminal incentive for the expansion of prosumer projects. Most notable of these are **feed-in tariffs** (FITs), which are long-term fixed tariffs that are enabled by a level of state subsidisation or by a levy on a consumer's electricity tariff (which is technically not a subsidy as the money does not come from the state budget). EU countries with FITs accounted for 77% of all RES that was installed between 1997 and 2008 (Ragwitz, 2011). In general, however, with the increased competitiveness of RE in relation to fossil fuels, incentives such as FITs are being phased out and are being substituted by tender schemes which are less accessibly for small scale prosumer projects (it should also be noted that fossil fuel subsidies continue to be in place). In Spain, the 2012 Royal Decree-law 1/2012 excluded FIT schemes to all new RE installations. Consequently, the growth of prosumer projects started to decline even before the 2015 Royal Decree-law 900/2015, which included the termination of all FITs. In France, there are FITs available for all types of power installations. In the Netherlands, only companies and non-profits engaging in prosumerism are eligible for FITs (GfK Belgium consortium, 2015, p.54).

Some countries use **Feed-in Premiums** (FIPs). A FIP is a type of price-based policy instrument whereby eligible renewable energy generators are paid a premium price, which is a payment in addition to the wholesale price. In France PV projects of over 100 kW are eligible for an FIP contract. In Croatia, prosumers are eligible for a FIP as long as they obtain the status of 'priority electricity producer' and have a meter calculating the net electricity they feed into the grid. In Belgium, an additional premium is offered to residential prosumers with low-income (GfK Belgium consortium, 2015, p.59).

7.2.3 Policy related to permits

In most countries, there are fees applied to prosumers for access to the grid. These fees are meant to compensate grid operators for their potential/required efforts to ensure a safe connection and sufficient capacity in the grid. These fees are usually regulated. They are fixed in Belgium and Portugal; variable in Bulgaria, Czech Republic, Germany, Croatia, Hungary, Italy and the UK; and are both fixed and variable in France, Slovenia and Spain (GfK Belgium consortium, 2015, p.50).

Furthermore, prosumers may be subject to additional costs for permits concerning the transfer of land and the construction of RE installations. Nevertheless, in Germany, The Netherlands, Portugal, Malta, Slovenia, Spain and Belgium the placing of rooftop household PV systems do not require a building permit. In other states, such as Poland, PV installations require permits though amount to a low one-time expense for the prosumer (GfK Belgium consortium, 2015, p.45).

7.3 Recommendations

The EU and its member states should ensure that fiscal policies contribute to the clean energy transition, where the prosumer model is accessible to all people. In other words, fiscal policy should not add a significant financial burden to people who are becoming prosumers. The right of remuneration for feeding excess energy into the grid in the RED II is an essential step towards making prosumerism more affordable. However, countries should reduce VAT tax rates on power that is fed into the network by prosumers, and they should facilitate tax-breaks and subsidies for the purchase of the RE system and power-storage equipment. In order to incentivise the prosumer model, taxes on electricity should differentiate carbon-intensive electricity from green electricity.

Furthermore, countries should ensure that grid-operators do not impose high fees to access the grid. At the municipal level, authorities should not present obstacles to prosumers in the form of expensive permits and bureaucratic hurdles. In turn, prosumers should be well informed of the different obligations and fiscal incentives that are available. Meanwhile, governments should work closely with prosumers to learn about any existing unnecessary fiscal obstacles.

8. Trade and international affairs

8.1 Frameworks

International trade and investment law can have a significant impact on RE development and the expansion of prosumerism. The main frameworks to consider are the relevant treaties of the **World Trade Organisation** (WTO), the **Energy Charter Treaty** (ECT), and the specifics of free trade and investment agreements, such as the **Comprehensive Economic and Trade Agreement** (CETA).

The **WTO**, with 164 members, is the main body that regulates and promotes international free trade. WTO law, most notably the 1994 **General Agreement on Tariffs and Trade** (GATT), sets the basic rules used within all bilateral and multilateral agreements on trade. The principle of non-discrimination, which aims to ensure equal treatment towards imports regardless of origin and between imports and domestic goods and services, is the foundation of WTO law, and in consequence of international trade law.

The **ECT**, with 54 members, is the main treaty covering all commercial aspects of the energy industry, including trade, investments and energy efficiency. Its rules regarding international investment are relevant as they protect foreign investors from political decisions.

On the other hand, free trade agreements, such as **CETA**, while they are built on WTO law, are essential to consider as their investor-state dispute settlement mechanisms (ISDM) can significantly shape national energy policies.

8.2 Issues

Two trade-related policy instruments which affect prosumer initiatives are **national incentives** - contingent to **local content requirements** (LCRs) of RE production - and **import duties** on foreign RE technology. Both of these policy instruments have been historically present in RE deployment programs. For instance, Denmark and Germany were early adopters of subsidising wind energy projects that had significant local content and in imposing customs duties on foreign assembled wind turbines (Delimatsis, 2016, p.120). The argument behind protectionist policies, such as LCRs and customs duties on RE materials, is that they enable job creation, revitalise local economies, and result in a higher RE deployment (Kuntze & Moerenho, 2013, p.6). The Danish experience of ensuring local ownership of RE farms illustrates that legislation which ensures local control over energy production is important for the expansion of prosumerism (Bauwens, 2016, p.140).

The question of whether there is an environmental benefit in adopting policies that favour local RE actors is an ongoing debate. For instance, while a FIT scheme without a LCR may result in foreign corporations undermining the development of local prosumers, it also may lead to more RE generation. On the other hand, import restrictions on foreign solar PV panels—such as was the case with the EU's import duties on under-priced Chinese PV panels from 2013 to 2018—favours the local PV industry but it also undermines the development of prosumers as the price of PV panels are higher than they would be without the import duty. Ultimately, the effect on RE development, and specifically on prosumers, depends on the details of the policy design.

Nevertheless, international trade law restricts the use of import duties, LCRs, and it may affect support schemes in general regardless of their LCR. International trade law is primarily composed of rules set out in the agreements of the World Trade Organisation (WTO). In fact, most of the EU's multilateral trade agreements are coordinated through the WTO and follow WTO law (Carleton University, 2019). Furthermore, many international trade agreements include provisions protecting foreign investment on natural resources, most notable of which is the Energy Charter Treaty (ECT). Protecting investment on fossil fuels can indirectly affect the scaling up of prosumerism as the continued use of fossil fuels slows down the demand on RE in general.

The **EU's trade and investment policy strategy communication** 'Trade for all' (adopted in 2015), includes the intention of updating trade agreements to take into account new economic realities; increasing the transparency of trade agreements; and supporting sustainable development and human rights (EC, 2016, p.7). Following this strategy, references to climate change commitments have been included in a number of the EU's bilateral and multilateral trade agreements, such as in the EU-Japan Economic Partnership Agreement. However, the 'Trade for All' strategy does not tackle the trade of fossil fuels nor fossil fuel subsidies. Besides this fact, it insufficiently promotes RE, tackles LCRs, and does not support prosumers (T&E, 2017).

