

Smart Grids after the Third Liberalization Package: Current Developments and Future Challenges for Regulatory Policy in the Electricity Sector

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Abstract

The smart grid is a concept for the development of power distribution grids that offers great promise for the realization of the ambitious objectives of European Energy Policy. In its Third Energy Liberalization Package, European energy law has introduced the concept of intelligent grids and intelligent metering systems. A new directive of EPBD (energy performance of buildings) is to press ahead with this trend. At the same time work is underway at the European Commission and with European Regulators concerning standardization and the new shape of regulatory policy in the implementation stage. The EU legislation and regulatory policy of the National Regulatory Authorities will have to take into consideration the current trends in the modernization of the networks. Among other things, this means revising the existing regulatory model, and that will have to take into account the performance and output of industry networks.

Résumé

Smart Grid est le concept du développement des réseaux de la distribution de l'électricité, qui donne la chance de réaliser des objectifs de grande importance

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de la perspective des Politiques Européennes de l'Énergie. Le droit européen de l'énergie a introduit, dans son troisième paquet de libéralisation, le concept des réseaux intelligents et des systèmes de compteurs intelligents. La nouvelle directive sur la performance énergétique des bâtiments (EPBD) constitue une continuation de cette tendance. Au même temps, les travaux de la Commission Européenne et des Régulateurs Européens concernant la standardisation et la nouvelle forme des politiques de régulation, sont réalisés. La législation de l'UE et la politique de régulation des autorités réglementaires, doivent prendre en considération les tendances contemporaines de la modernisation des réseaux. Cela signifie, entre autre, une révision du modèle de régulation existant, qui doit prendre en considération la performance et les effets des réseaux de l'industrie.

Classifications and key words: smart grids, smart metering, energy regulation, output-based regulation.

I. Introduction

In European law today there is no better concept than the smart grid for serving to demonstrate European energy policy in the areas of ensuring security of supply, sustainable development, and promotion of competition¹. The development of Smart Grids legislation in the EU up to the adoption of the Third Energy Liberalization Package² has been extensively discussed in the literature; this article will review the recent developments in this area³. In particular, I will present two important areas of the new legislative and regulatory landscape that was formed following the adoption of the Third Energy Liberalization Package, which includes the energy performance of buildings and regulatory effort seeking to adapt the regulatory policy to the

¹ J. Vasconcelos, 'Survey of Regulatory and Technological Developments Concerning Smart Metering in the European Union Electricity Market' (2008) 1 *RSCAS Policy Papers* 1.

² Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC, OJ [1994] L 211/94 (hereafter, new gas directive); 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, OJ [2009] L 211/55 (hereafter, new electricity directive); 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, OJ [2009] L 211/36; Regulation (EC) No. 714/2009 of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) 1228/2003, OJ [2009] L 211/15; Regulation (EC) No. 713/2009 of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators, OJ [2009] L 211/1.

³ M. Swora, 'The intelligent grid: unfinished regulation in the Third EU Energy Package' (2010) 4 *Journal of Energy & Natural Resources Law* (forthcoming).

requirements posed by the concept of the smart grid. I will go on to argue that, despite the maturity of the smart grid concept, EU legislation still treats smart grid obligations in a quite soft manner. Thus, further development of the smart grid concept needs strong regulatory effort to adopt a new model of regulation – namely, output-based regulation.

II. Smart performance of buildings

The introduction of intelligent grid and intelligent metering systems in the Third Liberalization can be seen as a top-down process, where the European legislator put certain obligations (albeit in very vague language) on Member States. In the directive on the energy performance of buildings (hereafter, EPBD)⁴, which will be the subject of our analysis in this part of the article, a different approach was presented, one that can be described as a bottom-up approach aimed at stimulating the introduction of intelligent metering systems in places where they should be installed.

