D1.2 Outlook for energy market, tariffs and regulatory aspects
Final Version

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ABOUT THE NEMoGRID PROJECT

The increase of distributed energy resources (DERs) reduces the energy sales of the distribution system operators (DSO). Given the present tariff scheme, the utilities will likely counterbalance the missing income deriving from a reduction in the amount of energy sold by increasing grid tariffs. Therefore, prosumers might decide to further increase self-consumption, invest in local storage technologies and even disconnect themselves from the grid, inducing the so-called death spiral in the utility sector. The goal of the project is to design and evaluate innovative business models favoring the integration of DERs in the distribution grid by attaining an economic and technical optimum at community level, considering three scenarios: centralized DSO planned, voltage based tariff (decentralized), P2P distributed market using blockchain for energy transactions. The proposed scenarios will be evaluated in simulation and validated in two demo sites in Switzerland and Sweden.

>> www.nemogrid.eu
1 ENERGY PRICE PROFILES AND GRID TARIFFS

The developments in the EU28 power sectors have significant impacts on energy costs and electricity prices, in particular in the short term. From 2010 to 2020, average electricity prices increase by 13%. This is due to increased capital costs, which more than compensate the observed decrease in fuel costs. Beyond 2020, average electricity prices increase up to 2030 and then remain broadly stable beyond 2030 (Table 1), as the benefits, in terms of fuel cost savings, resulting from the restructuring investments in electricity supply come increasingly to the fore. In addition, lower technology costs from technology progress and learning over time help contain electricity prices.

<table>
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Table 1. Forecasted costs for energy split between grid and other components.

More specifically, capital costs and fixed costs increase significantly [01]. Higher shares of RES in power generation with similar fuel prices imply a reduction of the fuel cost component. Smaller components of the cost increase are national taxes and ETS allowance expenditures. In addition, there are the arithmetic effects of successful energy efficiency policies, which through curtailing electricity demand reduce the denominator for sharing out the electricity costs while the numerator is less affected due to the high share of fixed costs in electricity generation and supply. The grid costs increase over time due to the augmenting share of RES, and particularly variable distributed RES. The PRIMES model although not being geographically defined uses functions to determine grid costs based on the share of distributed generation (mainly wind and solar); the function has been econometrically estimated based on the requirement for high, medium and low voltage grid requirements. In the period to 2030, the grid costs increase both due to the increase of distributed RES as well as to the development of the TYNDP of ENTSOE. The prices for households and services are projected to increase moderately in the medium term and to decrease slightly in the long term. Prices for industry on the contrary are stable or decrease over time as industry
maintains base-load profile and bears a small fraction of grid costs and taxes. Taxes apply mainly on prices for households and services.

2 REGULATORY ASPECTS

2.1 EUROPEAN UNION

2.1.1 European regulatory framework

The electricity sector is in transition towards a Smart Energy System. The existing regulatory framework is still based on the last decade generation technologies, mainly large-scale and fossil-fuel based, consumers are still viewed as passive actors and DSO is a monolithic, classic operator. The goal of the new legislative framework should be the integration of new technologies into the electricity system as well as the development of a more decentralised system with new players (firstly prosumers, maybe within a peer-to-peer market, and aggregators) and a reshaping of the role of DSO.

For our purpose, an empowerment and a more active role of customers in the electricity market represent a key pillar. The valorisation of active customers at the European level mainly relies on:

- Definition of rights (and duties) of prosumers
- Wide adoption of dynamic prices
- Incentive of demand response (implicit and explicit)
- Evolving roles of DSOs.

The European Commission, DG Energy, has considered all the above-mentioned aims in preparing the modification of the current energy regulatory framework with its last proposal, the Winter package “Clean energy for all the Europeans”. The Winter package includes 8 different legislative proposal covering the following topics:

1. Electricity market design (with the Internal Market for Electricity Directive, the Electricity Market Regulation and Risk-Preparedness Regulation)
2. Renewable Energy
3. Energy efficiency
4. Energy performance in Buildings
5. Governance
6. Rule for the regulator ACER.

