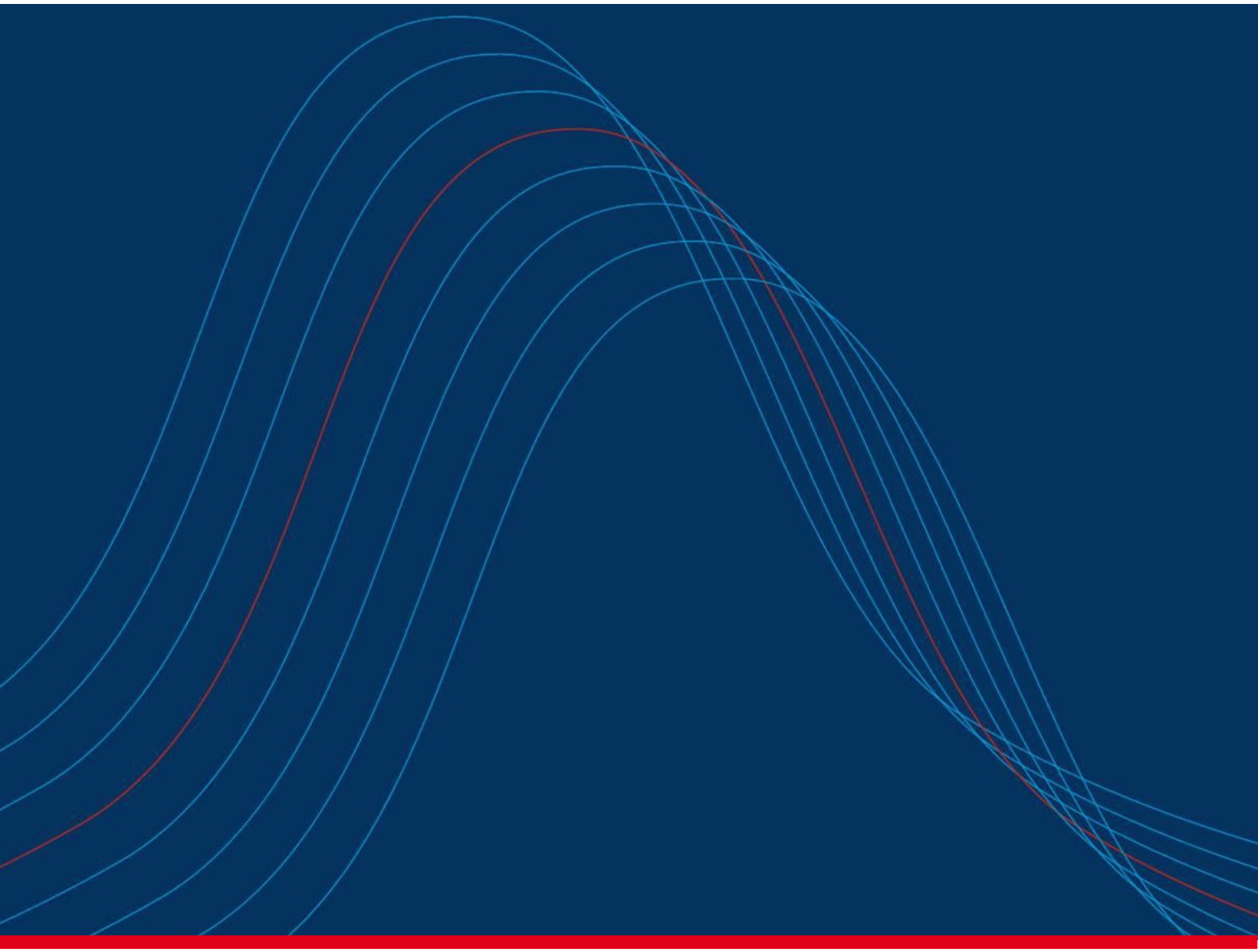
Energy Brainpool

A PROPOSAL FOR PROSUMER ELECTRICITY TRADING



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BÜNDNIS BÜRGERENERGIE e.V.

FOREWORD

Just being in the right is not enough – we must also be able to exercise our rights! This idea has been a driving force for Bündnis Bürgerenergie, an association promoting people's rights to generate and trade electricity, ever since the EU Commission at the end of 2016 drafted what is now referred to as the Winter Package, laying out new rights for all citizens to generate, store, and consume renewable electricity themselves – and to sell it on fair terms. In every respect, it seems obvious that surplus power from one's own photovoltaic system could be sold to one's neighbours. Theoretically this is already allowed in Germany, but the idea fails in practice due to a number of obstacles, legal requirements and taxes, charges and fees.

