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# PRICE FORMATION CRITERIA FOR ELECTRICITY SUPPLY COMPANIES IN THE CONDITIONS OF MARKET LIBERALIZATION

## ABSTRACT

The main goal of the research is to determine and analyze the criteria for the formation of electricity prices for generating enterprises using a systemic approach to evaluate the impact of the set specified criteria as a holistic system. An analysis of the influence of exchange, regulatory, technical and technological and other criteria and factors on price formation for energy industry enterprises was carried out. It is indicated that the offer of prices for electric energy on the stock exchange is formed by three components: marginal costs, "no-load" costs and "loading" costs. It is established that the opportunity given to the consumer to influence the price of electricity independently is an important criterion for the formation of the price of electricity in the conditions of market liberalization, and the mechanism of implementation of this criterion is detailed. The existence of both a positive and a negative impact of excessive market regulation by the introduction of the procedure "imposing special obligation" on energy industry enterprises is indicated. The main factors influencing the "cost of the supplier's services" criterion are established and analyzed. The conclusion that the criteria for the formation of the electricity price should represent a coordinated system that realizes the principle of compatibility of incentives for all parties that form a balance of interests - both producers and consumers is a scientific novelty. In addition to the principle of the compatibility of incentives, other principles which must be met by the criteria for the formation of the electricity price were also named for the first time. In order to introduce a systematic approach to analysis, a model of electricity price formation in conditions of market liberalization has been proposed for the first time. The advantage of this model lies in the fact that it allows not only for assessing the impact of the identified criteria on the electricity price but also to forecast this price for future periods.

**Keywords:** price formation criteria, electricity, energy market liberalization, model

**JEL Classification:** D40, D50, Q43

## INTRODUCTION

During the years of independence, conditions were created for significant imbalances in the volumes of electricity production and consumption, as well as inadequate financing of producing enterprises. This, in particular, was assisted by: a reduction in the population; a decrease in GDP (which significantly reduced consumption volumes); an inadequate level of management of the industry; strict institutional regulation of prices, old technologies and equipment, and a period of operation of which has long expired. All the mentioned above led to the inefficiency of production and significant cost of electricity. This stimulated changes, in particular, in terms of tariff deregulation and improving the management of energy enterprises. But this was not enough. The liberalization of the electric energy market in Ukraine has contributed to the solution of many problematic moments in ensuring a balance of interests in relations between energy producers and consumers. Institutional structures, generating enterprises, energy transmission enterprises, and consumers felt the need to create flexible competitive mechanisms that would stimulate investments in energy and electric energy consumers to use it effectively, provided that the electricity price was acceptable to consumers and producers. To achieve that, proper regulatory and organizational support is needed, as well as the

formation of mechanisms and tools for the realization of the specified tasks and a system of criteria that would support the aggregation of demand flexibility, and not only compensate costs to generating enterprises but also ensure the appropriate level of their profit. Flexible competitive mechanisms and a system of criteria are able to distribute the volumes of produced energy between different markets in an optimal way, which is a means of motivating both producers and consumers.

In Ukraine, according to the Law "On the Electric Energy Market" [1], the Resolution of the Cabinet of Ministers "On Approving the Regulation on Imposition of Special Obligations on Participants of the Electric Energy Market to Ensure Public Interests in the Process of Functioning of the Electric Energy Market" [2], other regulatory acts according to European norms, the electricity market became such a mechanism. One of the goals of the creation of the electricity market was to reduce the impact of threats on the level of energy security, which was analyzed in the works of Sukhodolia, Riabtsev [3] and Sukhodolia, Kharazishvili [4]. Liberalization of the electricity market contributed to a significant benefit for consumers as a result of a trend of price reduction due to the competition. After the introduction of "day-ahead" market prices EU electricity markets became transparent, indicative and comparable, which stimulated competition in the European area, as indicated by the works of Sarfati et al [5], Felling et al [6], Kyzym et al [7] and other researchers. This determines the importance of exchange mechanisms of price formation in conditions of market liberalization, therefore, the use of these mechanisms is analyzed in detail in the presented study. But it is necessary to note a significant level of price differentiation in the market. The structure of the electric energy (EE) supply is the main factor of price differentiation, and the structure of internal generation is the main factor of price formation in isolated markets, as proved by Salashenko [8]. The model of the European competitive market, which consists of wholesale (wholesale trade/transportation) and retail (distribution/supply) parts, was used to form the Ukrainian EE market. That is, EU Regulation 1227/2011 legally approved two forms of the EE market: commodity and financial. The effectiveness of such construction is confirmed by the practice of the Ukrainian EE market [7].

