METERING ROLE IN AN EVOLVING ELECTRICITY MARKET

ROLUL CONTORIZĂRII PE PIAȚA ENERGIEI ELECTRICE ÎN EVOLUȚIE

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Abstract**:** *The global concern about climate change forced policy makers to wright down new strategies for decarbonisation. Europe targets are among the highest worldwide (55% in 2030 and 100 % in 2050). Traditional power plant are going to be decommissioned and expectation for new technologies in generation are expected to be deployed on large scale is high. Efficiency in all power sector, mainly on the consumer side, is expected to increase. This paper presents tendency in power sector and the increasing role of metering in the whole sale market.. Renewable generation, integrated power markets, digitization, the conservation and efficiency use of electricity are included in R&D projects and are coming daily in our life. Traditional way of project promotion based on fesability study is obsolete. Some steps in order to evaluate the social benefit are introduced by different CBA (Cost Based Analise) which are trying to monetize social benefit like green gas reduction and creation of skills to the people. Generally speaking, distributed generation looks to be in conflict with global transmission grid. The scope of this paper is to prove, one more time that electricity is one key driver for social development and is a must from many points of view. Also, this new and old ideas should be aggregated in a state of the art concept which allow a revival of the power sector in the next decades.*

Keywords: Distributed generation, Global transmission grid, Renewables, Efficiency, Metering, Markets.

Rezumat*: Preocuparea globală cu privire la schimbările climatice a forțat factorii de decizie politică să elaboreze noi strategii de decarbonare. Țintele Europei sunt printre cele mai ridicate la nivel mondial (55 % în anul 2030 și 100 % în anul 2050). Centralele electrice tradiționale vor fi dezafectate și așteptările pentru noi tehnologii de generare vor fi implementate la scară largă sunt mari. Eficiența în toate sectoarele energetice, în principal pe partea consumatorilor, este de așteptat să crească. Această lucrare prezintă tendința în sectorul energetic și rolul din ce în ce mai mare al contorizării pe întreaga piață de vânzare. Generarea de surse regenerabile, piețele integrate de*

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energie, digitalizarea, conservarea și utilizarea eficientă a energiei electrice sunt incluse în proiectele de cercetare și dezvoltare și apar zilnic în viața noastră. Modul tradițional de promovare a proiectelor bazat pe studiul de fezabilitate este învechit. Unii pași pentru evaluarea beneficiului social sunt introduși de diferite CBA (Cost Based Analyse) care încearcă să monetizeze beneficiile sociale, cum ar fi reducerea gazelor verzi și crearea de abilități pentru oameni. În general, generarea distribuită pare să fie în conflict cu rețeaua globală de transport. Scopul acestei lucrări este de a demonstra, încă o dată, că electricitatea este un factor cheie pentru dezvoltarea socială și este o necesitate din multe puncte de vedere. De asemenea, aceste idei noi și vechi ar trebui să fie agregate într-un concept de ultimă generație care să permită o revigorare a sectorului energetic în următoarele decenii.

Cuvinte-cheie: Generare distribuită, Rețea globală de transport, Surse regenerabile, Eficiență, Contorizare, Piețe.

1. Introduction

Issues related to climate change have led to the emergence of new regulations at both EU and national level that promote the reduction of carbon emissions by encouraging the production of energy from renewable sources.

In order to better understand this context, the following questions must be asked:

WHY? Global warming and universal public service for electricity.

HOW ? Achieving environmental and socio-economic development targets in a sustainable way.

WHERE? The areas in which action must be taken to achieve these targets (5D). The reduction of greenhouse gas emissions must be done in all fields of activity in the conditions in which the energy transition takes place internationally. The solution is not unique and is based on the integration of renewable sources and the increase of energy efficiency.

The EU aims through FIT 55 to reduce decarbonization by 55% by 2030 and 100% by 2050. These environmental targets are associated with the integration of renewable sources up to the coverage of 30-40% of consumption by 2030 and an increase in energy efficiency by 1-2% / year.

