Surplus Power Tariffs

Boosting renewable investment through fair remuneration

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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.

To solve other problems that come with large-scale deployment of renewables, the refinancing mechanisms of the energy system needs to be revisited (levies, taxes, charges, etc.) and a new Energy Market Design is 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.

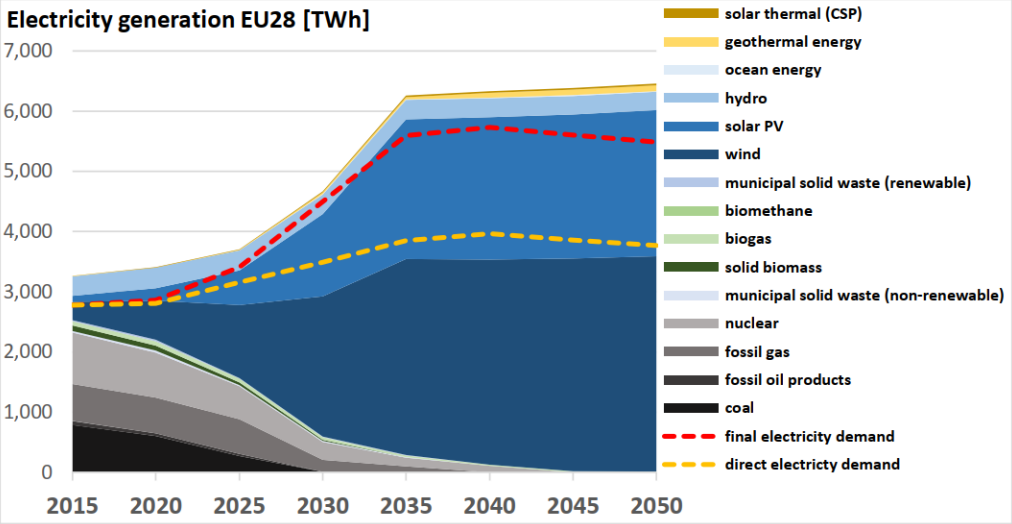


Figure 1: Paris Agreement Compatible (PAC) scenario. Source: CAN-E 2020

[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 yet[10]. 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, see also Annex 7.7. Regarding the issues that need to be tackled beyond support mechanisms see section 5.

[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). See also annex 7.10.

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 Council[12] 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:

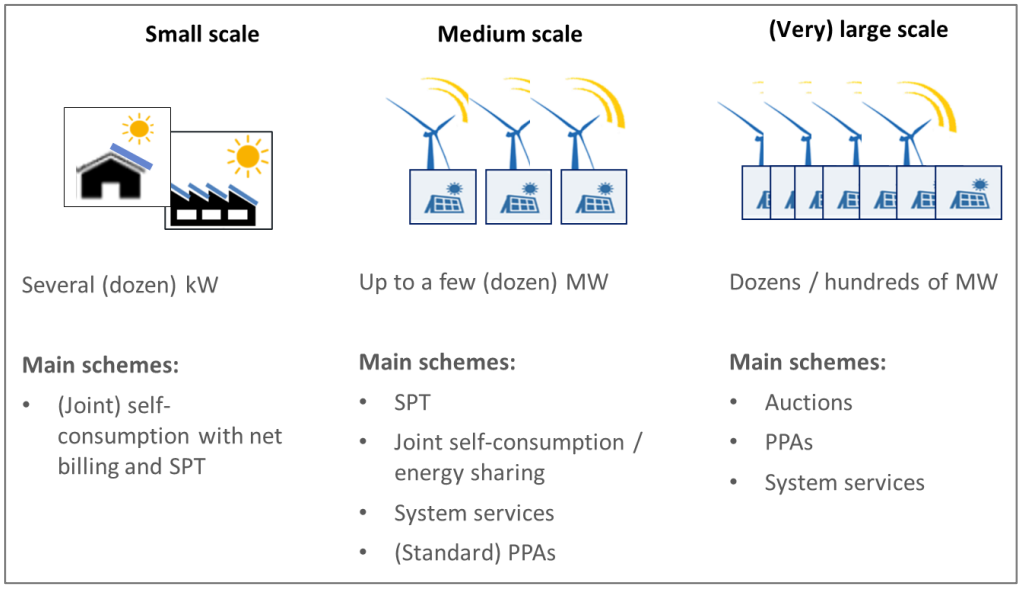


Figure 2: New Policy Mix based on Jacobs et al.

[12] Jacobs et al. 2020
[13] Other terms could be thought of, see reflections in annex 7.1.
[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 legislation[16] 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.

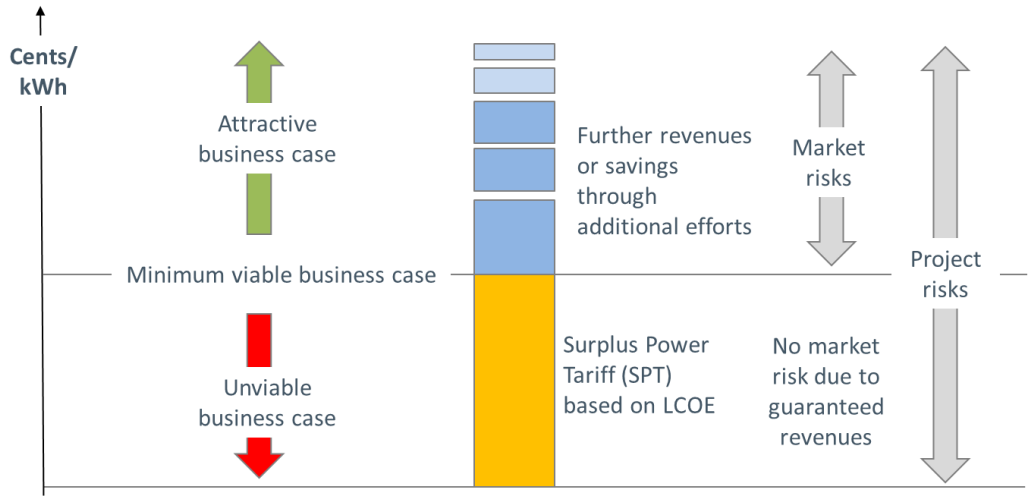


Figure 3: Two key design features of Support Scheme

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).[20]

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).
[20] See annex 7.9.

methodologies to investigate and compare price levels (market surveys, interviews, supplier data analysis, etc.). [21] 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 years[22], 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.

