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Sustainable Markets: Activating flexibility through integrated energy markets

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Introduction

The key issue for the Electricity system of tomorrow is the integration of variability, caused by ever-larger penetrations of intermittent renewables. If we're serious about decarbonizing our energy system, then integrating a large share of wind and solar sources into the electricity mix will be necessary.

EPEX SPOT and the SDIA propose using local flexibility markets to solve grid congestion at the distribution level. We call on authorities to adapt the regulatory framework to allow flexibility market operators to develop such marketplaces. We believe extending the role of the market will facilitate decarbonization, support the electricity grid, engage new technologies, accelerate sector integration, activate new flex players and overall reduce costs of the energy transition for end customers. In that regard, markets become sustainable.

Changing Fundamentals of the Electricity System

The electricity landscape is rapidly changing. It's decarbonizing as renewable energy sources such as wind and solar replace fossil fuels, and it's decentralizing as large centralized power stations give way to more distributed energy resources (DERs) located on the distribution grids. Furthermore, the digitalization of certain technologies promises to facilitate the roll-out of smart meters and other smart devices, as well as diversify energy sources, such as Electric Vehicle (EV) charging, heat pumps, domestic batteries, producer-consumers via rooftop Photo-Voltaic (PV) panels.

The rapid expansion of intermittent renewables with zero marginal cost of production increases the amount of grid congestion at the transmission level, which is currently addressed using redispatch and creates new challenges for the operators and planners. In many countries, the reinforcement of the transmission network has been unable to keep up with the growth in renewables, exacerbating the issue for the foreseeable future. Already today, transmission system operators are obliged to take costly re-dispatching measures to compensate grid constraints. In Germany alone, these re-dispatching costs have reached over 1billion Euros per year. Flexibility on the load side is urgently needed to make the energy transition cost-efficient.

Local Flexibility Markets

Currently, there is no incentive to invest in resources that can provide flexibility, nor is there an incentive for flexibility providers to sell their services to system operators. This greatly limits the offering and development of much-needed flexibility. Local flexibility markets efficiently activate and centralize local flexibility offers. Flexibility providers would finally be able to offer and price their services, and system operators would be able to reliably and economically relieve physical congestion on the grid close to real-time.

EPEX SPOT would like to stress that a meaningful price signal for congestion can only be achieved by market-based measures, and only market-based redispatch can integrate demand-side flexibility and foster the necessary flexibility

in the system. The potential for market-based redispatch is especially high in the distribution grid, where new and innovative solutions are needed. Regulated congestion management sits as a backstop in case there are inadequate offers for local flexibility. This approach harnesses the advantages of market-based congestion management yet retains cost-based congestion management as a backstop both for resiliency and to improve behavior in the flexibility market.

Benefits of a well-designed market

In addition to being powerful congestion management tools, particularly at the distribution level, markets offer a myriad of benefits that help the energy sector achieve a cost-effective and secure energy transition.

- **Efficiency**: Markets create efficiency in two ways. The first is short-run efficiency: making the best use of existing resources. The second is long-run efficiency: the market provides the proper incentives for efficient long-run investment.

- **Transparency**: It gives a transparent choice to System Operators of all flexibility options that have an impact on the congestion. Market rules, their development and review are publicly available. Market data are available in real-time and periodically reviewed monthly, quarterly, and annually. The planning process also requires a high level of transparency. Transparency helps identify and address problems and supports efficient operation and investment.

- **Neutrality**: Market-based mechanisms are technology-neutral and improve access for new potential flex actors such as Power-to-X, batteries and e-vehicles. The result is a more dynamic and innovative eco-system. Fairness is encouraged with the independence of the system operator and a governance structure that includes representation of all stakeholders.

- **Security**: Both sides of the market have a great deal of control over the timing of trade to resolve congestion. Cost-based redispatch from conventional generation serves as a backstop if additional flexibility is required close to real-time. The result is a modest change to current structures and little risk for regulators and system operators.

Data Centers as a source of Flex

The SDIA embraces the role of markets to bring flexibility to the energy system. As increasingly large electricity consumers with highly automated processes, **data centers** are optimal sources of flexibility for the future energy system. Data centers represent an increasing share of the total Europe electricity consumption, and accounted for approximately 2.5% or 78TWh in 2015, according to the European Commission. Data Center energy consumption is forecasted to continue to grow, with some estimating a 10% Compound Annual Growth Rate (CAGR) with the most recent forecast putting data center energy consumption at 3% of total global energy consumption by 2025 (Andrae 2018).

The highly automated nature of data centers allows operators to closely monitor and control the power consumption of their information technology (IT), equipment and cooling facilities, in real-time. The Lawrence Berkeley National Laboratory (LBNL) studied the flexibility in power consumption of four data centers under different management approaches and found that energy consumption could be reduced 5% in 5 minutes, and 10% in just 15 minutes without changing the IT workload schedule. That is to say, this was accomplished using adjustments to the building's management e.g temperature alterations.

Many typical data center workloads are delay-tolerant and can be rescheduled. The result is a form of workload "shifting", preserving the integrity of the grid during peak hours whilst providing data centers with reduced energy costs

and/or revenues from the sale of their flexibility. Clausen et al. (2014) estimated a 60MW data center could be able to provide 22 MW of demand response. Koronen (2018) estimated the maximum theoretical potential for demand response for data centres to be in the range of 38 to 80% of the installed power demand in 2030, which conservatively puts data centers as a source of more than 10 GW of demand response in the European electricity system in 2030. However, without a local flexibility market this data center flexibility will never be activated because, as mentioned earlier, there is simply no way for an operator to value their flex potential.

Conclusion: the Call

EPEX SPOT and the SDIA believe local flexibility markets are essential to solving increasingly congested transmission and distribution grids. Local flexibility markets would activate more flexibility from a broader field of actors and reduce costs for end customers while ensuring efficiency, transparency, neutrality, and security in the energy system.

EPEX SPOT and the SDIA call for regulators and system operators to create an economic space or pilot scheme where local flexibility markets can be tested, regulated and optimized before being rolled out on a larger scale. Energy markets will enable the direct participation of decentralized assets to energy markets, and resolve the bottleneck in the wider energy transition.