Renewable energy self-consumption

A Policy Brief from the Policy Learning Platform on Low-carbon economy

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Summary

Self-consumption of renewable energy can provide financial, environmental and security benefits for households, businesses, grid operators - Distribution system operators (DSOs) and transmission system operators (TSOs) – and society at large, though the market is newly developing, and significant progress is still needed to both deepen market penetration, and ensure that the grid can manage resulting changes in energy flows. In many countries, solar photovoltaics (PV) is approaching grid parity, making self-consumption an attractive measure, with 'prosumers' able to self-consume their generated sustainable electricity and sell-off any excess into the energy grid. Where parity is not yet met, further political and economic support is needed and there are multiple options available for regions. The EU's Clean Energy Package requires EU Member States to remove barriers to self-consumption, though the exact measures to be implemented are flexible and dependent on national and regional scenarios. For regions, enabling self-consumption puts consumers at the heart of the low-carbon transition and unleashes private investment, so is a potentially cost-effective strategy to meet renewable energy and emissions reductions targets. Although much is determined at the national level, regions have several options available for them to boost self-consumption.

Self-consumption of energy is possible using several technologies; this policy brief will *focus specifically on self-consumption of electricity*, rather than heat or cogeneration, and is focused mostly on individual applications rather than community initiatives. Additionally, as the leading technology, the focus is on solar photovoltaics (PV), but reference will also be made to other technologies.

Self-consumption of renewable energy

Whilst energy generation remains mostly centralised, technological development over past decades has made decentralised, mostly renewable, energy generation an attractive prospect for individual homeowners and companies. The benefits are evident – cheap and independent energy, reduced carbon emissions, improved property values, and the potential to make money from selling excess energy to other users.

Renewable energy use is growing, not only by the electric power industry (utilities), but also through decentralised consumer scale applications. Cheaper and more efficient technologies are allowing self-consumption to emerge as a model, wherein consumers are to generate their own electricity, giving energy autonomy and potentially reducing the cost of electricity. A particular driver for this has been the steep decline in cost of renewable energy technologies and approaching grid-parity costs for the kWh of solar PV in many European countries, which is emerging as the leading decentralised technology by installations (though not overall capacity).

Decentralised generation can apply to both heat and electricity, as well as to co-generation in some cases. The main technologies for decentralised electricity generation and self-consumption are:

- **Solar Energy** – The most prominent technology for energy self-consumption is solar energy, in particular, solar photovoltaic (PV), though solar thermal is also wide-spread. Solar PV generates electricity, whilst solar thermal is used to warm water, and can also be used to generate heat and air conditioning. Hot water can be stored until ready for use, and solar PV requires battery storage so that there is electricity when the sun doesn't shine.
- **Wind Energy** – Wind turbines are one of the most prominent renewable energy solutions, but are less used for home installation and self-consumption. Wind turbines are most likely

to be part of a commercial application (such as an industrial site) or funded and owned via a community scheme. Small-size wind turbines are available for home installation, yet the market is not as well developed, or as competitive, as the solar PV market. Performance is often inconsistent if proper wind assessment and installation is not implemented.

- **Bioenergy** – Self-consumption of bioenergy has been widely exploited, primarily in rural settlements, for both heat and electricity generation (though heat is significantly more common). Bioenergy can only really be considered as self-consumption if the biological resources used are owned by the installation operator (e.g., farmers, forestry industry).
- **Hydropower** – Most hydropower application worldwide is in very large-scale dam systems. Micro-hydropower is a niche technology, but suitable for some small-scale energy provision. It is are most commonly found in the developing world and rural communities in off-grid situations.

With the limitations outlined above, this policy-brief will focus primarily on self-generated electricity from solar PV, the most cost-effective renewable technology for electricity. (For more on decentralised bioenergy applications, see the Policy Brief, 'Supporting local bioenergy development').

'Renewables self-consumer' means a final customer operating within its premises located within confined boundaries or, where permitted by a Member State, within other premises, who generates renewable electricity for its own consumption, and who may store or sell self-generated renewable electricity, provided that, for a non-household renewables self-consumer, those activities do not constitute its primary commercial or professional activity."

Recast Renewable Energy Directive, Article 2 – Definitions

As the European Union's definition above lays out, there are several modalities related to energy self-consumption that need to be considered:

- **Degree of self-consumption** – The optimal set-up would be for a home or business to consume all of the electricity that it generates, though this is not always possible as a result of differentiation in generation and consumption patterns. Self-consumption may therefore only cover part of energy demand. Higher self-consumption rates can be achieved by integrating multiple different technologies, though with additional costs.
- **Grid connection or stand-alone** – Grid connection will most likely be present for the property to be able to purchase electricity when generation falls below demand. It also allows excess electricity to be sold into the grid, rather than storing it. In some cases, properties may seek to be completely energy independent and not connected to the grid (most likely in remote areas where grid connections are lacking).
- **Individual or collective approach** – Self-consumption can relate to both individual and collective or community approaches. In the latter case, the self-consumption is collective, with generation technologies collectively owned and distributed. Citizens can establish a legal entity (company, association, etc.) which is responsible for operation and finance, and deals with grid operators. Community approaches will not be covered extensively in this policy brief. (For more on collective self-consumption, see the Policy Brief, 'Renewable Energy Communities').