8.3 Prosumers and International trade and investment law

8.3.1 World Trade Organisation

Support instruments with LCRs likely breach the national treatment principle, which is one of the pillars of the WTO agreements. For instance, both *Canada Renewable Energy* and *India Solar cells*, were found

by the Appellate Body of the WTO to have their minimum LCR of their respective FIT schemes as being in violation of the national treatment principle embedded in Article 3 of the General Agreement on Tariffs and Trade (GATT) (Bodanski, Brunnée & Rajamani 2017, p.344-345). However, a support scheme with a LCR may still be compatible with the GATT if it can be justified under one of the exception clauses of Article XX. Article XX of the GATT enables the possibility of justifying measures that do not comply with the general obligations of the agreement on the grounds of health, safety, the protection of natural resources and other matters. The defendants, that is, *Canada—Renewable Energy* and *India—Solar cells*, both failed to meet Article XX, as remarkably, neither attempted to justify their schemes under one of the exceptions regarding environmental grounds.

On the other hand, a FIT scheme or other support measures for RE production may breach the Agreement on Subsidies and Countervailing Measures (SCM) of the WTO, regardless of if they possess a LCR or not. While subsidies contingent to LCRs likely breach the SCM, subsidies with no LCRs may also be prohibited if they benefit specific enterprises and adversely affect another state. Hence, a state may challenge the FIT scheme of another member state if it affects its national RE producers. Alternatively, the affected country can impose countervailing measures to balance the effect of the foreign FIT on the national RE market. Therefore, subsidies benefiting prosumers in one country may be challenged by another affected country.

Despite the common practice of states supporting fossil fuel energy production contingent to LCR, there are no related WTO cases. In fact, in general, member states have filed 9 complaints concerning RE subsidies, though the *EU—Energy Package* has been the only dispute regarding fossil fuel subsidies (Pereira, 2017). The absence of disputes regarding fossil fuel subsidies is alarming when considering that the costs of global fossil fuel subsidies amounted to $5.3 trillion in 2015 alone (Verkuijl, 2017, p.19). There are possible legal and political factors that explain the lack of WTO cases concerning support schemes for carbon-intensive industries regardless of the fact of if they are contingent to LCRs. Some legal factors may be that most fossil fuel subsidies are non-specific, and are provided on the consumption side, thus they are permitted by the WTO. Furthermore, even when a subsidy is directed at specific enterprises, the often highly distorted energy markets make it difficult for the complainant to demonstrate 'adverse effect' as required by the SCM (De Bièvre, Espa, Poletti, 2017). Concerning political factors, since subsidizing fossil fuels is a common practice globally, members may be hesitant to file a complaint to the WTO due to fear of retaliatory measures. Furthermore, fossil fuel industries have more resources to lobby than RE industries do (Marhold, 2017, p.10).

Another trade-related policy matter that can affect prosumers is the placing of a carbon tax on fossil fuels, including one on imported energy. If a country imposed a border tax adjustment on the carbon content of imported carbon, it would, in theory, be compatible with WTO rules as long as all carbon-intensive energy would be taxed evenly without discriminating based on its origin (domestic or foreign). Nevertheless, it is plausible that affected countries would emplace countervailing measures, which would stand until the resolution of the dispute.

8.3.2 Energy Charter Treaty

Countries may prefer to initiate disputes within a more specific platform, such as the Energy Charter Treaty (ECT). The investor-state dispute settlement (ISDS) mechanisms of the ECT allow investors to seek compensation from governments if their policies affect their businesses. For instance, in 2009, the

German government had to pay €1.4 billion in compensation to the energy giant Vattenfall, and had to relax environmental restrictions on coal-fired power plants. Furthermore, despite the Italian Parliaments ban on new oil and gas operations near its coast, in 2017 the fossil fuel company Rockhopper sued Italy on the grounds of loss of future profits for refusing a permit for off-shore oil drilling in the Adriatic Sea (Eberhardt, Olivet & Steinfort, 2018, p.14). Therefore, the ECT disincentives governments from limiting fossil fuel extraction, and thus, limits the expansion of RE deployment, indirectly affecting the scaling up of prosumerism.

8.3.3 Free Trade Agreements: CETA

In 2017, The EU and Canada provisionally enforced CETA, awaiting ratification by EU legislators that was to follow the upcoming decision of the European Court of Justice on whether CETA's investor-state dispute system (ISDS) is compatible with EU law. CETA´s dispute system allows for investors to sue countries, though not vice-versa. This has brought much criticism as corporations could potentially prevent states from implementing laws that affect their profit expectations. Furthermore, provisions regarding the ISDS do not prevent the lowering of national environmental standards. Thus, as the prosumer model is a potential threat to carbon-intensive multinational corporations, CETA may entail a drawback of regulations that promote prosumerism. The EU and Canada have reacted to the criticism by creating a permanent and more transparent Investment Court System (ICS). The details of the functioning of the ICS are still under negotiation, though the EU alleges that the ICS will limit the grounds on which an investor can challenge a State, and that it will prevent public bodies from being forced to change legislation or pay damages (EC, 2017).

8.4 Recommendations

Governments should work to make international trade and investment law more supportive of the energy transition, to phase out fossil fuels, to scale up RE deployment, and to protect prosumer initiatives.

At the WTO level, governments perhaps would be less hesitant to support RE production and tackle fossil fuel production if Article XX of the GATT agreement included an exception on the grounds of reducing GHG emissions in line with the Paris Agreement. The WTO should specifically tackle fossil fuel subsidies, as these are hampering the transition to sustainable energy. Hence, the SCM should first, strengthen the notification and transparency obligations concerning fossil fuel subsidies of member states (De Bièvre, 2017), second, prohibit fossil fuel subsidies, and third, potentially allow LCRs for RE subsidies to support prosumers.

Countries should restrain from signing trade and investment agreements, such as the ECT, that discourage countries from limiting fossil fuel extraction. Alternatively, the ECT's ISDS should actively support the transition to sustainable energy and hence prioritise the interests of the people rather than corporate profits.

Free trade agreements must actively support the transition to clean energy, limit the influence that large multinational corporations have on national policies through the ISDS and ensure the protection of the prosumer model. Specifically, the EU should aim at trade that enables accessible RE technology for all and that prevents dumping measures that threaten national RE manufacturing industries.

It is also a strategic question of national energy security, that is, if the energy system should be in the hands of the citizens or if it should be in the hands of big utility companies and open to foreign investors. In general, it is easier for foreign investors to buy (shares of) utilities than it is for them to take over shares in prosumer-led companies.

9. Education

9.1 Frameworks

The energy transition requires a considerable number of skilled workers to build and operate the energy generation infrastructures. However, several assessments suggest that there may be skill shortages for the achievement of ambitious national RE targets (Cox, Royston and Selby, 2016). The EU has adopted a number of policy actions aimed at increasing the number of STEM workers. For instance, within the New Skills Agenda for Europe, the Commission has asked member states to develop national digital strategies to support the training, upskilling, and re-training in the workforce. The Commission financially supports the achievement of these national strategies through a diversity of funds (EU Commission, 2017).

The energy transition also entails the digitalisation of the energy systems. Already in 2013, the Commission developed the Digital Competence Framework. This framework aims at boosting citizens' digital competences (Kounelis, 2017).

The Strategic Energy Technology Plan (SET-Plan), the technology pillar of the EU's energy and climate policy, aims at transforming the energy system in the EU, following the EU 2020 and 2050 targets. Besides, the SET-Plan has set a roadmap on education and training, which addresses the human resource challenge for the energy research and innovation sector. It puts forward recommendations for education and training programs to ensure the supply of trained human capital for the energy transition (European Commission, 2019).

