CEER Position Paper on Renewable Energy Self-Generation

September 2016

What is self-generation?

A definition of self-generation (SG) is not readily available. Prosumer, self-generators and self-consumers are words sometimes used interchangeably. For the purpose of this paper, the Council of European Energy Regulators (CEER) considers self-generation as the use of power generated on-site by an energy consumer in order to reduce, at least in part, the purchase of electricity from the grid.

The scalability of generation technologies such as rooftop photovoltaic (PV) systems, with an increasingly lower Levelised Cost of Energy (LCOE), coupled with the vast potential of the Internet of Things, makes SG possible to an extent that was difficult to anticipate a few years ago.

SG is expected to offer opportunities for network losses reduction, improved demand response, bill savings and CO_2 abatement. It also poses challenges for network operation and for the long-term economic sustainability of system operation, should their costs and benefits not be fairly shared.

What is the purpose of this CEER position paper on self-generation?

SG is highly relevant in the context of the drive towards greater consumer empowerment and engagement, and the realisation of Europe's renewable energy targets. With increasing amounts of small-scale electricity generation connected at distribution level, particularly rooftop solar and wind, SG has the potential to have a significant impact on Europe's future energy system, creating an opportunity for more consumer empowerment.

CEER, as the voice of the energy national regulatory authorities (NRAs), aims at providing the European Commission and policy-makers with an independent analysis of the impact that SG could have on a range of actors (individual prosumers and society), on system operation and costs, and on the market.

CEER is committed to protecting consumers as regulatory responses adapt to new energy market circumstances. As regulators, we are keen that the implementation of decarbonisation targets is done in a manner that minimises costs and maximises security for society as a whole. Importantly, the market has a key role in determining which generation solutions are most effective and efficient. Both self-generation and centralised, large scale production (transported via energy networks) can be valuable, compatible tools to reach renewable, competitiveness and security of supply targets. It is part of regulators' role to help implement an energy market design which allows the market decide on the appropriate generation solution. There should be no cross-subsidies between self-generation and centralised consumption.

An important key message in this paper is that prosumers have both rights and obligations, and that there is a need to reflect the costs and value of the network.

Key Principles

To achieve the benefits of SG for all consumers, whether self-generating or not, the wider market and network regulation framework needs to be fit for purpose. CEER sets out the following principles related to SG which policy-makers and energy regulators should take into account in the energy market design. For further detail, see the Annex.

- **Incorporate SG into network planning.** To reap the expected benefits of SG, regulatory frameworks need to allow Transmission System Operators (TSOs) and Distribution System Operators (DSOs) to account for SG when assessing network expansion needs and system operation to avoid inefficient grid expansion and improve active system management.

- **Consumers as prosumers.** When opting for SG, consumers become prosumers, hence play an additional role as power producers. As such, they are no longer passive clients but active market players, which may entail additional responsibilities.

- **Tariffs should be cost-reflective.** Prosumers that use the energy network should face network tariffs which are cost-reflective in the same manner as consumers that exclusively rely on the network for their energy supply. In particular, network tariffs should be designed to reflect the value of the network to all those connected - costs and benefits - irrespective of the type of consumer involved. All consumers should face relevant price signals. Network tariff structures should be non-distortionary: recovery of the fixed costs of building, operating and maintaining networks should be designed to avoid unintended distortions in decisions around investment in self-generation.

- **Avoid perverse incentives.** Consumers who rely exclusively on the network should not be unduly disadvantaged compared to prosumers. There should be a fair allocation of network costs and levies - for example taxes and renewable subsidies - across all consumers.

- **No cross-subsidisation.** Any adoption of SG by consumers, compared with (traditional) centralised generation, should be based on efficiency and on market principles, with all appropriate costs and benefits reflected in the market such that there is no cross-subsidy or unfair discrimination between prosumers and remaining consumers. This includes network tariffs (as above) and the application of taxes and levies such as renewable subsidies.