A model of self-consumption

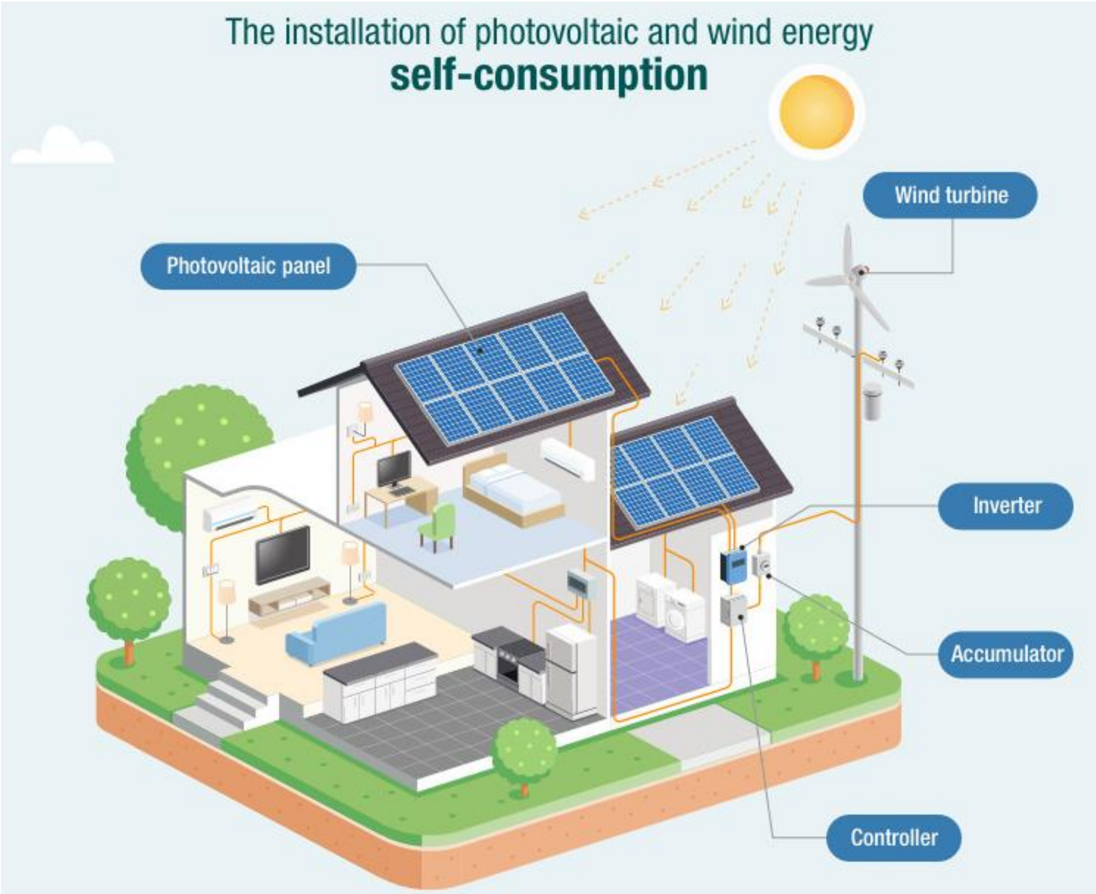

Figure 1 – Features of single building self-consumption [1]

The image above represents a model set-up for single building self-consumption, identifying the main technical aspects:

- **RES**: In this model, both a small wind turbine and solar photovoltaics are used. The choice of technology will be dependent on environmental (resource availability) and economic factors. Solar PV is the most commonly used technology;
- **Controller**: Manages power generation (connecting/disconnected the RES) and the battery to prevent overcharging and discharging. Controllers are not common in residential systems, where monitoring systems are used instead. Monitoring enables the household to adapt energy consumption to generation;
- **Accumulator/rechargeable battery**: The energy storage system which accumulates energy to use during off-peak moments;
- **Inverter**: The invertor converts direct current (as generated by PV) into alternating current, which is used for household applications (appliances, devices, etc.). Wind turbines generate alternating current without the need for inversion

N.B. – This idealised set-up does not take account of grid connection, assuming a fully self-sufficient unit, which is rarely the case without significant investment in energy efficiency and passive technologies (e.g., nearly zero-energy buildings).

[1] Source: Iberdrola – https://www.iberdrola.com/innovation/self-consumption

GOOD PRACTICE: Madeira Island's first energy self-sufficient hotel

Islands face particular energy challenges, often relying heavily on fossil fuel imports for energy supplies. To this end, self-consumption and use of decentralised energy generation can have an especially large impact when used on islands, and many island governments are attempting to support sustainable energy. Hotel Galomar, in Madeira (Portugal), is an innovative and leading application of energy self-sufficiency, including installation of solar thermal and solar PV panels, with a central power management system, as well as energy efficiency interventions. The renovation of the building was part funded through the European Regional Development Fund but was mostly done with private capital. The energy produced by the installations was enough to power the hotel, with its excess (5% of production) sold into the grid.

