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Reshaping the Energy Market:

The Impact of New Central Market Systems and the Role of Central Market Facilitation

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ABSTRACT

The energy market has never been more dynamic than it is today. Diverse political, economic, social and technological developments are having an enormous impact on the current energy market. Continuous and frequent changes in regulations also are increasing the pressure on the market to meet more complex requirements and tighter deadlines.

In addition, market changes are resulting in greater centralization, such as the introduction of data hubs, which are influencing the strategic choices and investments of market players. At the same time, decentralized sustainable energy production in conjunction with digital innovation are disrupting the energy supply chain.

Europe's energy policies are focusing on harmonizing, greening and smartening. With respect to these developments, the European energy market is shifting in two ways. First, harmonization of the energy market is leading to the centralization of market processes, improving transparency and lowering entry barriers for new entrants. Second, renewable energy production and consumption are moving the entire market toward decentralization.

This shift will be reinforced by new and disruptive technologies such as smart micro grids and energy storage. Current electricity systems will not be able to meet energy demand when the electrification of transportation expands. This requires innovative solutions and the widespread deployment of smart sensor devices. By creating such a digital grid, the flexibility of renewable energy can be unlocked and will develop into a flexible market. This flexibility can support the balancing of the grid. In this way, digital innovation plays a key role in balancing these ever-growing and complex grids.

Introduction

In the past decade, political developments, such as the harmonization and deregulation of the energy market, have had an unprecedented impact on market developments. Important changes have been undertaken to create a transparent energy market with equal conditions for all players. By 2020, the European Union (EU) aims to reduce greenhouse gas emissions by at least 20 percent, increase the share of renewable energy sources (RES) to at least 20 percent of consumption, and achieve energy savings of 20 percent or more. However, as renewable penetration rises towards 20 percent and beyond, more significant changes in the energy system will be needed. The stability of the grid will suffer due to an increase in RES, and transmission operators will have to find new ways to integrate or use energy flows from the distributed grid. In the next decade or so, this can only be achieved through the deployment of new technologies across the value chain.

To achieve these targets, the EU energy market is developing into a pan-European market. Authorities in different countries are investing in constructing the necessary interconnections, pipelines, LNG terminals and other infrastructure. The objective is that no EU country should be isolated from the internal market. This is a prerequisite to creating an internal energy market with new innovative entrants, which will change market dynamics. This transition of energy is evolving within European countries, and they are moving towards a collaborative market with organized procurement, cross border trading, and cross border supply.

The political debate regarding governments investing in green energy has raised questions on whether a government should control these developments or leave them to the market. In the European market, Germany leads in the area of greening, with Energiewende.* Some important lessons, both encouraging and cautionary, can be learned from Germany's example about the impact on grid reliability and the economic pitfalls of proactive renewables integration. In particular, extra investment is needed in grids to minimize congestion induced by renewable energy generation. A new kind of energy market is needed, and both energy provisioning and systems will have to change drastically.

In the future, the wholesale market will be made available to a broader "audience." Consumers or grid users will be able to benefit from flexible renewable energy sources via power exchanges. This will run through an aggregator or trader who has access to these markets.

It is hard to predict how these developments will impact the energy market. Privacy and security concerns have been raised in the past few years, which have increased the need to focus on a secure system. Technology developments are ongoing and changing the energy market. Smart meters will be rolled out, and smart homes and the "smartification" of the entire electrical grid have increased.

Also, new technology applications for electricity storage will enable large scale energy storage and could impact the way we use energy. Further, economic and social developments are being influenced by consumers who are becoming more involved with their energy consumption and turning into producers. Consumers and other parties are starting more local energy initiatives, organizing themselves into specialized groups.

Can we discover a commonality between all these developments? The biggest challenge in the new energy ecosystem is how to deal with the intermittency of renewables. Data at a precise, granular level is needed to support this new ecosystem. The need for real-time information exchange among market players increases as the production of renewable energy sources grows. This paper aims to provide a view on how these developments will impact the energy market and the role of central market facilitation in the new world.

De-regulation in the past 15 years has laid the foundation for central market facilitation in multiple countries.

* The "Energiewende" refers to the German Energy Transition, which has three main goals: 1) contribute to the reduction of greenhouse gases due to climate change, 2) increase the overall share of renewable energy sources, and 3) increase energy efficiency (reduce consumption by 25-50 percent). Source: Dr. Martin Schöpe, Federal Ministry for the Environment.

DRIVERS OF LIBERALIZATION

In liberalized markets, access to market data for competitive and non-competitive processes is essential for market players. To facilitate the functioning of the market, there must be a continuous flow of information between competitive and noncompetitive roles and their processes. Here, information flows involve highly complex market processes. Facilitating these market processes has led to high costs due to data inaccuracy and quality concerns. Also, unbundled companies are no longer allowed to share IT systems and need to invest in new systems. Finally, there is a trend within grid companies to focus more on their core business and outsource all other activities.

