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EU REGULATIONS AND DYNAMICS OF CHANGES IN LOGISTICS SYSTEM ARCHITECTURE IN POWER ENGINEERING

Abstract: The new EU energy policy is commonly associated with climate-energy package aiming at lowering emission and use of primary energy as well as increased share of renewable energy sources. In practice the accepted policy comprises a much more complex spectrum of issues and its realization requires a number of new legal regulations. Their application will result in diverse, often significant in scale and quality changes in functioning of the economy especially in the area of power engineering and environmental protection. One of the vital elements of power industry is its logistical system. The scope of the presented work was the dynamics of the changes in the architecture of the power engineering logistic system which results from applying the new regulations of new power engineering policy. New legal regulations were presented that were the most significant for functioning of the logistic system in power engineering. The logistic system architecture in Polish power engineering was characterized and analyzed. The most important tendencies of its changes were outlined as well as their economic and social consequences.

Keywords: common energy market, renewable energy sources, energy policy, transmission system operators, distribution system operators.

1. Introduction

The increasing European Union dependency on power resources imports, fears of using power resources as the means of political pressure, climate anomalies seen as the result of global warming and the risk of inefficient, large scale electroenergetic systems (black out, nuclear power failures) – these are the bases for creating new common energy policy for the whole Europe. The rules of the new power policy were

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formulated in a document entitled 'European Energy Policy'. The main, strategic aims were formulated as follows:

- Until 2020 lowering the emission of greenhouse gases in developed countries by 30% as compared to the level from 1990, EU accepting an obligation to reach minimum 20% reduction in emission of greenhouse gases as compared to the level from 1990,
- 20% reduction in total use of primary energy by 2020,
- Increasing share of renewable energy in EU energy balance from present 7% to 20% in 2020,

The aforementioned goals were the base for climate-energy package signed by the member countries on 12th December 2008. In a way, it forces the EU countries to carry out a 'green revolution' in the whole economy. Switching from high-emission coal to renewable energy sources as well as saving energy means for Europe and especially for Poland significant changes, mainly in energy production structure which will have substantial influence on the change of power engineering logistic system architecture. Reaching those goals requires a number of actions and activities as well as large investments involving sustainable development, building a competitive energy market and delivery safety. These are not possible without creating an efficient system for energy resources delivery, transferring, distributing and storing energy. The issues arising from changes in architecture and logistic systems models in Polish power engineering that have been going on under the influence of the regulations brought by the climate-energy package are important from both theoretical viewpoint and for practical economy.

The aim of this paper is to determine the directions of changes in logistic systems architecture for power engineering which are connected with the new regulations in this sector. The paper focuses on the EU legal regulations resonating on the logistic system in power engineering. Its main role is to ensure an equal access to transfer services for all players on the energy market which is necessary for the energy market to function. The emphasis is on the organizational and legal aspects of the transmission operators' activity and distribution of electrical power and gas which ensure their independence. The latest documents creating and directing further realization of the Community energy policy were analyzed taking into consideration changes in logistic systems. Special attention was paid to the necessity to increase the flexibility of the logistic system in power engineering connected both with the expansion of transnational lines and the development of regional and local energy systems. The changes in energy production structure that result from signing the climate-energy package set off for the Polish power engineering the development of the renewable energy sources which will require building necessary logistic systems e.g. for obtaining and delivering biomass or decentralizing energy supplies (in smart grids systems).

2. Directions of changes in EU Power Engineering

A significant issue that is also the subject of changes in EU regulations is to create a genuine internal energy market which would be up to the task of dealing with the three challenges of the modern energy market:

- To enable competitiveness leading to lowering of costs for energy recipients and stimulating activities promoting energy efficiency. Ensuring rules of competitiveness is one of the basic conditions for investments and thus incoming external capital;
- To ensure sustainability and stability of regulation and economic policy towards economic sector. Well-functioning market is indispensable for the right use of economic instruments, including the right functioning of emissions trading system. Transmission system operators (TSOs) and distribution system operators (DSOs) should be interested in supporting adding to the system the renewable energy sources, plants producing electricity in association with thermal energy production and micropowerplants. This will encourage smaller businesses and private individuals to use unconventional, spread energy sources.
- Increase security of energy supplies. Efficient and competitive internal energy market may ensure substantial benefits regarding supplies security and high standards of providing public services. Proper separating the network from businesses producing and trading in energy (or such parts of electroenergetic or gas companies) should stimulate independent operators to invest in new infrastructure, internetwork connections throughput and new powers thus preventing power failures. The independent transmission system operators and the distribution system operators for electrical energy and gas should contribute to stabilizing the network services prices. Introducing competition rules in power engineering often depends on carrying out necessary changes in previous regulation rules. The areas regulated in power engineering are bound with logistic processes comprising transfer and distribution of energy and gas. It is therefore important to provide such legal and organizational solutions that may generate businesses which ensure equal access for all players on the market to use logistic services for transfer and distribution of energy and gas. This area of activity, apart from the influence on introducing competition, also determines energy security regarding supplies logistics on electric energy and gas. In case of natural gas there is an additional element of the logistic system: creating reserves of this fuel via liquid gas storage system.

Important changes in functioning and organization of TSOs and DSOs were implemented in 2004 and 2007. An administrative order of unbundling was carried out, i.e. separating production, transfer, distribution and supplies which is the base for identification and assigning costs of a given activity. According to current EU directives: 2003/54/EC(1) and 2003/55/WE(2) regarding common rules for internal electric energy and gas market, member states established in the legal, organizational

and accounting form: Transmission System Operators (TSOs) since 1 July 2004; Distribution System Operators (DSOs) since 1 July 2007. These regulations are reflected in appropriate legal acts and are currently valid. In case of Poland, the basic legal act reflecting EU regulations is Prawo energetyczne (Energy Law) [5].

Analysis of the energy sector activity of EU countries showed that the rules regarding legal and functional separating determined in the directive 2003/54/WE did not lead to an effective emerging of transmission systems operators. Therefore, during the 8th and 9th March 2007 session European Council obliged the Commission to work out legislative motions regarding 'an effective separating production and supplies activities from network exploitation' [6]. This resulted in new directives regarding the rules for the internal electric energy and gas market in EU countries. Among other they include some interesting issues (interesting for us from the point of view of logistics) connected with functioning of TSOs and DSOs as well as distribution of electric energy and gas.

The directive regarding the common rules for functioning of the internal electric energy market [6] states that an efficient separation of transfer and distribution from other activities to do with energy can be ensured only via eliminating the phenomenon of vertically integrated companies discriminating their competition with regard to network access or investments scope. Ownership unbundling, understood as assigning the owner of TSO and DSO networks keeping them independent from all matters connected with supplies (sales) and production is both the most efficient and stable means of preventing potential dishonest competition practices. This solution should ensure the security of energy supplies due to concentration on a specific activity and specialization level. According to the rules of ownership separating of transfer operators from other energy companies, until 3.03.2012 the member states are obliged to the following:

- to ensure that the same individual (corporate body or private individual) or the same individuals are not entitled to control a company producing or delivering and at the same time to control or execute any rights with regards to TSOs or Transmission System,
- to follow the rule stating that controlling a Transmission System or TSO should exclude the possibility of controlling or executing any rights regarding a company producing or supplying electric energy. Within thus set limits however it is permissible for the company producing or supplying electric energy to possess minority shares in TSO or Transmission System.

The organizational and legal rules of TSO's functioning in case of electroenergetics are determined in the aforementioned Directive 2009/72/WE¹. In case of gas sector analogous regulations are contained in Directive 2009/73/WE². In both cases

¹ These are: Chapter IV „Eksplotacja systemów przesyłowych”, Chapter V „Niezależny operator systemu przesyłowego” European Parliament and Council Directive 2009/72/WE of 13th July 2009 r. regarding common rules of electric energy internal market and annulling directive 2003/54/WE European Union Journal of Acts L 211/71 of 14.08.2009

² European Parliament and Council Directive 2009/73/WE of 13 July 2009 r. regarding common rules of natural gas internal market and annulling directive 2003/55/WE, European Union Journal of Acts L 211/71 of 14.08.2009

there are substantial similarities the intent and concept of TSO functioning being the basic element of the logistic system in power engineering³.

