

# Market Mechanisms for Risk Management in Energy

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## Abstract

Energy is a strategically important sector for the Bulgarian economy as significant public and private financial and human resources are concentrated in the sector. Energy resources represent about 20% of the imports and 15% of exports. The development of the sector is important for the consumption of energy resources, the management of which requires significant financial and material resources. Furthermore, sustainability of energy is one of the main objectives of the Europe 2030 strategy. In this context, the EU sets itself goals aimed at integrating European energy markets and thus ensuring energy security and improving energy efficiency. The need for a high degree of dynamism in the Energy sector is indisputable as it requires timely and adequate risk management measures to be taken. Thus, the paper aims to present how, through the application of various market mechanisms, prevention can be achieved and how it contributes to good risk management in the sector. The main tasks are: to identify the risk factors influencing energy security, to systematize them and to assess them. Emphasis is placed on the disclosure of market mechanisms and the new market regulations

in the Energy law and resp. on the instrument for reducing energy risk. The main results are focused on summarizing guidelines for risk management in the energy sector.

**Keywords:** energy, risk management, market mechanisms

**JEL:** L52, M31, O25.

## Introduction

The energy sector is subject to increased strategic geo-political and economic interests, both within the country and abroad. The sector is highly regulated, but nevertheless, it is associated with a lack of transparency, dominance of private interests, abuses, corruption, economically unjustified investments. Currently, the sector is actively working to improve its management, focusing on a transparent and sustainable development.

At the European Union level, efforts are being made to maintain high levels of energy union. The fourth report on the state of the Energy Union of April 2019 shows that energy supplies in Europe are safer, more viable and more accessible to all than was the case a few years ago. Its results show that a modernized energy system increases the growth of the EU economy, attracts investment and creates local job opportunities [3].

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In order to achieve high levels of energy security, it is necessary to implement measures related to effective risk management in the sector. An important condition is that the measures be ahead of the risk events and provide a good degree of prevention. This paper reveals the possibility of risk prevention in the energy sector through the use of various market mechanisms.

### 1. Regulation of the Bulgarian Energy Sector

The Bulgarian law is synchronized with the European one, and one of the important regulations is DIRECTIVE 2012/27/EU [5] on energy efficiency. According to it, the responsibilities for an energy efficient driven economy are transferred to the national governments: *“Member States should be required to set indicative national energy efficiency targets, schemes and programmes.”* (Article 13)

According to Directive [5] (Chapter 1, article 2 (4)) *‘energy efficiency’ means the ratio of output of performance, service, goods or energy, to input of energy.*

The role of energy efficiency legislation could be found in two respects:

1. Energy consumption: schemes and measures for the renovation of buildings as a critical point of green gas reduction (*Preamble (17); (44)*)
2. Energy production: schemes and measures for high-efficiency cogeneration and district heating and cooling systems less than 20 MW (*Preamble (35-37)*).

Both energy production and energy consumption have to cover the requirements of the DIRECTIVE 2010/75/EU [4] on industrial emissions (integrated pollution prevention and control).

The national legislation is based on 3 main documents:

1. ACT ON ENERGY EFFICIENCY: This document regulates the public relations for increasing the energy efficiency in the final consumption of energy related to the EU and the national Energy strategies.
2. ACT ON ENERGY: This documents regulates the public relations for the production, import and export, transmission, distribution of electricity and heat and natural gas in the definitions of the EU and national energy strategies.
3. ENERGY STRATEGY 2020: This document gives a basic background for national energy policy. The document is based on the EU Energy policy framework as well as on the global trends in the development of the energy technologies.

The main priorities of the National legislation on Energy efficiency are set as follows:

- To ensure the security of energy supply;
- To achieve National renewable energy targets;
- To Increase the national energy efficiency level;
- To develop a competitive energy market;

According to the given priorities on Energy development, the national schemes and measures cover the next 4 results:

- Maintenance of a secure, sustainable and reliable National energy system;
- Keeping the leading position of Energy production inside the GDP growth of the Bulgarian economy with a clear export orientation;
- Establishment of a national economy on the usage of low-carbon emission energy that is based on the balance between the of quantity, quality and prices of differ-

ent energy sources: renewable energy, nuclear energy, coal and natural gas energy resources;

- Establishment of a national energy efficiency culture that is based on a transparent, efficient and highly professional management of energy production and consumption of the Bulgarian companies.

According to the above, analysis of the risk in the Bulgarian Energy sector as well as market mechanisms to manage them are in accordance with the EU energy markets cohesion.