For more information, visit the RESOR website.

Why support self-consumption?

Achieving our climate targets and stimulating investment

As already mentioned, there are many benefits from using self-generated electricity including cheaper energy bills, energy autonomy, reduced carbon emissions and the creation of new, local jobs. Tackling our carbon emissions has been the main cause of political support for renewables, with policy makers in Europe supporting their uptake since the 1990s and the United Nations Framework Convention on Climate Change. Initial focus was on large scale installations such as solar and wind farms, but as technologies have matured and other benefits have become clear, policy-makers are increasingly turning to also support small scale installations, aware that they can collectively have a large impact on emissions.

For regions, enabling self-consumption unleashes private investment into the energy transition and is a potentially cost-effective strategy for territories to meet energy and climate targets. Self-consumption also contributes to raising awareness and behaviour change, with citizens seeing themselves as a part of the solution, taking ownership of the transition and becoming involved stakeholders and agents of change. Those who self-generate electricity are often also more aware of their energy consumption, knowing that it will impact upon costs or profits, which therefore drives energy efficient behaviour, including shifting usage to peak generation periods.

Resolving grid issues from renewable intermittency

The increase of renewables in the energy mix since the 1990s is having a large impact on the electricity grid. The grid that we have known for so long involves large, centralised power plants, with one-way transmission (high voltage, long distance) and distribution (lower voltage, distribution to end users). Renewables complicate grid management as they are intermittent and not controllable (unlike a fossil fuel or nuclear plant) which makes matching supply and demand difficult.

SET-UP
Interreg Europe

GOOD PRACTICE: Portuguese Self-Consumption Legislation

In January 2015, the Portuguese Government and Parliament approved and passed a decree-law to promote self-consumption. The legislation sought to introduce new solutions for the production of decentralised energy and create 'prosumers' in the country and introduced the right for households to connect to the public electricity grid to sell excess electricity generation (feed-in tariff) and buy electricity when domestic consumption was too low to cover needs. It was hoped that this right to access the grid would reduce risks for those investing in decentralised energy. The new framework had an immediate impact, and by the end of 2016, more than 10,000 self-consumption installations had been made, accounting for more than 50,000 kW. In October 2019, the government published significant changes to the framework in line with European Energy Union legislation and 2030 framework. The new legislation simplified licensing and rules for self-consumption plants in order to speed up regulatory authorisations, and enable energy communities.

For more information, visit the SET-UP website.

Self-consumption technologies *could* add additional difficulty by also integrating energy into the grid, 'bottom-up'. However, if self-consumption technologies, energy storage and accompanying ICT and microgrid systems can mature further, then they will actually be able to contribute to smoothing out demand-supply discrepancy without having to rely on fossil-fuel power plants. With ICT it will be possible to aggregate distributed generation, where utilities can bid to purchase electricity from a 'virtual power plant' (VPP) made up of excess electricity generated in individual systems to help balance the grid. Microgrids – small physically connected electricity systems (unlike digitally aggregated VPPs) – can operate independently of the main grid, connecting and disconnecting as needed and supporting local resilience.[2]

An additional boost to development of self-consumption comes from accompanying support for electric vehicles, which will enable vehicle-to-grid (V2G) application. Electric vehicles are expected to act as storage options for electricity generated via self-consumption and add additional flexibility to the grid. Vehicles can be charged in the day and stored electricity could be used in the home or sold to the grid to overcome supply bottlenecks.

These multiple approaches to decentralised energy are why self-consumption is gaining so much attention from the energy industry and policy-makers, being seen as key enablers for the long-term low-carbon transition. The market is developing quickly. Self-consumption technologies are expected to reach global spending of more than 190 billion USD per year by 2027 as more and

[2] For more on microgrids and VPPs, see 'Microgrids, Virtual Power Plants and Our Distributed Energy Future'

more people invest in their own energy generation technologies and make the transfer to electric vehicles.[3]