- **Access flexibility mechanisms.** To use all available flexibility to improve system efficiency, SG should be able to participate in all flexibility valuation mechanisms on a level playing field.

- **Adequate metering for prosumers**. Prosumers must have metering devices to allow them to participate in balancing markets with other sources of flexibility on a level playing field. CEER consider accurate measurement of local production and consumption a prerequisite to ensure an efficient use of available renewable energy sources (RES) and distribution networks, and it is also required to accurately measure Members States' progress in achieving renewable energy targets. Otherwise, both generation and consumption figures would be distorted.

- **Avoid net metering[1] of self-generation.** Net metering should be avoided as it implies that system storage capacity is available for free. It reduces consumers' time-value sensitivity to volatile energy prices and hence undermines efforts to enhance flexibility and to develop a wider demand-side response with consumers playing a more active market role.

[1] As defined in Commission Staff Working Document "Best practices on Renewable Energy Self-generation", Commission Staff Working Document, July 2015, COM(2015) 339 final, http://ec.europa.eu/energy/sites/ener/files/documents/1_EN_autre_document_travail_service_part1_v6.pdf:

«Net metering is a regulatory framework under which the excess electricity injected into the grid can be used at a later time to offset consumption during times when their onsite renewable generation is absent or not sufficient. In other words, under this scheme, consumers use the grid as a backup system for their excess power production».

Annex I: Common perceptions of SG – Myth or Reality

Effects commonly attributed to Self-generation (SG)	CEER's appraisal
1. The prosumer's perspective	
• **Monetary savings** Whenever 'socket parity' is achieved, i.e. when the levelised cost per kWh of self-generated RES electricity matches or is lower than the cost of the electricity supplied on the grid by a contracted supplier, consumers can save money through self-generation.	• 'Socket parity' differs from 'grid parity' (achieved when the production costs of utility-scale RES plants are comparable to those of centralised generators) in network and system costs. • Transmission and distribution tariffs should be cost-reflective, and ensure that SG monetary savings due to lower tariff-related payments reflect reduced system costs. There should be a fair allocation of network costs and levies - for example taxes and renewable subsidies - across all consumers.
• **Empowerment** Considerable cost reduction and scalability in some generation technologies (namely solar PV) provide Small & Medium Enterprises (SMEs) and households with the opportunity to generate and self-consume electricity within their own premises. They become *prosumers* and can actively contribute to the energy transition and gain more control over (parts of) their energy bills.	• Currently there are significant differences in consumers' ability to generate their own electricity, such as whether they are rural/urban or owners/tenants. Regulation should ensure that the benefits of self-generation can be realised by as broad a base of consumers as possible
2. The society's perspective	
• **Mobilisation of private funds for financing the energy transition** Prosumers are investing their private funds into a RES installation. As such they are contributing to the financing of the energy transition and to the achievement of the overarching RES objectives.	• Society's acceptance and individuals' commitment to invest in RES installations will help in achieving EU's RES objective.

	• A cost-efficient allocation of RES support is also important; SG is an attractive option where peak demand and generation are synchronised, and grid losses are high or network development is difficult (e.g. in air-conditioned offices fed by solar PV and connected to an ageing grid in densely populated areas).
3. The system operation's perspective	
• **Reduced (or delayed) grid expansion needs** SG can lower energy system costs, e.g. solar PV generation in sunny countries can help reducing grid peak demand for electricity driven by air conditioning.	• When calculating the investments needed in the electricity system, TSOs and DSOs use a wide range of criteria. Importantly this includes the need to cover all demand of electricity at any time throughout the year, i.e. peak load is the decisive criterion. To reduce or delay grid expansion needs, self-generation must coincide with local peak demand. However, SG should be regarded as complementary, rather than an alternative, to other RES generation, whose integration will still call for grid expansion and reinforcements. • An expansion of SG, inducing more variable and diverse demand patterns, may push a change for tariffs that leverage the full potential of better matched load-generation profiles.

