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The need for more flexibility in the regulation of smart grids – Stakeholder involvement

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Abstract: Energy and climate policy drive large scale integration of distributed generation and demand side management, with massive consequences for distribution grids. New technologies and actors shape the transformation of electricity networks towards smart systems. We argue that future regulation of smart grids needs to allow more flexibility. Firstly, the core of network monopoly starts to weaken allowing for more third party involvement. Secondly, the increasing number and heterogeneity of stakeholders makes "one-size-fits-all" regulation simply less suitable, whilst regulation needs to take account of various interests. In this paper we discuss stakeholder involvement and make policy recommendations to render regulation of smart systems more flexible.

1 Introduction

Energy policy and climate change concerns drive the electricity system to decarbonization. This is associated with increasing shares of distributed generation and demand side participation. Distribution networks are challenged to become “smarter” as the interaction between network and its decentralized customers in-creases. The term smart grid suggests a focus on the network. We explicitly broaden this view and use the notion “smart system” in order to underline the interactive structure that goes beyond the network and incorporates network users, service operators, and markets. Apart from the technical considerations, the desired transformation towards smart grids raises regulatory questions (see e. g. Bauknecht 2011, Pollitt 2010, Brandstätt et al. 2011). The increasing number of actors and the growth of commercial interests create a challenge for establishing a neutral non-discriminatory platform for interaction and coordination across the smart system.

Pollitt (2008) discusses whether a paradigm shift in electricity regulation is necessary. Inter alia he suggests a “stronger focus on process of regulation not just outcomes” (p. 76), stakeholder involvement in negotiating investments and a stronger role for competition (p. 80-84).

In this paper we explore the potential of more stakeholder involvement and negotiated settlements as a means to enable more flexible regulation and address the need for ad hoc solutions tailored to a specific situation. Flexibility is needed to adapt to the decentralization brought about by smart grids. This decentralization encompasses two important developments. First, facilities-based competition and third-party subnetworks change the nature of the network monopoly. In some cases bypass, local generation or storage can be more efficient than network expansion. With emerging third party involvement, system development is no longer exclusively the responsibility of the monopoly network owners. While the scope and potential of third party investment in distribution networks is unclear, to the extent that it does play a role, it will affect the regulatory design. Second, the number and heterogeneity of stakeholders increase. Notably, stakeholders in smart systems are not only consumers, but also and importantly generators, aggregators, suppliers and any other actors that rely on the network as platform for their activities (EU SGTF 2012). Consequently, interactions with these very different stakeholders cannot be as uniform and standardized as before. Efficiency is reached best through interaction and coordination among stakeholders including the network. Active cooperation is considered crucially important to reap smart grid benefits.

Both developments have implications for the regulatory design in smart systems. Focus and mode of regulation, i. e. what is regulated in smart systems and how, are changing. Until recently, the electricity distribution network was considered a classical natural monopoly with sunk investment and was thus the key area for sector specific regulation of the network (Joskow & Schmalensee 1983, Knieps & Weiß 2009). This is changing into a notion of a differentiated set of businesses with different monopoly or markets characteristics which should be treated accordingly. The situation resembles that in telecommunications (see e. g. Briglauer 2010, Welfens & Graack 1996) where regulation has strongly focused on developing full-blown competition with the side-effect that (sector-specific) regulation could be phased-out accordingly. Regulatory design had to concentrate on the remaining bottleneck areas and secure unrestricted und non-discriminatory access; all other activities were left unregulated or regulation was to be phased out as soon as possible (Knieps 1997). Electricity networks are by no means so far as to phase-out network regulation, but as we will argue, markets develop which seems to imply a trend in this direction.

At the same time, regulatory decision-making becomes more difficult in view of diverse actors in the electricity system, a blurring boundary of the network monopoly as well as innovation and investment needs. Standard regulation providing a “one-size-fits-all” solution (Littlechild 2008, p. 33) might not fit the purpose. It ensures non-discrimination but certainly sacrifices attention to individually different characteristics. We suggest stakeholder involvement to advance regulation. By giving stakeholders flexibility to negotiate delivered values and returns, the regulatory effort and information search is reduced while at the same time achieving more targeted outcomes.