Energy Brainpool's proposal illustrates the comparatively low legislative and energy-related expenditure needed to facilitate the trade of consumer-generated electricity for the German market. It thus highlights the advantages of a decentralized and consumer-friendly market not only for Germany, but for the whole European Union. It would reduce operating costs as defined by Germany's Renewable Energies Act (EEG) – costs now covered by consumers of electricity – and significantly enhance usage of the public grid to transmit power from local photovoltaic systems. The benefits of prosumer electricity trading would go far beyond these economic and technical effects; finally, not only homeowners who have their own PV systems would stand to benefit. Electricity bills for the entire neighbourhood could be lower. All parties involved could join forces and invest together in storage systems to further reduce costs. This would be fairer than the present system and turn the energy transition into a community experience, helping to broaden its acceptance. Additionally, this development would result in the optimal use of roof space for PV panels. Today, only small systems are installed, even on large roofs, to provide only as much power as can be consumed within the building itself – clearly a disincentive in the current legislative framework. Changing this would quickly, cheaply and efficiently drive the energy transition forward, particularly in urban settings.

Given these obvious advantages, it is high time for a "second liberalisation of electricity markets". The first took place twenty years ago when large electricity suppliers lost their regional monopolies. Nevertheless, there is still a monopoly on consumers. In today's system, every household gets its electricity from a single power provider. If prosumer electricity trading were introduced, each household would still keep its regular supplier but would also be free to buy power from neighbours whenever these could provide cheaper and cleaner solar energy.

A stable legislative framework creating fair conditions for prosumer electricity trading is absolutely essential. The EU Commission's proposal is an important first step, as is the European Parliament's decision from Januar 17, 2018. The future of prosumer electricity trading is now in the hands of European institutions. We can only hope that EU Member States will understand their responsibilities and allow European consumers to shape the energy transition themselves by giving them this option.

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I. AIM AND APPROACH OF THE PROPOSAL

This proposal aims to illustrate how the direct and decentralised trading of electricity between citizens can become a reality in the European Union, using the German market as an example. It identifies options for changing general economic and energy-related conditions to enable people to trade decentralised electricity via the public grid. It also describes the positive effects of such changes on the entire electricity system.

Current approaches to a prosumer electricity system, such as regulations in Germany's Renewable Energies Act (EEG) regarding the landlord-to-tenant electricity surcharge, are limited to the supply of electricity that does not use the public grid. Although "prosumer electricity trading" on the public grid is not prohibited, this model faces major legislative, technical and economic obstacles.

This proposal describes the following steps toward achieving this goal:

- Defining prosumer electricity trading
- Reasons for prosumer electricity trading
- Obstacles in the way of prosumer electricity trading
- Ideas for changes that favour prosumer electricity trading
- Operational procedures for prosumer electricity trading

II. PROSUMER ELECTRICITY TRADING

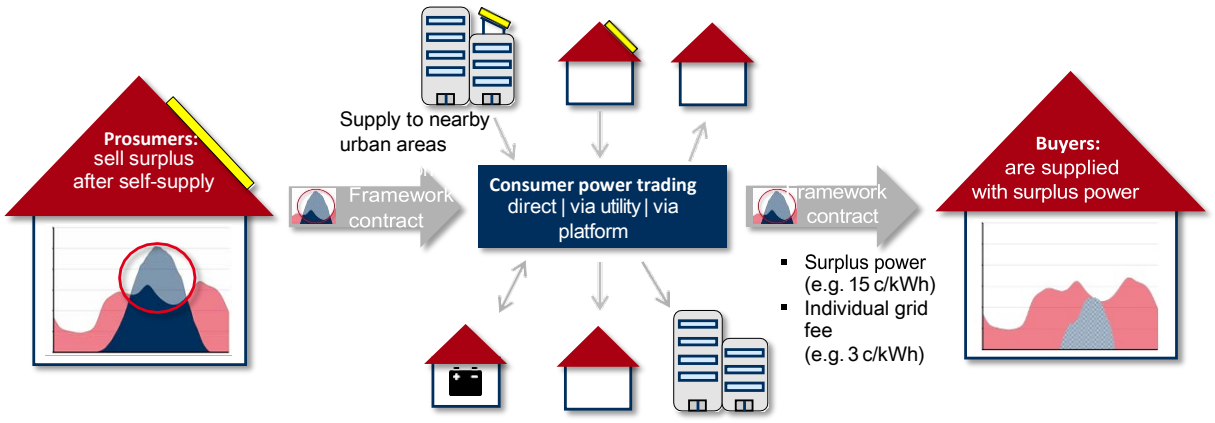
Prosumer electricity trading means that owners ("prosumers") of a photovoltaic roof-mounted system may supply surplus electricity to other consumers in the neighbourhood via the public grid. This would create a second level of trading in addition to the present wholesale trading of power on the electricity exchange. Electricity trading between prosumers and buyers can take place in three different ways (see Illustration 1):

a) Neighbours can trade electricity bilaterally by concluding a framework contract to exchange surplus power.

b) Private producers and consumers of electricity could also bring together supply and demand for surplus power on an electronic market platform.

c) Utility companies can also develop business models, bring together prosumers and buyers, and act as agents for facilitating the management of local surplus power.