• **Reduction of system losses** By generating and consuming electricity locally, system losses can be reduced.	• For regulation to duly monitor system losses, marginal loss variation should be taken into account when designing energy charges. When energy is transported over long distances losses occur. SG can be part of the solution to reduce losses as the generation and demand are, by definition, closely located. The effect of this may be felt across the grid through changes in flow patterns from historic norms. The higher the self-generation ratio[2], the better the chances to effectively reduce network losses. 'Smartly' controlled storage, designed to better match demand and production in a timely manner, would help increasing self-generation ratio. • According to some studies[3], at low penetration levels (up to 10-15 % energy penetration), distributed generation, either associated to SG facilities or not, is likely to reduce distribution network losses. Beyond that level, losses may actually increase. (The threshold varies from country to country: southern Europe, where peak demand may coincide with PV output, is likely to have a higher threshold.)

[2] Self-generation ratio is calculated by dividing the generated energy which is consumed locally by the total production. (The complement to this ratio is therefore the energy that is injected into the grid divided by total production.)

[3] "Identifying energy efficiency improvements and saving potential in energy networks", Tractebel and Ecofys for DG Energy (EC), December 2015.

Also "Assessment of energy distribution losses for increasing penetration of distributed generation", Méndez-Quezada et al., 2006; "Energy losses in a distribution line with distributed generation based on stochastic power flow", Marinopoulos et al., 2011; "Fostering microgeneration in power systems: the effect of legislative limitations", Fidalgo et al., 2012; as cited by "Regulatory practices and distribution system cost impact studies for distributed generation: Considerations for South African distribution utilities and regulators", U.J. Minnaar, 2015.

• **SG as a driver for flexibility** (through demand side management and storage). SG is advocated as a source of additional flexibility for the power system. This flexibility potential can either be achieved by adjusting prosumers' load to hours of onsite renewable energy generation, i.e. by better matching load with generation profiles so as to contribute to peak-shaving and/ or valley filling at distribution level. Consumers self-generating renewable energy can also offer flexibility to the wider power system, including through aggregators. Energy storage installed by consumers helps storing excess on-site renewable generation in periods of low demand (e.g. when residential consumers are not at home) for use in periods when energy demand is high and renewable production is low (e.g. peak-time in the morning and in the evening). Thus, storage can enable consumers to capture and utilise the electricity generated by their renewable energy systems more effectively by decoupling time of generation and consumption, while also supporting the grid, e.g. by reducing local voltage fluctuations as well as congestion problems.	• A number of prerequisites need to be met for SG to be a genuine driver for flexibility: • SG should be able to control power injection depending on variable consumption levels, via e.g. storage, demand response or smart inverters. Without such tools, SG paired with intermittent generation (solar PV or mini-wind turbines) would not provide by itself more flexibility than an ordinary consumer. • Prosumers should actively react to price signals, by themselves or through aggregators, so as to provide flexibility by adapting their consumption (or production) behaviour in accordance to the needs of the system. Other mechanisms to valuate flexibility are introduced in the paper "Scoping of flexible response"[4].
• **SG contributing to system operation** In combination with a storage, prosumers can utilise more effectively the generated electricity by decoupling time of generation and consumption, while also supporting the grid, e.g. by reducing local fluctuations as well as congestion problems.	• Price signals are deemed key to encourage prosumers into adapting their production and consumption patterns in a way that supports system operation needs.

