

Surplus Power Tariffs

Boosting renewable investment through fair remuneration

Short version

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Date: 25 February 2021

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Cite as: Petrick, K.(2021). Surplus Power Tariffs - Boosting renewable investment through fair remuneration (short version). PROSEU - Prosumers for the Energy Union: Mainstreaming active participation of citizens in the energy transition.

Summary

This paper explains why standardised tariffs for renewable energy generation should continue to play a central role in energy policy. The overall goal is to massively accelerate the uptake of renewables to comply with the Paris Agreement. The demand for new renewable capacity is still not sufficiently incited by the energy markets due to incumbent fossil and nuclear generation and slow electrification of the heat and transport sector. Therefore, policy intervention is still necessary.

A New Policy Mix should be envisaged which promotes renewable installations of all system sizes. To that end it is argued that a so-called Surplus Power Tariffs (SPTs) should be introduced for small and medium sized systems. These tariffs would provide a fair remuneration for energy that is not self-consumed or shared.

SPT levels would be set just high enough to make minimum viable business case. To achieve a good business case, (joint) self-consumption and energy sharing or further efforts like the provision of systems services will be required.

The paper builds on the recent study (Jacobs et al. 2020) and aims to provide additional considerations for the design of the New Policy Mix and the underlying tariff schemes.

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1. Massive investment in renewables is lacking despite its urgency

Renewable energy deployment is not on track to reach the Paris Agreement: The large-scale uptake of renewable energy is – in combination with energy savings – *the* key measure to achieve the committed climate targets. However, renewable energy targets defined by member states and the EU are not ambitious enough, and renewable deployment is too slow in many member states to even achieve these targets.¹

Investment in renewables is still too unattractive, complicated and risky: Despite the urgency, global investment in renewable capacity has stalled since 2015.² Over the last years, governments have put their focus almost exclusively on decreasing costs which has led to the situation where renewable investments have become unattractive especially for the small and medium sized segments.

Focus must be put on massive increase of renewable generation capacity: As can be seen in the Paris Agreement Compatible (PAC) scenario in Figure 1, the next 15 years are crucial to achieve a doubling of electricity generation by simultaneously phasing out fossil and nuclear fuels.³ Therefore, over the next years, the priority must be put on new renewable electricity installations.⁴ As renewable costs have come down to a level where they are even lower than fossil generation, the macro-economic impacts are manageable.

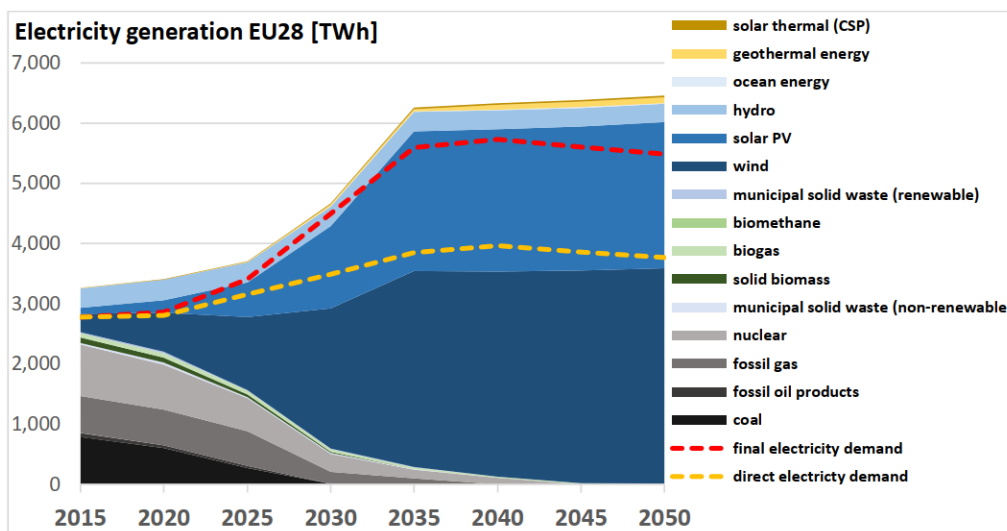


Figure 1: Paris Agreement Compatible (PAC) scenario. Source: CAN-E 2020

¹ The EU-2020 renewable energy target of 20% is likely to be only reached due to the Corona pandemic. While final data have still not been published, various member states (IE, NL, FR, UK, BE, etc.) are far from achieving their national targets. <https://www.eea.europa.eu/highlights/eu-on-track-to-meet>

