It's the environment, stupid!

LIBERAL CLIMATE CHANGE SOLUTIONS

Design:
Andreas Pohancenik
(wirsindattraktiv.com)

It’s the environment, stupid!
Liberal climate change solutions

The European Liberal Forum (ELF)
+ NEOS LAB (editors)

First edition, first print

Printed by Printpool 2020

ISBN: 978-3-200-07271-8

Published by the European Liberal Forum asbl
with the support of NEOS Lab.
Co-funded by the European Parliament.

It's the environment, stupid!

LIBERAL CLIMATE CHANGE SOLUTIONS

Author: Andrzej Ancygier

Editor: Dieter Feierabend

Executive Summary

Facing a major pandemic and consequently a massive economic crisis, some may forget – sometimes even deliberately – that the climate crisis is still an unsolved problem for nature and humanity alike. Despite the ongoing pandemic, European politicians should not lose the focus on future challenges such as the effects of rising greenhouse gas emissions. Thus, this study could provide the basis for liberal discussions on climate change and set the right direction the European Union and its member states may take to account when determining future climate politics.

Moreover, empowering citizens and the private energy sector, energy production and consumption can be much more efficient on a local level, and a wise legal framework may incentivize climate-friendly actions. Additionally, by decoupling GDP growth from a rise or fall of emissions, and thus get past a fruitless debate on degrowth, politics may follow the path of green growth. This will lead to the creation of jobs, wealth and improve the state of the environment, and paving a way to recover from the COVID-19 induced economic crisis.

In light of all this, this study aims to contribute to a scientific debate on how European politics need to cope with the climate crisis and its effects, by empowering citizens and encourage prosumers and local governments to build a legal framework for a healthy environment. Thus, policymakers at the European and national levels should consider the following recommendations when creating new possibilities
and legal frameworks climate politics:

Recommendation	Implementer	Possible action points
Make support mechanism for citizens' energy simple and predictable	Member states	→ Adapt the existing legal framework to reduce the bureaucratic effort to minimum → Introduce stable and predictable support mechanism for energy cooperatives, e.g. feed-in tariffs. → One time-grant and net-metering for prosumers
Get rid of unnecessary levies and charges	Member states	→ Remove any charges on electricity that does not leave the prosumer or energy cooperative → Introduce fixed tariffs for the electricity fed into the grid after the expiration of the support mechanism, e.g. at the level of the average electricity price at the wholesale market in the preceding year.
Provide incentives to foster usage & innovation of renewable electricity generation	Member states, National electricity regulatory authorities, Grid operators, Hydrogen consumers (e.g. public transport operators)	→ Adapt capacity markets to reward for grid stabilization → Provide the necessary resources for high upfront investments either in form of grants or low interest rates loans → Adopt feed-in tariffs-like system for hydrogen generated from renewables

Recommendation	Implementer	Possible action points
Harmonize definitions of energy cooperatives across the EU	EU institutions Member states	→ Adopt a harmonized definition of prosumers and energy cooperatives that is broad enough to encompass various aspects of their existing and potential activities → While implementing in national laws, ensure compatibility with definition in other EU member states.
Make electricity sector smarter	Member states Electricity grid operators Providers of the ICT solutions Electric appliances manufacturers	→ Accelerate deployment of smart metering → Create the possibility to take advantage of dynamic electricity rates → Equip electric appliances (e.g. refrigerators, driers) with the option to postpone electricity demand → Create tools (e.g. mobile phone applications) that influences electricity demand depending on the dynamic electricity rates
Price carbon, not energy	EU institutions Member states	→ Fully internalize the external costs of fossil fuels at the stage of electricity generation → Remove any additional charges for electricity at the stage of electricity consumption → Increase carbon pricing for fossil fuels used in transport and heating to facilitate fuel switching towards clear electricity (e.g. via the Energy Taxation Directive)
Improve cooperation between local governments and the cooperatives	Local authorities	→ Get in touch with local cooperatives / prosumers to investigate options for cooperation → Provide energy cooperatives with tools facilitating their activities (e.g. location, online platforms) → Utilize energy cooperatives to increase local ownership in climate mitigation activities
Allow for the commercialization of aspects of the community-owned projects	EU institutions Member states	→ Create an additional legal form of "Cooperative company" with obligations and benefits in-between those of energy cooperative and commercial entity → Harmonize this legal form across the EU to allow for de-localization of its activities.

Contents

1 Introduction

Meeting the Paris Agreement temperature limit, thus avoiding the worst repercussions of climate change, arguably constitutes the biggest challenge of our time. Meeting this challenge requires instigating a transformative change, resulting in halving greenhouse gas emissions by the end of the 2020s (IPCC, 2018). Failing to do so may result in circumstances that could encourage illiberal measures and a decrease in individual freedoms. This development could be driven by repercussions of climate change such as regional or international conflicts over increasingly limited resources, or the flow of climate refugees giving rise to xenophobic and populist sentiments. On the other hand, belated efforts to meeting the challenge with radical measures, therefore undermining citizens' freedoms, could be a further contribution (Beeson, 2010).

The core problem, historically speaking, is that since the industrial revolution, economic growth has been closely associated with an increase in emissions. At a global level, between 1913, the first year for which reliable data for global GDP is available, and 1970, emissions per capita doubled, whereas the GDP per capita increased 2.4-fold. The doubling of the global population resulted in emissions growing fourfold. The oil embargo of the 1970s and the ensuing economic crisis, combined with energy efficiency measures and the switch to natural gas, resulted in emissions per capita relatively constant at 4 tCO2/capita. In contrast, average GDP per capita increased by 60%. However, at the beginning of the 21st century, emissions growth per capita accelerated. Between 2000 and 2015, a 53% per capita increase in GDP was accompanied by a 20% increase in emissions (Global Change Data Lab, 2020).

This returning correlation between emissions and GDP gave rise to the idea that, in order to decrease emissions radically, we need to degrow our economy thus a negative change of the GDP. Economic growth should thus be replaced with sufficiency – starting with industrialised countries. The supporters of this idea argue that, while relative decoupling (two variables, e.g. emissions and GDP, changing in the same direction but at a different rate) is possible, an absolute decoupling taking place when change in one variable results in the other variable moving in the opposite direction, **has not** and **cannot** happen. This is due to a number of elements, such as rebound effects (e.g. driving more when the car is more efficient), underestimating the impacts of services, or limited potential for recycling (European Environmental Bureau & Make Europe Sustainable for All, 2019). Thus, the conclusion of supporters of degrowth is that shrinking the economy is necessary to save the planet.

However, the assumption that **degrowth** is the only way to reduce emissions to a level needed to achieve the Paris Agreement temperature limit, is in**correct for three reasons. Firstly,** while the advocates rightly point out that reduced emissions in one region, e.g. the EU, were counterbalanced by emissions ingrained in imported products, the relative and in some cases even absolute decoupling did indeed take place. Between 2010 and 2019, a decade not dominated more by globalization than the preceding ones, the EU27 and UK emissions decreased by around 34%, whereas its GDP increased by around 27% (Agora Energiewende & Sandbag, 2020; European Environment Agency, 2020; Eurostat, 2020).

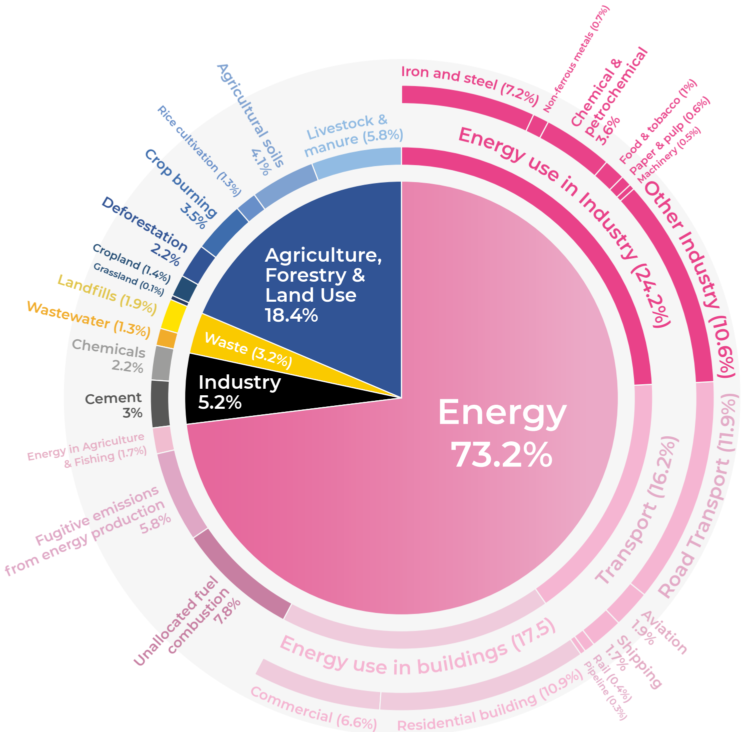
Secondly, whereas rebound resulting from higher efficiency and the potential of spending the saved resources on other carbon intensive activities presented by the supporters of degrowth is a valid one, it has strong limits. Few people enjoy driving to the extent that they would choose to drive around much more if the costs of driving were cheaper. Actually, the creation of viable and attractive alternatives (e.g. fast train connections) may discourage people from driving even at lower costs, as the time that would have otherwise been spent commuting is valued more than the costs of filling up the tank. Also, the often-quoted example of spending the saved money on a long-haul flight may be an exception, especially if the external costs of this flight are included in its price. Numerous low carbon alternatives exist, and can be added to spend the saved resources.

This, **thirdly,** links to the criticism of the underestimation of the impact of services and recycling on the use of materials. While few activities result in no impacts on the environment, in most cases a visit to a cinema, watching TV, or a night out has a minimal impact on the environment, especially if the electricity consumed for this purpose is decarbonised. The potentials of recycling or the reuse of products are far from being fully utilised, and here the past can in no way predict the opportunities of the future.

The main conclusion is that we can significantly reduce emissions while growing our economy, but under the condition that we **decouple energy and resource consumption from growth.** Instead of focusing on a path that puts economic prosperity against environmental protection, we need the combination of both. A core part of this change is tackling the energy sector.

FIGURE 1: GLOBAL GREENHOUSE GAS EMISSIONS BY SECTOR

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO2eq.



OurWorldinData.org – Reserach and data to make progress against the world's largest problems.

Source: Climate Watch, the World Resources Institute (2020). Licensed under CC BY by the author Hannah Ritchie (2020).

In 2016, 73,2% of all global greenhouse gas emissions were linked to the energy sector. Therefore, finding a sustainable path for the future means finding new solutions for the energy sector.

Luckily, we do not need to start from scratch. A closer look examines European success stories from which we can learn. We have already experienced a successful change in the energy consumption of producing goods. A good example of effective regulation is the standby and off-mode regulation that lowers energy consumption on products. This regulation had a global impact because producers around the planet had to adapt their production line in order to sell their products in Europe. **Examples such as this show the power of a liberal approach, which combines empowerment, the rule of law, innovation, and market-based mechanisms accompanied with government regulations when needed.**

This shows that, far from limiting our freedoms, smart and timely climate action may actually broaden our freedoms of choice and create the basis for long-term economic growth and an increased quality of life. This will be the case if we manage to continue growing our economy without undermining the natural ability of the environment to recover itself, and remain in the balance that constituted the basis for the development of our civilization. By driving innovation and deploying new technologies using smart policies, we can broaden the number of options for decarbonisation, providing new opportunities for job creation and economic growth.

The development and deployment of low carbon technologies, combined with the phase-out of fossil fuels, an increase in energy efficiency, and sector integration using electricity and hydrogen, are essential to reach the EU27's climate neutrality goal which was adopted in December 2019. In reaction to the COVID-19-induced economic crisis, the EU heads of states agreed to make climate mitigation – alongside digitalization and resilience – the main vehicle for economic recovery. Achieving this goal of economic recovery would be made possible by spending at least 30% of the European Multiannual Financial Framework and NextGenerationEU Recovery Fund for achieving the EU's emissions reduction goal (European Council, 2020).

This study uses **local energy generation** and the so-called **"democratization"** of the **energy sector as a showcase,** demonstrating how such a liberal approach could contribute to decouple energy and resource consumption from growth for the **following reasons:**

Firstly, the ability of local communities to generate their own energy constitutes a significant source of empowerment. It allows them to not only contribute to the decarbonisation of our economy, but also increases their freedom to generate their own electricity and other forms of energy, such as heat and mobility, in the future. It therefore contributes to the democratization of the energy sector, defined as "expanding democratic domain over private energy choices" (Szulecki, 2018, p. 34). Instead of being passive recipients of technocratic decisions shaping the energy sectors, individuals – either by generating their own energy, or participating in an energy community – can influence those decisions and be essential players in their implementation.

Secondly, increasing the role of local communities and individuals in itself brings numerous benefits related to driving energy transformation. Therefore, innovation shapes the wellbeing of local communities and facilitates the development of local solutions to global challenges. By being able to directly contribute to shaping their direct surrounding, they gain ownership of the transformation to a low carbon economy. This results in not only **increasing acceptance** of the changes, but in some cases, as described below, makes local communities the **driving force** behind these changes. There are also additional co-benefits in the form of regional job creation, additional income, lower energy bills, and reduced risk of energy poverty.

Finally, neither the prosumers, nor the energy cooperatives, in this study referred to as citizens' energy, exist in a vacuum. Their role in the transformation process depends on their particular existing technological, social, regulatory, and political framework. The scalability of renewables, and their decreasing costs resulting from technological progress, has been the *conditio sine qua non* of the involvement of communities of different sizes, and even individual households, a role that would have been unthinkable in the case of fossil fuels. But it was not the only condition that had to be met for local empowerment to occur. An adequate regulatory framework, or lack thereof, meant the difference between the existence of a strong renewable energy industry in a given country and the continuation of the status quo relying on centralised fossil fuels. The dominance of large electricity utilities, in some cases supported by the political elite, was also an inhibiting factor in strengthening the process of democratizing the energy sector (Aklin & Urpeleinen, 2018).

So far democratization of the energy sector concerned – with few exceptions – the power sector. Since electricity generation is currently responsible for less than a quarter of all greenhouse gas emissions in the EU27 (European Environment Agency, 2020), in order to meet the Paris Agreement temperature limit, this will need to change. The role of prosumers and energy communities will have to extend to other areas, starting from heating and transport, and finishing with hydrogen generation and sector coupling.

The purpose of this study is to provide insight into how this extension of the role of prosumers and energy cooperatives, can be achieved. To achieve this goal, the next section of this study will present the role played by the local communities and prosumers in driving the process of energy transformation. Section three will provide a selection of current examples of local energy generation. On this basis, the study will further investigate the potential roles of local communities in accelerating the process of energy transformation in Section four. Finally, section five will present suggestions concerning the ways in which the existing policy framework can be adapted to empower local communities.

