Smart Energy Grids

Smart Energy Grids within the Framework of the Third Energy Package

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The installation, design and functional potential of energy distribution networks are expected to change dramatically over the next decade. This process is essential to meet the specific demands set by the European legislator. Power distribution and transmission systems are being transformed into smart grids. But what is a smart grid? There is no single conclusive definition of what constitutes a "smart grid". One of its major features involves the architecture of an intricately automated infrastructure to facilitate the envisaged renewable power distribution. The development of smart grids is subject to binding legal requirements as laid down in the Third Energy Directive. The aim of this article is to explore and describe some of the key features of smart grids, and to use this as an instrument of analysis to identify the demands of the European Energy Legislation with respect to smart grids more clearly. Still, a lot remains to be clarified. For instance, another major issue that deserves closer consideration concerns the interrelation with telecommunications and defining its legal aspects under new EU NRF legislation. This article's focus is restricted to an analysis of the legal and regulatory framework for the energy sector only.

I. Introduction

The energy sector is about to cross the threshold towards major developments that will require tremendous new investment.[1] Many years of innovative research in transmission and distribution networks have resulted in the architecture of sophisticated smart grid designs. This new development takes place within the context of the European Union[2] and its progress has to be driven by consistent assistance from within the framework of the Third Energy Package.[3] Stimulation of this development process is listed as a high ranking priority in the two directives that are part of the Third Energy Package.[4] In November 2009 a special Smart Grid Task Force was installed[5] by the European Union in order to promote this development. This Task Force has been assigned the task of drafting a set of advisory rules to streamline an efficient, cost effective and consistent implementation of smart grid technology in the EU.[6]

In this respect it is relevant to know which articles of existing EU regulation apply to this new technology and will potentially require adaptation. Procedural standards dictate that smart grids are implemented in conformity with binding legal requirements as laid down in the Third Energy Directives,[7] e.g. in compliance with the universal right to be connected

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[1] European Commission, Communication "Energy infrastructure priorities for 2020 and beyond – A Blueprint for an integrated European energy network", p. 9; http://ec.europa.eu/energy/infrastructure/strategy/2020_en.htm.

[2] EC, DG Energy, Direction for Security of Supply and Energy Markets (2009). "Mission for the Task Force for the Implementation of Smart Grids into the European Internal Market", Dec. 2009; See: European Commission, Communication "Energy infrastructure priorities for 2020 and beyond – A Blueprint for an integrated European energy network", adopted on 17 November 2010, p. 6 and 11.

[3] The Third Energy Package comprises Directive 2009/72/EC; Directive 2009/73/EC; Regulation (EC) No. 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; Regulation (EC) No. 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005; Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 on establishing an Agency for the Cooperation of Energy Regulators.

[4] European Commission, Directorate General for Energy, Direction for Security of Supply and Energy Markets (2009). "Mission for the Task Force for the Implementation of Smart Grids into the European Internal Market", December 2009; Available online at: http://ec.europa.eu/energy/gas_electricity/smartgrids/taskforce and htm and http://ec.europa.eu/energy/gas_electricity/smartgrids/doc/work_programme.pdf.

[5] European Commission, Directorate General for Energy, Direction for Security of Supply and Energy Markets (2009). "Mission for the Task Force for the Implementation of Smart Grids into the European Internal Market", December 2009; Available online at: http://ec.europa.eu/energy/gas_electricity/smartgrids/taskforce and htm and http://ec.europa.eu/energy/gas_electricity/smartgrids/doc/work_programme.pdf.

[6] EC, DG Energy, Direction for Security of Supply and Energy Markets (2009). "Task Force Smart Grids – Vision and Work Programme", December 2009

[7] Directives can impose obligations on Member States only. A directive is binding in its entirety and as to the result to be achieved. Member States have discretionary authority to choose form and means. T.C. Hartley, *The Foundations of European Community Law*, 6th ed, Oxford: Oxford University Press, 2007, p. 102-104, 201-206; M. Horspool and Matthew Humphreys, *European Union Law*, 4th ed., Oxford: Oxford University Press, 2006, p. 77-78.

to the power distribution network as well as free access allowance to energy markets. This article will thoroughly explore the implications of these directives for the implementation of smart grids in the electricity sector in particular. It is expected that that implementation of smart grids in this sector will upturn the most. Every consumer depends on a sustainable supply of electricity and every household has a right to be connected to the electricity network. As far as the supply of gas is concerned, such a right does not exist.[8] Therefore, this article shall focus exclusively on the importance of a set of adequate Third Electricity Directive regulatory standards for the integration of smart grid technology into the existing electricity grid.

A description of relevant Third Electricity Directive smart grid criteria requires broad consensus on what constitutes a smart grid, followed by a concise definition of its distinctive features compared to existing energy networks. Only then can the relevance of existing European regulation directives and their likely implications for the design and implementation of smart meters be determined. Therefore, the article will start off by defining a smart grid. In the conclusive observations at the end of the paper, opportunities and limitations within the EU NRF relating to their implementation will be assessed accordingly.

II. What are Smart Grids?

2.1 Introduction

The concept of ''smart grids'' is extremely comprehensive and there is no one clear and unambiguous definition to describe its potential.[9] Subsequently, there can be no formal legal definition of the concept. Policy documents and scientific literature present various definitions to explain smart grids technology.[10] A wide range of scenarios, paradigms, prospects and visions on smart grid[11] designs, illustrating a vast number of targets and features is currently available. Their objectives vary from the security of the supply or optimization of demand and supply inputs to the achievement of climate and environmental goals. Smart grids exist on various scales, ranging from a highly self-sustained network to facilitate a small generated energy supply, to turning the existing local grid into a cross border super grid simply by making use of the available ICT infrastructure.

Concering smart grids, we are dealing with a multipurpose concept, the components of which refer to a future infrastructural energy distribution system.[12] A highly sophisticated system that adheres to the anticipated developments in the energy market as well as to new government requirements related to the demand and supply of energy. A number of key features and objectives of smart grids will be elaborated on in the next sections of this article. Only the specific characteristic properties of elements that are relevant for screening the Third Electricity Directive will be considered for further evaluation.

It is also important to differentiate between the nationwide transmission system and the local distribution networks. The national transmission system consists of a surplus of high voltage wires. Distribution networks mainly consist of middle and low voltage cables. Consumers are usually connected to the distribution networks only. It is obvious that any major changes that will occur after the integration of smart grids will mostly affect the distribution networks. Within most member states the national transmission system already functions as a smart grid, but it is essential that it also becomes a smart grid with

[8] A connected gas consumer is entitled to a gas supply of a reasonable quality at a reasonable price, Annex I, Section 1, sub g. Gas Directive. The validity of this provision does not extend its scope to a universal right to be connected to a distribution network. This distinctive feature is a contradiction to art. 3, sub 3 of the Electricity Directive, which defines the consumer's universal right to be connected to the power distribution network.

[9] European Technology Platform on Smart Grids (ETP), Strategic Research Agenda for Europe's Electricity Networks of the Future, 2007, p. 8; ERGEG, Position Paper on Smart Grids, 10 December 2009, p. 26.