Market facilitation drives improvements in energy markets and provides a level playing field for all companies. Central market systems provide equal access to energy information for all market parties. They also reduce complexity in accessing and exchanging information, as well as in executing harmonized market facilitation processes. This benefits all stakeholders through more efficient processes, reduced error rates, increased transparency and improved trust between stakeholders.

DE-REGULATION AND MARKET ROLES

In the past 15 years, roles in the energy market have changed substantially. Before 2007, the energy value chain was vertically integrated, and grid operators and suppliers were part of one multi-utility organization. In 2007, the law of Independent network management (LIMA) came into force. The objective was to create a clear distinction between the different market functions to prevent the abuse of dominant market positions and to ensure free and non-discriminatory access to the grid.

Fostering competition in retail markets was viewed as a way to drive innovation. This will result in the creation of new energy services, provided by suppliers, including those that will encourage consumer participation in support of managing the new energy system. For example, services that allow grid operators to exploit the flexibility of prosumers for the benefit of all stakeholders require consumers to trust their utility suppliers to provide them services that deliver real value.

Currently, the sector is preparing for leaner, more optimized and modernized organizations. While this implies that grid operators will not be involved in commercial activities, it does not mean that grid operators will just become “carriers” purely focused on maintaining and providing energy flow. de-regulation makes it possible for them to offer services that are not commercial such as providing information within the grid. These developments are progressing rapidly—making current market structures and roles unsustainable. In this scenario, what will the future look like?

BACK TO THE FUTURE

To have a glimpse of the future, one should look back at the past. With the invention of the light bulb in 1879, the importance of electricity increased and batteries could no longer meet the energy demand. Soon, the demand for electricity increased further due to the arrival of new applications and products, and controlling the supply of energy became a municipal task.

In 1886, Nikola Tesla, a Serbian American inventor, invented the alternating current concept, enabling the use of a transformer to step up voltages for long-distance transmission and thereby reduce grid losses. That same year, the first power plant was built in Rotterdam, providing electricity on a small scale to factories and households. Electricity production expanded rapidly. While this started with consumers producing energy locally to meet their own needs, excess capacity also was shared, making the consumers who generated their own electricity the first producers as well.

In the not too distant future, we might experience a similar revolution with renewable energy and smart applications. For instance, imagine self-providing cities that have their own windmill parks, and districts with their own power storage facilities that provide local electricity generators’ opportunities to distribute and sell electricity locally and use cost-reflective pricing arrangements that can unlock substantial new clean energy potential. Eventually, specialized groups and communities could take over the responsibility of electricity production, supply and distribution, just as they did in the old days when electricity first made its entry in the world.

MOVING TO A LEANER, OPTIMIZED AND MODERN ENERGY MARKET

The key word is "radical" decentralization. The tasks and operations of the grid operator and the supplier will now shift to the local grid, which means that local communities and collective organizations will arrange and manage their own energy production and distribution.

IT and new technology applications will play a key role in enabling this "radical" decentralization. First, the increase of distributed generation could escalate security risks and create greater grid instability. More local distribution also increases the vulnerability of the grid and the need for securing grid users' assets and connections. In this scenario, it becomes essential to implement IT security to avoid harmful attacks.

Second, it is necessary to monitor critical infrastructure in real time to ensure security of supply and any proposed economic savings. In addition, smart devices and sensors will be deployed across the energy system grid and self-healing grids will bloom. The next generation of power grids will include new technological applications for digital controls and monitoring devices. An example is the open smart grid platform (OSGP) developed by a grid company in cooperation with CGI for building a smart society in the Netherlands. The OSGP connects all digital controls, devices and sensors in order to optimize demand and electricity supply. It offers third-party services that are tailored to end-users' needs and increase their flexibility.