## LITERATURE REVIEW

A significant number of scientific works are devoted to the study of various aspects of the work of electricity generating companies in the conditions of the liberalization of the EE market and, accordingly, the criteria for the formation of the EE price depending on them.

Thus, in the analytical review of Capper et al [9], it is necessary to take into account the "physical limitations of the market" when introducing market mechanisms - we considered this when introducing a balancing mechanism using economic and non-economic factors; the formation of a "holistic approach to the development and operation of the market" - this was used in the modelling of the formation of the electricity price in the conditions of market liberalization. Sytalo [10] indicated that if it is necessary to apply traditional economic criteria (primarily - costs and profit rates) for the formation of the EE price in the conditions of market liberalization, the establishment of the "range of calculated marginal prices for PSO per regulated producer" becomes an important mechanism, which we used in the development of the model. Azzuni et al [11] studied the "dimensions" of the state's energy security, which are understood as groups of impact criteria. Social and technical-technological dimensions are considered, but special attention is paid to the mechanisms of forming the balance of economic influences, exchange mechanisms are called the main factor. Nitsenko et al [12] studied social and environmental factors of pricing. Rated capacity, the ratio of rated capacity use, investments expenditures, fixed operating costs, and variable operating costs are used in the analysis of economic criteria. Aghahosseini et al [13] studied the method of minimizing costs for the production of EE using a model with an hourly resolution. This is useful for internal corporate use, but, in our opinion, the introduction of market mechanisms in Ukrainian realities allows us to balance the market effectively. Maistro et al [14] indicated the mechanisms for balancing the production and consumption of EE: "increasing energy efficiency in all spheres of social life; diversification of sources and directions of supply of energy resources, an increase of energy production, reform of the national energy industry, balanced price policy". Ahlqvist et al [15] studied the market mechanisms of EE price formation. The need for a compromise combination of mechanisms of market centralization and decentralization in conditions of market liberalization is considered. It is indicated that decentralized day-ahead markets can be improved by implementing grid restrictions. Guerrero et al [16] proposed peer-to-peer energy trading in a low voltage system. This is considered in the presented article with an analysis of the effectiveness of the Ukrainian ASKOE/LU-ZOD system. Islam et al [17] developed an optimization approach to determine the priorities of buyers and sellers in the equal market of EE based on the distance from the aggregator. This approach in Ukraine embodies the implementation of the EE transportation price. Nitsenko et al [18] proposed a pricing algorithm that is implemented through price adaptability, which is useful in the condition of the modernization of energy-generating enterprises. But, in our opinion, exchange mechanisms form the appropriate adaptability of pricing. Kara et al [19] propose an optimization mechanism that will allow

exchange operators to estimate the limits of EE price fluctuations in real-time trading, which will ensure the balance of production and consumption while minimizing the price. Kühnbach et al [20] suggest allowing consumers to directly participate in the central spot market, which is economically impractical in Ukrainian realities. Yatsenko al [21] studied the impact of external economic factors on pricing. Ottesen et al [22] suggested that real-time EE volumes be distributed between different markets. Tsousoglou et al [23] examine the market model criteria, which are market size, market objective and the market mechanism. In our opinion, this approach is somewhat generalized. Ahmed et al [24] propose environmental impact, assessment models. In our opinion, this affects intra-corporate costs and is compensated by exchange pricing mechanisms.

## AIMS AND OBJECTIVES

The activity of the energy sector requires a detailed analysis of a difficult economic situation in the conditions of an active phase of military operations. First of all, the effectiveness of the criteria for the formation of the electricity price for enterprises of the industry requires an analysis, since the effective realization of the price policy in relation to electricity, which on the one hand is both a significant social factor and a necessary condition for the functioning of the country's economy, and on the other hand, must compensate the costs of generating enterprises and provide them with adequate profit level. And the proper financial condition of enterprises determines the success of their technological renewal, which shapes the strategic prospects of the energy industry.