The basic rule for all energy systems since 3.03.2012 has been the full independence of their TSO. Each company being the owner of Transmission System or acting as TSO (or person/persons connected with such activity) cannot be entitled to direct or indirect controlling a company that carries out any kind of activity regarding generation or supplying electric energy and gas. Government regulatory body is obliged to assign and certify TSO. It is recommended that operator isn't in any way connected with another energy company. When an independent owner was assigned of the system, which is part of a vertically integrated company, the owner of the Transmission System must be independent, at least in the scope of its legal, organizational and decision-making form, from any other kinds of activities not connected with transferring. Independence is bound with responsibility and tasks. Each independent TSO is responsible for granting access for third parties and managing such access but also for exploitation, maintenance and development of the Transmission System as well as ensuring a long term ability of the system to satisfy justified demand by means of investment planning. While developing the Transmission System the independent system operator is responsible for planning (including the permissions granting procedure), construction and commissioning of new infrastructure. New regulations also allow the state to have certain requirements with respect to TSOs. Therefore, having at their disposal production installations using renewable energy sources, TSOs are obliged act in a way that ensures their safe and effective connection to the network⁴. The state may also require TSOs to give priority to the following while disposing and managing the network:

- production installations producing thermal energy in association with electric energy,
- installations that use local fuels as sources of primary energy, in the scope not exceeding 15% of the total amount of primary energy necessary to produce electric energy consumed in a given member state in each calendar year.

In both discussed directives functional rules for DSOs were regulated as well. There are numerous similarities to TSOs but in case of DSO independence there is a vital difference in our opinion. The discussed directives it is stated that in the case when DSO in a part of a vertically integrated company, it must be independent – at least in the scope of legal, organizational and decision-making form – from other activities not connected with distribution. These rules do not make it obligatory to separate ownership of the distribution system assets from a vertically integrated company⁵. In order to create formal conditions for DSOs' independence in case when

³ In this case limiting and regarding electroenegetic and gas sector

⁴ Regards respecting art.16. European Parliament and Council Directives 2009/28/WE of 23 April 2009 regarding promoting use of energy from renewable sources altering and thus annulling directives 2001/77/WE and 2003/30/WE, European Union Journal of Acts L 140/16 of 5.06.2009

⁵ European Parliament and Council Directive 2009/72/WE of 13 July 2009 op. cit paragraph 26, European Parliament and Council Directive 2009/73/WE of 13 July

DSO is a part of a vertically integrated company the following rules should be followed and the following measures should be undertaken:

- DSOs should be self-reliant in the scope of their organization and permissions to make decisions from other activities not connected with distribution;
- Persons responsible for DSOs management do not take part in structures of integrated gas (energy) company that is responsible, directly or indirectly, for the day-to-day activity in the scope of production, transferring and supplying natural gas (electric energy);
- appropriate measures must be undertaken to ensure that professional interests of those responsible for managing DSOs were taken into consideration in a way that allows these individuals to act independently;
- DSO must possess efficient powers to make decisions, independent from integrated gas (energy) company, in relation to assets necessary for exploitation, maintenance or developing the network;
- DSO should have necessary resources at its disposal, including human, technical, financial and physical resources. This will not constitute an obstacle for functioning of the right coordination mechanisms to ensure protection of right and corporate order in company (including owner's supervision);
- it is not permissible for the mother company to intervene in respect to current activity and decisions regarding construction or modernization of distribution lines;
- DSO must prepare a conformity program that determines measures to be undertaken in order to eliminate discrimination practices and to ensure proper monitoring of its execution;
- Member states should ensure monitoring a DSO activities via regulatory bodies or other appropriate bodies so that it may not use its vertical integration to harm competition;
- vertically integrated DSOs cannot cause – in the scope of communication and brand – conflicts with respect to a separate identity of the part of the vertically integrated company dealing in supplies.

Distribution System Operator will be required to provide its system users all information necessary for them to efficiently access the system, including using the system.

Member states may require DSOs, while managing installations producing electric energy, to give priority to those installations that use renewable energy sources or wastes, or to these that produce thermal energy in association with electric energy⁶.

To sum up, new regulations make it possible to choose the following solutions of functioning transmission and distribution system operators.