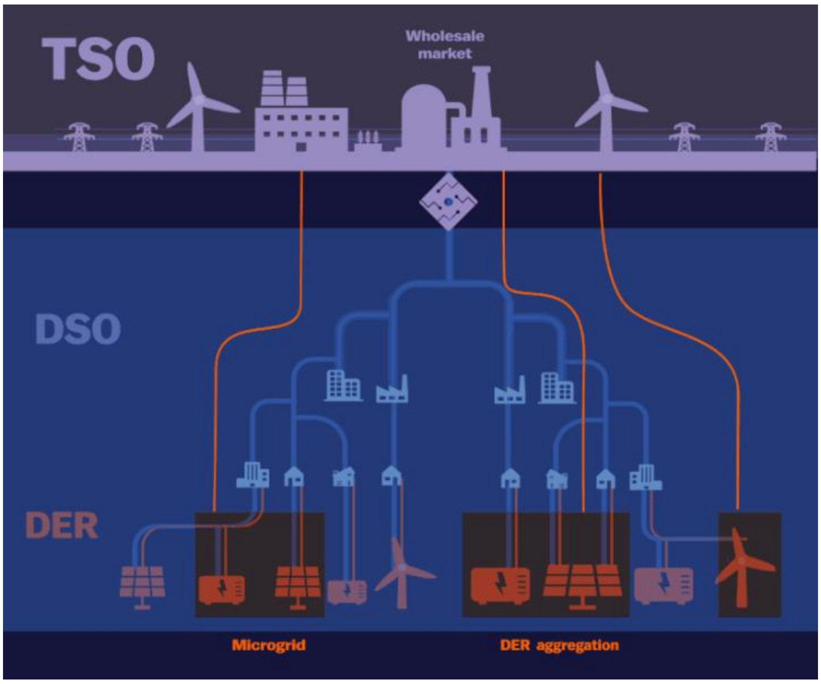

Figure 2 - Distributed generation and the 'grid' [4]

TSO = Transmission System Operator, DSO = Distribution Operator, DER = Distributed Energy Resources

Blue = traditional, top-down generation and distribution, Red = new bottom-up generation and distribution

Whilst the long-term perspective for a new generation and distribution model can contribute to grid stability, decentralised energy and self-consumption can also, in the shorter term, bring down costs of electricity for home owners, reduce carbon emissions, create new green jobs, avoid costs related to grid expansion, and help ween rural areas and islands away from fossil fuel imports.

Challenges to market expansion

Whilst the technologies for self-consumption are well developed, the **overall cost-competitiveness of technologies, which can be expensive to purchase and install, is not always guaranteed** and investment decisions must be balanced. Ultimately, to be successful, the cost of energy from decentralised renewables must be cheaper than the retail price of energy – something that is largely achieved now using subsidies.

Additionally, there remains a **disparity between electricity generated and electricity used in homes**, particularly for photovoltaics, meaning that self-consumption cannot cover all energy needs, requiring additional technologies and grid connection. Most electricity can be generated during the day when people are not (*usually*) at home – peak electricity use is instead in the mornings and the evenings. Therefore energy storage remains such a key issue, with energy generated in the day stored for when it is most needed.

Batteries remain expensive and until their cost comes down and their capacity improves, high costs and long amortisation mean that market growth is limited. Until these technologies mature,

[3] https://www.smart-energy.com/industry-sectors/distributed-generation/self-consumption-enablers-distributed-energy-resources-192-billion/
[4] Source: Vox https://www.vox.com/energy-and-environment/2018/11/30/17868620/renewable-energy-power-grid-architecture

intermittency will remain a key issue: a report from the European Commission found that with demand-side response (load shifting) and energy storage, the self-consumption rate of an average Central European household with PV could be 65-75%, but only 30% without. [5]

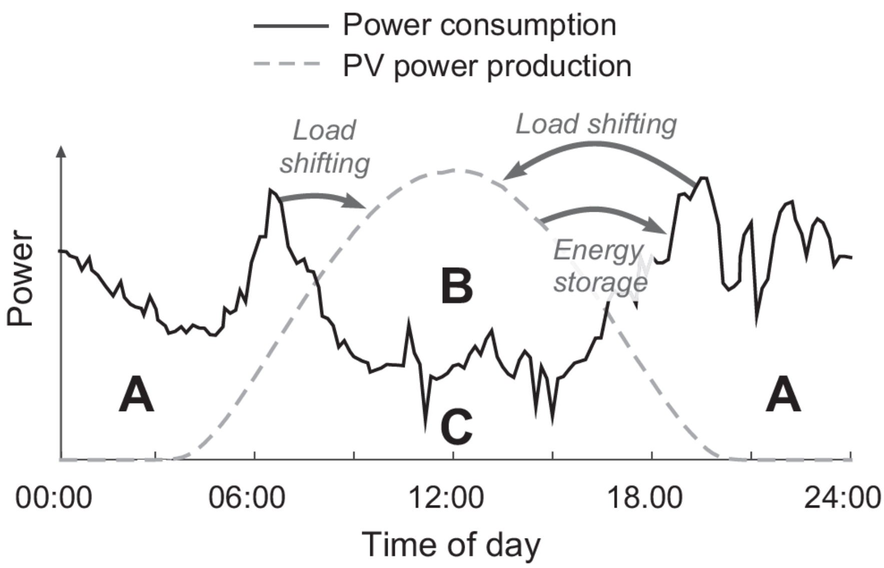

Figure 3 - Peak production and peak demand [6]

A = energy consumption, B = excess energy, C = self-consumption

Efforts can also be made to encourage **load shifting**, whereby households can use their appliances (e.g., washing machines, dish washers, boilers, e-vehicle charging, etc.), during the day, which can also be achieved with smart devices that can be programme to run at a given time. Load shifting will require not only technological innovations, but also behaviour change efforts.

