

## POWER INFRASTRUCTURE DEVELOPMENT AND THE IMPACT OF RENEWABLE ENERGY SOURCES IN A ROMANIAN DISTRIBUTION COMPANY

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### ABSTRACT

*The paper presents the company's main achievements, following the occurrence of new customers and the distributed generation. It also reviews the main actions of the local authorities and investors in renewable sources. EDMN has built by own means a small photovoltaic facility, as an experiment. The new SCADA/DMS system and an AMR system can be regarded as steps to a future Smart Grid and shows the awareness of the company for adapting the infrastructure to the new business realities.*

*Investment funds are inevitably limited and new requirements for quality in distribution, the development of new consumption areas and the strengthening of the grid for wind farms, put significant pressure on these resources, in an economically difficult period. In 2008 we had a significant infusion of capital from our major shareholder, ELECTRICA. The company has an active attitude regarding financial strategy, completed with renegotiating payments for most of the contracts. The company is committed to find the most appropriate ways for strengthening on the market, promoting improvements both in network as in mode of operation, leading to a change in depth virtually of the entire company and its development model.*

### INTRODUCTION

ELECTRICA Muntenia Nord Distribution (EDMN) operates in the south-east of Romania, having a highly diversified business area both geographically and in terms of electricity consumption (Figure 1). The relief of the 6 counties, within an area of 30,000 square kilometers, lies from mountainous regions, with over 2000 m altitude, to the Romanian plain and the lower Danube. Corresponding to this geographical diversity, the company offers various technical expertises in terms of power supply of consumers in industries like petroleum extraction, refining, steel, shipyards, agriculture, tourism, and manufacturing. The total amount of distributed electricity was about 7 TWh in a crisis year, 2009, with a load peak of 1100 MW. EDMN is one of the three power distributors own by state through our major shareholder ELECTRICA – a national society active in power distribution, supply, electrical equipment maintenance and development.

Another shareholder is the Property Fund (FP), an investment institution created by the Romanian government. After the complete market opening in electricity and natural gas field in Romania the legislation was fully harmonized with the European legislation by adopting Technical Codes and Performance Standards in electricity distribution and supply.

### RENEWABLE ENERGY SOURCES (RES) - TARGETS, ESTIMATION AND TRENDS

It is known that Directive 2009/28/EC establishes a mandatory target at the EU level for 2020. According to the law 220/2008, the Romanian targets for the amount of the electricity from renewable sources in the final consumption are 33 % in 2010, 35 % in 2015, and 38% in 2020, including the electricity produced in hydro-power plants larger than 10 MW.

In a recent report of Austrian and German institutes accomplished for the European Commission, Intelligent Energy Programme for Europe, it is considered that Romania will meet its 2020 RES target by 24% to 27 % share in final energy demand [1]. In the final consumption of electricity from RES, the RES share is estimated to rise between 41% to 53,5 %, in 2020.

In fact, a strong rising is known by the wind farms projects, exceeding expectations, being already approved the installation of over 3482 MW in wind generators only in EDMN area, with solutions for connection to the grid. In small hydro-power plants 32 MW are planned and 172 MW in large hydro-plants. In the most optimistic REPAP scenario Romania will have, by 2020, 3,200 MW installed in wind power plants and, as noted, only in EDMN area's already are approved connections for about 3500 MW (Table 1). However, not every project will lead to MWh produced by wind generators. Despite intentions, a lot of projects may remain only on paper. This "investments frenzy" is, in some cases, motivated by the recession of the real-estate and the interest of local investors to put money in a new dynamic business, with a good turnover. But, the most important, major players entered on this market, like Gas de France, Iberdrola, E.ON, ENEL, CEZ, OMV-Petrom and others [2].

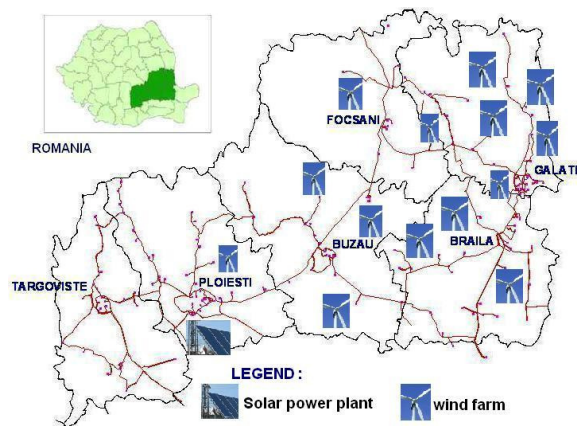
There are strong reasons to believe that the optimistic REPAP scenario for 2020 will be, probably, near to reality.

