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The need for competition between decentralized governance approaches for data exchange in smart electricity grids—Fiscal federalism vs. polycentric governance

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ABSTRACT

The institutional framework of the electricity sector is challenged by digitalization. With smart metering, data on energy consumption and production becomes available. Information management shall secure the efficient exchange of this data (e.g. from smart metering) in smart grids. Currently, national as well as regional governance approaches for information management systems are being developed. We discuss how the scale and scope of an information management system has an influence on the level of innovation in the process of the data exchange. We define information management as a club good and apply the insights from the theory of fiscal federalism. We conclude that neither of the extremes of national (central) and decentralized governance approaches for information management will be optimal. Rather, we identify the need of polycentric governance approaches that compete with each other to define the optimal degree of decentralization.

1. Introduction

The institutional environment of the energy sector in Europe changed significantly since 1996. Liberalization and unbundling were the key drivers for institutional change so far. Now, two new trends challenge the institutional status quo that was established within the last decades: the energy transition, or more specifically, the integration of renewable electricity supply (RES) and digitalization, the application of information and communication technology to the electricity system. Both, the energy transition and digitalization require further adaptations of the institutional environment of the energy sector. Several institutional and organizational aspects need further evaluation in this context, e.g. the market design, governmental policies and regulation schemes.

This paper focuses on one specific element of the institutional environment at the intersection between RES diffusion and the increasing digitalization of the energy sector: The institutional implications of the smart meter[1] roll-out. So far, data on energy consumption and production was only available in a low resolution and only to the companies being involved in electricity generation, trade and transport. This situation changes since the European Commission required a smart meter roll-out by the member states (see EUCOM, 2009). Based on smart metering data becomes available to the consumers and

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[1] US Federal Energy Regulatory Commission (FERC) defined smart meters in FERC (2015): *"[...] a metering system that records customer consumption [and possibly other parameters] hourly or more frequently and that provides for daily or more frequent transmittal of measurements over a communication network to a central collection point."*

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producers themselves, as well as other (market) parties. Therefore, the task of data handling and processing emerges to a very important task in electricity systems to coordinate generation, retail and the system stability on the network level.

The discussion about the institutional design in the energy sector picked up the topic of data management and different models for smart meter data handling and information management are currently discussed in Europe (cf. Ruester et al., 2013; van den Osterkamp, 2014). At the heart of the European discussion is the question how the governance approach for information or data management should be developed. Importantly, this discussion is based on theoretical arguments for now, as the first information and data management models for smart metering are only in the introduction phase in Europe. Therefore, data for a detailed qualitative analysis will only be available in the coming years, which is why we stick to a theoretical analysis in this paper.

Information or data management here refers to the collection, aggregation and distribution of data (e.g. from smart metering). Thereby, information management serves as an enabler for smart grids and innovative services, which are anticipated to evolve. The term "smart grids" describes the integration of information and communication technology (ICT) into the electricity distribution networks (for a detailed definition, see ETPSG, 2010). The primary driver for smart grids is the cost efficient integration of RES. The availability and exchange of data (e.g. on electricity consumption and production) is a key requirement for smart grids. Information management facilitates the data exchange between the different parties in the energy sector. This is why information management has an important role as an enabler of smart grids.

Basically, the institutional discussion in Europe currently distinguishes regulated and market based approaches. Different models are proposed to govern information management and we will elaborate on these in section 2 of this paper. Different evaluations, e.g. from the European regulators, try to define the institutional setup for information management (e.g. Ruester et al, 2013). However, the institutional debate on the European level about the governance of information management currently focuses on the assignment of this new task to an existing entity or role in the energy sector. Thereby, the size of an information management system is defined implicitly by the original function an entity already fulfils within the energy system (e.g. by the service areas of the network operators, suppliers etc.). We take a different perspective in this paper. Within our analysis we strive to identify criteria that help to define the (optimal) size of an information management system, independent from the fact who actually operates the system.

So far, the discussion about the exchange of data from smart metering (digital electricity meters) focused on neutral access to information and how to avoid incentives to discriminate third parties (Buchmann, 2016). Besides these two aspects the facilitation of innovation becomes an important criterion for the governance of information management as well. A key driver behind smart grids is the potential of smart technologies to reduce the costs of the integration of renewable energies into the electricity system, e.g. via substituting grid investments (dena, 2012). Furthermore, local balancing of load and demand should become more flexible. Data exchange is the key requirement to unlock these flexibility options. From today's perspective, it is difficult to anticipate how these innovative services could look like. However, the governance of information management should ensure that innovation is possible (CEER, 2014). Within this paper the focus is on the latter: Innovation here refers to developments in the governance approach (a future-proof governance approach), not to the creation of innovative products based on the governed system. Based on these three criteria the task of the governance approach of information management can be summarized as follows: develop a level playing field that secures innovation as well as neutral and non-discriminatory access to information for all eligible parties. The existing literature evaluates different institutional models against the mentioned criteria (Ruester et al., 2013; Brandstaett et al., 2017; Buchmann, 2016) and illustrates the strength and weaknesses of each institutional design.

Out of the three criteria (non-discrimination, neutrality and innovation) the first two are primarily determined by the institutional design, but rather independent from the size of the governance approach. This is different in the case of innovation. Here, the question has already been raised whether the size of a governance approach has an influence on the level of innovation within the governed system. This question is specifically addressed by the theory of fiscal federalism. This theory was developed to define how a governance approach for local public goods could secure innovation (Oates, 1972). In essence, whether a uniform governance approach, as it might evolve under a centralized regulated approach, or a more decentralized governance approach can better facilitated innovation depends on two criteria: first, the heterogeneity of preferences for the provided good and second, the existence of economies of scale. The theory of fiscal federalism postulates that with increasing heterogeneity in preferences and low economies of scale a decentralized governance approach can better facilitate innovation (compared to a central approach), and vice versa.

Importantly, the theory of fiscal federalism is based on the premise that the government or a public agent should determine the size of a governance approach. This is well in line with the current understanding in the EU, where several countries are currently defining national governance approaches for information management (e.g. Belgium and the Scandinavian countries, CEER, 2016). However, competition could be used to defining the size of a governance approach as well. Such a competitive approach is not covered by the theory of fiscal federalism, which is why we apply the polycentric governance approach to understand how competition between governance approaches can achieve the optimal size of the governance approaches.

In the first analytical step of this paper, we apply the theory of fiscal federalism to the governance of information management and deliver indicators that support the hypothesis that both exist: heterogeneity in preferences for the provision of information management, and economies of scale. This leads us to the conclusion that neither a pure central nor a purely decentralized governance approach for information management is optimal. Rather, a certain degree of decentralization is