The problem of distribution systems operators independence is particularly important in Polish conditions because basically all organizations of that type constitute a part of vertically integrated energy corporations. These are controlled companies

⁶ European Parliament and Council Directive 2009/72/WE of 13 July 2009 op. cit paragraph 26, European Parliament and Council Directive 2009/73/WE of 13 July op. cit .Chapter VII and VIII

of capital groups such as Polska Grupa Energetyczna SA or Tauron Polska Energia SA. Therefore an important issue from a viewpoint of building a genuine competitive market is efficient introduction of new regulations in 2012 which are supposed to ensure realization of an important element in the directives analyzed 'In any event, it must not discriminate between system users or classes of system users, particularly in favor of its related undertakings'.

An important document of social-economic character is the long-term EU development strategy for 2010–2020 entitled 'Europe 2020 – Strategy for smart, sustainable and inclusive growth'. The accepted document replaced the Lisbon Strategy. The EU strategy contains: three priority areas, five headline targets, ten integrated guidelines and seven flagship initiatives⁷. The area of interest for our research corresponds with the following:

- a) one of the three priority areas i.e. sustainable growth – transformation in the direction of low emission economy, more competitive and utilizing resources more effectively,
- b) target 3 i.e. greenhouse gas emissions 20% lower than 1990, 20% of energy from renewables in total energy consumption; 20% increase in energy efficiency. By 2020 European Union is determined to reach 30% reduction in emission compared with 1990 as long as other developed countries undertake comparable emission reductions and developing countries contribute as much as they can,
- c) guideline 5 meaning more effective utilizing the resources and reduced emissions of greenhouse gasses – flagship initiative entitled 'Resource efficient Europe'. These activities aim to make the economic growth independent of utilizing natural resources and facilitating transformation in the direction of low emission economy using renewables on a larger scale. It is assumed that building the internal energy market will be completed which corresponds with the presented regulations contained in the directives regarding this market. The initiative contains some very significant actions that influence logistic systems also in power engineering. Those are:
 - using incentives in order to promote changes in production and consumption patterns for more sustainable ones as well as withdrawing those subsidies that are harmful for the environment, for instance, economic instruments or 'green' public tenders will be used on a larger scale,
 - activities aiming at creating modernized, smart and integrated networks for energy and transport infrastructure, especially transport in cities
 - rising energy efficiency standards for buildings. Within the project a vision of structural and technological changes until 2050 should be drawn up in order to make Europe an economy friendly for the environment but climate-change-proof⁸. More details, goals and intentions of the dis-

⁷ Further in: "Europe 2020 – EU Strategy for smart, sustainable and inclusive growth" document accepted by European Council on 17 June 2010. Krajowy Program Reform Ministerstwo Gospodarki, Warszawa 2010

⁸ Ibidem p. 2 and further

cussed strategy regarding power engineering is to be found in a document entitled 'Energy 2020. Strategy for competitive, sustainable and safe energy sector'⁹.

The new strategy for energy the five main priorities are as follows:

- 1) Achieving an energy efficient Europe;
- 2) Building a truly pan-European integrated energy market;
- 3) Empowering consumers and achieving the highest level of safety and security;
- 4) Extending Europe's leadership in energy technology and innovation;
- 5) Strengthening the external dimension of the EU energy market.

For each of the priorities presented some task were formulated to be realized. The most significant ones, setting the direction for changes in logistic systems are:

- 1) Action 3 within Priority 1. Reinforcing efficiency in energy supply. Distribution and supply companies (retailers) should be required to secure documented energy savings among their customers, using means such as third party energy services, dedicated instruments such as 'white certificates', public benefit charges or equivalent and speeding up the introduction of innovative tools such as 'smart meters' which should be consumer-oriented and user-friendly so that they provide real benefits for consumers.
- 2) Preparing a plan for European infrastructure for 2020–2030 is an action within the second priority. A priority infrastructure will be determined which is supposed to be introduced in order to obtain a functioning internal market, ensuring integration of energy production on a large scale and from renewables and guarantee supplies security according to the vision of sustainable European energy system until 2025.

Until 2015 all member states should be included in European internal market. Trans-border corridors shall also be taken into account. 10-year-old plans of network development will be carried out with the help of Agency for Cooperation of Energy Regulation Bodies along with all other interested parties. The base for this action will be successful regional initiatives, such as those in the Baltic Sea region; it will also include an evaluation of necessary storage installations and adjustment means in the scope of climate change taking into consideration any future potential needs in the scope of CO₂ transport infrastructure in EU. Preparing the network for unavoidable changes resulting from energy and transport policy, such as electromobility and increased decentralized generation of electric energy as well as generation of electric energy from renewables on a large scale.