² REN21, Global Status Report 2020

³ The PAC scenario calls for massive electrification combined with massive energy savings and efficiency increases which will lead to a halving of the final energy demand to roughly 6000 TWh/a. Almost all energy will be derived from renewable electricity, considering that only small amounts of bioenergy can be sustainably sourced, and assuming that technologies like geothermal heat remain niche applications. This means that renewable energy can be almost used synonymously with renewable electricity. Nuclear energy cannot be considered sustainable.

⁴ Flexibility, storage and grids will be important, too, but their deployment depends on renewable generation capacity.

2. Renewable support schemes are still needed

There is still no energy market which provides a level playing field for renewables. As fossil and nuclear generation congest electricity systems, and the electrification of the building and transport sector has hardly begun, there is insufficient market pull driving demand for more renewables. On-going subsidies to fossil and nuclear energy as well as other market distortions make the situation even worse. Claiming that “renewables should compete on the market” ignore the various ways in which current energy markets protect incumbents.⁵ Hence, in many countries it is still not possible to attract sufficient investment in renewable capacity without public intervention. As long as markets are not redesigned for an energy system based on renewables, support schemes will be required.⁶

Auctions have not delivered as intended: The current EU policy practice – based on the current State Aid Guidelines – makes governments assume that auctions are the preferred, “market-based” policy instrument, leading them to pre-emptively scale down other support schemes. However, there are various issues with auctions, for instance lack of actor diversity, lack of variety in project sizes, unresolved poor public acceptance, increasing market concentration, un-achieved deployment targets due to postponed or abandoned projects.⁷ Only few energy communities are able to build larger wind and solar parks because they must deal with tenders where the risk is high to not be awarded.

New business models based on self-consumption schemes or grid services are not enough. Many countries like Germany have reduced Feed in Tariffs (FiT) schemes to levels that are hardly attractive for small and medium sized projects, and some have abandoned them altogether like the UK.⁸ Certain countries like Spain hope that schemes like individual and joint self-consumption or aggregation are sufficient to make projects viable and/or increase profitability. However, these schemes are only attractive under certain circumstances.⁹ Joint self-consumption requires a certain level of sophistication when it comes to allocating the generated electricity in a fair manner, and most countries do not have any regulation in place yet¹⁰. Hence, these schemes are more for professionals and energy enthusiasts, hardly understandable by “normal people”. That way, the huge potential of citizen energy is far from being explored.¹¹

⁵ In fact, when many of the existing power plants were built, markets were not yet liberalized. Investments in fossil capacity during the last years in liberalized markets were supported by giving free emissions allowances, capacity mechanism, tax exemptions, etc. Hence it may even be argued that pure market-driven investment in generation capacity has been quite limited.

⁶ IEA RETD 2016 (RE-TRANSITION) had predicted the imminent transition from “policy support phase” to a “policy framework phase” but in fact this transition seems to take longer than it was hoped for. Regarding the issues that need to be tackled beyond support mechanisms see section 5 in the full version.

⁷ See Jacobs et al. 2020, Recent research even shows that costs per kWh are not necessarily lower with tendering as they would have been with the degression of the FiT, at least in Germany, see Grashof et al. 2020

⁸ Hall et al. 2019 (PROSEU)

⁹ For instance, the Export Tariff for surplus energy has to be negotiated with the supplier. It is too low to promote rooftop systems which go beyond self-consumption.