9.2 Prosumers and Education

Education policies are essential for promoting RE education among all people and ensuring the supply of technical staff required to operate the RE infrastructures. Existing policies have mainly resulted in different projects that aim at increasing the coverage of sustainable energy in higher education, such as the Knowledge Centre for Renewable Energy Jobs, which facilitates the collaboration between universities, governments, and industries to close the skill gap in the RE sector.[26]

There is a lack of policies that result in RE education to the general population—and that, therefore, would promote the adoption of prosumers—for instance, by requiring RE education in early school years, as well as within tertiary education that leads to careers that are related to the energy transition, such as architecture. Policies can further educate and incentivise the general population to become prosumers and RE-literate through different types of campaigns that target people beyond students, such as by local conferences.

[26] See http://www.knowres-jobs.eu/en/About-KnowRES/Overview/

Furthermore, there is a lack of policies that directly aim at training and educating prosumers.

On the other hand, prosumers—especially when organised in energy cooperatives—are key actors in training their members, raising awareness and expanding renewable energy education within local communities. This process results in the broader acceptance of RE deployment. For instance, in Lochem, the Netherlands, the local government sponsored the creation of a prosumer cooperative. In turn, the cooperative has, not only facilitated RE to local residents but also trained them to become energy coaches, which in turn further raises awareness in the local community (Luyts, 2014).

9.3 Recommendations

To expand the development of prosumerism, the EU must develop robust policies that aim at improving the energy literacy of all people. The energy transition needs an education strategy at all levels that promotes energy savings, the change of consumer habits, and the importance of prosumerism. A first step would be to develop guidelines concerning the integration of RE education in primary, secondary, and tertiary education. As national and often subnational government have power over curricula content in primary and secondary school, they could effectively implement such guidelines, while they would have to agree with higher education institutions and work within the Bologna process to increase RE education within the different careers (van Lersel, Petrick, van Breevoort, 2010).

Governments at all levels can further promote RE education to the general public through awareness campaigns, seminars, conferences, and training programs, including vocational training programmes. These actions can be more effective if they are organised with the collaboration of prosumer initiatives.

To further ensure meeting the skill required for the energy transition, the EU should continue to promote STEM workers, and in particular technicians of renewable energy infrastructures.

10. Conclusions

The central contribution of this policy paper is the assessment of the effects of relevant policy frameworks in relation to prosumerism. The following table offers a general overview of the overall impact of the different policy areas on prosumerism.

Table 6: Overall impact of EU policies on prosumerism

Policy area	EU Framework	Overall impact on prosumerism
Climate	RED II, EU ETS, ESL, EED, EPBD, Governance Regulation	positive
Environment	Habitats, Birds, Soil, Water, Noise, Air pollution, Waste	neutral
Development & Infrastructure	Rural development policy, Clean Energy Directive, European Fund for Strategic Investments (EFSI), Digital Single Market strategy, ESD	neutral

Social Affairs	Equal Treatment Directive (2006)	neutral
Data Security	The General Data Protection Regulation (GDPR)	positive
Economic and fiscal policy	RED II	positive
Trade and international investment	'Trade for All' (2015)	negative
Education	SET-Plan	neutral

(positive) means there is a positive impact, such as an increased adoption of prosumerism, (neutral) means no relevant impact, (negative) means there is a negative impact, such as a reduction of prosumerism

Regarding the international climate regime, there is no recognition of the importance of the prosumer model, nor are there any obligations concerning renewable energy, in reaching the goal of the Paris Agreement. However, the EU climate-related policies, especially RED II, overall improve the conditions for the prosumer model. Nevertheless, there is a need for an increase of ambition with respect to RE targets, an effective carbon price, energy efficiency requirements, and incentives for RE deployment and prosumer projects.

The EU environmental policies have a neutral impact on prosumerism as they do not actively promote or halt prosumerism. However, prosumers should carefully assess the environmental impacts of potential technologies and their compliance with EU and national law. This needs to be done to ensure consistency, mitigate negative externalities and overcome potential barriers to prosumer mainstreaming.

Infrastructure and development policies currently do not embrace the prosumer model. EU policies should ensure that both, rural and urban areas, have the proper infrastructure to facilitate the expansion of prosumerism. Furthermore, policies should facilitate local ownership of RE projects and enable the virtual sharing of prosumer energy. Besides, the different funds catalysing rural development should scale-up their support for prosumer initiatives, such as those involving land-sharing between RE farms and agriculture.

The EU can further incentivise prosumerism by adopting stringent transport emission regulations to promote electric vehicles. This, in turn, can play a vital role in the expansion of the prosumer model with the help of vehicle-to-grid services. Concerning policies targeting industrial development, the EU should urgently tackle subsidies on carbon-intensive energy products, and it should direct support to RE and prosumer energy production.

On policies concerning social affairs, the EU and its members should step up energy efficiency, and support the mainstreaming of the prosumer model to tackle energy poverty. Furthermore, the growth of prosumerism will require the organisation of the prosumer labour force in order to adequately protect the RE-related workforce from any EU or national policies that may potentially affect the sector. Concerning the fact that currently the majority of prosumer projects are dominated by males, the EU should require further regulations on targeting the overall gender disparity within all STEM sectors. This needs to entail a mix of policies upon education, media, industry and others.

EU data security policies--specifically the GDPR—have a beneficial impact on prosumers as they aim at ensuring data protection in smart grid and smart metering systems. Nevertheless, there is a need

for a more robust framework that provides the data security of prosumers that is shared with the support of smart meters and smart grids.

The policy area on economic and fiscal policy has an overall positive impact on prosumers because RED II abolishes taxes for RE consumption and enables selling excess energy into the grid. However, the EU should step up directed tax breaks and subsidies to facilitate the prosumer model.

EU trade and investment policy have an overall negative impact on prosumers as they complicate Local Content Requirements, and do not tackle fossil fuel subsidies. The WTO and the different trade and investor agreements should be amended to address the unlevelled playing field in which fossil fuels have the upper hand over RE. These agreements need to directly support the deployment of RE and the protection of prosumers.

Finally, EU education policies have an overall neutral impact on prosumerism, because although the EU has adopted some policies aimed at addressing the current skill gap for the energy transition, they are insufficient. Furthermore, there is a lack of policies that train prosumers as well as policies that offer RE education to the general population. Hence, EU policies should adopt education policies that ensure the level of skills required by the energy transition, and that boosts the RE literacy of the general population.

Overall it can be stated that **prosumerism touches many different legislative and regulatory frameworks.** While in several of these the increasing importance of renewable energies has been acknowledged, **the concept of prosumerism is still rather new or is not being embraced in such a way that it can reach its full potential.** Policy makers, especially in the areas of social affairs, regional planning, fiscal policies and industrial development, should get more familiar with the opportunities that prosumers can offer and adopt their strategies and objectives accordingly. Prosumers should make the best-use of the existing frameworks and try to influence them in order to mainstream the prosumer model.

11. References

11.1 Climate

International Agreements:

The United Nations Framework Convention on Climate Change (Rio, 9 May 1992) 172 U.N.T.S. entered into force 21 March 1994 [UNFCCC].

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (Kyoto, 11 December 1997) 192 U.N.T.S. entered into force 16 February 2005 [Kyoto Protocol].

UNFCCC (2018) The Paris Agreement. Retrieved from: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (accessed 8 January 2018).