2 Local energy generation as an early driver of energy transition

Wind energy was used for power generation for the first time in 1890 (Hills, 1994), and in 1921 Einstein was awarded the Nobel prize for discovering the "photoelectric effect" (Scientific American, 2015). However, it was only in the 1970s for wind and the 1990s for solar, that these energy sources started to be perceived as possible contributors to the energy sector. An essential role in this regard was played by amateur engineers, farmers, local communities and prosumers. The following subsections describe their roles to better understand the potential they represent on the pathway to full decarbonisation of the European economy.

2.1 A "SOFT" ALTERNATIVE TAKING SHAPE IN DENMARK

Local energy generation played an essential role in initiating the shift towards energy transformation. Arising from opposition towards nuclear energy in Denmark and a way to reduce dependency on oil exports in the United States, especially California, local initiatives and enthusiastic amateurs looked into possibilities to generate their own power in the 1970s. This gave rise to the prosumerism movement in which members produced their own goods and services (Toffler, 2020). After an explosion in the activity of citizens' energy in the 1990s and 2000s, radical changes to the legal framework decreased their roles. Recent years witnessed a renewed increase in the number of local initiatives and prosumers, which in some cases went beyond merely electricity generation.

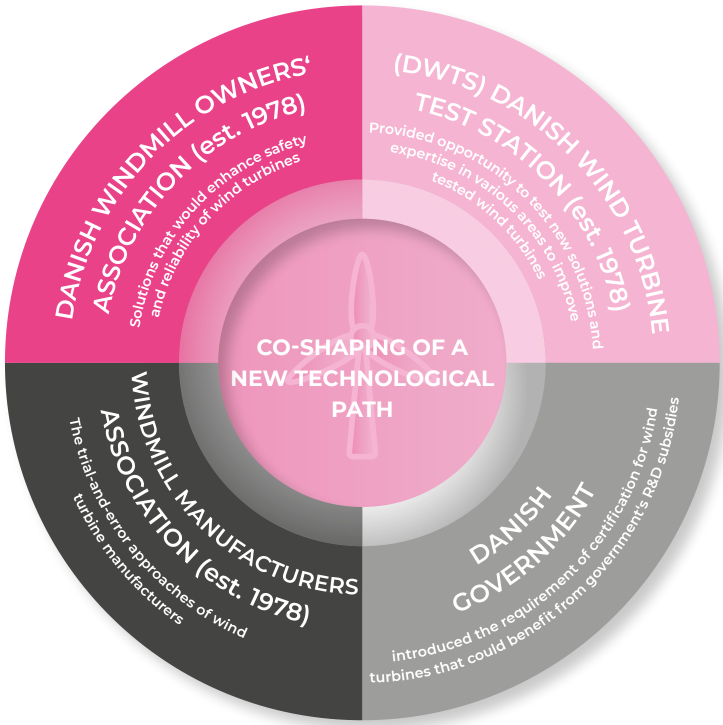
The idea of decentralised, renewable sources of energy operated by energy consumers themselves, had already been presented by Amory Lovins in 1977. He described energy generation from local sources, such as wind, solar, and bioenergy, as the optimal way to satisfy a significant portion of energy needs. Lovins referred to it as the "soft energy path" which he contrasted with the "hard energy path" of centralised electricity generation, with the resulting losses at the stage of fossil fuel combustion, electricity transportation, and transformation to the energy form needed, e.g. heat or warm water (Lovins, 1977, p. 26, 38).

Around the same time the soft path was already being implemented in practice in Denmark, where the development of wind energy was triggered during the 1970s by opposition to the government's plans to rely on nuclear energy. Initially, the attempts of "enthusiastic amateurs" to develop a reliable wind energy turbine turned out to be more effective than many of the state sponsored projects. However, it was the combination of these "amateur" academic engineers and favourable economic and technical conditions, that made Denmark the hub for wind energy, with 7 out of 10 of the largest wind-turbine manufacturers coming from this country (Heymann, 1998, p. 661).

The close cooperation between wind turbine users (which consisted of mostly energy cooperatives and prosumers) and manufacturers (facilitated by the establishment of the innovation hub in the form of the Danish Wind Turbine Test Station, or DWTS, and driven by the requirement for certification to benefit from state-driven support for Research, Development and Deployment), was the main determining factor in the success of the Danish wind energy industry. This co-shaping approach was very different from the one adopted in the United States, the only other country with a meaningful wind energy industry at that time. There priority was given to increasing the wind turbines' aerodynamic efficiency, however, without the continued feedback from the wind turbines' operators (Garud & Karnøe, 2003). This decoupling between the manufacturers and the operators in the USA resulted in a much smaller reliability of wind turbines in this country. Although the USA, spearheaded by California, was the leader in installed capacity in the 1980s, it was Denmark that managed to develop an economically sustainable wind energy industry.

FIGURE 2: FRAMEWORK FOR DEVELOPMENT OF A NEW TECHNOLOGICAL PATH IN DENMARK.

Source: Author's elaboration on (Garud & Karnøe, 2003).



2.2 DRIVING INNOVATION FROM THE BOTTOM-UP IN GERMANY

In Germany, in the 1980s two parallel streams of research in the area of wind energy took place. The government funded a number of large scale wind-turbines, the most popular of which was GROWIAN with a capacity of 3MW. This was the largest operating wind energy turbine at the time, and went online in 1983. However, due to numerous technical issues, it was taken offline only 4 years later (Hauschildt & Pulczynski, 1995). The second and much more successful stream of wind energy development was focusing on much smaller wind turbines developed by amateur engineers and farmers for self-consumption. It relied on already tested solutions that were steadily scaled up (Bechberger et al., 2008; Tacke, 2004).

The failure of the large scale-driven innovation resulted in a change in the government's approach to instigating innovation. Instead of focusing on large projects, from the end of the 1980s the resources for innovation were distributed among small entrepreneurs in the framework of "100 MW Wind" program, and later scaled up to 250 MW. The support was granted either in the form of an investment grant amounting to 60% of the costs, or a fixed premium additional to the income from the sale of electricity (Bechberger et al., 2008, p. 17). This resulted in a boom of new installations – between 1989 and 1992 the installed wind energy capacity increased almost 10-fold: from 18 MW to 172 MW (Hoppe-Kilpper, 2004).

In 1986 a new group of stakeholders entered the scene: In reaction to the explosion of the nuclear reactor in Chernobyl, the first energy cooperative was established in Germany to operate a wind power plant imported from Denmark. The main motivation behind this initiative was a political one: to present an alternative to nuclear energy. From an economic perspective, investment in wind energy constituted a significant risk not only due to the still defective technology at the time, but also the lacking guarantee that unused generated electricity could be fed back into the electricity grid. Joining forces as an energy cooperative allowed distributing this risk across more shoulders (Byzio et al., 2002).

The situation improved with Germany's adoption of the Electricity Feeding Act *(Stromeinspeisungsgesetz),* which obligated operators of the electricity grid to purchase electricity from renewable energy installations at a certain price, which for solar and wind energy amounted to 90% of the electricity price for consumers (Deutscher Bundestag, 1990). This increased the security of investment and drove innovation. Thus, between 1991 and 2000, the number of installed wind turbines in Germany increased 12-fold: from 769 to 9.375. The significant majority of all wind turbines was operated by energy cooperatives (Byzio et al., 2002).

The experiences of Germany and Denmark show the impact of a certain approach to entrepreneurship based on improvisation and co-shaping, resulting in modest and continued improvements (Garud & Karnøe, 2003). According to Garud & Karnoe, innovation occurs in the *process of creative synthesis,* in which different types of actors (which could, in the case of the wind energy development, include amateur engineers, energy communities, equipment producers, and regulators) generate inputs in the framework of a *specific* technological path. This *specificity* means that their freedom to deviate from the existing technological development pathway is somehow limited, but nonetheless big enough to drive innovation in the process of *mindful deviation* (Garud & Karnøe, 2000, 2003). This assumption is clearly visible in the case of wind energy in Denmark, and later in Germany: initially the farmers produced equipment that they used themselves, but on the basis of existing solutions. Steadily their role was overtaken and scaled up by manufacturers. But they were also local so that the feedback loop was relatively close and resulted in faster improvements.

The constant improvements in the framework of an existing technological path resulted in a continued progress, which – especially during the 1970s and the 1980s – relied mostly on R&D funding, with a transitionary period to policy-driven improvements in the 1990s. The adoption of the Renewable Energy Act in Germany in 2000 and Renewable Electricity Directive at the European level in 2001 changed the balance: policies were driving the deployment and investment in R&D (Bundestag, 2000; European Parliament and the Council of the European Union, 2001).

2.3 THE IMPACT OF EUROPE

In 2001, the European Union's renewable electricity directive on the promotion of electricity, produced from renewable energy sources in the internal electricity market, entered into force. It required all EU member states to adopt support schemes for renewable sources of energy that would allow them to reach their indicative shares of renewables in the electricity mix. The support mechanisms were to fulfil a number of requirements, such as cost effectiveness, simplicity, compatibility with EU's internal electricity market, and stability that would increase investor confidence. In addition, they had to take into consideration the differences between different sources of renewables, thus involving differentiated levels of support for renewables at different stages of development (European Parliament and the Council of the European Union, 2001).

The implementation of this directive resulted in a major transformation of the European electricity sector. In the subsequent years, all EU countries adopted policies facilitating the deployment of renewables. As a result, after increasing by only 2.3%-points in the 1990s, the share of renewables in the power sector rose by 6.3%-points in the 2010s (European Environment Agency, 2014). Even more importantly, due to the economies of scale and technological progress, the costs of renewables decreased significantly, creating the basis for even faster growth in the subsequent decade.

The choice of support mechanism determined the role that energy communities and prosumers played in the deployment of renewables. In countries where feed-in tariffs or feed-in premiums were adopted, the role of energy communities and prosumers was significant. However, in the few member states where quota mechanisms were adopted, their role was very limited. Furthermore, the source of energy that contributed to this boom was determined by the policies: the initially much higher costs of the solar photovoltaic system (PV system) required correspondingly higher levels of support. Equal support for all renewable sources of energy led to the dominance of biomass co-firing – whenever it was considered a renewable source of energy – or wind energy. Solar PV was only developed in countries with differentiated levels of support.

A case in point was Germany, where the Renewable Energy Law from 2000 obliged operators of the electricity grid to purchase electricity from renewable sources at differentiated prices. An amended version of the Law from 2004 compensated each kilowatt hour of electricity from solar PV with up to €0.57 over the next 20 years. The level of support decreased with the size and the year of the installation – with each passing year the level of support for the new installations decreased by 5% (Der Bundestag, 2004).

This stable and simple level of support resulted in an explosion of citizens' energy in the form of prosumerism (for solar PV) and energy cooperatives (mostly for wind energy). By 2010, almost 40% of the installed renewable energy capacity belonged to individuals who did not operate their installations for commercial reasons. An additional 11% of the installed capacity was operated by farmers (100 Prozent Erneuerbare Stiftung, 2011). In 2015 there were already almost 1.5 million prosumers in Germany and over 900 energy cooperatives, representing almost 150.000 members (Fischer & Wetzel, 2018; Frauenhofer ISE, 2017).

Citizens' energy also played an important role in Spain, where generous levels of support for solar energy in particular were adopted in 2007, with the goal of installing 371 MW of solar PV. This goal was already achieved and exceeded in the same year on the basis of earlier measures. In 2008 over 2.7 GW of new capacity was installed. The exploding costs, combined with the financial crisis of 2008/2009, resulted in a moratorium being instituted on new installations in 2009, leading to much smaller levels of installations in the subsequent years (del Rio & Mir-Artigues, 2014). In 2015 a tax was introduced on electricity generated and self-consumed by the prosumers (Forbes, 2018).

In Germany the outlook for prosumers and energy cooperatives also worsened after the solar PV boom in the early 2010s. In reaction to the significant decrease in the costs of renewables, and solar energy in particular, the levels of feed-in tariffs for solar energy were reduced by over 20% in 2012, and the annual degression for new installations accelerated from 5% to over 11%. The reform also introduced a corridor for new installations of between 2.5 and 3.5 GW, or less than half of the annual additional capacity in the preceding two years (BMU, 2012).

Another factor decreasing the role of local energy generation was the replacement of feed-in tariffs by auctions in almost all EU member states. This meant that the fixed level of tariffs was not determined by the governments, but rather resulted from competitive bidding. This transition, strongly supported by European Commission (European Commission, 2014), resulted in a decrease in the levels of the tariffs paid. However, it also undermined the role of energy communities: the risk of not receiving the contract, despite of the high costs of preparing the projects and the necessary permits, discouraged many individuals, especially small-scale investors.

FIGURE 3: ENERGY COOPERATIVES IN EUROPE

Source: EVWind, 2020.

2.4 CURRENT STATUS AND FUTURE OPPORTUNITIES

The decreasing costs of renewables, the availability of batteries, and the possibility to use the energy to charge one's own car created the opportunity for a renaissance of prosumerism in the coming years. In Spain, after the abolishment of solar tax in 2018 and a number of auctions, more solar energy was installed in June 2019 than in the preceding seven years, and 2020 is expected to beat the earlier records (EVWind, 2020).

The exact number of local initiatives in the EU is difficult to determine. Their varied legal forms – starting from housing associations, through to limited partnerships and energy cooperatives, and ending with public utility companies – result in discrepancies in quantification. According to the European federation of citizen energy cooperatives, around 1500 energy cooperatives with around 1 million members currently exist (REScoop, 2020b). However, the number of prosumers can be estimated in the single-digit millions, and increases rapidly as electricity self-generation becomes the standard for new buildings.

In terms of density of local energy initiatives, there is a clear East-West divide, with such initiatives much more common in older EU member states such as Germany, Austria, Sweden, Denmark, Belgium, and the Netherlands. In Germany in 2016, almost 32% of the installed RES capacity was owned by private individuals, and a further 10% by farmers. The latter group owned almost 74% of the biogas power plants and 16% of the PV plants (Renewable Energies Agency, 2018). In 2019 there were 843 energy cooperatives representing 200.000 members with a combined turnover of around €1 billion (DGRV, 2020). By May 2020, the number of German households equipped with PV panels exceeded 1.7 million, of which almost 100.000 were added in a period of 12 months (BSW Solar, 2020). During 2019 in the Netherlands, an additional 100 energy cooperatives were created and their total number increased to 582, representing around 85.000 members (hier opgewekt, 2020). In Denmark, after a decrease to 32% in the 1990s, the share of installed onshore wind energy owned by local citizens increased to over 60% at the beginning of the 2000s, before stabilizing at between 50-55% (Gorroño-Albizu et al., 2019).