¹⁰ France has three options available for allocation keys (see [Enedis](#)). Spain struggles with a static allocation key which does not allow for full utilisation of the self-consumption potential.

¹¹ For citizen energy potential see PROSEU WP5 report, also JRC 2019 (rooftop PV potentials).

3. A call for a New Policy Mix, including “Surplus Power Tariffs”

3.1 Appropriate renewable support scheme for all project sizes

Surplus Power Tariffs (SPT): The recent publication of the World Future Council¹² calls for a “New Policy Mix” which should provide for appropriate mechanisms for each project size, including FiTs for small and medium sized projects. The following proposes to expand the concept of pure FiT to self-consumption and regional energy sharing for all small to medium size projects by introducing the term of Surplus Power Tariffs (SPT)¹³.

The SPT is a fair remuneration for surplus energy which is not self-consumed or shared. It is based on the LCOE of the installation.

- **Small sized projects** up to a few (dozen) kilowatts are mainly rooftop PV projects in both urban and rural areas. Self-consumption is likely and easily implementable, therefore a net billing scheme is used. For energy that is exported to the grid, the SPT is either paid out or deducted from the energy bill.
- **Medium sized projects** of up to several MW are built in rural and urban areas, on larger roofs on farms and commercial buildings.¹⁴ While direct self-consumption is possible, a large part if not all of the production will be fed into the grid. However, as these projects are typically close to urban areas or villages, their energy can be used for joint-self consumption or energy sharing. These project sizes are also the ones that are of interest for renewable energy communities. The part of the energy that is not shared receives the SPT.¹⁵
- **For large scale projects** in the multi-MW scale with dozens or hundreds of MW, auction schemes are appropriate. This is especially the case for sites that are publicly owned, like offshore locations, floating PV on reservoirs and (artificial) lakes, conversion areas, etc.

Figure 2 illustrates this scheme:

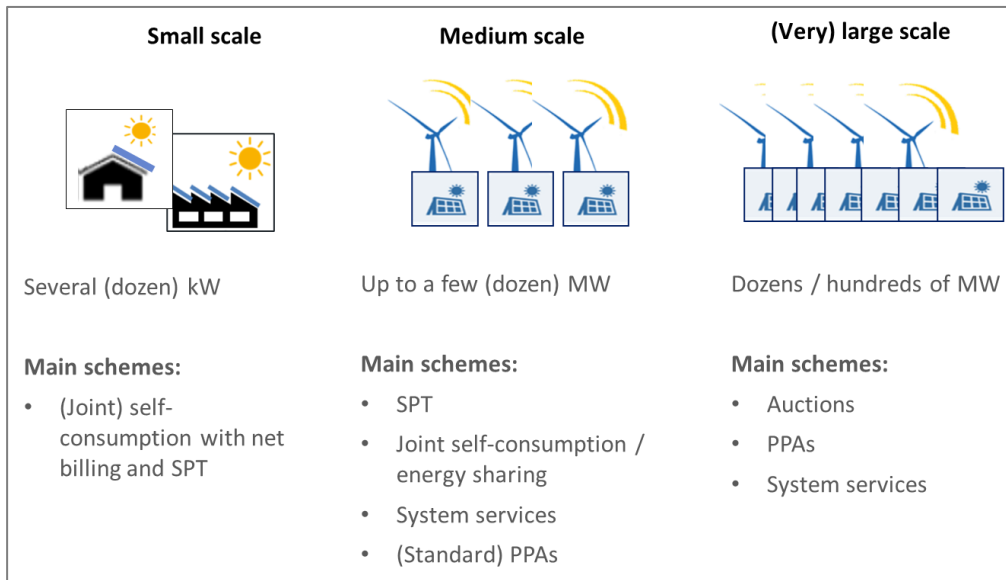


Figure 2: New Policy Mix based on Jacobs et al.