[10] KEMA, Reflections on Smart grids of the future, March 2008, p. 8; ETP, Vision and Strategy for Europe's Electricity Networks of the Future, 2006, p. 4; ERGEG, Position Paper on Smart Grids, 10 December 2009, p. 11-14; Debora Coll-Mayor, Mia Paget, Eric Lightner, ''Future intelligent power grids: Analysis of the vision in the European Union and the United States'', *Energy Policy* 35 (2007), p. 2461-2462. Cf. ERGEG, Position Paper on Smart Grids, 10 Dec. 2009, p. 12; US Department of Energy, The Smart Grid Stakeholder Roundtable Group Perspectives, September 2009, p. 4-5; EC, DG Energy, Direction for Security of Supply and Energy Markets (2010), ''Task Force Smart Grids – visions and work programme'', March 2010; http://ec.europa.eu/energy/gas_electricity/smartgrids/taskforce_en.htm; EC, DG Energy, Direction for Security of Supply and Energy Markets (2010), ''Task Force Smart Grids – visions and work programme'', March 2010; http://ec.europa.eu/energy/gas_electricity/smartgrids/taskforce_en.htm.

[11] G. Ault, D. Frame, N. Hughes, N. Strachan, ''Electricity Network Scenarios for Great-Britain in 2050 – Final Report for Ofgem's LENS Project'', November 2008. The assignor Office of Gas and Electricity Markets (OFGEM) is a public body that is governed by the Gas and Electricity Markets Authority, whose duties and authorities are defined in the Gas Act (1986), Electricity Act (1989) en Utilities Act (2000). The LENS-rapport is available online at: http://www.ofgem.gov.uk/Networks/Trans/ElecTransPolicy/lens/Documents1/20081107Final20Report.pdf. Also: Op weg naar intelligente netten in Nederland; Discussion paper from Taskforce Intelligence Networks, July 2010, Dutch Secretary of Economic Affairs, p. 25-31

[12] Vgl. Clingendael International Energy Programma (CIEP), Energiebeleid en de Noordwest-Europese markt: Brandstofmix en infrastructuur, February 2010, p. 9-11.

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respect to the cross-border interconnections of high voltage lines between member states.

2.2 Integration of power installations for the generation of sustainable energy; maintaining balance and security

We must prepare ourselves for a rapid expansion of sustainable energy generation installations, such as large and smaller scale wind farms and solar panels. This development is likely to impact significantly on the continuous imperative of ensuring a balance between supply and demand on the network. Maintaining a balance between supply and demand is necessary for a successful system performance and is considered a crucial factor to guarantee the quality and reliability of the distribution network.[13] This is partly due to the fact that there are hardly any storage provisions to collect and store electric power in an economically profitable way. All generated power must be used immediately. It is this aspect in particular that affects the security of the network. Irregularities in supply and demand may lead to (major) power failures.

Balancing electricity demand and sypply will become more and more complex when large scale generation of renewable energy will take effect. Weather induced renewable energy generation from wind and solar energy sources, for example, is intermittent because it relies entirely on atmospheric conditions. A cloudy or windless day is not uncommon in our climate. Therefore, this source of renewable energy does not provide a predictable or consistent production level that can be planned ahead. A rapid expansion of renewable energy installations and their fluctuating feed-ins demands extremely intricate system requirements for which current distribution networks are as yet insufficiently equipped.

In fact, this is a problem that large-scale offshore and land-based wind farms are currently facing. Their renewable energy generation units necessitate the installation of new high voltage networks.[14] These networks have to operate smarter as they expand. Intelligent generated power storage facilities will have to be developed to compensate for the expansion of these high voltage units.

In contrast to this large-scale generation, this article will mainly address smart grids that are designed to facilitate the integration of new relatively small-scale generation units that will be connected to the distribution networks.

As regards the implementation of smart grids it is envisioned that they will tremendously change the role of distribution networks, compared to their current functioning.[15] In view of the planned large-scale integration of numerous smaller wind parks, solar cells and other renewable energy units, the structural features of existing distribution networks will have to be transformed considerably. The integration of these installations will place new demands on the construction of the network, as power inputs into the network will originate from different places than conventional large (fossil) power stations that are connected to the nation-wide transmission system, i.e. the high voltage network.

These expected changes will greatly extend the tasks allocated to the distribution system operators; besides securing the supply of electric power to consumers, they have to provide access to local producers to feed their "homegrown" generated power into the network. It follows that in an increasingly complex market smart grids are implemented to optimize the performance of the distribution network[16] so as to ensure the balance between demand and supply at all times. Intelligent networks are therefore necessary to enable the feed-ins of renewable electric power that is generated decentralized[17] and to secure the robustness of the network infrastructure in a rapidly changing energy market.

At this time it is primarily the national transmission network operator that is in charge of balance control.[18] The biggest share of energy inputs is

[13] H. Knops, *A Functional Legal Design for Reliable Electricity Supply*, Antwerpen: Intersentia (2008), p. 10; ERGEG, Final Revised Guidelines of Good Practice on Electricity Balancing Markets Integration, 9 September 2009, p. 10; J. Tooraj and M. Pollitt, "Security of supply, and regulation of energy networks", *Energy Policy*, Volume 36, Issue 12, December 2008, p. 4584-4589; Clingendael International Energy Programme (CIEP), Energiebeleid en de Noordwest-Europese markt: Brandstofmix en infrastructuur, February 2010, p. 23-24.

[14] CEER, Regulatory aspects of the integration of wind generation in European electricity markets, A CEER Conclusions Paper, July 2010, p 16-17 and 19-22; COM(2010) 677 final, Communication from the Commission, Energy infrastructure priorities for 2020 and beyond – A Blueprint for an integrated European energy network, p. 6.

[15] ERGEG, Position Paper on Smart Grids – An ERGEG Conclusions Paper, 10 June 2010, p. 22-23; G. Ault, D. Frame, N. Hughes, N. Strachan, "Electricity Network Scenarios for Great-Britain in 2050 – Final Report for Ofgem's LENS Projects", November 2008, p. 103-104; COM (2010) 677 final, Energy infrastructure priorities for 2020 and beyond – A Blueprint for an integrated European energy network, Brussels, 17 November 2010, p. 39-40.

[16] Article 15 Directive 2009/72/EC on the subject dispatching and balancing refers only to TSO's and art. 26 Directive 2009/72/EC. Recital 28 of Directive 2009/72/EC; See art. 26 Directive 2009/72/EC. TenneT, Annual Report 2009 – Netwerken, Arnhem 2010, p. 4-5.

[17] CEER and ERGEG, "Smart Grids and smart regulation help implement climate change objectives, A Fact Sheet by the European Energy Regulators on how smart grids can help meet climate change objectives and empower customers", January 2010.