Energy communities in countries that joined the EU in or after 2004 are almost non-existent (REScoop, 2020a). The lower levels of disposable income in the latter group of countries could be the main variable highlighting the difference. In addition, cooperatives in former communist countries have negative connotations, due to their misuse of resources to buttress the state's control over the economy – the opposite of the current role of energy cooperatives. Finally, the manner in which renewable sources of energy were supported (further explained in section 4) also played an important role in increasing this discrepancy between countries. This also applies to differences between some western European countries, such as Germany and France.

However, prosumerism can play an important role in countries that have introduced adequate support mechanisms. In Poland, to name one example, a simple and non-bureaucratic support mechanism for micro PV resulted in over 131.000 new installations within the same period of time, almost doubling the total installed capacity from all previous years (Rynek Elektryczny, 2020).

3 Examples of energy communities

The purpose of prosumers and energy communities is not necessarily to achieve a complete separation from the existing energy infrastructure. Such an autarchy would in most cases be inefficient, as it would not take into account the benefits of complementarity between different regions, and the opportunity to use the already existing infrastructure. Instead, the aim of prosumers and energy communities is to increase their contribution in the areas where (I) the energy transformation would result in changes to their immediate surroundings, and (II) centralised energy generation is not necessarily cheaper – or only marginally so. As mentioned earlier, when there are additional costs, they can be counterbalanced by the feeling of ownership and co-creation.

This section starts with a short description of the legal status of energy cooperatives and prosumerism in EU legislation, especially after the adoption of the revised Renewable Energy Directive (Directive 2018/2001/EC) and the Electricity Market Directive (Directive 2019/944) in 2018, both of which are still to be implemented by EU member states. Subsequently, the five main areas in which local energy plays a role are described. This section finishes with a short description of the main advantages of local energy generation and consumption.

3.1 LEGAL STATUS OF LOCAL ENERGY GENERATION IN THE EU'S LEGISLATION

The key difference between the local energy and commercially generated energy sectors, is the non-commercial character of the former. The main goal of the energy generation – usually with regard to electricity, but heat, transport, or energy services are also becoming important considerations – should be to generate social and environmental benefits, not financial profits. However, this does not mean that the stakeholders generating energy or providing energy services as members of an energy community or prosumers cannot sell this energy. For example, many energy cooperatives are created to finance the construction of a wind or PV farm and sell the electricity to the grid. However, generating income from this activity should not contradict their main goals of strengthening the local economy, strengthening energy independence, and improving local infrastructure.

Community energy is currently defined in two European Directives. The internal Electricity Market Directive (Directive 2019/944 later referred to as EMD) includes a definition of *citizen* energy communities, whereas the recast of the Renewable Energy Directive (Directive 2019/944 later referred to as RED II) speaks about *renewable* energy communities. There are numerous similarities between the ways in which community energy is defined. In terms of membership, in neither of the two kinds of communities can *decision-making* power be given to a member or shareholder of a company for which the energy sector constitutes a primary area of economic activity. In fact, the definition of the *renewable* energy communities excludes their membership completely, whereas *citizen* energy communities are more liberal in terms of their participation.

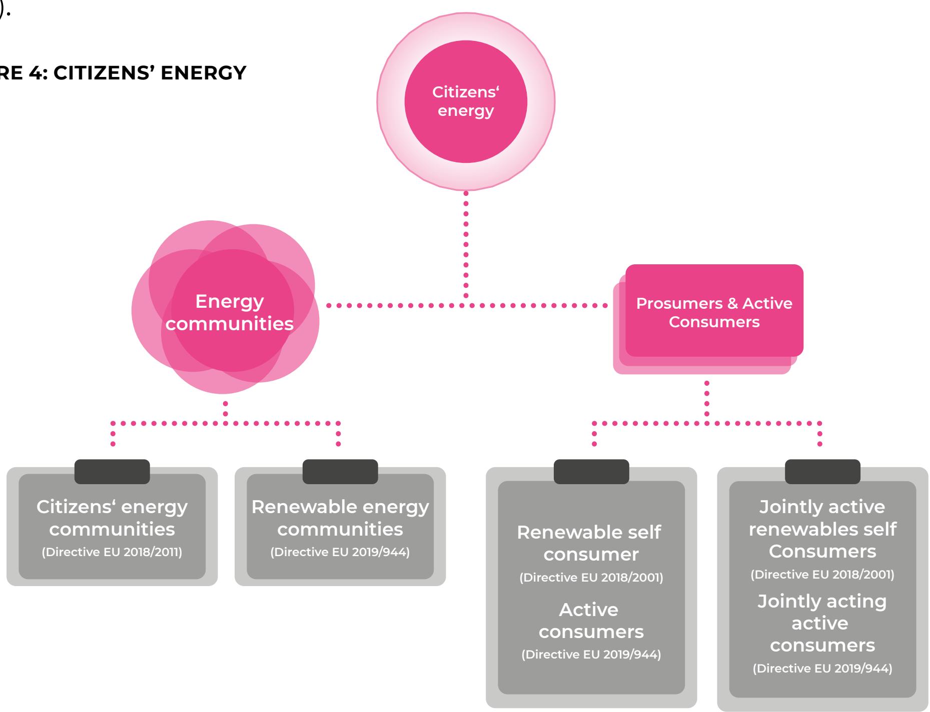
Both types of communities have certain rights and obligations. In terms of the renewable energy communities, member states have to ensure that they can participate in the support mechanisms for renewables on an equal footing with commercial participants. This may require additional measures to balance the weaker positions of renewable energy communities resulting from weaker financial buffers, risk aversion, or smaller or completely lacking experience in participating in the bidding process. Therefore, RED II explicitly allows for the creation of tailored bidding for this group of actors, or by providing them with direct support up to a certain installed capacity. It also obligates member states to ensure that renewable energy communities are allowed to share energy produced by the community-owned installations among themselves (European Parliament and the Council of the European Union, 2018).

At the same time, renewable energy communities also have the obligation to be independent from its individual members by establishing a legal entity and be open to all potential local members based on objective and transparent criteria. While the directive bans the introduction of additional charges on the self-generated electricity (this would apply to the aforementioned "solar tax" introduced in Spain in 2015), it also states that they should not be exempt from charges and costs borne by customers who are not members of the community, e.g. grid charges whenever public grid infrastructure is used. When designing the legal framework for renewable energy communities, member states should ensure that they contribute to fighting energy poverty by enabling the participation of vulnerable consumers and tenants (European Parliament and the Council of the European Union, 2018).

The recast of the Renewable Energy Directive also clarified the definition of prosumers, which was previously open for interpretation. The directive referred to the prosumer as a "renewables self-consumer" who generates power for its own consumption. Importantly, the definition also allows the prosumer to sell part of the self-generated electricity, as long as it does not constitute its primary or commercial activity.

The directive furthermore introduces the definition of "*jointly acting* renewables self-consumers" which have to fulfil the requirement of generating and consuming electricity in the same building or apartment block. The jointly acting renewables self-consumers may store or exchange self-generated electricity between themselves without any charges or fees. However, this exemption does not apply to installations larger than 30 kW, those benefitting from support schemes, or if their existence threatens to undermine the long-term financial sustainability of the electric system. The latter point, which only kicks in after 2026 and applies to countries in which capacity for self-consumed electricity constitutes more than 8% of the overall installed capacity, is indicative of the fears of a massive uptake in self-generation and the subsequent decreasing share of "regular" consumers who would have to bear a higher share of the grid costs (European Parliament and the Council of the European Union, 2018).

FIGURE 4: CITIZENS' ENERGY



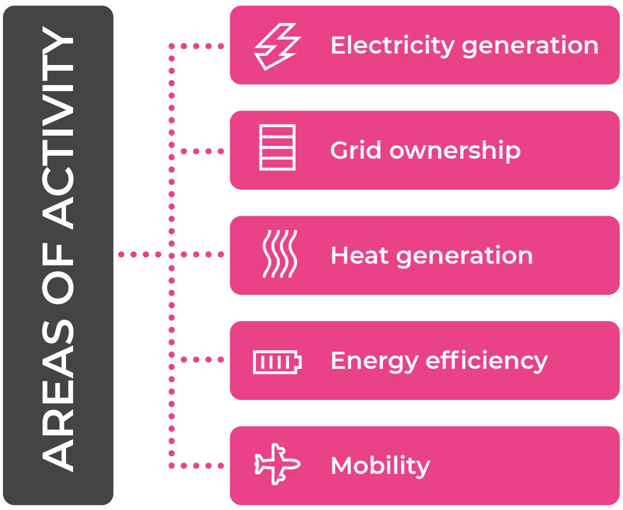
According to some definitions of cooperatives, their main products are the resulting values that come with their activities (Energieagentur Rheinland-Pfalz, 2016). These can range from a willingness to reduce the negative impact on the environment, to increasing the local value chain. The possibility to directly influence policies for which local communities and energy consumers have for decades only been recipients, also plays an important role. In the past, the large scale of energy and transport projects made energy and transport policies a domain for technocrats and national politics. The scalability of renewable sources of energy, combined with the opportunities presented by the digital economy, changed this and allowed for democratization of these sectors of economy. This is reflected in the "one person – one vote" rule applied in energy cooperatives, independently from invested capital (however, often above a certain threshold). The importance of these values is reflected in the fact that some electricity consumers are ready to pay more for electricity if it's coming from low-carbon (Sagebiel et al., 2014).

The most common legal form of energy communities are energy cooperatives, e.g. *Energiegenossenschaften* in Germany, Austria, and Switzerland, community benefit societies or Bencoms in the UK, and cooperative limited companies or A.m.b.A's in Denmark (Co-Operatives UK, 2014; DGRV, 2020; Erhvervsstyrelsen, 2013). The common denominator in these energy cooperatives entails that financial profits – if such exist – should be reinvested and can only, to a limited degree, be distributed among members in the form of capped dividends. The main benefit of membership in a cooperative should take the form of non-material benefits, such as lower energy prices generated locally, access to low-carbon mobility, or increased energy efficiency.

3.2 AREAS OF ACTIVITIES

Prosumers and energy cooperatives are active in a broad range of activities. While their activities are predominantly focused on electricity and heat generation, they are beginning to play an increasingly important role in the development of grid ownership and stabilization, and electric mobility. This subsection presents a selection of energy cooperative examples focused on these five main areas. It must be noted that in almost all of the examples the activity goes beyond the respective area and the categorization is based on the **main** or **original** area of activities. This subsection serves as a basis for Section 5, which explores new potential areas of activity.

FIGURE 5: SELECTED AREAS OF CITIZENS' ENERGY ACTIVITIES



3.2.1 ELECTRICITY GENERATION

Electricity generation by local communities and prosumers is the most popular form of empowerment within the area of energy. It is also a direct continuation of the movement from the 1970s and 1980s, as described in Section 2, that initiated the significant decrease in the costs of renewables.

A novel form of an energy cooperative focusing on generation and sale of electricity from renewables is Som Energia. It was initiated in 2010 as a result of a campaign by 350.org, an environmental organization focused on the fight against climate change. In October 2011 350.org was formally permitted to sell electricity and started construction of its first production facility: a 100 kW PV-solar roof in Lleida, 150 km east from Barcelona. The plant started generating electricity in March 2011 and was joined by an additional three solar roofs with a combined capacity at 55 kW in Riudarenes, 80 km west of Barcelona. It also started commercial activity in the Balearic Islands. In the following years, additional power plants were added in different parts of Spain. Among them are bioenergy power plants in Barcelona and a 500-kW biogas power plant in Torregrossa. In 2015, within only two hours, Som Energia collected the €800.000 necessary to purchase and renovate a 1 MW hydro power plant in Valladolid (Som Energia, 2015). Two wind energy power plants in Asturias and La Tejeria will start generating power in 2021 and 2022, respectively. Currently Som Energia generates 17 GWh of electricity annually, enough to power almost 7.000 homes. With a number of larger projects to be connected to the grid in 2021 and 2022, this amount is set to increase significantly (Som Energia, 2020a).

The electricity is fed into the transmission and distribution grid operated by Red Eléctrica de Espana (REE), subject to national and European regulations. Subsequently, electricity is purchased from the grid by Som Energia and sold to the final customers. A share of the proceeds from the sale of electricity finances projects for social welfare. An example is the funding for the installation of PV panels on a building occupied by 19 families in vulnerable situations and affected by energy poverty. As a result, their energy expenditures decreased by 30% (Som Energia, 2018a). Som Energia also facilitates the creation of further initiatives in the framework of a Social Germinator contest for ideas. In this contest ideas for projects with environmental or social benefits are presented. The authors of the most popular ideas are supported in their implementation of funding (a total of €25.000 is distributed between the successful projects), access to preferential loans, support in networking, and support in facilitating the creation of further projects (Som Energia, 2018b).

An interesting aspect of Som Energia's activity is its high level of democratization and digitalization. The highest decision-making body of the cooperative is the Members' Assembly which consists of all members and partners of the cooperative. Despite different statuses and financial contributions, it is governed according to the rule: one person, one vote. The responsibility for the implementation of the guidelines of the Members' Assembly is given to a Governing Council consisting of 9 persons, including a president, vice-president, and secretary. The day-to-day operations are led by work teams operating from a virtual office. In June 2014 Som Energia held its General Assembly in 15 different venues simultaneously (Som Energia, 2020b).

A more traditional form of energy cooperative focusing on electricity generation is the Edinburgh Community Solar Co-operative (ECSC), established in 2013 with the purpose of facilitating installation of solar panels on community buildings. Until then, the high share of people living in tenement flats with no access to the roof, inhibited the development of solar energy in the city. To solve this challenge, the solar panels are operated through collective ownership. In the first phase of the project, solar installations with a combined capacity at 1.38 MW were installed on 24 buildings and generated 1.1 GWh of electricity (Edinburgh Community Solar Co-operative, 2020b).

In 2020 there were 540 members of the cooperative. The membership is offered primarily to Edinburgh citizens and can be gained by purchasing shares starting from minimum 100 GBP. The return on the shares is capped at 5% and is projected at 4.5% for Phase 2 of the project, which entails expanding the co-operative to additional buildings. The remaining part of the proceeds flows to a Community Benefit Fund which annually distributes 4-5 grants to buildings participating in the project. The grants and aim to reduce energy poverty, facilitate improvements in energy efficiency, and encourage behaviour changes, resulting in lower emissions (Edinburgh Community Solar Co-operative, 2020a).

3.2.2 GRID OWNERSHIP

Until the late 1990s electricity generation, transmission and distribution were in most cases vertically integrated (Pepermans, 2019), thus resulting in regional and even national monopolies. This made it challenging for independent electricity suppliers, especially small scale cooperatives, to feed their electricity to the electricity grid where it would compete with the electricity generated by the same company that transported it. In some EU countries the support schemes for renewables came with guaranteed or priority access to the electricity grid (Council of European Energy Regulators, 2018). However, in the case of larger projects, the connection to the grid was made difficult due to the monopolistic character of the sector.