¹² Jacobs et al. 2020

¹³ Other terms could be thought of, see reflections in the annex in the long version.

¹⁴ Jacobs et al. suggest that medium size projects are up to 10 MW for most renewable technologies and for wind energy up to 10 turbines with a standard size (which may be up to around 6 MW/turbine in the next years). These limits may require a revision of the EEAG.

¹⁵ Until appropriate (i.e. well defined and attractive) regulatory sharing schemes are in place, the SPT will basically function like a FiT.

3.2 Guiding principles for a functioning supporting scheme

Every renewable kWh is welcome: Produce as much RE as possible, at any time. The RE uptake must take place as fast as possible to reach the targets of the Paris Agreement. As long as there are countries that are not 100% renewable, there is no *overall* shortage of renewable generation. This means that any kWh, including surplus energy of self-consumption installations, should be welcome and made use of.

Finding a use for surplus power and avoid curtailing. RE technologies are supply driven, they generate when there is sun or wind, this cannot be influenced. Most prosumers, especially households and most enterprises, have limited possibilities to change their demand patterns. It should not be *by default* upon the producers to find ways on how to make use of the energy generated, but they should be encouraged to do so to improve their business case. Specialised service providers or utilities should take care of surplus generation and use for storing it in batteries, charging electric vehicles, Power-to-Gas or Heat, export, etc. To squeeze fossil and nuclear generation out of the energy systems, each renewable kWh needs to get used, and regulation needs to support this. Curtailing should be avoided to the maximum extent possible.

All systems sizes are needed, while maximising capacity on every roof and in the built environment: Some economists argue that rooftop PV is more costly and less efficient than large scale RE. However, apart from empowering people to generate close to them, a distant RE installation does not create the same type of ownership. Prosumers need simple business models which entice them to install as much as they can afford, otherwise available resource potential remains unused. The installation of renewables in wild and unspoilt natural areas should also be avoided where possible. Therefore, it must be made utmost use of every rooftop and the already existing built infrastructure to boost renewable generation.

Fully recognising new citizen rights: The new EU legislation¹⁶ obliges member states to provide an “enabling framework” so that citizens can exercise their newly granted rights to generate, self-consume, sell, share and store energy. Citizens are entitled “*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.*” These provisions have not been implemented yet, and without a viable business case it cannot be expected that citizens put their savings into renewables.¹⁷ Citizen involvement is key to successfully transform the energy system in a truly sustainable and inclusive way. Hence, there must not be any restrictions and additional burdens on them to become active energy citizens. Even if this means that incumbent energy companies are likely to lose market share (at least when it comes to generation), this structural change must not be hindered.

¹⁶ Namely the Recast of the Renewable Energy Directive (RED II) and the Internal Electricity Market Directive (IEMD)

¹⁷ Notwithstanding, there are citizens that have supported the energy transition voluntarily or without expecting financial gains. However, less-engaged citizens need to be addressed as well in order to achieve a large-scale uptake of renewables.

4. Two key features for well-designed SPT schemes

For a renewable support scheme to be both attractive and efficient, the following two key design features are suggested:

- 1. SPTs provide for a *minimum viable business case*:** The state should guarantee a basic return on renewable investments, just high enough to not lose money, taking away the market risk and making projects bankable.
- 2. Further efforts are required for a *good business case*.** The business case can be improved if investors put additional efforts into making it work.

These principles are depicted in Figure 3. The following describes them in more detail.