A great portion of energy in the EU is consumed by buildings, which are responsible for 40% of energy consumption and 36% of the EU's CO₂ emissions. Taking this into account the EU made the energy performance of buildings a key to achieving its climate and energy objectives (20% reduction of greenhouse gas emissions by 2020 and 20% energy savings by 2020). One of the areas to improve the energy performance of buildings is to empower their ICT (Information and Communication Technologies) – i.e., their Home Area Network (HAN) infrastructure which enables interactions between home appliances and the grid. In a broader perspective this also involves opening the market for new players from the ICT sector, aggregators, ESCOs (Energy Savings Companies) and for the provision of new services for customers (demand response, net metering, etc.). Development of ICTs for energy-smart buildings and districts and integration of renewable energy systems in buildings seem to be one of the main European R&D Objectives in the area of energy efficiency within the European Economic Recovery Plan 2010–2013⁵. It is worth noting that support instruments have also been sharply focused on this purpose in the plans aimed at combating the economic crisis in other Western economies⁶. Given the contribution of ICT-HAN technologies

⁴ Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings, OJ [2010] L 153/13.

⁵ http://ec.europa.eu/research/industrial_technologies/lists/energy-efficient-buildings_en.html#3

⁶ S. Ferrey, 'Restructuring a Green Grid: Legal Challenges to Accommodate New Renewable Energy Infrastructure' (2009) 39 *Environmental Law* 983.

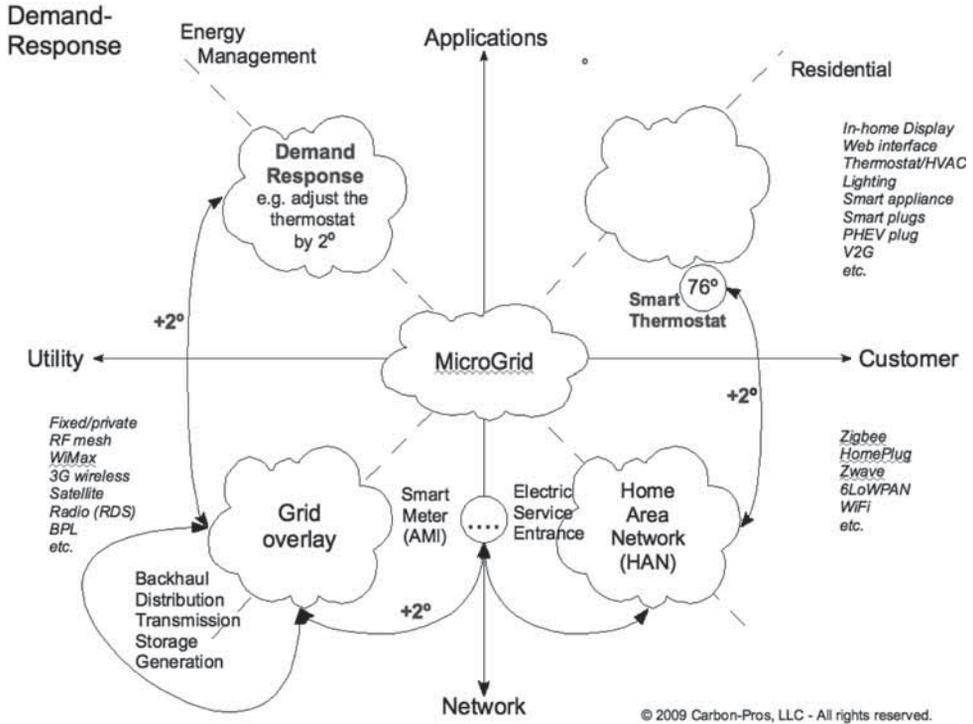
in improving the energy performance of buildings, European legislators included smart metering in the EPBD. A combination of energy efficiency and ICT seems to be very promising in achieving the goals of the EPBD, however, broad introduction of ICT appears to be very difficult considering the different technical condition and age of buildings and uncertainty as to the universal acceptance of this kind of technology in newly constructed buildings and buildings undergoing major renovations. Indeed, this was at the basis of the EPBD's new regulations, which provide for the rather cautious evolution towards energy-efficient buildings with a complex internal structure of ICT, based on a two-way communication system (hereafter, smart homes), which are a part of the smart grid ecosystem (see Figure 1 below).

