

# The Security of Energy Supply and Regulatory Procedures

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**Abstract** The aim of this article is to identify and analyze relations between the security of energy supply and used regulatory instruments. The point of reference for further discussions will be a thesis that in Poland we are beyond the security of energy supplies now and we are in a position of lack of clear goals related to the environmental protection. However, used regulatory instruments became ineffective – they do not lead the targets. At the end of our deliberations We make a postulate to change the regulatory paradigm and verify specific regulatory procedures.

**Keywords:** entities active in the energy sector, governance, local governance, economic and social factors, effectiveness, risk, renewable energy sources

## I. THE ESSENCE OF THE SECURITY OF ENERGY SUPPLY AND REGULATORY

In recent years, after relatively peaceful time, uncertainty over possibilities to fulfill the needs by securing energy supplies has intensified. It refers mostly to the hazards of shortages in transmission of energy and gas supplies (over a certain period of time). As a result of it, belief enhancing the uncertainty and risk of lack of energy supply in certain period of time, and place, and security of energy supplies has become a subject to long discussions among scientists, entrepreneurs and politicians.

Even though, the security of energy supplies becomes a subject of special interests it is defined in many different ways. The security of energy supplies is one of the main terms in the energy system. In all states in the world the priority action in the energy system is to ensure the supply of energy, heat and gas.

The security of energy supply is defined in many ways with a special consideration to the variety of different aspects. However, the commonly accepted general definition of security of electricity supply is **“the ability to satisfy the electricity, heating and gas demand in the market conditions in terms of its quantity and quality, for the possibly lowest price resulting from supply and demand considering the environmental protection”** [2].

The Union for the Co-ordination of Transmission of Electricity (UCTE) and The European Transmission System

Operators (ETSO) refer to energy security throughout technical activity of the electro-energetic system. Reliability of the system has been perceived as a superior term [4] understood as an ability to provide the consumers with demanded energy having a certain quantity and meeting particular standards. On the level of industrial and distribution networks, frequency, duration and the possibility of delivery delays, transfer or production.

Within the reliability system we may distinguish between 2 aspects: **adequacy** as an ability of the system to provide power and energy to cover the aggregated need requested by consumers in/at any time, including planned and rationally expected system blackouts (quality standards and reliability) and **security** as an ability of the electro-energetic system to sustain unexpected interferences, such as short circuit or unexpected losses of the system elements due to breakdowns, natural disasters (technical breakdowns) or terrorist attacks.

In the outdated Poland’s Energy Policy 2025 the security of energy supply was defined as <sup>1</sup>[5, p.5]:

“... state of a national economy enabling to cover current and future consumer needs for fuel and energy in a way technically and economically justified by the minimization of the negative impact of the energy sector over environment and social living conditions”

It is difficult to agree entirely with such a definition. On one hand, there is a set of factors determining level of the security of energy supply which exceeds far beyond the area where economy functions. Thus, “the security of energy supply” is not a distinction of “economy” but rather a result of many external conditions determining its function. On the other hand, for the consumers all of a sudden with the power cut off is basically all the same whether the cause for it lies outside of the country’s borders or whether it is a result of district’s or an enterprise’s negligence in providing fuel, energy or heat. First of all, the consumer is interested in when the power will be supplied and what will be the financial

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<sup>1</sup> In the approved Poland’s Energy Policy 2030 [6] the quoted definition does not exist. However, indicated are goals supporting the security of energy supply within specific energy carriers.

consequences of supply shortages and finally what are the possibilities to prevent the situation from happening.

The classification of factors influencing the level of security of energy supply has to be thoroughly analyzed. It seems that some of them as a matter of fact are only means needed to achieve the aim, and real factors have not been defined. [see: 5].

Evaluation result of the level of security of energy supply depends on three parameters:

1. Who benefits from the evaluation – state, region, district, branch or a consumer?
2. What forms of energy does it affect (what kind of consumer need)?
3. What is the time horizon?

Term of the security of energy supply for the benefit of the state energy policy has to take into consideration, provided it performs its tasks in a given way, both global and local aspects, not neglecting any of the indirect ties and should run in a long-term perspective. The United States can serve here as a good example, as their energy policy has been prepared for the next 100 years. The European Commission tries to catch up, however, is still behind. Commission's forecast cover 25 years.

