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The Integration of Electricity from Renewable Energy Sources in the European Union Electricity Market – The case for "Smart Grids"

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Abstract
The power sector is to play a central role in a low carbon economy. In all the decarbonisation scenarios of the European Union renewable energy sources (RES) will be a crucial part of the solution. Current grids constitute however major bottlenecks for the future expansion of RES. Recognising the need for a modernisation of its grids, the European Union has called for the creation of a "smart supergrid" interconnecting European grids at the continental level and making them "intelligent" through the addition of information and communication technology (ICT). To implement its agenda the EU has taken a leading role in coordinating research efforts and creating a common legislative framework for the necessary modernisation of Europe's grids. This paper intends to give both an overview and a critical appraisal of the measures taken so far by the European Union to "transform" the grids into the backbone of a decarbonised electricity system. It suggests that if competition is to play a significant role in the deployment of smart grids, the current regulatory paradigm will have to be fundamentally reassessed.

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I. Introduction

The power sector is to play a central role in a low carbon economy. Analysis shows that electricity could be almost carbon dioxide (CO2)-free by 2050, and such low-carbon electricity promises to partially replace fossil fuels in transport and heating.[1] In all the decarbonisation scenarios of the European Union (EU), renewable energy sources (RES) will be a crucial part of the solution.[2]

Renewable energy resources are plentiful all over Europe and their share in the European energy mix of electricity production is constantly augmenting. The current growth path, however, is increasingly challenged by insufficient grid capacity. Grids constitute major bottlenecks for the expansion of RES, with many transmission lines, especially cross-border interconnections, suffering from congestion and overload. Moreover, the intermittent availability of many renewables is threatening the stability of the grids.

[1] COM (2011) 112
[2] COM (2011) 885

Despite the policies set in place by the EU under its "e*nergy and climate package*", the annual growth of RES may hence not be sustained in the middle and long term.[3] Recognising the need for an upgrade and a modernisation of its grids, the European Union has called for the creation of a "*smart supergrid*" interconnecting European grids at the continental level and making them "*intelligent*" through the addition of information and communication technology (ICT). [4]

To implement its agenda the EU has taken a leading role in coordinating research efforts and creating a common legislative framework for the necessary modernisation of Europe's grids within the context of a liberalised electricity market. Following the lines of the latest communication of the European Commission, entitled *Smart grids: From innovation to deployment*, this paper intends to give both an overview and a critical appraisal of the measures taken so far by the European Union to "*transform*" the grids into the backbone of a decarbonised electricity system. It suggests that if competition is to play a significant role in the deployment of Smart Grids, the current regulatory paradigm will have to be fundamentally reassessed.

The paper proceeds as follows. The first section gives an overview of the state of integration of RES in the electricity market of the EU. In the second section, both the research agenda and the legislative framework on Smart Grids are analysed and critically assessed. The third section appraises the underlying tenets of two of the most salient issues: the creation of common standards and regulatory incentives for the implementation of Smart Grids. The papers ends with an outlook on a possible paradigm shift for electricity regulation.

II. The Integration of Electricity from Renewable Energy Sources in the European Union Electricity Market

A. The Liberalised Electricity Market

The integration of electricity from RES in the EU is taking place in a market that has been progressively liberalised since 1996.[5] The internal market directive[6] laid down the basic structural reforms for a common internal market in electricity. It progressively opened up the generation market to competition, provided for non-discriminatory third party access (TPA) to both distribution and transmission grids and made accounting unbundling mandatory for vertically integrated utilities. It has undergone two major reforms.

The most recent revision had become necessary because vertical integration and high market concentration of historic incumbent operators continued to hamper the development of meaningful competition and discouraged new entrants. Furthermore, cross-border trade had remained limited due to congestion at the borders and insufficient development of interconnectors between Member States. Finally, the significance of having stronger rules on consumer protection and the environment was increasingly acknowledged.

[3] COM (2012) 271
[4] COM (2011) 658
[5] Johnston and Block (2012).
[6] Directive 96/92/EC of the European Parliament and of the Council of 19 December concerning common rules for the internal market in electricity.

The so-called "third energy package" entered into force in 2009. It provides the current legislative basis for the completion of the internal electricity market and consists of a revised internal market Directive (hereafter "Electricity or E-Directive")[7], and two regulations, which address the conditions for access to the network for cross-border exchange of electricity,[8] and establish an agency for the cooperation of energy regulators (ACER), respectively.[9,10]

To address some of the shortcomings of the previous frameworks the E-Directive provides for more effective unbundling of energy production and supply interests from the network,[11] and increased transparency of retail markets as well as strengthening consumer and environmental protection rules. The revised cross-border regulation provides for increased cooperation and coordination among transmission system operators (TSOs).[12] Finally, ACER[13] is responsible for the development of technical rules at the EU level together with the body representing the transmission system operators (ENTSOs) and the Commission.[14]

While the reform package has set the basis for more effective cooperation at the European level, it has so far failed to deal effectively with the market power of historic incumbents.[15] As a result, electricity markets continue to be perceived as insufficiently transparent and open to newcomers. Also, in one third of the Member States, households and small businesses still have no choice of suppliers and in many Member States regulated electricity prices for households effectively reduce competition. Finally, the majority of the electricity markets remain national in scope and the implementation of the legislative frameworks set in place in 2009 remains slow.

To tackle these challenges, the European Commission has recently issued a communication, in which it places emphasis on the effective implementation of the legislative framework by 2014.[16] It further recommends better coordination between energy regulators and competition authorities to achieve a level playing field.[17]

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[7] Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC.
[8] Regulation 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003.
[9] Regulation 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators.
[10] The reform package was supplemented in 2011 by a regulation on wholesale energy market integrity and transparency. See Regulation 1227/2011 of the European Parliament and of the Council of 25 October 2011 on wholesale energy market integrity and transparency.
[11] The Directive leaves it up to the Member States to choose between Ownership Unbundling (OU), the Independent System Operator (ISO) and the Independent Transmission Operator (ITO). See for an explanation of these models in particular http://europa.eu/rapid/press-release_MEMO-11-125_en.htm?locale=en.
[12] The TSOs are inter alia required to create network codes enhancing network access and ensure the coordinated planning of the European transmission system, including the creation of more interconnection capacities.
[13] ACER is independent from the Commission, national governments and energy companies and replaces the former European Regulator Group for Electricity and Gas (ERGEG).
[14] It is inter alia allowed to adopt decisions on cross-border issues and is entrusted with the task of monitoring the functioning of the internal market.
[15] COM (2012) 663.
[16] COM (2012) 663.
[17] COM (2012) 663.