Article 8(2) EPBD referred to intelligent metering systems obliging the Member States to “encourage” introduction of such systems whenever a building is constructed or undergoes major renovation. While the word “encourage” in reference to intelligent systems is quite clear, the softer stipulation in this article *in fine* refers to the installation of active control systems such as automation, control and monitoring systems that aim to save energy, and which the Member States shall encourage only “where appropriate”. Forms of such “encouragement” may include, in particular, free or subsidized technical assistance and advice, direct subsidies, loan schemes or low interest loans, grant schemes, and loan guarantee schemes. EPBD does not constitute a complete list of all possible measures of encouragement. It may be argued how much more effective strictly fiscal instruments like tax relief might be, especially in the case of deploying intelligent metering systems. According to Article 8(2) this bottom-up approach adopted by the EPBD should be in line with the top-down obligations in Directive 2009/72/EC of the European Parliament and of the Council from July 13, 2009 concerning common rules for the internal market in electricity. It is not entirely clear why European Law did not adopt the similar solutions of Directive 2009/73/EC of the European Parliament and of the Council from July 13, 2009 concerning common rules for the internal market in natural gas. Looking for cross-references it is also advisable to refer to Directive 2006/32/EC, which in Article 13(1) imposes on Member States a conditional and (again) softly expressed condition to ensure that final customers are provided with “individual meters that accurately reflect the final customer’s actual energy consumption and that provide information on actual time of use”⁷. Directive 2006/32/EC refers to final customers of electricity, natural gas, district heating and/or cooling and domestic hot water, which may lead to the assumption that Member States

⁷ 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/EC, OJ [2006] L 114/64.

should encourage provision of meters for such media. It is worth noting that the directive counts final customers in the context of metering, but it does not resolve the problem of integrating metering systems.

Figure 1. Smart grid ecosystem



Source: http://carbon-pros.com/blog1/2009/07/smart_grid_smart_house.html

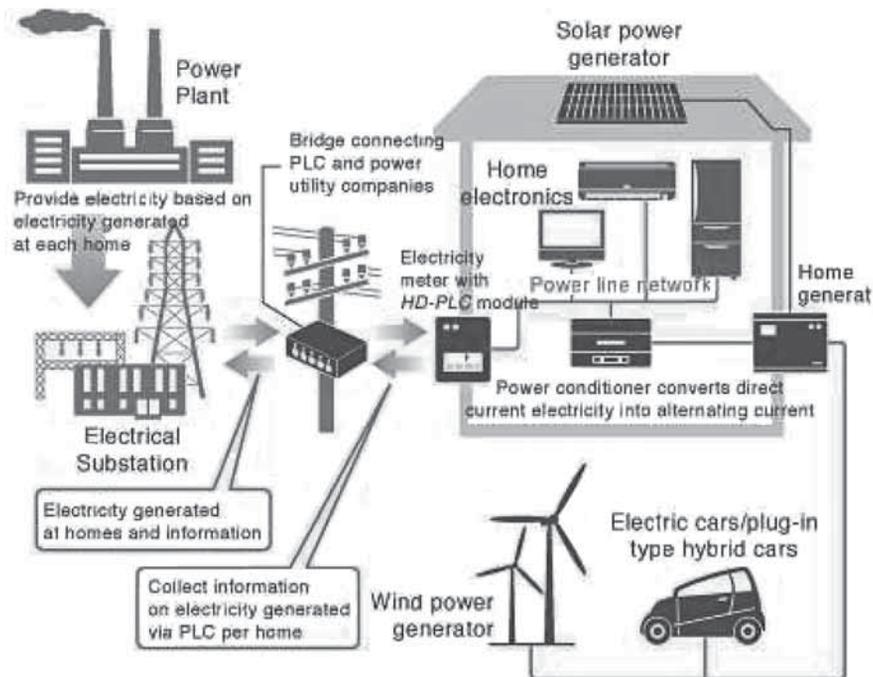
According to Article 8(1) of the Directive 2006/32/EC *in fine*, when a new connection is made in a new building or a building that is undergoing major renovations, as set out in Directive 2002/91/EC (a predecessor of the EPBD), such individual meters shall always be provided⁸.