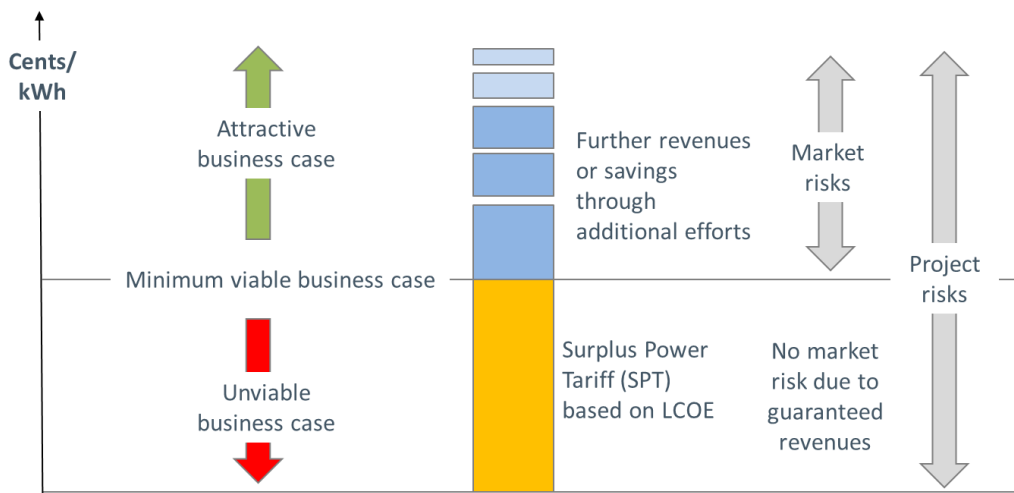


Figure 3: Two key design features of Support Scheme

4.1 Minimum viable business case for “just producing”

Viable business case but cost efficient: The SPT should not be “too generous” or “inflated” to avoid unjustified windfall profits; funds that are wrongly allocated will decrease overall societal benefits. On the other hand, if the value is set too low, the uptake will be too slow. For PV the adjustment of values can show fast effects, but for wind energy there will be delays due to longer project lead times.

Obviously in real life, such a clear line as shown in the figure above between a viable and unviable business case cannot be drawn but it should be possible to come sufficiently close to it.¹⁸ This does not mean that *any* investment is made viable; but under normal circumstances, i.e. at a reasonable site with sufficient resources and a competitive offer, an investor should not lose money.

Installation-size dependent SPT: Prizes per kW installed differ significantly depending on the system size, especially between 2 kW and 100 kWp and above. In order to reflect true prices, it is better to define more segments than too few. This also supports installations of all sizes, avoiding that systems are mainly built just at the thresholds.¹⁹ In order to avoid that larger projects are split into smaller ones, appropriate legislation has been introduced in Germany and also Spain (in the past).

Applying market experience and monitoring: As in most European countries a renewable energy market exists by now, it should be possible to determine average costs per kWp installed for the different technologies and system sizes. National regulators, supported by Research institutes, can use different

¹⁸ It may be considered if a minimum amount of self-consumption or energy sharing is required to make the business case viable. This depends on how much emphasis should be put on the local/regional aspect.

¹⁹ This effect has been observed in Germany where it was exacerbated with the introduction of additional costs or obligations for the next higher segment (see annex 7.7 in the long version).

methodologies to investigate and compare price levels (market surveys, interviews, supplier data analysis, etc.).²⁰ Monitoring true installation costs is crucial to be fair and to avoid undue profit making.

Evidence-based SPT adjustment and degression: SPTs need to be reviewed and adjusted to the market developments, e.g. on a semi-annual or annual basis. However, a pre-set degression as “base case” should not be defined because it would not consider sufficiently the actual deployment and market prices. Remuneration for power generated should be guaranteed for all projects that installed within the next 10-15 years (at least until 2030).

Reasonable Payback-time of initial investment: The SPT level should allow for a pay-back time of about ten years, depending also on the country circumstances, maturity of the local market, experience and regulatory provisions for energy sharing, financing costs, targets to be reached, etc. The shorter the payback time, the more attractive the investments and the faster the renewable deployment.

Potentially frontloading: To further speed up investments in the crucial years before 2030, the payback time could be further reduced by providing higher SPT in the first 5-10 years. After the initial investment is paid back, the SPT can then be decreased to roughly the LCOE level. Latest after 20 years²¹, the remuneration will be adjusted to the average market price or a level that ensures that the system stays connected and covers maintenance costs plus taxes. This concept is shown in Figure 4.