Comparatively, businesses and public buildings, used in the daytime, may benefit most from PV self-generation, using electricity at peak generation. The European Commission calculated that businesses can already achieve 50-80% of their energy from self-consumption.[7]

Finally, we must also consider **distribution and network costs**. The retail price of electricity is comprised of three parts: the energy itself, transmission and distribution costs, and taxes/surcharges. The price to cover all three portions is usually determined by the overall electricity consumption. Self-consumers, however, whilst using grid infrastructure do not pay as much as they are not using as much grid electricity, leading to unfair distribution of charges. New approaches will be needed, taking account of smart metering, to ensure fair compensation for DSOs and TSOs and avoid the shift of costs to other consumers.

European policy for encouraging self-consumption

Recognising the benefits of self-consumption, and the remaining barriers to overcome, the European Union and its Member States have sought to provide an enabling Framework and ensure that individuals are placed at the centre of the energy transition and can contribute to Europe's CO_2 reduction targets.

[5] Commission Staff Working Document, 'Best practices on Renewable Energy Self-consumption', p. 3.
[6] Source: Improved Self-Consumption of Photovoltaic Electricity in Buildings, Rasmus Luthander, Uppsala University - https://www.researchgate.net/publication/302587113_Improved_Self-Consumption_of_Photovoltaic_Electricity_in_Buildings
[7] Commission Staff Working Document, 'Best practices on Renewable Energy Self-consumption', p. 3.

The European Union's Energy Union Strategy, launched in 2015, set out to enable consumers to take ownership of the energy transition and play an active role in decarbonising Europe. Under the Energy Union, the EU updated its energy policy framework through the 'Clean Energy for all Europeans' package (the 'Clean Energy Package'), to create a new wave of 'prosumers'. In particular, the revisions of the Renewable Energy Directive (RED II) and the Electricity Market Directive (EMD II) have set out provisions related to self-consumption. [8]

Under RED II, Member States are required to ensure that consumers can become self-consumers (in accordance with the definition on page 3), under Article 21.

Consumers are entitled:

(a) **to generate renewable energy**, **including for their own consumption, store and sell their excess production of renewable electricity**, including through renewables power purchase agreements, electricity suppliers and peer-to-peer trading arrangements, without being subject:
   a. in relation to the electricity that they consume from or feed into the grid, to discriminatory or disproportionate procedures and charges, and to network charges that are not cost-reflective;
   b. in relation to their self-generated electricity from renewable sources remaining within their premises, to discriminatory or disproportionate procedures, and to any charges or fees;

(b) to **install and operate electricity storage systems combined with installations generating renewable electricity for self-consumption** without liability for any double charge, including network charges, for stored electricity remaining within their premises;

(c) to **maintain their rights and obligations as final consumers**;

(d) to **receive remuneration, including, where applicable, through support schemes**, for the self-generated renewable electricity that they feed into the grid, which reflects the market value of that electricity and which may take into account its long-term value to the grid, the environment and society.

RED II, Article 21, 2

The EMD II specifies that, "All customer groups (industrial, commercial and households) should have access to the electricity markets to trade their flexibility and self-generated electricity,"[9] and sets outs the principle that consumers, "should be able to consume, to store and to sell self-generated electricity to the market and to participate in all electricity markets by providing flexibility to the system, for instance through energy storage, such as storage using electric vehicles, through demand response or through energy efficiency schemes."[10]

In order to do this, the EMD requires Member States to adapt and change their domestic energy laws to not only enable self-consumption, but to remove commercial and legal barriers, such as, "disproportionate fees for internally consumed electricity, obligations to feed self-generated

[8] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market in electricity (recast) & 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 (recast)

[9] Recital 39

[10] EMD II, Recital 42

electricity to the energy system, and administrative burdens, such as the need for consumers who self-generate electricity and sell it to the system to comply with the requirements for suppliers." [11]

Member States shall ensure that active customers are:

a) entitled to **operate either directly or through aggregation**;
b) entitled to **sell self-generated electricity**, including through power purchase agreements;
c) entitled to participate in flexibility schemes and energy efficiency schemes;
d) entitled to **delegate to a third party the management of the installations** required for their activities, including installation, operation, data handling and maintenance, without that third party being considered to be an active customer;
e) subject to **cost-reflective, transparent and non-discriminatory network charges** that account separately for the electricity fed into the grid and the electricity consumed from the grid, in accordance with Article 59(9) of this Directive and Article 18 of Regulation (EU) 2019/943, ensuring that they contribute in an adequate and balanced way to the overall cost sharing of the system;
f) **financially responsible for the imbalances they cause in the electricity system**; to that extent they shall be balance responsible parties or shall delegate their balancing responsibility in accordance with Article 5 of Regulation (EU) 2019/943.

Energy Market Directive, Article 2

National and regional support options

Whilst these EU-level initiatives set the overriding framework for decentralised energy, national and regional legislation and support schemes are highly flexible and must be adapted to specifics of the area covered.