Illustration 1: Prosumer electricity trading



Energy utilities Prosumers

- Service providers for trading surplus consumer electricity
- Cover remaining needs for power

Inclusion of storage facilities

Power supply to residential buildings

Energy utilities Buyers

- Feed-in of surplus power to the balancing mechanism
- Settlement of accounts
- Cover remaining needs for power

Regardless of which way prosumers and buyers trade with each other, utilities will still play an important role in prosumer electricity trading, particularly in terms of the services they can offer and the handling of processes. More details are in the sample calculation on page 8. An example of prosumer electricity trading is outlined below.

1. Starting point: prosumers[1] (on the left side of Illustration 1) supply their households partly with electricity generated by their own photovoltaic (PV) systems, but cannot consume all the power produced. Up until now, prosumers have fed surplus power into the grid and received EEG remuneration. However, prosumers cannot meet all the power needs of their households solely with PV systems, so they also buy power from a utility company to cover remaining needs.
2. The prosumer offers surplus power to a neighbour. This can be arranged through personal contacts, bulletins boards, Ebay classified ads, or by using a utility company as an agent. In any case, the prosumer and the buyer conclude a framework contract. Peer-to-peer transaction technology such as blockchains can also be used. The contract regulates prices and accounting procedures for the electricity traded this way as well as the distribution of power if several buyers are involved. The trading participants' utility companies can act as service providers and offer support in trading, supplying and accounting.

3. The prosumer can make an offer to all consumers of electricity in the neighbourhood. For practical and technical reasons, the prosumer could limit the target group by addressing only those buyers connected to the grid at the same grid level, which in this context would be the area supplied through the same transformer station. This would provide an opportunity to define the decentralised nature of prosumer electricity trading in terms of geographic location, and it would improve grid usage too, as described below in sections II. 7. and V. 3. In the next step, buyers accept the offer of surplus electricity or let their utility companies choose the best offer. This reduces the buyers' electricity procurement costs, as described below.

4. Trading between prosumers and buyers is transacted with the help of the PV system's metering device which records electricity production that is higher than the prosumer's self-consumption. It is this surplus electricity which the buyer consumes simultaneously. If there is no smart meter installed, load profiles are created using a grid operator's standard load profile. In this way, prosumer electricity trading can be handled with or without smart metering devices. With smart meters, buyers can consume not only surplus quantities of electricity that match their standard load profile, but also quantities that match their individual consumption behaviour and /or integrate a storage facility.

[1] This refers to householders or legal entities who generate renewable electricity below a threshold value yet to be defined.

The amount of electricity traded is calculated as the difference between meter readings – with or without smart meters. Accounting is done with the help of schedules exchanged between the balancing mechanisms of the participating utility companies. The buyer's utility company either lists the profile of the surplus electricity in its balancing mechanism precisely every fifteen minutes next to the buyer's consumer profile, or forms a sub-balancing mechanism for each market participant.

5. In legislative terms, prosumer electricity trading is a form of "non-promoted direct marketing" as regulated by the EEG. In the context of prosumer electricity trading, this means that PV systems do not receive any EEG remuneration at all. Prosumers can currently discontinue or deregister their systems from this form of marketing within one month. As long as prosumers are involved in the prosumer electricity trading model, they do not receive any EEG remuneration for the electricity they produce – not even for the electricity that they or buyers have not consumed. The prosumer is paid only the market price for this electricity. However, the option to switch between marketing forms on a monthly basis ensures investment security.

6. For prosumer electricity trading to work, it has to be profitable for prosumers and buyers. Buyers decide to trade when they can reduce the cost of their power consumption. Prosumers decide to use this form of marketing when they can expect revenues that are at least equal to those revenues otherwise available from EEG remuneration. Profitability exists for both sides when the regulation for self-consumption according to Section 61 of the EEG applies both to prosumers and buyers of surplus electricity. Consequently, there should be no EEG surcharge in the consumer electricity trading model on any electricity generated by a PV system[2] when either the prosumer or the buyer self-consumes it. This proposed regulation can be justified by the reduction in the EEG account due to prosumer electricity trading. This reduction occurs because the loss of income (from the EEG surcharge and market revenues) to the EEG account is less than the reduction in financial subsidies paid out from the EEG account. This is the case today and in all realistic future scenarios. The following sample calculation illustrates this effect:

   A roof-mounted PV system today typically receives EEG remuneration of 12 c/kWh. In the prosumer electricity trading model, the payment of this sum from the EEG account can be waived. In turn, income from the EEG surcharge (6.79 c) and the marketing of electricity on the exchange (about 3 c) does not flow into the EEG account – a sum of about 10 c/kWh. The bottom line is that the EEG account would gain around 2 c/kWh today. Admittedly, market prices and remuneration levels could change, but this would also lead to a change in the EEG surcharge which would

[2] Threshold values apply here which are yet to be defined for the prosumer electricity trading model. Threshold values of 10kW$_p$ and 10 MWh of annual electricity consumption are currently valid for self-consumption.

restore the ratio described above – with a time delay of course.