[18] TenneT, Kwaliteits- en Capaciteitsplan 2010-2016, Management survey, Arnhem, 30 November 2009, p. 7; AER, Brandstofmix in beweging. Op zoek naar een goede balans, Den Haag, January 2008, p. 51; Dutch Ministry of Economic Affairs, Op weg naar intelligente netten in Nederland – Discussion paper on Taskforce Intelligente Netten, July 2010, p. 6, 16 and 52-53.

produced by large installations that are connected to the high voltage network. Momentarily there are hardly any production units that are directly linked to distribution networks.[19] This means that if equilibrium on the network is disrupted, only the main large-scale conventional energy companies will be called upon to restore the balance. They do so by ceasing or increasing production, which they are compensated for by the national transmission network operator at the going market price.[20]

If small-scale generated renewable energy from local units will be integrated into the distribution network to a great extent, it can be anticipated that balancing will become a more decentralized matter too, thereby (also) becoming a responsibility of distribution network operators. This may partly be due to the occurrence of a new phenomenon, i.e. individual agreements with small-scale contract partners. It is to be expected that as a consequence of the implementation of smart grids the distribution system operator's duties will be widened in a way similar to those of the current transmission system operators,[21] but with the exception that their responsibilities are limited to a single region. Therefore, distribution network operators too will increasingly have to adapt to play a more active role in operating the network.

Supply and demand determine the price in the energy market. The energy market itself falls beyond the scope of a smart grid,[22] but a smart grid can play an interactive role in that particular market and make it function more efficiently. In case of impending supply disruptions, a smart grid could provide the necessary information to guide market behavior and this way facilitate an efficient price mechanism.

2.3 Flexibility

The energy distribution network has been designed to maintain a continuous balance between consumer demand and the available energy as supplied by generators. In the event of impending imbalance, these have to adjust immediately to accommodate any shortfall or surplus on the network. Equilibrium can be restored by consumers using less than they intended, thereby reducing demand, or by producers increasing supply in case of excess demand.

Maintaining the balance between supply and demand on a smart grid is characterized by a high degree of flexibility,[23] needed to eliminate the risk of outages induced by ever-changing energy demands or sudden changes in supply as a result of fluctuating weather conditions. This self-healing intelligence should enable distribution network operators to actively adjust the system to accept and feed in electricity so as to ensure the security of the network.[24] Special computerized programs and marketable services can be developed to meet these new flexibility requirements.[25]

At this time, flexibility at the level of a distribution network is quite unlikely. Today's estimates of the needed capacity of distribution networks are entirely based on an average hourly peak demand. In reality, consumers tend to use electric power when needed, which implies that access to electric power has to be warranted also in peak situations so supply has to adjust accordingly. In the existing situation, a considerable proportion of the available capacity of electricity grids remains unused and gets wasted every day. An alternative solution would be to make consumers aware of the advantages of spreading their household energy peak demands to achieve a more economical use of power, for instance with a (digitally) programmed and (semi) remotely controlled operation of fan motors in freezer, refrigerator and air conditioner or when charging the electric car.

2.4 The energy consumer; from a passive user to an active contributor

Another distinctive element of the smart grid concept is that end-users and their respective energy demands

[19] R. van der Veen en L.J. de Vries, "The impact of microgeneration upon the Dutch balancing market", *Energy Policy* 37 (2009) 2788-2797, p. 2789-2790; ERGEG, Final Revised Guidelines of Good Practice on Electricity Balancing Markets Integration, 9 September 2009, o.a. p. 10; C. Jones (ed.), *EU Energy Law*, Vol.1, The Internal Energy Market: The Third Liberalisation Package, 2010, p. 540-541.

[20] R. van der Veen en L.J. de Vries, "The impact of microgeneration upon the Dutch balancing market", *Energy Policy* 37 (2009) 2788-2797, p. 2789-2790; ERGEG, Final Revised Guidelines of Good Practice on Electricity Balancing Markets Integration, 9 September 2009, i.a.. p. 10; C. Jones (ed.), *EU Energy Law*, Vol.1, The Internal Energy Market: The Third Liberalisation Package, 2010, p. 540-541.

[21] R. van der Veen en L.J. de Vries, "The impact of microgeneration upon the Dutch balancing market", *Energy Policy* 37 (2009) 2788-2797, p. 2789-2790; ERGEG, Final Revised Guidelines of Good Practice on Electricity Balancing Markets Integration, September 9, 2009, o.a. p. 10; C. Jones (ed.), *EU Energy Law*, Vol.1, The Internal Energy Market: The Third Liberalisation Package, 2010, p. 540-541.

[22] Regional Body Energietransitie Nederland, Duurzame energie in een nieuwe economische orde, 14 November 2008, p. 20.

[23] Article 25 Directive 2009/72/EC: tasks of distribution system operators.

[24] View Annelies Huygen, De consument en de (on)vrije elektriciteitsmarkt, in: De consument en de andere kant van de elektriciteitsmarkt (ed. S. Pront-van Bommel), Amsterdam: Centre for Energy, Faculty of Law, UvA, Januari 2011, section. 5.3; R. Walawalkar, S. Fernands, N. Thakur and K. Reddy Chevva, Evolution and current status of demand response (DR) in electricity markets: Insights from PJM and NYISO; *Energy*, Volume 35, Issue 4, April 2010, p. 1553-1560.

[25] ERGEG, Position Paper on Smart Grids, An ERGEG Public Consultation Paper, 10 December 2009, p. 21.

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are the point of focus.[26] End-users can be households as well as small or medium sized enterprises and even conglomerates. This articlés focus will be on the substantial group of small-scale consumers such as households and smaller enterprises. These end-users will hereafter be referred to as energy consumers.[27]

Smart grids are designed to facilitate the energy consumers' free choice.[28] They should therefore be equipped to facilitate not only consumer demand but to manage the input of new energy production as well. In the latter case any home-generated energy is primarily destined for household use, but surplus quantities can be fed into the network and made available to other end-users. This transforms the energy consumer profile into that of an energy supplier at the same time. In this dual capacity these consumers are referred to as a prosumers.[29] Prosumerś should be entitled to freely negotiate any amount of their home-generated energy surpluses on the network and they should be provided with intermediary services if and when required.

Consumers are a valuable group to be reckoned with in their expected role in fulfilling European climate and environmental targets,[30] which is one of the considerations for defining consumer behavior as a determining factor in the design of smart grids. Consumer behavior is regarded as a strategic link for the attainability of government objectives to reduce CO_2 emissions and reach energy efficiency, i.e. a sustainable energy generation in accordance with the so called 20%-20%-20% targets set for 2020.[31] Smart grids are capable of shaping consumer behavior.

Future consumers will have access to smart meters and other technological innovations that will enable them to obtain real-time data on a two-way frequency information flow showing both their energy use as well as their own supply of home-generated energy. Moreover, with the support of new technology and intelligent appliances that have built-in technologies to respond to signals from the grid, consumers will be able to transfer their energy demands to times their usage will have the least effect on the ability to maintain the energy balance, i.e. when sustainable energy levels are high and prices are low. Energy consumers taking charge of their own energy consumption and generation make beneficial real-time decisions based on real-time prices.

Future energy consumers will have the option of contracting a service provider for the facilitation of their activities on the network. This provider must have authorized full access to frequent real-time data with regard to the usage and generation as well as to the supply and demand patterns of the contracting party. Moreover the service provider does not necessarily have to be an existing network operator or energy supplier.[32]

2.5 The ICT network

Maintaining the energy balance in the context of an increasingly intricate environment of demand and supply of electric power requires detailed forecasts, frequent submission of accurate data and a sustained monitoring of demand and supply also at the level of distribution networks. At this time the organisation of distribution networks is not equipped with the appropriate technology[33] to operate their own networks.