B. The Promotion of Renewable Energies

1. The European Climate Change Programme

In the fledgling stages of the development of its liberalisation agenda, the European legislator did not pay much attention to the deployment of RES. Clearly, concerns of economic efficiency and security of supply were the main drivers of the process. With the adoption of the first European Climate Change Programme (ECCP) in 2000, a change of paradigm was however perceptible. The EU recognised that domestic action had to be taken swiftly to tackle climate change. This implied in particular that the deployment of renewable energies had to be more vigorously encouraged.

In the follow-up to the ECCP, the EU adopted a series of legislative acts, in particular a first Directive on the promotion of renewable energies[18] ("RES-Directive") and the European emission trading scheme (EU ETS),[19] which creates a market for carbon emission certificates for the electricity and energy-intensive sectors. Whereas the first RES-Directive fixed non-mandatory national targets for renewable energies, in particular for the electricity sector, the EU ETS promotes RES through the creation of a price on carbon for fossil fuel electricity production.

To reach their targets under the first RES-Directive, Member States like Germany, Spain and Denmark implemented feed-in-tariff schemes, which guarantee investors a stable return on investments. Other Member States opted for a certificate scheme to support RES. While there was an intensive debate on the compatibility of these schemes within the newly liberalised electricity sector,[20] it was clear that without any state support the RES targets would not be reached as many RES had not yet reached 'grid parity'.[21]

The liberalisation of the electricity market had indeed radically transformed the economic conditions under which electricity were produced and consumed. Investment risks in power generation had been shifted from captive consumers to investors. This meant that unless investors could expect a reasonable return on their investment, they would shy away from investing in RES.

Moreover, although the liberalisation process has opened up the market for new investors and widened the choice of consumers, many barriers continue to hamper the deployment of RES. In particular, high market concentration of incumbents, insufficient unbundling requirements, low interconnection capacity, difficulties in gaining access to wholesale markets, and operational rules continue to favour large-scale generation of thermal and nuclear power stations. To that can be added the pressure exerted by competition on research and development (R&D) budgets and the increase of capital and transaction costs in a liberalised environment which negatively affect the development of RES. Finally, complicated

[18] Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market.

[19] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.

[20] See ECJ C-379/98, Preussen Elektra v. Schleswag AG, 13 March 2001, ECR I -2159.

[21] Grid parity is achieved when the renewables become competitive in the electricity market without the support of subsidies.

authorisation procedures combined with lengthy planning and registration processes seriously undermine their competitiveness.[22]

Whereas the successful implementation of many feed-in-tariffs schemes has contributed to the deployment of RES, the progress made was considered insufficient. The necessity to take new measures to accelerate their uptake was hence increasingly stressed both for reasons of security of supply and to combat climate change.

2. The "Energy and Climate package"

The adoption of the "20/20/20" target and the so-called "climate and energy package"[23] in 2009 has confirmed the commitment of the EU towards the wide deployment of RES. Since then the promotion of renewable energies has represented a major building block of the 2020 strategy for smart, sustainable and inclusive growth[24] and is one of the principal pillars of the Roadmap towards achieving a decarbonised economy by 2050.[25]

With the revision of the RES-Directive[26] the EU has introduced major reforms to accelerate the deployment of renewable energies. Unlike the previous directive, it sets mandatory national targets for renewable energy and requires Member States to design national action plans to implement them.[27] It further encourages cooperation between Member States and mandates Member States to build the necessary transport infrastructures.

Despite the high growth rates in RES over recent years, driven by economies of scale and improved technology,[28] this positive trend may not last. Many States have started to reduce the levels of their feed-in-tariffs and the EU has so far proven incapable of restoring the price of the European emission allowances (EUA), which has dropped to historically low levels, hovering at around 3 Euros/tonne since the start of 2013. Furthermore, the export of large quantities of "cheap" coal from the United States to Europe due to the discovery of large quantities of shale gas in America has further contributed towards eroding the competitiveness of RES.[29]

In this context of policy uncertainty, it has become increasingly clear that the current legal framework does not suffice to foster the necessary long-term investments that would allow

[22] COM (2012) 272.

[23] The climate and energy package is a set of legislative acts which aims to ensure the European Union meets its climate and energy targets for 2020. These targets, known as the "20-20-20" targets, set three key objectives: a 20% reduction in EU greenhouse gas emissions from 1990 levels; raising the share of EU energy consumption produced from renewable resources to 20%; a 20% improvement in the EU's energy efficiency. See http://ec.europa.eu/clima/policies/package/index_en.htm.

[24] COM (2010) 2020

[25] On 4 February 2011, the European Council stressed its commitment to achieving the long-term targets of 80–95% domestic greenhouse gas reductions and recognised that this means nothing less than "*a revolution in our energy systems*". One month later, on 8 March 2011, the European Commission reiterated this communication in its *Roadmap for moving to a competitive low carbon economy in 2050*. See COM (2011) 112.

[26] Directive of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

[27] COM (2012) 271.

[28] COM (212) 163.

[29] See for more information http://www.telegraph.co.uk/earth/energy/10088341/Pollution-is-rising-because-of-cheap-coal-says-environment-boss-Lord-Smith.html.

further cost reductions and a greater share of renewable energy in the period after 2020.[30] Clear, legally binding, renewable energy targets post-2020 are needed; support schemes must be adjusted and concerns about land use and other environmental impacts of RES will have to be carefully addressed to ensure that public acceptance of RES does not diminish over time. [31] Furthermore, to cope with the intermittent character of many RES (particularly ocean, solar photovoltaic, wind) a portfolio of measures should be implemented to manage variability and uncertainty,[32] including, in particular, the combination of better forecasting with shorter market closure times for electricity trade.

3. The Building of a Smart Supergrid

The implications that a large deployment of RES has for the operation and the development of the grids must be carefully analysed. The EU still lacks the grid infrastructure which allows RES to develop and compete on an equal footing with large-scale fossil fuel and nuclear power installations.[33] Unless there is a modernisation and reinforcement of the grids, the integration of about 37% of renewables by 2020, as foreseen by the Member States' renewable action plans under the RES-Directive, will most likely not be possible.[34]

Anchoring its approach in the European 2020 strategy for smart, sustainable and inclusive growth, the EU has recognised the need for a step change in the way grids are planned, constructed and operated[35] and has called for an upgrade of the networks with the aim of setting up a European “smart supergrid”.[36]

This concept encompasses two different approaches.[37] The first aims at reinforcing cross-border transmission lines for the transport of electricity over long distances and is commonly known as the “supergrid”. This is particularly important for the integration of large offshore power stations which are generally located far away from major demand areas. The second responds to the necessity to equip distribution grids with smart information technologies so that volatile supplies of intermittent energy sources, such as wind and photovoltaic, can be matched with demand. This approach is commonly referred to as the “Smart Grid”.