Measurement of the security of energy supply is supplies reliability in terms of reasonable price level and limited impact on the natural environment. It is easily recognizable that such a measurement is constructed from the consumer point of view, both local and connected to the energy system, in particular somewhere on the peripheries as well as "a group of consumers" which I mean here different spheres of life (such as: telecommunication, banking systems, health, military, police and administration, etc) and national economy understood as an entire entity. Inappreciable is here the fact that discussions on the international level focus on the security of energy supply in the sense of "security of supply" regardless from the fact whether they focus on long-term access of fuel and gas supplies for Europe, bearing in mind the stability of transmission systems operating in natural disasters and preventing them from happening.

As it has been explained below factors determining the level of security of energy supply build a chain where particular links are [4]:

1. access to primary energy carriers at the level enabling to satisfy the demand, including the transportation technologies of primary carriers
2. technologies transferring primary energy carries into usage carriers
3. technologies of a long-term usage of transportation carriers
4. technologies of short-distance transport of usage carriers, mechanisms of financing and development of energy sectors

Each category undergoes analysis:

- a. economic – the ability of economy to finance together with costs limiting ecological consequences,
- b. ecological – impact level on the environment in part which is not being economically measured,
- c. the risk level of interferences, including interferences related to hazards of terrorist attacks
- d. the scale of hazards being the effect of interference
- e. availability of procedures eliminating interferences

It undergoes individual distinguishing due to specific features of individual carriers, both primary energy and usage carriers and due to timeline analysis.

As noticed, analyzing the "security of energy supply" in details leads to a conclusion that assigning it to a simple chain structure is an oversimplification. It has a structure of a multidimensional complex and that is why any attempts to refer to some extracts without an appropriate comment explaining the context is so risky. Multidimensionality of the security of energy supply term is a reason for hazards to which it is exposed to, as well as actions aiming at its protection is extremely diversified, however, the responsibility for the condition of security of energy supply is not focused (it cannot be focused) on one object.

Ensuring the security of energy supply in a variety of aspects it should be explained by different sides of political, economic and social life, respectfully to their role and competencies: public administration bodies and their local entities, and private energy businesses, and the consumers. Action coordination on different levels wins here a special attention as the security of energy supply is correlated and may be resolved in an alternative ways. However, supporting one option excludes usage of other.

According to T. Jamasb and M. Pollitt it is necessary to redefine the security of energy supply in liberalized energy markets and in multidimensionality of the security of energy supply. They suggest that within the markets liberalization, role of the state owned enterprises, operational conditions of enterprises outside of energy sector and consumers, the meaning of security of energy supply should change and be perceived as a risk of lack of energy supply and risks involved in the costs increase [4].

Consequentially, the "security of energy supply becomes a risk-management strategy with a strong inclination towards cost effectiveness, involving both the supply and the demand side" [4]. Additionally, if we assume there is no lack of supplies on the side of the energy producers, then the strategic position will be taken over by the energy network and the regulatory.

The transmission and distribution of energy networks (for electricity and gas) are naturally businesses monopoly and are subject to regulations. The aim of the regulation theoretically is to accomplish the idea of public interests (benefit). In this particular case the public interest (public benefit) plays a role of an effective and an active (we understand that terms in a praxeological sense) management of energy networks. There remains an issue whether

practically the idea of public interest is accomplished or accordingly to J. Stiglitz it should be understood as a phenomenon of regulation capture meaning the fact that the regulation is “taken over” (perhaps even in a bigger part) by regulated subjects and operates for their benefit.

In researching documents it is emphasised that since 1990 regulation has been understood as a factor playing key role in implementation of market reforms in the energy field using efficiency improvement as a factor ensuring its effectiveness and ensuring the possibility of competition by the TPA rule. Results of those regulations seem to be quite positive, especially in the UK. [4].

From the perspective of economic effectiveness goals, an appropriate energy network regulation should play a key role in ensuring impulses for energy supplies. In this context, the regulatory task is to ensure the stimuli (impulses) needed for sufficient efficiency of networks and capacity using different types of primary energy. The aim of the regulation from the economic point of view except for the security of energy supply is the price stability for energy consumers using high or low voltage. Generally, the aim of the regulation is the security of energy supply referring to climate changes, international exchange of energy carries and the proliferation of nuclear materials.

In the light of the above deliberation it should be concluded that regulatory by using effective regulatory instruments may and should play a role in the security of energy supply in a short- and long-term perspective. The aim of this article is not to propose any instruments but to identify only challenges and pay an attention to the need of regulation changes existing in Poland.

## II. SECURITY OF ENERGY SUPPLY AND REGULATORY IN POLAND

In such a short article it is not possible to thoroughly discuss security and features of the regulations in terms of the security of energy supply. We can only advance a thesis and give a few quotations, and give a few practical examples.