## 2. Risk in Bulgarian Energy

Contemporary risk management increases the probability of success in the habitual activities of each organization and sector and at the same time reduces the probability of failure and the level of uncertainty regarding the achievement of the overall goals of the sector. Hence the need for risk management to be a continuous and evolving process, to be an integral part of the organizational strategy and each element of its direct application.

Based on the many definitions of risk, from the scientific literature, it can be summarized that risk is: **the assessment of the quantitatively existing uncertainty**. It is assumed that the risk exists when, as a result of an event, a situation would arise that would lead to the loss of something valuable. Risk is something that may be a problem in the future. [13]

The value of risk management in Energy has been recognized by different authors [15]. The development of electricity markets in the United States since the 1990s and the introduction of competitive electricity markets in various countries have significantly expanded the application of risk management tools. [10]

The characteristics of risk threats in the energy sector are directly related to the factors and reasons for their occurrence. Therefore, it is quite natural when looking for effective measures and solutions to prevent risk or to reduce and balance losses, to look for the causes that led to risky situations. [12]

The first group of risky factors includes the following:

- EU policies for the development of the Energy sector;
- the EU and National legislation in the Energy sector;
- access to energy resources at European and global level;
- the Governmental decisions on the development of the national energy system;
- possibilities for the use of alternative energy sources and the utilization of renewable energy;
- natural and climatic features concerning energy and energy transition;
- financial and cultural characteristics for energy efficiency;
- green and smart economy possibilities, etc.

Due to the wide range and multifaceted nature of the potential risks threatening the energy sector, only some of the sectors in the sector will be emphasized here.

**First** of all, the risks in the Nuclear Energy with a representative of Kozloduy NPP and its two power units, which produce about 35% of the national electricity generation [8] and the remaining controversial issue with the construction of the Belene NPP. The main risk groups here are related to the management of radioactive waste and treated nuclear fuel. On the territory of the country there are storage facilities for heavy metals and radioactive waste, as well as sites with ionizing radiation [11]. The potential risks that may arise here

are related to the occurrence of severe natural pollution and endangering the life and health of the population. Among the main problems leading to risks in nuclear energy is the reduction of the qualified personnel to ensure the safety and proper operation of nuclear energy [11]. Another group of risks here stems from the inconsistent government policy towards the nuclear energy sector.

**Secondly**, energy obtained from renewable sources. According to the requirements of Europe 2030, about 30% of energy sources by 2030 must be renewable energy sources. This will reduce greenhouse gas emissions, as well as the EU's dependence on fossil fuels and imported energy, and this contributes to security of energy supply [14]. The composition of this energy includes: solar, wind, marine, hydro, geothermal and bioenergy. Despite the EU's efforts to increase the share of energy from renewable sources and the available funding programs, there are still a number of risks that stop the widespread penetration of this energy. Among the main risks are the following: risk associated with inappropriate procedures for the selection of viable renewable energy projects; weaknesses in monitoring; risk of unsustainable supply of bio-mass for energy; lack of clearly defined policies for energy from renewable sources [14].

These are just two of the key risk factors in energy sectors, which are characterized by the manifestation of specific risk groups. Specificity is also characteristic for the other industries, but in order to derive a general risk characteristic of the sector in recent years the application of the International Energy Security Risk Index has entered. It is the first energy risk indicator of its kind to use quantifiable data, information on historical trends and government forecasts to identify

policies and other factors that contribute more positively or negatively to international energy security. [9].

The index covers the following main indicators:

- Global fuel - oil, gas and coal reserves and products;
- Fuel imports - imports of oil, gas, coal and total energy imports;
- Energy costs - intensity of energy costs; energy costs per capita; retail prices for electricity; crude oil prices;
- Instability of market prices - instability of the price of raw petrol; instability of energy expenditures; use of the world's oil refinery.
- Intensity of energy use - energy consumption per capita; energy intensity; oil intensity.
- Electricity sector - types of sources of electricity; non-carbon generation.
- Transport sector - energy for transport per capita; transport energy intensity.
- Environment - trends in CO2 emissions; CO2 per capita [16].

The data from the index for Bulgaria show that in recent years it has improved significantly. Historically, from 3,455 points in 1980, it decreased to 1,248 in 2016. The average annual difference between the indicators of Bulgaria and those in the OECD 1980-2016 was 122%, which decreased to 45% in 2012. [16]

### 3. The Bulgarian Energy Market

The liberalization of energy markets in the EU [6] is carried out through the directives on electricity (1) and natural gas (2), which all Member States had to transpose into national law. The directives contain important provisions for the proper functioning of energy markets, including rules for the cooperation

of transmission system operators from energy suppliers and producers, for the strengthening of national regulatory authorities and for the improvement of the functioning of retail markets in the interests of consumers (3). The Commission monitors the full and correct transposition of directives and has initiated infringement proceedings against a number of Member States, including Bulgaria.