Although the realisation of the latter can to a certain extent reduce the necessity to build the former, the two approaches are by no means mutually exclusive. Combined intelligently, a smart supergrid may on the contrary contribute to speeding up the decarbonisation of the European electricity system.[38] This is supported by both economic arguments as well as the need to ensure security of supply.[39]

[30] COM (2012) 163 final.
[31] COM (2012) 163 final
[32] IPCC (2012: 107 ff).
[33] COM (2010) 677.
[34] COM (2011) 31 final.
[35] See for instance the communication on Energy 2020 and its blueprint for an integrated European energy network. See COM (2010) 639; COM (2010) 677.
[36] COM (2011) 658.
[37] Battaglini et al. (2010: 291).
[38] Battaglini et al. (2010: 291).
[39] As most RES continue to be generally more expensive than traditional power sources, it is important to have recourse to the best production sites. These are not, however, evenly spread over Europe. While countries like Spain and Italy present good sites for solar and Sweden may advantageously deploy wind, biomass and hydro, other Member States like the Benelux countries have quite limited potentials for RES, due in particular to their geography and high population density. Second, supply will have to be secured throughout the transformation

a) The Supergrid

With liberalisation, the development of the grids underwent a profound change. Decisions regarding the modernisation, reinforcement and expansion of grids were no longer controlled by generators, but became the responsibility of grid operators.[40] Accordingly, optimal coordination between generation and development became more difficult and new forms of cooperation had to be found to guarantee that future investments in generation were matched by investments in transmission and vice versa.

At the outset of liberalisation little attention was paid by the European legislator to the consequences the process had on grids. Over time, it became clear that to guarantee their optimal development, grid operators would have to be controlled by independent regulators that have at their disposal a minimal set of competences, in particular, the right to fix grid tariffs and to monitor interconnection capacity.[41]

To ensure a sufficient European focus, regulators were further required to cooperate with each other in the framework of the European Regulators' Group for Electricity and Gas (ERGEG), the energy regulators' advisory group to the European Commission. Moreover, a first Cross-border Regulation was adopted to ensure the construction of new interconnection capacity and the development of fair criteria for allocating existing cross-border capacity.[42] A further step in the completion of this legislative framework was the Security of Supply Directive, which invites Member States to define security standards for grids and seeks to increase interconnections between countries to enable effective competition.[43] Finally, guidelines for trans-European energy networks (TEN-E) were adopted that define those projects which are eligible for financial assistance from the European Union.[44]

Despite these improvements in coordination and support, investments in interconnection capacity have remained slow. Long and uncertain authorisation procedures delay the implementation of cross-border infrastructure projects[45] and vertically integrated utilities continue to show little interest in developing new interconnection capacity as increased cross-border flows lead to more competitive pressure and may reduce the profitability of their generation branch in their 'home' markets. This attitude is in part encouraged by national regulators whose primarily national focus often prevents an optimal overall development of the grids.

To address these shortcomings, the European legislator has decided to further step up European cooperation. Accordingly, the third energy market package lays down the basic elements for a more European focus in grid planning. The revised Cross-border Directive provides new rules on cross-border compensation and investments under the guidance of

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and decarbonisation process of the power system. A high diversification of renewable sources over large geographical areas, an increase in the share of domestic fuels as well as a more flexible power system may contribute to realizing this goal. See Battaglini et al. (2010: 291).

[40] Art. 10 (2) c E-Directive.

[41] E-Directive, Article 23.

[42] European Commission, COM (2001) 125.

[43] European Commission, COM (2003) 740.

[44] The first guidelines were set out in 1996. They were revised several times, in particular in 2003 and 2006. See Decision 1364/2006/EC of the European Parliament and of the Council of 6 September 2006 laying down guidelines for trans-European energy networks and repealing Decision 96/391/EC and Decision 1229/2003/EC.

[45] COM(2010) 677.

ACER.[46] Furthermore, transmission system operators (TSOs) have been required to elaborate regional and European 10-year grid development plans (TYNDP) in the framework of the European Network of TSOs (ENTSO).

This legal framework shall further be completed by a thorough overhaul of the guidelines for trans-European Networks for Energy (TEN-E).[47] In its proposal for a new regulation on guidelines for trans-European energy infrastructure the European Commission sets out how interconnections can be improved and the grids adapted to meet the new needs of a progressively decarbonised electricity system, addressing in particular authorisation and financing issues. Stressing the need to modernise as well as upgrade the grids to meet increasing demand, foster market integration and maintain existing levels of system security, it proposes to create so-called "electricity highways" that could accommodate increasing renewable-based generation, connect these "new generation hubs" with major storage capacities and consumption centres and cope with an increasingly flexible and decentralised electricity demand and supply.[48]

Building on the first 10-year network development plan, the European Commission proposes to create twelve strategic trans-European energy infrastructure corridors and areas as well as to set new rules for the identification of projects of common interest (PCIs).[49] According to the draft regulation these would be selected by regional expert groups and be submitted for approval to the Commission, which, every two years, would update a union-wide list of projects. Financial aid to carry out the selected projects would come from a new institution, the "Connecting Europe Facility", whose setup is planned for the end of 2013. A methodology and a process for the elaboration of a harmonised cost–benefit analysis for PCIs would further complete the picture.

b) The Smart Grid

Until recently, grids predominantly transported power in one direction from large power stations, via the transmission and distribution systems, to the final consumers.[50] In this situation, distribution grid operators assumed an essentially passive role, ensuring the delivery of unidirectional power flows to end-users. With the emergence of new technologies such as "Flexible Alternative Current Transmission Systems" (FACTS) the situation has changed: grid operators are now able to accommodate bi-directional power flows and can accept injections of power by distributed generators[51] as well as taking into account demand response from consumers. This situation, however, entails a fundamental modification of their behaviour: grid operators will have to become far more active than they were in the past and will have to make distribution grids "smart".