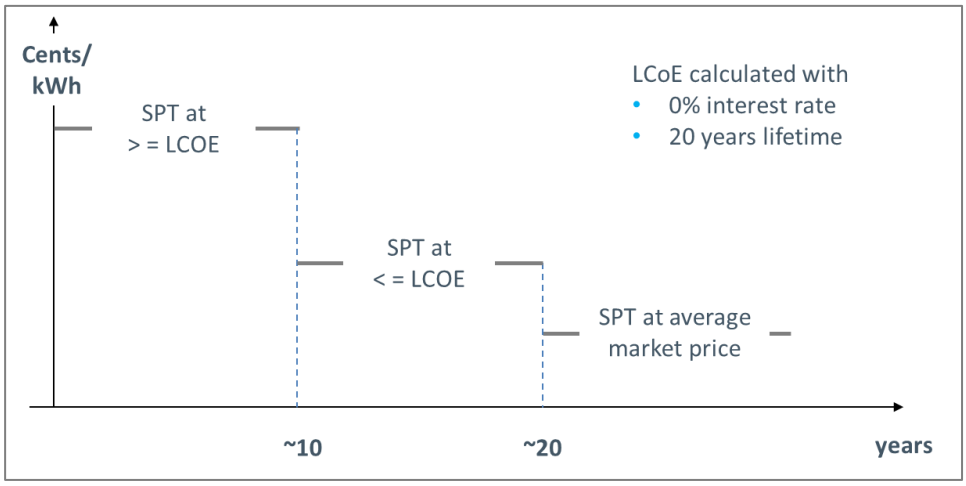


Figure 4: Frontloading of revenues

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. Examples of the FiT calculations are given in annex 7.1.

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]

[21] 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.
[22] 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.
[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".

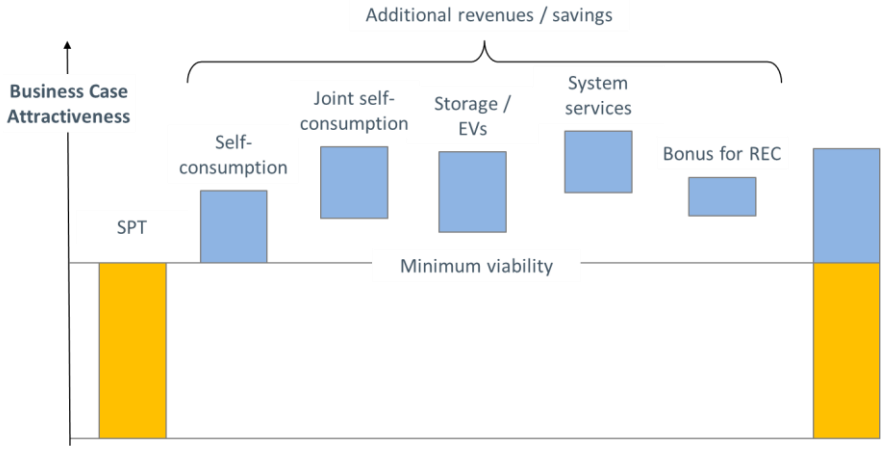


Figure 5: Improving business case through additional efforts

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).

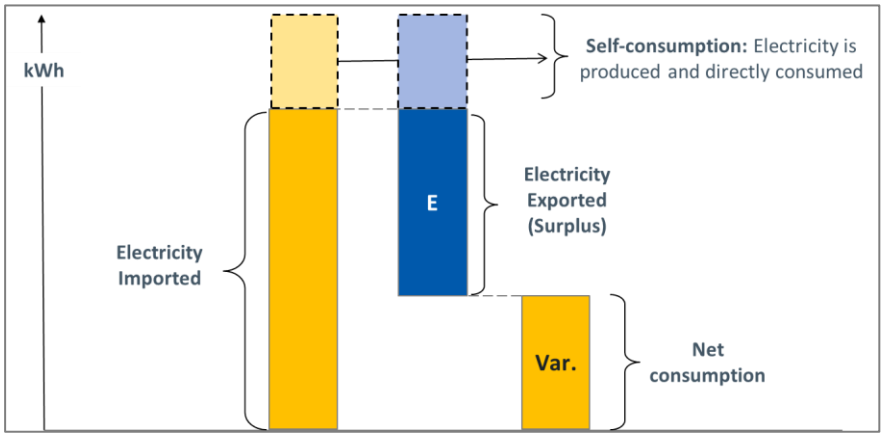


Figure 6: Self-consumption (generation < consumption)

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.

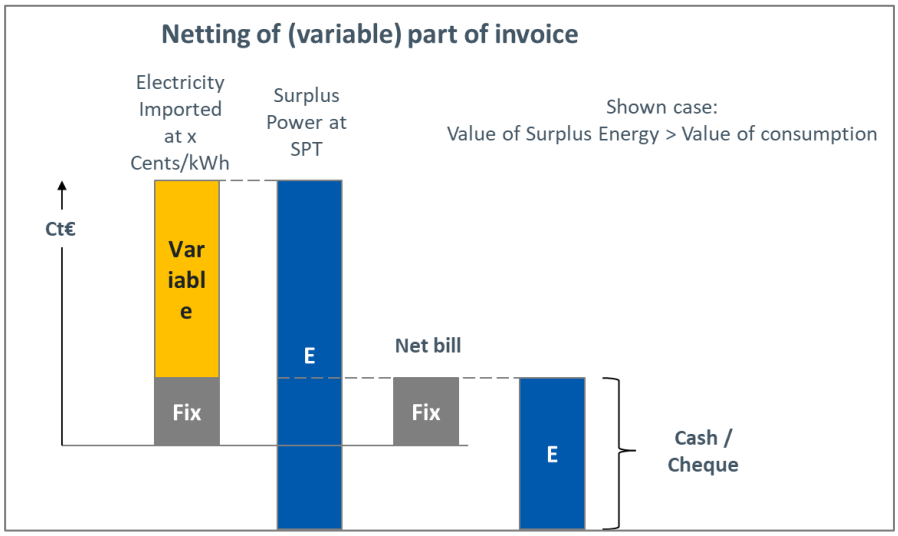


Figure 7: Netting of (variable) part of the invoice

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, see also annex 7.1).

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 are 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.

For a discussion of potential critical questions see annex 7.3

[26] See also annex 7.1 and 7.7

5. SPT will not solve everything – the entire energy systems needs to be built on renewables

SPT will help to boost renewable capacity. But there are various issues that must urgently be tackled in a more comprehensive way in order to reach 100% renewable economies and in a fast and cost-efficient way. These issues are a) the refinancing mechanism and b) the energy market design.

5.1 Revisiting refinancing/funding mechanisms

Renewables in general and FiT schemes in particular are often blamed for high electricity tariffs due to the levies used for refinancing support schemes. However, this view tends to overlook the billions of Euros of subsidies that fossil and nuclear receive, directly or indirectly, as well as profits of utilities and other market actors which often are less transparent.

Different energy components of the energy system need to be funded/(re-)financed. Apart from generation capacities – which are targeted by revenue support schemes such as the SPT– there are costs to expand and maintain the transmission and distribution grid, provide flexibility and ancillary services and – important for the future – long term storage including heat storage. All these costs need to be financed, be it through the energy retail tariffs, levies, fees and charges, or taxes. The balance between costs and refinancing is depicted in Figure 8.