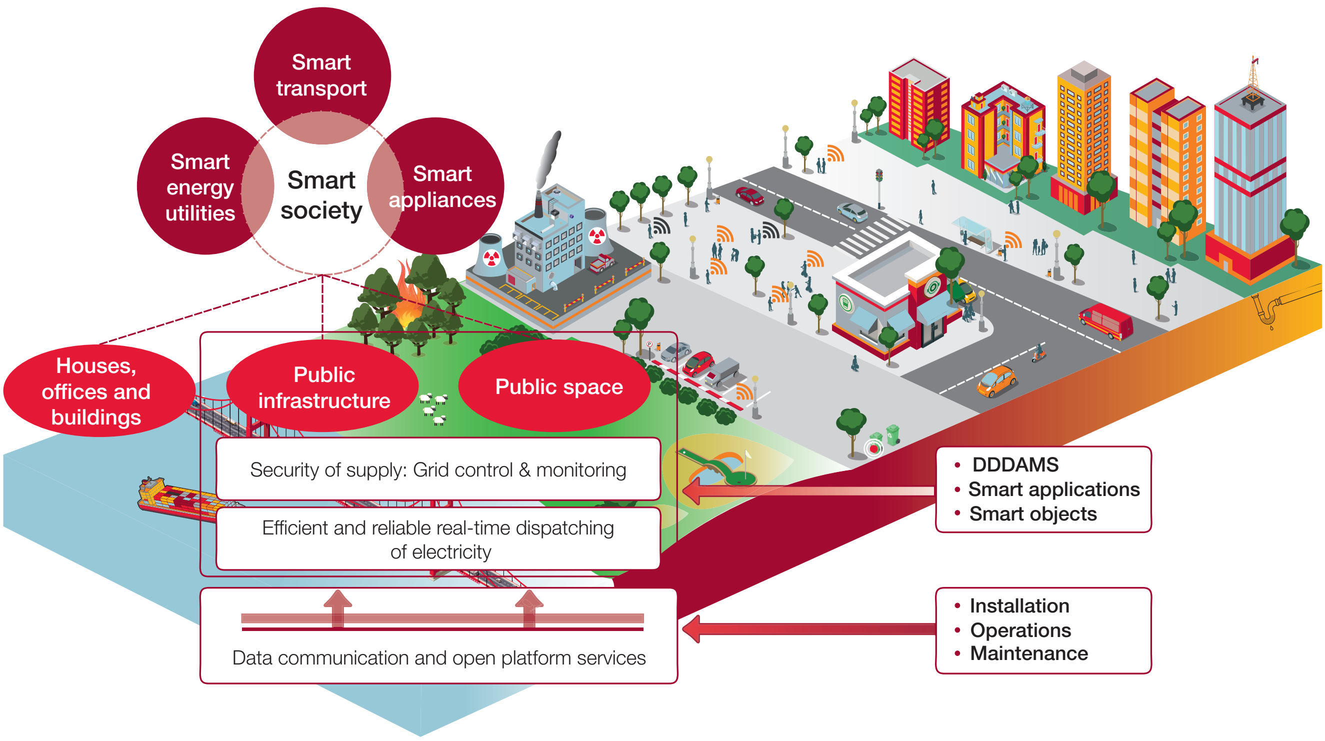

Figure 1 – The smart society and OSGP (Source: Libelium, December 2015)

A third development is the deployment of energy storage in the future grid. Energy storage will be the catalytic converter of the new market and may transform the way we produce and consume electricity. It will enable the "timeshifting" of local demand and supply, helping to mitigate the key issue of uncertainty of renewable generation and misalignment between demand and generation. An example is the California "duck curve" phenomenon, which is so named because its demand slope resembles the profile of a water fowl. In California, 19 percent of electricity supply is accounted for by solar generation. But, in the evening, when electricity consumption peaks, it becomes necessary for the state to balance its grid with conventional flexible gas fired power plants due to a drop in solar generation when the sun disappears. By storing renewable generated energy, utilities are able to displace peaking generation during the day—reducing costs and emissions. This is discussed in greater detail in our Demand Response white paper series.

Some of the effects of decentralization on current market roles are significant. These changes can be reflected in the roles which market participants fulfill. The following two scenarios may occur:

- Everyone and everything will be connected, and there will be high volumes of information energy flows—both up and down the energy value chain. Retailers will lose their raison d'être, as earning money on national energy trading will not be profitable any longer due to fewer imbalances in local markets. These retailers will survive only by taking bold decisions in offering the market new energy services. Consumers will use only the grid when production falls short of demand. In this case, consumers will pay a small fee as insurance for power through the grid. In this scenario, grid operators will have to change their business models of providing additional services to grid users. A possible role is system operator of regional grid, through balancing "energy islands" in a region, city, district or even street.

- Large consumers will be provisioned by renewable power plants such as wind parks and grids at sea. Coal power plants have high capital costs and must run at full capacity to be profitable. So, large scale producers will switch from coal power plants to renewable (solar and wind) power plants. The conventional power plants will only be necessary in case of emergency power and when stored energy appears to be insufficient. Linkage to energy storage will be possible at different intervals of time—months, days, hours and even seconds. On an hourly basis, it will provide a time shift that enables producers and consumers to create a generation buffer that increases the stability of the grid. Consumers with significant production capacity assume a favourable position on the flexibility market—providing the needed capacity against higher prices when demand rises and supply falls short.

CURRENT DEVELOPMENTS IN MARKET FACILITATION

In this context, market facilitation relates to the exchange and sharing of data among all market parties, including data from loads at the edge of the grid to consumer specific data. This not only supports transparent and fair competition, but also facilitates essential collaboration between suppliers and grid operators. This collaboration will be essential in supporting the creation of new energy services that are based on costs and reflect real grid conditions. Market facilitation is provided by a central market operator (CMO).