What exactly is meant by "smartening" grids defies a clear understanding. While transmission grids, controlled on the basis of reliable data, are already relatively "intelligent", distribution grids[52] are mostly "as dumb as dumb can be".[53] They are nearly controlled "blind". An

[46] Idem.
[47] Idem.
[48] Idem.
[49] Idem.
[50] European Commission Smartvision (2006: 15).
[51] Distributed generation stays for electricity that is fed in directly to the distribution grid.
[52] Distribution grids are medium and low-voltage grids.
[53] Kurth (2013: 11).

element common to most definitions is that electricity grids become “intelligent” through the addition of two-way digital communication technology to devices associated with the grid. Each device on the grid can be given sensors, managed by automation technology, to gather data, thus allowing the management of data flows from a central location. As a result, the adjustment and control of millions of devices becomes possible and the actions of all users connected to it, generators as well as consumers, can be integrated intelligently.[54]

Several types of technology are generally distinguished. In upstream (generator) or downstream (consumer) markets, smart meters, measuring output or consumption in real time, play a crucial role.[55] For the grid operators, communicating instruments transmitting data on the status of the grid in real time constitute the principal assets they can use to optimise the management of demand, decentralised production resources, storage and possibly also fleets of plug-in electric vehicles.[56]

Smart-grid technologies offer a wide range of possibilities. Each country has its own view as to which market segment would gain most from Smart Grids.[57] Among the benefits most often stressed are the transformation of consumers into active players, the reduction of peak loads to avoid grid reinforcements, the integration of renewables and energy storage, the promotion of innovation, the reduction and anticipation of outages and the development and the storage of data flows.[58]

While the potential to improve the whole system is clear, its benefits will not accrue to all players to the same extent and some may lose out. While Smart Grids may help consumers reduce their electricity bills, and generators may be able to adjust production to meet demand, grid operators can optimise traffic in a more economical manner and would have at their disposal more effective instruments to balance supply and demand, in particular thanks to selective load-shedding at peak hours.[59] The deployment of Smart Grid communications resources will also assist new players (aggregators or managers of intermittent generation resources) in devising new strategies in a reconfigured market. [60]

The number of applications that can be used in connection with the Smart Grid once the communications technology is deployed is growing fast. Also, whilst many technologies will remain invisible to the consumer, smart meters, which are devices that record the consumption of electricity, will have to be installed on the consumer’s premises. They represent however only the first step.[61] Eventually they will communicate with smart thermostats and other appliances, giving people a clearer view of their patterns of consumption of electricity.

For the deployment of large amounts of RES, the deployment of smart-grid technologies is crucial. As increasing quantities of intermittent RES imply a greater need to manage variability and uncertainty, more flexibility is required both from the generation mix and from demand. Moreover, storage can help regulate the balance between supply and demand.[62] All

[54] See http://energy.gov/oe/technology-development/smart-grid.
[55] Clastres (2011: 4).
[56] Idem.
[57] Clastres (2011: 6).
[58] Clastres (2011: 6).
[59] Clastres (2001: 8).
[60] Clastres (2011: 32).
[61] The Economist, available at http://www.economist.com/node/13725843.
[62] IPCC (2012: 109).

this implies that advanced communications technologies, combined with smart electricity meters linked to control centres are installed and that generators and consumers are informed in real time and given the appropriate incentives to adapt their behaviour. Furthermore, improved operational methods are necessary to determine both the required reserve to maintain the demand–generation balance and ensure optimal generation scheduling.[63] Finally, RES may be pooled to form virtual power plants, which through the aggregation of their complementary characteristics, assist the individual installations in sharing and reducing the risks related to their deployment.[64]

III. Smart Grids in the European Union: from Innovation to Deployment

While the benefits of Smart Grids are widely recognised, their implementation prompts many questions.[65] Unlike the US, which engaged at an early stage in legislative development efforts, the EU initially mostly supported research and fostered government-backed deployment of Smart Grids.[66] Since 2009, however, it has devoted increased attention to standardisation, privacy and market design issues. In the following sections we give a brief overview of the EU policy framework and discuss some of the most salient issues.

A. The European Research Agenda

The interest of the EU in Smart Grids dates back to 2004, when the first international conference on the integration of renewable energy sources and distributed energy resources was held in Brussels. In 2005, spurred on by industrial stakeholders and the research community, the European Commission set up the European Technology Platform for the Electricity Networks of the Future (hereafter "Smartgrids Platform"), aiming at creating a joint vision and a research agenda for the deployment of Smart Grids.[67] Representing a wide variety of stakeholders, this platform has produced a series of reports[68] on how grids may become smart, in particular by defining a vision and setting out a strategic research agenda up to 2035.[69]

With the adoption of the SET-Plan in 2009, which was a response to declining R&D budgets for energy and the desire of the EU to position itself at the forefront of research and innovation in low carbon technologies, the EU has moreover created a valuable tool to foster research in the sector of low carbon energy.[70] Based on the premise that the climate challenge may only be addressed if the entire energy system is transformed, with far-reaching implications for how energy is produced, transported, traded and used, the EU has decided to establish so-called "European Industrial Initiatives" (EIIs),[71] whose aims are to strengthen industrial participation in energy research and demonstration projects, boost innovation and accelerate deployment of low-carbon energy technologies. One of the EIIs created is the

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[63] Idem.
[64] See Clastres (2011: 29).
[65] SRA (2012: 20)
[66] Zhang (2011: 47).
[67] See http://www.edsoforsmartgrids.eu/index.php?page=smart-grids-european-technology-platform
[68] See http://www.smartgrids.eu/ETP%20Documents.
[69] ETP Smartgrids (2012).
[70] The EEGI has adopted an implementation plan for the upgrade of networks, particularly at distribution level, and stressed the need for close collaboration between distribution and transmission operators. See COM (2011) 202 final.
[71] See SET-Plan (2010).

European Electricity Grid Initiative (EEGI), a particular aspect of whose scope is to promote the setup of electricity systems that are able integrate up to 35% of electricity from distributed RES by 2020 and to work towards completely decarbonised electricity production by 2050.

With the SET-Plan a novel kind of political process has been created, which combines top-down and bottom-up approaches, encouraging on the one hand a broad variety of stakeholders to form "platforms" to develop responses to new challenges and to act both as "incubators" and lobbyists, and on the other hand, ensuring an appropriate policy response. While the participation in the platforms is usually open to all interested stakeholders, the political process is guided by a Steering Group, composed of a group of representatives from EU Member States, chaired by the European Commission. This framework is further complemented by the European Energy Research Alliance (EERA), which fosters the cooperation of leading European research institutes and SETIS, the Strategic Energy Technologies Information System that monitors the progress of the implementation of the SET-Plan.

B. The European Legislative Agenda

Despite the strong support for research activities, the implementation of the Smart Grid did not accelerate as expected.[72] Among the reasons identified for the delay were the prevailing uncertainties regarding the acceptance of the new technologies by consumers, the lack of clarity regarding future business models, the scale of the necessary investments and, to some extent, the technologies that would be needed for its deployment.[73]

While the EU initially adopted a relatively hands-off approach to legislative issues, this changed over time. To provide better co-ordination, and to speed up the legislative process at the European level, the European Commission set up a Smart Grid Task Force (SGTF), which is composed of a Steering Committee[74] and four expert groups. Its role is to advise the Commission on the implementation of the Smart Grid. More specifically, it was tasked to "produce a set of regulatory recommendations" to ensure EU-wide a "consistent, cost-effective, efficient and fair implementation of Smart Grids".