Some of the most important risk factors in the Energy sector are 1. highly concentrated market structure, 2. Existing long-term electricity purchase agreements and obligations to use local coal.

According to the report of the Bulgarian Ministry of Energy [2], the organization of the Energy market is regulated by the Rules for Trade in Electricity. The rules for trade with neighbouring countries are in line with the rules in the EU, as well as with bilateral agreements and the rules on cross-border exchange and trade in electricity.

The Bulgarian Energy market has been in the process of liberalization since 2004. According to the linearization process, it will finally finish at the end of 2025 when all of the energy users will buy energy on the Energy market. Until then, there are 2 main segments: 1. A segment with regulated prices that covers 60% of energy and 2. A segment with market negotiated prices or the so-called free energy market. [1]

**First**, the regulated energy market: energy prices (electricity, gas and etc.) are set by the (Bulgarian) Energy and Water Regulatory Commission (EWRC). The consumers included in this segment are served by final suppliers that distributed energy on a territorial basis. Currently, this segment includes household consumers as from 1<sup>st</sup> of Octobers 2020 all business consumers entered the free market segment.

**Second**, the free market segment: energy is purchased by traders at freely negotiated prices or by the platforms of the IBEX (Independent Bulgarian Energy Exchange). All producers of renewable energy sources and renewable energy sources with an installed capacity greater than or equal to 1 MW must offer their electricity on the IBEX platform.

On the regulated market the main energy risk is the limited price for the household end-users that could make the energy trade unfavourable for energy trading when the share of the Nuclear Power Plant (NPP) energy reduces in the energy pool.

On the free market the main energy risk is the unstable price for the industrial customers as the price depends on the Energy balance and the national energy consumption.

For the energy producers there is limited risk as most of the energy prices are long-term negotiated, for example:

- The energy prices from renewable energy (RES) and Highly efficient cogeneration (HEC) are set annually by a decision of the Energy and Water Regulatory Commission (EWRC).
- The prices of National Electric Company (NEK), NPP Kozloduy, Water Power plants (HPP) and national thermal power plant (CHP) are also are set annually by a decision of the Energy and Water Regulatory Commission (EWRC).
- The prices of the Privet thermal power plants (CHPs) are long-term negotiated at stable prices.

The Energy market model in Bulgaria [16] is presented on Figure 1.