**Table 1. RES projects in EDMN area**

Renewable Energy Source for electricity production	Installed power with connection agreements for 2010 (MW)	Connection contracts in 2009 (MW)
Wind, onshore	3482	377
Small hydro<10 MW	32	-
Large hydro>10 MW	172	-
Photovoltaic	7,03	0,03
Biomass (biogas)	6,11	-
Total RES projects	3699,14	377,03

The policy instrument to support the electricity from renewable sources is a quota system based on tradable green certificates. RES power plants, except large hydro (>10 MW), qualify for receiving green certificates per MWh produced, in different number, according to the law. The mandatory quota for electricity suppliers increases every year, up to 8.3 % in 2010, from the total electricity supply. The certificates price is determined by market competitive mechanisms, but, in fact, this system established by the law 220/2008 is not entirely effective. The lack of the secondary legislation turns into malfunctions, the secondary legislation being expected to emerge in 2010. Until now appeared an imbalance between the supply and demand for green certificates.

As suggested in Figure 1, the main locations of the projected wind farms are in the east, where the wind potential is proper for power generation.



**Figure 1. The operation area of EDMN, the 110 kV network and the approximate location for wind-farms**

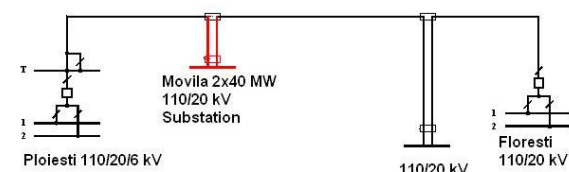
In the area where EDMN is active, we meet also a high

number of initiatives from the part of County Councils, Town Halls, as by universities or private companies promoting green energy. An oil and gas producer started the construction of an 860 MW combined-cycle power plant, with low NOx and carbon emissions [3], in Ploiesti, the main industrial city of the area. Another 800 MW Gas Power Plant will be developed near Galati, an important town in the east, by a major investor. Power generation projects in EDMN area are numerous and diverse, and they require an adequate strategy for the network up-to-date.

## RESHAPING THE POWER DISTRIBUTION INFRASTRUCTURE

The electricity distribution infrastructure has been developed especially in centers of consumption while in areas regarded as less important in terms of consumption the power lines have a lower density (agricultural areas, small rural households). The electricity utilities has been driven in some of these areas more on the principle of public responsibility for a less advantaged population, then on commercial bases [4]. A major challenge is now given by the fact that many of these areas might require an accelerated development of the power network due to the increase on renewable energy, particularly in wind farms.

In parallel, in the traditional consumption centres, respectively, Ploiesti, Targoviste, Titu, Buzau, etc., are developing new industrial parks and residential investment, therefore the demand for electricity in areas other than the old industrial platforms is high. Usually the network was not prepared for the new demand. Where it was possible and considered advantageous the utility bought the power station of an industrial consumer which previously stopped its activity. The purchase imposed in this case, an effort for the station refurbishment. The distribution networks are often in a technical state requiring repair or modernization. The monitoring requirements arising from the Performance Standard and the results of implementation of ANRE codes are greater than in the previous period. Therefore the pressure on the investment finances is becoming increasingly higher.



**Figure 2. Typical new 110/20 kV substation insertion in the existing network**

In the last five years 8 substation of 110/MV were submitted to extensive retrofit actions, 3 new substation

were built and put in operation and one was bought (and retrofitted). A substation is typically inserted in the existing 110 kV network as in the Figure 2. An important amount of investment funds were foreseen for the medium and low voltage network as well.

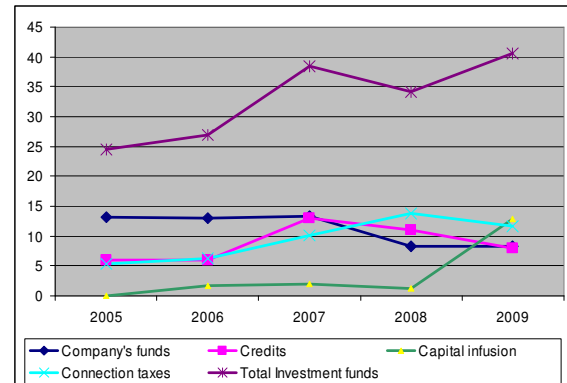
As a result of the decreasing of energy consumption of the industrial sector, since the beginning and mid-'90s, the company inherited sufficiently sized HV lines for the present needs. However problems persist concerning the age and quality of the equipment. But the consumption rise, which prefigures, and the new wind farms, requires also an increased capacity of the 110 kV overhead lines. These works are needed and planned in the following years, in the eastern and western sides of the operation area. New HV lines imply a high level of compensations for the land, required by new owners; therefore works for increasing the transmission capacity will be preferred.

Given the importance of a monitoring and control system (SCADA), about ten years ago have started the first attempts for the introduction of such systems. Initially, the applications were limited to one or two substations. This period had the merit of clarifying the need for control and monitoring and to highlight the technical and infrastructure problems that occur in an integrated SCADA system. For organizational and investment reasons, only in recent years an integrated system at the company level was designed and achieved. In the period 2007-2009, it was developed a modular and scalable SCADA/DMS system for the substations and the dispatching points. Also, it continued the expansion of distribution automation system in medium voltage networks SAD and SAD-U (urban networks), integrating these systems into SCADA. About 750 reclosers and remote controlled disconnectors were mounted in the medium voltage network. AMR systems include about ten thousands meters, to be integrated in a common platform, as part of a Smart Metering strategy. The technological leap is compulsory as an adaptation to the new standards, but also answers to the need of efficient operations with fewer personnel.