The Winter package is currently under discussion and has been defined as a priority in the next months by the Presidents of the European Commission, the European Parliament and the European Council.

With refers to our project and to the previous lists concerning the valorisation of customers, most important reforms are sketched out in the legislative proposal I and II.

Prosumers: currently, the EU has no specific legislation on prosumers, self-generation or self-consumption, nor a common definition of prosumers. Then, the European Parliament has called for a common operational EU definition of prosumers and for new energy legislation that provide measures for encouraging investment into self-generation capacity. The Internal
Market for Electricity Directive (IMED) [01]. introduces for the first time with article 2, the concept of prosumer. In spite of the reception that this term has in literature on energy law and economics, the proposal Directive use the term “Active customer”, defined as “a customer or a group of jointly acting customers who consume, store or sell electricity generated on their premises, including through aggregators, or participate in demand response or energy efficiency schemes provided that these activities do not constitute their primary commercial or professional activity”. More detailed, the following article 15 specify that member States have to ensure, with national legislation, that active customer are entitled to “generate, store, consume and sell self-generated electricity in all organised markets either individually or through aggregators without being subject to disproportionately burdensome procedures and charges that are not cost reflective” - so they can participate in the market through local energy communities - as well as “subject to cost reflective, transparent and non-discriminatory network charges, accounting separately for the electricity fed into the grid and the electricity consumed from the grid”. A third party for installation and operation may manage their distributed generation facilities. They are not considered energy suppliers - so they are not subject to their regulation, in particular the part dedicated to the obligations in terms of universal service - if they feed into the grid (DSO grid?) less than 10 MWh for households and 500 MWh for legal person on annual base.

Prosumers’ definition is extended also to self-consumer of renewables. In the Renewable Energy Directive (RED) [01] in fact, article 1 (aa) specifies that renewable self-consumer means an active customer as defined in IMED Directive who consumes and may store and sell renewable electricity which is generated within his or its premises, including a multi-apartment block, a commercial or shared services site or a closed distribution system, provided that, for non-household renewable self-consumers, those activities do not constitute their primary commercial of professional activity. Again, with article 21, the EU de-fines rights and duties of renewables’ prosumers, individually or through aggregators (see following point).

**Dynamic prices**: in the explanatory memorandum at the beginning of IMED is specified that consumers must have access to fit-for-purpose smart systems as well as electricity supply contracts with dynamic prices linked to the spot market. However, they are still not being applied widely: residential customers can only take advantages of dynamic pricing in the Spanish, Nordic and Estonian market. Main reasons are related to their complexity, particularly if we consider dynamic network tariffs; they are not formally prohibited, but they can have potential social adverse redistribution effects (mainly for consumers with less flexible consumption patterns or less access to flexibility sources).

**Demand Response (DR)**: the IMED contains provisions ensuring that customers are entitled to a dynamic price contract and are able to engage in demand response - intended as a shift or a reduction in consumption due to price or non-price incentives - , self-generation and self-consumption; again, it entitles every consumer to request a smart meter equipped with a minimum set of functionalities.

The Demand response could be implicit or explicit. In the first case, consumers change their consumption patterns avoiding high prices; this will reduce demand peak with positive effects
for the whole system. With explicit DR consumer are organized and helped in changing their demand by aggregators.

**Aggregators**: are defined by IMED as market participants that combine multiple customers’ loads or generated electricity for sale, for purchase or auction in any organized energy market. They offer their services between prosumers and electricity markets. There are currently some relevant regulatory obstacles to their widening due to restricted national registrations, and then article 17 of IMED points out that Member States shall ensure that NRAs encourage final customers, including those offering DR, to participate in all organized markets. Transparent and non-discriminatory rules and shall discipline their active participation in the market of ancillary services. Aggregators could enter the market without the consent from other market participants and the do not have to pay a compensation to other suppliers.