EU Law:

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora**.** Retrieved from: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN (accessed 7 January 2019).

Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) no 525/2013 OJ L 156/26 (Effort Sharing Regulation).

Reports:

Ambel C. C. (2018) From Effort Sharing Decision to Climate Action Regulation: the good, the bad and the ugly (T&E, March 2018)

EC (2018) Guidance document on the requirements for hydropower in relation to EU Nature legislation. European Commission. Retrieved from: ec.europa.eu/environment/nature/natura2000/management/docs/Hydro%20final%20May%202018.final.pdf (accessed 7 January 2019).

EC (2018b) Guidance on Energy Transmission Infrastructure and EU nature legislation. European Commission. Retrieved from: ec.europa.eu/environment/nature/natura2000/management/docs/Energy%20guidance%20and%20EU%20Nature%20legislation.pdf (accessed 7 January 2018).

Fraunhofer ISE (2018) *Recent Facts about Photovoltaics in Germany*, Fraunhofer ISE, p.8.

IPCC, (2018) *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. World Meteorological Organization, Geneva, Switzerland.

Vailles C. et al., (June 2018) Mind the Gap: Aligning the 2030 EU climate and energy policy framework to meet long-term climate goals, 14CE, 33.

Articles:

Barron-Gafford, G.A. et al. (2016) The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures. *Nature*, 1-7. Retrieved from: https://www.nature.com/articles/srep35070.

Binder, G. (2016) Researchers discover solar heat island effect caused by large-scale solar power plants. (7 November 2016) *Phys.org*. Retrieved from: https://phys.org/news/2016-11-solar-island-effect-large-scale-power.htm (accessed 9 January 2019).

Newspapers:

Psaledakis, D. and Lough, R. (November 2018) New EU energy targets put bloc on course to overshoot climate goals. *Reuters*. Retrieved from: //www.reuters.com/article/us-eu-energy/new-eu-energy-targets-put-bloc-on-course-to-overshoot-climate-goals-idUSKCN1NI28L (accessed 8 January 2019).

Working Papers:

Bel G. and Joseph S. (2015) Certificate Oversupply in the European Union Emission Trading System and its Impact on Technological Change. IREARP, UB, Working Paper 2015/15 1/32.

Perino G and Willner M, 'Remove or reserve? (2017) Allowance prices and design choices in Phase IV of the EU Emission Trading System' (February, 2017) Universität Hamburg, WiSo-HH Working Paper Series Working Paper N°13.

Websites:

EC (2017) EU Action Plan for nature, people and the economy. Retrieved from: ec.europa.eu/environment/nature/legislation/fitness_check/action_plan/index_en.htm

EC (2018) Effort sharing 2021-2030: targets and flexibilities. Retrieved from: <https://ec.europa.eu/clima/policies/effort/proposal_en>

EEA (2017) Natura 2000 Network Viewer. Retrieved from: natura2000.eea.europa.eu (accessed 7 January 2019).

EEA (2018) EU28 - Birds and Habitats Directives. Retrieved from: https://www.eea.europa.eu/data-and-maps/figures/natura-2000-birds-and-habitat-directives-9/eu28-birds-and-habitats-directives (accessed 7 January 2019).

UNFCCC (2018) The Paris Agreement. Retrieved from: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (accessed 8 January 2018).

World Bank (2018) Carbon Pricing Dashboard. Retrieved from: https://carbonpricingdashboard.worldbank.org (accessed 7 January 2019).

11.2 Environment

EU law:

Commission Delegated Regulation (EU) 2015/1187 with regard to energy labelling of solid fuel boilers and packages of a solid fuel boiler, supplementary heaters, temperature controls and solar devices [energy labelling regulation]. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2015.193.01.0043.01.ENG.

DIRECTIVE 2001/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment OJL 197/30

Directive 2002/49/EC relating to the assessment and management of environmental noise. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32002L0049.

EC proposal for amending Directive 2004/35/EC. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52006PC0232&from=EN (accessed 7 January 2019).

Directive 2008/98/EC on waste (Waste Framework Directive). Retrieved from: http://ec.europa.eu/environment/waste/framework/framework_directive.htm.

DIRECTIVE 2012/19/EU on waste electrical and electronic equipment (WEEE). Retrieved from: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:197:0038:0071:EN:PDF.

DIRECTIVE 2014/52/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment OJL 124/1.

DIRECTIVE (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants OJ L 313/1. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32015L2193.

Commission Regulation (EU) 2015/1189 of 28 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel boilers

DIRECTIVE 2010/75/EU 2193 of the European Parliament and of the Council of 24 November 2010 on industrial emissions, OJ L334/17. Retrieved from: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010L0075.

Directive 2010/75/EU on industrial emissions. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010L0075.

EC (2018c) Ecodesign legislation. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/list_of_ecodesign_measures.pdf (accessed 7 January 2019).

Directive (EU) 2018/844 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency (2018 EPBD).

Reports:

COWI (2009) Study concerning the report on the application and effectiveness of the EIA Directive. Report for European Commission DG ENV. COWI A/S, Denmark.

EC (2016) The EU Emissions Trading System (EU ETS). EU

Energia (2015) The medium combustion plant (MCP) directive needs to be cost-effective for biomass plants and shouldn't hamper investments in renewables. Retrieved from: https://energia.fi/files/183/MCP_position_paper_15012015.pdf (accessed 7 January 2019).

Nielsen L.K. (ed.) (2010) IEA WIND TASK 28 SOCIAL ACCEPTANCE OF WIND ENERGY PROJECTS "Winning Hearts and Minds" STATE-OF-THE-ART REPORT Country report of Denmark. Retrieved from: www.socialacceptance.ch/images/State-of-the-Art_Acceptance_Wind_Energy_Denmark.pdf (accessed, April 10 2019).

SCU (ed.) (2015) Science for Environment Policy. *European Commission Environment News Alert Service* Issue 421. Retrieved from: ec.europa.eu/environment/integration/research/newsalert/pdf/methods_to_resolve_conflicts_energy_production_421na8_en.pdf (accessed 7 January 2019).

Articles:

Anses (2017) Exposure to low-frequency sound and infrasounds from wind farms: improving information for local residents and monitoring noise exposure. Retrieved from: https://www.anses.fr/en/content/exposure-low-frequency-sound-and-infrasounds-wind-farms-improving-information-local (accessed 7 January 2019).

Barron-Gafford G. et al. (2016) The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures. 6 Scientific Reports.

Bowyer, C, Baldock, D, Tucker, G, Valsecchi, C, Lewis, M, Hjerp, P (2009) Positive Planning for Onshore Wind Expanding Onshore Wind Energy Capacity While Conserving Nature, IEEP, London.

Bowyer, C. et al. (2015) Delivering Synergies between Renewable Energy and Nature Conservation. IEEP. Retrieved from: https://ieep.eu/uploads/articles/attachments/df418523-370c-49ef-822a-63812e24d163/Final_25_Nov_RES.pdf?v=63664509923 (accessed 7 January 2019).

Jianu, O., Rosen, M. & Naterer G. (2011) Noise Pollution Prevention in Wind Turbines: Status and Recent Advances. Sustainability 2011, 3. Retrieved from: https://sciforum.net/manuscripts/623/original.pdf (Accessed April 10 2019)

Natur värds verket (2018) Noise from wind turbines. Retrieved from: www.swedishepa.se/Guidance/Guidance/Noise/Noise-from-wind-turbines/ (accessed 7 January 2019).