The paper is organized as follows. Section 2 describes the changing structure of electricity supply in smart systems. Section 3 presents the trend towards increasing third party investment in smart systems introducing competition in the sector. In Section 4 we discuss stakeholder involvement in regulation. Section 5 presents a concept for stakeholder involvement in information management in smart distribution grids. Section 6 concludes.

2 Smart Systems – (R)Evolution in electricity distribution

The value chain in electricity distribution used to be straightforward and unidirectional. Traditionally, customers at the end of the value chain received electricity produced in centralized power plants. New actors emerge in distributed generation, storage, active demand and aggregation and alter this paradigm (Giordano et al. 2011). Active demand that reacts flexibly to network congestion or unexpected changes in feed-in is a precondition for the integration of electricity generation from renewable and decentralized sources. Furthermore, aggregators pool and manage (small) network customers in groups. These can be virtual power plants, but can also refer to the customer side and electric mobility. Managing this heterogeneity becomes one of the main challenges for system operation.

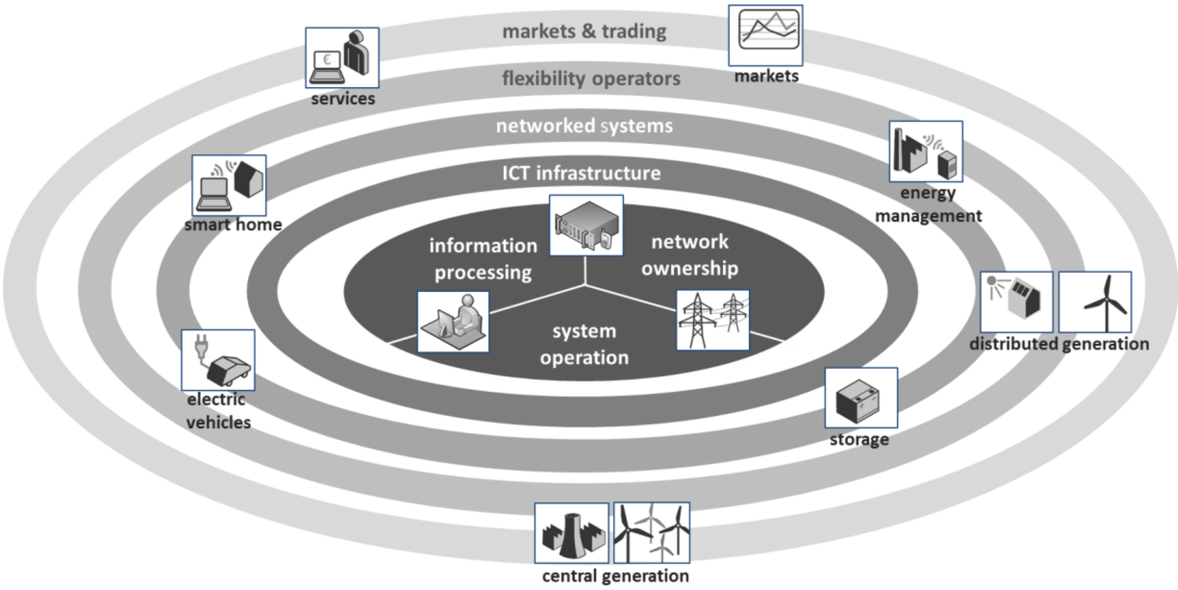

Fig 1: The different layers of a smart system
Source: own illustration adapted from acatech (2012)

Smart grids are expected to facilitate the integration of these diverse actors into a smart electricity system. The expected benefits are among others (cf. IEA 2011, Clastres 2011, Giordano et al. 2011)

- improving supply security and system reliability,
- integrating intermittent renewable electricity generation,
- improving network operating efficiency,
- facilitating energy savings and
- enabling efficient network investment.

Figure 1 depicts a smart system in different layers. The three functions at the center of the smart system, namely network ownership, system operation, and data management, are considered the core monopoly. The further outside rings are increasingly organized within a market environment. While the technologically driven visions of the smart grid and potential benefits are quite clear, the institutional set-up of the smart system is still uncertain. Neither the assignment of roles and responsibilities in smart systems nor the delineation of monopolistic and competitive activities is sufficiently clear yet (Brandstätt et al. 2012). Historically the formerly integrated network operator is in charge of developing the system. In a liberalized energy system generators and demand side resources act self-determined and system development is more and more driven by investments in generation, storage and demand. Hence, top down management is not feasible anymore and regulation leaves the network operator to react to rather than shape changes in the system.