As a consequence of a more decentralised market, where customers are more and more empowered, a demand response a **peer to peer market (P2P)** could emerge. From a regulatory point of view, several questions have to be solved. The first one concerns the role of the prosumer within this market: should it be considered a consumer or a business? With refers to above mentioned definition of prosumers in terms of size (less than 10MWh/500MWh), active customers that want to engage in P2P trading would not lose their rights as consumers and thus they would not have to comply with the stricter requirements of business-to-consumer regulation and more severe tax regime. In this case, it is clear that prosumers are not required to meet Universal Service Obligations; nonetheless, in the future the exploitation of such a digital market could ask for a specific regulation aimed to avoid the creation of an unbalanced playing field as well as a cherry peaking of more economical attractive customers (while traditional suppliers have to serve less attractive ones).

The second is about the possibility to create some self-sufficiency microgrid (such as the Transactive Grid in Brooklyn, NY, USA), with a necessary connection to the DSO’s grid in order to ensure the security of supply. In this case, the focus of the regulation is on the management of electricity flows between micro and macro grids that could be made by DSO. The third is focused on the role, the regulation and the nature and of the digital platforms used for the transactions: shall they be subject to the same obligations of any other energy supplier or should they be considered as information society services? In the last case, the main consequence could be a different (higher) degree of freedom, with more difficulties for Member States to impose any kind of licences or authorization.

**Role of DSO**: article 25 says that the DSO key task is the responsibility to ensure the long-term ability of the distribution system, as well as to manage a secure, reliable and efficient electricity distribution system. This core activity should not be influenced by the increasing role of prosumers and the diffusion of smart meters. In this field, however, DSOs could facilitate the flexibility services delivered by prosumers, aggregators and demand response to reach the market in a transparent and non-discriminatory way (article 32). In any case, DSOs should not act as aggregators, as according to unbundling requirements they should not participate in the electricity market supply. Finally, a revision about Electric Vehicles (EVs) is included in articles 33 and 36 whereas is specified that “DSOs shall not own, develop, manage or operate energy storage facilities or reaching point for EVs, unless others have not
shown their interest – following an open and transparent tendering procedure – and the NRA has assessed or approved that a derogation is necessary.

2.1.2 Blockchain regulatory framework

EU – together with JRC and EU Policy Lab, is taking steps towards a more active support in the blockchain field. Even thought at present there is not a specific legislative framework aimed to regulate this new technology – and its concrete falls out in several industries – there are various plans and initiatives taken by European Commission, European Parliament, ECB and ESMA. More detailed:

» European Commission:
  » In June 2017 has launched the #Blockchain4EU Project for nonfinancial sectors aimed to “unlock the new opportunities provided by these technologies for industrial transformations and mitigate potential risks” (DG GROW’s). The project’s objective is to identify, discuss and communicate possible uses and impacts of blockchain and other DLT objects, networks and services within EU industrial or business contexts;
  » In July 2017 has adopted a proposal for legislation to amend the 4th Anti-Money Laundering Directive that will bring virtual currency exchanges (only between virtual and fiat currencies) and wallet providers into the EU’s anti-money laundering framework;
  » Set up a EU Blockchain Observatory whose mission is to create a platform for the European blockchain community and provide up-to-date information on relevant initiatives around the world as well as development of the technology and related opportunities and challenges;
  » Wants to create a Blockchain proof-of-concept focused on regulation.

» European Parliament:
  » In 2016 has voted for ‘smart regulation’ of blockchain technology, taking a hands-off approach. The MEPs voted in a proposal set out in a resolution drafted by Jakob von Weizsäcker, suggesting that a new task force established at the EU level which would be overseen by the European Commission, should build expertise in the underlying technology. It would also be tasked with recommending any necessary legislation, but the text warns against taking a “heavy-handed approach” to this new technology. The proposal clearly stated that distributed ledger technology should not be stifled by regulation at this early stage.