IUCN (2012) Small scale hydro power: Impacts on nature and people. Retrieved from: https://www.iucn.org/content/small-scale-hydro-power-impacts-nature-and-people (accessed 7 January 2019).

Opperman, J. (2018) The Unexpectedly Large Impacts of Small Hydropower. Forbes. Retrieved from: https://www.forbes.com/sites/jeffopperman/2018/08/10/the-unexpectedly-large-impacts-of-small-hydropower/#a5855407b9d5 (accessed 7 January 2019).

Newspapers:

Hickman, L. (2012, February 27) Wind myths: Turbines kill birds and bats. The Guardian. Retrieved from https://www.theguardian.com/environment/2012/feb/27/wind-energy-myths-turbines-bats (10 April 2019)

Websites:

Bioenergy Europe (2019) Industrial Emissions Directive (IED). Retrieved from: https://bioenergyeurope.org/industrial-emission-directive-ied/.

EC (2016) The EU Water Framework Directive - integrated river basin management for Europe. Retrieved from: ec.europa.eu/environment/water/water-framework/index_en.html (accessed 7 January 2019).

EC (2016a) Soil. Retrieved from: ec.europa.eu/environment/soil/three_en.htm (accessed 7 January 2019).

EC (2017) EU Action Plan for nature, people and the economy. Retrieved from: ec.europa.eu/environment/nature/legislation/fitness_check/action_plan/index_en.htm.

EC (2018d) Rural development 2014-2020. Retrieved from: https://ec.europa.eu/agriculture/rural-development-2014-2020_en (accessed 7 January 2019).

EC (2018e) The common agricultural policy at a glance. Retrieved from: https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cap-glance_en (accessed 7 January 2019).

EC (2018f) Public consultation on the evaluation of the Strategic Environmental Assessment Directive. Retrieved from: https://ec.europa.eu/info/consultations/public-consultation-evaluation-strategic-environmental-assessment-directive_en (accessed 7 January 2019).

EC (not dated) Reducing CO2 emissions from passenger cars. Retrieved from: https://ec.europa.eu/clima/policies/transport/vehicles/cars_en#tab-0-0%20,%20https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0001:0015:EN:PDF (accessed 7 January 2019).

EC (2019a) Management of Natura 2000 sites. Retrieved from: ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm.

EEA (2018) EU28 - Birds and Habitats Directives. Retrieved from: https://www.eea.europa.eu/data-and-maps/figures/natura-2000-birds-and-habitat-directives-9/eu28-birds-and-habitats-directives (accessed 7 January 2019).

Environment and Ecology (2019) Hydropower and the Environment. Retrieved from: environment-ecology.com/energy-and-environment/100-hydropower-and-the-environment.html (accessed 10 April 2019).

Wind Europe (2018) Environment and Planning. https://windeurope.org/policy/topics/environment-planning/ (accessed 7 January 2019).

11.3 Infrastructure and development policies

EU Law:

Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles. Retrieved from: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0033&from=EN

Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32011L0092.

EU regulation 1305/2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), Art. 5(c). Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R1305&from=EN.

Directive (EU) 2018/844 of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency (EPBD, 2018)., Art. 2(a)(1).

EU Communications:

EC (2018a) European Commission - Press release EU budget: The Common Agricultural Policy beyond 2020. Retrieved from: europa.eu/rapid/press-release_IP-18-3985_en.htm (accessed 7 January 2019).

Reports:

Ambel C. C. (2018) From Effort Sharing Decision to Climate Action Regulation: the good, the bad and the ugly (T&E, March 2018) 23.

CEE Bankwatch Network (2018) Time for the EU's bank to lead on the clean energy transition. Retrieved from: https://bankwatch.org/wp-content/uploads/2018/12/Time-for-the-EU-bank-to-lead-on-climate.pdf.

EC (2018a) Our Vision for A Clean Planet for All: Industrial Transition. Retrieved from: https://ec.europa.eu/clima/sites/clima/files/docs/pages/vision_2_industrial_en.pdf (accessed 7 January 2019).

EC (not dated) Rural Development Programmes 2014-2020. European Commission. Retrieved from: https://ec.europa.eu/agriculture/sites/agriculture/files/rural-development-2014-2020/country-files/common/rdp-list_en.pdf (accessed 7 January 2019).

ECTP-CEU and TCPA (2017) Spatial Planning & Energy. *Special*. Retrieved from: www.special-eu.org/assets/uploads/SPECIAL_Pan_Euro-Guide.pdf (accessed 7 January 2019).

Egenhofer, C. et al. (2016) Towards an effective EU framework for road transport and GHG emissions. CEPS special report no. 141.

ESPON (2017) Policy Brief: Shrinking Rural Regions in Europe. Luxembourg: Espon. Available Retrieved from: https://www.espon.eu/sites/default/files/attachments/ESPON%20Policy%20Brief%20on%20Shrinking%20Rural%20Regions.pdf (accessed 7 January 2019).

Gençsü, I. et al. (2017) 'Phase-out 2020: Monitoring Europe's fossil fuel subsidies' (ODI, September 2017) 23-27. Retrieved from: https://www.odi.org/sites/odi.org.uk/files/resource-documents/11762.pdf (accessed 7 January 2019).

Nielsen L.K. (ed.) (2010) IEA WIND TASK 28 SOCIAL ACCEPTANCE OF WIND ENERGY PROJECTS "Winning Hearts and Minds" STATE-OF-THE-ART REPORT Country report of Denmark. Retrieved from: www.socialacceptance.ch/images/State-of-the-Art_Acceptance_Wind_Energy_Denmark.pdf (accessed, April 10 2019).

OECD (not dated) Linking Renewable Energy to Rural Development: Executive summary. Retrieved from: https://www.oecd.org/regional/regional-policy/Renewable-rural-energy-summary.pdf (accessed 7 January 2019).

Talus K et al. (2017) Energy Union, renewable energy and the 'Winter Package (2017) EL-TRAN policy brief 2/2017.

Articles:

Bauwens, T. et al. (2016) What drives the development of community energy in Europe? The case of wind power cooperatives. 13 *Energy Research & Social Science* 136–147.

Dance. S. (September 2018) Clean vehicles directive: Race against time. The Parliament Magazine. Retrieved from: https://www.theparliamentmagazine.eu/articles/opinion/clean-vehicles-directive-race-against-time (accessed 8 January 2019).

Fraunhofer (2017) Harvesting the Sun for Power and Produce – Agrophotovoltaics Increases the Land Use Efficiency by over 60 Percent. Retrieved from: https://www.ise.fraunhofer.de/en/press-media/press-releases/2017/harvesting-the-sun-for-power-and-produce-agrophotovoltaics-increases-the-land-use-efficiency-by-over-60-percent.html (accessed 7 January 2019).

The Institute for Industrial Productivity (not dated) GE-3: Rebate on energy and electricity tax for energy intensive companies "Spitzenausgleich." Retrieved from: http://iepd.iipnetwork.org/policy/rebate-energy-and-electricity-tax-energy-intensive-companies-%E2%80%9Cspitzenausgleich%E2%80%9D (accessed 7 January 2019).