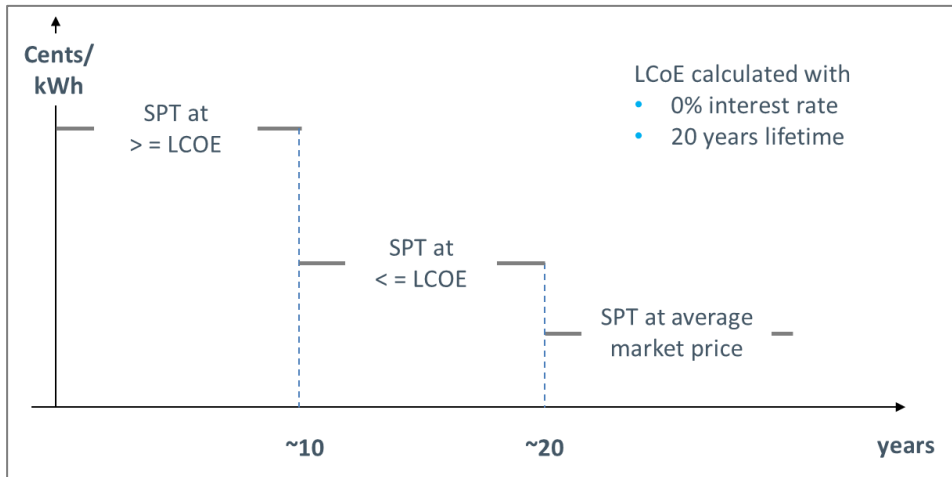


Figure 4: Frontloading of revenues

It is suggested to calculate the payback time using assumptions for the LCOE calculation with an **interest rate (WACC – Weighted Average Cost of Capital) of zero** and a **lifetime of 20 years** to make LCOE calculations comparable.²²

SPT depending on RE resource availability: Larger countries may consider having more than one SPT if the solar and wind resource differ substantially between the regions. This will allow that technologies are spread more equally across the countries and not only where the resource potential is excellent.²³ Obviously SPTs must be technology-specific to reflect real costs.²⁴

²⁰ Another option to increase market knowledge could be a web tool where prosumers/customers put the prices they paid for their installations. It is important that it is not the installers providing information but the clients. The FiT levels could be informed by the best prices per kWp and capacity range.

²¹ For commercial projects it could even argued to have an SPT only for the first 10 years because most commercial self-consumption projects will have payback times of under 7 years (otherwise businesses do not do them). Retail prices are usually rising in the meantime, making PV even more attractive than in year 0.

²² Examples of the FiT calculations are given in annex in the long version.

²³ In Germany a qualifier for wind sites is used, the FiT is based on a reference site. For small scale PV there may just have two tariffs, one for the sunnier, and one for the less-sunny regions.

²⁴ Innovative renewable energy technologies should still receive a FiT.

4.2 Further efforts for a good business case

The SPT will ensure that a prosumer, energy community or investor does not face an unforeseeable market risk. But revenues will not be high enough to be really attractive. This is where other business models will become interesting which aim to either reduce costs (like self-consumption) or improve revenues by providing additional services, like providing flexibility, increasing network efficiency and resilience, etc. This is depicted in Figure 5. Most of these activities require further efforts or knowledge, making them less accessible for the “average citizen”.