Self-consumption is supported and promoted by public authorities as a way of easing pressure on the grid and contributing to greenhouse gas emissions reduction targets, and several policy options are available for those regions looking to boost self-consumption.

Legislative frameworks – The Clean Energy Package means that Member States must enable self-consumption and guarantee access to the grid, entailing new domestic laws for self-consumption. Member States have flexibility on different provisions in their national law with respect to taxes and levies for individual and jointly acting 'active customers', as well as for household and other final customers. Efforts also need to be made to establish simplified authorisation procedures for installations and access to the grid.

Investment Subsidies – Uptake of new technologies can be supported through investment subsidies. Access to capital and finance remains a barrier for consumers, with new business models and financial instruments needed to ensure widespread roll-out. Many countries have offered subsidies for purchasing renewable technologies, but they can also support demand management solutions and storage technologies, depending on national need and market maturity. Subsidies need to be monitored to ensure they remain cost-effective and cease as the market develops, and should only support installations that can truly support self-consumption, introducing size limits for technologies.

[11] EMD II, Recital 42

FIRESPOL
Interreg Europe

GOOD PRACTICE: Domestic Solar PV Pilot Scheme

In the absence of a feed-in tariff for domestic PV electricity to be sold into the grid, the Irish Government launched a pilot scheme in 2018 that offered grants to homeowners for Solar PV systems, including metering and control technologies (700 EUR/kWp) and battery storage systems (1,000 EUR). Systems had to be sized for household self-consumption of generated electricity and could include solar PV systems up to 2kWp, or 4kWp if installed with battery storage. The batteries themselves had to provide minimum storage of 2kWh (and be connected to a minimum 2kWp PV system). Since 2018, the scheme has led to more than 1,500 domestic PV systems and new installed capacity of 5,000 kWp from 3.5 million EUR of grants. As well as the benefits for homeowners, the scheme also contributed to growth in the PV sector with the registration of 90 new PV installers and the establishment of a stronger market. Typically, each installation could meet around a third of household energy requirements.

For more information, visit the FIRESPOL website.

Feed-in-tariffs and premiums – Whilst PV is approaching grid parity in several countries, in others, where this is not the case, feed-in-tariffs and premiums can help to make investment feasible for self-consumers. With a feed-in-tariff, the prosumer can receive a financial benefit for excess energy sold into the grid per kWh, but premiums can also be applied to kWh self-consumed, which can be used to encourage load-shifting (i.e., premiums on self-consumption during peak generation periods only). Between 2009 and 2012, Germany had a premium tariff for self-consumed electricity, though it was eliminated as grid parity was met. In the UK, PV for self-consumption is given a generation tariff, with a bonus for grid feed-in of excess generation.[12] As technologies mature, costs will reduce and self-consumption will become competitive with electricity prices, allowing for the removal of feed-in-tariffs.

Sometimes, the rates of renewable self-consumption are not even across a country, or they differ between urban and rural areas. Here, regions can play a direct role in supporting self-production and consumption in their territory as the example of Brussels region demonstrates.

[12] Both cases: European Commission, Staff Working Document, Best Practices on Renewable Energy Self-consumption, p. 10.

GOOD PRACTICE: Brussels Capital Region green certificate scheme for private renewable energy production

The Brussels-Capital Region has issued a decree to set up a support system through green certificates that allows a return on investment in renewable energy self-consumption systems in just seven years. On the one hand, producers of green electricity are entitled to obtain green certificates for their production, no matter how much of this is self-consumed and how much is fed into the grid. On the other hand, electricity suppliers are obliged to declare annually a determined number of green certificates to comply with a mandated share of renewables in their electricity mix. To meet their obligation, they buy certificate from private producers. Supply and demand for certificates meet on the market and a market price is derived from this.

In the end, suppliers pass on the cost of their quota obligation to all their end customers. The regulator 'Brugel' plays a key role in the system, as it carries out the calculations and allocations, organises the quota return and manages the certificate transactions on the market. A green certificate is awarded to the holder of a certified installation for every 217 kg of CO2 saved by its production of 'Green Electricity'. In practice, a typical home PV system of 14 panels that costs approx. 6,000 EUR and produces 4,000 kWh of electricity per year currently gets 12 certificates with a value of c.950 EUR per year for ten years, resulting in a payback time six-seven years.

The support is well accepted by households who react by investing in their own PV systems. Legislation also allows third party investors to rent roofs from individuals and invest in PV systems on these, providing roof owners electricity produced from these PV systems free of charge and remunerating the investors through the green certificates which provide a safe and positive return. The support system requires an annual adjustment, depending on the evolution of the cost of renewable energies. Different renewable energy technologies are supported through different certificate allocations, allowing their cost differences to be taken into account.

For more information, visit the Brugel website.