The basic scenario built for the period up to 2050 is based on the following aspects:

- high cost of tons of CO2 (now it is about 100 E / t);

-100% RES + storage (centralized and decentralized);
- 100 % GHG reduction (greenhouse gas);
- no nuclear power plants, fossil fuels;
- high energy efficiency;
- important energy exchanges inside the EU and with neighboring countries;
- no fossil fuel imports;
- res import only.

This synthetic scenario is shown in the following diagram.

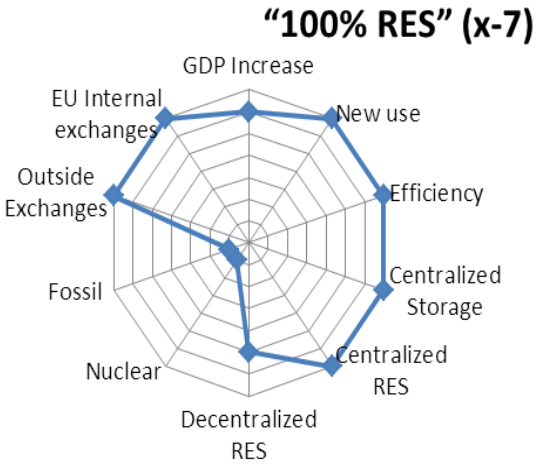

Figure 1. Syntetic Scenario 2050

Solution for the future is res synergy in large power plants and distributed generation both locally and globally.

The large share of renewable sources with a pronounced volatile character must be accompanied by the large-scale introduction of storage capacities on all levels of the energy sector. The storage must provide flexible solutions during the period when the RES production decreases and the spare capacities are loaded.

The contribution of storage must be seen as absolutely necessary:

-in the ERT for f-P adjustment, balancing market, cross-border exchanges;

-in RED to cover the top of the load, system services, DMS... increasing the role of OS for distribution operators.

-to consumers for peak loadcoverage, local generation (prosumers, aggregators).

2. The need for change

5 D= Democratization + Decarbonisation + + Deregulation (Liberalization) + Decentralisation + Digitalization

2.1. Democratization

Democratization in energy represents access to energy but also the possibility to choose the energy source. Sustainable development encourages economic development and creates new jobs. The RES cost decreases and consumers are willing to accept prices, given the total benefits.

Distributed generation is an effective mechanism. RES projects have become feasible without aid schemes. Similar to the development of prosumers, we have to expect a revolution in distributed storage with the progress of battery technologies (Li-Ion, Zinc, graphene, etc.... Aggregation regulations bring significant quantities to the wholesale market, increasing the responsibility of small generators, consumers and storage facilities in the safety of the system.

The cost of the energy produced by the wind and the sun is estimated to become lower than the price of gas-fired power plants, which is why gas is regarded as a transitional solution.

2.2. Decarbonisation

Coal-fired power plants provide about 40% of the total electricity production and generate over 65% of CO2 emissions.

Gas plants are much more "clean" than coal-fired ones, but they are only a transitional solution for the transition to an economy without greenhouse gas emissions.

Compared to the targets of 2050, the current evolution implies an increase of the efforts to introduce new RES and increase the energy efficiency in all the activities of the company.

Structural changes in the energy sector in which the relocation of production to other locations and even to other levels of voltage require a restoration of the energy systems and a substantial preparation of their operation by "soft" methods.

Many champions in production will disappear, transmission and distribution networks will have to be reconsidered, consumers will have to assume new roles in the safety of energy systems.

2.3. Deregulation (Liberalisation)

Green energy policies must take into account:

-research, development and major investments in utilities for the elimination of greenhouse gas generating technologies and their replacement through "clean" technologies;

- Generation technologies: solar, offshore, biofuels, geothermal etc... can be achieved,in the initial phase, only with institutional funding and favorable regulations;
- The introduction of RES should be seen only together with the increase in storage capacities necessary to counteract the volatility of the RES;
- Substantial modification of the market rules by promoting the concept in which consumption to pursue the production of renewable energy, the expansion of markets from a territorial point of view attracting in wholesale markets of as many actors with responsibilities in these markets etc...
- National/ European / international strategies must be completed with efficiency standards that allow the real-time measurement and verification of the saved energy;
- Aid schemes must be promoted to replace household consumers with high energy consumption with some with increased energy efficiency.
- It is encouraged the passage in all fields of activity of the use of electricity to the place of other forms of energy, taking into account that most res generates electricity (examples : transport, agriculture, processing industry, etc...). An example of this is the National Program for Implementation in Energy and Climate Change (PNIESC).