The information layer in smart systems provides distribution system operators with crucial information on actual system conditions. Advanced control of network components but also of generation or demand resources becomes possible. Furthermore, advanced metering enables new tariffs and billing, as well as business models. Management of distributed resources can be realized via market mechanisms. The network thereby becomes the platform for the interaction between the diverse users in the smart system. On this platform users can coordinate mainly via commercial arrangements and markets. Central control is merely necessary to guarantee stable system operation while a large part of the system interacts in a decentralized way through market transactions, competition and stakeholder participation.

3 Competition from stakeholders and third parties

While in many countries the electricity industry originates from an integrated and often public structure, in the past decades the importance of private companies and new stakeholders, so called third parties, is increasing steadily. Following the generation and retail stages, third party involvement is now emerging in the network stages. Regulation and new business opportunities related to renewable energy and smart grids encouraged actors other than the traditional incumbents to engage in tasks that were formerly assigned to network operators. The consequently altered organizational structure in the sector triggers a discussion on adaptations of network regulation.

So far third party investment in distribution networks occurs, if at all, mostly for network extension. Stakeholders invest in network extensions that connect new customers or generators to the existing grid or interconnect between networks. As a consequence they may own and operate single lines as well as entire sub-networks connected to the incumbent's grids. The United Kingdom (UK) introduced the concept of independent distribution network operators (IDNOs) which do not originate from a traditional incumbent and hence do not have an established supply area. The idea is that such third parties could connect new customers faster and possibly cheaper than the incumbent and potentially provide innovative services (Ofgem 2005). Currently, six IDNOs exist and 9 % of the connections made in 2009-2010 were to IDNO networks (Ofgem 2011, p. 12). Where incumbents can demonstrate competition in the connections market, they are allowed an unregulated margin to incentivize friendly behavior towards new entrants (Ofgem 2011, p. 8). In principle IDNOs are subject to standard regulation albeit price control does not occur directly but relative to the incumbent. They pay use-of-system charges to the host DNO. This so-called boundary charge can be locationally differentiated under the distribution charging methodology for the extra high voltage level (EDCM).

The duplication of infrastructure seems to remain economically unfeasible and direct competition for the network operator therefore remains rare. However, a few examples of parallel network infrastructure seem to exist for example in the United States of America (USA) (Kwoka 1996) and in India, where this was explicitly introduced with the Electricity Act of 2003 (Khaparde 2004).

With the emergence of distributed generation, competition for the incumbent system operator is increasingly expected not only in the network sector itself but also in the form of facilities based competition (Pollitt 2010). For larger customers or customers at locations with good availability of (renewable) energy sources, local generation may substitute electricity supply from the grid. Customers can build microgrids to be run in isolation. In other words customers or customer groups may decide to operate their systems without connection to the main grid. Thus, distributed generation, flexible loads and storage put competitive pressure on the incumbent network operators. With good on-site energy management the benefits of a regular electricity grid connection reduce to emergency back-up and balancing own generation and demand over time.

A challenge with third party activity in the network stage is efficient system coordination. Based on an analysis of third party activity in New Zealand's distribution stage Gunn & Sharp (1999) find opportunities for competition in connecting new customers, but also for bypassing. They conclude that incentives for such behavior arise 'artificially' from regulation via accounting rate of profit and induce inefficient network development (Gunn & Sharp 1999). This underlines the responsibility of regulation to set a framework that ensures efficient coordination between grid and off-grid solutions of different actors.

At the same time, ownership unbundling is part of the debate on electricity market design, while it has never played much of a role in telecommunications.[1] In electricity systems the borderline between monopoly networks and competitive businesses used to be clear and stable. Therefore it was relatively easy to define what actually needed to be unbundled. Moreover, the necessary coordination between the unbundled parts was lower in electricity than in telecommunications systems. In other words, the downside cost of vertical unbundling in telecommunications is likely substantially higher than in electric systems.[2] As a result, access requirements are more important and more detailed than in electricity.

In the emerging smart systems we see first cases of infrastructure competition as well as increasing possibilities for facilities based competition. At the same time the boundary between monopoly and commercial businesses is starting to blur. This might imply that regulation should focus more on access regulation. The follow up question is: what is the genuine monopolistic bottleneck to which access is needed. It appears that access to data is of key importance in smart systems.