Modernising network charges – EU Member States have begun to explore new ways of ensuring that grid operators are properly compensated for their services. This involves changing tariffs for all consumers to ensure that the heaviest energy users contribute the most (progressive volumetric tariff), or that users face different tariffs based on time of use, dependent on grid capacity (peak/off peak). In Italy, for example, self-consumption units above 20kWp of above will pay an annual fee to grid operators for their services.[13]

Research and innovation – As outlined in the challenges facing self-consumption, further technological development will be required for decentralised energy to meet its full potential, including ICT, energy storage, demand management technologies and smart metres. Regions that lead in research and innovation will be well placed to benefit most from the energy transition, hosting expertise and manufacturing capacity to provide new technologies.[14] Business development in new technologies can be supported through clusters and co-operation between research, public and private sectors.

[13] Commission Staff Working Document, 'Best practices on renewable energy self-consumption', p. 8

[14] Advice on integrating smart grids into regional smart specialisation strategies can be found at Smart Grid S3 Partnership.

ENERSELVES
Interreg Europe

GOOD PRACTICE: Sardegna Ricerche – Experiment microgrids

The transition from programmed and centralised energy generation to decentralised and intermittent generation provides a challenge for the transmission grid and operators. Microgrids could provide a solution for the challenges of excessive load. A microgrid is a collection of energy generators which are a part of the wider grid, but can be disconnected to form an autonomous network, separate from the main grid. Microgrids can also be used for small scale communities where connection to the main grid would be too costly (such as islands and rural communities). Sardegna Ricerche operates three experimental microgrids, each with a different solar technology, to determine the benefits of microgrids for supply stability and to see challenges related to control and management, with the ultimate aim of supporting widespread roll-out of renewable technologies whilst limiting impact upon the grid.

For more information, visit the ENERSELVES website.

Support for specific communities – Self-consumption has specific benefits for communities which are 'off grid', including isolated villages and islands. In these cases, new renewable technologies will not be competitive with fossil-fuel based systems (such as individual generators, which are typically used), and as such, additional support is required to help these community meet decarbonisation goals. Investing in self-consumption can be significantly cheaper than grid expansion.

BUILD2LC
Interreg Europe

GOOD PRACTICE: An off-grid solution for rural electrification

Decentralised energy generation and self-consumption is an excellent solution for rural communities which may not be connected to the grid and (like islands), dependent on fossil fuels. In Croatia, there remain many such villages and hamlets without access to the electricity grid. Under the United National Develop Programme (UNDP) for Croatia, more than fifty rural households were equipped with 2.4kW solar PV systems for economic, social and environmental advancement. At a cost of around 6,500 EUR per household, an economic analysis revealed that the total cost of installation, maintenance and ownership over twenty-five years (lifetime of the equipment) was up to twenty-five times cheaper than extending the electricity grid.

For more information, visit the BUILD2LC website.

Public buildings as demonstrators – With awareness of self-consumption technologies remaining relatively low, installation onto public buildings represents a valuable awareness raising opportunity for regional authorities. As well as being visible to citizens (with public authorities also able to arrange visits and awareness raising activities), public procurement is a powerful tool for stimulating regional markets and can lead to new skill development and business creation. With many public buildings being large, there is also scope for benefiting from a combination of technologies, and the scale can make the exploration of innovative financing and ownership schemes feasible.

EMPOWER
Interreg Europe

GOOD PRACTICE: Citizen ownership and leasing of solar panels for self-consumption

Realising that a major barrier to the uptake of self-consumption technologies was the price for purchase and installation of solar panels, the municipality of Lorient (Brittany, France) entered into an agreement with a group of organisations, led by 'Bretagne Énergies Citoyennes', which had established the OnCIMè Citizen and Participatory Company, for the rental and installation of solar PV systems on two schools, the townhall and an apprentice training centre. The solar facilities are owned by OnCIMè (which is itself owned by 106 citizen shareholders) and leased to the municipality to power public buildings. In this way, the municipality gets cheaper electricity than purchasing from the grid, whilst costs paid are returned to citizen shareholders rather than to utilities and energy companies. As part of the rental contract, OnCIMè is also obliged to carry out awareness-raising actions for the users of the buildings, giving this practice an additional educational angle.

For more information, visit the EMPOWER website.

Communication and education – As well as awareness raising through public buildings and demonstrations, regional authorities and energy operators can contribute to the transition by providing easily accessible information to potential self-consumers, such as the Energuide.be, operated by Sibelga, which operates the gas and electricity distribution systems in Brussels and provides guidance to citizens on renewable energy topics. The use of decentralised energy can be also be promoted through personalised and in-depth advice, such as that offered by one-stop-shops. (For more information on one-stop-shops and citizen advice, see the Policy Brief 'Supporting energy renovation of private households through One-Stop-Shops')

Available support for energy self-consumption

As outlined, the European Union has set out an enabling framework for self-consumption and is supporting its roll-out, Europe-wide. As well as the legislative support, several financial and knowledge support services are available.