The work of the SGTF has focused on several cross-cutting issues concerning inter alia the roles of the various stakeholders, standards, privacy and security challenges and infrastructure deployment.[75] Based on the outcome of the latter, the European Commission issued a Communication in 2011 entitled "Smartgrids: from innovation to deployment". The European Commission identifies therein four policy areas which require European cooperation: first, developing common European standards for Smart Grids, second, addressing data privacy and security issues, third, regulatory incentives for deployment of Smart Grids, and fourth, continuous support for innovation and its rapid application.

[72] See European Task Force for the implementation of smart grids into the European internal market, available on the internet under http://ec.europa.eu/energy/gas_electricity/smartgrids/doc/mission_and_workprogramme.pdf

[73] See European Task Force for the implementation of smart grids into the European internal market, available at http://ec.europa.eu/energy/gas_electricity/smartgrids/doc/mission_and_workprogramme.pdf

[74] The Steering Committee (SC) is represented by high level representatives of all involved stakeholders, both public and private.

[75] Covassi da Encarnaçao (2013: 96).

In the following sections we shall discuss two issues in more detail: the development of common standards and regulatory incentives for deployment of Smart Grids.

1. Developing Common European Smart Grids Standards

The deployment of Smart Grids requires the definition of hundreds of new standards describing the technical requirements of the devices associated with the grids and their interaction. The need to define so-called "interoperability standards", specifying the parameters of how actors and components throughout the Smart Grid interact with each other, was recognised at an early stage in the United States.[76] Although the country has a strong tradition of "bottom-up" private-sector standard-setting processes,[77] it acknowledged that the enormous scope and the complexity of the Smart Grid would make federal involvement indispensable.[78]

A federally coordinated process thus started as early as 2007 under the leadership of the National Institute of Standards and Technology ("NIST"), which was given the "primary responsibility to coordinate the development of a framework … to achieve interoperability of Smart Grid devices and systems".[79] It works under the guidance of the Smart Grid Interoperability Panel ("SGIP")[80], and is assisted by the Federal Energy Regulatory Commission ("FERC"), whose role is to "adopt" the standards established by the NIST if this is required to ensure the interoperability of the federal electricity system.[81] The scope of the standard-setting process is large and encompasses in particular the creation of a common information framework.[82] So far, the FERC has refused to adopt mandatory standards at the federal level, leaving the regulatory role essentially to the states.

In contrast to the US, the involvement of the EU in the standard-setting effort started much later, with a first mandate being given to the European standardisation organisations (ESOs) in 2009 for the interoperability of smart utility meters, and another in 2010 for chargers for electric vehicles.[83] Acknowledging the necessity of a broader range of standards, the European Commission eventually issued a mandate in 2011 to develop standards "facilitating the implementation of high-level Smart Grid services and functionalities".[84] It announced at the same time that if progress was insufficient, it would consider defining a "network code".[85]

Building on the work carried out by NIST, the European standardisation process has since then gained considerable speed.[86] In 2012, the Smart Grid Coordination Group (SG-CG) set up by the ESOS delivered reports on the main elements of the mandate: a technical reference

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[76] Zhang (2011).
[77] Eisen (2013: 129).
[78] Eisen (2013: 132 ff).
[79] See http://www.nist.gov/public_affairs/releases/upload/smartgrid_interoperability_final.pdf.
[80] Eisen (2013: 138).
[81] Eisen (2013: 137).
[82] Zhang (2011: 49).
[83] COM (2012) 202.
[84] See for a definition of these functionalities European Commission SEC (2011) 463, available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2011:0463:FIN:EN:PDF
[85] COM (2012) 202. European network codes are sets of rules which aim is to provide effective access to the transmission grids across borders and to ensure the coordinated evolution of the transmission system. The areas, as well as the procedure for developing them, are set out in Article 6 of Regulation 714/2009/EC. The European network codes are not intended to replace the necessary national network codes for non-cross-border issues.
[86] See the summary made by Commissioner Oettinger at the Conference in January 2013, available at http://ec.europa.eu/energy/gas_electricity/events/20130128_smartgrids_standardization_en.htm

architecture, a first set of standards supporting the exchange of information and the integration of all operators, sustainable standardisation processes and standards on information security and data privacy. It also produced a Framework Document, which provides an overview of all the activities related to the deployment of Smart Grids and describes how the different elements fit together.[87] A first stock-taking conference took place in January 2013.[88]

The methodology applied by the SG-CG for the standard-setting process is based on so-called high-level "use cases", which represent narrative descriptions of how actors will interact.[89] Applying the principles of system engineering to standardisation, this methodology departs considerably from the way standardisation processes have so far been organised and will constitute the backbone of all the future standardisation work within the ambit of Smart Grids.[90]

With this standardisation effort, the EU has set an important milestone for the future deployment of Smart Grids. As a matter of fact, interaction between the thousands of devices and actors will not be possible without the creation of common interoperability standards. Standards, however, do more than make interaction possible. They promote investments in technology, eliminate market obstacles and foster competition.[91] If it is true that a standardisation process also entails a certain risk of eliminating innovation, this risk is probably minor compared to the consequences of building Smart Grids without foundational standards.[92] Also, if designed properly, standards may well allow for future upgrades, ensuring their fluid evolution.

There is not yet enough experience to determine whether an expanded role of the EU for the development of standards is advisable. Following the example of the Internet, a flexible approach would probably yield better results than dictating mandatory standards at an early stage.[93] The risk of a balkanisation of standards will however have to be closely monitored to allow the establishment of network codes in the field of Smart Grids, if need be.

2. Regulatory Incentives for Smart Grid Deployment

Prior to 2009 the EU had, with the exception of some rather vaguely framed provisions in the first RES-Directive, not given much guidance to Member States regarding the implementation of Smart Grids. This has changed with the adoption of the revised RES-Directive and the EE-Directive, which set framework conditions for structural changes of the grids to ensure a larger uptake of renewables and provide incentives for energy efficiency.

a) The uptake of large quantities of RES by the Grid

According to the revised RES-Directive Member States are required to take all appropriate steps to develop transmission and distribution grid infrastructure, intelligent networks and

[87] See http://www.etsi.org/news-events/news/646-2013-01-smart-grid-results.
[88] See for a full account of the Conference the video on demand available on the internet under http://ec.europa.eu/energy/gas_electricity/events/20130128_smartgrids_standardization_en.htm.
[89] See Eisen (2013: 127).
[90] E3G (2011)
[91] Eisen (2013: 124).
[92] Eisen (2013: 124).
[93] Eisen (2013: 155).

storage facilities to absorb the expected growth of RES, "taking into account the specificities of variable resources and resources which are not yet storable".[94] Particular emphasis is placed on the acceleration of authorisation procedures and better coordination between grid infrastructure approval, planning and administrative procedures.[95] These issues are crucial, as delays due to inefficient procedures hamper adequate investments in RES.