With reference to the EPBD, it has to be noted that the term “individual meters” is no longer used in this directive, but it borrows its language from new liberalization directives. Although the EPBD counts only “intelligent metering systems”, it may be argued that some of its provisions refer to

⁸ Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings, OJ [2003] L 1/65.

the broader concept of “intelligent grid”⁹. Article 6 EPBD opens the way for micro-generation in new buildings, namely for such high efficiency systems as: (a) decentralized energy supply systems based on energy from renewable sources; (b) cogeneration; (c) district or block heating or cooling, particularly where it is based entirely or partially on energy from renewable sources; (d) heat pumps. According to the above Article for new buildings, Member States shall ensure that, before construction starts, the technical, environmental, and economic feasibility of such high-efficiency alternative systems, if available, be considered and taken into account. Also in this case the language of EPBD is somewhat vague, referring to “availability” as well as technical, environmental, and economic considerations.

Figure 2. Smart home in a smart grid model



Source: <http://hd-plcmag.com/en/feature/smartgrid01.html>

It may be argued that European legislation in the EPBD is not conclusive about intelligent metering systems and the intelligent grid. On the other hand, it is difficult to expect strong obligations imposed on the Member States to roll-out existing meters in all types of buildings or to integrate metering of

⁹ M. Swora, ‘The intelligent grid: unfinished...’.

different media regarding the techno-economic maturity of ICT solutions in this area, privacy concerns, propriety of meters, and other factors. One thing is certain, in the name of energy efficiency the obligation imposed on the Member States is to encourage deployment of intelligent metering systems, allowing them to draw the appropriate measures to fulfill this obligation.

III. The regulatory framework for smart grids – towards a new model of regulation

In addition to the adoption of new solutions by European legislation, national regulators gathered in the European Regulators' Group for Energy and Gas (ERGEG) adopted their own framework regarding smart metering and smart grid implementation¹⁰. Regulatory effort should be considered a part of the process of implementing liberalization directives and other EU legislation concerning intelligent grids and intelligent metering systems. The work of regulators is carried out alongside intensive standardization work, which aims at the creation of European standards that will enable the interoperability of utility meters (water, gas, electricity, heat) which can raise final customers' awareness of their actual consumption¹¹. These issues are high on the agenda of European energy regulators primarily because intelligent grid/intelligent metering is the core activity of regulated grid operators. The smart grid is an idea which is a good starting point in changing the regulatory model, but also a change in the network utilities model. This change is well exemplified by J.P. Tomain, who has said: "The traditional model of utility regulation must be replaced with a smarter version – the *iUtility*. Where the old model encouraged consumption, the new model must encourage conservation. Where the old model fostered economic inefficiency, the new model must foster the efficient use of electricity. Where the old model was content with capital-intensive, centralized power production, the new model must promote distributed, small-scale power production. Where the old model was satisfied with burning dirty fossil fuels, the new model must expand the development,

¹⁰ Smart grid issues are also on the agenda of other regional and international organizations like the Energy Regulators' Regional Association and International Confederation of Energy Regulators, e.g. 'A Description of Current Regulatory Practices for the Promotion of Energy Efficiency', ICER, 21 June 2010, Ref. I10-CC-02-04.

¹¹ 'Standardization mandate to CEN, CENELEC and ETSI in the field of measuring instruments for the development of an open architecture for utility meters involving communication protocols enabling interoperability M/441', European Commission M/441/EN, Brussels, 12 March 2009.

production, and consumption of alternative and renewable resources”¹². It is obvious that such changes to the ‘DNA’ of the electricity grid need a regulatory response.

The activity of the European regulators towards smart grids should significantly influence the change in the model of regulation. European regulators do not have legislative power, but their advisory voice is heard through their expertise and knowledge about the regulated industry. So far, two main regulatory developments on the European stage are particularly worth noting: consultations on smart grids and on smart metering¹³. One of the implications arising from the consultation documents, being of utmost importance from the perspective of regulatory policy, is to change the regulation model associated with the change of priorities in the development of the grid operators. According to the ERGEG, output-based regulation of grid industries (hereafter, OBR) shall focus on smart grid benefits and can be done in two ways: 1) by direct regulation, i.e., minimum requirements for certain parameters, and/or 2) by performance-based incentive regulation providing penalties and rewards related to certain criteria and performance indicators¹⁴. This concept of regulation goes beyond the traditionally functioning cost-based or incentive-based regulation models. A key element of such a model of regulation is to define the outputs, which are part of the very definition of the efficiency-based and customer-focused element of the smart grid. An important factor that adds an element of uncertainty to such a model is the degree of innovation of solutions defining the performance of network operators.