Presently regulation often neither allows nor incentivizes the network operator to interact with generation, storage, flexible loads and aggregators in order to exhaust the efficiency benefits they can provide. Given the example of islanding or bypassing the network, present charging would increase network charges for the average network customer if fewer customers have to finance the same grid. This however increases the attractiveness of islanding. Hence, in some cases rebates on the network charges might be efficient to prevent customers from islanding and to ensure a good utilization of the

[1] The term "unbundling" is used in telecommunications as well, but the meaning and implications are different from electricity markets. First, product bundling, possibly leading to price squeezes, has been widely discussed in telecommunications. Second, unbundling has been used to indicate that a third party would rent the entire line for a monthly fixed fee rather than pay a usage based fee. Thirdly, unbundling (or rather re-bundling) has been used to describe the development in the USA where the local intrastate telcos were allowed to integrate forward into the interstate markets. These are phenomena that are conceptually related to ownership unbundling as used in electricity but by no means equivalent.

[2] Cf. Meyer (2012) for an overview of vertical scope economies in unbundling of electricity systems.

grid. In other cases islanding might be desirable as network expansion would be too costly. More differentiated pricing can contribute to efficient coordination by signaling local network conditions to network users. The implementation can be realized in general tariff plans such as locational price signals in EDCM in the UK. An alternative can be to allow individual smart contracts between the network operator and a network customer (Brandstätt et al. 2011). We discuss stakeholder involvement more generally as a means to flexibilize regulation.

4 Stakeholder involvement to flexibilize regulation

Stakeholder involvement and negotiated settlements receive growing attention in regulation in several sectors such as the water sector (Ofwat 2011) or airport regulation (Littlechild 2012) and also in general European energy policy (EESC 2012).[3] In telecommunications, negotiated settlements have long been debated.[4] In many cases, the role of regulation and/or the regulator was simply not straightforward. In other words, the line between clear-cut regulatory and negotiated solutions was blurred. Two remarks are in place. First, in practice and in the literature, the regulator was given a role as mediator or as the default option. Therefore, third parties were never left alone vis-a-vis the incumbent. Second, negotiated settlements have been discussed especially in a context, where it was assumed that the incumbent would not have an incentive to discriminate against third parties. This was a particularly important issue in New Zealand, under the regime of light-handed regulation. The key point in the discussion is whether access to infrastructure is regulated or not; if it is not, then it is not obvious why the infrastructure owner would foreclose access to its infrastructure, leaving scope for negotiated settlements (cf. Brunekreeft 2003).

With the diversification of actors actively involved in the energy system, high investment needs ahead and a blurring boundary between regulated and competitive markets, stakeholder involvement may be favorable in regulation in smart systems as well. Direct involvement and negotiated settlements are a means to empower stakeholders to defend their own interest (Littlechild 2009). They thereby provide a protection against a ‘regulator knows best’ philosophy. Negotiations fit with the idea of smart grid as enabling platform. The grid (operator) has to find out what its customers want. By involving them in the decision making they are allowed a say in how the system should develop. This can take two forms: stakeholder involvement in the design of regulation or negotiated settlements with regulation as default option. Forms of involvement can be differentiated by the degree to which stakeholders can determine the outcome of the decision-making process (Arnstein 1969).

There are two key motivations for stakeholder involvement: improving information and increasing legitimacy (CEPA 2011). In a competitive setup the market enables customers to signal their preferences via consumption decisions. Consequently, firms value customer preferences to thrive in competition. In monopolies, such as electricity distribution, this way of customer feedback is limited. Hence, regulators (and network companies) should find other ways to incorporate the customer perspective (Muzzini 2005, p. 20). Stakeholder involvement can serve regulation to better match user preferences (Abdala 2008), prioritize investments and gain legitimacy which is relevant for an electricity sector that awaits significant changes and investments likely associated with price increases.

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[3] There seems to be a more general trend of decentralization and direct democracy elements also in politics e.g. the concept of liquid democracy where voters can participate in decision-making process beyond going to vote every several year. “The decision-making is based on the so-called intelligence of the network” (Litvinenko 2012, p. 406).

[4] This was triggered by a fierce debate under the “light-handed-regulation” regime in New Zealand on the role of “voluntary” access negotiation, which later came to be known as the Efficient Component Pricing Rule (ECPR), proposed in particular by Baumol et al., (1996). Later the analysis was critically formalized by Carter & Wright (1999).