7. Moreover, the purchase of prosumer electricity should be accompanied by lower grid fees.[3] This is justifiable for several reasons:

    a) Only one grid is used: the prosumer's self-supply of electricity does not involve any grid fees and prosumer electricity trading would generally use only a few hundred metres of the public grid, avoiding the installation of an expensive parallel grid infrastructure for prosumer electricity. Prosumer electricity trading encourages the optimal use of the existing distribution network infrastructure and encourages the expansion of renewable energy systems that provide power to the neighbourhood.

    b) In the future, the expected need for grid expansion due to electromobility (more urban consumption) would be counteracted by prosumer electricity trading (more urban power production).

The amount of this "short-distance grid fee" would be calculated by the relevant distribution network operator. Other regulated components of the electricity price and taxes dependent on grid usage, listed below in section IV.1, could also be reduced in prosumer electricity trading. Here the legal groundwork still needs to be reviewed. Much speaks in favour of exemptions, especially for electricity tax, if electricity is locally supplied. For presentation purposes in this paper, we have estimated that all regulated price components of electricity traded at the same grid level add up to 3 c/kWh.

The economic benefits of prosumer electricity trading for the actors involved are illustrated in the following sample calculation:

- **Starting point**

  Prosumer: The prosumer's own annual electricity consumption is 3,300 kWh; the prosumer's PV system generates 5,000 kWh per year. During the previous year, the same PV system generated a surplus of 3,000 kWh, for which the EEG remuneration was EUR 360 (based on 12 c/kWh).
  Buyer: The buyer's household consumes 3,500 kWh per year, with the annual cost of electricity amounting to EUR 1,015 (at 26 c/kWh).

- **Trading**

  Prosumer: The prosumer offers to the local market the expected annual surplus of

[3] Grid operators currently charge households flat rates and consumption-based fees. This system could be modified in the course of the grid fee reform currently under discussion. A reformed grid fee system should also boost the consumption of prosumer electricity that optimises the use of existing grid infrastructure.

3,000 kWh for EUR 450 (at 15 c/kWh), either actively or through the utility company acting as an agent. Consequently, the prosumer no longer receives EEG remuneration for the period for which the offer is valid and must now find buyers at the same grid level. If there is a lot of surplus electricity available at the same level, prices will probably be lower for the surplus electricity traded. For the purpose of prosumer electricity trading, the prosumer informs the utility company of their intention to sell surplus power locally. This gives the utility the responsibility for handling surplus electricity until a framework contract for electricity trading has been concluded with one or more buyers. For trading purposes, the prosumer needs unique identification (meter numbers), in addition to the framework contract, which enable the actors involved to assign trading transactions to points of delivery (meters) and draw up a framework contract.

Buyer: The buyer concludes a framework contract with the prosumer for surplus electricity at 15 c/kWh; the grid operator has set a reduced grid charge for using surplus electricity at the same grid level and the EEG surcharge does not apply to this surplus electricity. The regulated variable electricity price components add up to 3 c/kWh for surplus electricity. The buyer pays 18 c/kWh for simultaneously consumed surplus electricity, which is 8 c/kWh or 31 percent lower than for conventional power from the grid. The buyer is charged for consuming surplus electricity only as far as it matches the buyer's consumer profile and thereby bears no risk of paying for more than what is really consumed. Should more than one framework contract apply, the amount of power consumed can be calculated according to share and ranking.

- **Settlement of accounts**

Prosumer: The prosumer's utility company supplies the remaining electricity needed by the prosumer and also integrates into its balancing mechanism or into a special sub-balancing mechanism the surplus electricity that was not delivered. The utility acts as a trading service provider for its customers and takes responsibility for deviations in the balancing mechanism. A schedule of surplus electricity is sent to the buyer's utility company. If there is no load measurement, the previous year's values and standard load profiles are used for accounting. Accounting requirements in terms of electricity trading and supply are taken on by the prosumer's utility company for its customers. The surplus electricity schedule includes at most the consumption profile of the buyer. It may be necessary to have a second schedule in the opposite direction for balancing the amount of surplus electricity that cannot be consumed.

Buyer: The utility company integrates the surplus electricity in its balancing mechanism or in a special sub-balancing mechanism. This means that it procures on the wholesale market only the customer load that is not covered by local surplus electricity. This remaining load is subject to regular taxes, fees and charges. For the surplus electricity purchased, the buyer's utility pays the reduced grid charges determined by the grid operator plus other components of the electricity price. The utility company continues as before to balance surpluses and shortfalls in quantity that result from deviations in consumption forecasts. The buyer's utility is responsible for invoicing and identifying the origin of all amount of electricity concerned.