[4] Source: http://www.ceer.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_PAPERS/Electricity/2016/C16-FTF-08-04_Scoping_FR-Discussion_paper_3-May-2016.pdf

	• The annual consumption of households and SMEs are not yet metered on an hourly/ quarter-hourly basis in most Member States (MSs), but rather monthly or even only once or twice a year. Suppliers rely then on standard load profiles to forecast their expected consumption profile over the year. With increasing shares of SG, and different SG ratios, the need for data feeding closer to real time becomes more urgent.
4. The system costs perspective beyond network related ones	
• **When it comes to assessing prosumers' contribution to system costs, those other than strictly network-induced ones are sometimes missed,** probably because analysis gets more complex, since it progressively moves from energy regulation to energy policies, and there are almost as many approaches to pay for them as jurisdictions exist. • **Charges on electric consumption** (either as part of the access tariffs, or by means of specifically designed taxes or levies) **usually provide for all or part of relevant system costs not related to network ones** — sometimes not even strictly related to electricity supply itself—, such as support mechanisms for renewable generation and cogeneration, vouchers for vulnerable consumers, long-term contracts providing capacity firmness against future scarcity situations, cross-regional compensations pursuing that end-users in hinterland or on remote islands pay no more than the average urbanite, etc.	• As regards charges to be faced by prosumers, all system costs (including, but not exclusively, grid costs) must be considered in a consistent regulatory analysis. • SG should not be regarded as a cost for the system, but as a potential reduction of income which should be mirrored by a comparable reduction of costs. Cost-reflective tariffs should shield network costs' sustainability from any given extension of SG. • Without a sound cost-reflectiveness, SG may create cross subsidisation whereby the monetary savings enjoyed by prosumers is financed, via a cross-subsidy, by traditional (non-self) consumers.

5. The market perspective	
• **Prosumers can act as additional market players** and react to market price signals by adapting their generation and consumption profile.	• Previously cited flexibility drivers also apply here: modulation capabilities and clear price signals are prerequisites for SG to become an active market player. Otherwise, assuming that rational prosumers would optimise their share of self-consumed electricity, and could enjoy some kind of regulatory incentive regardless when they produce or consume, they could feel better shielded from (and hence less involved with) market price volatility than a *conventional* consumer. • Whenever a net metering scheme is in place, time value of energy may be completely lost, and the storage capacity of the system as a whole is taken for free. From a market-enhancing perspective, CEER strongly recommends not to allow net metering. • Prosumers must have metering devices enabling measurement periods coherent with balancing settlement rules. Installed generation power and technology should be registered, and production data should be independently available for plants above a certain size (to be determined via due cost-benefit analysis), and anytime they are active on the market, so that they might be held liable for imbalances regarding the energy injected into the grid. Otherwise, both generation and consumption figures would be distorted, and policymaking based on such evidence, misguided.

Annex III – List of abbreviations

Term	Definition
CEER	Council of European Energy Regulators
DSO	Distribution System Operator
DSM	Demand Side Management
LCOE	Levelised Cost of Energy
MS	Member State
NRA	National Regulatory Authority
PV	Photovoltaic
RES	Renewable Energy Sources
SG	Self-generation
SME	Small and Medium Enterprises
TSO	Transmission System Operator

About CEER

The Council of European Energy Regulators (CEER) is the voice of Europe's national regulators of electricity and gas at EU and international level. CEER's members and observers (from 33 European countries) are the statutory bodies responsible for energy regulation at national level.

One of CEER's key objectives is to facilitate the creation of a single, competitive, efficient and sustainable EU internal energy market that works in the public interest. CEER actively promotes an investment-friendly and harmonised regulatory environment, and consistent application of existing EU legislation. Moreover, CEER champions consumer issues in our belief that a competitive and secure EU single energy market is not a goal in itself, but should deliver benefits for energy consumers.

CEER, based in Brussels, deals with a broad range of energy issues including retail markets and consumers; distribution networks; smart grids; flexibility; sustainability; and international cooperation. European energy regulators are committed to a holistic approach to energy regulation in Europe. Through CEER, NRAs cooperate and develop common position papers, advice and forward-thinking recommendations to improve the electricity and gas markets for the benefit of consumers and businesses.

The work of CEER is structured according to a number of working groups and task forces, composed of staff members of the national energy regulatory authorities, and supported by the CEER Secretariat. This report was prepared by CEER's Sustainable Development Task Force, under the CEER Electricity Working Group.

More information at www.ceer.eu.