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Toward an operational definition and a methodology for measurement of the active DSO (distribution system operator) for electricity and gas

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The ongoing transformation of the energy system toward decarbonisation is affecting the traditional network activities of electricity, gas and heat distribution system operators (DSOs) The energy system required for net zero entails decarbonised end use sectors such as transport and heating. This will require greater amounts of renewable power and enabling carriers and technologies, like battery storage, power-to-gas, biogas, hydrogen, demand management, energy efficiency, digitalization and others. These evolutions are likely to impact the role of the DSOs. They will face potentially accelerated processes of electric and renewable gas based transport, electrified heating and gas decarbonization, demand management and flexibility. At the system level, better integration and planning between electricity and gas DSOs will be needed to optimize this process. Ultimately, innovation will be needed for new technologies and business models to be explored and adopted to face the new challenges.

DSOs are highly regulated as natural monopolies. Hence, DSOs will become active if policy and regulation create the right incentives. In recent years, regulation has changed and continues to adapt in order to encourage DSOs to take on new roles. A more accurate definition and a conceptual framework for measurement are required for regulators to be able to operationalize and monitor progress on DSOs becoming active.

To contribute to the decarbonization process, the DSOs will increasingly need to deal with distributed generation and demand-side management, storage, advanced metering and data management, gas decarbonization, EV charging, heat pumps, coordination with transmission system operators (TSOs) and other parties. The breadth of new activities will require new - more active - capabilities, which may amount to a new role, on top of the established functions.

In this paper, our aim is to help clarify the definition of an active distribution system operator (DSO). This is important because regulators across Europe are seeking to encourage the DSO to be more active, without clear agreement on how the active DSO is defined and on how we might measure the degree of activation of the DSO. Measurement is important because it would allow us to better compare progress over time and between companies in their journey to become a more active DSO. This would allowing leading DSOs to be identified and, in the longer term, for regulators to assess whether more active DSOs are actually delivering for society.

We discuss how defining the active DSO is complicated by a number of factors. Firstly, DSOs are regulated businesses and their decisions are in response to regulatory incentives. These are in turn based on wider policy choices at country level. Secondly, identifying the enabling role of the DSO may be difficult. For example, a DSO that serves electric vehicle (EV) chargers, heat pumps or various distributed energy resources (DERs) is performing its traditional role. To be considered active, it needs to manage and optimize the additional resources in the grid.

We define **the active DSO as one that, in addition to its traditional roles, performs new tasks and engages with new actors to contribute to the decarbonization of the system. The active DSO goes beyond its core functions of developing and maintaining the grid and connecting customers, and takes an additional role as the facilitator of new processes, technologies and business models required for decarbonization.**

We group these new tasks along five dimensions: transport, heating, flexibility and DER integration, adaptive indicative planning, and innovation. We propose a methodology for measuring the extent to which a DSO is active by looking at indicators along the five dimensions.

Measurement is important because it allows DSOs and their regulators to quantify and compare the extent to which a given DSO is ‘active’. This could be useful for setting corporate strategic goals and for setting regulatory targets under incentive regulation. The indicators of activity we suggest include the presence of management and enabling activities for EVs, biomethane and hydrogen, demand management, non-wires or non-pipeline alternatives, dynamic planning, and innovation adoption. We apply the methodology to electricity and gas DSOs in the United Kingdom. Based on this initial attempt at measurement, a number of conclusions emerge. First, many of the new tasks of the active DSO are still in their infancy, which makes measurement less relevant at this stage. Second, there seem to be more opportunities for becoming active for electricity DSOs, given the challenges of intermittency, storage and decentralizations, which create opportunities to use digitalization. Third, for gas DSOs, becoming active may be a response to an existential threat, the efforts around hydrogen, biomethane and coupling with electrification are telling and are becoming significant. Fourth, DSO and regulatory disclosure and reporting may need to include standardized information on the new tasks of the active DSO to enable incentives and oversight.

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