2.4. Decentralization

The current rules of operation and market in energy are based on the principle that the energy production must ensure the total consumption. The important thing is that production follows the consumption curve.

In the future, with the substantial increase of the RES share, but also of the attraction among market participants of producers, consumers and small storage installations, it is it sees a paradigm shift in the sense that consumers will try to consume only renewable energy. In this respect, we are working on market mechanisms that create commercial advantages for those who will consume mainly renewable energy.

Another phenomenon is the appearance of micro-networks that can be connected (or not) to the classical system. In this way, together with the large-

scale introduction of storage along with distributed generation, the energy chain is completed.

2.5. Digitalization

A global analysis demonstrates that reducing consumption by 10% will reduce carbon emission by 18% and reducing consumption by 20% will lead to a carbon emission of 48% by 2050.

With the help of new technologies in ITC (defined Internet of Things) we can substantially improve the energy management at the level of consumers. With the help of these technologies you can integrate information in real time from many points of consumption: heating systems, ventilation, air conditioning, industrial equipment, equipment housewives etc. and optimize in the sense of reducing consumption.

Already available IT solutions that control consumption in buildings, factories, etc...

There are analytical solutions for forecasting consumption that combine weather forecasting to facilitate consumption from renewable sources.

Energy management allows consumers to reduce their consumption and find solutions to reduce bills in the knowledge of the cause.

Smart metering and IoT systems can increase the capabilities of the distribution network, being able to create additional possibilities for network management and increasing the role of System Operator in the license area.

At the same time, there is a risk of data loss and even the appearance of cyber security breaches. All these new solutions must be thought out holistically by addressing a coherent cyber security strategy and identifying the vulnerabilities of these systems being necessary to protect the applications, databases of physical and cyber attacks .

The energy industry *has to* cope not *only with the demand for energy but also* with the *preferences of* the *MILLENIUM and Z generation for renewable energy. The sustainable* development *of utilities depends on* the intelligent *way in which energy will be produced, transported, distributed and stored.*

3. Global Transport Network

In addition to the internal solutions of some clearly defined economic zones (for example, Europe) there are trans-continental interconnection

projects such as: Eurasia (Continental Greece -Crete-Cyprus-Israel) and EuroAfrica (Cyprus-Israel) and EuroAfrica (Cyprus - Egypt) given that Europe is covered by many submarine cable projects.

At the level of CIGRE, a project related to the Global Transport Network has been developed in recent years.

The concept is based on the use of the potential of RES at a very long distance. CBA (Cost Benefit) analyses present the advantages of very large investments in transport infrastructure, but which is significantly lower than the benefits obtained by using availability RES globally and in which it is assumed that no conventional production capacities will be used.

Additional sensitivity analyses the influence of storage, consumer behavior (DSM) as well as the possibility of creating the legal framework for investments in areas belonging to various economic blocs.

Another important aspect is the analysis of the possibility of implementing viable market mechanisms at global level.

The global transmission grid is designed taking in account the global wind and solar potential (Figure 4 and Figure 5).