The European Structural and Investment Funds (ESIFs) for regional and infrastructure development can provide support to regions looking to make the energy transition by providing funding for projects that can contribute to European goals. Of the five ESIF funds, the European Regional Development Fund (ERDF) is the main source of funding for small scale renewables projects, with regions able to use funds to establish financial instruments and policy schemes that can support individual households and businesses. Investment Priority 4 ('supporting the shift towards a low-carbon economy in all sectors') is the main IP under which such instruments can be established. The current budget period for the ESIFs is coming to an end, but Regional Development and Cohesion Policy in 2021-2027 will focus on five priorities, with opportunities for decentralised energy in the priority 'Greener, carbon free Europe'.

As well as providing support for uptake of proven renewable energy technologies, the EU also operates the Framework Programme for Research and Innovation, better known in its current (eighth) phase as Horizon 2020. As of 2021, a new programme will be in place, Horizon Europe, which will run until the end of 2027. This follow-up programme will provide significant support for sustainable energy development, though the strategic planning is ongoing at the time of writing.

Horizon 2020 has funded many projects related to self-consumption and energy storage, which provide cutting-edge research and resources. These include:

- PV4GRID – 'Enabling consumers to become PV prosumers in a system-friendly manner'
- COMPILE – 'Integrating community power in energy islands'
- SCORES – 'Self consumption of renewable energy by hybrid storage systems'
- STORY – 'Added value of storage in distribution systems'

Additionally, the INTENSYS4EU project launched the BRIDGE platform, bringing together more than 60 projects to work together on issues of data management, regulations, business models and customer engagement.

As well as Horizon, the EU has adopted the Sustainable Energy Technologies (SET) Plan, to help contribute to technological development and innovation with a 2050 view for limiting climate change to two degrees and reducing greenhouse gas emissions by 80-95%. The SET Plan targets research and innovation activities towards key areas, including integration of renewables, new technologies and services for consumers and competitiveness in storage and batteries. Details on accompanying actions can be found at the SET Information System (SETIS).

After technologies are developed, there is the need to support regions and cities in developing policies that can support roll-out. This is where Interreg Europe comes in. Interreg Europe projects have found lots of good practices related to energy technology roll-out. Some of these are featured in this policy brief, with others available via the Good Practice Database.

ENERSELVES
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PROJECT FOCUS: Policy instruments for energy self-consumption in buildings

The ENERSELVES project has managed to make substantive changes to their regional policy instruments, which will lead to the installation of new self-consumption technologies in public buildings in Extremadura (Spain), Skåne and Blekinge provinces (Sweden), Świętokrzyskie Voivodeship (Poland), and Lazio Region (Italy).

For more information, visit the ENERSELVES website or see the feature article, 'ENERSELVES: Supporting energy self-consumption'.

Recommendations

- **Self-consumption of renewable energy can help in reaching our climate obligations, whilst also contributing to economic development and supporting grid-stability**, though further development of ICT systems and energy storage will be needed to see their greatest impact;
- **Regions benefit from creating enabling framework conditions for self-consumption**: it creates qualified local employment as highlighted in the Irish solar PV pilot scheme, and strengthens local value chains; it mobilises private investment as shown in the case of Portugal, creates a feeling of ownership amongst citizens as actors of the energy transition, and greens the image of the territory;
- Given the nature of the electricity grid, most initiatives will be national. New European legislation and initiatives are requiring EU Member States to change their domestic frameworks. **Regions should engage in the process and consult and discuss with national policy-makers** to help shape these developments;
- Region should **design complementary support frameworks** particularly adapted to their territory's socio-economic and geographical conditions that tie in hand-in-hand with the national RES legislation in place, such as Brussels region with its green certificates;
- Efforts are needed to **simplify administrative requirements and streamline processes**. The average home or business owner is not an expert in these processes, and so regions should make efforts to provide advisory services to guide through the process. With one-stop-shops becoming increasingly popular solutions for building energy performance issues, they should be charged with providing such advice;
- **Regions that take the lead in researching and testing new technologies will be well placed to benefit most from job and business creation** in this growing sector, as in Sardinia;
- **Self-consumption technologies are particularly relevant for rural communities and islands**, as demonstrated in Croatia. These technologies may not be cost-competitive with existing decentralised use of fossil fuels, but these communities should be of particular focus for policy-makers to assist them in the low-carbon transition.

Sources and further information

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- RESCoop & ClientEarth – Energy Communities under the Clean Energy Package: Transposition Guidance (2020)
- European Commission Staff Working Document, Best Practices on Renewable Energy Self-consumption (2015)
- European Commission Joint Research Centre – Impact of solar PV self-consumption policies on distribution networks and regulatory implications (2018)
- ENTSO-E – Towards smarter grids: Developing TSO and DSO roles and interactions for the benefit of consumers

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#lowcarbon #renewables
#selfconsumption
#regionaldevelopment

Low carbon economy

Interreg Europe Policy Learning Platform on Low-carbon economy

Thematic experts:

Simon Hunkin & Katharina Krell

s.hunkin@policylearning.eu k.krell@policylearning.eu

https://interregeurope.eu

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