The OBR model focuses on the performance of operators, which is evaluated by performance indicators. While selecting the indicators it should be ensured that they are objectively verifiable. The following are outputs and indicators that have been proposed by ERGEG.

This list of benefits and indicators is a proposal of the European Regulators and currently has no normative value – rather, it is an example of good practice promoted by ERGEG. However, this is the first serious approach to the development of a regulation model that takes into account the concept of the intelligent grid. In analyzing the benefit groups presented by ERGEG it has to be noted that they relate in part to the transnational electricity market and transmission system operators (TSOs). This area is a natural point of

¹² J. P. Tomain, ‘Steel in the Ground’: Greening the Grid with the iUtility’ (2009) 39 *Environmental Law* 951.

¹³ ERGEG Conclusion Paper on Smart Grid’, Ref: E10-EQS-38-05, ‘An ERGEG Public Consultation Paper on Draft Guidelines of Good Practice on Regulatory Aspects of Smart Metering for Electricity and Gas’, Ref: E10-RMF-23-03, 10 June 2010.

¹⁴ ERGEG Conclusion Paper on Smart Grid, p. 10

Table 1. Effects/benefits of smartness and list of potential performance indicators by ERGEG

Effects/benefits	Potential performance indicators
(1) Increased sustainability	Quantified reduction of carbon emissions Environmental impact of electricity grid infrastructure
(2) Adequate capacity of transmission and distribution grids for “collecting” and bringing electricity to consumers	Hosting capacity for distributed energy resources (‘DER hosting capacity’) in distribution grids Allowable maximum injection of power without congestion risks in transmission networks Energy not withdrawn from renewable sources due to congestion and/or security risks
(3) Adequate grid connection and access for all kind of grid services	Benefit (3) could be partly assessed by: – first connection charges for generators, consumers, and those that do both – grid tariffs for generators, consumers, and those that do both – methods adopted to calculate charges and tariffs – time to connect a new user
(4) Satisfactory levels of security and quality of supply	Ratio of reliably available generation capacity and peak demand Share of electrical energy produced by renewable sources Measured satisfaction of grid users for the ‘grid’ services they receive Power system stability performance Duration and frequency of interruptions per customer Voltage quality performance of electricity grids (e.g. voltage dips, voltage and frequency deviations)
(5) Enhanced efficiency and better service in electricity supply and grid operation	Level of losses in transmission and in distribution networks (absolute or percentage) Ratio between minimum and maximum electricity demand within a defined time period (e.g. one day, one week) Percentage utilization (i.e., average loading) of electricity grid elements Availability of network components (related to planned and unplanned maintenance) and its impact on network performances Actual availability of network capacity with respect to its standard value (e.g., net transfer capacity in transmission grids, DER hosting capacity in distribution grids)

Effects/benefits	Potential performance indicators
(6) Effective support of trans-national electricity markets	Ratio between interconnection capacity of one country/region and its electricity demand Exploitation of interconnection capacity (ratio between mono-directional energy transfers and net transfer capacity), particularly related to maximization of capacity according to the Regulation on electricity cross-border exchanges and the congestion management guidelines Congestion rents across interconnections
(7) Coordinated grid development through common European, regional and local grid planning to optimize transmission grid infrastructure	Benefit (7) could be partly assessed by: <ul style="list-style-type: none"> - impact of congestion on outcomes and prices of national/regional markets - societal benefit/cost ratio of a proposed infrastructure investment - overall welfare increase, i.e. always running the cheapest generators to supply the actual demand); this is also an indicator for benefit (6) above - time for licensing/authorization of a new electricity transmission infrastructure - time for construction (i.e. after authorization) of a new electricity transmission infrastructure
(8) Enhanced consumer awareness and participation in the market by new players	Demand side participation in electricity markets and in energy efficiency measures Percentage of consumers on (volunteer) time-of-use / critical peak / real time dynamic pricing Measured modifications of electricity consumption patterns after new (volunteer) pricing schemes Percentage of users available to behave as interruptible load. Percentage of load demand participating in market-like schemes for demand flexibility Percentage participation of users connected to lower voltage levels to ancillary services