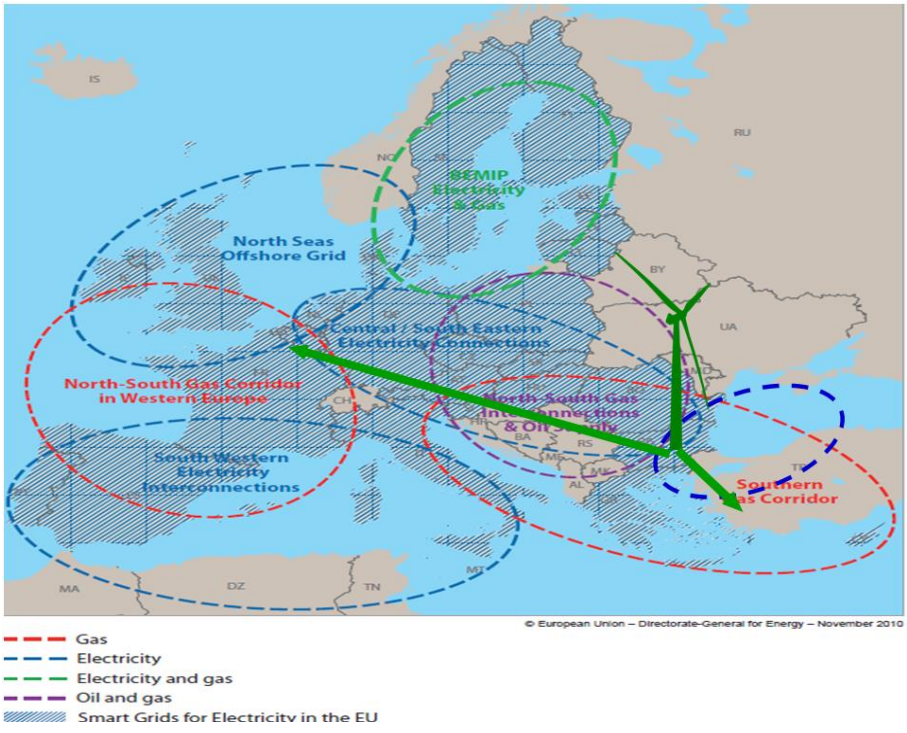

Figure 2. European corridors for electricity, gas and Smart Grid areas.

Figure 3. Global GRID.

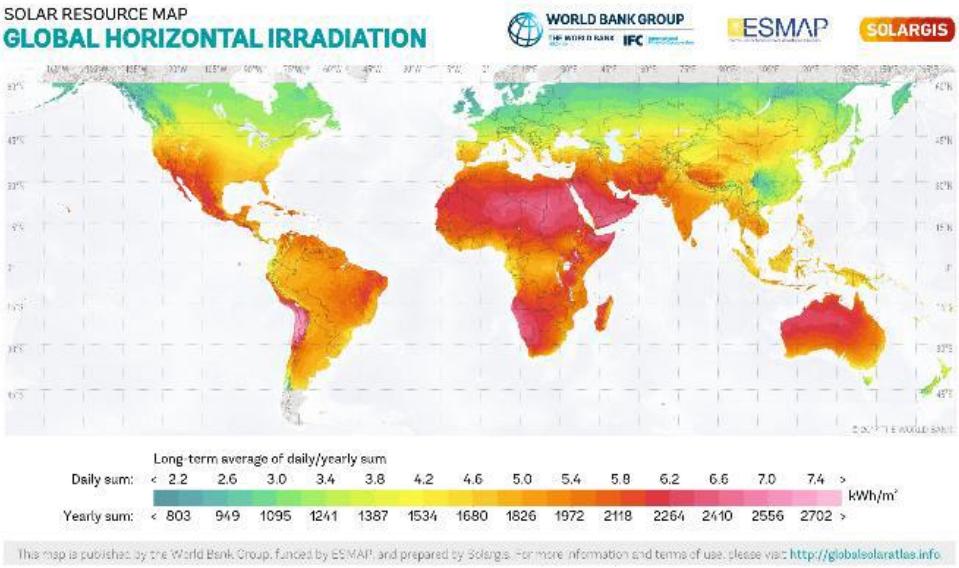

Figure 4. World solar potential.