The purpose of the study is to determine and analyze the criteria for the formation of electricity prices for generating enterprises using a systemic approach to assess the impact of the set of specified criteria as a complete system.

## METHODS

To ensure the fulfilment of the goals of the presented research, general and special methods of cognition were used. In particular, the method of induction and deduction is used to substantiate the purpose of the research and identify unresolved aspects of the problem; using the method of content analysis, an analytical review of the scientific literature on the specified issue was carried out; the method of system analysis was implemented to determine the criteria for price formation at electricity supply enterprises in conditions of market liberalization; with the help of the system approach method, the stratification of price formation criteria was carried out; using the method of induction and deduction, a model of electricity price formation in the conditions of market liberalization was developed: the implementation of the convergence from abstract to concrete method made it possible to conduct a detailed analysis of the effects of determined groups of criteria - economic, social, climatic, technical and technological and market mechanisms on the formation of electricity prices at enterprises of all types of energy.

## RESULTS

The effectiveness of achieving the goal of balancing the volumes of electricity production (hereafter EE) and the volumes of its consumption due to the introduction of the EE market was proven by the uninterrupted functioning of the specified market in the first days after the beginning of the Russian aggression.

A day before the start of the active phase of the war - the so-called "day-ahead" market (hereinafter DAM) - 165666.8 MWh were purchased on the spot market. This shows that the business did not wait for the start of the war. The shock reaction of the market to the fact that the energy system of the country began to work in isolation from the energy systems of Russia and Belarus from 24.02.2022 was significant price volatility and a significant decrease in the volume of sales in the period until 27.02.2022. According to the decision of the National Commission for State Regulation of Energy and Public Utilities (NCSREPU), the minimum price restrictions on the electricity market were raised and the price restrictions on the intraday market (hereinafter IDM) were left. This led to the stabilization of the market, supported electricity producers during the crisis and proved the effectiveness of market price formation even in an emergency situation.

At the same time, according to the Minister of Energy G. Galushchenko, for the period from February 24, 2022, the level of settlements on the EE market deteriorated by 30%. According to opinion polls, a significant number of consumers (this applies to both the population and industry) point to the high prices of EE as the main reason for this.

But our analysis (see Table 1) indicates that electricity prices in Ukraine are significantly lower than prices in EU countries, our neighbours. In particular, the data shown in Table 1 indicate that for twenty days in May of this year, the average EE

prices of DAM in Ukraine were lower than the corresponding EE prices of neighbouring European countries by 48.0% - 66.1% [25].

The weighted average prices for the IDM at the EE market in Ukraine during the same period were UAH 2,740.78/MWh, which is also lower than the price level of EU countries by 55.5%-55.7% [25]. For example, for Slovakia, the weighted average price of EE at IDM for this period was 6158.34 (OEC/SK -55.5%), and for the Czech Republic, respectively, it was 6187.57 (OEC/CZ-55.7%) [25].

Electricity market trading takes place through the electronic exchange trading platform of Ukrainian Energy Exchange LLC (hereinafter UEE LLC). "UEE" LLC is a commodity and raw material exchange that has significant long-term trading experience in the energy markets of natural gas, oil products, coal and other energy resources. With the introduction of exchange trading, a new type of criteria for influencing the formation of the price of electricity as a product of electricity supply enterprises appeared. Conventionally, we will call this type of influence criteria "exchange". The EE price offer on the exchange is formed by three components: marginal costs, "no-load" costs and "loading" costs. The offer is accepted at marginal costs, but there are also price premiums for manufacturers to cover costs. The need for an exchange balance of supply and demand in real-time trading and the need for risk hedging by exchange trading parties require a strict definition of time limits for trading in electricity as a commodity.

Different trading time limits are determined by different goals pursued by the bidders. The long-term limit provides hedging of risks and guarantees the return of capital investments. The short-term limit is focused on maximizing sales revenue and minimizing electricity purchase costs. Real-time trading ensures the balancing of electricity production and consumption.

Different trading time limits are also a criterion for choosing exchange instruments for EE seller companies and EE consumer companies. Futures and forward contracts are used for long-term trading. In short-term (or spot) trading, buying and selling are carried out according to the conditions of DAM or IDM. Under the conditions of IDM, the buying and selling process is stopped in the time interval from one hour to 5 minutes before the moment of physical delivery of electricity. The balancing market provides instant electricity supply with settlement after delivery.