Furthermore, cooperation and coordination of stakeholders are necessary when system development does no longer solely depend on the network operator. Littlechild (2008, p. 33) argues that present regulation devalues the relationship between companies and consumers who "each find that their ends are more effectively achieved by appealing to the regulator – often using the media – than by talking to each other." Stronger stakeholder involvement can serve to foster relations, strengthen cooperative outcomes and tap third parties' creative potential.

4.1 Consultation & Appeal Rights

The purpose of stakeholder information is to increase the transparency of the regulatory activity, of company cost and services, and of the reasoning for decisions. Some processes to bring consumer input to regulation are passive such as quantitative and qualitative consumer research. Examples are surveys and focus groups to elicit stakeholder preferences prior to the draft process (Ofgem 2009). In other cases, stakeholders are explicitly asked to comment on draft regulatory decisions.

In 2010 the UK regulator Ofgem promoted a stronger role for consumers within "RPI-X@20", a regulatory review of 20 years of regulation. One focus of the new regulatory model is that networks shall deliver value for money for today's and future network customers. Consequently, Ofgem encourages network companies to engage with their customers and discover their needs. With the Consumer Challenge Group introduced for DPCR5[5] in 2010 and the Consumer First Panel, Ofgem recently moved to more actively engaging consumers in the discussion process. Consultation takes stakeholders' interest into account in the regulatory decision. However, the decisive power rests completely with the regulator. Hence, in the UK, regulatory decisions are still taken by Ofgem.

UK regulation also features a right for third parties to challenge regulatory decisions. They can request the regulator to make a "price control modification reference" to the Competition Commission (Ofgem 2010a). Introducing appeal rights is considered to improve regulatory decisions. First, it improves the quality of regulatory decisions ex-ante by bringing stakeholder interest practically on the agenda of regulators since they have to anticipate possible complaints. Second, it introduces an instance of ex-post control to the regulator and thereby allows for better detection and subsequent correction of errors or mismatches if they arise (Energy UK 2012, p. 9).

Within the third regulatory package on the internal market, the European Commission made appeal rights mandatory. Member states have to ensure that "suitable mechanisms exist at national level under which a party affected by a decision of a regulatory authority has a right of appeal to a body independent of the parties involved and of any government" (EC 2009). An important argument seems to be that transparency avoids regulatory capture.

4.2 Negotiated Settlements

Approaches of "acting and deciding together" are a consequent extension of consultation-based stakeholder involvement (Muzzini 2005, p. 2). Consumers and other stakeholders are constructively engaged during the regulatory process and allowed to negotiate the outcome with the regulator and the other stakeholders. Hence, the regulator shares its decision-making power. This can occur to different degrees. In general the regulator retains supervision and monitoring function. The regulator has to secure that all relevant interests are represented, such as future generations and check for balance between the different views such that outcomes do not exploit certain stakeholders. Information acquisition and drafting of agreements might be left to stakeholders. The regulator's task shrinks. It

[5] DCPR refers to distribution price control review which is the price control applicable to distribution network operators.

has to enable negotiations, for example by disclosing relevant information. At the same time it serves as a neutral instance to fall back upon and provide arbitration when negotiations fail.

In the first instance, such negotiations may ease information discovery on customer preferences and willingness to pay. Large part of the information gathering and evaluation of customer benefits and utility cost is shifted to the stakeholders. In addition, negotiated settlements may increase the legitimacy of the outcome since stakeholders negotiated an agreement as consensus. Negotiations may further enable individual solutions a top-down regulator could not realize by including case-specific preferences and circumstances. In comparison to an appeal right which introduces an ex-post control mechanism on the regulator[6], negotiations foster meaningful and constructive input right from the beginning. However, appeal rights to the negotiated outcomes might be necessary to ensure responsible negotiations.

In New Zealand negotiations are used at the distribution level with respect to regulation under "customized price-quality paths". Distribution network companies are required to consult a proposal for such a path with their customers before submitting it to the Commerce Commission. The consultation should cover the rationale for the proposal, its overall effects, prices and quality (ComCom 2012, p. 138). The discussion of the proposal is left to consumers and the regulated company, but the company has to submit evidence on the consultation and demonstrate customer support for the proposal. The regulator's role is to guarantee that customer involvement is carried out satisfactorily (CEPA 2011).