Smart grids cannot be developed without the underlying support of highly advanced innovative information and data communication technology (ICT). Technology modules may be installed to facilitate mass access to the energy network for consumers acting as prosumers,[34] or to steer the demand for energy – which is also an inherent feature of renewable energy generation. Furthermore, they may facilitate the integration of a large number of small-scale and widely spread installations for the generation of renewable energy. Finally, they can be employed for a sophisticated mechanism for balance maintenance and its required flexibility. None of the above can be realized without a consistent and

[26] S. Pront-van Bommel, 'De elektriciteitsconsument centraal', in: *De consument en de andere kant van de elektriciteitsmarkt* (ed. S. Pront-van Bommel), Centrum voor Energievraagstukken Universiteit van Amsterdam 2011, section, 3.

[27] Ibid.

[28] European Technology Platform on SmartGrids, Vision and Strategy for Europe's Electricity Networks of the Future, 2006, p. 12. This Europese platform is esthablished in 2005 by the t DG Research of the European Commission.

[29] S. Pront-van Bommel, 'De elektriciteitsconsument centraal', in: *De consument en de andere kant van de elektriciteitsmarkt* (ed. S. Pront-van Bommel), Centrum voor Energievraagstukken Universiteit van Amsterdam 2011, section, 3.

[30] G. Ault, D. Frame, N. Hughes, N. Strachan, "Electricity Network Scenarios for Great-Britain in 2050 – Final Report for Ofgem's LENS Project", November 2008. The Office of Gas and Electricity Markets (OFGEM) is a government body, under the supervision of the Gas and Electricity Markets Authority, whose task and responsibilities are stipulated in the Gas Act (1986), Electricity Act (1989) and Utilities Act (2000). The LENS-report is available at: http://www.ofgem.gov.uk/Networks/Trans/ElecTransPolicy/lens/Documents1/20081107Final%20Report.pdf.

[31] See for clarification: S. Pront-van Bommel, Het Derde Energiepakket, SEW 2010, p. 264.

[32] EC DG for Energy, Direction for Security of Supply and Energy Markets, "Task Force Smart Grids – Vision and Work Programme", 1 March 2010, p. 3-4; ERGEG, Position Paper on Smart Grids, An ERGEG Public Consultation Paper, 10 December 2009, p. 7, 21-22.

[33] European Commission, Findings by the High-Level Advisory Group on ICT for Smart Electricity Distribution Networks On the Energy Sector, Smart Electricity Distribution Networks – ICT for a Low Carbon Economy, July 2010.

[34] Cf. ERGEG, Position Paper on Smart Grids, 10 December 2009, p. 20.

accurate exchange of information between all market participants involved and with the support of a highly sophisticated ICT network to enable sharing data input.

In other words, future distribution networks will no longer constitute just the physical grids consisting of iron, copper and aluminium, but they will be reinforced by a highly advanced complementary data communications network infrastructure. It is not the physical electricity network but the data communications network that will be subject to substantial changes.[35] It is the data communications network that will transform a distribution network into an intelligent system.[36] It is expected that the application of innovative IT and data communication technology may lead to a full integration of two distinctive networks, namely a coordinated resource sharing between a hardware electricity grid and a sophisticated IT networks infrastructure.

The question whether market participants can match supply and demand will furthermore depend on who and to what purpose will have access to data processed through the IT network. This participant can be either the energy consumer, the service provider acting on his behalf, or the distribution network operator exclusively. In this respect it may be of significance to gain insight in the legal aspects involved in the participation in imbalanced markets, as well as any other regulations and limitations that may apply.[37]

2.6 Summary

The design of smart grid technology and its envisioned large-scale implementationprompt legislators to review the regulatory scope of existing relevant European legislation and practice in relation to energy distribution systems. A questions in this domain is for example: will the ICT integrated physical electricity grid be part of the distribution network in the sense of the Third Electricity Directive? Questions like these are welcomed as they will ensure amongst other things that policymaking and adequate regulationary standards are introduced and adopted consistently across network infrastructures. For example, this will determine whether regulations concerning access to the electricity network are equally applicable to the ICT network it is interwoven with.

This leads to the question who should, or could, operate both networks and under which binding legal European conditions? Should the exclusive task of the distribution network operator also be extended to operating the integrated ICT network of the smart grid? Another inherent logical question would be whether the right to be connected to the network automatically includes the individual's right to feed his home-generated electricity into the distribution network.

The extended responsibilities for distribution network operators to balance the energy supply were labeled ''active'' network operations. The installation design of smart grid technology calls for a new definition of network operators' competence levels. Can the operation of an active interwoven distribution network still be considered the legal duty of the operators of the (public) distribution networks exclusively, even if these operational duties involve the supply and/or purchase of electricity? Existing energy law needs to be re-assessed to determine whether distribution network operators are entitled to enter into contracts with local producers, consumers, suppliers and other network operators for the purpose of maintaining a reliable balance (the so-called system services or support services).[38] Another relevant question may be which general services and other network activities, such as for example stimulating energy efficiency or the acquisition of electricity from third parties, can be added to the operational duties of network operators. It would then be necessary to assess the legal implications this entails.

The legal framework as described by the Third Electricity Directive will be assessed in the next paragraph in order to find appropriate answers to the above questions.

III. Legal Framework

3.1 General

The central question is which aspects of the Third Energy Directives' regulatory framework apply to the ICT technology underpinning smart grids, and what are the implications thereof. A clear description of the characteristic elements of regulatory aspects in this domain strongly depends on the following labels: distribution network, distribution network operator and network operation. These three labels will serve as a basis from which to proceed in the assessment of

[35] ERGEG, Position Paper on Smart Grids, An ERGEG Public Consultation Paper, 10 December 2009 p. 6-7 and 20; EC DG for Energy, Direction for Security of Supply and Energy Markets, ''Task Force Smart Grids – Vision and Work Programme'', 1 March 2010, p. 3-4.

[36] See for example: Debora Coll-Mayor e.a. (2007), p. 2453–2465. Cf. art. 1 sub c Instellingsbesluit Taskforce Intelligente Netwerken.; E. Niesten, ''Network investments and the integration of distributed generation: regulatory recommendations for the Dutch electricity industry'', *Energy Policy*, Volume 38, Issue 8, August 2010, 4355-4356.

[37] Vgl. ERGEG, Final Revised Guidelines of Good Practice on Electricity Balancing Markets Integration, 9 September 2009; C. Möller, S.T. Rachev, F.J. Fabozzi, Balancing energy strategies in electricity portfolio management, Energy Economics, Volume 33, Issue 1, January 2011, p. 2-11.

[38] See Annelies Huygen, De consument en de (on)vrije elektriciteitsmarkt in: 'De consument en de andere kant van de elektriciteitsmarkt (ed.. S. Pront-van Bommel), Amsterdam: Centrum voor Energievraagstukken UvA, section 2.7.

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Third Power Directive regulatory conditions and their relevance for the architecture of smart grid regulation.