In this way, the "exchange" criteria provide a balance of the interests of EE-selling enterprises and their buyers by market methods, provided that the necessary level of profit of EE-selling enterprises is formed and their costs are covered. At the same time, exchange trading forms a proper balance of production volumes and EE consumption volumes at different time intervals - from long-term to real-time taking into account the balance of interests.

To some extent, this was assisted by the formation of conditions for the liberalization of the electricity market in Ukraine [1] and the introduction by the Ministry of Energy of Ukraine of a financial model for price formation by state energy companies. This criterion-based approach to price formation at electricity supply enterprises is called "imposing special obligations" (ISO) on state enterprises for the production of EE in accordance with the Resolution of the Cabinet of Ministers "On approval of the Regulation on the imposition of special obligations on participants in the electricity market to ensure the interests of the general public in the process of functioning of the electric energy market" [2]. The ISO envisages the sale to enterprises that belong to the category of "guaranteed buyer of electricity" to enterprises-providers of universal services for the distribution of EE to household consumers at a lower tariff under the conditions of concluding bilateral contracts at prices set at electronic auctions without exceeding the limits.

In accordance with the Decree of the Cabinet of Ministers [2], if ISO is fulfilled state-owned enterprises Energoatom and Ukrhydroenergo were granted the right to sell the entire amount of electricity produced by them under market conditions. With the obtained profit, the state electricity-generating companies can compensate for the difference between the tariffs for the population established by the state and the market price of EE.

Such a financial model allows state-owned electricity-generating enterprises to stabilize or even improve their financial condition. At the same time, the introduction of such a financial model allows supplier companies to provide electricity to vulnerable segments of the population at a lower price.

The negatives of the introduction of the ISO mechanism include the fact that this mechanism has become one of the factors of excessive market regulation, which leads to the distortion of market principles declared by the Law of Ukraine "On the Electric Energy Market" [1]. It is also a violation of market principles to introduce various mandatory sales volumes of EE under the terms of ISO by regulatory acts for enterprises in various spheres of the energy industry. For example, let's compare nuclear energy enterprises and TPPs. At the first stage of EE market liberalization, the Cabinet of Ministers decreed that up to 90% of EE produced by nuclear power companies should be sold at a fixed tariff, and only 10% - at the EE market. NAEC "Energoatom" produces more than half of the country's EE volume, but the cost of the share of electricity sold at the market remains low compared to other areas of the energy industry. At the same time, TPPs produce

about a third of the national volume of EE, but their share in the energy costs of the country is ~ 47%. Also, thanks to the limitation of the maximum price by NERCP, TPPs can sell EE at the balancing market, where the auctions are characterized by higher marginal prices. In order to ensure equal market conditions and to form the strategic efficiency of market mechanisms, it is necessary to either reduce the ISO for nuclear and hydropower enterprises or apply the specified ISO to manufacturing enterprises in other areas of energy.

It should also be taken into account that not only the production sector, which includes energy-generating enterprises, but also the electricity transmission sector, without which EE distribution will not take place, is important in electric power. Therefore, the issue of price formation is also important for enterprises that provide this transmission. The mechanism of financial support for the activities of these enterprises differs from the mechanism of price formation for electricity-generating enterprises. This mechanism is based on the flexible formation of tariffs for electricity transmission services. Thus, before the start of the EE market functioning, the Ukrenergo tariff for EE transmission services amounted to UAH 57.4/MWh. In June 2019, the tariff increased 6.05 times and amounted to UAH 347.43/MWh, and already in the second half of 2019, it increased by another UAH 8.9/MWh to compensate for the costs of dispatch management services. The increase in tariffs for EE transmission services made it possible to compensate for the costs of covering grid losses and provided the opportunity for "Ukrenergo" to fulfil, under the contract, compensation payments to the guaranteed buyer, additional costs for performing the functions of the administrator of settlements and commercial accounting of EE. After the start of the EE market functioning, NKREKP reduced the tariff by 14.16%, in particular, because the costs of purchasing EE to compensate for technological grid losses were reduced.

For further analysis, it should be taken into account that the same formula pricing model applies to all categories of consumers. The difference lies in the price at which the supplier company sells EE to a specific consumer.