It was against this backdrop that a group of local citizens in Schönau in the South West of Germany decided to take over the management of the local electricity grid. Initially their goal was to promote an alternative to nuclear energy after the nuclear catastrophe in Chernobyl in 1986. As a reaction to this event, they initiated campaigns promoting energy efficiency and renewable sources of energy. They also requested the local power utility and operator of some nuclear power plants *Kraftübertragungswerke Rheinfelden AG* (KWR), to introduce electricity tariffs, encouraging energy savings and increasing the role of renewable sources of energy. To date, none of these requests have been fulfilled.

In 1994 a local initiative consisting of 650 citizens established *Elektrizitätswerke Schönau GmbH* (EWS) with the purpose of purchasing the local electricity grid from KWR. After winning a local referendum in 1996, the shareholders of the EWS still had to collect DM 8.7 million. This was only possible due to massive promotional campaign support, also from numerous environmental organizations, and advertising agencies providing services for free. After the necessary amount was collected in 1997, EWS Schönau took over the electricity grid in the town. Since 2009 it has changed its legal form to an energy cooperative (EWS Schönau, 2020a).

EWS Schönau provides support to owners of PV plants, small CHP plants, and hydrogen cells by additional funding of 6 cents/kWh for the first kW installed in the first 5 years. Only new installations are funded. By 2019 over 3000 installations, mostly PV plants, with a combined capacity of 28.5 MW received support in the framework of the program. Combined, however, EWS Schönau purchases electricity from 185.000 renewable energy generators (EWS Schönau, 2020a).

Currently EWS Schönau represents over 8.000 members. To become a member of the cooperative, one needs to be a consumer of the EWS Schönau or one of the three selected community owned electricity providers, and purchase at least five shares, each worth €100 (EWS Schönau, 2020a). To broaden the number of members, the number of shares that can be purchased by new members is limited to 10 (EWS Schönau, 2020b).

In the meantime, the legal framework has also changed substantially. The process of the liberalization of the European electricity market, initiated with the adoption of the first Electricity Directive in 1996 and accelerated with the subsequent two directives (European Parliament and the Council of the European Union, 1996, 2003, 2009), resulted in an unbundling of ownership in the electricity sector: member states had to ensure that the electricity grid was managed separately from electricity generation and sale. An exception was granted for electricity grids serving less than 100.000 customers (SWP Berlin, 2007).

The liberalization of the electricity market and the obligation to introduce an independent energy regulator, in many cases made it easier of energy cooperatives and prosumers to access the grid. The example of Som Energie, presented in the preceding subsection illustrates this point: this cooperative may generate electricity in different parts of Spain and sell it to customers all across the country, taking advantage of the liberalised electricity grid.

3.2.3 HEAT GENERATION

Household *heat* generation predated decentralised *electricity* generation. The obvious example is biomass, which has been burnt for heating purposes – though with steadily increasing levels of efficiency – since pre-industrial times (Smil, 2017). However, it has steadily been replaced with fossil fuels: coal, oil, and natural gas. A renewable source of energy used for heating was solar energy. The predecessor of the current solar water heaters were developed at the end of the 19th century in the United States. By 1941 around 60.000 solar water heaters were installed in the United States, especially in Florida. The start of the 2nd World War resulted in an abrupt end to this development, as the copper used for their construction was utilised for military purposes instead (Butti & Perlin, 1980).

It was the oil crisis that triggered the development of solar water heating in Europe. However, the systems installed in the 1970s and the 1980s worked poorly. It was only in the 1990s that significant improvements increased the reliability of the installations, and thus their popularity: by the end of the 1990s, the annually installed capacity exceeded 1 million m^2 – a 2.5-fold increase compared to the beginning of the decade. The difference between European countries in terms of the density of the installed capacity was striking: Greece and Austria with over 200 m^2 per 10.000 citizens were far ahead of the remaining members of the EU. In Italy, a country with similar solar radiation to Greece and much better than Austria, only 6 m^2 of solar thermal collectors per 10.000 citizens were installed (EREC, 2004).

Examples of energy cooperatives focusing on renewable energy generation for heating purposes were much rarer. There are, however, a few exceptions, such as Denmark, where wood-based district heating was organised as cooperatives back in the 1950s. Currently there are about 300 district heating cooperatives in the country (Caramizaru et al., 2020). In Sweden there were 10 energy communities focusing on local heating in 2018 (Magnusson & Palm, 2019). Increasingly, biogas is also playing a role as the next area of activity for energy cooperatives that were initially focused on electricity generation, but decided to expand their activities to other areas as well (e.g. Feldheim, Som Energie).

Due to its location, a surprising example of a community-owned district heating system owned by an energy cooperative is located in Marstal, a town of 2.000 inhabitants in the South of Denmark. Due to windy conditions, as described in Section 2, Denmark was the pioneer in the development of the wind energy industry. However, in 1994 the citizens of Marstal initiated the construction of a large scale solar heating plant that would replace oil-powered heating. It is able to provide 100% of the town's hot water in the summer months. In the winter it is complemented with a Combined Heat and Power (CHP) plant powered by wood chips and a heat pump – the latter using electricity generated from the wind turbines. To balance the differences of energy generation, the installation is accompanied with a 2.100 m^3 solar tank able to satisfy Marstal's heat consumption needs for 3–5 days (Solar Marstal, 2020).

3.2.4 ENERGY EFFICIENCY

In most cases, energy efficiency is an additional focus area for energy cooperatives, conducted from the framework of their social responsibility. The earlier described EWS Schönau promotes energy efficiency measures by subsidizing the change of an old heat pump with a new one with €75 (EWS Schönau, 2020a). One of the areas of activity promoted in the framework of the Social Germinator project contest organised and co-funded by Som Energia, is promoting energy efficiency. Experts from Ecopower in Belgium, a cooperative that provides electricity and heat, conducts energy audits for its members and helps them to set their priorities for home insulation. Part of the cost for this expertise is covered from the proceeds from the electricity sales. Ecopower also encourages energy savings by allowing its 58.000 members to track their energy consumption and compare themselves with others. It also provides access to energy savings (CityInvest, 2017; Ecopower, 2020) .

An interesting way to facilitate an improvement in energy efficiency is being implemented by the Belgian cooperative, PajoPower. In 2017, the city of Halle cooperated with PajoPower to collect €225.000 from the citizens of the city to replace existing street lamps along four streets with LED alternatives. A similar approach was taken by the municipality of Liedekerke, where €26.000 was collected to install more energy efficient street lighting. PajoPower is also collecting money for installation of PV panels on public buildings. The proceeds resulting from the energy savings and income from the sale of the energy are distributed among the members of the cooperative as dividends capped at 6% annually, however it amounted to 2% in the last two years. In order to join the cooperative, prospective members must purchase at least one share worth €250. A maximum of 20 shares can be purchased by one person, with priority given to the residents living in the vicinity of the project (PajoPower, 2020).

The example of the PajoPower cooperative illustrates how the impact of cooperatives can be strengthened if there is a close cooperation between municipalities and a well-organised civil society. The cleanest energy is energy that has not been consumed, and there are numerous opportunities to reduce energy consumption through ultra-efficient lighting or building insulation. Thus, it is surprising that cooperatives focusing on increasing energy efficiency are more the exception than the rule, and that such activities are an (important) add-on to energy generation.

3.2.5 MOBILITY

Similar to energy efficiency, mobility is an additional activity for the majority of energy cooperatives focused mainly on electricity generation. An example of such a cooperative is Courant d'air based in the village of Elsenborn in Belgium. In addition to wind turbines and a solar PV installation, since 2017 it has also provided an electric car for rent to Elsenborn's citizens (Courant d'Air, 2018). For the Svalin community with 20 households in Denmark, charging electric vehicles with collectively generated renewable energy was driven by the goal of becoming fully reliable on renewable sources of energy. On average, the community as a whole generates more electricity than it consumes, including electricity used for charging of electric vehicles (The Energy Collective project, 2020).

One of the few examples of cooperatives focusing mainly on providing mobility is Mobicoop in France. It focuses on providing mobility to its members in various circumstances, starting from long-distance carpooling, through sharing private cars when not used by their owners, to supporting people in vulnerable situations in the framework of a "solidarity community" (Mobicoop, 2020). In addition, there are eight mobility cooperatives from four different EU member states that joined forces in the Mobility Factory. Whereas some of them represent an additional activity of cooperatives mainly focusing on electricity or heat generation, others function similarly to conventional car sharing enterprises. What all of them have in common, however, is the reliance on electrically-powered vehicles (The Mobility Factory SCE, 2020).

While comparatively still being newcomers, the mobility cooperatives bring with themselves numerous benefits. Firstly, they complement commercial mobility providers through their deeper embeddedness in their specific community. With commercial car renting services almost exclusively focused on urban areas, the mobility cooperatives provide such services also for rural areas, and in most cases use locally generated renewable electricity. This results in decreasing emissions and increases the number of mobility options in areas where there are not many alternatives. Secondly, replacing imported fossil fuels with local renewables results in economic benefits, also at the local level. Finally, mobility cooperatives allow for more active utilization of the (fewer) vehicles, thus decreasing the average costs of owning a car and, especially problematic in the case of urban mobility, decreasing the need for parking space.

3.3 WHY EMPOWER?

As described in the preceding subsection, energy cooperatives and prosumers can play an important, often complementary role to commercial energy producers. While the comparatively smaller scale of their activities makes it challenging for them to compete with commercial energy companies, there are numerous benefits which make them essential players in reaching the goals of climate neutrality, as adopted by the EU, by 2050.

Local ownership or co-ownership of renewable energy installations significantly increases their acceptance, an especially important factor that determines the development of onshore wind energy. A number of studies have shown that wind power developments driven only by professional developers or large energy companies are less welcome by local communities than projects in which local communities have a stake (Bauwens et al., 2016; Otto et al., 2020). Whereas the economic cost-benefit assessment has been the strongest predictor of acceptance for a specific project, transparency and co-creation have also been identified as important determinants of acceptance (Upham et al., 2019; Zoellner et al., 2008).

Energy cooperatives and prosumerism are examples of the process of democratization of the energy sector, from centralised units governed by regional monopolies or oligopolies to numerous small scale, locally owned installations. This transforms the energy sector from one driven by technocratic decision-making, to one shaped by a local, deliberative democracy in which preferences can be transformed through the process of deliberation (Dryzek, 2002; Szulecki, 2018). This process may have repercussions that go well beyond the energy sector: the process of creating energy cooperatives strengthens social capital by facilitating networking and willingness to get involved in the development of the local community, also in other areas, thus strengthening democracy of proximity (Rosanvallon & Goldhammer, 2011).

Involvement of local communities and individuals, especially when combined with expert knowledge, creates an opportunity for social and technological innovation (Szulecki, 2018; TU Dormund, 2020). Whereas the first kind of innovations focus on better satisfying local needs (e.g. limited access to mobility), the latter drives development of new technological solutions (e.g. using a combination of different sources of renewables to satisfy energy needs of a small town). The examples provided in this section show how these two kinds of innovation can complement and reinforce each other. The history of wind and solar energy development, initially driven mainly by local communities and prosumers as described in section 2, illustrates the potentially transformative character of this mutual reinforcement.

While individual projects (e.g. prosumer PV installations) may be more expensive per unit of energy generated when compared with large scale installations implemented by private companies, local communities and prosumerism may actually decrease the costs of transformation to a low carbon economy. This is caused by three elements. Firstly, reaching the EU's climate goals requires massive development of wind power, which belongs to the cheapest sources of energy, and solar PV which is approaching this stage. In both cases, the full potential of these sources of energy can only be utilised (or utilised more effectively) if local communities are involved. The utilization of household roofs, for example, can only be used with the agreement of its owner.

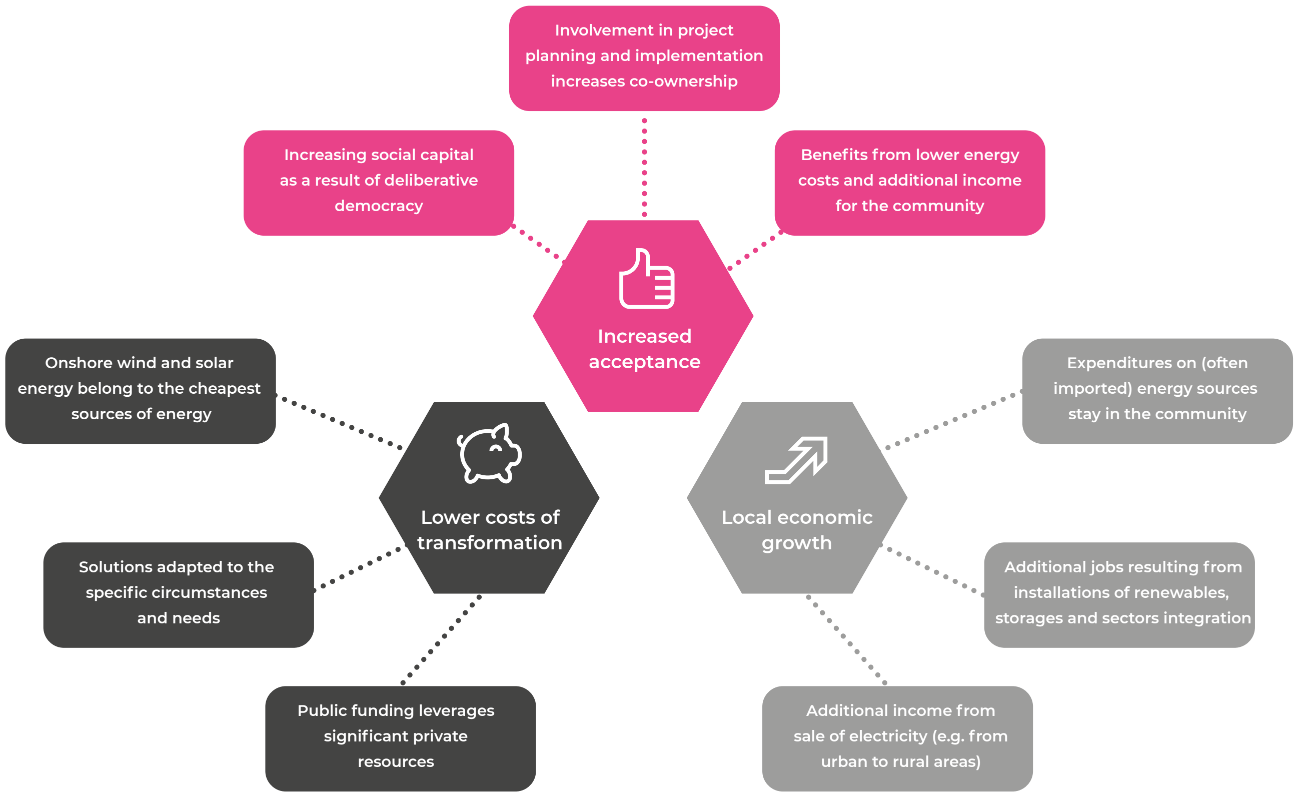
Secondly, sectoral integration, which decreases the need for energy storage, can in many cases be best implemented if adapted to the specific economic, social, and geographic needs of a specific community. The example of district heating in Marstal described above shows how oversupply of electricity can be used for heating purposes. Such a project could hardly be developed without the participation and co-ownership of local citizens. Also, local generation and consumption of energy decreases the costs of grid development, especially high-voltage transmission connections.

