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Increasing the Effectiveness of State Policy in Ensuring Energy Security and Environmental Protection

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ABSTRACT

The significance of modeling the process of implementing state policy for energy security and environmental protection lies in its potential to guide effective decision-making. The purpose of the article is to determine the main objectives of the state policy to ensure the energy security and environmental protection. The object of the study is the system for ensuring the energy supply and energy security. The scientific task is to model the process of implementing an effective state policy to ensure the energy security and environmental protection and calculate the most optimal way to supply energy to cities in the EU. The research methodology involves the use of ERD (Entity Relationship Diagram) and Linear Programming methods. ERD is used to visually organize and structure the complex data associated with energy supply systems and environmental policies, highlighting the interrelationships and dependencies between various elements. As a result of using the above methodology, a scheme for implementing state policy in the field of energy security and environmental protection was formed, the most optimal method of energy use was calculated, and also, based on the generated calculation models, a recommendation list was proposed for optimizing modern state policy in the field of energy security and environmental protection. The results of the study fully fulfill the tasks and goals. The novelty of the article is revealed in the proposed methodological approach to the presentation of the system for optimizing modern state policy in the field of energy security and environmental protection. In the future, it is planned to expand the list of elements of the scheme for state policy in the field of energy security and environmental protection and unify existing mathematical calculations for other countries. The methodological approach's novelty lies in its unique integration of ERD and Linear Programming to address a highly relevant and complex issue-balancing energy security with environmental protection. This approach differs from existing literature.

1. INTRODUCTION

Mankind throughout history has been forced to solve various problems of a natural-climatic and socio-economic nature. Now, among the key problems of survival, one can single out the problems of providing food, energy and maintaining a livable environment. Reflecting on the existence of a limit to the growth of energy consumption by human civilization and how to restrain it without compromising the improvement of the quality of life, it should be recognized that it is impossible to give an exhaustive answer to them today. Obviously, in the first half of the 21st century, a radical increase in energy efficiency in all sectors of human activity, as well as the widespread use of the energy potential of renewable sources, will be justified. In today's world, the general safety of the environment and the availability of hydrocarbons, in particular oil and natural gas, are interrelated. The threats to energy security include the uneven distribution of oil and natural gas deposits on our planet, as well as the uneven consumption of energy resources between countries. International environmental security will become unsustainable if the world's energy supply system with raw materials is out of balance. Accordingly, its balance should be managed on the basis of a common international legal framework and a common energy strategy. Despite the introduction of new fields, fears about the reduction of available hydrocarbon reserves are not unfounded. These fears are exacerbated by the objective uneven distribution of the main deposits on the planet. It should be borne in mind that energy consumption is also uneven, especially the specific energy consumption per capita in different regions of the world.

In general, according to the international energy security index, most EU countries still do not have high results, as depicted in Figure 1.

Figure 1. Level of the international energy security index

One of the most important tasks of energy management, a necessary condition for its successful stable development, is the process of providing all sectors of the economy with various types of energy and fuel. The formation and implementation of the energy policy is an important component of its activities on the way to fulfilling this task, as well as further European integration. The democratization of society, integration into the European and world economy, liberalization of the economy put forward new rules for the content and quality of state power. Effective government activity becomes absolutely impossible without a clearly defined strategy acceptable to society as a whole to achieve the priority goals of the state (including economic, energy) policy.

In discussing the uneven distribution and consumption of energy resources, a 2022 report by the International Energy Agency (IEA) highlights that while some regions like the Middle East are abundant in oil reserves, others, such as many European countries, rely heavily on imports. Additionally, the World Energy Council's 2023 World Energy Scenarios underline significant disparities in per capita energy consumption globally, with developed nations consuming far more than their developing counterparts. These sources provide empirical evidence supporting our discussion on the challenges of hydrocarbon distribution and usage. While global energy challenges such as the distribution of hydrocarbons and environmental sustainability are pressing, their implications for EU energy policy are particularly pertinent. The EU's approach to these challenges reflects a microcosm of the broader global energy dilemma. For instance, the EU's increasing investment in renewable energy sources is not only a response to global environmental concerns but also a strategic move to mitigate its reliance on imported hydrocarbons, as evidenced by recent policy shifts post-2020. This example showcases how global energy issues directly inform and shape the EU's specific policy decisions.

The purpose of the article is to determine the main objectives of the state policy to ensure the energy security and environmental protection.

The structure of the article implies a review of the literature, a description of the methodology and main methods, a presentation of the main results of the study, their discussion and conclusions.

2. LITERATURE REVIEW

The scientific literature [1, 2] notes that the energy security of the environment is one of the most important components of the economic security of any country and affects the phenomena and processes not only of the energy system, but also of the economy. It is defined as the protection of citizens and the state as a whole from the threat of a shortage of all types of energy and energy resources arising from the influence of negative natural and man-made, managerial, socio-economic, domestic and foreign policy factors.

It is noted in the literature [3, 4] that the problem of global energy security of the environment that has arisen in our time is defined as the urgent need to reliably supply the world economy with all types of energy without excessive harm to the environment and at prices that reflect basic economic principles. The global nature of threats to energy security and their consequences requires coordinated international action and the development by the world community of the concept of a sustainable and secure energy future, as well as the implementation of measures to ensure its practical implementation.