If the supplier company buys EE on the terms of DAM, then a specific consumer can receive EE at the lowest price. At the same time, the vast majority of supplier enterprises set the supply price in the Electricity Supply Agreement simultaneously based on the prices of the DAM, IDM, and the market price of bilateral contracts (hereafter MPBC). In addition to this mix of prices, the supplier enterprises include their own operating costs in the price, the so-called "cost of the provider's services". "The cost of the provider's services" consists of the cost of licenses and permits, mandatory payments to all public and private structures, the price of EE under imbalance conditions, etc.

**Table 1. Electricity prices in Ukraine compared to prices in EU countries for 20 days in May 2022, hryvnias/MWh. (Source: according to [25])**

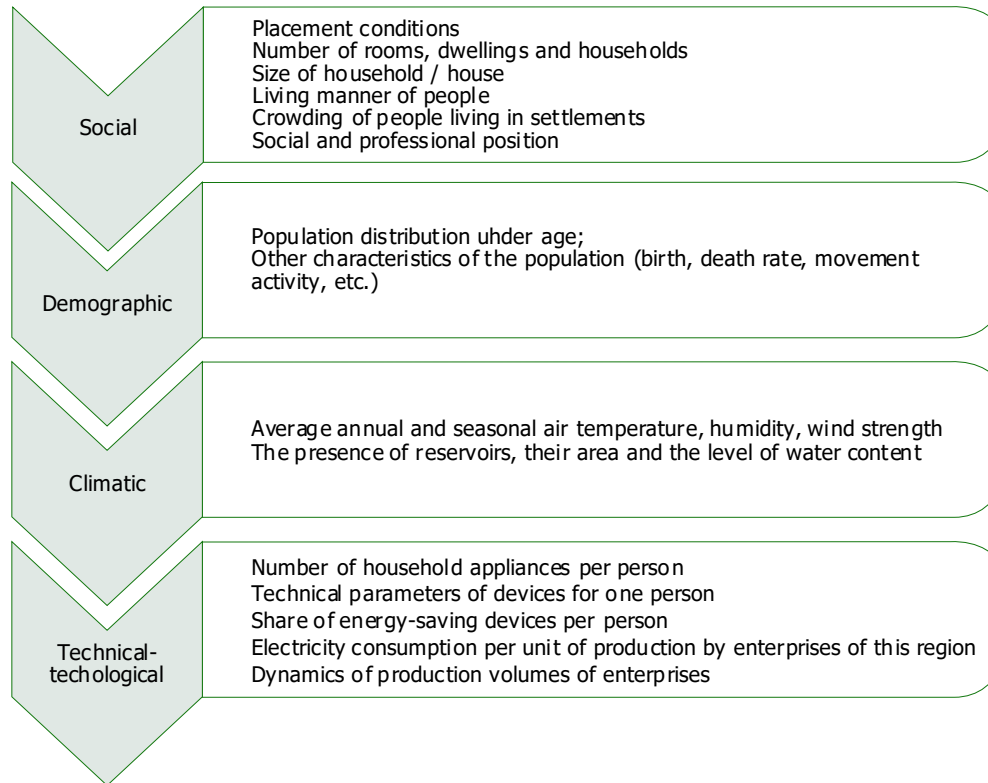
Price, hryvnias/MWh	The name of the country								
	Ukraine	Poland	OEC/Poland	Romania	OEC/Romania	Hungary	OEC/Hungary	Slovakia	OEC/Slovakia
Base	2223.82	4274.28	-48.0%	6436.00	-65.4%	6554.05	-66.1%	6273.57	-64.6%
Peak	2646.25	4170.16	-36.5%	6031.04	-56.1%	6221.60	-57.5%	5994.68	-55.9%
Off peak	1801.40	4453.71	-59.6%	6840.98	-73.7%	6886.48	-73.8%	6552.46	-72.5%

The criterion "the cost of the provider's services" (hereinafter CPS) depends on several factors: volume of consumption - the larger the volume of consumption, the lower the CPS criterion; payment schedule for EE – for advance payment, the share of CPS in the price of EE will be smaller. For payments at the end of the calendar period, the share of CPS in the price of EE will be greater; expenses for the purchase of electrical energy; from the volume of the client base - if the number of clients increases, the share of the CPS in the price of EE will be smaller.