Newspapers:

Reuters (2018) EU agrees to cut emissions from cars by 37.5 pct by 2030. Retrieved from: https://www.reuters.com/article/eu-autos-emissions/eu-agrees-to-cut-emissions-from-cars-by-375-pct-by-2030-idUSL8N1YM4XE (accessed 7 January 2019).

Websites:

BMVI (2018) Bundesminister für Verkehr und digitale Infrastruktur. Retrieved from: https://www.bmvi.de/DE/Home/home.html.

EC (2018) Rural development 2014-2020. Retrieved from: https://ec.europa.eu/agriculture/rural-development-2014-2020_en (accessed 7 January 2019).

EEA (2018) Electric vehicles as a proportion of the total fleet. https://www.eea.europa.eu/data-and-maps/indicators/proportion-of-vehicle-fleet-meeting-4/assessment-2 (accessed 7 January 2019).

EC (not dated a) Inspire: registry. Retrieved from: https://inspire.ec.europa.eu/featureconcept/SpatialPlan (accessed 8 January 2019).

EC (not dated b) 2050 long-term strategy. Retrieved from: https://ec.europa.eu/clima/policies/strategies/2050 (accessed 7 January 2019).

EC (not dated c) Reducing CO2 emissions from passenger cars. Retrieved from: https://ec.europa.eu/clima/policies/transport/vehicles/cars_en#tab-0-0%20,%20https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0001:0015:EN:PDF (accessed 7 January 2019).

European Network for Rural Development (2017) Laastu farm - Generating solar power on a strawberry farm. Retrieved from: https://enrd.ec.europa.eu/projects-practice/laastu-farm-generating-solar-power-strawberry-farm_en (accessed 7 January 2019).

Greenpeace Europe (2018) EXPOSED: €58 billion in hidden subsidies for coal, gas and nuclear. Retrieved from: https://www.greenpeace.org/eu-unit/issues/climate-energy/1519/exposed-e58-billion-in-hidden-subsidies-for-coal-gas-and-nuclear/.

Special (not dated) Knowledge Pool. Retrieved from: www.special-eu.org/knowledge-pool/module-2-spatial-planning-frameworks/policies-and-objectives/(accessed 7 January 2019).

11.4 Social affairs

EU Law:

Directive 2006/54/EC of the European Parliament and of the Council of 5 July 2006 on the implementation of the principle of equal opportunities and equal treatment of men and women in matters of employment and occupation (recast) (OJ L 204, 26.7.2006, pp. 23–36. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:c10940&from=EN

Directive 2012/27/EU on energy efficiency (EE Directive). Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012L0027&from=EN

EU Communications:

European Economic and Social Committee (2017) Opinion of the European Economic and Social Committee on 'Prosumer Energy and Prosumer Power Cooperatives: opportunities and challenges in

the EU countries' 2017 OJ C 34/44. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016IE1190&from=EN

Reports:

ACA (2018) 'Pobreza Energética en España 2018' (ACA, 2018). Retrieved from: https://niunhogarsinenergia.org/panel/uploads/documentos/informe%20pobreza%20energética%202018.pdf (accessed 25 October 2018).

Alberici S. et al. (2014) 'Subsidies and costs of EU energy.' *Ecofys*, Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/ECOFYS%202014%20Subsidies%20and%20costs%20of%20EU%20energy_11_Nov.pdf

BOE (2017) Disposiciones Generales Ministerio de Energía, Turismo y Agenda Digital, (BOE, n. 242, 7 October 2017). Retrieved from: https://www.boe.es/boe/dias/2017/10/07/pdfs/BOE-A-2017-11505.pdf (accessed 7 January 2019).

EC (2016) for Gender Equality Strategic Engagement 2016-2019. Luxembourg: Publications Office of the European Union. Retrieved from: https://ec.europa.eu/info/sites/info/files/strategic_engagement_en.pdf (accessed 7 January 2019)

EurObserv'ER (2017) 17th annual overview barometer. Retrieved from: https://www.eurobserv-er.org/17th-annual-overview-barometer/

Gençsü I et al. (2017) 'Phase-out 2020: Monitoring Europe's fossil fuel subsidies' (ODI, Septermber 2017).

Golla A.M et al. (2011) Understanding and measuring women's economic empowerment definition, framework and indicators. *International Center for Research on Women*. Retreived from: https://www.icrw.org/wp-content/uploads/2016/10/Understanding-measuring-womens-economic-empowerment.pdf (accessed 11 April 2019).

ICER (2014) The ICER chronicle. ICER, 21. Retrieved from: http://icer-regulators.net/wp-content/uploads/download-manager-files/ICER%20Chronicle%20Edition%202.pdf#page=20> accessed 25 October 2018.

ILO, (2017) 'Green jobs and renewable energy: low carbon, high employment' ILO. Retrieved from: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_250690.pdf

Masera D., Couture T. et al., (2015) 'Industrial Prosumers of Renewable Energy, Contribution to Inclusive and Sustainable Industrial Development,' UNIDO, Vienna, 19. Retrieved from: https://www.unido.org/sites/default/files/2015-04/PROSUMERS_Energy_0.pdf (accessed 21 November 2018).

Ordonez J. A. et al. (2017) A blind spot of European policy? Energy efficiency policies for low- income households. *ECEEE* 1461.

Sawin J.L. et al. (2018) Renewables 2018 Global Status Report. REN21. Retrieved from: www.ren21.net/wp-content/uploads/2018/06/17-8652_GSR2018_FullReport_web_final_.pdf (accesses 7 January 2019).

Standal K et al., (2018) 'Enable.EU, synthesis report on the case study "From Consumer to Prosumer", CICERO and ISINNOVA.

Whitley S et al. (2017) Cutting Europe's lifelines to coal: Tracking subsidies in 10 countries. ODI Policy Briefing. Retrieved from: https://www.odi.org/sites/odi.org.uk/files/resource-documents/11494.pdf (accessed 7 January 2019).

Articles:

Flaute M et al. (2017) 'Macroeconomic Effects of Prosumer Households in Germany' 7:1 *International Journal of Energy Economics and Policy* 146.

Katsoulakos N. et al. (2014) The problem of energy poverty in mountainous areas. NTUA.

Makandya A. et al. (2015) Towards a green energy economy? Tracking the employment effects of low-carbon technologies in the European Union,' 179 *Applied Energy* 1342.

O'Dell K., Peters S., Wharton K. (2014) Women, energy, and economic empowerment. Deloitte Insights, 18 September 2014. Retrieved from: https://www2.deloitte.com/insights/us/en/topics/social-impact/women-empowerment-energy-access.html#endnote-7 (accessed 7 January 2019).

Rogríguez L.R. (2018) 'Mitigating energy poverty: Potential contributions of combining PV and T building thermal mass storage in low-income households.' 173 *Energy Conversion and Management* 65.

Simoes S.G. et al., (2016) Mapping fuel poverty in Portugal, 106 *Energy Pocedia* 106 155–165.

Tam C. (2018) Commentary: Gender diversity in energy sector is critical to clean energy transition. International Energy Agency. Retrieved from: https://www.iea.org/newsroom/news/2018/march/commentary-gender-diversity-in-energy-sector-is-critical-to-clean-energy-transit.html (accessed 7 January 2019).

Conferences:

Pizzinato S, (2018) 'Pobre energética y energía renovable' (Segundo Congreso Catalán de Pobreza Energética, Sala Som Energia, Barcelona, November 2018).