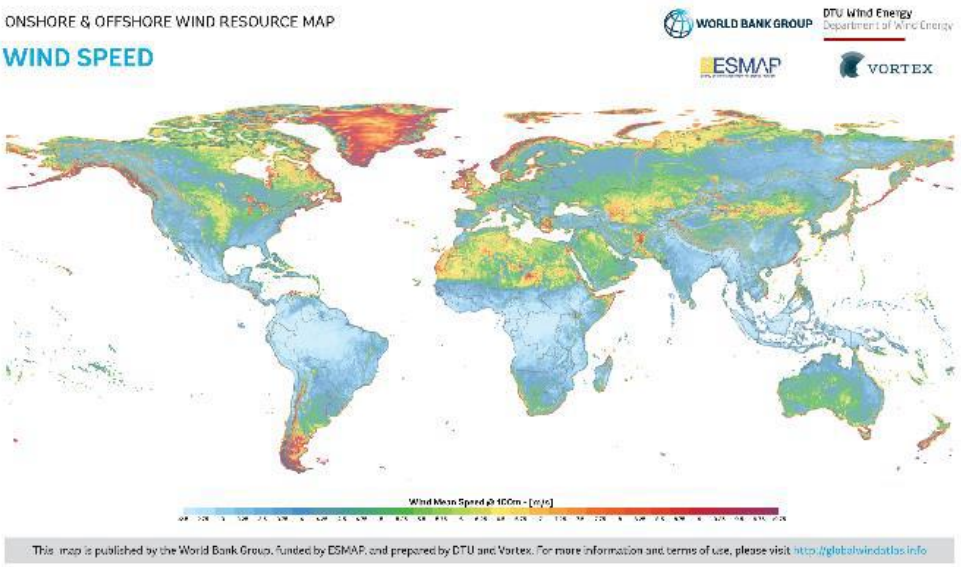

Figure 5. World wind potential.

4. Solutions framework

In order to achieve the objectives associated with climate change, there are several solutions that involve action at local level, but also a wide international cooperation.

Some ideas in this regard are:

- Expanding and increasing the capacity of the networks, building new lines, stations with a high relative cost;

- Innovative new "soft" solutions for System Operators to meet these challenges and ensure an efficient control of the systems. Technologies are evolving, and some that seemed to be utopian, today are economically viable.

During the energy transition, system operators must research and develop new solutions by implementing new technologies (HVDC, Hydrogen, etc...) and adapting the processes to maintain the safety of the system under the conditions of maintaining the tariffs within reasonable limits.

The combination of RES and realistic storage at all levels (large, distributed) will increase efficiency in production, transport, distribution and consumption.

Flexible and lear mechanisms in the energy market, including the global one, in which different load profiles will allow access to renewable

energy on a much larger scale, anytime and anywhere according to the wishes of the Millennial generation.

Sun, Wind, Water are practical resources inexhaustible and available at a lower and lower cost.

5. Energy measurement -challenges

Clean energy fields often neglect the importance of using an instrument that has been part of the energy distribution network since its inception: the meter. Data resulting from measuring energy beyond billing can create value.

Automatic metering data collection was introduced in the mid-80s, largely due to the advent of RAM technology for water and energy metering devices. Today, smart meters can remotely collect consumer and diagnostic data, and then transfer that data to a central database for billing, analysis, and troubleshooting. As the capabilities of smart meters expand, it is important that utilities understand how this technology can play a key role in saving clean energy.

5.1. Evolution of smart meters

When applied through advanced metering infrastructure (AMI),this data can contribute to smart grid projects, smart homes, buildings, infrastructure and a new level of innovation in smart city concepts.

Some of the ways smart meters are revolutionizing smart energy data include:

- **Measuring the quality of electricity:** Smart meters provide more detailed information about the quality of energy. Ecan detectthem when voltage and current waves cause power distortions, so utilities can proactively detect inefficiencies and minimize the ratio of active and apparent power .

- **Real-time energy consumption data:** Smart meters allow prosumers to access real-time information on energy use within distributed energy resources. They allow prosumers to make data-driven decisions to streamline energy consumption and save on annual utility bills.