Source: ERGEG Conclusion Paper on Smart Grid, Ref: E10-EQS-38-05.

reference at the European level and will certainly be of interest to the newly established agency – the Agency for the Cooperation of Energy Regulators (ACER). The problem of implementation of smart grids lies predominantly not at the level of TSOs, but rather at the level of distribution system operators (DSOs). For the national regulatory authorities the ERGEG position can be an important reference point, but it is not binding. It is still too early to demand the adoption of new laws, but once the OBR model becomes everyday practice in the activities of regulators, it should find place in the provisions of the liberalization directives.

Some national regulatory authorities are already developing new methods of regulation. So far, the new model of price control, RIIO (Revenue = Innovation + Incentives + Outputs), has been proposed by British Ofgem. The RIIO is based on the previous price control regime used by Ofgem (RPI-X), but according to its authors better meets the investment and innovation challenge by placing much more emphasis on incentives to drive the innovation needed to deliver the required outputs in terms of improved customer service and smarter grids¹⁵. According to Ofgem key features of the RIIO model include:

- Much greater say for network customers in setting out what network companies need to deliver, i.e., renewable developers might want faster connections
- Fast track price controls will be introduced for companies who innovate, deliver good service, and produce well-documented plans setting out how they will invest efficiently for the future. They will be rewarded with higher returns
- Poorly performing companies will face much more intrusive regulation and will face lower returns
- Lengthening price controls from five to eight years will provide more stability
- A stronger incentive regime to encourage more efficient investment and innovation
- The additional option of giving new network companies a greater role in delivering certain large-scale projects where this does not delay delivery. This could open up new sources of finance and encourage innovation
- Expansion of the current low carbon networks fund to encourage greater innovation across gas and electricity networks¹⁶.

¹⁵ ‘Ofgem reengineers network price controls to meet £32 billion low carbon investment challenge’ – press release of July 26, 2010; available at: <http://www.ofgem.gov.uk/Media/PressRel/Documents1/JULY%20RPI%20PRESS%20NOTICE.pdf>

¹⁶ Ibidem.

The British model of price control is certainly an interesting proposal, taking into account the requirements of the smart grid concept. At the moment there is no one common regulatory model which would be a ready-to-use product adoptable by all the European Regulatory Authorities. The Member States are free to choose a regulatory model which best suits local conditions, but they must take into account the current trend in network development, with its focus on the smart grid concept.

In analyzing the ERGEG document on the smart grid, regulators stress the importance of one more priority which should be included when drafting the regulatory policy. The smart grid concept is not only about the energy sector, as it requires the involvement of various stakeholders from the ICT sector, consumer organizations, the construction industry, renewable energy sector, etc. Regulators should therefore play an active role in favouring cooperation among those stakeholders to achieve the targets set for the various smart grid concepts, innovations, and solutions. According to ERGEG the role of regulators should be to facilitate smart grid discussions, hammering out common views, and cooperation among all stakeholders. ERGEG stresses the fact that such cooperation should be “especially devoted to agreeing which smart grid concepts will provide clear and greater net benefits (i.e., the benefits minus any possible additional costs) to network users and to the whole society, to identifying the possible presence of regulatory barriers to such smart grid concepts and to finding the best solutions to remove them”¹⁷. Consequently, in the process of implementing the smart grid, regulators must go far beyond their erstwhile relationship with the energy sector, and try to bring together as many smart grid actors as possible. For herein depends the success of a holistic vision for modernizing the electricity grid.