Newspapers:

Bolaños A. (2013) Cortocircuito a la energía solar. *El País*, 3 April 2013. Retrieved from: https://elpais.com/sociedad/2013/04/03/actualidad/1365012737_419571.html (7 January 2019).

Intereconomia (2018) La factura de la luz se dispara un 49% en la última década pese a las reformas. Retrieved from: https://intereconomia.com/empresas/energia/la-factura-de-la-luz-se-dispara-un-49-en-la-ultima-decada-pese-a-las-reformas-20180601-2005/.

Planelles M. (2018) La reconversión climática afectará a 160.000 empleos del carbón en Europa. *El País*, 10 september 2018. Retrieved from: https://elpais.com/economia/2018/09/07/actualidad/1536334486_195854.html (accessed 7 January 2019).

Websites:

EC (2018) Employment, Social Affairs & Inclusion. Retrieved from: https://ec.europa.eu/social/main.jsp?catId=157&langId=en (accessed 7 January 2019).

EC (2018a) Employment, Social Affairs & Inclusion: European employment strategy. Retrieved from: http://ec.europa.eu/social/main.jsp?langId=en&catId=101 (accessed 7 January 2019).

EPOV (2018) Understanding energy poverty. EPOV. Retrieved from: https://www.energypoverty.eu/about/about-observatory (8 January 2018).

FACUA (2018) El recibo de la luz del usuario medio ha subido un 85,7% en sólo 15 años, según el análisis de FACUA. Retrieved from: https://www.facua.org/es/noticia.php?Id=13180 (accessed 7 January 2019).

INE (2019) Evolución Salario mínimo interprofesional. Retrieved from: www.mitramiss.gob.es/estadisticas/bel/SMI/.

International Energy Agency (2018) Clean Energy Education and Empowerment (C3E TCP), Retrieved from: https://www.iea.org/tcp/cross-cutting/c3e/ (accessed 7 January 2019).

Mitramiss (2018) Evolución del salario mínimo interprofesional. Retrieved from: www.mitramiss.gob.es/estadisticas/bel/SMI/smi1_top_HTML.htm (accessed 7 January 2019).

Morris, C. (2018) Comparing "energy poverty" in Germany with other countries. Retrieved from: https://energytransition.org/2016/08/comparing-energy-poverty-in-germany-with-other-countries/.

11.5 Data Protection

EU Law:

DIRECTIVE 95/46/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, OJL 281/31.

REGULATION (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679&from=EN.

Reports:

European Smart Grids Task Force (2016) My Energy Data. European Commission. Retrieved from: https://ec.europa.eu/energy/sites/ener/files/documents/report_final_eg1_my_energy_data_15_november_2016.pdf (accessed 7 January 2019).

Websites:

EC (not dated) What is personal data? Retrieved from: https://ec.europa.eu/info/law/law-topic/data-protection/reform/what-personal-data_en (accessed 7 January 2019).

11.6 Economic and fiscal policy

EU Communications:

Chaitan B., Huluban R.V., Fortuna G. (2018) Energy: new target of 32% from renewables by 2030 agreed by MEPs and ministers. European Parliament press release. Retrieved from: www.europarl.europa.eu/news/de/press-room/20180614IPR05810/energy-new-target-of-32-from-renewables-by-2030-agreed-by-meps-and-ministers (accessed 7 January 2019).

Reports:

Energy Community Secretariat (February, 2018) 'Policy Guidelines, on the Grid Integration of Prosumers.'

GfK Belgium consortium, (2015) 'Study on "Residential Prosumers in the European Energy Union"', European Commission.

Ragwitz M. (2011) 'Effective and efficient long-term oriented RE support policies' (Fraunhofer, 4 April 2011).

Roberts J. (2016) 'Prosumer rights: options for an EU legal framework post-2020' (ClientEarth and Greenpeace). Retrieved from: https://www.documents.clientearth.org/wp-content/uploads/library/2016-06-03-prosumer-rights-options-for-an-eu-legal-framework-post-2020-coll-en.pdf (accessed 7 January 2019).

Websites:

EC (not dated) Economic and fiscal policy coordination. Retrieved from: https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination_en (accessed 7 January 2019).

11.7 Trade and international affairs

Books:

Bodanski D., Brunnée J., Rajamani L. (2017) International Climate Change Law, *Oxford University Press*.

Delimatsis P. (2016) Research Handbook on Climate Change and Trade Law. *Edward Elgar*.

Articles:

Bauwens T. et al., (2016) 'What drives the development of community energy in Europe? The case of wind power cooperatives.' 13 *Energy Research & Social Science* 136–147.

De Bièvre D., Espa I., Poletti A., (2017) 'No iceberg in sight: on the absence of WTO disputes challenging fossil fuel subsidies' *Int Environ Agreements* 1.

Reports:

Eberhardt P., Olivet C. & Steinfort L. (2018) One Treaty to Rule them all, CEO and TNI.

EC (2016) Strategic Plan 2016-2020 trade. Retrieved from: trade.ec.europa.eu/doclib/docs/2016/august/tradoc_154919.pdf (accessed 7 January 2019).

Kuntze J.C., Moerenho T. (2013) 'Local Content Requirements and the Renewable Energy Industry - A Good Match?', Geneve: ICTSD.

Marhold A., (2017) Fossil Fuel Subsidy Reform in the WTO: Options for Constraining Dual Pricing in the Multilateral Trading System (Geneve: *ICTSD*)

Pereira H. (2017) How the WTO Can Help Tackle Climate Change through Fossil Fuel Subsidy Reform: Lessons from the Fisheries Negotiations. *ICTSD*.

T&E (2017) Trade for all score card. Retrieved from: https://www.transportenvironment.org/sites/te/files/publications/2017_11_ReportCardTradeForAll.pdf (accessed 8 January 2019).

Verkuijl C et al., (2017) Tackling Fossil Fuel Subsidies through International Trade Agreements, *Climate Strategies*.

Websites:

Carleton University (2019) Extension: What is Multilateral Trade? Retrieved from: https://carleton.ca/ces/eulearning/politics/foreign-affairs/extension-what-is-multilateral-trade/

CES (2018) 'Extension: What is Multilateral Trade?' Carleton University of European Studies. Retrieved from: https://carleton.ca/ces/eulearning/politics/foreign-affairs/extension-what-is-multilateral-trade/ (accessed 7 January 2019).

EC (2017) CETA explained. Retrieved from: ec.europa.eu/trade/policy/in-focus/ceta/ceta-explained/index_en.htm (accessed 8 January 2019).

11.8 Education

Reports:

Kounelis I et al. (2017) Blockchain in Energy Communities, European Commission, Brussels. https://core.ac.uk/download/pdf/146996825.pdf

Cox E., Royston S. & Selby, J. (2016) The impacts of non-energy policies on the energy system: a scoping paper. UKERC.

van Lersel, S., Petrick, K. & van Breevoort P. (2010) REEDUCATION A Scoping Study into Renewables and Education. IEA-RETD.

Luyts, S. (2014) Collaboration between Local Authorities and Renewable Energy Cooperatives A bottom-up approach, partners in mitigating climate change. KTH School of Industrial Engineering and Management Energy Technology

Websites:

European Commission (2019) SETIS. Retrieved from: https://setis.ec.europa.eu/setis-output/education-training-roadmap.