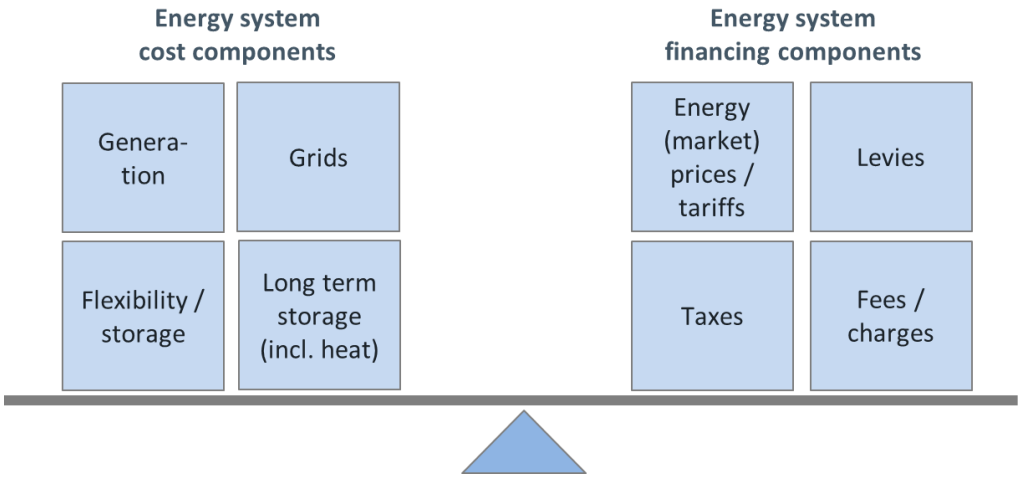


Figure 8: Energy system cost vs. financing components

As the basis for the cost side is changing dramatically, the refinancing side needs to be renegotiated as well. The introduction of renewables creates a different composition of cost components (e.g. variable costs for fuels will decrease while costs for flexibility will increase) and hence the corresponding costs. The key questions are how to minimize the costs on the left side, and which financing component should have which share to cover these costs.[27]

Levies provide stable support but are regressive: A part of the success of RE schemes in Europe is based a stable regime for refinancing based on levies which are not dependent on state budget fluctuations.[28] On the other hand, renewable levies have made electricity artificially expensive when compared to natural gas and other fuels, contributing to the impediment of decarbonising heat and transport – which may be

[27] Currently this is not transparent and for often historic reasons there are many inconsistencies.

[28] Levies on electricity retail tariffs are not subsidies. Subsidies by definition are coming from the state budget. In fact, that the German FiT was ruled not to be a subsidy was a crucial argument against the position of EC DG COMP that FiTs would not comply with the EEAG. However, scholars of science and technology would argue for a more lenient definition of subsidies to include these types of mechanism.

considered even a greater challenge in the context of domestic energy policy.[29] Moreover, these charges make renewables unpopular.

There is a legitimate argument to say that the net economic impact of policies like FITs has been regressive (apart from an abstract impact on climate) as unlike direct government spending these costs are disproportionally paid by those on low incomes, whereas the wealthy have disproportionately benefited from FITs as an investment vehicle. Some have even argued that this constituted a direct transfer of wealth from poor to rich.[30] Even though investment in renewables is positive, social imbalances must be avoided, and therefore levy designs need to be revisited.[31]

Tax-based financing may come in at least partially: Certain costs may be increasingly financed through taxes[32]. Energy system is part of the basic public infrastructure like roads and therefore not all these costs have to be necessarily shown on the energy bill. That means that parts of the grid infrastructure may be paid through taxes, thus lowering network charges.[33] However, as said above, there is a risk that the financing of RE support would not be as stable as it should be. To ensure political stability, there can be a provisions that a certain amount must be paid to some kind of entity that organizes the refinancing (regulator, agency, etc.) no matter what the government is.[34] Energy taxes and VAT are important components in energy bills, and fiscal revenues will change when self-consumption and energy sharing become more prominent.

Disentangling energy policies from industrial and social policies: The issue of regressive levies has been exacerbated by policies that allow many exemptions for entities to not pay the levies. For instance, in Germany many medium and large companies are exempt from levies with the argument that they would lose competitiveness.[35] This means that industrial policies have been mixed with energy policies without carefully considering the impacts on the most vulnerable. The refinancing of the energy system therefore needs a transparent analysis and discussion on benefits and impacts.

Carbon pricing across all sectors: Parts of the funding should also come from the revenues of a carbon price applying the "polluters pay principle". This is crucial to establish not only a level playing field for renewables but also to push fossil fuels out of all sectors and applications. A steadily increasing carbon price will keep revenues stable during a certain time even when carbon emissions decrease. However, given the objective of full decarbonisation, this funding source will sooner or later disappear which means that alternative sources (like levies and taxes) need to be developed in a timely manner.

No levies or taxing of self-consumption: Ideally, there should not be any levies, charges or other taxes on self-consumption, independently of the size of the installation. This practice makes self-consumption less attractive and reduces project viability. However, if joint-self consumption and energy sharing gets close to "regular" energy supply agreements, then a fair way of cost allocation needs to be developed.

5.2 New market design required for high shares of variable renewables

Critically assessing current energy market paradigms: With the increasing the share of wind and solar PV, it becomes less clear if today's market, policy and regulatory frameworks are fit for purpose. In a 100% renewable energy system the economics will be quite different, as the main purpose will be to maintain generation capacity by replacing old installations and to become more efficient. Further research is required to better understand how such a system could look like, and there is some urgency to do so because at

[29] https://www.raponline.org/wp-content/uploads/2020/03/rap-rosenow-lowes-principles-heat-decarbonisation-march-2020.pdf
[30] https://link.springer.com/article/10.1007/s00181-013-0728-z
[31] Another issue is that renewable levies may be based on the difference between guaranteed prices and market prices, with the latter being suppressed the higher the share of renewables becomes, leading to even higher levies. See also next section.
[32] See PROSEU 2020 (Petrick et al. and Brown et al.), dena 2020 (Proposal to reduce the renewable levy to zero and increase energy tax.
[33] Building up generation capacity may be better paid through levies – because this is where prosumers can be active and are needed with their investments to make a fast transition.
[34] This is similar to child allowances which are paid out independent of the actual government's budgetary situation.
[35] A claim which has been contested in various instances.

least for electricity is ideally in place in most of the countries between 2030 and 2040, so within the next 10-20 years. In the transition towards such a new system, some of the current market paradigms may have to be adapted or even replaced.[36]

Liberalisation: Across the world, many countries have liberalised their energy markets. While there are undoubtedly benefits like efficiency gains, some effects can be questioned, e.g. the privatisation of gains and socialisation of costs (like the indemnification payments to fossil power plant operators, externalisation of environmental costs, disposal of nuclear waste, etc.). A critical review of the liberalisation is therefore required and a discussion about which energy services should be considered a public service.

Merit order and marginal costs: Energy markets driven by a price-building mechanism based on the merit order and marginal costs will not be sufficient to incite investment in new renewable capacity as renewables will always create low market prices when they are producing most, thus undermining their own business case[37]. It is thus questionable if the merit order is the most appropriate mechanism in the future when variable renewables become the dominant technologies as this would increase price fluctuations (including negative prices) and uncertainty, leading to higher risk premiums and overall costs. Surprisingly, there is not a lot of debate on these inconsistencies.

Investments in grid infrastructure and flexibility: The uptake of distributed and variable renewables will require network upgrades, storage capacity and other flexibility options to deal with variable renewables. Generators should not be concerned with how the energy is transported and used (unless they wish to do so in order to improve their business case). The optimisation of investment decisions, e.g. grid reinforcement, investment in storage or conversion technology, should be dealt with by the grid operators in collaboration with service providers. New forms of responsibilities, processes for interaction and cost allocation (market splitting, nodal pricing, time-of-use tariffs, etc.) may need to be established.