As shown by the analysis of the criteria for the formation of the electricity price in the conditions of market liberalization, they should represent a coordinated system that implements the principle of compatibility of incentives of all parties that form a balance of interests - both producers and consumers. In addition to the principle of the compatibility of incentives, the criteria for the formation of the electricity price must also comply with the following principles:

1. Individual rationality of the market participant. That is, ensuring the condition of realizing the non-negativity of each participant's gain.
2. Group rationality of market participants. This principle stipulates that the profit of each group of market participants cannot be acquired at the expense of other groups.
3. Understandability, controllability and transparency of the action of each of the criteria.

To determine the importance of the influence of the criteria for the formation of the electricity price in the conditions of market liberalization, let us stratify them (see Figure 1.). Stratification requires dividing the price formation criteria into groups. We have selected the following groups of criteria: economical, social, demographic, climatic, technical and technological.



**Figure 1. Stratification of the criteria for the formation of the electricity price in conditions of market liberalization.**

In the group of economic criteria, the main subgroups are highlighted: intra-corporate price regulation criteria (costs and rate of profit); criteria for market balancing of production and consumption volumes; stock exchange pricing criteria.

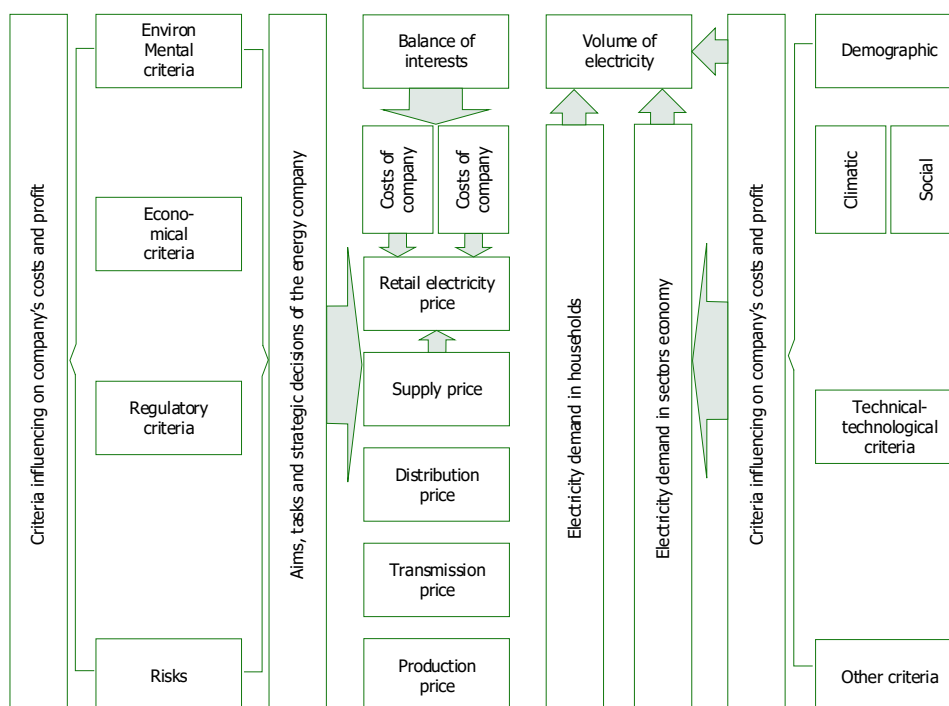
The social group includes averaged specific criteria (that is, per person living in a given area). These specific criteria determine the impact on the balancing of production and consumption for certain localities: living conditions, number of rooms, apartments, households, household/house size, people's lifestyle, crowding of people living in settlements, social and professional status, etc. The demographic group of criteria includes the population distribution criterion by age, the "birth rate" criterion, the "mortality rate" criterion, the "movement activity" criterion, etc.

The climatic group of criteria includes average annual and seasonal air temperatures; average annual and seasonal indicators of humidity, and wind strength; the presence of reservoirs, their area and water content level; the presence of forest and park massifs, area and other climatic criteria.