We let ourselves to advance the following theses and namely:

1. National energy, and in particular electricity system is in an unbalancing and growing state due to the security of energy supply. It concerns transmission and distribution of electro-energetic network systems and their production subsections.
2. Regulations within the security of energy supply are dispersed between international bodies (EU regulations) and numerous national ones. Lack of regulation tools used by different entities is to be found. As a result of it, binding regulations do not meet efficiency requirements and do not meet the energy supply needs.

To support our theses we bring up some deliberations included in “*Polska 2030*”, an official national document

describing development challenges for the country. Energy and climate security was given the number 5 [6, p.166-204]. This part was granted the motto of two expressions and namely: “except for the energy security and without of clear goals within the environmental protection” and “harmonization of climate and energy challenges, the factor of development”.

Over recent years in Poland there was a significant interference in energy supplies (Szczecin in 2008, Podkarpackie region in 2010). Conditions of the transmission and distribution networks prove they gradually wear out. Furthermore, some urban agglomerations (Wrocław, Poznań, Trójmiasto, etc.) are supplied with one transmission line with a sufficient capacity to cause a serious interference in energy supply.

In table 1 we see the basic conditions to ensure the security of energy supply in the whole country and for particular regions.

TABLE 1. CONDITIONS OF THE SECURITY OF ENERGY SUPPLY ON THE NATIONAL AND REGIONAL LEVEL

Basic conditions of the security of energy supply	Additional conditions
Sustained energy balance	Economic security preservation
Access and sufficiency of infrastructure processing, storing and fuels and energy distribution	Ecological and technical security preservation
Diversification sources of energy carriers	Resistance to random and intentional hazards

Source: see [1]

In spite of the coal domination Poland has relatively well diversified energy balance structure. However, the security of energy supply is not synonymous with supplies diversification. Russia is probably the main crude oil and gas deliverer for Poland. Probably it is because of the economic reasons and Russian supplies are the cheapest once. To ensure the security of energy supply for Poland it is required to have real possibilities of supplies diversification. Currently, it is partially possible in case of crude oil, however it is not possible in case of petroleum gas. The key condition for the security of energy supply for Poland is a national supervision over transmission infrastructure and storage of crude oil, gas and fuels.

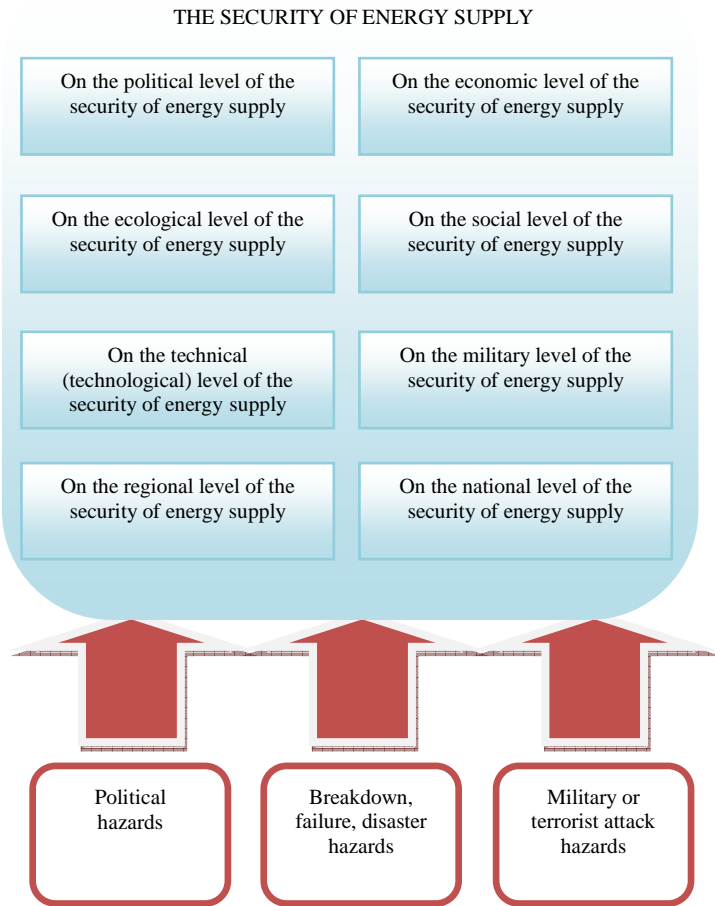
On the scheme 1 there is a hazard to the security of energy supply for Poland and the decomposition of the term of the security of energy supply into individual components and its functional structure from the perspective of analysis measures

As a result of experience, there are some serious interference in applying offered energy (electricity, petroleum gas, heat from centralized sources) and causes losses for the consumers (economic, financial and political and social) and their value often exceeds expenditures borne for its production and transmission.