Thirdly, locally owned and generated energy may leverage public resources with the resources of the local community and individuals. The recent support program for a small PV in Poland worth PLN1 billion (€220 million) resulted in more than PLN5 billion (€1.1 billion) spent on renewable energy installations in the country by homeowners (Wysokie Napięcie, 2020). As described earlier in the case of energy cooperatives, the dividend is usually capped at a maximum of 6%, often much below this level, with a portion of the revenues reinvested in other projects, such as improving energy efficiency or conducting energy audits. Combined, these three elements not only decrease the costs of the energy transformation, but they also increase citizens' ownership in solving the major challenge of the 21st century.

At the same time, locally generated energy has additional economic benefits for the local community. While larger projects (e.g. wind or PV farms) result in job creation, prosumer installations result in lower electricity bills, especially when keeping in mind the rapidly decreasing costs of renewables. Furthermore, replacing imported oil for transport or natural gas for heating with local renewable energy sources (e.g. electricity, heat pumps and biogas) allows for reinvesting financial resources that would otherwise flow out of the community.

The numerous benefits of citizens' energy can be further strengthened if combined with new technologies. The electrification of transport and heating, decreasing costs of battery storage, potential offered by hydrogen, and new digital solutions (e.g. blockchain) creates numerous opportunities for local communities and individual home owners to contribute to the decarbonisation of the economy. The following section looks into some of these new opportunities.

FIGURE 6. THE BENEFITS OF CITIZENS' ENERGY



4 What role can citizens' energy play in the future?

The role of citizens' energy, is set to increase in the future. This section will present three areas in which prosumers and energy cooperatives may contribute to decarbonisation, while increasing democratization of the energy sector and empowerment of local communities.

Reaching the EU's 2030 emissions reduction targeted of "at least 55%" – if not "at least 60%" as suggested by the European Parliament - as well as the already adopted goal of climate neutrality by 2050, requires high levels of acceptance in the society for the radical change in which energy is generated and consumed. This can only be achieved with co-ownership of that change. Full decarbonisation of the energy sector can not only be achieved, but also accelerated with the citizens' ingenuity and entrepreneurship that drove the development of wind and solar energy installations from niche products in the 1970s, to mainstream and the cheapest sources of energy in the 2020s.

According to some estimates, around 17% of installed wind and 21% of solar energy capacity will be owned by energy communities in 2030 (European Commission, 2016). By 2050, almost half of EU households are expected to produce renewable energy (CE Delft, 2016). Some EU member states include specific goals for the share of locally owned energy generation capacity. The Dutch Climate Agreement adopted by the coalition parties in 2019 includes the target of 50% ownership of renewable energy installations within the local community – which also includes local businesses (The Government of the Netherlands, 2020). The draft of Poland's Polish Energy Strategy 2040 includes the goals of a five-fold increase in the number of prosumers to 1 million, and the creation of 300 "energetically balanced" regions (Climate Ministry, 2020).

Whether these estimates concerning the role of citizens' energy will be met, or even exceeded, depends on the legal and economic framework introduced at the European Union and member states levels. What is clear, however, is that the role of prosumers and energy communities will not only change in terms of their number, but also as far as their roles are concerned. Starting from helping to stabilise the grid, through de-localization of citizens' energy, to generating negative emissions to make up for the delay in climate action, local communities and prosumers will be playing an instrumental role in developing a carbon-neutral economy. The following subsections present some ideas for additional areas of activity for prosumers and energy cooperatives. However, it can safely be expected that the variety of specific local circumstances, combined with the opportunities offered by digitalization and technological progress in the area of energy generation, transformation, and storage will result in multiple varied ways in which local entrepreneurship will contribute to decarbonisation of the energy sector.

4.1 REPLACING SAUDI OIL WITH LOCAL SUN: SECTOR INTEGRATION

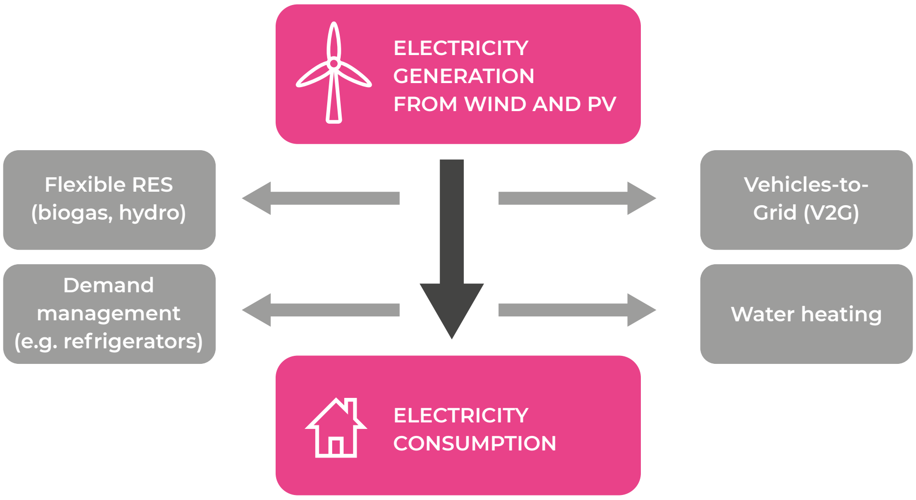
The European Commission's Impact Assessment of the proposed new EU 2030 goal of reducing emissions by at least 55% indicate an increased share of electricity in the final energy demand from 23% in 2015 to between 29–31% in 2030 and 46–50% in 2050. Almost half of the electricity generated in the EU in 2030 will be coming from wind and solar (European Commission, 2020). However, the increasing share of variable sources of electricity will pose a challenge to the electricity grid.

However, there are already numerous solutions to deal with this challenge. The reliance on a mix of different variable sources of energy (e.g. wind and solar) has already lead to more stable electricity generation (Sun & Harrison, 2019). Furthermore, innovations in electricity storage and the development of the electricity grid will allow for better balance in temporal and spatial changes in electricity generation and demand. Dispatchable sources of energy, namely those that can be switched off and on when needed, can be better utilised. Whereas hydro energy does already play an important role in stabilizing the grid, significant improvements can be made to biogas power plants by introducing incentives to make them more flexible (FNR, 2018). The significant progress made in digitalization could offer new opportunities for demand management, allowing enterprises to save money by shifting their electricity consumption whenever possible (Agora Energiewende, 2015). Electrification of different sectors, especially in transport and heating, will offer further opportunities to stabilise the grid and phase out fossil fuels in those sectors (Wietschel, 2019).

Except for grid development, all of these solutions can be utilised by prosumers and local cooperatives. As a result, from merely generating electricity and consuming (part of) it, energy cooperatives and prosumers could become Renewable Energy Clusters (RE-Clusters), which could also store electricity, manage differences between supply and demand, and expand their activities to other sectors (Lowitzsch et al., 2020). The mix of these solutions would strongly depend on the local and regional circumstances. In rural areas, electricity generation from solar and wind may be complemented with biogas power plants when the wind is not blowing and the sun is not shining. In the past, the fixed level of feed-in tariffs resulted in constant electricity generation from biogas power plants – even when there was too much electricity in the grid. To allow them to become part of the solution instead of the problem, some countries introduced additional flexibility premiums to encourage the installation of larger storage infrastructure for biogas. This biogas is used in larger electricity generators, but during fewer hours throughout the year (FNR, 2018).

Local communities may also use the oversupply of electricity from the renewable energy installations which they operate by shifting their energy demand by a few hours. This is the case for large consumers of electricity, especially farmers, where some flexibility exists in terms of the temperature for heating or cooling. One example is the large refrigerators used for agricultural products, where in times of high electricity supply (e.g. during a windy night) the temperature can be decreased below what is necessary, significantly decreasing their energy demand for a few hours at times when electricity demands tend to increase (e.g. mornings). The refrigerators may again be operated at higher capacity in the middle of the day, when solar-PV provides enough electricity to meet their demand, but before the evening peak in electricity demand is accompanied by a decrease in electricity generation from solar-PV. Breweries and water pumping for farming purposes offer further alternatives to balance electricity generation from community-operated renewables (Aghajanzadeh & Therkelsen, 2019; Kaak, 2015).

FIGURE 7: CONTRIBUTION OF DIFFERENT OPTIONS TO GRID STABILIZATION.



Even communities who do not operate their own wind and solar energy installations could benefit from opportunities to stabilise the electricity grid. In Germany, the high share of variable renewables combined with inflexible nuclear and coal-fired power plants (especially lignite) result in negative electricity prices occurring, especially during winter months. In 2019 there were 211 hours during which large electricity consumers were paid to consume electricity (BHKW-Infozentrum, 2020). A community-owned district heating installation similar to the one in Marstal, Denmark, could complement other sources of energy (e.g. biogas) with electricity from the grid, which would not only contribute to grid stabilization, but could also provide the community with an additional income.

Some of the opportunities can also be utilised at the prosumer level. Electricity used for individual heating, complemented with water storage, offers flexibility that can be used to reduce energy costs. Electric vehicles, which are only used a fraction of the time, can otherwise be used as storage for electricity generated during the day (e.g. from PV-solar installation) and consumed during the night. However, to take advantage of these opportunities, prosumers need to be equipped with smart meters and dynamic electricity tariffs reflecting electricity costs at certain times of the day. Smart phone (e.g. comparing electricity demand, generation, and price) applications will allow prosumers to adapt their energy management to their circumstances, for example, by ensuring that only a limited share of the electric vehicle's battery is used overnight, in case a longer trip is expected before it can be recharged the following day.

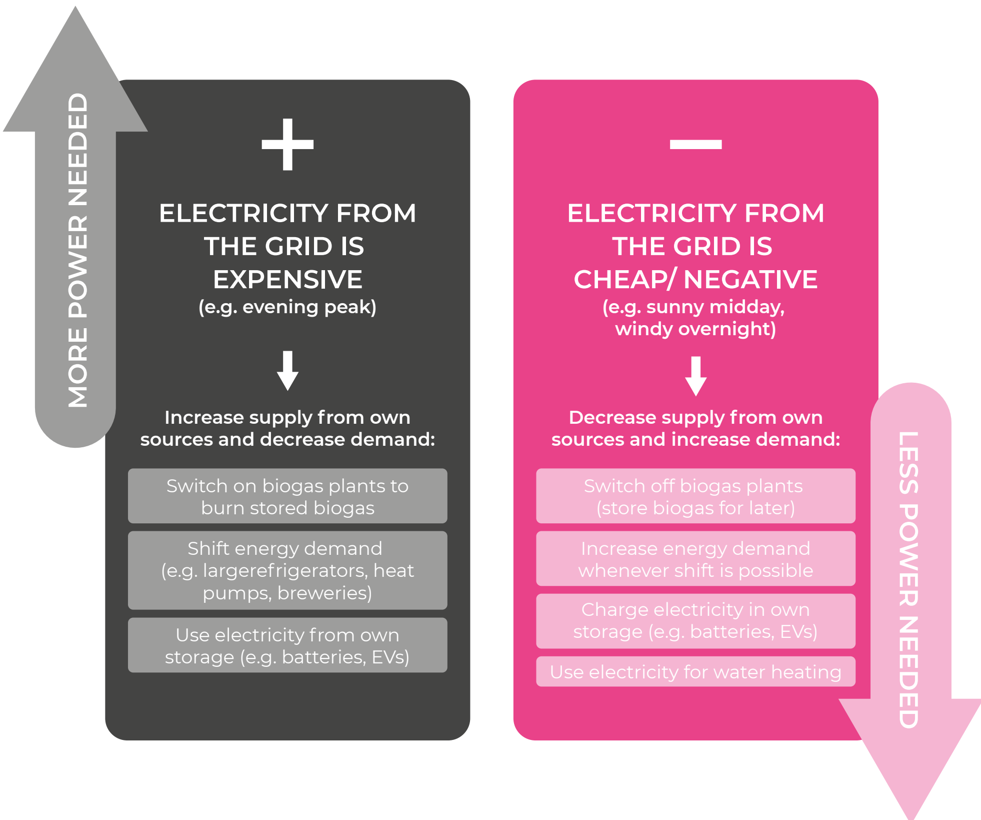
4.2 FROM CO_2 TO H: DRIVING THE HYDROGEN ECONOMY

While the share of electricity in energy consumption is set to more than double by the middle of the century and be responsible for around half of all energy consumed, another fuel may also gain importance. Hydrogen – generated from renewables – allows for long-term (e.g. seasonal) energy storage, and offers strong potential in areas where batteries don't necessarily offer an optimal replacement for fossil fuels, such as heavy-duty vehicles or buses. According to existing scenarios, hydrogen is set to constitute between 10 and 23% of the energy consumed in 2050 (Joint Research Centre, 2019).

The major obstacle in the uptake of green hydrogen has been the high price of the electrolysers, which break down water into hydrogen and oxygen with the help of electricity. However, over the last few years a significant decrease in their costs was observed, which could make green hydrogen a competitor for conventionally-generated hydrogen by 2030 at the latest (Reuters, 2020). Similarly to the developments that resulted in the significant reduction in costs of wind and solar-PV installations, a policy-driven uptake of electrolysers could accelerate the decrease of costs exponentially. In this case, energy communities and prosumers could also play an important role.

The price of green hydrogen is determined by the level of utilization of the electrolysers: the higher the number of hours during which the electrolysers are used, the cheaper the hydrogen. The costs of hydrogen decrease especially fast until it reached the utilization rate of 25% (IRENA, 2018). While hydrogen has often been presented as a way to balance the variable character of renewables, running the electrolysers on an ad hoc basis using only the oversupply of electricity would significantly increase the costs. Energy communities, having at their disposal different sources of energy that balance each other out (e.g. wind, solar-PV, biogas), and possibilities to store electricity and manage electricity demand as described in section 4.1, could jointly function as a virtual power plant which, in turn, could ensure a more constant supply of electricity for the electrolyser. This could significantly decrease the costs of hydrogen generation. The hydrogen could subsequently either be fed into the gas grid, or used locally as fuel for transport (e.g. the local bus fleet).