Member States must further ensure that priority[96] is given to RES when dispatching electricity "in so far as the secure operation of the national electricity system permits" it.[97] To minimise possible curtailments, they have to ensure that "appropriate grid and market-related operational measures are taken" and require system operators to take corrective measures "to prevent inappropriate curtailments".

When it comes to connecting RES to the grid, the allocation of related costs is of utmost importance.[98] So-called "connection charges" may either cover "shallow costs", i.e. the costs related to the single connection, or "deep costs", which, in addition to the connection costs, include costs related to the reinforcements of the core grid.[99] Whereas connection charges are generally a minor cost factor for large utilities, as reinforcement costs related to the transmission network are in general shared by all users of the network, this is different for distributed generation, for which connection charges may represent a significant cost factor.

While the RES-Directive provides considerable leeway to Member States as to how they want to allocate the connection costs for RES producers[100], they must ensure that rules "relating to the bearing and sharing of costs of technical adaptations, such as grid connections and grid reinforcements" are published and based on objective, transparent and non-discriminatory criteria "taking particular account of the costs and benefits associated with the connection of those producers to the grid".[101] RES producers must further be appropriately informed and may, if Member States allow it, organise a call for tender for the connection work.[102]

In addition to connection charges, other fees, covering in particular costs of transport and ancillary services, influence the uptake of RES. Although in most countries the largest share of these costs is borne by consumers, a few countries allocate a non-negligible component of such tariffs to generators (the so-called G-component).[103] To avoid these rules placing a disproportionate burden on RES, the Directive posits that the overall charging of transmission and distribution tariffs may not discriminate against RES[104] and that tariffs have to "reflect realisable cost benefits resulting from the plant's connection to the network, in particular

[94] RES-Directive, Recital 61, Article 16.
[95] RES-Directive Art. 16 par. 1.
[96] "Priority access to the grid provides an assurance given to connected generators of electricity from renewable energy sources that they will be able to sell and transmit the electricity from renewable energy sources in accordance with connection rules at all times, whenever the source becomes available. In the event that the electricity from renewable energy sources is integrated into the spot market, guaranteed access ensures that all electricity sold and supported obtains access to the grid, allowing the use of a maximum amount of electricity from renewable energy sources from installations connected to the grid". See RES-Directive, Recital 60.
[97] RES-Directive, Art. 16 par. 2 (c).
[98] See for a thorough discussion of transmission costs and tariffs THINK (2012).
[99] THINK (2012: 22).
[100] According to it Member States may but are not obliged to pass connection costs on to the system operators. See RES-Directive, Art. 16 par. 4.
[101] RES-Directive, Art. 16 par. 3 and 6.
[102] RES-Directive, Art. 16 par. 5.
[103] See for a thorough discussion of these issues THINK (2012: 21).
[104] RES-Directive, Art. 16 par. 7.

benefits from the direct use of the low-voltage grid".[105] Accordingly, Member States must make sure that grid tariffs reflect the benefits such as a reduced need for grid reinforcements that distributed RES provide to the grid.

b) The Roll-out of Smart Meters

Smart meters are electronic devices that can measure the consumption of energy and provide bi-directional communication between the consumer and supplier/operator. Unlike traditional meters, which have to be read physically at their point of installation, they make it possible to read and record energy consumption very frequently. Among other advantages, it enables "demand response" and "time-of-use" pricing for electricity and the introduction of "smart" household devices.[106]

The implementation of smart meters is considered a prerequisite for the deployment of Smart Grids. The E-Directive[107] has set out new[108] requirements for the roll-out of smart metering systems. Member States are required to install them by 2020 for at least 80% of their customers, where such a roll-out is assessed positively regarding the long-term costs and benefits. To assist Member States in carrying out these assessments, the European Commission has issued a recommendation[109] in which it provides advice with respect to three key elements: data protection and security considerations, a methodology for the economic assessment of the long-term costs and benefits, and minimum functional requirements.

Despite the legislative framework set in place by the European Union, a large number of customers are not yet in receipt of the appropriate information that would enable them to regulate their energy consumption.[110] While not requiring a mandatory roll-out of smart meters, the Directive on Energy Efficiency ("EE-Directive") lays down new requirements which aim at improving the contribution of smart metering systems to energy efficiency.[111] More specifically, the EE-Directive requires that metering systems provide customers with information on actual time of use and measure the electricity exported to the grid from a consumer's premises. Furthermore, if no meters are installed, Member States must ensure that billing information is appropriate and based on actual use.[112] Finally, the Directive mandates that both billing information and access to consumption data for final customers are supplied free of charge.[113]

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[105] RES-Directive, Art. 16 par. 8.
[106] European Data Protection Supervisor (2012: 3).
[107] E-Directive, Article 3 par. 11.
[108] Before the adoption of the revised E-Directive, two basic instruments laid down the legal framework for smart metering: the Directive on energy end-use efficiency and energy services and the E-Directive. Article 13 of the former required that final customers were provided with competitively priced individual meters. The requirement was however made subject to technical feasibility, financial viability and ability to create potential energy savings, with the result that only a limited number of Member States have deployed them, among them notably Italy.
[109] European Commission, Recommendation 2012/148/EU.
[110] EE-Directive, recital 32.
[111] EE-Directive, Art. 9-11.
[112] EE-Directive, Art. 10.
[113] EE-Directive, Art. 11.

c) The promotion of Energy Efficiency

Another focus of the EE-Directive is the reduction of so-called grid losses[114] related to the design and/or the operation of the grids.[115] This objective may be achieved both through the replacement of equipment and the modification of the grid architecture and its management.[116] For instance, grid losses can be reduced if electricity is consumed locally. Accordingly, well located RES can help increase the energy efficiency of the grids. This is true, however, only if the production can be adjusted to meet the demand, i.e. if the production is flexible and/or backed up by storage.[117]

A particular emphasis is placed on the development of grid tariffs and regulations which incentivise grid users to implement energy efficiency measures.[118] Two main elements are relevant in that respect: how much of the grid tariffs is charged to the grid user and whether there is a regulation in place that allows the system operator to recover costs related to investments for energy efficiency purposes.[119] Annex XI of the EE-Directive lists a series of criteria that should guide Member States in their approach towards a more energy-efficient grid. It mentions in particular that tariffs should reflect cost-savings achieved through demand-response and distributed generation and that Member States may support dynamic pricing for demand response measures.