3.2 Distribution network

Before elaborating on the issue of regulatory aspects it needs to be established whether a smart grid is a distribution network in the sense of the Third Electricity Directive. The Directive does not define a distribution network. It does however define the term distribution itself. According to the Directive's description, distribution is the physical transmission of electricity through high, medium and low voltage networks for the transport of power supply to consumers, excluding the physical supply itself.[39]

According to the Citiworks judgment of May 22, 2008 (C-439/06), the term distribution network should be interpreted widely so regulations that may potentially contribute to the Electricity Directive's objective of establishing a free market with allow for as many open networks as feasible. In that particular law suit an electricity supplier had appealed before the court against the ruling of the German Bundesministerium für Wirtschaft und Arbeit in the (federal) state of Saxony, to be granted a statutory licence to operate the network on behalf of Flughafen Leipzig/Halle GmbH (FLH).[40] As a result of the court's ruling FLH was under no (legal) obligation to allow consumers a non-discriminatory access to the network according to German Law.[41] In their judgment the European Court of Justice concluded that the term "distribution" should be interpreted as "distribution system". Consequently the European Court of Justice ruled that the request was in consistency with art. 20 of the Second Electricity Directive (art. 32 of the Third Electricity Directive). This ruling underlines each individual's right to free access to the energy market, a right that had equal validity in the case described.

According to this judgment, the Third Electricity Directive regulation is not restricted to the size of the network nor to the network operator's objectives, i.e. whether its contemplated network management involves frequent major or infrequent minor tasks. It is also irrelevant whether the network is owned by a private enterprise or by a legal entity that is predominantly government controlled.[42] As a consequence of this judgment, operation of distribution networks by private enterprises is clearly in accordance to the Third Electricity Directive. The court's ruling will therefore also apply to smart grids. Member States however have individual regulatory authority and may therefore adopt a different and stricter policy in national regulation, as will be elucidated in section 3.3 hereafter.

A second conclusion drawn from the Citiworks judgment must be that in order to determine whether a smart grid is a distribution network within the terms of the Third Electricity Directive, the meaning thereof should be broadly interpreted. It is evident that a smart grid, including its integrated ICT network, resorts under the provision of distribution, regardless of the nature its ownership. The reason for this explanation is particularly the vulnerability of the innovative ICT network that is interconnected with the physical electricity network and serves to ensure the reliability of the transmission network as well as the physical delivery of electricity to consumers. The Directive's definition is however not clear on this point.

Furthermore it is unclear whether the ICT infrastructure that is largely intended to facilitate participation in electricity markets by numerous connected parties is also covered by the terms of the Third Electricity Directive and whether it can therefore be considered a distribution network. Answering these questions will raise new questions as their outcome will co-depend on establishing the extent to which electricity network operators should be exclusively be allocated the task of facilitating these new markets. This latter query highly correlates with the next one, i.e. the extent to which, within the framework of European legislation, smart grids management can be – or should be – the exclusive task of a monopolist. They will therefore be worked out in more detail in section 3.3 hereafter.

The conclusion that the ICT network that is part of a smart grid that is regarded as a distribution network in the sense of the Third Electricity Directive has far reaching consequences, as for this ICT network all directive provisions for distribution networks apply. However in this instance it may be assumed that only the "conventional " ICT network installed to maintain the physical balance on the electricity network is involved.

3.3 Admission to the market; third access

Within the Citiworks judgment the legal reasoning to extend the interpretation of the term distribution to a distribution network was based on the universal right of access of individuals to the electricity market. This right is essential for the realization of a properly functioning internal energy market, which is one of the main objectives of the Third Electricity Directive.

The right of third access implies the right of a connected party to enter into an agreement with a supplier of his own choice, or, in a reverse situation, a supplier's right to negotiate with parties connected to any network. Such a supplier may – as was the case in the Citiworks judgment – be connected to an entirely different network than his consumers. This should however not impede the execution of supply contracts.

[39] Art. 2(5) Directive 2009/72.
[40] Section. 110(1), article 1 Gesetz über die Elektrizitäts- und Gasversorgung (EnWG).
[41] Section. 20(1) EnWG.
[42] See conclusion of Advocate General J. Mazák of 13 December 2007 in this case (section 75–87).

This supplier must be allowed to make use of all facilities that are available on the distribution network of his consumers for as long as his dependence on any of those facilities serves to enable the fulfillment of his obligations as a supplier. What counts of course is that the connected party had a choice whom to assign the facilitation to. The main issue here is that the individual's right of choice is warranted.

This interpretation of the Citiworks judgment and the right of access to the market could mean the following for smart grids. Each individual's right to access also includes the operation of the ICT network, which is part of smart grids and its integrated appliances. This would mainly concern the provision of data on the consumption and generation of electricity that are relevant for the execution of a variety of electricity contracts.

In the above situation this right of third party access should also apply to providers other than suppliers with whom consumers have entered into service contracts. This could be for instance a service to participate in imbalance markets or to make use of local facilities. The future will tell whether and to what extent connected parties depend on the support of the integrated ICT network in the smart grid. A separate ICT network for balancing demand and supply may develop as a side effect to the ICT infrastructure that is used for an active network management by distribution network operators. Alternatively, a cluster of ICT networks gathering data on energy usage could co-exist. The frequency and the purpose of communicating these data may vary. This could equally be the case in the data exchange between connected parties.

3.4 Distribution network operator

The Third Electricity Directive has a binding authority to assign duties and competences to distribution network operators.[43] EU member states have a mandatory obligation to implement these regulatory aspects in their energy legislation. Moreover, EU member states are under the obligation to appoint a distribution network operator for each network in conformity with art. 24 Third Power Directive. For the operational performance of a smart grid it is therefore essential to determine whether the person in charge of the ICT network has the qualifications to be considered as a distribution network operator.

A distribution network operator is a natural person or a legal entity that is responsible for proper operation, maintenance and, if necessary, a sustainable development of the distribution network as well as the ability to interconnect with other networks, if so required. That person will also have to ensure that a long term distribution of electric power is warranted to accommodate a dynamic demand.[44]

The regulatory body of the Third Electricity Directive does not distinctively stipulate that a distribution network operator must be a government or state enterprise. But Member States have the opportunity for energy legislation on a national level to insert a restrictive internal clause to determine that distribution network infrastructures are exclusively controlled by state-owned operators or state enterprises. Such a conclusion can be derived from the Citiworks judgment.[45] On a national level the regulatory policy of the Third Power Directive may be interpreted in a different way. The Dutch electricity legislation for instance has adopted an article that limits distribution network operation to the discretion of government institutions only.[46]

Network operators have monopoly power within their territory.[47] As it turns out, strictly speaking Third Electricity Directive regulation does not automatically preclude the occurrence of a multiplicity of networks operating within a dynamic competitive environment, and the potential delegation of control to more than one operator in the same locality. Member states can make use of their local authority to adopt a monopoly clause in their national legislation, as is the case in Dutch legislation for example. The Dutch electricity legislation provides a number of requirements in relation to the monopoly issue.[48] Firstly, it has been determined that a distribution network operator must perform his legal obligations exclusively, as the single operator. Secondly, distribution and network management are assigned specific regions that are defined in compliance with existing electricity legislation[49] and require legal authorization from the Minister of Economic Affairs Agriculture and Innovation.

