Smart grids: levers towards reducing disparities between cities or targets on the European energy innovation map?

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Abstract

The energy market liberalization in Europe strives to be more than an aggregation of functional energy national systems, but a smart and unified approach to a market subjected to various disparities amongst states. Given that states are characterized by distinctive levels of investments in the innovation sector, as well as the technological one, a swift and harmonized market liberalization seems to be more a desiderate, rather than an actual objective.

The objective of this research is to deliberate and analyse to which extend a smart grid, in its whole mechanics, may reduce the number of disparities between European cities. Moreover, the research will try to depict a smart approach towards implementing successful models of smart grids on markets not yet matured. In this paper I will refine and further deliberate concepts that I have advanced during my Doctoral research in the field of energy market liberalization, but now on a more evolved and in-detail approach; trying to answer to questions such as: is the actual liberalized energy market capable to successfully sustain a smart grid/ smart network approach? And if yes, are the smart consumers enabled to use the advantages, such as smart metering, to full potential?

The main result of this research will be to create a matrix, based on comparative research and case study approach, of existing capabilities on the Romanian energy market versus the European ones, thus advancing further recommendations to future approaches; for example, what would enable consumers to become fully operational as smart consumers and which are the state policies that can transform the emergy market in asmart grid enabled one.

Through this paper, I will advance the existing debates concerning the energy market in Romania, but from a more scientific approach, one under the umbrella of the political science approach.

Keywords: *energy market, liberalization, smart consumer, smart meter, platforms.*

1. Introduction

In a field so vast and so complex such as the energy market, the mere possibility of not adapting to on-going technological advancements would enable on the long run, a greater gap in between consumers' households, areas and, subsequently nations/ Member States of the European Union. The energy policy has always been one of the strong indicators of the development that characterizes a country, and paired with other variables, could depict an useful overview when one wants to understand the disparities amongst states. Still, in an area like the energy policy, implementation *per se* would not be sufficient to ensure stability and competitiveness on the market for any of the actors. All efforts that are deployed in this field, must be accompanied by strong harmonized cross-policy initiatives.

2. Smart Grids: premises for smart development?

Even though the grounds for a more homogenous energy policy can be pin-pointed in the overall roll-out of this initiative, 2009 was the year when more activities started to be implemented striving towards achieving an efficient and competitive energy system.

The first one of them was the Third Energy Package that aimed to address the existing disparities which directly influenced the internal energy market, and, on the long run, to improve its overall functionality [1]. Four documents in this initiative can be considered as a starting point for the discussion about the Smart Grids initiative, even though throughout these communication the Smart Grid is not treated as a singular point of discussion, whereas a step (a lever) towards a mean: attaining a coherent and harmonized internal market.

Directive 72/2009 in the field of electricity stressed the importance of Member States as promoters towards modernizing the existing distribution networks with the usage of Smart Grids [2]. Still, the course of this initiative would have been directly impacted by the capacity and the degree of technological development which characterized each state. Moreover, having in mind the impact on the long run, Smart Grids were presented as an alternative solution alongside smart metering, in ensuring energy efficiency and the modernization of the electric system [3]. Again, this approach would have been offset by the attributes of each state, more exctly how mature the national energy market was and to what extent the consumers were able to understand and use, to the best of their advantages, the innovative solutions.

A similar direction was followed when developing Directive 2009/73 in the gas sector. In this document, Smart Grids were presented as a predicament for sustainable development as long as they are part of a complex and comprehensive measures system. Hence, Smart Grids became a solution alongside pricing formulas and intelligent metering systems towards amending the way in which gas was used [4]. Similar to the electricity Directive, Smart Grids were not a singular objective, but a phase in a strategical approach.

As a next phase in a comprehensible roll-out, the Smart Grid Task Force was put in place in order to address and advise in matters concerning the implementation and advancement of smart grids [5]. Closely related to how the European Energy Policy has evolved throughout time (from an economic lever, to a coehision and reducing regional disparities enabler), a structure was needed in this regard in order to harmonize what seemed to be a puzzle piece-by-piece European Energy Market. The drivers which paved the way for such an initiative were presented during the 2009 Steering committee meeting [6], as being the following ones:

- The necessity of deploying the internal market for energy by using more active systems of transmission and distribution
- The existing EU policies which aimed to embrace new solutions
- And last, but not least, a need of defining a coordinated approach in dealing with various variables, such as actors and existing issues

Analyzing the afore mentioned pillars, we can see that the approach characterizes both the macro level (of the European policy framework), as well as the micro layer (the national, and, in subsidiary, the way in which each national actor implements the energy policy. In addition, having as a driver the need to establish coordinated approaches, would imply the fact that all participating parties would be able to address the situation from similar power/ knowledge levels.