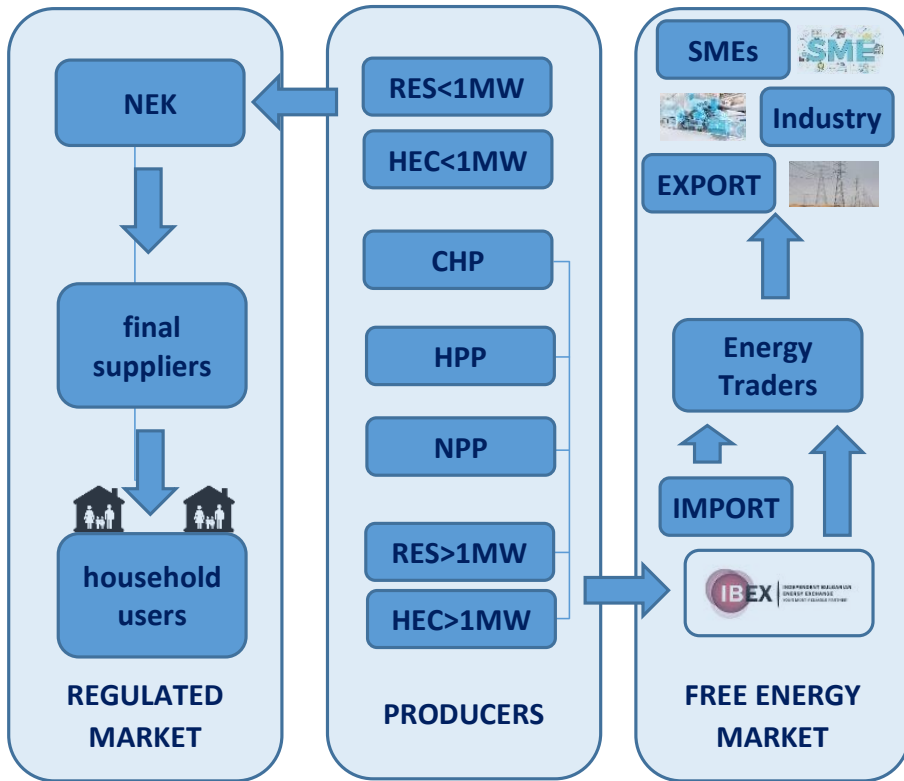
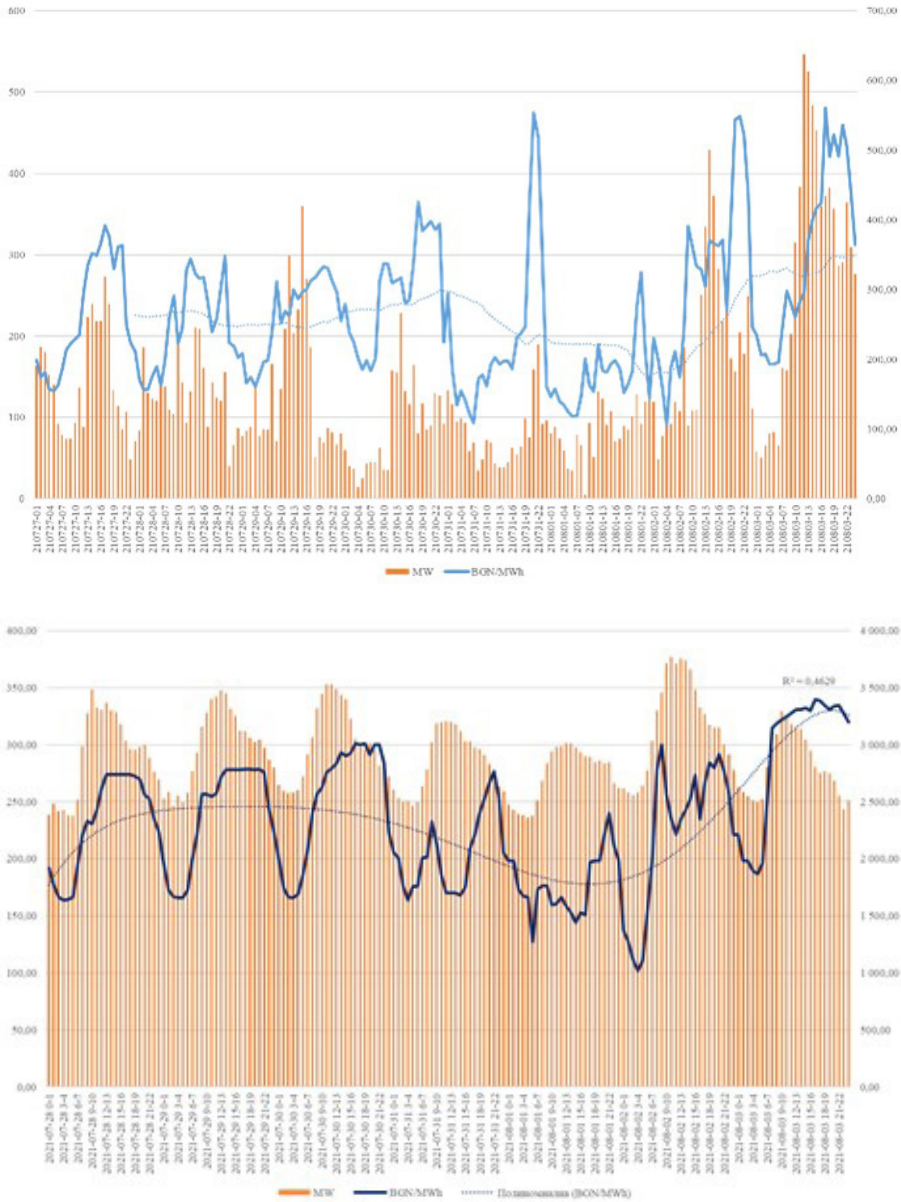


Figure 1: Bulgarian National Energy market

The Energy market prices by the platforms of the IBEX (Independent Bulgarian Energy Exchange) [8] are organized into 2 markets:

- Intraday market: this is the shortest market segment, which gives the opportunity to energy traders to purchase energy on the day for their balancing market. The main participants in this market are the producers from renewable sources (RES), which are the main reason for the creation of the market segment. The Intraday market segment operates in a single market environment (Single Intraday Coupling)
- Market day ahead: This is the main energy market used for purchasing energy for the industrial end-users. It is characterized by a high degree of transparency and it guarantees equal access that helps for increasing competition in the Energy sector, which has a favourable impact on both energy consumers and energy producers. The Day-ahead market is in accordance with the requirements of the market association “Day Ahead” - Single Day-Ahead Coupling

The comparison between these 2 energy markets could be presented in Figure 2.