- **Outcome**

Prosumer: If a prosumer is able to sell all surplus electricity at 15 c/kWh, earnings rise by EUR 90 per year or 25 percent – from EUR 360 to EUR 450 compared to the EEG remuneration. These earnings go down if there is little demand or if prices generally fall for surplus electricity. This can be expected in regions that are saturated with PV systems. On the other hand, if average prices for surplus electricity rise due to high demand at the relevant grid level, it can be worthwhile for a prosumer to invest in new PV systems or reinvest in continued PV operation. The utility company's fees for accounting services must be deducted from income. It can be expected that utilities will compete with each other in terms of who can offer prosumers the least expensive or least complicated prosumer electricity trading and accounting services.

Buyers: A buyer consumes 1,000 kWh of surplus electricity. This reduces the cost of purchasing electricity from the grid from EUR 1,015 to EUR 935, with savings adding up to EUR 80 or 8 percent in a year. To consume more surplus electricity, the buyer can invest in a smart meter, a storage facility or an electric car and adapt consumption behaviour wherever possible. A buyer's utility company can also become a market agent acting on behalf of its customers' economic interests to provide such services as improving the integration of renewable electricity feed-in at the same grid level.

III. REASONS FOR PROSUMER ELECTRICITY TRADING

There are several economic, technical and legislative reasons that speak for improving general conditions for the prosumer electricity trading model.

1. Economic and technical reasons

- A price signal to induce a decentralised, direct and load-profile-precise balance of supply and demand would have a positive impact on cost efficiency and the effective use of the public grid for decentralised renewable electricity production and storage. This applies not only to operations but also to the further expansion or continued maintenance of these systems. A price signal would stimulate improved allocative efficiency, described here in an example: in the future, prosumer electricity trading could reduce the expansion of the distribution networks needed for battery-powered electromobility by stimulating the local expansion of PV systems in urban areas. Indeed, the potential for optimising renewable electricity supply systems in residential areas is very high. But such a price signal does not yet exist. Today's form of electricity trading prevents decentralised market actors from using the public grid. But trading prosumer electricity via the public grid means that constructing economically inefficient, non-public, parallel grid infrastructures would be avoided.

- Prosumer electricity trading would ease the financial burden on the EEG account and improve the cost efficiency of the growth of renewable electricity under present (and expected future) general conditions. As far as it is politically desired, decentralised photovoltaic systems can be operated adequately in a prosumer electricity trading model without any EEG remuneration. Higher cost efficiency is based on the economically optimal use of roof space.

- Utility companies would assume the responsibility for decentralised load balancing. This would increase their motivation to forecast decentralised customer load (consumption and production) as accurately as possible and offer services to help customers consume decentralised surplus electricity. This is particularly significant for the further construction and operation of household storage facilities and the controlled charging of electric vehicles. The services needed for implementing prosumer electricity trading could offer new business opportunities to utility companies, inducing them to offer green electricity products with a high level of credibility.

2. Legal reasons

Improving general conditions for prosumer electricity trading is desirable as far as legislation is concerned, especially in European law. The process toward a European Directive has been initiated and is being negotiated by the European Union's legislative bodies. The current proposal of the European Parliament for a recast of the EU's Renewable Energy Directive[4], in the version dated 17 January 2018, refers to prosumer electricity trading in both recitals and provisions. The Directive identifies the growing importance of the self-consumption[5] of renewable electricity and aims to create a legal framework, pointing out that:

> *"there is a need for…a regulatory framework which would empower self-consumers to generate, store, consume and sell electricity without facing disproportionate burdens. Tariffs and remuneration for self-consumption should provide incentives for the development of smarter renewables integration technologies and motivate renewable self-consumers to make investment decisions that mutually benefit the consumer and the grid."*

This approach will oblige EU Member States to observe the provisions of the Directive expected to apply in the future, particularly Article 21, as follows:

- Member States shall ensure that prosumers "*are entitled to carry out self-consumption and sell, including through power purchase agreements and peer-to-peer trading arrangements, their excess production of renewable electricity without being subject to discriminatory or disproportionate procedures and charges that are not cost-reflective",* exempting from all charges and fees the self-consumption of self-generated electricity and the use of storage facilities.
- According to the draft EU proposal, prosumers should not be considered energy suppliers under EU or national legislation for renewable electricity if they do not feed into the grid more than 10 MWh per year as households and 500 MWh as legal entities. Member States should be entitled to set higher thresholds than those specified here.
- The option of being supplied directly with prosumer electricity should also be guaranteed to consumers who live in the same residential building or the same commercial or industrial area where renewable electricity is produced and shared.

[4] P8_TA(2018)0009 (Decision of the European Parliament, 17 January 2018). See also COM (2016) 767 (the original draft proposal for the EU Directive by the European Commission from November 2016). This paper refers only to the latest version of the European Parliament's proposal. Once the Directive is adopted, it will be necessary to review the concept of "prosumer electricity trading" to reflect any final changes made to the Directive in the interim.

[5] Self-consumption in the sense of the Directive also includes the sale of electricity.