⁹ COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, Energy 2020, A strategy for competitive, sustainable and secure energy SEK(2010) 1346. KOM(2010) 639 final version. Brussels, of 10.11.2010

- 3) Action 3 within Priority 2 is connected with streamlining permit procedures and market rules for infrastructure. The streamlined and improved procedures will provide for more transparency and ensure open and transparent debates at local, regional and national level to enhance public trust in and acceptance of the installations. In addition, ways of positively rewarding, through enhanced access to public fund regions and Member States that constructively engage and succeed in facilitating the timely construction of projects of European interest will be explored. A detailed program of action will be presented accordingly to assist the Member States in the process of rolling out smart metering/smart grids and encouraging new energy services.
- 4) Within Priority 4 The Commission will be launching four large-scale European projects, especially the following:
 - 4.1) Taking forward a major European initiative on smart grids to link the whole electricity grid system, from the off-shore wind farms in the North Sea, solar plants in the South and existing hydro-electric dams, to individual households, while making power networks more intelligent, efficient and reliable.
 - 4.2) Re-establishing Europe's leadership on electricity storage. Ambitious projects will be developed in the fields of hydro capacity, compressed air storage, battery storage, and other innovative storage technologies such as hydrogen. These will prepare the electricity grid at all voltage levels for the massive uptake of small-scale decentralized and large-scale centralized renewable electricity.
 - 4.3) Implementing large-scale sustainable biofuel production, including in the light of the ongoing review concerning the impact of indirect land use change. The €9 billion European Industrial Bioenergy Initiative will be launched shortly to ensure quick market uptake of sustainable second-generation biofuels.
 - 4.4) Providing cities, urban and rural areas with ways of making greater energy savings. The 'Smart Cities' innovation partnership launched early 2011 will bring together the best from the areas of renewable energies, energy efficiency, smart electricity grids, clean urban transport such as electro mobility, smart heating and cooling grids, combined with highly innovative intelligence and ICT tools. EU Regional Policy can play an important role in unlocking local potentials. Rural areas also have a significant potential in this respect and could make use of the EARDF that provides financial means to support such innovation projects.

The strategy presented and especially European projects will have substantial influence on energy logistic systems, especially on its two elements. One is implementing smart grids and energy meters, the other is development of energy resources logistics for renewables.

3. The analysis of the current logistic system architecture in polish power engineering

Logistic system architecture in power engineering, made up by specific processes and entities could be analyzed in the aspect of their allocation and meaning in value chain that is created by that field of the economy. Generally speaking, parts of this chain are links among specific actions and entities of power engineering which create value via mutual interaction. In case of Polish power engineering these are:

- Obtaining energy resources (hard and brown coal, oil, natural gas, biore-sources)
- Supplying and storing energy resources for generating electric and thermal energy,
- Preliminary processing (desulphurization, enriching, conditioning) of coal,
- Transmission of gas, electric energy and liquid fuels.
- Storing condensed gas,
- Distributing (supplying) gas, electric energy, thermal energy, liquid fuels, wa-ter, solid fuels (coal, coke),
- Selling electric energy, thermal energy, gas, water, solid and liquid fuels.

Some of the element mentioned above comprise regional, national or even trans-European logistic systems. Due to the character and meaning of power engineering system (especially its energy security aspects) the scope of our interests are electric energy and gas logistic systems:

- Transmission and distribution of electric energy
- Transmission, distribution and storing gas
- Supplying resources for electroenergetics.

These systems are organized in a form of logistic operators models called Transmission System Operator (TSO) and Distribution System Operator (DSO). Their organization and functioning is largely based on the concept determined by energy policy legal expression of which are appropriate EU directives and national law. The following are current logistic solutions in gas and power engineering.