**Figure 2:** Prices on Intraday market (left) and on Market day ahead (right) for period 27.07 – 03.08.21

- The Market day ahead is more predictable and the traded volumes and prices are similar in daily and weekly cut: the Monday peaks, week days equal trade and weekends bottoms as well as daily peaks between 08 – 12 am could easily be found. The Intraday market is less predictable as there are different peaks through weekdays and the weekend vol-

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umes do not differ from the weekdays ones.

- The price varies in a vast range within the Intraday market (for example: min: -62% and max: +105% from the average price: 234.43 BGN) in comparison with the Market day ahead (for example: min: -57% and max: +45% from the average price: 234.71 BGN)
- On the weekly base the average price on both market segments are equal, for example, the Intraday market: 234.43 BGN and Market day ahead: 234.71 BGN, difference: 1‰.

The example does not cover some extreme situations such as taking out some producers from the energy pool but covers extra heating temperatures. Nevertheless, risk management in energy should read beyond the figures and try reducing more energy payments than needed.

In conclusion, the fully-free energy markets will help to increase the competitiveness of the energy sectors and good risk management in energy will allow reducing extra-payments for energy resources.

### 4. Conclusion

The energy market in Bulgaria is not fully free as the biggest energy consumption (60%) is on the regulated market. In addition, the biggest energy producers are limited in their price offers as well as on traded energy volumes on this regulated market. These limits are set by the decisions on prices and energy trades volumes of the Energy and Water Regulatory Commission (EWRC) in Bulgaria. Thus the EWRC increases the political risk to the level of non-prediction values.

The energy market is organized as a competitive market through IBEX (Independent Bulgarian Energy Exchange) for the business

and Renewable Energy Producers (RES). The analysis of the 2 different segments: Intraday market and Market day ahead, shows that risk in traded prices and volumes is greater on the Intraday market as the Market day ahead is more predictable.

Thus, we could recommend some policy changes in the accession of the free market approach into the regulated market:

1. Maintaining the lowest prices of energy resources in the EU, based on the implementation of the scope of the regulatory activity of the State. The regulated price can be formed by the following measures:
  - Restructuring of the pool of energy sources when forming the price for the regulated market. At the same time, looking for a transition to a market-oriented method, which will enable resource-efficient energy producers to earn more, and resource-inefficient ones to look for internal mechanisms for cost restructuring.
  - Using social mechanisms for compensating the energy dependence of the energy poor Bulgarians. In doing so, there must be a reasonable limitation of the compensation mechanisms.
  - Establishing more effective regulatory mechanisms similar to the water sector, where the recognized costs of the regulated market should be linked to real investments in real assets, leading to an increased resource efficiency of producers.
2. Policy support for the real restructuring of the relations along the energy value chain with a view to delivering higher added value for end users: business and individuals. If necessary, major contracts with energy



producers could be reviewed, which lead to an increase in the price of energy resources. In order not to significantly violate the interests of these energy producers and the public, appropriate mechanisms may be offered for compensation in case of change of contracts, which is tied to the financing of investment costs at the expense of a special investment variable in the price.

3. Change of the regulatory framework for the regulated market regarding the production and supply of energy resources in order to reduce the effect of natural monopolies in the sector. It is necessary to consider the place of the regulator (EWRC) and state-owned companies (NEK, ESO and BEH).
  - Opening the state companies to private investments and realization of public-private partnership. It is also possible to include the compensatory mechanisms of the companies in case of change of the contracts.
  - Usage of an established investment fund for compensation of energy from TPPs and renewable sources (green energy) in the amount of BGN 1-1.5 billion per year. These funds can also be used for large infrastructure projects such as the Belene NPP and Balkans Gas Stream.
  - Possibility to use funds from the EU structural funds for mixed type companies, which are not entirely state-owned.
4. Review of the Energy Policy with a view to fulfilling the national commitments against climate change and sustainable development with priority of the measures and means for production of low-emission energy. At the same time, an Energy policy is needed to support the use of renewable

energy sources and reduce harmful emissions by 2025.

A new approach to renewable energy is needed and priority should be given to investments by individuals related to reducing the energy dependence of citizens and companies and creating incentives to increase the energy efficiency of households and companies.

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