IV. OVERCOMING THE OBSTACLES FACING CONSUMER ELECTRICITY TRADING

Although the trading of renewable electricity between citizen prosumers and buyers through the public grid is in principle legally permissible today, there is in fact no such trade. High taxes, charges and fees for electricity make this idea uneconomical and they pose formidable administrative efforts for participants.

1. Taxes, charges and fees for electricity

When electricity is supplied through the public grid, a large number of regulated taxes, charges and fees must be added to its price. These currently account for 80 percent of its end price for customers and they can add up to a total of 19 c/kWh without value-added tax (VAT). The table below shows typical values for electricity price components when power is supplied to a household by a utility company. Under the current system, buyers of surplus renewable electricity would have to pay the same regulated price components. The fourth position in the table shows that the share of costs for grid fees, metering, the operation of metering points, and accounting averages 0.3 c/kWh.[6] The time and effort reflected in this position would still have to be paid in full in a prosumer electricity trading model.

	Components of the price of electricity in Germany (in EUR cents)	***for***	***c/kWh***	***%***
Market 20%	Wholesale price (average procurement for a household over 3 years)	supply from grid	3.740	12%
	Selling, trading and structural costs; risk premiums	supply from grid	1.400	5%
	Sales margin (estimated)	supply from grid	1.000	3%
Regulated 80%	Grid fees, metering, operation of metering points, accounting	grid use	7.480	25%
	Concession fees, licences, franchises	grid use	2.000	7%
	Renewable Energies Act (EEG) surcharge	no privilege	6.792	23%
	CHP surcharge	grid use	0.438	1%
	Grid surcharge for small consumers defined in Network Charges Ordinance (StromNEV, „§19-Umlage“)	grid use	0.388	1%
	Offshore liability surcharge	grid use	0.028	0%
	Disconnectable load surcharge	grid use	0.006	0%
	Tax on electricity	more than 2 MW	2.050	7%
	Value-added tax (19%)		4.828	16%
Total (gross)			**30.150**	

[6] Bundesnetzagentur [German Federal Network Agency] (2017): Monitoringbericht 2017 [2017 Energy Monitoring Report], p. 231.

2. Administrative expenses

Supplying power to consumers involves a high level of administrative effort. This effort is warranted by the need for a secure and reliable power supply. Among the demands which must be met are the obligation of electricity suppliers to maintain a balancing mechanism, to compile reports at various stages in the trading process, and to comply with requirements applying to electricity supply contracts, metering and accounting. In detail:

2.1. Reporting requirements

Regulation	Content of report	Sent to	By when	Sanctions in case of non-compliance
Energy Industry Act (EnWG), Section 5	Start and termination of activity; change of company	Federal Network Agency	Imme-diately	Prohibition of activity, if relevant
Renewable Energies Act (EEG), Section 74 (1)	Delivery status; information on reduction of EEG surcharge, Section 60	Transmission system operator	Imme-diately	None, provided that no EEG surcharge is paid; termination of balancing mechanism contract, Section 60 (2)
Renewable Energies Act (EEG), Section 74 (2) 1.	Notification of volume of electricity supplied to end consumer	Transmission system operator	Imme-diately	see above
Renewable Energies Act (EEG), Section 74 (2) 2.	Submission of final accounts for the previous year	Transmission system operator	31 May of each year	see above
Renewable Energies Act (EEG), Section 76 (1)	Notification of volume of electricity supplied to end consumer	Federal Network Agency	Imme-diately	see above

2.2. Obligations of grid users

Prosumers who supply electricity to third parties through the public grid are grid users. Among other things, they must comply with the following regulations:

Regulation	Content
Electricity Grid Access Ordinance (StromNZV), Section 3 (1) and Section 24 (1)	Grid users are entitled to conclude a grid usage contract that provides access to the entire electricity supply system.
Electricity Grid Access Ordinance (StromNZV), Section 4 (1) (3)	Within one control area, one or more grid users must form a balancing mechanism. A balancing mechanism must have at least one point for feed-in or offtake.
Electricity Grid Access Ordinance (StromNZV), Section 4 (2)	A balancing mechanism manager must be named who is primarily responsible for a balance between feed-in and offtake. This requires the most accurate possible forecasting of feed-in and offtake.

2.3. Requirements for electricity supply contracts

According to Section 41 of the Energy Industry Act (EnWG), electricity supply contracts with householders must contain the following provisions, among others:

- Duration of contract, price adjustments, termination date, notice period, cancellation rights
- Scope of services, mode of payment
- Liability and compensation provisions
- Provisions granting the consumer the right to a free and rapid change of supplier
- Information on the rights of household customers in cases of dispute

2.4. Requirements for metering

One of the basic requirements for electricity trading is that the amounts of electricity consumed are properly metered and recorded. In general, household electricity consumption is currently measured with selective readings from a totalizer. As soon as surplus electricity is generated, this is either recorded by a totalizer or by a smart meter in a load curve with high temporal resolution in the prosumer's load profile, starting from an output value to be specified for prosumer electricity trading. In principle, this electricity can be exchanged as a

schedule between balancing mechanisms and could be sold in this way.