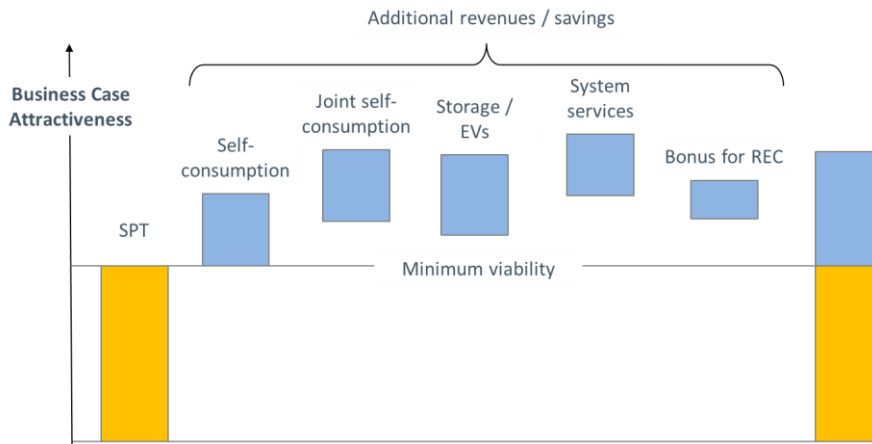


Figure 5: Improving business case through additional efforts

Self-consumption: Considering self-consumption as such does not complicate the installation but *increasing* self-consumption rates may require additional efforts by changing behaviour or production processes (in the case of commercial entities), or additional costs by investing in storage capacity, electric vehicle, or heat pumps.²⁵

Figure 6 shows the concept of self-consumption in energy units (not in values).

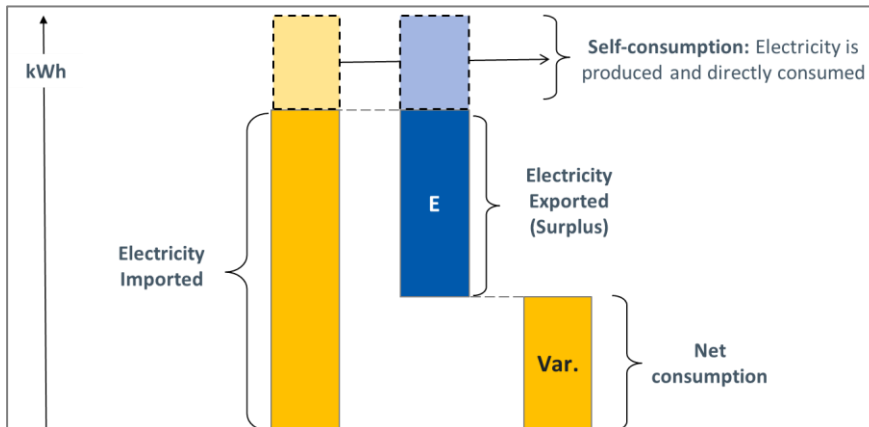


Figure 6: Self-consumption (generation < consumption)

There are different ways to deal with the remuneration of the surplus power. Ideally it is paid out independently from the net consumption invoice in order to provide an independent revenue stream. However, it can also be considered to offset the (variable part of the) invoice and then only to pay the net economic surplus, see Figure 7.

²⁵ Digital/smart meters help to better integrate self-consumption into the energy system as they allow measuring of import and export flows on a sub-hourly level. Self-consumption business models in Germany still seem to be restricted by analog meters, see e.g. <https://www.pv-magazine.de/2020/06/23/das-prosumer-modell-der-bundesnetzagentur/> The costs for the digital meter roll-out may be spread over all energy consumers or even be tax-financed. See also section 5.1 in the long version.