FIGURE 8: ENSURING STABLE SUPPLY OF ELECTRICITY FOR ELECTROLYSERS



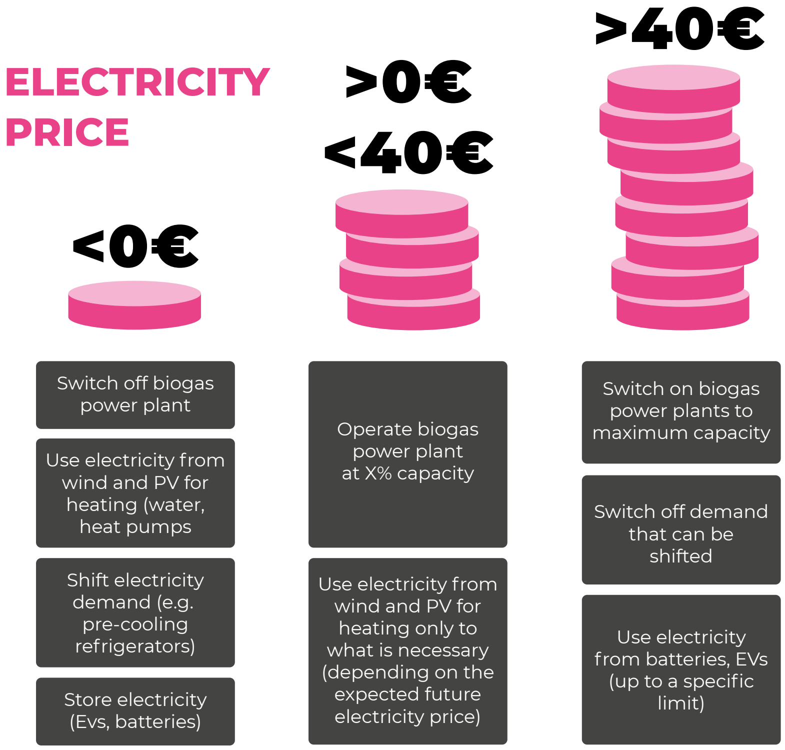
4.3 MERGING "SMART" WITH "GREEN": DE-LOCALIZATION OF CITIZENS' ENERGY

The development of information and communication technology (ICT) will play an important role in expanding the role of citizens' energy in the areas described above. Information showing real-time electricity prices, energy consumption of community members, energy generation from different sources operated by the community, and weather forecasts indicating expected energy generation in the coming hours and days will be essential to contributing to grid balancing services (section 4.1) and providing a steady flow of electricity to generate hydrogen (section 4.2). From a technological perspective, the different streams of information can automatically trigger appropriate decisions. For example, if there are negative electricity prices on the market, local biogas plants could be switched off and demand management adapted to temporarily increase electricity consumption.

The situation can be complicated by the need for contractual arrangements between the different members of an energy community. The contributions of operators of the different sources of energy (e.g. PV, wind turbine or biogas plant) and energy services (e.g. shifting energy demand) to electricity or hydrogen generation need to be recorded independently and rewarded accordingly.

To this extent, a blockchain based ledger could offer the solution to transparently and objectively trace electricity generation and consumption. Smart contracts would allow the blockchain to automatically execute a predefined agreement when specific conditions are met (Joint Research Centre, 2017). These conditions may include provisions for a certain amount of energy to be allocated to either the consumers, the grid, or the electrolyser generating hydrogen. They may also reflect provisions to certain services, such as shifting electricity demand or scaling down electricity generation, if further conditions (such as low or negative electricity prices in the public grid) are met. Fulfilling the conditions specified in the smart contract may result in increasing the share of proceeds that the whole community generates.

FIGURE 9: EXAMPLE OF A PRE-DEFINED AGREEMENT DEPENDING ON THE ELECTRICITY PRICE.



In addition to facilitating the operation of a much more comprehensive energy cooperative, blockchain technology can also de-localise energy communities. The Spanish energy cooperative, Som energia has already taken steps in this direction by generating electricity in different parts of Spain and distributing it to members across the country. However, the electricity is sold to the grid at the point of generation and purchased at the point of consumption. To this affect, a blockchain based ledger could offer the opportunity to skip the intermediary between members of a cooperative and replace it with a peer-to-peer exchange. This would reduce the costs and increase the speed of transactions (IEEE, 2018). It could also facilitate cooperation between energy communities and prosumers across the country.

The main limit on the de-localization of energy communities will, however, remain the capacity of the electricity grid to transport the traded electricity. If the electricity purchased in one region cannot be transported to another region due to an underdeveloped electricity grid, this will result in a dissonance between actual availability and purchases in electricity. This challenge can be mitigated by introducing a cap, determined by the grid's capacity for electricity distribution, within which the peer-to-peer transactions may occur. This cap would reflect real-time constraints and could be added as another condition to the smart contract between the energy communities or prosumers exchanging electricity.

Another challenge is posed by the fact that electricity purchased by final consumers is charged with taxes and fees, which would not be paid in a peer-to-peer exchange. Since these charges also cover the costs of the necessary investments in e.g. grid infrastructure, excluding some citizens from paying them would result in higher taxation of the remaining consumers. In some cases, this issue is partly solved by charging the grid fee in the form of a fixed, monthly fee, independent from electricity consumption. Charges reflecting GHGs emissions should exclude electricity from renewable sources anyway. As a result, cheaper, low carbon electricity could potentially replace carbon intensive, (mostly) imported fuels such as coal, natural gas, and oil.

5 Policy recommendations and conclusions

Since 73% of all CO-2emissions are connected to energy production and consumption, citizens' energy will be essential in meeting the EU's goal of climate neutrality by 2050. Their involvement will not only increase the acceptance of transformation of the energy sector, but also democratise the energy sector and empower local communities by giving them a stake in solving the biggest challenge of the 21st century. As this study has shown, empowerment, a good legal framework, and market-based solutions offer a powerful approach of decoupling growth from CO2-emissions.

An increased complexity of the support mechanisms, and therefore a regime of bureaucratic rules, discourage local communities from creating energy cooperatives. We need to change this. As discussed in Section 4, citizens' energy needs a new legal framework under which it can operate, therefore empowering local communities.

The following ten policy recommendations provide a number of suggestions for how the legal framework at the European and national level can be adapted to empower energy consumers and use their potential to contribute to meeting the EU's goal of emissions neutrality by the middle of the 21st century.

5.1 MAKE SUPPORT MECHANISMS SIMPLE AND PREDICTABLE

The current regulatory framework on European and local level is not suitable for further innovation and growth of sustainable and participative energy production. While bureaucratic, it fails to offer incentives for investments in renewables. A new framework should focus on mechanisms for prosumers and investors to be simple and predictable, and thus set a legal framework on both a European and local level to meet incentivised demands.

Despite a significant decrease in the costs of renewables, in many cases they still cannot compete with already existing, large scale generation units. This is the case for three reasons: firstly, most of those installations, especially large coal and nuclear plants, have been built with direct or indirect state subsidies and paid off. Secondly, electricity from conventional sources does not reflect external costs. Thirdly, even if the external costs of conventional sources of energy were fully internalised in the electricity price, equal treatment of all renewables would make the development of energy sources that are currently more expensive but have huge potential to contribute to full decarbonisation in the future impossible. Therefore, a predictable framework fostering investment in renewables is needed.

The specific co-benefits of citizens' energy as described in Section 3.3 provide an additional reason for targeted support for citizens-owned and operated energy installations. The recast of the Renewable Energy Directive, which each member state needs to implement by June 2021, requires treating renewable energy communities "on an equal footing with large participants" (European Parliament and the Council of the European Union, 2018).

5.2 GET RID OF UNNECESSARY LEVIES AND CHARGES

Policymakers need to free electricity up to a certain limit (e.g. up to 30 kW) from any charges, and purchase electricity from household or cooperative installations not benefiting from support mechanisms, at the average market price from the preceding year.

In some EU member states (e.g. Germany with the largest number of prosumers), after the expiry of support mechanisms, self-consumed electricity is charged with additional levies and taxes. Such an approach does not apply to any other product which is produced and consumed by the same person. In addition to Value Added Tax, one of these charges is the levy reflecting the costs of support mechanisms. This charge has not been applied to any other fuels which benefitted from generous state subsidies in the past and currently benefit from additional subsidies in the framework of coal or nuclear phase-out. In addition, after the expiry of the support mechanism, operators of renewable energy units need to trade this relatively small amount of electricity which it did not consume. Due to the complexity of this, it is usually done via an intermediary, which results in additional costs that may exceed the income from the sale of electricity. Whereas storage could mitigate the issue, stored electricity is, in some cases, taxed twice: first when stored and again when used (Bundesverband Neue Energiewirtschaft, 2018).

Such an approach not only undermines the idea of energy democracy, but is also contrary to the requirements of the Renewable Energy Directive from 2018, which bans the introduction of disproportionate charges on energy generated from renewable sources (European Parliament and the Council of the European Union, 2018). Change is needed to implement innovative technological solutions, especially in areas like energy storage.

5.3 PROVIDE INCENTIVES TO FOSTER USAGE & INNOVATION OF RENEWABLE ELECTRICITY GENERATION

As mentioned in Section 4.1, the contribution of citizens' energy to decarbonisation of the energy sector is set to go beyond electricity generation from renewables. Energy cooperatives and prosumers are in a perfect position to contribute to grid stabilization due to their variety and their role as both energy producers and consumers who are able to shift their energy demand. They may also provide forms of energy other than electricity, such as biogas, heat (e.g. for district heating), or hydrogen. However, this expansion of their activities requires clear incentives.

To increase their role in the stabilization of the electricity grid, energy cooperatives may become active members of the capacity markets. This has already been explicitly permitted by the Energy Market Directive. However, to trigger their contribution to that market, energy cooperatives should be provided with initial support, especially in terms of necessary modifications required to be made to the existing infrastructure (e.g. expansion of the biogas storage, installation of other storage possibilities, and deployment of the necessary ICT infrastructure).

To encourage the generating of other sources of energy, a support mechanism similar to feed-in tariffs could be implemented. This could especially be the case for hydrogen, for which a fixed tariff per kilogram of hydrogen produced could be paid for a certain period of time. As in the case of renewables, this tariff would decrease for installations coming online in subsequent years. To avoid windfall profits on one hand (in case the costs decreased faster than the tariffs) or lack of interest on the other (in case of the opposite happening), the dynamic of this decrease would be adapted depending on the existing trends.

5.4 HARMONISE DEFINITIONS OF ENERGY COOPERATIVES ACROSS THE EU

One indicator of a good legal framework is the clarity of its definitions, as it is the basis for implementation on all levels of governance. However, the current Renewable Energy and Energy Market Directives, despite its innovations, introduced different definitions of energy communities. As we know from successful projects in different EU-member-states, this is not necessary and complicates an implementation of local decarbonisation initiatives.

For example, it is difficult to find an explanation for the differentiation between *citizen* and *renewable* energy communities in terms of the proximity to the generation installations. An optimal approach could be to permit electricity exchange between members and shareholders of an energy community, but within the limits of the existing electricity grid. This reduces regulatory burdens. Therefore, a harmonization of the definition of energy communities and prosumers is needed. New definitions should be designed in a way that would allow existing and future initiatives to take advantage of their various potentials. This harmonization will empower Europeans to contribute to energy transformation without an unnecessary bureaucratic burden. It will also strengthen cooperation between members and shareholders of energy communities and prosumers in different EU member states, thus facilitating European integration.

5.5 MAKE ELECTRICITY SECTOR SMARTER

To reap the benefits of the rapid development of ICT solutions, the energy sector needs to become smarter in terms of transferring price signals. Electricity grids need to become smarter, meaning they have to better integrate the actions of electricity producers and consumers, and reflect them in electricity prices. The essential element of smart grids (although, by no means the only element) is smart metering (JRC, 2011). Smart metering is essential for prosumers and energy cooperatives, as it allows them to adapt their actions (e.g. by shifting electricity consumption) to better reflect the supply and demand. While the EU and member-states have started the rollout of smart metering, additional ICT solutions are needed to unleash the full potential of smart electricity grids.

The main aim should be to accompany smart metering with dynamic electricity rates reflecting supply and demand on the electricity market. This offers a reduction in energy consumption as well as reduced costs for individuals. Until now, time-based pricing has primarily been applied to large industrial users, with residential electricity consumers being able to opt for tariffs with fixed peak and off-peak pricing. Dynamic pricing has only been tested in exceptional cases for selected consumers (Eid et al., 2016). The Electricity Market Directive obliges EU member states to enable electricity suppliers with more than 200.000 final customers to offer dynamic electricity price contracts (European Parliament and the Council of the European Union, 2019). However, both the deployment of smart meters and the possibility to choose a dynamic electricity price contract, lag behind the expectations of prosumers and conscious electricity consumers.

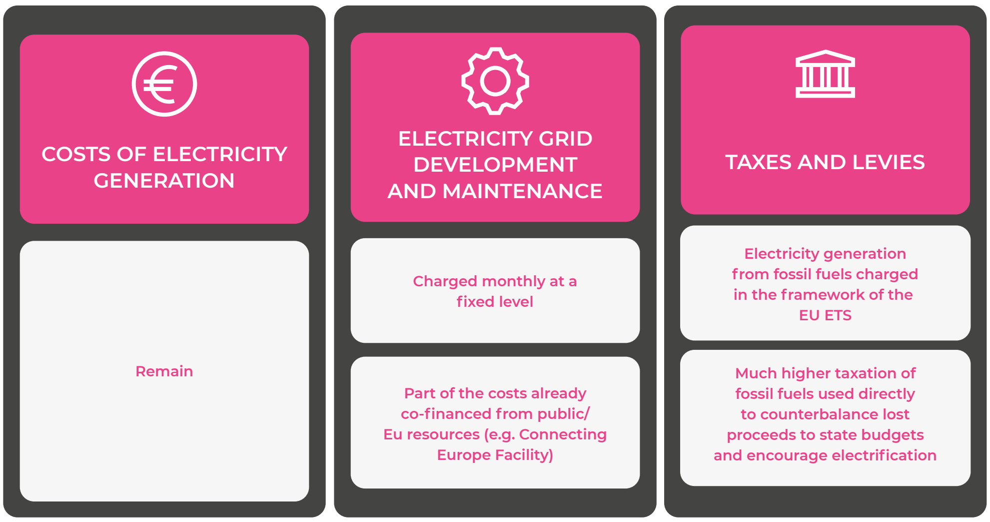
5.6 PRICE CARBON, NOT ENERGY

To make up for the lost proceeds to the states' budgets, the level of taxation of fossil fuels consumed as final energy (e.g. natural gas for heating and oil for transport) could be increased accordingly. Network fees charged per unit of energy consumed could be replaced by a monthly connection fee, which is already the case in some member states. Fossil fuels used for electricity generation (e.g. coal and natural gas) could be charged by the strengthened EU Emissions Trading Scheme.