The Third Electricity Directive does not explicitly include a delegation of control to distribution network operators. However, Directive may seems to implicitly assume as well as accept the monopoly power model, as can be derived from a previously described Third Electricity Directive definition, which clearly states the presence of one distribution network operator for one

[43] Article 49 Directive 2009/72.
[44] Article 2(6) Directive 2009/72.
[45] Simone Pront-van Bommel, Particuliere elektriciteitsnetten onder communautair vuur?, *SEW* 2009, p. 244-252.
[46] Art. 24 Directive 2009/72; Article 10-11 and 14 Dutch Electricity Act.
[47] R. Cossent, T. Gómez, P. Frías, "Towards a future with large penetration of distributed generation: Is the current regulation of electricity distribution ready? Regulatory recommendations under a European perspective", *Energy Policy*, Volume 37, Issue 3, March 2009, p. 1146-1147; ENTSOE and EDSO, The European Electricity Grid Initiative (EEGI), Roadmap 2010-2018 and Detailed Implementation Plan 2010-12, Version V2, 25 May 2010, p. 11.
[48] I.a.. article 16, 17 and 31(1) Electricity legislation.
[49] Zoning of 27 February 2009, Zoning as meant in art. 31(1) sub d, Electricity Act determined by the board of the national regulator (NMa) based on artikel 36, Elektricity Act; cf. article 25(1) Directive 2009/72: "...and efficient electricity distribution system in its area...".

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specific region. A wider interpretation of the definition of distribution network management should however not be rejected beforehand. Moreover, the statutory mandate to protect the universal access of consumers to general services could imply a potential ground for legitimacy of this monopoly. This has been defined in art. 3 (3) Third Electricity Directive. On grounds of this right, households are entitled to be connected to an electricity network as well as have access to a secure electricity supply. A monopoly control of the utility might be legitimate, based on the fact that until this time it has not been economically rewarding to have parallel or alternative networks installed.[50] This may therefore be undesirable in the public interest. Taking this view, the transmission and distribution networks constitute natural monopolies due to the high sunk costs involved in their hardware infrastructure, as well as the occurrence of operational scale economies in infrastructural services. Transmission upgrade costs constitute an important impediment to invest in this infrastructure.

In this respect it is essential to realize that a natural monopoly depends highly on economies of scale and scope that result from advanced technology. This natural monopoly would therefore be beneficial to fulfilling Third Electricity Directive objectives as far as it justifies securing a sustainable electricity supply to households.

On the other hand the natural monopoly feature of distribution network system control may lose its legitimacy when large scale implementation of smart grids will start taking effect in the near future. The current monopoly situation may therefore be subject to new (further) analysis. These scale economies are not consistent over time. Technological changes may lead to competition in an economic sector that was initially characterized as a natural monopoly.[51] In the 1990s for example integrated energy companies were described as natural monopolies. As a result of the liberalisation of the energy market energy producing and distributing companies are no longer regarded as monopolies. Today only the transmission networks are characterized as natural monopolies.

The imminent implementation of smart grids calls for an in-depth review of the procedural guidelines for exploitation of the integrated ICT networks. Also it needs to be established under which binding legal conditions a person or legal entity is authorized to exploit these ICT networks. Finally, it should be determined whether the allocation of network operations control for smart grids must remain the exclusive task of national governments and be entrusted entirely or partially to network operators who are appointed in conformity with national legislative standards for electricity utility management. For an answer this question it is recommended to consult the principles guiding the internal market in relation to the free movement of goods and services. The current practice has been that these principles may only be breached if there is sufficient cause or justification. In the operation of distribution networks the abovementioned justification ground could be derived from the statutory mandate to ensure the universal access of consumers to electric power services. In the absence of a legally protected monopoly, the principle of security of energy supply to households could be jeopardized.

In any event it is ambiguous whether the above legitimacy ground can be applied for the ICT data communications infrastructure that comes with a smart grid. Each individual has a basic right to exploit ICT networks as well as to provide ICT services,[52] a right that is consistent with existing European telecommunications legislation policy.[53] In order to ensure access to ICT networks and -services this access may be restricted in conformity with Universal Services Directive regulation.[54] This legislation may apply for an ICT network that renders an electricity distribution network ''intelligent''. The European Regulatory Framework's authorisation of the networks and services Directive covers all electronic communications networks and services.[55] Moreover these two legislative features should be subjected to a wider interpretation. It is essential that smart grids are described more clearly in order to determine whether the European Regulatory Framework's authorisation includes the type of networks and facilities deployed for data communication transmission. This could well

[50] Christopher W Jones, *EU Energy Law, Volume 1: The international energy market*, Claeys & Casteels, 2006, second edition Introduction, p. 4: ''Third, the construction and operation of the network is either a natural monopoly or, even if parallel networks can be constructed legally, under normal circumstances it will not be feasible in economic terms for gas and electricity suppliers to construct a new comprehensive competing network with full coverage in order to sell in a new market.'' Derde Energienota *Kamerstukken II* 1995-96, 24525, nr. 2, p. 79 and *Kamerstukken II* 2005-06, 30212, nr.6, p. 15.

[51] A. Huygen, *Regulering bij concurrentie; De Nederlandse elektriciteitssector*, Thesis Leiden University, 1999.

[52] M. Pollitt, ''Does Electricity (and heat) network regulation have anything to learn from fixed line telecoms regulation?'', *Energy Policy*, Volume 38, Issue 3, March 2010, p. 1360-1371; Articles 3 and 4 Directive 202/20/EC on the authorisation of electronic communications networks and services (Authorisation Directive).

[53] Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive), OJ L 108, 24.4.2002.

[54] Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive).

[55] Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive), OJ L 108, 24.4.2002. See Article 2(a).

be the internet, but this is not necessarily the case. The technology of smart grids, as well as their hardware installation, will partly determine the significance of the two legislative concepts.

A variety of networks may be used for the transmission of data, including those that are protected by the scope of European telecommunication networks. In addition, it is important to determine in how far a provision of telecommunication services is involved in order to assess the extent of this legislation's validity.

The preliminary conclusion is that a monopoly in relation to an integrated ICT electricity distribution network can only be legitimate if and insofar as this ICT network forms an inseparable part of the operation of the physical electricity distribution network as described in the scope of the Third Electricity Directive and if this monopoly represents an intrinsic value in the assurance of a universal service to electricity consumers in accordance with article 3 (3) of the Third Electricity Directive. This subject is momentarily under scrutiny.

However, if the ICT network benefits all market parties concerned, a reasonable assumption would be that monopolizing the ICT network operation has no legitimacy and as such other market parties have the right to employ a distribution network operator. This may be the case if the ICT network is meant to create energy efficiency gains within connected homes or companies, or to facilitate parties to participate in imbalance markets. These smart grid features pertain to the domain of the free market.

3.5 Network operations

The Third Electricity Directive does not generally nor explicitly describe the operation of distribution networks. From this Directive it may be derived that network operations comprise all the specific elements of operation and maintenance of the distribution network necessary for the realization of a continuous network connection and to a secure electricity supply to consumers. Network connections are established on the basis of contracts that assume a profiled consumption in the operator's network.[56] A summary of the network operational duties may be derived from the task description for network operators in the Third Electricity Directive.