- **Time of use** and energy **disaggregation:** Consumers, utilities and retailers can leverage smart meter data to disaggregant electricity consumption for certain appliances and devices. Energy consumption can be detected by analyzing data, helping consumers reduce consumption and reduce costs during peak hours.

- **Remote control:** Smart meters can be controlled and monitored remotely so that utilities have real-time visibility into the health of devices and can proactively debug, which reduces the need for manual work.

- **Support for networks :** Utilities can monitor the management of the charge for their entire distribution network and use this information to distribute energy equally between networks without suffering interruptions.

- **Switching services:** Prosumers can seamlessly switch between service providers, depending on their preferences in terms of renewables, tariffs or benefits of suppliers.

- **Flexible services:** Prosumers and utilities can ensure the security of their supply and maintain high-quality services efficiently by managing their production and consumption through the flexibility of services.

5.2. The key to unlocking the potential of smart meters

As the integration of big data and the adoption of storage in data lakes grows, so does the shift to mobilizing data on smart meters for more than just billing and cost savings.

"How can we use smart meters and big data to achieve maximum value for our customers, achieve clean energy goals, improve service *quality, and* increase cost savings?"

By using the next generation of smart meters, utilities can process millions of data points in real time and process them into various information. Advanced visibility throughout the network informs preventively about the maintenance of asset health. Being able to detect anomalies before the occurrence of outages or other harmful system failures, provides considerable cost benefits and the proactive customer service utilities they need in the current competitive landscape.

Utilities can be alerted to an electrical outage before the customer can call her. AMI (Advance Metering Infrastructure) hascleared utilities to send proactive communication to customers during a outage or when restoration is completed.

5.3. Using smart metering to achieve clean energy savings

When utilities learn to use this data and adopt an analysis-based approach, they can extract true value and harness the full potential of their smart meters. As the number of global adoptions continues to increase, energy companies will need an architecture that not only manages big data, but also

makes it available to different market participants, helping to accelerate innovation and promote the energy transition.

The integration of prosumers that produce and consume energy at home - with their own solar energy on the roof, for example - still requires flexibility services and infrastructure for punct-point trading and other types of energy sharing possibilities. However, the data is traditionally located in a single ODS and is therefore not shared. This harmful practice stops the value of smart metering from being realised.

The value of smart metering can be further increased by sharing and connecting distributed data sources – including data from time, network, usage consumption, tariffs, and manylts. By activating community-oriented platforms, utilities can use a platform to exchange data with market participants and support prosumers in tracking renewable energy.

6. Conclusions

The paper is trying to indentify WHY (global warming and universal public service for electricity) HOW we can reach the environmental and social-economic development targets in a sustainable way focusing on 5Ds, and briefly description of WHERE we have to act to reach these targets.

The worldwide objective for a reduction of carbon emission in all sectors of life the energy transition will move forward globally.

First of all solutions is -the simple one - to develop and increase network capacity and build new substations and power lines. But this solution will be at least extremely costly so there have to be new and innovative solutions for the system operators to manage these challenges and control the risks. Not one solution will fit all challenges. But there are single or combined solutions to most of the challenges, they are not all implemented today but technological available.

With the ongoing process of energy transition system operators have no choice, they have to implement new technologies and processes to keep the system stable on an accepted level of network tariffs. The search for additional technologies and new solutions is going on as described in chapter 2&3. A real combination of new RES generation and storage (large, but also distributed small scale), increase of efficiency in generation, transmission, distribution and consumption, comprehensive market mechanism in much larger area and nevertheless a much global approach on transmission worldwide based on different load profile which made also availability of RES for all consumers worldwide.

The Millenium generation is looking with concern to environmental issues and their need for electricity anywhere, anytime.

Electricity revival should consider not only RES penetration and change of market rules but also a change in mentality: consumers have to follow the RES generation. More then that, distributed generation (RES also) should be encouraged to act near large RES facilities for the security of the grid.

All these resources must be available through global transmission grid and global market adding lot of new R&D in technology.

Sun, wind , water do not cost money and electricity should be consider as a basic need of humans after air, water, and food.

R E F E R E N C E S

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