Energy markets: Energy and system services are traded in different markets (futures market, day-ahead market, intraday market, over-the-counter market, market for ancillary service, balancing market, etc.). Prices of some markets have effects on levies and charges (e.g. when wholesale market prices are used to calculate the UK's Contracts-for-Difference, the German EEG-Umlage or the market premium) while other market prices are not visible to customers although that may actually help to foster demand side management (e.g. short term price increases). It may also have to be reviewed to which extend the prices reflect the true costs, where windfall profits occur and where high risks prevent investments in necessary infrastructure. For instance, the costs of existing, amortized installations and new installations are different which may require different price building mechanisms.

Is "energy too cheap to meter" the goal? Energy needs to be affordable, and the paradigm to drive energy costs down is prevalent. On the other hand, it is crucial that energy maintains a value to further drive energy efficiency and avoid spillage – keeping in mind that final energy demand must roughly be halved in Europe by 2050.[38] In that context it may be discussed if it is appropriate that commercial and industrial consumers with high energy consumption should pay lower prices per kWh. While it is common practice with other commodities to receive a better price the more is purchased, in the case of energy – whose consumption should be reduced and not promoted – this is counterproductive with regards to the climate goals. As mentioned above, industrial policies that support companies to increase their competitiveness may not be based on unsustainably low energy prices.

[36] See also IEA-RETD RE-TRANSITION 2016
[37] See e.g. Neue Energie 01/2020
[38] CAN-E 2020 PAC Scenario

6. 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, 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. 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.

7. Annex: Further considerations and reflections

7.1 Key advantages of FiTs also apply to SPTs

The following briefly recaps the key advantages of FiTs which also apply to SPTs.[39]

SPTs/FiTs are easy to understand: SPTs/FiT allows calculating the payback time of a renewable investment in a straightforward way. It should not be expected from citizens who want to put their savings in something secure and "good for the planet" that they must deal with a complicated setup where they even may lose money.

SPTs/FiTs reduce market risk: An investor in renewable capacity, especially individual and collective prosumers, need to have the confidence that there is an off-taker for the energy they produce. A FiT provides this confidence. However, SPTs/FiTs do not make an investment risk free: One must still go through the hassle to identify a trustworthy installer who offers a good price for equipment and service, and there is always risk that something goes wrong.

SPTs/FiT projects are bankable: SPTs/FiTs provide a predictable revenue flow which is bankable – and that is crucial for small investors who must take a loan for their installation. Bankability was identified as one of the key issues for renewable deployment.[40] Projects whose viability depends on the consumption of its participants (be it individual or joint-self-consumption) do not provide a secure revenue for a bank: If the consumer uses less energy (e.g. because of reduced business activity) or even goes bankrupt, or a participant in a joint self-consumption project leaves the project, the produced energy can only be fed into the grid; if there is not sufficient remuneration for this energy, the project investment will not be recovered.

SPTs/FiTs allows for fast renewable deployment in all customer and technology segments. The success of FiT could be seen in the deployment figures in many countries globally in the beginning of the 2010s. SPTs/FiTs support small to medium sized individual and community renewables projects in an efficient way by – unlike investment support schemes – spreading payments over various years based, incentivising optimised systems, good maintenance and high production per kW installed.

7.2 Exemplary calculations of FiT levels, LCOE and business case calculations

Example of a 3kW system

Table 1: LCOE comparison

	Spain		Germany	
Current Tariff for export energy	5 – 6 ct€/kWh (depending on provider)		8.56 ct€/kWh (EEG 2021)	
Full load hours	1300		900	
Price per kWp	2000 €[41]		1800 €	
LCOE (20 years, WACC=0%)	9.5[42]ct€/kWh		12.4 ct€/kWh	
SPT at LCOE	without self-consumption	with self-consumption (30%)	without self-consumption	with self-consumption (30%)

[39] More details and reasons can be found in Jacobs et al., see also annex 7.7
[40] IEA-RETD 2016 RE-TRANSITION
[41] The cost of 2000 Euro/kWp has been the best-price offer among four offers in 2020.
[42] The LCOE changes depending on the years: 25 years -> 7.8 ct., 20 years -> 9.5 ct, 15 years -> 12.2 ct., 10 years -> 17.7 ct/kWh

	Spain		Germany	
Retail tariff saved (incl. Taxes etc.)	n/a	18.7	n/a	27.00
Payback-time (years)	20	13.9	20	13.1

As can be seen, the payback time with a SPT set at the LCOE level is by definition the number of productive years which is not attractive. With self-consumption the business case improves.

Table 2: LCOE and business case calculation

Rooftop Solar PV in Spain			
Assumptions (for LCOE)			
Project size	kWp	3,00	
Project	€	6.000,00	
Capital Costs	€/kWp	2.000,00	
CAPEX	€	6.000	
Full load hours	kWh/year	1.300	Based on country values
Cost of Debt	%	0,0%	
Weight of Debt	%	0,0%	
Cost of Equity	%	0,0%	
WACC / Discount Rate	%	0,00%	
Productive Years	number	20	
Derating	%	100%	considered in full-load hours
Degradation	%/kWp/ye	0,50%	
Operation Cost	%/kWp/ye	0,50%	
Inverter replacement year	number	15	
Inverter replacement cost	EUR/ KWp	150,00	
Yearly production	kWh/year	3.900	
Other assumptions (for business case)			
Electricity Costs retail [ct€]		10,4229	Coste de energía (Som Energia): 10,4229
Taxes etc. on Electricity tariff		4,4	Peaje de acceso
Variable Electricity Tariff		**14,8**	
Electricity tax 5,11%		0,8	Impuesto eléctrico
VAT 21%		3,1	IVA
Final Electricity Tariff	ct€/kWh	18,7	saved on each kWh self-consumed; as of year 1
Surplus Power Tariff 100,00%		9,5	Surplus Power Tariff based on LCOE
Electricity tax 0,00%		0,0	Saved tax
VAT 0%		0,0	Saved VAT
Value of Surplus Power Tariff	ct€/kWh	9,5	
Reduction after 10 years 100%		9,5	
Self-consumption ratio		30%	0,2321
Annual increase Tariff		0%	
Summary Investment indicators for prosumers			
LCOE	**ct€/kWh**	**9,5**	
NPV for prosumer	**EUR**	**2.059**	
IRR	**%**	**3,1%**	
Payback Years	**years**	**13,9**	

7.3 Critical questions and answers

Question / potential critique	Response
SPTs do not take fully away the risk for wind developers: Due to long lead times, a degression may lead to too low SPT levels once a project is developed in 3-5 years.	**Developers may have more confidence in a SPT scheme** where they can assume that policy makers will not allow lower levels than a free market where strategic bidding or other effects may drive down prices to a point where especially RECs/CECs cannot compete.