3.1. Gas engineering¹⁰

The transmission system operator is OGP GAZ-SYSTEM SA, a company wholly owned by the State Treasury of a strategic importance for Polish economy responsible for security of supplying natural gas via transmission networks. In 2009 the company exploited the gas transmission network of 9.709 km, 8.637 km of which is owned by OGP Gaz – System SA and the remaining 1.072 km is managed by the company on the basis of operating leasing agreement with PGNiG SA. Since 6th July 2005 the company has also been in possession of 100% shares in Polskie LNG SA company

¹⁰ Collected using: Polska 2010 – Raport o Stanie Gospodarki, MG Warszawa 2011, p. 165 and further

which is responsible for construction of the LNG condensed natural gas terminal in Świnoujście.

In 2008 the President of URE assigned PGNiG SA to be gas fuels storing system operator (SSO) for the period between 1st January 2009 and 31st December 2025. In order to ensure organizational and accounting separation PGNiG SA set up a subsidiary of the company which performs the functions of SSO under the name of Polskie Górnictwo Naftowe Spółka Akcyjna w Warszawie – Oddział Operator System Magazynowania w Warszawie. Table 1 presents the state of underground natural gas storage facilities in Poland.

Table 1. *Underground gas storage facilities in Poland (2009)*

Lp.	Name	Type	Active capacity (mln m ³)	Amount of gas collected from storage (mln m ³)	Amount of gas pumped to storage (mln m ³)	Minimal storage (mln m ³)	Maximum storage (mln m ³)	End of reporting period status (mln m ³)
1	Wierzchowice	depleted gas deposit	575,00	545,825	458,938	130,793	589,731	386,564
2	Brzeźnica	depleted gas deposit	65,00	79,522	65,540	5,801	71,341	41,153
3	Strachocina	depleted gas deposit	150,00	149,890	142,542	16,920	159,410	98,964
4	Swarzów	depleted gas deposit	90,00	103,325	86,487	3,521	90,000	49,521
5	Husów	depleted gas deposit	350,00	384,264	324,072	101,324	375,396	270,313
6	Mogilno	Salt cavern	370,00	267,488	195,042	232,364	375,000	302,308
7	Daszewo	depleted gas deposit	30,00	0,381	9,206	0,000	9,206	8,825
TOTAL			1630,00	1530,695	1281,827	490,723	1670,084	1157,648

Source: PGNiG SA data

Distribution system operators are controlled by national gas monopolist PGNiG SA in Warsaw (over 98% share in Polish gas market). These are six regional gas companies responsible for supplying gas fuel to individual, industrial and wholesale recipients as well as for exploitation, renovations and development of gas networks. In 2009 the total length of the distribution network managed by gas companies was 115,8 thousand kilometers and natural gas was being delivered to about 6.6 mln recipients.

3.2. Electroenergetics

Transmission system operator is PSE-Operator SA w Warszawie - a company wholly owned by the State Treasury (of a strategic importance for Polish economy). It is the owner of the transmission network (high and highest voltage – 220 and 400 kV) with the total length of about 41.6 thousands kilometers.

Distribution system operators are companies within structures of vertically integrated capital groups of energy companies. Table 2 presents the list along with the number of the so called general agreements (with sellers or big recipients).

Table 2. *Distribution system operators and number of general distribution agreements*

Company name	Status on 31.12.2008 r.	Status on 31.12.2009 r.
Enea Operator Sp. z o.o.	26	32
Energa Operator SA	28	35
PGE Dystrybucja LUBZEL Sp. z o.o.	19	25
Vattenfall Distribution Poland SA	23	35
EnergiaPro SA	27	33
ENION SA	30	35
PGE Dystrybucja Łódź Sp. z o.o.	20	26
RWE Stoen Operator Sp. z o.o.	23	27
PGE Dystrybucja Rzeszów Sp. z o.o.	20	28
PGE Dystrybucja Łódź – Teren SA	19	28
PGE Dystrybucja Białystok Sp. z o.o.	18	26
PGE Dystrybucja Warszawa – Teren Sp. z o.o.	21	31
PGE Dystrybucja Zamość Sp. z o.o.	21	29
PGE ZEORK Dystrybucja Sp. z o.o.	21	30

Source: URE based on data provided by DSO

The amount of energy supplied by operators indicate the growing potential of those companies which is illustrated by Table 3.