2.5. Requirements for electricity invoices and identifying the origin of electricity

According to Section 40 of the Energy Industry Act (EnWG), it is mandatory to include certain information on invoices for end consumers, such as:

- the official business address: correct supplier address including email address
- duration of contract, prices, termination date, notice period
- point of delivery identification
- meter reading

V. CHANGES THAT FAVOUR CONSUMER ELECTRICITY TRADING

For consumer electricity trading to function well, obstacles must be removed at all levels to allow preferential treatment for the small amounts of power being discussed also in proposed European Union legislation.[7]

1. Definition of the amount of electricity that can be traded

A plan for prosumer electricity trading with reduced taxes, charges and fees is possible only if the amount of electricity involved is defined. Regulations governing self-consumption can be a guideline here; at present the threshold values for self-consumption are 10 kW_p per PV system and 10,000 kWh for annual electricity consumption. For pending and future EU legislation, thresholds for surplus electricity in prosumer electricity trading must be specified in a similar way. In the interest of liquid prosumer electricity trading, the thresholds prescribed by EU legislation should be fully exhausted and have additional upward leeway. Furthermore, capacity threshold values must be set. Small suppliers that remain below these threshold values would not count as utility companies and would not need to carry out the administrative tasks required of conventional power suppliers. The threshold value should be higher than the standard value set by the pending EU Directive, in accordance with the enabling provision in the Directive.

The jurisdiction of the relevant arbitration body must be clarified in accordance with Section 101 of the Energy Industry Act (EnWG) to settle disputes between users of the trading platform or contracts otherwise concluded.

2. Definition of the geographical area of application

The geographical area within which a prosumer electricity trade takes place must also be defined. This ensures that production meets demand and contributes to local grid stability.

3. Reduction in taxes, charges and fees

In view of cost savings, improved grid usage, and the limited geographical area of a prosumer electricity trade, eliminating or at least significantly reducing the requirement to pay certain grid-related charges, fees and taxes is justified. Elimination or reduction of the EEG surcharge and grid fees is substantiated by cost reductions (EEG surcharge[8]) and efficiency gains (improvement of grid usage). A legal basis for exemption from electricity tax is probably already in place under current legislation, but this aspect was not reviewed for this paper. Conversely, the perhaps politically desirable reduction of fees for metering, the operation of metering points, accounting and licencing, for example, is not based on efficiency gains or

[7] Here too, this proposal refers solely to the European Parliament draft version of 17 January 2018 of the EU Renewable Energy Directive (P8_TA(2018)0009); possible or pending changes were not taken into account.

[8] The total amount of the EEG account's reduced revenue (EEG surcharge of 6.792 c/kWh plus the market price of about 3 c/kWh) is lower than the expenditure avoided (EEG remuneration of about 12 c/kWh).

cost advantages. The specific organisation of prosumer electricity trading and the reduction in taxes, charges and fees for surplus electricity can and should be designed to make sure that shifts in costs are socially equitable. This calls for low participation barriers, made possible by a standardised framework contract. Utility companies can also contribute to lowering barriers by integrating surplus electricity into the power they supply to end consumers.

4. Waiver of reporting requirements

In line with pending and future EU legal regulations and in view of the limited scope of a prosumer electricity trade, it would be possible to dispense with reporting requirements that apply to electricity suppliers. There is no reason to fear gaps in information or in the recording of the amount of power supplied to buyers because all the electricity a buyer purchases would be recorded by the buyer's utility company. The amount of electricity fed into the grid would be recorded by the grid operator connected to each prosumer PV system.

5. Minimising the grid use contract and the requirement to manage the balancing mechanism

For very small amounts of electricity, a very simplified grid usage contract is sufficient to satisfy notification requirements. A standard must be defined for this purpose. The measures needed to comply with the requirement to manage the balancing mechanism currently pose too great an effort to effectively allow prosumer electricity trading; these measures must be minimised. However, there are various conceivable models for managing the balancing mechanism, described below under point 6.

6. Metering, accounting and managing the balancing mechanism

Surplus electricity can be metered and accounted for precisely every fifteen minutes or it can be calculated using a totalizer and applying a standard load profile of the grid operator. Regarding these volumes, either a schedule of the EEG balancing mechanism must be sent to the utility companies of prosumers/buyers, or the feed-in point is attributed to the prosumer's balancing mechanism. In the first case, the grid operator who manages the EEG balancing mechanism would be involved in communications. This would make it easy to identify the amount of electricity sold as surplus electricity. In the second case, the prosumer's utility company would send a schedule to the buyer's utility company; the advantage here is that there would be one less actor involved, resulting in lower processing costs. The surplus electricity schedules referred to are based on metering data or estimated values for prosumers' excess power production, standard load profiles, and basic data that must be specified in framework contracts between prosumers and buyers. This information must at least include the share of surplus electricity, the utility's energy identification code (EIC), the start and end of delivery, and market participants' unique identifiers (such as their meter numbers). The latter is required so the utility company can attribute surplus electricity to the consumers benefitting from it and determine individual grid fees.