Question / potential critique	Response
Are too low tariffs really the main reason for slow deployment? Higher SPT or FiT remuneration may lead to windfall profits. The real issues may lie in administrative and regulatory issues which may make applications and processes slow and cumbersome.	**SPT indeed will not address and solve all existing energy issues.** However, the boom in the RE sector was taking place when investors could see good business opportunities. Apparently, this is not the case anymore. Nevertheless, improving administrative and regulatory procedures should be part of the New Policy Mix.
By offering a fixed tariff for exported power, you effectively hinder business models which are based on dynamic pricing for exported power on the public grid. Therefore, P2P models, Local Time-of-Use Tariffs and Virtual Power Plant type approaches may struggle to develop or compete against an alternative which offers a (potentially inflated) fixed price – despite the fact that the former may be delivering greater value for the grid and its users in the form of system stability, network utilization and avoiding fossil fuel backup. Obviously, this depends on how generous the FIT is in relation to the price signals created by these models, however this has already been shown to be a key problem in the large P2P trial in Australia[43]	**Additional services and business models will be needed – but they will deal with finding solutions *for flexibility, not for generation*.** More and other business models based on dynamic pricing will emerge once more variable renewable energy are pushing into the power systems. At the moment the pressure to provide flexibility options is probably still not be high enough in many markets due to the low shares of renewables.
FiT not well perceived: There are voices within the RE community that one should not call again for FiT to not give the impression that renewables still need subsidies. Public opinion may be against renewables if they perceive them as costly.	**It is important to convey that FiT are not supposed to make anybody rich but just to trigger people to invest.** The uptake is just not fast enough, there are not sufficient viable business cases to get a widespread deployment.
There is no market mechanism in FiT: It is argued that setting FiT would be like a command economy that does not allow market forces to find the right balance between supply and demand. It is also stated that in more mature places we should be moving to more dynamic & cost reflective pricing of prosumerism.	**There is the risk that these business models will remain peripheral for too long.** There are also not enough "mature" markets yet, as can be seen when looking at all the empty roof tops all over Europe and in the world. It is too early to overcomplicate the use of renewables; so many more renewable kWhs are urgently needed.

7.4 Avoiding the term "Feed-in Tariff"?

Feed-in Tariffs (FiT) are not well perceived among certain policy makers anymore which is also due to mistakes that have been made in the past. Other terms that basically mean the same are for instance,

- Standard (offtaker) contracts
- Standard PPAs
- Export Prices / Export Tariffs / Export Guarantees (these are based on a "market-value" though[44])

This paper chose Surplus Power Tariff (SPT) in order to illustrate the link to self-consumption and energy sharing. A German translation could be "Überhangstromtarif" oder "Differenzstromtarif" if the term

[43] https://www.chalmers.se/en/staff/Pages/hojckova.aspx
[44] See Hall et al. 2020

"Einspeisetarif" is not seen as appropriate. The term „Überschuss" ("excess") should be avoided because they have a connotation of "superfluous" – but these energy is highly needed to satisfy other demands.

Other terms that could be used for the remuneration of surplus energy in the case of self-consumption could be:

- EGT (Export Generation Tariff),
- SET (Surplus Energy Tariff),
- PEP (Prosumer Export Price),
- REST (Renewable Energy Surplus Tariff)

7.5 SPT-eligibility only for prosumers and energy communities?

Instead of offering a SPT to any renewable generator and just making it depending on the system size, another approach could be to define a group of actors that are eligible to receive a FiT, namely:

- **Citizens / prosumers:** Private citizens and households should always be eligible.
- **Energy communities:** Once Renewable Energy Communities (RECs) and Citizen Energy Communities (CECs) are well defined nationally, projects that are initiated, financed and/or operated by them (they may not do all steps but only some) could always be eligible.

However, the question is if this will work in practice and if this concept is water-tight and will not be hijacked by other, larger commercial companies or utilities.[45] If the "enabling framework" for RECs envisaged in the RED II does not give RECs a commercial advantage but is just about information or some kind of low-level support (e.g. easier administrative processes), then commercial companies will not try to "disguise" themselves as RECs. But if there is a real economic advantage to create a REC or CEC, commercial players will try to go for it. An idea could be to regularly assess of who is benefiting and adjust eligibility criteria accordingly.

The monitoring and control of these projects may also be complicated: If the owner of an installation changes, e.g. a REC sells its project to a another entity, the change of ownership will have to be notified to the regulator or some other agency to determine if the new owner is also eligible for the FiT.

Still, if the hesitance to introduce SPT for all project types (up to a certain size) is politically not feasible, then at least prosumers and energy communities should get the privilege to receive a SPT, assuring that the necessary safeguards are in place.

7.6 Ideas for a refinancing mechanism

A potential refinancing mechanism in a 100% renewable energy system (or potentially also during the transition) may look as follows. Note that further reflections are required:

Fixed base price: All consumers pay a fixed base price per kWh, which corresponds to the average guaranteed generation remuneration (i.e. the average paid SPT and PPA prices, so possibly in the order of 4-6 ct/kWh across all sectors); the sum of the generation costs thus always corresponds to the sum of the base price costs of consumption.

Grid costs covered: Furthermore, consumers may pay a certain fixed price per kW for the connection, which covers the grid costs. Parts of the grid costs may be covered by taxes.

Flexibility surcharge: Finally, the consumers pay a flexibility surcharge per kWh, which is higher when there is low renewable electricity supply. This stimulates supply-dependent demand behaviour. This money is

[45] The German government had put a lot of effort into a fair definition for Bürgerenergiegesellschaften but the concept was misused by commercial entities nevertheless. This approach was abandonded later: 19/18964 - Gesetzentwurf: Entwurf eines Gesetzes zur Änderung des Erneuerbare-Energien-Gesetzes 2017 und weiterer energierechtlicher Bestimmungen - 05.05.2020. https://www.bundestag.de/dokumente/textarchiv/2020/kw20-de-eeg-aenderung-695084

used to pay providers of flexibility options (batteries, PtG, PtH, possibly also grid expansion, etc.). The provider also pays the fixed base price per kWh for the electricity which he purchases and stores, but he can then sell it with the flexibility surcharge.

- **Market solution:** A market may be the best solution for organising flexibility; however, an investor in storage would then have to speculate quite a lot, so maybe there are other ways to avoid these risk premiums. In addition, one would also have to try to avoid investments in storage where this is unnecessary. The solutions would also have to map the grid levels, periods to be covered (milliseconds up to months), etc..
- **Flexibility fund:** Therefore, perhaps the flexibility surcharge could also (partially) flow into a pot from which at least some critical investments would be paid, e.g. to cover strategic reserves for periods with no sun or wind.

Consumer group pricing: The tariffs and surcharges could also be made dependent on consumer groups (e.g. low-income households pay less, certain industries too), but in general these and other state aid/subsidies should be better kept out of the system and covered via taxes. That would be fairer and more transparent.

Non-renewable squeeze-out: Fossil/nuclear energies are forced out of the market via CO2 or "radioactivity" levies or regulation; they are also not allowed to offer flexibility (or only to a limited extent for a well determined period).

Potential disadvantages of this approach: Market participants can become very creative if they have to and if they the possibility to do so. This approach may leave less room for market players to optimise themselves in a free market and to distribute and manage opportunities and risks themselves in the best possible way. This may suppress creativity, which is required to encourage and speed up the energy transition. In a regime that is highly regulated, the goal would be reached, too, but maybe not as smart and efficient.