2010 was the year when The Organisation for Economic Co-operation and Development (OECD) released a paper concerning Smart Grids in the field of electricity. In this document, Smart Grids, alongside smart metering, were defined as being part of a cluster of innovations which enabled more effective decisions in consumption [7] Similar to the gas and energy Directives, Smart Grids were paired with smart metering activities, both acting as levers in empowering the consumer towards advancing in a more educated usage of resources. As aims and objectives of these technology, the paper outlines the following [8]:

- Decreasing consumer demand when supply is not optimal
- Increasing receptivity of consumers to the overall electricity market workflow

When evaluating prior mentioned targets, one can notice that the overall aims is slightly enhanced versus the gas and electrivity Directives; apart from the immediate direct effect (balancing consumption within the overall market framework), there appears a more integrative dimension, namely educating consumers towards a smarter usage. Still, without national policies that seek to tackle the same issues, a Smart Grid would not be able to fulfill all the European desiderates. The document creates a more in-depth perspective into the Smart Grid approach to the market, by emphasizing on which are the exact innovations that support this endeavor [9]:

- A more refined metering technology which enables two-way metering
- A direct communication line between consumers, electricity producers and operators
- Enhancing appliances capabilities by making them autonomously responsive to the network's signals

Similar to the gas and electricity Directives, a Smart Grid is characterized both by a macro-level lense, as well via a micro-level one. Thus, the advance network

surpases the target of development, and aims to interconnect all actors in real time (both providers and users). Moreover, as a long-term approach, the capabilities of the enhanced network reach an economical development stage, namely producing more developed technical appliences which are used by the end consumer. Contrarily, not all Member States could have been able to use to the fullest this advantages, given their development stage and the national capabilities.

In 2011, the European Comission released a communication concerning Smart Grids and means towards their implementation. Linking directly the Smart Grid approach to the EU2020 agenda, the document underlines the importance of Smart Grids as the next level of electricity networks which allow both ways communication between suppliers and consumers [9]. Building on the long term approach already observed as well in the previous documents, in this communication Smart Grids are presented as [10]:

> *"[...]the backbone of the future decarbonized power systems. They will enable the integration of vast amounts of both on-shore and off-shore renewable energy and electric vehicles while maintaining availability for conventional power generation and power system adequacy" .*

In this regard, Smart Grids are described to be both a lever towards system development, as well as a gate-keeper of a more sustainable type of energy consumption. Plus, by tailoring the grid to have the capacity of encompassing different sources of energy, it implies that its availability would be an aggregated and balanced one – not more resources from the unconventional sources instead of newly discovered and sourced ones. Again, the question would arise if all Member States would be able to maintain an equilibrium between energy sources in the final consumption for the end consumer; having in mind that some Member States have more renewable energy sources than the others, but not all have the economic capacity to harness these advantages to the fullest of their potential.

In 2013 the Regulation number 347 concerning trans-European energy infrastructure brought a more in-depth overview concerning the further deployment of Smart Grids and how Member States could adopt this type of workflow. In terms of their importance, the approach seems now to incline more to the cause-effect pattern, Smart Grids being described as [11]:

> *"[...] Union-wide integrated networks and deployment of smart grids are vital for ensuring a competitive and properly functioning integrated market, for achieving an optimal utilization of energy infrastructure, for increased energy efficiency and integration of distributed renewable sources [...]"*

In the above mentioned paragraph, Smart Grids act as levers and enables for a sustainable and competitive market (which would imply that the market is already well established enough so that Member States would function under optimal parameters within the framework, the grid). In addition, a Smart Grid would be a working mechanism in ensuring market equilibrium between energy sources and efficient means of transportation.

The same document pin-points Smart Grids as being part of the 12 strategic priorities from a trans-European energy infrastructure point of view, alongside electricity highways, oil infrastructure, gas transmission, storage a.o.[12].

The more mature perspective coming for the feasibility reasoning behind Smart Grids, aligned priorities in terms of action fields (gas, oil and electricity) and means of implementation (transportation and storage), ensuring this way a holistic approach to the energy network and market.

3. Innovation and capabilities: do all countries have a similar development pace?

As observed from the before mentioned Smart Grid descriptions, this type of approach on the energy market implies having a long-term strategy, as well as the actual capabilities of implementing it. From smart metering, to smart consumption decisions, such a direction (alongside the market liberalization) would harmonize and shape the economical equilibrium at European market level. This is why, when addressing the capacity of each state to successfully deploy such an initiative, an innovation benchmark ought to be taken into consideration.

In order to assess each state's capability in terms of innovation acumen, data from the European Innovation Scoreboard will be used in the following paragraphs. Apart from a general overview of how innovation is rolled-out throughout European countries, a more relevant indicator could be the degree of invesetment in research and development at country level.