A conceivable alternative to the idea described here is a sub-balancing mechanism formed for each market participant and assigned to the utility company's balancing mechanism. As a result, the volume of each consumer electricity trade would be accounted for separately, but the utility company would still be responsible for all deviations and accounting for energy balancing. However, a sub-balancing mechanism would have to be formed for each market participant, involving the coordinator of the balancing mechanism more closely in market communications, thereby increasing the cost of processing. As this system would lead to a significant increase in sub-balancing mechanisms, it would be necessary to determine the prerequisites for implementation for balancing coordinators and transmission system operators. However, this alternative system does have several advantages: separate recording in sub-balancing mechanisms increases each market participant's own responsibility and improves transparency of the overall system. To the best of our knowledge, added value for the energy economy at the system level does not depend on the choice of model.

Whether buyers or prosumers have an intelligent metering system, a smart meter or a totalizer is irrelevant for successfully implementing the system. However, only a smart meter will individually record electricity load variations, and only an intelligent metering system will make these variations accountable for invoicing. In this context, the legality of the grid operator's requirement to install a smart meter for an EEG system, depending on the form of marketing, must also be clearly regulated. But whether or not to invest in a smart meter should not interfere with the decision to market renewable electricity.

VI. SUMMARY

Germany's electricity system today balances supply and demand with a basic national pricing scheme without regional differentiation. Efficiency incentives that should actually be fostered through electricity trading are lost when it comes to decentralised electricity production because local actors do not participate in this market. On the demand side, there are electricity consumers who are willing to switch to decentralised power, but who currently receive no incentives to adapt their consumption behaviour to meet decentralised production requirements. On the other hand, the decentralised expansion of renewable electricity is not connected to local demand. A prosumer electricity market enabling households to trade decentralised power through the public grid could improve this situation.

This paper proposes a model for prosumer electricity trading in which prosumers sell their self-generated, surplus electricity to other consumers at the same grid level under simple conditions. Prosumers use standardised framework contracts for this purpose, directly concluding contracts with buyers such as their neighbours. The purchase of local surplus electricity means that some components of the price of electricity are reduced; however, EEG remuneration is not granted to prosumers for feeding electricity into the grid. The utility companies of buyers and prosumers integrate surplus renewable electricity into their balancing mechanisms and take on administrative obligations that are part of the business of trading and supplying electricity. Utility companies, as the main suppliers, bear full responsibility towards the balancing coordinators and transmission system operators.

Economic, technical and legislative reasons argue in favour of improving general conditions for the prosumer electricity trading model. A price signal inducing a decentralised, accurate load-profile balance of supply and demand for renewable electricity would have positive effects on cost efficiency, improve grid usage and stability, and would also promote the further expansion and maintenance of decentralised renewable electricity and storage facilities. Installing a parallel grid infrastructure is not the most efficient way of achieving a more efficient and needs-based distribution of decentralised production systems at the point of consumption, or of efficiently bringing together supply and demand for decentralised power. The continued operation of renewable electricity systems would become feasible when remuneration runs out at the end of the 20-year period prescribed in Germany's Renewable Energies Act.

The potential to exploit urban areas for renewable electricity could also be tapped. The improvement of general conditions for prosumer electricity trading is also desirable from a legislative point of view, especially in European law. Article 21 of the current draft version of the EU's Renewable Energy Directive will probably oblige Member States to facilitate the simplified sale and purchase of surplus renewable electricity.

This kind of trading currently faces obstacles because energy legislation with its various requirements in terms of reporting, energy trading and the supply of power to end consumers is clearly geared towards wholesalers. Adapting energy legislation to make way for retail trading requires defining the amount of surplus electricity involved, establishing threshold values and identifying the geographical area concerned. Grid-related taxes, charges and fees must be significantly reduced. Decentralised market participants should be able to forego reporting requirements, a grid usage contract and the requirement to manage balancing mechanisms.

ABOUT ENERGY BRAINPOOL

Energy Brainpool GmbH & Co. KG provides independent expertise on energy markets with a focus on market design, price development and trading in Germany and Europe. Tobias Federico founded the company in 2003 with one of the first spot price forecasts in the market. Today Energy Brainpool's range of products includes the fundamental modelling of electricity prices using Power2Sim software, diverse analyses, forecasts and research-based studies. Energy Brainpool provides advice on strategic and operating issues and since 2008 has been offering advanced training programmes for experts in the field. The company combines knowledge and competence on business models, digitalisation, and the management of trade, procurement and risk, boasting many years of practical experience in controllable and intermittent energy production.

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