7.7 Previous perceived short-comings of FiTs are not valid (anymore)

Costs can be controlled as RE costs have come down significantly: Renewables have become in most markets the least-cost technology option, allowing for much lower FiT levels than a few years ago. This has substantially reduced the risk of creating large public deficits that need to be refinanced through levies or taxes.

Market growth can be managed. Unlike in the years up to the early 2010s, there are now various tools available which allow to steer the uptake like regular tariff degression, growth corridors and caps. However, as mentioned before, given that the Paris Agreement targets must be met, the current problem is not that renewable markets are growing too fast but too slow.

Appropriate tariff levels can be set. Due to largely improved data availability from national and international markets, in-depth costs analysis by various institutions (IEA, IRENA, Bloomberg, as well as numerous national research institutes), information asymmetries between policy makers and project developers have been largely reduced.[46]

[46] See also the annex 7.7 with the table “Perceived and re-visited shortcomings of FiTs”. Source: Jacobs et al. 2020

Jacobs et al. (2020) explains the difference between FiTs in the 2000s and the 2020s in the table below:

Table 3: Perceived and re-visited shortcomings of FiTs. Source: Jacobs et al. 2020

	Perceived shortcomings of feed-in tariffs in the 2000s	Re-visiting shortcomings of feed-in tariffs in the 2020s
Managing market growth	• Rapidly growing shares of renewable energy capacity in countries without annual capacity caps, exceeding conservatively formulated political goals in some instances • Sharp increases in installed capacity, especially in the case of solar PV, due to short lead times, modularity and large potential for cost reductions along the learning curve which was perceived as problematic due to policy costs	• Higher market growth required due to Paris Agreement objectives • Availability of design options like tariff degression, growth corridors, etc.
Cost control	• High costs of solar PV, leading to high policy costs • The financial crisis of 2008 increased policymakers' concerns as regards the cost burdens on rate-payers • Policymakers pulled back, looking for options that allowed for stricter control of costs and market growth	• The cost of rapidly deployable technologies (solar PV) has fallen rapidly, but the pace of the cost reductions has slowed down • Solar PV and other renewable energy technologies are now least-cost technologies • Therefore, exceeding deployment targets will no longer lead to ex-cessive costs for rate-payers
Setting tariffs appropriately	• Challenges resulting from infor-mation asymmetries between project developers and policyma-kers, especially for technologies (PV) with rapidly declining costs • Difficulties to adjust tariff levels fast enough • Limited data for tariff calculation because of rather small markets	• Improved data availability due to larger national and international markets • Data collection effort by IRENA and research institutes • Availability of auction results to inform tariff-setting • Improved implementation of auto-matic tariff reduction elements

7.8 Avoiding segment thresholds with additional costs and obligations

The following graphs show that in 2017 various system size segments in Germany only saw very limited installations compared to 2011. This is due to the introduction of additional costs and obligations at 10, 30, 100, and 750 kW.

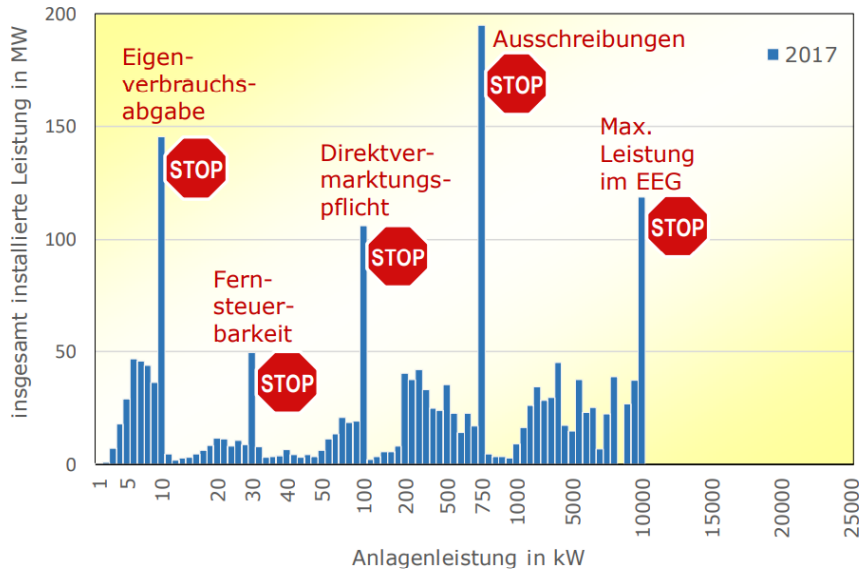


Figure 9: Photovoltaikzubau des Jahres 2017 aufgeteilt nach der Anlagenleistung und Hürden für den Photovoltaikausbau.

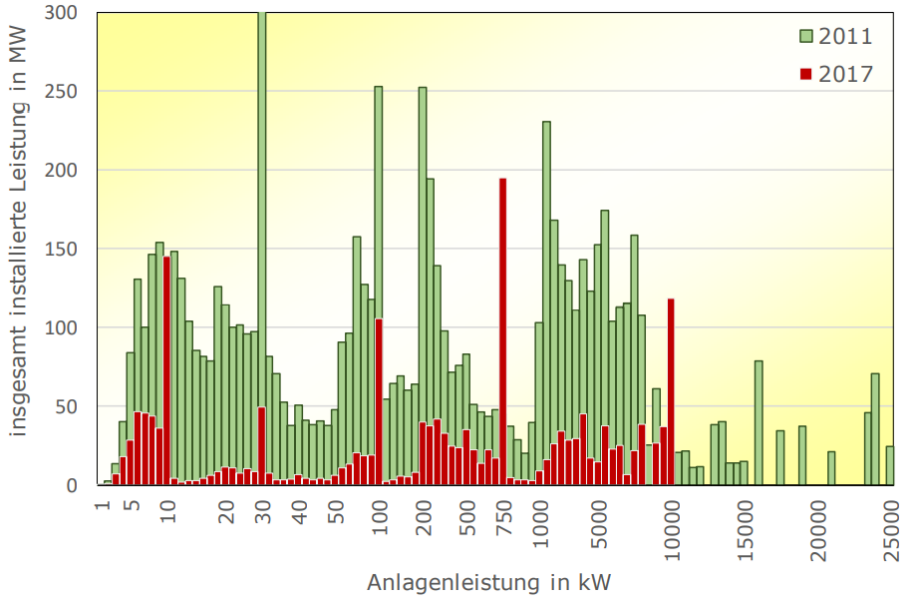


Figure 10: Photovoltaikzubau der Jahre 2011 und 2017 aufgeteilt nach der Anlagenleistung

7.9 Avoiding plant splitting

There are ways on how to avoid that plants are split to receive higher FiTs:

Germany:

EEG 2021, § 24 Zahlungsansprüche für Strom aus mehreren Anlagen

(1) Mehrere Anlagen sind unabhängig von den Eigentumsverhältnissen zum Zweck der Ermittlung des Anspruchs nach § 19 Absatz 1 und zur Bestimmung der Größe der Anlage nach § 21 Absatz 1 oder § 22 für den jeweils zuletzt in Betrieb gesetzten Generator als eine Anlage anzusehen, wenn
1. sie sich auf demselben Grundstück, demselben Gebäude, demselben Betriebsgelände oder sonst in unmittelbarer räumlicher Nähe befinden,