The technical and technological group of criteria includes possession of electrical appliances; the number of household appliances per person; technical parameters of devices per person; share of energy-saving devices per person; the level of electricity consumption per unit of production by enterprises of this region; the dynamics of production volumes of enterprises, etc. An important criterion for the formation of the EE price in the conditions of market liberalization is also the opportunity given to the consumer to independently influence the price of electricity. For this purpose, according to the Law of Ukraine [1], consumers are divided into groups. Group "A" is those consumers who are connected to the automated system of commercial electric energy accounting (hereinafter ASCEEA) and the system of local data collection and processing equipment (hereinafter LDCPE) and group "B" - those who are not connected to the ASCEEA/LDCPE system. The ASCEEA/LDCPE system is introduced by the code of commercial accounting of electric energy, which was approved by the resolution of the National Energy Regulatory Commission of Ukraine dated March 14, 2018, under No. 311. This system allows to read and transmit to the operational information centre data on the hourly consumption of EE, which, in turn, allows consumers of the group "A", to settle at a price that corresponds to their actual consumption profile. For example, when consumers plan their activities in accordance with the schedule of energy supply under the conditions of

minimum prices of DAM, and not prices for peak imbalances, this leads to significant savings on large volumes of consumption. The introduction of such an approach stimulates the economical consumption of EE, that is, educates a rational consumer and, at the same time, facilitates the formation of general and regional balances of EE production and its consumption volumes.

The influence of price formation criteria on electricity supply enterprises in the conditions of market liberalization is not isolated. The totality of the specified criteria forms a system, and their impact must be assessed using a systemic approach. To introduce a systematic approach to analysis, we have developed a model of electricity price formation in conditions of market liberalization (see Figure 2). The main criterion for price formation at electricity supply enterprises in the conditions of market liberalization - ensuring the balance of production and consumption of EE is realised in Figure 2 block "Balance of interests". This block indicates not only the need to ensure the balance of production and consumption of EE. It also indicates an integral balance of interests of social, political, narrowly professional and other groups of influence. The block "Balance of interests" determines the ratio of the blocks "Costs of the company", "Profit" and the block "Retail electricity price". The block "Retail electricity price" consists of sub-blocks "Supply price", "Distribution price", "Transmission price" and "Production price". Undoubtedly, the balance is affected by the volumes of EE consumption, the criteria of which are shown in Figure 1. In Figure 2, the "Volume of electricity" block is responsible for this, it is divided into two sub-blocks: "Electricity demand in households" and "Electricity demand in sectors economy". The criteria affecting the company's costs and profits are shown by sub-blocks: "Environmental criteria", "Economic criteria", "Regulatory criteria" and "Risks". The influence of the "Regulatory criteria" sub-block is manifested in the regulatory actions of the authorities, for example, regarding the limitation of the price of EE for vulnerable segments of the population. The importance of considering the "Risks" sub-block of criteria for determining the price of EE is clearly evident now, during the active phase of the war when nuclear plants are seized, bomb and rocket attacks are carried out on thermal power plants and main power grids. This does not exclude the need to take into account the criteria affecting the costs and profits of the company: demographic, social and, especially for production, technical and technological.



**Figure 2. The model of electricity price formation in conditions of market liberalization.**

In general, the proposed model allows not only to weigh the influence of the mentioned criteria on the price of electricity, but also to forecast it, both for the day-ahead market and the intraday market, as well as in operational activity and, even, in a strategic perspective.

## DISCUSSION

Research in the direction indicated in the presented article continues by the authors, in particular, with regard to determining the effectiveness of price formation criteria for energy industry enterprises under dynamic changes in internal and external factors. Comparative analysis of prices was carried out in some studies earlier, but at an integrated level using averaged data for six months or a year. With sudden changes in the price of EE over a long time interval, the comparison of averaged data introduces a systematic error. In this study, in order to avoid the influence of systematic errors, comparison data for the twenty days of the month of May are given. Various authors cite only the positive impact of the "imposition of special obligations" procedure on energy industry enterprises. The presented work analyzes both the positive and negative impact of excessive market regulation by implementing the specified procedure. For the first time, it was indicated that the criteria for the formation of the electricity price in the conditions of market liberalization should represent a coordinated system that realizes the principle of compatibility of incentives of all parties that form a balance of interests - both producers and consumers. In addition to the principle of the compatibility of incentives, other principles, which must be met by the criteria for the formation of the electricity price were also named for the first time. In order to introduce a systematic approach to the analysis, a model of the formation of the electricity price in conditions of market liberalization was proposed for the first time. This model allows not only to evaluate the impact of the identified criteria on the price of electricity, but also to forecast it, both for the day-ahead market, the intraday market and in operational activity, even, from a strategic perspective.