¹⁷ ERGEG Conclusion Paper on Smart Grid, p. 11.; networking strategy of Polish energy regulator can serve as an example of this type of action, which: 1) commissioned preparation of feasibility study on smart metering and initiated a discussion on that subject, 2) finalized signing of *Declaration concerning the introduction of smart grid into the Polish power system*, together with consumer organizations, National Energy Conservation Agency; which won support of several ministries, professional organizations, scientific institutions and other public bodies (http://www.ure.gov.pl/portal/en/1/21/Polish_Regulator_and_consumers_urge_the_energy_sector_to_implement_smart_grid.html), 3) initiated creation of smart metering platform (<http://www.piio.pl/>), 4) organized several conferences and meetings, whose purpose was to, e.g. gather interest of members of parliament in smart grid (http://www.ure.gov.pl/portal/en/1/71/Prospects_for_the_development_of_smart_grids_technological_breakthrough_in_the_.html), 5) initiated press releases, 6) built interest of industry in creating smart economic zones 7) activated dialogue with energy sector, ICT industry, self – government bodies, scientific organizations on smart grid, including creation of a common definition of outputs of smart grid solutions (http://www.ure.gov.pl/portal/en/1/86/Towards_Smart_Grids_in_Poland_smart_UTILITIES_2010_Conference__Wroclaw_27__28_Ma.html; http://www.ure.gov.pl/portal/en/1/77/Intelligent_networks_intelligent_control_Forum_Energy__Effect__Environment.html).

In closing it should be pointed out that the idea of changing the regulatory model is in fact not a purely European phenomenon. The developmental direction of modern industry networks towards smart grids is being widely adopted in many industrialized economies¹⁸. One good example is the United States, where the shift in regulatory policy toward taking into consideration the smart grid is described in terms of a transition towards a new regulatory model described as “regulation 3G”, which: “affects the development of the smart grid in many ways. The smart grid requires innovation, collaboration, and technological investment. It promises efficiency, reliability, and smoother working electricity markets. It also promises to transform the industry from sellers of electricity to providers of energy services and products. Regulation 3G also promises to revamp the old regulatory structure into one that is more flexible, market-based, and less prone to capture”¹⁹.

IV. Conclusion

Due to the user-centric approach and focus on energy efficiency and sustainable development, the approach to the network industry is changing: a new axiology for grids is being added in the form of sustainable development, security of supply, and promotion of competition. European energy law and policy describes this shift in terms of intelligent metering systems and intelligent grids. Neither concepts are ready-made products, but rather determinants of the direction of future network development, indicating the axiology of the desired changes with the use of modern ICT solutions. At the same time these concepts ought to be regarded as offering the most promising vision of the objectives of European Energy Policy.

This direction has already been reflected in Directive 2006/32/EC and more explicitly in the liberalization package directives. In the post-package legal environment the directive is represented in the bottom-up approach of the EPBD, but once more the obligations regulated in this directive are rather soft. According to Directive 2006/32/EC, one clear obligation of the Member States is to encourage deployment of intelligent metering systems, but countries are free to choose their own proper measures. It should be clear that the EU shall adopt harder measures in the future legislation aimed at the effectiveness of smart grid deployment. The provisions of the Directive 2006/32/EC will have

¹⁸ W. Breuer, D. Povh, D. Retzman, Ch. Urbanke, M. Weinhold, ‘Prospects of Smart Grid Technologies for a Sustainable and Secure Power Supply, available at: <http://www.worldenergy.org/documents/p001546.pdf>

¹⁹ J.P. Tomain, ‘Steel in the Ground’..., p. 976.

to change in the future towards clarification of obligations that which this directive put on energy firms in the area of informing customers and frequency of information delivery.

Along with legislation and European Commission efforts focused on standardization, regulators have begun the process of adapting to a new model for the functioning of network industries. One of the important outcomes of these efforts is to propose a new model of regulation based on outputs. The smart grid sets new tasks for regulators, who will have to play a leading role in the introduction of new solutions, offering within their regulatory tools price control models that define performance indicators and measure and reward outputs of regulated industries. This is to significantly include innovation and changes in the management of the modern industry grid. This task requires moving beyond the established model of economic regulation. Success will be achieved if “smart regulators” meet “smart industry” in regulatory policy.

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