2. sie Strom aus gleichartigen erneuerbaren Energien erzeugen,

3. für den in ihnen erzeugten Strom der Anspruch nach § 19 Absatz 1 in Abhängigkeit von der Bemessungsleistung oder der installierten Leistung besteht und

4. sie innerhalb von zwölf aufeinanderfolgenden Kalendermonaten in Betrieb genommen worden sind.ç

Abweichend von Satz 1 sind mehrere Anlagen unabhängig von den Eigentumsverhältnissen und ausschließlich zum Zweck der Ermittlung des Anspruchs nach § 19 Absatz 1 und zur Bestimmung der Größe der Anlage nach § 21 Absatz 1 oder § 22 für den jeweils zuletzt in Betrieb gesetzten Generator als eine Anlage anzusehen, wenn sie Strom aus Biogas mit Ausnahme von Biomethan erzeugen und das Biogas aus derselben Biogaserzeugungsanlage stammt.

Abweichend von Satz 1 werden Freiflächenanlagen nicht mit Solaranlagen auf, in oder an Gebäuden und Lärmschutzwänden zusammengefasst. Abweichend von Satz 1 werden Solaranlagen, die nicht an demselben Anschlusspunkt betrieben werden, zum Zweck der Ermittlung des Anspruchs nach § 19 Absatz 1 Nummer 3 nicht zusammengefasst.

(2) Unbeschadet von Absatz 1 Satz 1 stehen mehrere Freiflächenanlagen unabhängig von den Eigentumsverhältnissen und ausschließlich zum Zweck der Ermittlung der Anlagengröße nach § 38a Absatz 1 Nummer 5 und nach § 22 Absatz 3 Satz 2 für den jeweils zuletzt in Betrieb gesetzten Generator einer Anlage gleich, wenn sie 1. innerhalb derselben Gemeinde, die für den Erlass eines Bebauungsplans zuständig ist oder gewesen wäre, errichtet worden sind und 2. innerhalb von 24 aufeinanderfolgenden Kalendermonaten in einem Abstand von bis zu 2 Kilometern Luftlinie, gemessen vom äußeren Rand der jeweiligen Anlage, in Betrieb genommen worden sind

Spain

Real Decreto 1578/2008[47], 10. Potencia de los proyectos. (this RD had been repealed).

1. La potencia máxima de los proyectos o instalaciones que sean inscritos en el Registro de preasignación de retribución no podrá superar los 2 MW o los 10 MW para instalaciones de tipo I o II del artículo 3 de este real decreto, respectivamente.

2. A los efectos de la determinación del régimen económico establecido en el presente real decreto, se considerará que pertenecen a una única instalación o un solo proyecto, según corresponda, cuya potencia será la suma de las potencias de las instalaciones unitarias de la categoría b.1.1, las instalaciones o proyectos que se encuentren en referencias catastrales con los catorce primeros dígitos idénticos. A estos efectos, los titulares de las instalaciones suministrarán la referencia catastral de los inmuebles en los que se ubiquen las mismas.

Del mismo modo, a los efectos de la inscripción, en una convocatoria, en el Registro de preasignación de retribución, se considerará que pertenecen a un solo proyecto, cuya potencia será la suma de las potencias de las instalaciones unitarias, aquellas instalaciones que conecten en un mismo punto de la red de distribución o transporte, o dispongan de línea de evacuación común.

7.10 High potential for prosumer technologies

PROSEU 2020: *"Adding up the results for all the member states on EU level shows that prosumers can contribute a very high share to the generated energy in 2050. In the residential sector, 98% of the electricity can be generated by prosumer technologies and the heating and cooling needs can be covered by prosumer technologies completely."*

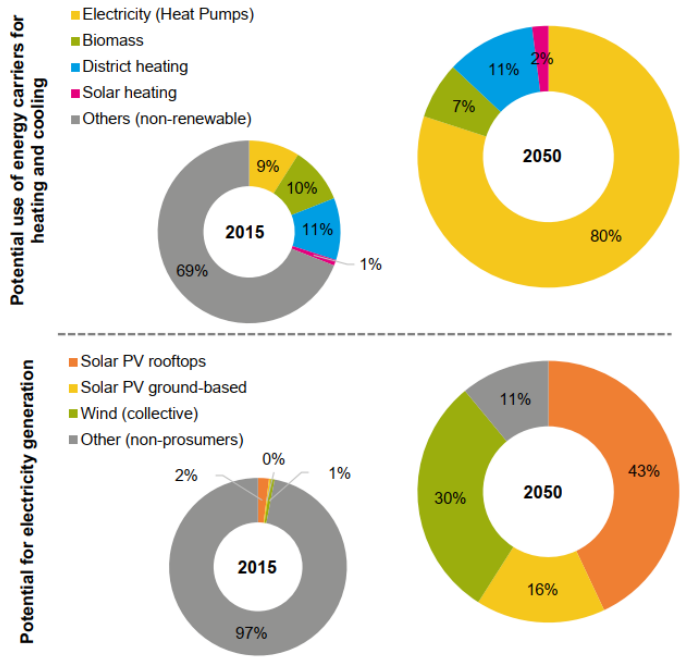
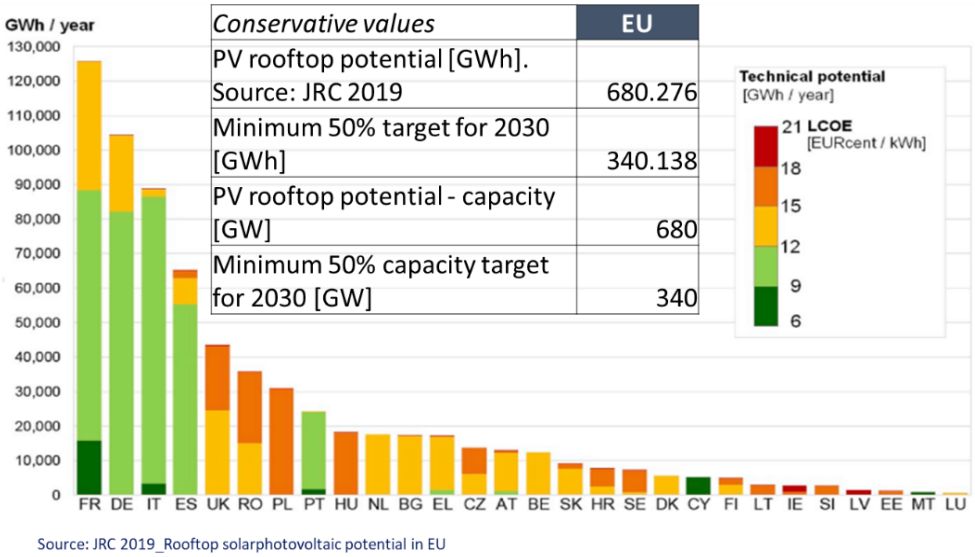


Figure 11: Share of energy sources used for generation of electricity or heating and cooling in 2050. Source: Gährs et al. 2020