From a broad perspective, innovation seems to be at a slow pace in Eastern European countries versus the Western or the Nordic ones. The last six ranking countries in this regard are as follows [13]:

- Romania with a score of 34.13
- Bulgaria with a score of 48.72
- Croatia with a score of 59.58
- Poland with a score of 61.10
- Latvia with a score of 65.66
- Hungary with a score of 69.03
- Sweden, the top state in the innovation index with a score of 147.74

Of course, the first explanation that comes with ease is that the less innovative states are former communist one. On the other hand, taking into consideration that this states have had powerful industries and operational technological sectors (be they fully competitive or not when compared to the Western states), more factors must be taken analyzed before explaining the differences.

This is why, when reducing the data cluster to the ''innovators'' in the field of innovational activities, the situation changes in terms of top innovators, wherease it remains more or less the same for the least performing actors, as follows [14]:

- Romania: no score available
- Poland with a score of 14.95
- Bulgaria with a score of 24.52

- Hungary with a score of 30.88
- Latvia with a score of 36.09
- Slovakia with a score of 37.85
- Portugal, the top innovator with a score of 155.64

Whilst Sweden is on the upper side of the ranking with a score of 104.78 [15], we can observe that Croatia has increased its ranking whereas Romania and Bulgaria remain at the bottom of the cluster.

Still, as European policies are translated at state level through national policies, an even more efficient overview would be to analyze the level of investment in research and development. Thus, when considering public research and development expenditure, we can detect a substantial change in the bottom part of the ranking [16].

- Bulgaria - a modest innovator with a score of 4.76
- Malta - a modest innovator with a score of 4.76
- Romania - a modest innovator with a score of 4.76
- Cyprus having a score of 19.70
- Ireland having a score of 23.43
- Hungary having a score of 30.09
- Denmark the top innovator with a score of 161.63

Versus the previous two clusters of data, we can observe that in terms of research and development level of investment the difference between the top innovator and the last rasnking ones is grater than 150 pints, whereas in the field of innovation as an activity, the difference was of approximately 140 points; from the general perspective (the innovation index), the difference between the top innovator and the last innovator was of approximately 113 points. Consequently, the differences between the capabilities of implementing an approach such as Smart Grids, resides far beyond the past of each country, and it can be interpreted through the optics of the present: how much they are willing to invest now for the future advantages.

4. Conclusions. Smart Grids: what is next?

This paper did not intent to draft a full overview in the field of Smart Grids, but to draw some analysis lines and pin a starting point on the map of the European energy market. As we have seen from the previous data, even though Smart Grids are designed to harmonize the existing energy network, and, on the long run to reduce disparities in between member states, having an action plan may not be sufficient. Given the existing situation and levels of development (such as investment in research and development), some member states may be prone to be followers, rather to adapt the framework to their own needs.

In addition, the Smart Grid initiative stretches far beyond from a technological approach to making energy networks more effective. When assuming that consumers will be able to directly interact with operators and producers, or they will be able to make smart decision regarding their consumption pattern, this implies a certain level of development in this regard. This level could be attained, of

course on the long run, via comprehensive policies and activities of informing consumers about existing advantages, as well as how the system works as a whole.

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References

[1] European Commission, *Third Energy Package*, https://ec.europa.eu/energy/en/topics/markets-and-consumers/market-legislation/third-energy-package
[2] Official Journal of the European Union L 211/55, *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*, Chapter I, (27), https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0072&from=EN
[3] *Idem* [2], Art. 3, (11)
[4] Official Journal of the European Union L 211/94, *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*, Art. 4 (8), p. 11, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0073&from=EN
[5] European Commission, *Smart grid task force*, https://ec.europa.eu/energy/en/topics/markets-and-consumers/smart-grids-and-meters/smart-grids-task-force
[6] The Smart Grid Task Force, *Steering committee meeting 2009, Presentations, MSJ 10/28*, (2009), https://ec.europa.eu/energy/en/topics/markets-and-consumers/smart-grids-and-meters/smart-grids-task-force
[7] OECD, *Policy Roundtables Electrivity: Renewables and Smart Grids*, (2010), p. 1 https://www.oecd.org/regreform/sectors/46586020.pdf
[8] *Idem* [7]
[9] *Ibidem* [7], p. 12
[10] The European Smart Grid Task Force *apud Communication from the commission to the European Parliament , the Council, The European economic and social committee and the committee of the regions Smart Grids: from innovation to deployment, {SEC (2011) 463 final}*, p. 2, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0202:FIN:EN:PDF
[11] Official Journal of the European Union L 115/39, *REGULATION (EU) NO 347/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision no 1364/2006/EC and amending Regulations (EC) no 713/2009, (EC) no 714/2009 and (EC) no 715/200,* (8), P.2
[12] *Idem* [11], Art 21, p 3
[13] The European Innovation Scoreboard 2019, *Summary Innovation Index 2019*, (2019), https://interactivetool.eu/EIS/EIS_2.html#a
[14] *Idem* [13]
[15] *Ibidem* [13]
[16] *Ibidem* [13]