**Thus, it can be said that from the economic point of view not supplying a certain amount of energy causes a loss which may significantly exceed the value of its production and supply to consumers.** The security of energy

supply involves situations where not energy shortages but problems with its supply cause benefit losses, which value exceeds the costs borne for its production and readiness to supply electricity.

SCHEME 1. THE SECURITY OF ENERGY SUPPLY



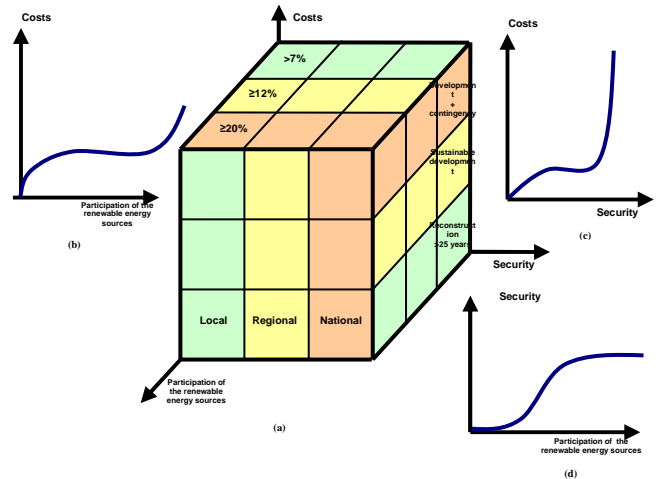
Source: see [1]

As it has been mentioned here, the security of energy supply can be discussed on the local, regional and national level. It refers to specific carriers of energy and to particular links in the logistic chain (from the manufacturer to the user). The regulatory problems and the security of energy supply in the respect to network infrastructure have been pointed here briefly. A crucial issue is here the relation between level of the security of energy supply and the development of renewable energy sources. Here arises a question what happens to the costs ensuring the security of energy supply and what is the interdependence between energy supply with the costs due to increasing participation of renewable energy sources costs. That problem has been described in brief on picture 1.

Picture 1a shows the relation along with the increase of the renewable energy sources the level of local, regional and national security improves. The assumed percentage is complied with the EU guidelines. It has been noted that the costs ensuring the security are correlated with type of the

investment (recreated and developed). Basing on the economic law the proposed theses on the dependence between the participation of the renewable energy sources and security costs (Pic. 1b), security level and its costs (Pic. 1c) participation of the renewable energy sources and security costs (Pic. 1d). Dependences will be, however, not discussed in this article as it is not its subject.

PICTURE 1 RELATION BETWEEN LEVEL OF SECURITY, RENEWABLE ENERGY AND COST OF SECURITY



Source: by authors

In recent years the importance of security of energy supply has increased tremendously because of the interference in the functioning mechanisms in energy supplies. Practically, actions undertaken by the energy sector within the security of energy supply are not sufficiently effective. That is why there is an urgent need to harmonize actions with the local environment, especially with governmental agencies, non-governmental agencies, and small and medium enterprises to ensure effective and safe balance of produced energy with its consumption.

### III. IN STEAD OF A SUMMARY

Within the context of the above deliberations raises a critical question whether regulations may reduce the blackout effect and how it can become a part of the energy supply strategy in a long-term perspective. Answering such a question it is worthy to mention two basic regulatory aims. The first of them are effectively working transmission and distribution networks, the second are the relations between the operating industrial and distribution networks and the “consumer behaviour”.

Within the first goal we should distinguish between:

**effectively operating industrial** and distribution networks

1. Necessary and sufficient investment to ensure the security
2. Creation of effective sector structure and division between transmission, distribution and unbundling.
3. Diversification of energy sources enabling to ensure the competition
4. Legal, financial and economic responsibility for security violation.
5. International, national and regional coordination of regulatory instruments.

Within the second goal we should distinguish between: **relations between operating network and “consumer behaviour”**:

Actions for energy respect, the so called “demand side”

1. Development of intelligent and flexible energy supply within the consideration of micro generation
2. Active influence on the energy need announced by the public sector (including governance).
3. Price calculation methods and tariffs tailored to the need of energy respect

4. Implementation of new and effective management forms and ownership structure of the transmission and distribution networks.

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