A direct investment in 2009 was in a solar battery of 22 kW photovoltaic inside the Floresti substation of 110/20 kV, in Prahova. Our first MWh of "green sources" were thus already produced. It is a test of direct involvement in renewable energy that, most likely, will continue.

Investment finance is a permanent issue for the EDMN management, especially in this time of crisis. The growth trend (Figure 3) was obvious in the recent years, but it can be encumbered by the economical crisis. At this moment we can not estimate the effects of the crisis on power consumption for 2010 and further. Some of the sources for investment were represented by an important capital infusion of the shareholders and by agreements with credit

suppliers concluded during the years 2007-2008, the contracts having a median of two years of exemption. Also, was not insignificant and was a preventive action, attracting funds from a commercial bank that has offered us a credit line to finance the working capital, which enabled the stability of financial flows.



**Figure 3. Investment funds evolution (million €)**

Another measure that has resulted in keeping within the parameters of the money flow was to renegotiate maturity dates of bills, for most suppliers to 90 days. Thus were created prerequisites for timely payment of supplier's invoices, bills without penalties that reduce profits. The additional capital contribution totaling approximately 13 million €, made by the two shareholders, Electrica SA and the Property Fund (FP) was a "relief" for the cash flow of our company, having a double effect:

- was a source of investment, financing without cost, increased the share capital of the company, consolidating the company from the point of view of the financial statement;
- created the premises of financial for the incomes increase. These resources were obtained by using money optimally, storing funds in banks until the time the money was actually being paid for investments, everything from the correlation with the investment plan.

The company intends to continue financing from sources and through the policies that have given positive results. Changes are expected in the near future consequently from the appearance of a new member in the board, given that FP management will be accomplished by a private investment group. That will mean, in principle, an even greater attention on getting profit. An important destination for investments will be for the connection to the electricity grid of still non-electrified households in more isolated places, a process that will be completed within 2010-2012.

The company is aware about the multitude of aspects involved and strives to extend and adapt its power network

to the new requirements and business realities. On long term, all these developments will change profoundly the company's operations, know-how, and even culture [5].

## OVERVIEW ON LOCAL INITIATIVES

In areas where EDMN is active, there are parallel concerns more or less supported by County Councils, Town Halls, as by universities or businesses initiatives, promoting green energy, renewable sources. Thus, in Ploiesti was installed and put into service in 2003 first wind generator in the country, and subsequently continued these concerns, including the creation of the Agency for Energy Efficiency and Renewable Energy Prahova (AE<sup>3</sup>R). This non-governmental organization benefiting from the EU funding through the Intelligent Energy Europe (IEE) program has provided consultancy for a number of projects for the installation of photovoltaic panels, heating with heat pumps, wind farms, etc. Promoting green energy is achieved also through the initiative entitled "Growth Pole Ploiesti", to reduce energy consumption in the city, promoting renewable energy and increasing the share of bio fuels in transport. Specific steps are foreseen in the Growth Pole Ploiesti Area, which includes: Ploiesti and 3 towns, 10 communes, 58 villages. Some of the mayors and counsellors from the region are aware about a goal that is still remote, namely, of achieving a "green area", potentially energy independent as in some European countries there are projects to undertake complex restructuring of settlements on the principle of sustainable development. These players have their role in shaping the local business environment and it is compulsory for us to be accepted in this partnership on long term basis.

Photovoltaic panels have been installed and a number of schools or local government area of activity, these institutions being interested in obtaining green certificates. Also, actions have emerged for establishing biogas plants as well as other biofuels (Table 1). Through the partnership of the local authorities and the Chamber of Commerce and Industry a number of projects will be developed projects in this regard. In this brief paragraph we want to show how, gradually, significant changes might appear in the local production-consumption balance of power. The distribution operator adopted an open attitude, it maintains contact with the centres of expertise and authorities to encourage and provide support through technical expertise of these initiatives, starting from the following considerations:

- To bring new customers into the company's portfolio;
- To benefit from all opportunities for punctual renewal of the infrastructure, as a means of ingress and experimentation of technical innovations.

## CONCLUSIONS

The analysis of the development directions and strategies

in electricity distribution allow identifying trends, both globally and in regional or local issue. We believe the truth of the assertion that the economical crisis can be overcome by restructuring our business, in a profound renewal of technology, both in the electricity generation and distribution. The principle of sustainable development adopted by the European documents must be followed in a consistent manner in the investment strategy for the distribution of electricity and distributed generation, having regard to Directive 2009/28/EC on the promotion of renewable energy. Those goals will be achieved by the opening to local initiatives in the field, but with the permanent objective of adequate infrastructure to enhance business development in new conditions. There is a need to adapt the infrastructure to new realities of power production and consumption, to RES generation and specially the wind farms appearance, to promote the latest technologies, SCADA/DMS and the Smart Grids concept. A local company must be able to fulfil both European requirements and the performance standards of the National Regulatory Authority in a sustainable economical pattern of development. To strive towards excellence [6] with the help of the right technological choices might be a chance to face the economical crisis as a stand-alone company.

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