[47] https://www.boe.es/buscar/doc.php?id=BOE-A-2008-15595

The potential for PV rooftop is around 680 TWh, equalling some 680 GW in capacity:



Conservative values	EU
PV rooftop potential [GWh]. Source: JRC 2019	680.276
Minimum 50% target for 2030 [GWh]	340.138
PV rooftop potential - capacity [GW]	680
Minimum 50% capacity target for 2030 [GW]	340

Figure 12: Rooftop PV potential and targets. Source: JRC 2019 and Petrick et al. 2019

7.11 Energy Sharing

Energy Brainpool 2020: *"Electricity consumers and renewable electricity producers should be given the right to join and leave a regional Renewable Energy Community (REC). In doing so, they acquire and sell shares in a REC. The REC is considered as one virtual electricity consumer whose electricity consumption is calculated on the basis of the cumulative consumer load that is not covered by electricity from its own renewable energy plants. As a virtual load profile customer, the REC assumes all energy related obligations as a final consumer. The distribution grid operator calculates a virtual total consumer load profile per REC using a combination of measured data and standard load profiles."*

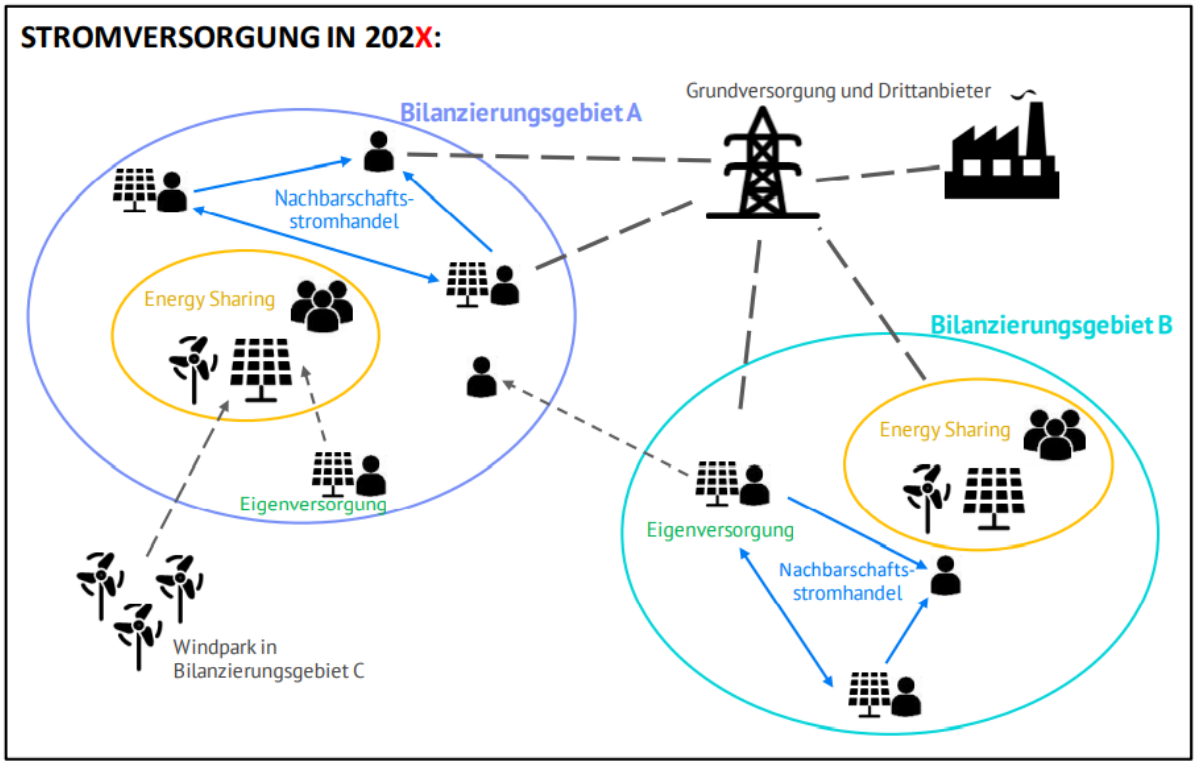


Figure 13: Energy sharing concept. Source: Energy Brainpool 2020.

7.12 SPT/FiT Examples

France

Tarif de vente du surplus d'électricité photovoltaïque du 1er juillet au 30 septembre 2020 (3eme trimestre 2020) :

Puissance de votre installation solaire	Tarif du surplus (€/kWh) du 01/07 au 30/09
⩽ 3 kWc	0,10 €
⩽ 9 kWc	0,10 €
⩽ 36 kWc	0,06 €
⩽ 100 kWc	0,06 €

Tarifs de vente de l'électricité photovoltaïque en vente totale au 3eme trimestre 2020 :

Puissance de votre installation solaire	Tarif en vente totale (€/kWh)
⩽ 3 kWc	0,1849
⩽ 9 kWc	0,1572
⩽ 36 kWc	0,1179
⩽ 100 kWc	0,1025

Figure 14: Tariffs in France for surplus energy and full feed-in. Source: In sun we trust.[48]

Given these numbers, it is questionable why someone with less than 9 kW would opt for self-consumption as selling all electricity seems to make more sense.

Germany

(2) Für Strom aus Solaranlagen, die ausschließlich auf, an oder in einem Gebäude oder einer Lärmschutzwand angebracht sind, beträgt der anzulegende Wert

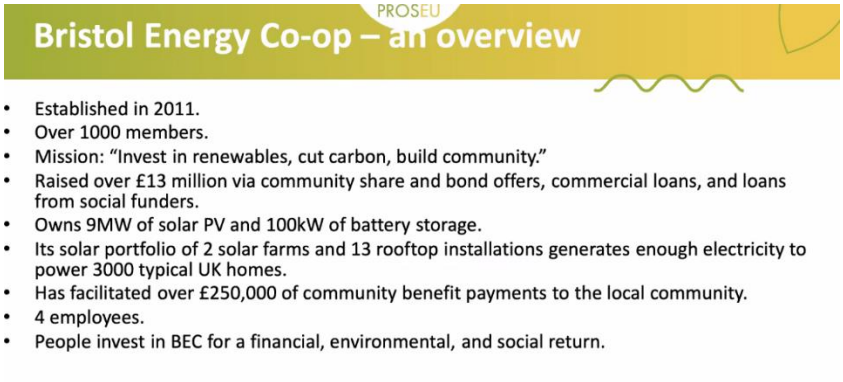
1. bis einschließlich einer installierten Leistung von 10 Kilowatt 8,56 Cent pro Kilowattstunde,
2. bis einschließlich einer installierten Leistung von 40 Kilowatt 8,33 Cent pro Kilowattstunde und
3. bis einschließlich einer installierten Leistung von 750 Kilowatt 6,62 Cent pro Kilowattstunde.

Figure 15: FiT in Germany. Source: EEG 2021, §48[49]

7.13 Call from Bristol Energy for FiT or access to CfD

Presentation of Bristol Energy at PROSEU Event on 3 February 2020

[48] https://www.insunwetrust.solar/blog/le-solaire-et-vous/tarif-rachat-photovoltaique/#tarif
[49] https://www.gesetze-im-internet.de/eeg_2014/__48.html



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