To ensure that Member States comply with their obligations, the EE-Directive mandates that by 30 June 2015 they must have undertaken an assessment of the energy efficiency potentials of their grids and have identified the measures and investments necessary for cost-effective energy efficiency improvements, with a timetable for their introduction.[120] Member States are further required to remove those incentives in grid tariffs that are detrimental to the overall efficiency of the system and those that "hamper participation of demand response, in balancing markets and ancillary services procurement". Finally, Member States have to make sure that grid operators improve the design and the operation of the infrastructure to increase its efficiency and allow suppliers to improve consumer participation in system efficiency.[121]

Mirroring the provisions on RES, the EE-Directive requires that Member States guarantee the transmission and distribution of electricity from high-efficiency co-generation by providing it priority or guaranteed access and by determining special conditions for its connection to the grid.[122] Also, Member States have to ensure that demand-side resources, such as demand response, are encouraged "*alongside supply in wholesale and retail markets*". Accordingly, demand response providers, including aggregators, have to be treated in a non-discriminatory manner with respect to balancing and ancillary services.[123] Finally, similar provisions on the design of National Energy Efficiency Action Plans, reporting and monitoring, to those laid down by the RES-Directive, round off the picture.[124]

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[114] Grid losses are defined as the amount of electricity that is consumed by a power system for the transmission of electricity from generation to consumption. In the EU, the average losses in transmission grids are between 1% and 2.6% and between 2.3% and 11.8% in distribution grids. See Ecofys (2013: 2).
[115] EE-Directive, Article 15 par. 1.
[116] Ecofys (2013: 4).
[117] Ecofys (2013: 5).
[118] EE-Directive, Article 15 par. 1.
[119] Ecofys (2013: 7).
[120] EE-Directive, Article 15 par. 2.
[121] EE-Directive, Article 15 par. 4.
[122] EE-Directive, Article 15 par. 7.
[123] EE-Directive, Article 15 par. 8.
[124] EE-Directive, Article 24.

C. Evaluation of the European Legislative Framework

The European regulatory framework sets out basic framework conditions for the deployment of Smart Grids according to the priorities set out by the 20/20/20 target aiming at a reduction of greenhouse gas emissions, the deployment of RES and an increase in energy efficiency. Overall broad discretion is left to Member States how to implement these goals. This takes into account the diversity of the power generation mix, the market and the existing structure of Member States' electricity grids and reflects the different levels of "*smartness*" that are needed.

The vague character of many provisions however also carries the risk that Member States will drag their feet in implementing appropriate changes. Also, the current economic downturn may tempt many Member States to reduce their support to Smart Grids. Given the current uncertainty regarding the carbon signal after 2020, private parties may further be reluctant to engage in infrastructure investments whose benefits are uncertain and, if they do, will materialise only in the mid- and long-term. Finally, it is important to keep in mind that the Smart Grid threatens the business model of some of the main players who may well try to block or at least slow down its deployment.

While the setting of sometimes ambiguous framework conditions reflects the unavoidable compromises that the European decision-making process entails, it is also the expression of the regulatory puzzle that the deployment of Smart Grids poses. As a matter of fact, there exists no consensus as to what type of regulatory framework will prompt a quick and efficient deployment of Smart Grids. While some experts argue that, given the characteristics of the industry, only its complete re-regulation could bring about the desired results,[125] others stress that a market-driven deployment of Smart Grids will contribute both to more innovation and to more cost-efficiency and will eventually also address some of the problems of the liberalisation process.[126]

The more general question is thus how policies should be framed to ensure that grids incorporate the increased level of intelligent functionalities and make them accessible to the largest majority of users, while keeping costs as low as possible. This further gives rise to the questions on the form of regulations and the determination of the actors that will be responsible for delivering the required functionalities.[127] While we do not intend to provide a final answer to these questions, we want to sketch out some of the decisions that Member States will have to make within the boundaries set by the European framework.

1. The Setting of New Incentives

One of the crucial questions that Member States will have to address is what needs to be done to incentivise grid operators to encourage both the integration of large quantities of distributed RES and energy efficiency? More specifically, how can electricity grid regulation move from grid-cost-incentive based towards "*combined grid-cost-incentive, operational quality-incentive and sustainability-incentive based*"?[128]

[125] http://smartgridtech.wordpress.com/the-case-for-regulated-monopoly-in-the-electric-grid/
[126] See COM (2011) 202.
[127] Clastres (2011: 31).
[128] Vandezande (2012).

When it comes to defining regulatory incentives for Smart Grids' outputs, regulators face an unprecedented challenge. The current revenue models of grid operators are mostly volume-based and include various forms of price control mechanisms, such as price- and revenue-caps, which incentivise short-term cost reductions, but not innovation and modernisation.[129] While the volume-based remuneration discourages energy-efficiency measures, cost-reduction incentives may prevent the development and deployment of distributed generation.

Under the new regulatory framework three main goals have to be pursued: first, the integration of massive amounts of distributed generation, in particular RES, second, the integration of demand-response measures and storage, and third, the upgrade of transmission lines to absorb energy from large-scale RES.[130] All three targets require the development of new grid services, new technologies and the creation of incentives for grid users to participate actively in the management and the development of the grid.

For instance, to encourage distributed generation, tailor-made services need to be developed and technologies to be installed that ensure the monitoring, communication and control capabilities of the distribution grid.[131] To incentivise demand-response and the installation of storage, an active management of the grid is necessary: information has to be dispatched to all actors and their participation has to be encouraged with a view to optimising the functioning of the grid.[132] Finally, the integration of more important quantities of large-scale RES requires the general reinforcement of the transmission grids, the deployment of innovative technologies, such as HVDC for off-shore grids, and the participation of producers in the planning of new grids.[133]

Accordingly, to accelerate the deployment of Smart Grids, a fundamental reassessment of the revenue models of grid operators will have to be undertaken to adjust the incentives of the grid operators. An interesting approach in this respect is represented by the new RIIO[1] model, which rewards the achievement of outputs that aim at the improvement of the services to grid users, long-run cost reductions, and incentives for energy efficiency.[134] However, many questions remain as to how it will accelerate the deployment of Smart Grids.

While, theoretically, output regulation is superior to input regulation as it leaves more flexibility to companies in the implementation of the goal, it also has its limitations. In practice it can be difficult to define and measure appropriate performance targets and measurable output parameters, in particular with respect to the numerous and sometimes conflicting requirements of Smart Grids.[135] Also, a reform of grid tariffs is unlikely to be able to address all challenges. Grid tariffs are not, for instance, an appropriate instrument to incentivise infant technologies that are still at the R&D stage.[136] Hence, other funding mechanisms should be envisaged, such as public–private partnerships and the imposition of public service obligations, particularly if goals are pursued that do not benefit grid users but society at large. Finally, it will be important to create an overall environment that is conducive to innovation processes.[137]

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[129] THINK (2012:11).
[130] Meeus et al. (2010: 2).
[131] Meeus et al. (2010: 3).
[132] Meeus et al. (2010: 3).
[133] Meeus et al. (2010: 4).
[134] THINK (2012: 11).
[135] EU SGTF (2011: 15).
[136] Meeus et al. (2010: 8).
[137] Bauknecht (2011).