» European Securities and Markets Authority (ESMA)
  » In its report of 7 February 2017 “The Distributed Ledger Technology Applied to Securities and Markets” clarifies that “At this stage, ESMA believes that it is premature to fully appreciate the changes that the technology could bring and the regulatory response that may be needed, given that the technology is still evolving and practical applications are limited both in number and scope”. Again: “ESMA sees as unlikely for DLT to eliminate the need for financial market infrastructures, such as Central Counterparties (“CCPs”) and
Central Securities Depositories (‘CSDs’). Still, the watchdog says it “realizes” that blockchain technology may render some traditional processes redundant, or affect and “change the role of some intermediaries through time”. The ESMA adds that it will continue to monitor developments in the Fintech space, to assess if block-chain technology requires a regulatory response.

In general, where contract are made by blockchain applications, the civil law principles governing the conclusion of contracts. At national level, Germany has been very active: The German Energy Industry Act contains provision on energy supply contracts, which are aimed at balancing consumers protection interests with the interests of energy suppliers.

3 NATIONAL REGULATORY FRAMEWORKS

3.1.1 Switzerland

On January 2018, a new energy regulatory framework package will enter in force. It includes several orders. To our goals, most interesting improvements are the following listed below:

**Smart meters**: by 2027 (ten years after the entry into force of the new legislation) 80 percent of all measuring devices must be made up of smart meters (the remaining 20 percent can be used until the end of its functionality. Without the consent of the people concerned, data from the use of intelligent measurement, control and regulation systems can be used by network operators only for measurement, control and regulation, for use tariff systems, as well as for safe, efficient and efficient exercise, for planning of the network, for the billing of the energy supply, of the fees for the use of the network and remuneration for the use of control and regulation systems.

**Self-consumption groups**

Even now, self-producing electricity also has the right to consume it on its own. At the same way, it is already possible for end consumers in the vicinity of a production plant decentralized electricity, to constitute a group for the purpose of own consumption. The new law on energy establishes the framework conditions for relations in and out the exterior of the pool, which includes relationships between landowners, plant manager, potential tenants and tenants as well as the relationship with the network operator. In addition to the bottom on which it is located the production plant, also the surrounding funds are considered as production sites. These funds must be confined to each other and at least one of them must confine with the bottom on which the plant is located of production. A grouping can not therefore extend beyond a soil considered as soil public (e.g. a road) or a private fund whose owner does not intend to join the pool.

Between the production plant and final consumers, electricity can not flow through the operator distribution network. Customers on the surrounding funds are measured to one measuring point; this means, as a rule, that they are connected to the same point of attachment to the network.
3.1.2 Germany

The German regulatory framework represents an important case of legislation aimed to balancing consumer protection interests with the interest of energy suppliers. Whereas contracts are made using a blockchain technology, several civil law principles included in the German Civil Code must be taken into account; where contracts are formed through this technology a high level of standardization should be required. Additionally, there are further legal requirement for energy-related contracts set out in the German Energy Industry Act in sections from 36 to 42. In detail, section 41 could sets out the minimum content and formal requirements for energy supply contracts. Again, specific rules for energy bills (sections 40 and 42) specifies mandatory requirements that must be considered when developing blockchain projects.

Finally, in addition to the Energy Industry Act, again focusing on blockchain technology, we also remember:

» The German Electricity Third-party Access Regulation (all prosumers applications must comply with the general rules for use of public networks);
» The German Electricity Network Tariff Regulation, applying to all blockchain applications using public networks;
» The Data Protection Act, for the data protection requirements;
» The German meter Operation and Metering Regulations: Germany has fully liberalized the meter business. It is so expected that blockchain applications will fundamentally transform the market role of meter operators, as they will no longer be required to perform the task of collecting and transmitting data: all the information will be shared directly between energy producers and energy consumers. Moreover, the task of certifying physical data and transactions (The German Measurement and Verification Act), so security requirements for meters and data transmission are bound to increase even further where blockchain application come into play.
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