The development of market facilitation can be divided into two waves. The first wave is driven by liberalization, which transforms the market from a bilateral model that uses point-to-point message exchanges between market players into a central model for message exchange—also called a data hub. This data hub is essentially different from the bilateral model, considering the difference in the interactions between the acquiring retailer, distribution system operator (DSO) and outgoing retailer.

The second wave is driven by digital innovation and the transition to sustainable energy. The data hub can support the market with additional services and third-party access. Also, by enriching data, it will provide pivotal information on areas such as grid condition, solar or wind generation capacity, and consumer preferences. This is significant, as grid operators' future success will depend on their ability to provide data concerning renewable generation to all market parties.

Finally, Europe is moving towards the centralization of supporting market processes such as allocation, reconciliation and grid fee billing. The goal is to reduce the cost of implementation by sharing the cost of the implemented central market system, standardizing processes and increasing market efficiency. While central market systems differ in scope, they have common functions. In the table below, the current implementation level in different countries has been identified.

	Participation Management	Retail Processes						Wholesale Processes			Trading	
		Customer Switching	Central Master Data	Meter Reading Distribution	Smart Meter Access	Central Master Data	Central Metering Data	Volume Allocation	Imbalance Settlement	Grid fee billing	Power Exchange	Balancing Market
AEP-AU	●	●	○	●	○	○	○	○	○	●	○	○
EDP-PT	●	●	●	●	○	●	●	●	●	●	○	○
EDSN-NL	●	●	●	●	●	●	●	◐	○	●	○	○
Elexon-UK	●	●	○	●	○	○	○	●	●	●	○	●
ENDK-DK	●	●	●	●	●	●	●	●	○	●	○	○
Fingrid-FI	◐	◐	◐	◐	◐	◐	◐	◐	○	○	○	○
GRMS-USA	●	●	●	●	○	●	●	●	●	●	○	○
MOSL-MOSL	●	●	●	●	○	●	●	◐	○	●	○	○
Netorka-IC	●	●	●	●	○	●	●	○	○	○	○	○
OTE-CZ	●	●	●	●	○	●	●	●	○	●	●	●
SKN	◔	◔	◔	◔	◔	◔	?	?	?	?	○	○
Remco-AU	●	●	○	●	○	○	○	○	○	●	○	●

●	Functionality has been implemented
◕	Functionality is being implemented
◐	Client plans to source a solution for this functionality
◔	Client put this functionality on the roadmap
○	Nothing planned

Figure 2 – Level of implementation of central market systems functionality in the different countries

The European Commission (EC) has asked the energy sector to investigate market model changes needed to support the transition to sustainable energy. This has resulted in options for viable business models and suitable instruments for accelerating the rollout of smart meters.

The differences in various countries relate to three distinct scenarios for handling smart grid data: These include the following:

- **The DSO as market facilitator of a data hub**: All personal and aggregated data is maintained by the DSO, which stores the data in one or several data hubs. One data hub also can be jointly operated by several DSOs. Here, metering and sub-processes stay with the DSO. Supplier switching takes place through the DSO and the hub. TSOs also can demand relevant information in order to balance such data hubs. In this case, data hubs are standardized. Countries that support a data hub are the Netherlands and Belgium.
- **Third-party market facilitator managing an independent central data hub**: All personal and aggregated data is with a newly introduced and regulated third party. This entity is independent from the DSO and all other market players, and stores all relevant market information in one or several data hubs. Metering and sub-processes might then be undertaken by the DSO or commercial market players. This new central data hub agent also will be responsible for organizing supplier switching. Regions where the CMO is performed by a third party are the UK, Estonia, Denmark, Poland, Nordic Exchange Markets and Italy.
- **Data access point manager**: Personal and aggregated data is not centrally stored and no official market data hubs exist. Data is directly extracted from meters for all necessary processes. The entity responsible for guaranteeing data access at each meter point is the data access-point manager (DAM), which can be any certified commercial actor. Hence, several DAMs might co-exist and compete for delivering their services to grid users. However, metered agents (households, distributed storage, electronic vehicles or distributed generation) do not really choose their data manager; they choose the entity that invests in a smart meter instalment.

CONCLUSION

Clearly, central market facilitation scenarios across the different countries are diverse. But, while energy markets have been changing for a long time, the impact of this transition on market roles is now more evident than ever before. As we have discussed in this white paper, the changing role for markets is driven by new technology applications and the need to move to a low carbon economy. The shift is now to a decentralized and optimized energy market, where consumers will play a central role in both managing the grid and adopting next generation energy related services. This is driving a paradigm shift in both market facilitation and market roles, and the energy market will have to evolve with these changes. In our next white paper on this topic, we will consider how the changing role of market facilitation is creating new market designs to support this energy transition.