With negotiated solutions, it is important that all interests, also those who are not part of the negotiations, are represented and duly considered. This is a non-trivial issue. One approach to achieve just this would be that the regulator represents the group of small end-consumers as it is the role of a regulator in a standard model. Secondly, it would be possible to involve third-party interest more explicitly in decision making. Section 5 of this paper provides an example of this in an information management approach for smart systems.

While for small relatively homogenous groups successful negotiations are likely, agreement becomes more difficult with growing participant numbers and conflicting interests. The quality of the outcome for stakeholder groups depends on their ability to defend their own interest. In particular for consumers, there seems to be some reservation on "meaningful" involvement (Ofgem 2010b). It has been doubted whether consumers are willing to engage and whether they have sufficient knowledge and resources (Ofgem, 2009). Also, interest of small consumers is often diffuse. In comparison, other stakeholder groups (e. g. industry) are usually well represented and devote significant resources to lobbying which can lead to biased outcomes when negotiations are left unsupervised. It is therefore important that consumers can rely "on spokespersons that can articulate their interests, and counterbalance the industry perspective". More generally, consumer involvement via representatives that are accountable to consumers as a whole may also reduce the risk of regulatory capture by specific interest groups (Muzzini 2005, p. 7). In the UK, this is realized by professional consumer representatives and organizations that act on behalf of consumers and other groups of small actors (Ofgem, 2009).

[6] Even though the control takes place ex post, an appeal right might still have certain ex ante effects in encouraging regulators to involve consumers.

4.3 Empowerment

Empowering stakeholders to self-govern the system and possibly own it moves even one step further. Empowerment is the most intense form of engagement since it delegates decision-making power to stakeholders. Hence, network customers are empowered to manage their infrastructure together with the owners. CEPA (2011, p. 15) argue that empowerment, including the delegation of decision making power to consumers, is “most appropriate” for small networks under the control of a single community. For large-scale infrastructure it may be unfeasible “due to the complexity of managing diffuse consumers groups with conflicting interests” (Muzzini 2005, p. 2). Yet, consumer-owned cooperatives exist, were limited self-governance takes place in practice.

In the context of sustainable energy supply, we find a number of cooperative approaches of organizing the electricity supply within a city or a region. Energy cooperatives are already an established structure in particular for the generation stages. Examples are wind or photovoltaic cooperatives (e.g. Degenhart 2010). For the network and retail stage they are less well known in Europe, but the concept is common for example in New Zealand where consumer-owned trusts manage the electricity supply in certain regions, in Denmark, where electricity distribution and district heating are typically cooperatives and in the USA, where several cooperatives exist at distribution level.

The consumer-owned trusts in New Zealand operate for the benefit of the consumers in their service area, also financially. Consumers are the owners and elect representatives that manage the business. In particular in rural areas, consumer-owned electricity supply businesses have persisted even after a reform that tended towards privatization. One factor might be that consumer ownership circumvents the information problem regulators face when determining the adequate price level. Optimally, the prices should “both stimulate appropriate levels of investment and minimize the risk of consumers facing inefficiently high prices” (Talosaga & Howell 2012, p. 13). In other words, regulation shall secure consumer interest against a natural monopoly. But regulators typically do not know the firms’ true cost and managers have incentives not to disclose relevant information. Consumer ownership in networks reduces the need for regulation since consumers “as owners, are able to ensure that the business acts in their interests” (ComCom 2009, p. 2). For that reason cooperatives and consumer owned trusts in New Zealand are exempt from price-quality-regulation. The cooperatives are assumed to find the adequate combination of price, investment and profit without need for regulatory intervention. Information disclosure regulations apply which enables transparency and public control. Notably, the exemption from regulation is withdrawn if its consumers petition to apply price-quality regulation to the distribution business (Government of New Zealand, 2011). Hence, regulation remains as fall back solution. This optionality allows for self-governed solutions with low regulatory intensity where this seems beneficial. Regulation applies in the remaining cases.

5 A common information platform for smart systems

As a specific example, we apply our ideas on involvement to smart systems and concentrate on the information layer. As outlined in section 2, data management plays a crucial role at the interface between open-access network monopoly and markets. It enables market-based interaction in situations when the network situation is uncritical and market-based provision of ancillary services for the network operator. In critical network situations however, market based interaction is limited, and network operators have control rights to retain system balance. Coordination of network and market activities needs to be secured. Also, non-discrimination is important to facilitate market interaction.