Article 25 of the Third Electricity Directive describes in detail the duties and limits of the network operator. The network operator is responsible for ensuring the capacity of the network, which entails maintaining a balance in order to comply with a reasonable demand for electric power distribution. The condition of a reasonable demand forms an important clause. It provides the distribution network operator with opportunity to refuse future generation facilities for renewable energy the distribution of electric power, arguing that the network is not adequately equipped and that it will take time and considerable investment to adapt the distribution system. The same applies for the provision of charging stations for electrical vehicles. At this time neither the EU Court of Justice nor the authorized European bodies have adopted clear views in their jurisdiction so as to define a reasonable demand of electricity supply.

In addition to this, the distribution network operator is responsible for the management, maintenance and development of a reliable and efficient electricity distribution network, taking into account the environment as well as energy efficiency. Discriminatory behavioragainst users, in particular related companies, is strictly prohibited.

In compliance with Article 25 (5) of the Third Electricity Directive network operators have a mandatory obligation to eliminate energy losses and to provide reserve capacity himself or to purchase this extra capacity in accordance with transparent, non-discriminatory and market based procedures.

The network operator is also under legal obligation to provide users of the network all relevant information that may be required to effectuate efficient access to the network.[57] Complementary Directive framework regulation contains detailed rules pertaining to the calculation of tariffs for end users as well as to the purchase of electric power by network operators.

Article 27 of the Third Electricity Directive determines the security settings with regard to file integrity and network security, ensuring that any commercially sensitive data that may be disclosed to the network operator in his operational capacity is treated confidentially and that the network operator undertakes efforts to avoid any discriminatory disclosure of hiw own network activities that may be beneficial to him. The operation of smart grids is protected by general European privacy and security guidelines[58] and it is considered likely that European privacy regulation on telecommunications[59] will be appropriate and adequate to warrant privacy on the integrated ICT network in smart grids.

[56] Cf. H.P.A. Knops, Hoeveel contracten gaan er door één draadje? *Onderneming & Financiering*, nr. 62: Themanummer Energierecht, Elsevier, 2004, p. 22-28.

[57] Art. 15(6) and 30(2) Directive 2009/72. Cf. Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications), OJ L 201, 31.7.2002; Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, OJ L 281, 23.11.1995.

[58] Ibid.

[59] Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 on the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications).

Unlimited access to data sources is a predominant feature of smart grids to optimize electricity usage and generation based on end users' typical consumption profiles. It is of extreme importance that information integrity and network security are protected by a mandatory label. Member states have a discretionary power to define their own complementary regulation on the above network operator's duties as described in the Third Electricity Directive.

It may therefore be necessary to subject the mandatory duties of the distribution system operator to a critical analysis to assess the scope of existing rules' applicability for the exploitation of the integrated ICT network of smart grids. The above elaborations may lead to the assumption that this is at least the case when the ICT network is exploited for of active network management.

3.6 The right of access to the network at regulated distribution prices

In addition to the right of access to the market there is the individual's right to be connected to the network (article 32 of the Third Electricity Directive). The distribution network operator has the duty to accommodate those rights. Both rights are closely linked, implying a symbiotic relationship between distribution network operators and consumers. The right to be connected is a precondition for most market parties – in particular for end-users – to be allowed access to the market and at the same time be assured of a secure energy supply. In practice this right of access is subject to a few significant restrictions. The European Court of Justice of October 9, 2008 ruled that a market party may be obligated to connect a specific type of network (C-239/07).[60] That particular network may well be a private network or it could refer to a nearby situated smart grid or even an outdated ''unintelligent'' network in the requesting party's locality.

Another restriction is the right under the utility's mandate to refuse access to the network when there is insufficient network capacity. Reasons for this refusal must be stated. There are no restrictions to the length of the time period during which access is refused (article 32(2)).

The cited Citiworks judgment clarifies that member states have an obligation to implement a network system that is accessible to third parties at published tariff standards to be applied objectively and non-discriminatory for all network participants.[61] In addition it is the member states' responsibility to ensure that these tariffs as well as the calculation models used are approved prior to their application. Also this obligation of prior revision is legally binding.[62] The same applies for distribution networks that are operated by private enterprises. Closed circuit networks that are connected to the distribution network may be excluded by an internal clause provision on closed circuit networks in article 28 of the Third Electricity Directive, which allows for a deviation from the binding aspect of prior approval. Member states are not committed to incorporate this exception in national legislation, but can choose to do so at their own discretion. The European legislator's policy aimed at airports, hospitals, large campsites and chemical industry locations.[63] The scope of this Directive is limited and the exception is meant only for non-household users. In principle the Directive impedes household consumers on the network.

The right to be connected to the network at least applies to the hardware connection to the network. It needs to be determined whether the right to be connected also includes the ICT network that is an integrated segment of smart grids. In any case this holds for the connection to the ICT network that enables the facilitation of active network management by distribution network operators. This right is in compliance with the extended interpretation of a distribution network following the preliminary ruling of the European Court of Justice in the Citiworks judgment.

According to this interpretation, connection to an ICT network will be subject to the same European Legal requirements as the connection to the physical electricity distribution network. According to the Citiworks judgment, these regulations would be valid irrespective whether the ICT data transmission network is controlled by a government or a legal entity owned by the government, or by a 100% privately owned enterprise.

This extensive interpretation implies that national legislators may have to subject the connection of households to legally binding regulatory protocols insofar as connection to smart grids may be considered a basic condition to warrant the individual's right of access to universal services.

IV. Concluding Observations

The European Regulatory Framework is a powerful descriptive instrument for the purpose of creating a structured and supportive environment towards the development and implementation of next generation technologies. This article attempts to scrutinize the Third Power Directive's regulatory aspects on control and security issues in order to assess their effectiveness in the development and implementation process of smart grid networks.

[60] Annotation Simone Pront-van Bommel to EU Court of Justice EG 9 oktober 2008, nr. C-239/07, *SEW* 2009, July/August, nr. 131.

[61] Simone Pront-van Bommel, Particuliere elektriciteitsnetten onder communautair vuur? SEW 2009, p. 244-252.

[62] Case C-274/08 Commissie v. Sweden.

[63] Preamble nr. 30 Third Electricity Directive (2009/72/EC).

At the time of this article, the development and implementation of integrated smart grids are not bound by these guidelines' provisions. Such provisions would be hard to determine, as a clear and commonly shared vision for smart grids has not been adopted by legislators or regulators. Therefore, a broad consensus on its global market potential and the scope of its environmental benefits is lacking. Legally binding regulations can only be applied if the (performance) safety of smart meter devices – for example in regard to the individual's right of access, or to facilitate demand equation – necessitates such regulatory amendments. This article's findings are consistent with our initial impression that the Third Electricity Directive is oriented towards delaying the introduction of innovative infrastructures that have the potential to support the realization of a two-way electricity distribution network, or a large-scale introduction of connecting stations for charging electric vehicles. This policy may be due to a lack of distributive capacity and (therefore) an unreasonable demand, but it is not in the interest of the deployment of smart grid technologies.

At face value, in conjunction with the right to have access to a supply of generated renewable electric power, each market party is entitled to be connected to the distribution network. However, a more in-depth assessment of the Directive shows that this is not the case: access to a supply of generated renewable energy can only be assured if there is a reasonable demand. Moreover a connection to the network may be refused for lack of capacity. This Directive's guideline provides distribution network operators with an ideal opportunity to manipulate the pace of implementation of integrated smart grids.