Example Germany:

Urban development law (Städtebaurecht or Bauplanungsrecht) is a branch of Germany's public building law (öffentliches Baurecht). It is the purpose of urban development law to establish the legal status of land and to determine its potential uses, thereby regulating the site-specific requirements applying to a building project. Urban development law aims to ensure the orderly development of settlements; its basic tool is development planning (Bauleitplanung). To that effect, urban development law regulates how to prepare for and manage the use of land including for building purposes.

Urban development law is federal law; its sources are the Federal Building Code (Baugesetzbuch - BauGB) and related Ordinances: the Federal Land Utilization Ordinance (Baunutzungsverordnung - BauNVO), the Standardized Symbols Ordinance (Planzeichenverordnung - PlanZV) and the Real Estate Value Assessment Ordinance (Immobilienwertermittlungsverordnung - ImmoWertV). There are numerous other legal areas that accompany and supplement federal urban development law by providing for specific building requirements applicable in part to all building projects, in part to building projects on specific sites or in some cases only to special non-residential buildings and structures.

Public building law denotes the body of public laws and regulations concerned with guiding and promoting the use of land for building purposes. These laws and regulations primarily set a legal framework for the permissibility of building projects and regulate the construction, use, modification, removal and required properties of buildings. They serve to balance the interests of real estate owners with those of the public. Private building law (privates Baurecht) on the other hand balances the interests of private real estate owners. Private building law also encompasses contract law concerned with building (Bauvertragsrecht).

Building regulations (Bauordnungsrecht) are another branch of public building law. They are enacted by the German Länder, notably in the form of Länder building regulations (Landesbauordnungen). This branch deals with the structural and technical requirements for building projects and serves primarily to prevent hazards emanating from the construction, the existence and the use of buildings. The Länder's building regulations also encompass provisions on the building permit procedure and on construction supervision.

12. Annex

12.1 EU Directorates

Table 7: Directorates of the EC

2.	DIRECTORATE GENERALS – EUROPEAN UNION	2.15.	Trade
2.1.	ENVIRONMENT	2.15.1.	EU as a global actor
2.1.1.	Internal Market	2.15.2.	EU-US Free Trade
2.1.2.	EU as a global actor	2.15.3.	Energy Union and Climate
2.1.3.	Democratic change	2.15.4.	Digital single market
2.1.4.	Energy Union and Climate	2.15.5.	Jobs, growth and investment
2.1.5.	Jobs, growth and investment	2.16.	Communication
2.2.	Energy	2.17.	Climate Action
2.2.1.	Public Procurement rules	2.17.1.	Climate change
2.2.2.	Subsidies and rate regulation	2.18.	European Civil Protection and Humanitarian Aid Operations
2.2.3.	Jobs, growth and investment	2.18.1.	EU as a global actor
2.2.4.	Energy Union and Climate	2.19.	European Neighbourhood Policy and Enlargement Negotiations
2.3.	Employment, Social Affairs and Inclusion	2.19.1.	Jobs, growth and investment
2.3.1.	Economic and monetary union	2.19.2.	EU as a global actor
2.3.2.	Justice and fundamental rights	2.19.3.	Migration
2.3.3.	Migration	2.20.	Eurostat - European statistics
2.3.4.	Digital single market	2.21.	Financial Stability, Financial Services and Capital Markets Union
2.3.5.	Internal Market	2.21.1.	Jobs, growth and investment
2.3.6.	Jobs, growth and investment	2.21.2.	Internal Market
2.4.	Education, Youth, Sport and Culture	2.21.3.	Economic and monetary union
2.4.1.	Jobs, growth and investment	2.22.	Health and Food Safety
2.4.2.	Digital single market	2.22.1.	Internal Market
2.5.	Economic and Financial Affairs	2.22.2.	Jobs, growth and investment
2.5.1.	Jobs, growth and investment	2.22.3.	EU-US Free Trade
2.5.2.	Economic and monetary union	2.22.4.	Digital single market
2.6.	Competition	2.23.	Human Resources and Security
2.6.1.	Jobs, growth and investment	2.24.	European Civil Protection and Humanitarian Aid Operations
2.6.2.	Energy union and climate	2.24.1.	EU as a global actor
2.6.3.	Internal Market	2.25.	European Neighbourhood Policy and Enlargement Negotiations
2.6.4.	Digital single market	2.25.1.	Jobs, growth and investment
2.7.	Budget	2.25.2.	EU as a global actor
2.8.	Communications Networks, Content and Technology	2.25.3.	Migration
2.8.1.	Digital single market	2.26.	Eurostat - European statistics
2.8.2.	Jobs, growth and investment	2.27.	Financial Stability, Financial Services and Capital Markets Union
2.9.	Informatics	2.27.1.	Jobs, growth and investment
2.10.	International Cooperation and Development	2.27.2.	Internal Market
2.10.1.	Energy Union and Climate	2.27.3.	Economic and monetary union
2.10.2.	Justice and fundamental rights	2.28.	Health and Food Safety
2.10.3.	Migration	2.28.1.	Internal Market
2.10.4.	EU as a global actor	2.28.2.	Jobs, growth and investment
2.10.5.	Democratic change	2.28.3.	EU-US Free Trade
2.11.	Joint Research Centre	2.28.4.	Digital single market
2.11.1.	Migration	2.29.	Human Resources and Security
2.11.2.	EU as a global actor	2.30.	Internal Market, Industry, Entrepreneurship and SMEs
2.11.3.	Justice and fundamental rights	2.30.1.	Jobs, growth and investment
2.11.4.	Jobs, growth and investment	2.30.2.	Digital single market
2.11.5.	Digital single market	2.30.3.	Internal Market
2.11.6.	Economic and monetary union	2.30.4.	Economic and monetary union
2.11.7.	Internal Market	2.31.	Interpretation
2.11.8.	Energy Union and Climate	2.32.	Justice and Consumers
2.11.9.	EU-US Free Trade	2.32.1.	Digital single market
2.12.	Maritime Affairs and Fisheries	2.32.2.	Jobs, growth and investment
2.12.1.	Jobs, growth and investment	2.32.3.	Justice and fundamental rights
2.12.2.	Energy Union and Climate	2.32.4.	Democratic change
2.13.	Mobility and Transport	2.33.	Migration and Home Affairs
2.13.1.	Jobs, growth and investment	2.33.1.	Jobs, growth and investment
2.13.2.	Energy Union and Climate	2.33.2.	Justice and fundamental rights
2.13.3.	Digital single market	2.33.3.	Migration
2.13.4.	Internal Market	2.33.4.	EU as a global actor
2.13.5.	Migration	2.33.5.	Democratic change
2.14.	Research and Innovation	2.34.	Regional and Urban Policy
2.14.1.	Jobs, growth and investment	2.34.1.	Jobs, growth and investment
2.14.2.	Digital single market	2.34.2.	Internal Market
2.14.3.	Energy Union and Climate	2.34.3.	Digital single market
2.14.4.	Internal Market	2.34.4.	Economic and monetary union
2.14.5.	Migration	2.34.5.	Energy Union and Climate
2.14.6.	EU as a global actor	2.34.6.	Migration
2.14.7.	Justice and fundamental rights	2.34.7.	Infrastructure and Development
		2.35.	Taxation and Customs Union
		2.35.1.	Economic and monetary union
		2.35.2.	Digital single market
		2.35.3.	Internal Market
		2.36.	Translation

info@proseu.eu