## CONCLUSIONS

In order to establish the conformity of the level of prices for electric energy, a comparative analysis was performed with prices in the countries of the European Union - Ukraine's closest neighbours, whose national GDP is close to Ukraine's GDP. To ensure the necessary level of rationality of the analysis, the criteria were stratified according to the types of their influence. An analysis of the influence of exchange, regulatory, technical and technological and other criteria and factors on price formation for enterprises in the energy sector was carried out. The impact of time intervals of market trades on the formation of the price balance, ensuring both the appropriate level of financing of energy enterprises and the interests of vulnerable segments of the population is detailed. The impact of the day-ahead market, the intraday market and the balancing market, which provides instant electricity supply with settlement after delivery, on the price formation, are analyzed separately. Both the positive and negative impact of over-regulation of the market by the introduction of the "imposition of special obligations" procedure on energy industry enterprises are analyzed. It is indicated that the offer of prices for electric energy on the stock exchange is formed by three components: marginal costs, "no-load" costs and "loading" costs. The main influencing factors on the "cost of the supplier's services" criterion were established and analyzed. It is indicated that an important criterion for the formation of the price of electricity in the conditions of market liberalization is the opportunity given to the consumer to independently influence the price of electricity, and the mechanism of realization of this criterion is detailed. The conducted analysis proved that the criteria for the formation of the price of electricity in the conditions of market liberalization should represent a coordinated system that realizes the principle of compatibility of incentives of all parties that form a balance of interests - both producers and consumers. In addition to the principle of the compatibility of incentives, other principles that must be met by the criteria for the formation of the electricity price have been identified.

In order to introduce a systematic approach to the analysis, a model of the formation of the electricity price in conditions of market liberalization has been developed. This model allows not only to evaluate the impact of the identified criteria on the price of electricity, but also to forecast it, both for the day-ahead market and the intraday market, as well as in operational activities and even, from a strategic perspective.

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## **КРИТЕРІЇ ФОРМУВАННЯ ЦІНИ НА ЕЛЕКТРОПОСТАЧАЛЬНИХ ПІДПРИЄМСТВАХ В УМОВАХ ЛІБЕРАЛІЗАЦІЇ РИНКУ**

Основною метою представлено дослідження є визначення та аналіз критеріїв формування ціни електроенергії для генеруючих підприємств за застосування системного підходу для оцінювання впливу сукупності вказаних критеріїв як цілісної системи. Проведено аналіз впливу на формування ціни для підприємств енергетичної галузі біржових, регуляторних, техніко-технологічних та інших критеріїв і факторів. Указано, що пропозиція цін на електричну енергію на біржі формується за трьома складовими: маржинальними витратами, витратами «холостого ходу» та витратами «на завантаження». Установлено, що важливим критерієм формування ціни на електроенергію в умовах лібералізації ринку стає надана споживачеві можливість самостійно впливати на ціну електроенергії, та деталізовано механізм реалізації цього критерію. Указано на наявність і позитивного, і негативного впливу надмірної регуляції ринку впровадженням процедури «покладання спеціальних обов'язків» на підприємства енергетичної галузі. Установлені та проаналізовані основні фактори впливу на критерій «вартість послуг постачальника». Науковою новизною є визначення того, що критерії формування ціни на електроенергію мають являти собою узгоджену систему, яка реалізує принцип сумісності стимулів усіх сторін, що формують баланс інтересів, – і виробників, і споживачів. Крім принципу сумісності стимулів, також уперше названі інші принципи, яким мають відповідати критерії формування ціни на електроенергію. Для запровадження системного підходу до аналізу вперше запропоновано модель формування ціни на електроенергію в умовах лібералізації ринку. Перевагою цієї моделі є те, що вона дозволяє не тільки оцінити вплив виявлених критеріїв на ціну електроенергії, а й прогнозувати цю ціну на наступні періоди.

**Ключові слова:** критерії формування ціни, електроенергія, лібералізація енергоринку, модель

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