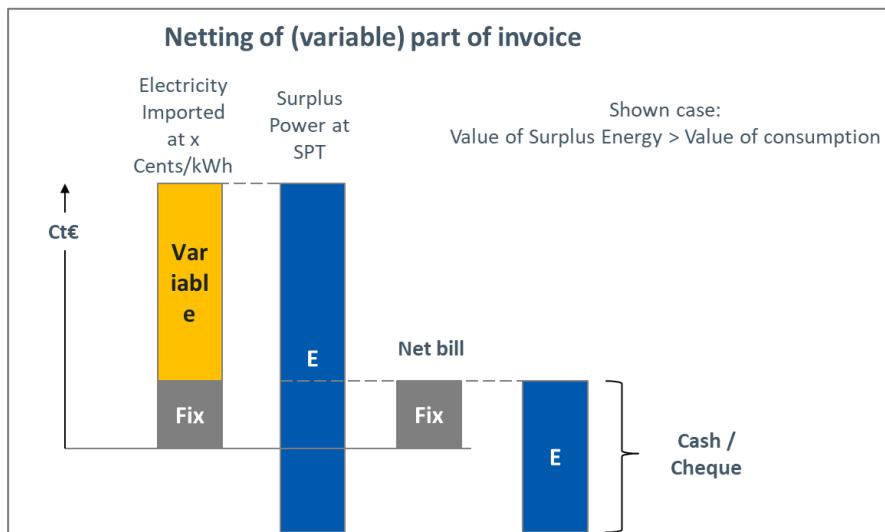


Figure 7: Netting of (variable) part of the invoice

Joint self-consumption or energy sharing: Prosumers may be able to achieve higher returns if they are able to develop agreements with their neighbours, other members of energy communities, electricity providers or services companies. Joint self-consumption means that participants can reduce their own energy bills, while energy sharing may also include the purchase of energy from a joint installation. The value of energy sold to or shared with other parties should be higher than the LCOE and higher than the SPT.

System support – flexibility and balancing: Investors may enter the more complex flexibility, balancing and ancillary service markets, or to find new business models that bring additional value and generate additional revenue streams. Prosumers and energy communities may for simplicity reasons concentrate on generation but they may build up the relevant expertise themselves. Otherwise they may deal with professional service providers, aggregators or utilities who could buy power from the generators directly.

Premiums for participating in energy communities: Policy makers may consider within the enabling framework for energy communities to give premiums for energy generated by energy communities based on the additional societal, local and environmental benefits that these projects can offer. However, the eligibility criteria for energy communities need to be well defined to avoid misuse as has happened in Germany.

4.3 Advantages of this approach

Maximum amount of renewable energy produced in all segments for reasonable costs: Provided that appropriate SPTs levels can be defined, generation capacity of the energy system will be built up at the lowest possible costs. The advantages of previous FIT schemes apply: they are easy to understand, reduce market risk, make projects bankable independent from own consumption (which especially for commercial prosumers can be difficult to predict) and allows for fast renewable deployment in all customer and technology segments.²⁶

Fostering local and regional energy sharing: Investors are not only incentivised to invest in renewable capacity but also to further optimise the production and to find local/regional opportunities for sharing energy. The market determines the maximum return rates which means that the risk for rate and tax payers is limited.²⁷

²⁶ See also annex 7.1. and 7.7 in the long version.

²⁷ For a discussion of potential critical questions see annex 7.3 in the long version.

5. Conclusion

This paper calls for standardised Surplus Power Tariffs to massively accelerate the uptake of small/medium scale renewable capacity. Given the experience with standardised revenue support schemes and their flexibility, the widespread introduction of an SPT scheme can create the long-awaited boost in renewables within a very short timeframe. Today, there are solutions to overcome perceived as well as justified issues of revenue support schemes. SPTs may not be required anymore once electricity generation is largely based on renewables and markets are apt to accommodate the adequate amount of renewables without further intervention.

There is still a lot to be done: As pointed out, SPTs will only solve issues on the generation side helping to boost renewable capacity. But there are various other challenges in the energy systems that must be tackled in a holistic way to make them fit for very large shares of renewables. **Two key issues are a) the refinancing mechanism and b) the energy market design. Reflections on these points are given in the long version of this paper.**

Appropriate energy market models, policy measures and tools need to be developed within the next one to three years to be able to manage the energy transition in a smooth way.

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PROSEU - Prosumers for the Energy Union (2018-21) is an EU Horizon 2020 programme funded research and innovation project. Its aim is to enable the mainstreaming of the renewable energy Prosumer phenomenon into the European Energy Union. It brings together 11 partners from nine European countries.



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