Feed-in tariff regulation on a national level may constitute another barrier that could induce distribution network operators to manipulate its pace of development.[64] In view of the scope of this article this particular aspect has not been elaborated, but it is a probability that tariff setting could undermine the implementation of smart grid technologies.

The Directive has however adopted an exception clause[65] on energy end-use efficiency and energy services (2006/32/EC)[66] which refers to the mandatory obligation of member states to provide energy consumers with individual meters that will provide access to user information. Energy policy stipulates that by 2020 at least 80% of all households must be equipped with smart meters. Moreover, consumers should be kept updated on their energy consumption in order to be able to parallel their current usage pattern with similar periods in previous years and, if required, compare their own usage levels with those of similar consumers.[67]

At this time these options are not (yet) available for consumers. Today most households' energy bills are based on a pre-defined format of an estimated annual user profile average. At the end of each term the actual consumer usage will be matched to the estimated average and the costs of a surplus or negative balance will then be settled with the final invoice. In some cases this pre-defined format may lead to tremendous costs that were not anticipated by the average consumer.[68]

Reviews on a national level of the above clause are recommended. Any smart meter that is implemented in accordance with current legislation is bound to be restricted in its facilitation of consumer activity. Smart grids are hardly worth their functionality if they are solely required to produce smart meter generated bi-monthly data surveys of consumers' actual usage over the same period. It follows that the development and implementation of smart grid technologies should be regulated by a set of legally binding parameters. At this stage the legal standards are too restricted to allow for a deployment of their full performance potential.

This article's aim is to answer questions on the applicability of the requirements for distribution networks as described in the Third Electricity Directive. These requirementsare relevant as far as they apply to any ICT network that provides a task facilitation service to the distribution network operator.

[64] R. Cossent, T. Gómez, P. Frías, "Towards a future with large penetration of distributed generation: Is the current regulation of electricity distribution ready? Regulatory recommendations under a European perspective", *Energy Policy*, Volume 37, Issue 3, March 2009, p. 1145-1155: This paper reviews the current regulation of distribution in the European Union Member States, focusing on those aspects that might hinder the future integration of DG. Several regulatory issues that may hinder a successful integration of DG have been identified.

[65] See Article 3(11) Directive 2009/72; Annex I, Section 2, Third Electricity Directive, which stipulates that "the implementation of intelligent metering systems may be subject to an economic assessment of all the long-term costs and benefits to the market and the individual consumer or which form of intelligent metering is economically reasonable and cost effective. Such assessment shall take place by 3 September 2012." In the Commission staff working paper of 22 January 2010, Interpretative note on directive 2009/72/EC concerning common rules for the internal market in electricity and directive 2009/73/EC concerning common rules for the internal market in natural gas, retail markets, the Commission suggests some criteria that should be covered by the economic analysis, see p. 8. Examples include energy savings, energy bills, retail competition, reduction of carbon emissions, after intelligent metering is implemented. This list is not exhaustive and there is no obligation for Member States to apply these criteria. (Cf. *Kamerstukken II* 2009/10, 32374, nr. 7, p. 10).

[66] Article 13, Directive 2006/32/EC of the European Parliament and of the Council, of 5 April 2006, on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC, OJ 2006 L 114.

[67] Article 13(3) b and c, Directive 2006/32/EC.

[68] *Kamerstukken II* 2007/08, 31374, nr. 3, p. 10-11.

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Furthermore, any monopoly position for a future distribution network operator's performance will be legitimate as far as his respective duties are covered by the scope of regulatory conditions relating in particular to the universal service to households as described in the Third Electricity Directive. As far as smart grid integrated ICT networks are implemented to facilitate the supply and demand of the connected market parties, the smart grid domain may be assumed to be a free market under European telecommunications legislation and abide to appropriate regulatory provisions for telecommunications networks (services). These definitions must be interpreted broadly. It is evident that the implementation of integrated ICT smart grids requires a new set of harmonized European regulatory provisions. Both functionality and operational authorization will determine the parameters for assessing the relevant European legislative framework for electricity distribution networks.

At this time balancing is not considered an obligatory duty for distributionsystem operators, as may be derived from article 25 of the Third Electricity Directive. It is expected that this specific operational feature will become the more and more also a task of distribution system operators. The Third Electricity Directive does not impose mandatory standards for balance maintenance, but for those operators who are authorized to balance the electricity supply it provides a binding non-discriminatory clause which stipulates that any activities involving third parties are subjected to contractual obligations and to non-discriminatory. Taking into account the need for sufficient European incentives to boost the development of smart grids technology this internal clause might appear to be too vaguely formulated, giving too much leeway to distribution network operators.

The Third Electricity Directive stipulates that utilities must be permitted to purchase electric power so as to compensate for network losses. It is not clear whether this right includes the negotiation of additional services to market participants connected to the smart grid network. Article 25(7) seems to offer ample opportunity. In any case it does not exclude exploiting these kinds of economic opportunities. Member states have discretionary power to enact their own regulatory provisions. Such a power may lead to distinctive regulatory models for the functioning and operation of member states' utilities.[69]

It may be necessary to assess the extent of power allocated to distribution network operators in regard to the provision of additional services to market parties within the scope of the operators' monopolies. Moreover, if these complementary activities are also executed by other service providers, it needs to be determined to what extent existing regulatory conditions may prevent a discriminatory competition. The Third Electricity Directive lacks a clear standpoint on these aspects and this absence represents an uncertainty factor which may impede the development of smart grids. In any case, the exploitation of data generated in the smart grid framework falls beyond the scope of the network operators' monopolies when a service is provided to generate energy efficiency and to enable stakeholders to engage in (imbalance) markets,

In short, a number of aspects of the Third Electricity Directive's implications in regard to the implementation of smart grids needs clarification. This entails the design of a set of new harmonized global standards describing which key components of a smart grid fall under the legal definition of a distribution network and a network operator's duties respectively. One of the major issues that should be considered more closely in relation to the design of smart grid related regulatory standards is the priordetermination of components that are part of an energy distribution network in the sense of the Third Electricity Directive. A Smart Grids Task Force has been assigned to provide the European Committee with recommendations in this regard. Of one thing we may be certain: the definition of a distribution network will change dramatically in the next decades.

Another important issue that requires the attention of the Smart Grids Task Force concerns the absence of adequate stimuli to induce legislation by member states – also on behalf of distribution network operators and third parties – to accelerate the development and implementation process of smart grid technologies. At this time the measured amount of incentive stimulus inputs towards creating new value on energy efficiency is not worth mentioning in this article.

Within the parameters of the European Legal Framework member states are entitled to impose their own regulatory standards for the installation design and operation of distribution networks. This creates a window of opportunities for large scale variations between member states as far as time frames, implementation methods and the specific installation design features and performance scope of smart grids are concerned.

Europe has prioritized the development of smart grid technology. Today however itsevolution and progress is (still) predominantly a national issue.

[69] R. Cossent, T. Gómez, P. Frías, "Towards a future with large penetration of distributed generation: Is the current regulation of electricity distribution ready? Regulatory recommendations under a European perspective", *Energy Policy*, Volume 37, Issue 3, March 2009, p. 1150-1151.