2. The Setup of the Information Infrastructure

Until recently, the distribution grid was considered a classical natural monopoly, which distributed electricity from point A to point B. With the inclusion of new services and the active management of bi-directional flows of both information and electricity, the nature of the grid business changes radically. One of the questions that this new situation raises is which tasks should be performed by the system operators and which can or should be "*outsourced*" to third parties? Also, to the extent that third parties are entrusted with some of these tasks, the question arises of whether this will affect the overall regulatory design.

We shall illustrate this question through the example of the information layer. One of the crucial tasks of a Smart Grid will be to provide an information infrastructure which both collects and dispatches information on the actual system conditions to the various grid users. Given this setup, the information infrastructure has been described as a multi-sided platform that is characterised by cross-network effects, which means that benefits to be realized by one group of customers crucially depend on the participation of others.[138]

The creation and operation of an information platform requires investments in the physical infrastructure (i.e. communication technologies, smart meters) and the mechanisms that allow the dispatch of the information.[139] Theoretically, these two elements can be carried out by two separate entities, which will, however, have to operate in close coordination to ensure the effective functioning of the information platform. Given its network effects it is difficult to see how a business case can be built without some form of state intervention.

When it comes to allocating the responsibility for the operation of the information platform, the national regulatory framework and culture plays an important role.[140] The UK, for instance, plans to entrust the handling of the data to a "*Data and Communications Company*" (DCC) that will be selected through a competitive tendering process. The chosen company will be subject to the control of the regulator and recover its costs through regulated service charges. France, in contrast, has decided to charge the distribution system operator (DSO) both with the setup of the physical infrastructure and the handling of the information flows. Costs of the roll-out of smart meters are to be borne by the society at large.[141]

As these two examples suggest, the information platform can be delivered by different actors, which have both advantages and trade-offs.[142] The allocation of the responsibility to the DSO will probably enhance the overall coordination of the system. It will, however be more difficult to ensure the neutrality and the non-discriminatory handling of the information flows. The indepe ndent company provides better guarantees as to its neutrality, but this might come at the expense of other grid services related to the enhancement of the system stability.[143]

[138] Brandstätt et al. (2012: 2).
[139] Brandstätt et al. (2012: 2).
[140] Brandstätt et al. (2012: 2).
[141] Brandstätt et al. (2012: 4).
[142] Friedrichsen et al. (2013: 10).
[143] Friedrichsen et al. (2013: 10).

IV. Outlook: A paradigm Shift for Electricity Regulation?

At present, electricity regulations focus on grid operators. To ensure that they do not abuse their monopoly position, the terms and conditions for connection and access to the grids are controlled by neutral regulators, whose core duty constitutes the fixing or approving of transmission and distribution tariffs or their methodologies.[144] While the emphasis placed on the regulation of grid tariffs may have been justified in the past, this approach becomes too narrow in the light of the requirements that the deployment of Smart Grids entails. One of the main regulatory challenges will consist of creating a neutral platform that ensures the smooth coordination of an increasing set of heterogeneous grid users and markets.

We argue that these new challenges justify a more fundamental reassessment of the current regulatory system than has been done to date. First, the current focus on grid tariffs has to give way to a broader view which encompasses all terms and conditions related to the access to facilities that are essential for the deployment of Smart Grid activities. Second, the role of the regulator in the tariff-setting procedure should be challenged. The current system requiring an ex ante decision on either the methodologies or the tariffs by the regulator may indeed become increasingly inappropriate in a changing environment which values innovation, flexibility and rapidity. Third, the regulatory framework should take into account the increasing involvement of third parties in the grid business

Pollitt suggests that a stronger focus of regulations should be placed on processes rather than outcomes.[145] Along the same lines, some authors argue that more space should be given to negotiated settlements, which would guarantee more targeted outcomes, reduce regulatory intervention and provide protection against a "*regulator knows best*" philosophy. [146] Such an approach does not make the regulator redundant, but would change its current role. Instead of fixing or approving access conditions, it would become an enabler of negotiations and "*an instance to fall back upon and provide arbitration when negotiations fail*".[147] While such a change of paradigm does not imply that grid access regulation would become obsolete, it implies that outcomes are shaped principally by stakeholders and state intervention will be confined to tackling market failures and ensuring the pursuit of goals in the public interest.[148]

Some lessons in this respect may possibly be drawn from telecom regulations.[149] The premises of the Smart Grid resemble that of the telecommunication sector, where the regulator focuses on promoting competition for a large set of activities while securing non-discriminatory access to those facilities that are owned by the network operators and that cannot be duplicated.[150]

To guarantee the latter, the telecom regulator is entitled to impose on network operators with "*significant market power*"[151] a range of obligations.[152] It may, for instance, impose

[144] See E-Directive, Art. 15 par. 1; Maes (2012: 123).
[145] See Pollitt (2008: 76).
[146] Friedrichsen et al. (2013: 6).
[147] Friedrichsen et al. (2013: 8).
[148] See Pollitt (2008: 76).
[149] See Pollitt (2010).
[150] See for a comparison of both sectors Pollitt (2010).
[151] See for a discussion of this term Burri (2007: 209).
[152] Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (Access Directive), See Art. 9-15.

obligations of transparency, of non-discrimination or of accounting separation. An even stronger remedy represents the right to impose an obligation to give access to, and use of, specific network facilities. This includes, in particular, granting third parties access to specified network elements and/or facilities that operators negotiate in good faith with undertakings requesting access. Furthermore, they must not withdraw access to facilities already granted and must grant open access to technical interfaces that are indispensable for the interoperability of services. The most "invasive" remedy, finally, is the right granted to the regulator to impose price controls that prevent excessive and predatory pricing.

When imposing this set of obligations, regulators must be guided by the objectives of the telecom framework, in particular the promotion of competition to the benefit of the customers.[153] The intervention has to be proportionate, i.e. it must not exceed what is necessary to achieve the goal pursued.

While, of course, the electricity industry differs in many respects from the telecom sector,[154] the underlying philosophy of its regulatory framework may well guide future regulation of Smart Grids. The following ideas may be worth considering and exploring further: first, actors should in principle be able, within the boundaries of competition law, to freely agree on the terms of their interaction. This is important in a system where the boundaries between monopoly and commercial businesses are increasingly blurred. Second, while state intervention is justified, namely to rectify market failures and to pursue goals of public interest, it should be done in a proportionate manner and with a view to encouraging the provision of Smart Grid services on a competitive basis.[155] Last but not least, the regulatory framework should be sufficiently flexible to adapt to the changing needs and requirements of a rapidly evolving industry.

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153 See Burri (2007: 230).
154 See for a comparison oft the sectors Pollitt (2010).
155 See Burri (2007: 326).

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