Electricity prices differ significantly between EU member states. In 2017, Germans, Danes, and Belgians paid up to 3-times the price for electricity than the citizens of Bulgaria or Lithuania. The main three elements shaping electricity prices are: (I) the cost of electricity generation, (II) network charges, and (III) taxes/fees, with the last one playing the most important role in creating these differences between member states. In the majority of EU member states, electricity is the source of final energy taxed at the highest rates (European Commission, 2019). This change can be conducted within the framework of the Energy Taxation Directive, the update of which is to be proposed by June 2021.

Apart from the fact that the cleanest and domestic source of energy is taxed at the highest level, the current way electricity is taxed poses two main issues for citizens' energy. First of all, as already flagged in Section 4.3, increasing the share of self-consumed electricity by prosumers and energy cooperatives results in higher costs for the remaining citizens (Caramizaru et al., 2020). Secondly, different levels of electricity taxation in different EU member states makes it challenging to establish a transboundary energy cooperative. At the same time, proceeds from electricity taxation constitutes an important contribution to national budgets, whereas network fees are essential for maintaining and expanding electricity grids.

FIGURE 10: MAIN ELEMENTS OF ELECTRICITY PRICES AND PROPOSAL FOR THEIR REDISTRIBUTION



The main drawback of this approach is a significant decrease in electricity prices, thus possibly resulting in a rebound effect and increasing electricity consumption. However, this drawback would also be the drive towards electrification of different energy sectors, especially transport and heating.

5.7 IMPROVE COOPERATION BETWEEN LOCAL GOVERNMENTS AND COOPERATIVES.

To facilitate cooperation between local authorities and energy cooperatives, the former may explicitly include citizens' participation as an additional criteria in their Call for Tenders to realise certain investments, e.g. provision of energy for district heating or hydrogen for local public transport.

In many cases, energy cooperatives very closely cooperate with the local or regional authorities. This is especially the case in rural areas, where an investment in wind energy or solar farms requires adapting the corresponding spatial development plan. At the same time, citizens' energy can be essential in implementing a regional climate action plan. When combined with the co-benefits, such as job creation and increasing citizens' acceptance, driven by co-ownership and co-creation, the close cooperation between the energy cooperatives and local authorities result in a win-win situation.

There are also examples showing that local authorities consult with energy cooperatives when implementing new policies and regulations, thus further democratizing the policy-making process at a local level. Finally, local authorities may empower local initiatives by providing them with meeting venues, facilitating networking, and putting their communication channels (e.g. website, newsletter, or mailing lists) at their disposal to inform the community about planned project (Luyts, 2017).

The model of cooperation between energy cooperatives and local authorities represented by PajoPower, as described in Subsection 3.2.4, is an excellent example of how local authorities may take advantage of citizens' willingness to co-shape their immediate environment. The comparably low dividend paid out to the cooperative shareholders is enhanced with an increase in ownership and feeling of agency in instigating positive change at the local level. On its part, local authorities facilitate this change by improving energy efficiency (e.g. for street lighting) or utilization of space on public buildings by developing renewable sources of energy.

5.8 ALLOW FOR THE COMMERCIALIZATION OF ASPECTS OF COMMUNITY-OWNED PROJECTS

The fact that the development of certain technologies have been driven by the activities of energy cooperatives does not mean that these technologies should only be realised by citizens’ energy. The involvement of commercial actors is essential to scale them up and decrease their costs. A way to solve this challenge could be by creating an additional legal form for companies initiated by local communities that would enjoy certain benefits but also certain obligations, e.g. “cooperative company”. It could operate as a regular company, with the exception **that it should not undermine the benefits for which the initial cooperative had been created.**

Currently there is not, nor should there be, any possibility to stop members of a not-for-profit entity (e.g. energy cooperative) to initiate their own *commercial* activity based on the knowledge gained as members of the cooperative. This may actually accelerate technological change: Commercial entities have advantages that cooperatives or prosumers do not have: full time focus on the improvement of certain solutions, less consensual decision-making which may slow down making important decisions, and the possibility to accelerate technologies by using its dedicated R&D infrastructure. However, the prospect of commercialization of some of the cooperative activities may lead to a degree of mistrust among other members of the cooperative. Introducing the legal form of “cooperative company” could mitigate this issue.

6. Conclusion

The energy sector is undergoing a major transformation. To reach the EU's proposed 2030 emissions reduction goal of at least 55%, the speed of emissions reduction needs to at least triple in the 2020s and continue at that speed until fully decarbonised. This requires contributions from all players, including small and large companies. However, citizens' energy needs to be an important part of the equation resulting in the full decarbonisation of the EU's economy.

This transformation is driven not only by the need to become fully decarbonised by the middle of the century, but also by technological developments and scalability of new generation units, therefore shifting the focus from centralised power generation to a distributed one. However, the potential offered by local communities and prosumers goes beyond merely generating electricity. The entrepreneurship which led to the ongoing transformation in the electricity sector can also be used to decarbonise other sectors of the economy, such as transport and buildings. Smart policies can empower not only homeowners, but also tenants to contribute to meeting the challenge of climate change. The design and implementation of blockchain based ledgers scan allow electricity trading without involvement of third party actors. Sector coupling, combined with IT, may replace imported energy for transport with self-generated electricity on the roof, thus further contributing to the liberal vision of the society.

However, citizens' energy is also an example of two much broader trends that transcend the energy sectors. The first of these trends is one towards broader democratization and empowerment, an impact that goes beyond participating in the European, regional, and national elections. While voting is essential in a liberal democracy, in the rapidly changing world it must be complemented with a deliberative democracy, especially at the local level, and replace the technocratic decision-making that dominates the centralised electricity sector. This process of democratisation has already been accelerated with the rise of the internet, which democratised the spread of information, with all its advantages and downsides. In the area of energy, whether through participation in energy cooperatives or becoming prosumers, citizens can gain the possibility to co-create and increase ownership of the new, low carbon, reality.

Another of these broader trends represented by citizens' energy is aimed towards decoupling consumption of resources and economic growth. Renewables and energy efficiency offer the potential to not only free future generations from the calamities caused by climate change, but also create the opportunity to continue increasing our quality of life and grow our economy with a much smaller carbon footprint. Indeed, as development of renewables and investment in energy efficiency are some of the most effective ways to create new jobs and drive economic growth, they may also result in a negative correlation between economic growth and GHGs emissions.

Which, in conclusion, brings us to the current debates surrounding the best ways to drive economic recovery from the COVID-19-induced economic crisis. Due to their comparably short investment circles, distributed renewables and energy efficiency offer the potential to revive the economy and create new jobs where they are needed most. Coincidentally, the countries most affected by the crisis in the EU, such as Italy and Spain, also offer the largest potential for solar-PV development, and the resulting job creation. Relying on citizens' energy as one of the contributors to economic recovery presents an opportunity to make the EU and its member states more sustainable and democratic in the post-COVID time.

Literature

100 Prozent Erneuerbare Stiftung. (2011). *40 Prozent der Erneuerbare-Energie-Anlagen in Bürgerbesitz.* http://blog.100-prozent-erneuerbar.de/wordpress/2011/10/26/40-prozent-der-erneuerbare-energie-anlagen-in-deutschland-in-burgerbesitz/

Aghajanzadeh, A., & Therkelsen, P. (2019). Agricultural demand response for decarbonizing the electricity grid. *Journal of Cleaner Production,* 220, 827–835. https://doi.org/10.1016/j.jclepro.2019.02.207

Agora Energiewende. (2015). *Aktionsplan Lastmanagement.* https://www.agora-energiewende.de/fileadmin2/Projekte/2014/aktionsplan-lastmanagement/Agora_Aktionsplan_Lastmanagement_web.pdf

Agora Energiewende & Sandbag. (2020). *The European Power Sector in 2019.* 48.

Aklin, M., & Urpeleinen, J. (2018). *Renewables: The Politics of a Global Energy Transition.* MIT Press Ltd.

Bauwens, T., Gotchev, B., & Holstenkamp, L. (2016). What drives the development of community energy in Europe? The case of wind power cooperatives. *Energy Research & Social Science,* 13, 136–147. https://doi.org/10.1016/j.erss.2015.12.016

Bechberger, M., Mez, L., & Sohre, A. (2008). *Windenergie im Ländervergleich.* Peter Lang.

Beeson, M. (2010). The coming of environmental authoritarianism. *Environmental Politics,* 19(2), 276–294. https://doi.org/10.1080/09644010903576918

BHKW-Infozentrum. (2020). *Negative Strompreise – Infos zu negativen Stundenkontrakten.* BHKW-Infozentrum. https://www.bhkw-infozentrum.de/wirtschaftlichkeit-bhkw-kwk/negative-strompreise-fakten-und-statistiken.html

BMU. (2012). *Bundestag beschließt Anpassung der Fördersätze für Solarstrom im EEG.* https://www.bmu.de/pressemitteilung/bundestag-beschliesst-anpassung-der-foerdersaetze-fuer-solarstrom-im-eeg/

BSW Solar. (2020). *100.000 neue Photovoltaik-Prosumer innerhalb eines Jahres in Deutschland.* https://www.bhkw-infozentrum.de/bhkw-news/46238_100-000-neue-Photovoltaik-Prosumer-innerhalb-eines-Jahres-in-Deutschland.html

Bundestag. (2000). Gesetz für den Vorrang Erneuerbarer Energien (Erneuerbare-Energien-Gesetz—EEG) sowie zur Änderung des Energiewirtschaftsgesetzes und des Mineralölsteuergesetzes. *Bundesgesetzblatt Teil I, 13,* 305.

Bundesverband Neue Energiewirtschaft. (2018). *EU-Parlament gegen Doppelbelastung von Stromspeichern.* bne - Bundesverband Neue Energiewirtschaft e.V. https://www.bne-online.de/de/news/detail/verbaende-appell-doppelbelastung-stromspeicher/

Butti, K., & Perlin, J. (1980). *Solar water heaters in California,* 1891—1930. https://www.osti.gov/biblio/6772173

Byzio, A., Heine, H., & Mautz, R. (2002). *Zwischen Solidarhandeln und Maktorientierung.*

Caramizaru, A., Uihlein, A., European Commission, & Joint Research Centre. (2020). *Energy communities: An overview of energy and social innovation.* https://op.europa.eu/publication/manifestation_identifier/PUB_KJNA30083ENN

CE Delft. (2016). *The potential of energy citizens in the European Union.* https://www.foeeurope.org/sites/default/files/renewable_energy/2016/ce-delft-the-potential-of-energy-citizens-eu.pdf

CityInvest. (2017, June 14). *CITYNVEST animation.* https://vimeo.com/221553586

Climate Ministry. (2020). *Minister Kurtyka: „Polityka energetyczna Polski do 2040 r." udziela odpowiedzi na najważniejsze wyzwania stojące przed krajową energetyką w najbliższych dziesięcioleciach - Ministerstwo Klimatu - Portal Gov.pl.* Ministerstwo Klimatu. https://www.gov.pl/web/klimat/minister-kurtyka-polityka-energetyczna-polski-do-2040-r-udziela-odpowiedzi-na-najwazniejsze-wyzwania-stojace-przed-polska-energetyka-w-najblizszych-dziesiecioleciach

Co-Operatives UK. (2014). *Guidance on the FCA's registration function under the Co operative and Community Benefit Societies Act 2014 (CP14/22).* https://www.uk.coop/sites/default/files/uploads/guidance_on_the_fcas_registration_function_-_co-operatives_uk_consultation_response.pdf

Council of European Energy Regulators. (2018). *Status Review of Renewable Support Schemes in Europe for 2016 and 2017.* 126.

Courant d'Air. (2018, January 31). *Mobilität.* https://www.courantdair.be/wp/de/mobilitaet/

del Rio, P., & Mir-Artigues, P. (2014). *A Cautionary Tale: Spain's Solar PV Investment Bubble.* https://www.iisd.org/gsi/sites/default/files/rens_ct_spain.pdf

Der Bundestag. (2004). *Gesetz zur Neuregelung des Rechts der Erneuerbaren Energien im Strombereich.* http://www.iwr.de/recht/eeg/eeg_novelle_010804.pdf

Deutscher Bundestag. (1990). *Stromeinspeisungsgesetz.*

DGRV. (2020). *Zahlen und Fakten.* https://www.dgrv.de/bundesgeschaftsstelle-energiegenossenschaften/

Dryzek, J. S. (2002). *Deliberative Democracy and Beyond: Liberals, Critics, Contestations.* Oxford University Press.

Ecopower. (2020). *Zoekresultaten · Ecopower.* Ecopower. https://www.ecopower.be/search?q=ecotrajet

Edinburgh Community Solar Co-operative. (2020a). *Community Benefit Fund.* https://www.edinburghsolar.coop/community-fund/

Edinburgh Community Solar Co-operative. (2020b). *History.* https://www.edinburghsolar.coop/about-us/history/

Eid, C., Koliou, E., Valles, M., Reneses, J., & Hakvoort, R. (2016). Time-based pricing and electricity demand response: Existing barriers and next steps. *Utilities Policy, 40,* 15–25. https://doi.org/10.1016/j.jup.2016.04.001

Energieagentur Rheinland-Pfalz. (2016). *Geschäftsmodelle für Bürgerenergiegenossenschaften.* https://www.energiegenossenschaften-gruenden.de/fileadmin/user_upload/Newsletter-Anhaenge/2016_Newsletter_Februar/Buergerenergiegenossenschaften_Broschuere_160210_Small.pdf

EREC. (2004). *Renewable Energy in Europe.*

Erhvervsstyrelsen. (2013). *Virksomheder med begrænset ansvar (A.M.B.A. og F.M.B.A.)* https://erhvervsstyrelsen.dk/vejledning-virksomheder-med-begraenset-ansvar-amba-og-fmba

European Commission. (2014). *Guidelines on State aid for environmental protection and energy 2014-2020.* https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0628(01)&from=EN

European Commission. (2016). *Impact Assessment.* Impact Assessment of the Proposal for a Directive of the European Parliament and of the Council on the Promotion of the Use of Energy from Renewable Sources (Recast). https://eur-lex.europa.eu/resource.html?uri=cellar:1bdc63bd-b7e9-11e6-9e3c-01aa75ed71a1.0001.02/DOC_2&format=PDF

European Commission. (2019). *Energy Prices and Costs in Europe.* https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019DC0001&from=EN

European Commission. (2020). *Impact Assessment; Stepping up Europe's 2030 climate ambition. Investing in a climate-neutral future for the benefit of our people.* https://ec.europa.eu/clima/policies/eu-climate-action/2030_ctp_en

European Council. (2020). *Special meeting of the European Council (17, 18, 19, 20 and 21 July 2020) – Conclusions.*

European Environment Agency. (2014). *Renewable electricity.* https://www.eea.europa.eu/data-and-maps/indicators/renewable-electricity-consumption-1/assessment-2

European Environment Agency. (2020). *EEA greenhouse gas – Data viewer* [Page]. https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer

European Parliament and the Council of the European Union. (1996). *Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31996L0092

European Parliament and the Council of the European Union. (2001). *Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the Promotion of Electricity Produced from Renewable Energy Sources in the Internal Electricity Market.* https://doi.org/10.1017/CBO9780511664885.044

European Parliament and the Council of the European Union. (2003). *Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32003L0054

European Parliament and the Council of the European Union. (2009). *Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC.* https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32009L0072

European Parliament and the Council of the European Union. (2018). *Directive (EU) 2018/ 2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources. 128.*

European Parliament and the Council of the European Union. (2019). *Directive (EU) 2019/944 of the European Parliament and of the Council—Of 5 June 2019—On common rules for the internal market for electricity and amending Directive 2012/27/EU.* https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0944&from=EN

Eurostat. (2020). *Gross domestic product at market prices.*

EVWind. (2020). *2020: The year of photovoltaic records in Spain.* https://www.evwind.es/2020/08/09/2020-the-year-of-photovoltaic-records-in-spain/76377

EWS Schönau. (2020a). *Die Geschichte der Stromrebellen.* EWS Schönau. https://www.ews-schoenau.de/ews/geschichte/

EWS Schönau. (2020b). *Fragen und Antworten zur Genossenschaft.* EWS Schönau. https://www.ews-schoenau.de/ews/genossenschaft/fragen-zur-genossenschaft/

Fischer, B., & Wetzel, H. (2018). *Entwicklungsdynamik und strukturelle Merkmale von Energiegenossenschaften in Deutschland in den Jahren von 2009 bis 2015.* 16.