Table 3. *Energy supplied to end users by distributors*

Specification	2000	2001	2002	2003	2004	2005	2006	2007	2008
	(GWh)								
Energy sent from network to end users	101323	100639	99535	102965	106089	107400	113025	116564	118951
NN and WN	27290	25572	24034	25301	25896	24945	25664	27005	27233
SN	29565	29884	30158	31311	33187	34581	37033	38854	39508
Nn	44468	45183	45343	46354	47005	47875	50328	50705	52210
Including households and farms	25787	25986	25741	26076	25710	26336	27549	27713	28269

Source: ARE data

The exception is the decrease in energy supplies between 2002–2007 via high voltage networks which resulted from heavy industry restructurization. Unfortunately none of the companies uses smart grids or measuring systems.

3.3. Resource supplies logistics for electric energy generation

The resource logistic system for electric energy generation is determined by its production structure dominated by coal transporting which is still the biggest part of cargo transported in Poland. In spite of a significant, almost 13.5%, decrease in transported mass of that resource between 2005–2010, its share in total volume of cargo still fluctuates at a very high level between 42 and 45%. Due to mass character of this sort of transporting as well as loading capacity greater than demand generated mainly by energy industry, train transport covers almost 90% all transport needs for coal. In 2010 transports of hard coal was realized by more than half of all functioning on the market licensed carriers¹¹. In 2009 144.3 mln tons of hard coal was transported by train, car and inland boat transport. Share of road transport is still insignificant. In 2009 16.4 mln tons of coal was transported. The potential of a developed network of long distance river routes is still unused. Inland boat transport which is among other features low cost and low level of energy consumption, is still marginal and does not exceed 1.5%. Share of the remaining players on the market is marginal.

4. Changes in logistic system architecture

The review of new EU regulations and analysis of the current logistic system in the area of managing distribution and energy resources supplies indicates the following directions of changes in logistic system architecture.

- 1) Electric energy and gas distribution system operators in Polish power engineering are part of vertically integrated energy companies functioning as capital groups. Desired solution will be ownership unbundling between distribution and generation and selling electric energy or gas. In our opinion it is the best of the three variants shaping operator's independence.
- 2) In case of gas storing system operator, this activity should be quickly separated from PGNiG SA structures, national monopolist carrying out extraction works, sales and purchases of gas which is in conflict with regulations to be introduced in 2012.
- 3) Distribution network structure will undergo significant changes. According to projects realized within the Energy 2020 strategy, smart grids and measurement systems will be introduced. Smart grids feature a system of two-way, digital communication between the supplier and the consumer as well as smart measuring and monitoring systems. Advantages of smart grids are commonly acknowledged. Smart grids can manage direct interactions and communication between prosumers and energy suppliers.

¹¹ P. Bedyński, Struktura przewozów węgla kamiennego, Rynek Kolejowy, Portal WNP, 20.07.2011.

- 4) There will be a rapid development of biomass extraction logistics and supplies systems. According to new regulations the OZE energy production increase will accelerate. Forecasts in 'Polish Energy Policy until 2030'¹² state that until 2020 the energy production from renewables will grow almost 4 times. For instance it is planned to build a few hundred biogas plants of different capacities¹³. For example, in order to generate 3,65 mln m³ of biogas, a biogas plant of 1 MW power needs 21 thousand tons of silage which requires 450 ha.

5. Conclusions

- 1) New EU directives regarding the internal electric energy and gas market clearly require increasing transmission and distribution operators independence. Formula of this type of organization functioning without connection with generation and sale companies seems to be a condition of ensuring equal rights as a base for competitiveness.
- 2) Creating a genuine energy market is one of the main goals of EU power engineering and at the same time the condition of realizing the new energy policy. Drawing up new rules of logistic systems functioning to ensure equal chances to use the infrastructure (including energy networks) is an important instrument of supporting competitiveness.
- 3) New regulations being introduced may result in changes in logistic architecture through unbundling or separation of operators from vertically integrated companies. It is our conviction that 'ownership unbundling is the best solution enabling distribution system operators in Poland to gain independence'.
- 4) Planned projects connected with energy infrastructure may significantly modernize distribution systems in Poland. Applying smart grids and measuring systems will bring a substantial improvement into this vital area of public service of energy supplies.

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¹² Polish energy policy till 2030. Document accepted by the Council of Ministers 10.11.2009, p. 83

¹³ Further in: *Rynek biomasy w Polsce*. Przegląd Energetyczny, No 2, June 2011, p. 6

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