The discussion on governance of information in smart systems features several models, which address the trade-off between competition and cooperation differently. As a first model, distribution system operators might take care of the information tasks since they require (and possess) significant information for system operation anyhow. They have full network responsibility and can also be active in the commercial stages such as generation or retailing. This model is discussed as distribution system operator (DSO) as „market facilitator" (Lorenz 2012) in the European Union and similarly in the USA as „energy service utility" (Fox-Penner 2010, p. 189). This setup might benefit coordination across the smart system. Yet, it is not clear, whether neutrality and non-discrimination can be guaranteed. Separation between regulated and competitive stages might be necessary. A DSO involved in competitive activities and also responsible for information management might lack neutrality and use its position to discourage activity by third parties and other stakeholders. As a second model, distribution system operators can become pure network operators responsible for the electricity network as well as information processing and data management. They would not be active in the commercial stages. While this guarantees neutrality, it might hinder coordination among the market and network activities.

A third alternative balances between coordination and discrimination concerns. We suggest stronger involvement of stakeholders in what we call a common information platform (CIP). Relying on public-choice literature, a CIP is a club. It is a cooperative, not-for-profit solution constituted by the relevant stakeholders of the smart system. More specifically, generators, consumers, network operators, state agencies and other interested stakeholders might form a common platform or club which organizes the information function within the smart system. Figure 2 presents the setting. All stakeholders and actors involved can become members of the common information platform and develop the smart system to mutual benefit. The stakeholders include the DNO and possibly the regulator. This platform integrates the competences of the stakeholders and creates institutional neutrality. Therefore the CIP can guarantee non-discrimination and improve coordination among the stakeholders in smart systems, whilst ownership structures are not affected.

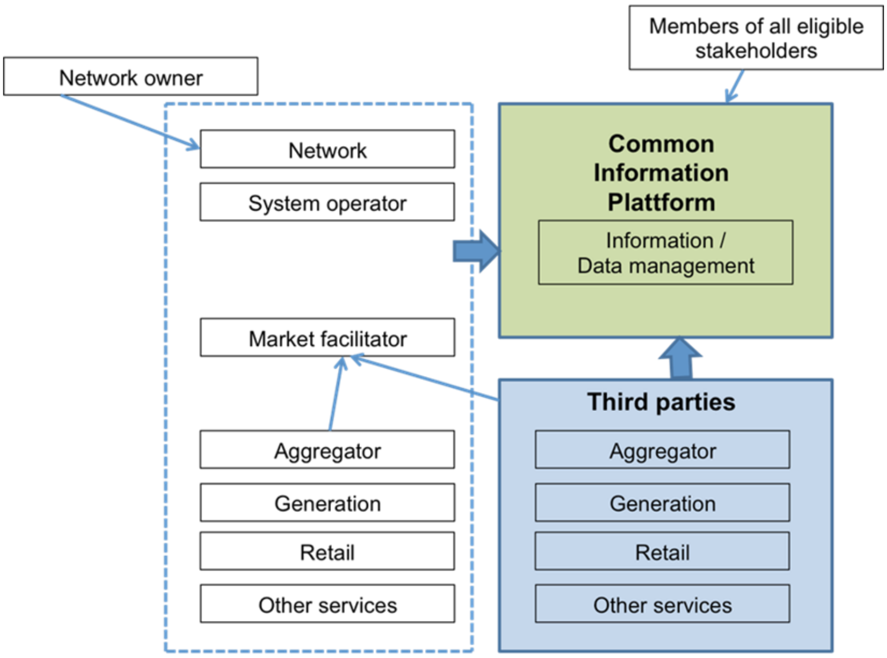

Fig 2: The CIP-approach
Source: own illustration.