FNR. (2018). *Flexibilisierung von Biogasanlagen.* 72.

Forbes. (2018). *Renewable Energy In Spain: From The "Sun Tax" To The Promotion Of Collective Self-Consumption.* https://www.forbes.com/sites/anagarciavaldivia/2019/04/15/renewable-energy-in-spain-from-the-sun-tax-to-the-promotion-of-collective-self-consumption/#788a8e29aeeb

Frauenhofer ISE. (2017). *Aktuelle Fakten zur Photovoltaik in Deutschland.* 86.

Garud, R., & Karnøe, P. (2000). *Path Creation as a Process of Mindful Deviation.* 44.

Garud, R., & Karnøe, P. (2003). Bricolage versus breakthrough: Distributed and embedded agency in technology entrepreneurship. *Research Policy,* 24.

Global Change Data Lab. (2020). *Energy and Environment. Our World in Data.* https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions

Gorroño-Albizu, L., Sperling, K., & Djørup, S. (2019). The past, present and uncertain future of community energy in Denmark: Critically reviewing and conceptualising citizen ownership. *Energy Research & Social Science, 57,* 101231. https://doi.org/10.1016/j.erss.2019.101231

Hauschildt, J., & Pulczynski, jörn. (1995). *Growian: Zielbildung für bedeutende Innovationsvorhaben.* https://web.archive.org/web/20100704221230/http://www.offshore-wind.de/page/fileadmin/offshore/documents/TU-Berlin_GroWiAn.pdf

Heymann, M. (1998). Signs of Hubris: The Shaping of Wind Technology Styles in Germany, Denmark, and the United States, 1940–1990. *Technology and Culture, 39*(4), 31.

hier opgewekt. (2020). *Lokale Energiemonitor 2019.* https://www.hieropgewekt.nl/uploads/inline/Lokale%20Energiemonitor%202019_DEF_feb2020_2.pdf

Hills, R. L. (1994). *Power from Wind.* Cambridge University Press.

Hoppe-Kilpper, M. (2004). *Perspektiven der Windenergienutzung in Deutschland.*

IEEE. (2018). *Blockchain for Smart Grid Resilience: Exchanging Distributed Energy at Speed, Scale and Security.* https://www.smartenergyportal.ch/wp-content/uploads/2018/07/IEE.pdf

IPCC. (2018). *Summary for Policymakers—Global Warming of 1.5 oC.* https://www.ipcc.ch/sr15/chapter/spm/

IRENA. (2018). *Hydrogen from renewable power: Technology outlook for the energy transition.* 52.

Joint Research Centre. (2017). *Blockchain in energy communities: A proof of concept. Publications Office.* https://data.europa.eu/doi/10.2760/121912

Joint Research Centre. (2019). *Hydrogen use in EU decarbonisation scenarios.* https://ec.europa.eu/jrc/sites/jrcsh/files/final_insights_into_hydrogen_use_public_version.pdf

JRC. (2011). *2011 Technology Map of the European Strategic Energy Technology Plan (SET-Plan).* https://setis.ec.europa.eu/system/files/Technology_Map_2011.pdf

Kaak, R. (2015). *Energiekosten sparen dank flexibilisiertem Stromverbrauch | LVT-WEB.de – LVT Lebensmittel Industrie.* https://www.lvt-web.de/topstories/betriebstechnik-dienstleistungen/energiekosten-sparen-dank-flexibilisiertem-stromverbrauc

Lovins, A. B. (1977). *Soft Energy Path.* Penguin Books.

Lowitzsch, J., Hoicka, C. E., & van Tulder, F. J. (2020). Renewable energy communities under the 2019 European Clean Energy Package – Governance model for the energy clusters of the future? *Renewable and Sustainable Energy Reviews, 122,* 109489. https://doi.org/10.1016/j.rser.2019.109489

Luyts, S. (2017). *Collaboration between Local Authorities and Renewable Energy Cooperatives*. 93.

Magnusson, D., & Palm, J. (2019). *Come Together—The Development of Swedish Energy Communities.* ResearchGate. https://doi.org/10.3390/su11041056

Mobicoop. (2020). *Services de covoiturage | Mobicoop—La mobilité partagée.* Mobicoop. https://pro.mobicoop.fr/

Next Kraftwerke. (2020). *Liberalization & Unbundling of Energy Markets | Definition.* https://www.next-kraftwerke.com/knowledge/liberalization-energy-markets

Otto, A., Ancygier, A., & Jankowska, K. (2020). Windenergienutzung und Landschaftsdebatten—Erfahrungen aus Polen und Deutschland. In *Kulturlanschaften in Deutschland und Polen* (pp. 193–216).

PajoPower. (2020). Kapitaalsoproep. *PajoPower Erkende CVso.* https://www.pajopower.be/nieuws/kapitaalsoproep-75-000-e/

Pepermans, G. (2019). European energy market liberalization: Experiences and challenges. *International Journal of Economic Policy Studies, 13*(1), 3–26. https://doi.org/10.1007/s42495-018-0009-0

Renewable Energies Agency. (2018). *Infographic dossier: Renewable Energy in the hands of the people.* https://www.unendlich-viel-energie.de/media-library/charts-and-data/infographic-dossier-renewable-energy-in-the-hands-of-the-people

REScoop. (2020a). *Map.* REScoop.Eu. https://www.rescoop.eu/

REScoop. (2020b). *Welcome to REScoop.eu.* REScoop.Eu. https://www.rescoop.eu/

Reuters. (2020). *Rapid scaling of electrolyzers accelerates wind hydrogen savings.* https://www.reutersevents.com/renewables/wind/rapid-scaling-electrolyzers-accelerates-wind-hydrogen-savings

Rosanvallon, P., & Goldhammer, A. (2011). *Democratic Legitimacy: Impartiality, Reflexivity, Proximity.* Princeton University Press; JSTOR. https://doi.org/10.2307/j.ctt7stdc.13

Rynek Elektryczny. (2020). *Mój Prąd ma już rok. Ile zostało pieniędzy?* https://www.rynekelektryczny.pl/stan-programu-moj-prad/

Sagebiel, J., Müller, J. R., & Rommel, J. (2014). Are consumers willing to pay more for electricity from cooperatives? Results from an online choice experiment in Germany. *Energy Research & Social Science, 2,* 90–101. https://doi.org/10.1016/j.erss.2014.04.003

Scientific American. (2015). *Einstein's Legacy: The Photoelectric Effect.* https://www.scientificamerican.com/article/einstein-s-legacy-the-photoelectric-effect/

Smil, V. (2017). *Energy and Civilization. A History.*

Solar Marstal. (2020). *Summary technical description of the SUNSTORE 4 plant in Marstal.* https://www.solarmarstal.dk/media/6600/summary-technical-description-marstal.pdf

Som Energia. (2015, September 1). [NdP] Som Energia recoge en sólo 2 horas 800.000 € para invertir en una central hidroeléctrica. *El Blog de Som Energia.* https://blog.somenergia.coop/comunicados-prensa/2015/09/som-energia-recoge-en-solo-2-horas-800-000-e-para-invertir-en-una-central-hidroelectrica/

Som Energia. (2018a, January 24). [NdP] Som Energia financia en Lleida su primer proyecto dirigido a paliar los efectos de la pobreza energética. *El Blog de Som Energia.* https://blog.somenergia.coop/comunicados-prensa/2018/01/som-energia-financia-en-lleida-proyecto-paliar-efectos-pobreza-energetica/

Som Energia. (2018b, March 13). ¡Abrimos las inscripciones a la 2a Edición del Germinador Social! *El Blog de Som Energia.* https://blog.somenergia.coop/som-energia/2018/03/abrimos-las-inscripciones-a-la-2a-edicion-del-germinador-social/

Som Energia. (2020a). Producción propia de Energías Renovables. *Som Energia.* https://www.somenergia.coop/es/produccion/

Som Energia. (2020b). ¿Quiénes somos? *Som Energia.* https://www.somenergia.coop/es/quienes-somos/

Sun, W., & Harrison, G. P. (2019). Wind-solar complementarity and effective use of distribution network capacity. *Applied Energy, 247,* 89–101. https://doi.org/10.1016/j.apenergy.2019.04.042

SWP Berlin. (2007). *Privatisations in Europe's liberalised electricity markets – the cases of the United Kingdom, Sweden, Germany, and France.* 23.

Szulecki, K. (2018). Conceptualizing energy democracy. *Environmental Politics, 27*(1), 21–41. https://doi.org/10.1080/09644016.2017.1387294

Tacke, F. (2004). *Windenergie: Die Herausforderung: Gestern, heute, morgen.* VDMA-Verlag.

The Energy Collective project. (2020). *Towards direct sharing and trading of energy!* http://the-energy-collective-project.com/

The Government of the Netherlands. (2020). *National Climate Agreement.* https://www.klimaatakkoord.nl/documenten/publicaties/2019/06/28/national-climate-agreement-the-netherlands

The Mobility Factory SCE. (2020). *The Mobility Factory SCE.* http://www.themobilityfactory.eu/

Toffler, A. (2020). *The Third Wave.* Bantam Books.

TU Dormund. (2020). *Social Innovation.* http://www.sfs.tu-dortmund.de/cms/en/social_innovation/index.html

Upham, P., Bögel, P., & Johansen, K. (2019). *Energy Transitions and Social Psychology: A Sociotechnical Perspective.* Taylor & Francis Group. http://ebookcentral.proquest.com/lib/nyulibrary-ebooks/detail.action?docID=5667443

Wietschel, M. (2019). *Integration erneuerbarer Energien durch Sektorkopplung: Analyse zu technischen Sektorkopplungsoptionen.* 334.

Wysokie Napięcie. (2020). Polacy wydali 5 mld zł z własnych kieszeni na fotowoltaikę. *WysokieNapiecie.pl.* https://wysokienapiecie.pl/32271-polacy-wydali-5-mld-zl-z-wlasnych-kieszeni-na-fotowoltaike/

Zoellner, J., Schweizer-Ries, P., & Wemheuer, C. (2008). Public acceptance of renewable energies: Results from case studies in Germany. *Energy Policy, 36*(11), 4136–4141. https://doi.org/10.1016/j.enpol.2008.06.026

AUTHOR

Andrzej Ancygier works as a Senior Energy and Climate Policy Expert at Climate Analytics in Berlin where he specializes in the European climate policy with a focus on renewable energy and energy efficiency. He is also teaching courses dealing with environmental social movements at the New York University in Berlin. Ancygier holds a PhD in Social Sciences awarded by the Freie Universität Berlin and a Master Degree in International relations from the University of Wrocław. In his PhD he analyzed the implementation of the EU's renewable energy directives in Poland and the impact of different groups of interests on the way renewable energy policy is shaped at the European and national levels.

The views expressed in this study are solely those of the author and do not necessarily reflect the views of the institutions he is currently working for.

EDITOR

Dieter Feierabend works as scientific director at NEOS Lab. He holds a PhD in Social Sciences and a BSc in Statistics from the University of Vienna. In his studies, he focused on the relationship between policy issues and electoral behaviour. Furthermore, he is a graduate of the postgraduate program "Multi-Level Politics in Europe" at the Institute for Advanced Studies in Vienna. Before joining NEOS Lab, he worked as a freelance consultant i.e. for the Austrian Academy of Sciences (Institute for Technology Assessment).

INSTITUTIONS

NEOS Lab is the political academy of the liberal grass-roots movement NEOS, and an open laboratory for new politics. The main objective of NEOS Lab is to contribute to enhancing political education in Austria by providing a platform for knowledge exchange and liberal political thinking on the key challenges and pathways of democracies and welfare states in the 21st century. Particular emphasis is placed on the core topics of education, a more entrepreneurial Austria, sustainable welfare systems and democratic innovation. NEOS Lab conceives itself as a participatory interface between politics and society insofar as it mediates between experts with scientific and practical knowledge on diverse policy issues and interested citizens. A network of experts accompanies and supports the knowledge work of the diverse thematic groups and takes part in the think tank work of NEOS Lab. Additionally, NEOS Lab provides several services, such as political education and training, workshops and conferences and a rich portfolio of inter- and transdisciplinary research at the interface between science, politics, economy and society.

NEOS Lab is the successor of the Liberal Future Forum, which was previously a member of ELF.

lab.neos.eu

The European Liberal Forum (ELF) is the official political foundation of the European Liberal Party, the ALDE Party. Together with 46 member organisations, we work all over Europe to bring new ideas into the political debate, to provide a platform for discussion, and to empower citizens to make their voices heard.

ELF was founded in 2007 to strengthen the liberal and democrat movement in Europe. Our work is guided by liberal ideals and a belief in the principle of freedom. We stand for a future-oriented Europe that offers opportunities for every citizen. ELF is engaged on all political levels, from the local to the European.

We bring together a diverse network of national foundations, think tanks and other experts. At the same time, we are also close to, but independent from, the ALDE Party and other Liberal actors in Europe. In this role, our forum serves as a space for an open and informed exchange of views between a wide range of different actors.

www.liberalforum.eu

lab.neos.eu

ISBN: 978-3-200-07271-8