Both network and system operation remain in the hands of the DNO. Yet, the information management layer is isolated and turned into a club of which the relevant stakeholders can be members with voting rights. The CIP is a decision making body, it does not carry out the functions of information processing and data management or operate any assets itself. It "merely" allows institutionalized stakeholder representation on the most fundamental part of a smart system: information management. It is essentially a decision-making body which sets the rules and delegates operation and execution of tasks. These rules would be too detailed and too context-specific to be dealt with by law or the regulator. Tasks of the club further include data and privacy protection as well as provision of non-discriminatory access to information and of arbitration and mediation in case of disputes. The club can tender tasks if necessary or realize them internally depending on the decisions of the club members. This procedure allows allocating tasks to the best offering stakeholder or third party while decisions are made cooperatively and non-discriminatory. All stakeholders have a say in the requirements on what outcome shall be delivered and can make their interest count. Besides the above described benefit for coordination, this model seems to offer significant potential for reducing regulatory efforts. If the club is not too large and the interests are not too diverse, it can coordinate towards a common goal and form a stable organization without need for significant regulatory intervention.

An example may illustrate. It is currently debated who should be responsible for the communication infrastructure to facilitate data transfer in the smart system. Telecommunication providers offer their broadband and mobile infrastructure while network operators in contrast advocate the use of their electricity infrastructure with powerline technology. The discussion is complex and beyond the scope of this paper. Yet the optimal technology choice is context dependent and relies heavily on the demand on the network. Instead of determining the technology to be used or the player in charge by legislation, the CIP can decide on a case-by-case basis. Within the CIP both stakeholders (network operators and telecommunication companies) are directly or indirectly represented and the parties within the CIP would to come to agreement. If they cannot agree they can refer to the regulator.

Balmert & Brunekreeft (2010) studied the club approach in more detail for independent system operators (ISOs) at transmission level. They find that even though every type of ISO is regulated, those organized as clubs (as it is the case in some parts of the USA) typically experience less stringent regulation. The obvious explanation is that by involving all stakeholders within the club, including state agencies, interests are taken into account in an early phase of decision. Consequently, there is little disagreement after decisions are made and only rarely ex-post intervention is needed (Balmert & Brunekreeft 2010). Although the CIP and the ISO appear similar, there is an essential difference. The ISO organizes system operation while the CIP as presented above does not deal with system operation but instead with information management. Moreover, the term ‘independent’ is somewhat misleading. The CIP does not make decision on information management ‘independently’, but rather tries to include and involve all relevant stakeholders. Therefore, the term ‘common’ is more suitable.

6 Conclusions

Decentralization is changing the structure and operation of electricity distribution. Consumers, generators and other stakeholders become more active participants in the electricity supply system and thus challenge the traditional responsibility and scope of action of the network operator. Based on two trends we analyzed possible implications for the regulation of smart distribution grids. First, the emergence of new service and new markets offered by various players in smart systems weakens the core of the network monopoly. The demarcations of what to regulate and what not to regulate start to blur. Regulatory systems should allow flexibility to leave competitive part of smart systems to the market as soon as possible. This approach reminds strongly of the phasing-out approach in telecommunications. Second, the diversity of stakeholders in a future energy system calls for more individualized approaches. Coordination of the stakeholders across the system is crucial. Consequently, interactions with these very different stakeholders cannot be as uniform and standardized as before. Regulation needs to be flexible enough for the network operator to respond efficiently to the heterogeneity of challenges and benefits that these stakeholders offer. As a result of these two trends focus and mode of regulation, i. e. what is regulated in smart systems and how, are changing.

In this paper we proposed stakeholder engagement to adapt regulation to the needs of emerging smart systems. Negotiations enable individualized solutions in comparison to a one-size-fits-all solution. At the same time, stakeholder engagement lowers the need for hierarchical regulatory intervention since network customers are able to defend their interests themselves. In regulation of smart grids, the prevention of discrimination between competitors becomes more important than direct price control towards the customer. The regulator's task remains to check and approve negotiation results and provide for a default and dispute settlement. Hence, the regulator's task changes; it will be more monitoring and arbitration, rather than rule-setting. .

In conclusion, stakeholder involvement seems to be promising for regulation of smart systems. It enables more creative and targeted solutions that address the different needs of the various stakeholder groups given they all agree. The network is merely an enabling platform for commercial relationships between inter alia consumers, generators and services companies. The relationship and the outcomes of the network become more complex and hence challenging for regulation. Enabling direct discussion among stakeholders paves the way for an adaptation of regulation towards the needs of smart systems. Individualized solutions can be found while regulation remains manageable. A monitoring and fall back function of the regulator ensures protection of consumer and other societal but underrepresented interest. The role of the regulator is to allow and continually foster the development of flexible solutions and adapt the framework to the altered system that develops.

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