The authors in the literature [5, 6] note that the reverse side of energy security is the energy danger arising from an acute shortage of fuel and energy resources, uneconomical use of energy carriers, excessive dependence on their imports, irrational denationalization and privatization of the state energy system. The main factors affecting the energy security of the environment are the level of self-sufficiency in oil, gas and some raw materials, as well as the high energy consumption of production.

The literature [7, 8] describes that now the resource, and, accordingly, energy, environmental security has become one of the most important components of international security, the basis for the socio-economic development of peoples and states, in contrast to the 20th century, where the main guarantee of survival was the military-strategic reliability of national security. relied on: the development of the military-industrial complex, which created more and more powerful and deadly weapons; the formation of military "camps" and blocs that divide peoples and states into hostile forces; the creation of an ideology of confrontation that justifies the arms race and the resolution of peace. Today, states must build a common system for ensuring the energy security of the environment, relying on mutual cooperation and not fomenting rivalry for the diversification of sources and routes of supply, and also not building up strategic fuel reserves at a pace reminiscent of military preparations.

Another problem in the literature [9, 10] indicates that there is an imperfect infrastructure that hinders the development of many industries, including energy. And all this is happening against the background of a significant level of state regulation, the absence of a unified state energy policy, an unambiguous interpretation of terms, etc. and the practical absence of effective self-regulators of the energy market. To this, it is also necessary to add a high level of corruption and lack of transparency in the functioning of energy product markets. Potential directions for improving the structure of the energy balance and solving existing problems in this area are as follows.

As noted in the scientific literature [11, 12], today, thanks to scientific and technological progress, the time horizon of hydrocarbon energy is constantly moving away, which to some extent compensates for the growth in primary energy consumption. Thus, in the 21st century, only the improvement of technologies for the extraction and processing of fossil energy carriers ensured an increase in their proven reserves. Expansion of the use of nuclear energy, renewable energy sources, unconventional gases, combustible shale and oil sands, taking measures to reduce energy costs and discovering new deep-sea energy deposits, reserves of energy raw materials on the sea shelves and in the Arctic can increase the life of hydrocarbons in the world creation of industrial technologies obtaining methane from gas hydrates may allow humanity to push the problem of depleting fossil fuels for an even longer period.

Supporting the discussion on energy danger and high consumption, studies such as those by literature [13] demonstrate the correlation between rising global energy demands and increased environmental risks. Additionally, data from the World Energy Outlook provide empirical evidence of escalating energy consumption trends, especially in rapidly industrializing nations. Further analysis of infrastructure and state regulation issues is essential, as highlighted by some literature [12, 13], who discuss how outdated infrastructure limits energy efficiency gains. Illustrates the impact of fragmented state policies on sustainable energy development, emphasizing the need for cohesive regulatory frameworks to ensure both energy security and environmental protection.

Based on the results of the analysis of the literature, a number of gaps can be identified in our study, as depicted in Figure 2.

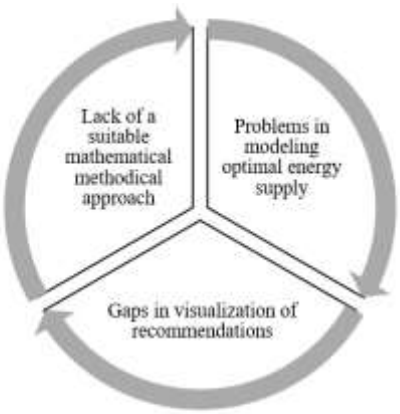

Figure 2. Key gaps in literature

The identified gaps make it possible to form a scientific question: How, according to a new methodical approach, is it possible to present an effective state policy in the field of energy security and environmental protection? The scientific task is to model the process of implementing an effective state policy to ensure the energy security and environmental protection and calculate the most optimal way to supply energy to cities in the EU.

3. METHODOLOGY

During the research, we used the following key methods: ERD (Entity Relationship Diagram) and Linear Programming. Let us describe these methods in more detail, justifying their relevance for this study.

Thus, the ERD (Entity Relationship Diagram) method is a methodology for graphically visualizing large amounts of data into an organized structure. To model the process of increasing the effectiveness of public policy in ensuring energy security and environmental protection, this method will be useful for the following reasons:

1. The level of structuring of large data sets is significant. The field of energy security and environmental protection itself in the context of the implementation of public policy is characterized by an abundance of variables and the number of elements. This methodology will allow the most effective way to organize data arrays, in a vector for key objects, their internal and external relationships.

2. An integrated approach to modeling. State policy in ensuring energy security and environmental protection is a multi-aspect phenomenon and includes various types of factors, such as the content, structure and features of the use of energy resources, existing technologies, the state of the energy infrastructure, and so on. The ERD methodology allows you to present these factors in the most generalized and organizationally structured form.

3. The ability to determine interdependencies between elements. The ERD methodology makes it possible to demonstrate in a simple and clear way the existing relationships between each element of the system.

4. Clear and understandable display of results. For people who directly formulate or implement public policy in ensuring energy security and environmental protection, it is important that the model is simple to construct, as well as understandable in the context of reflecting complex relationships.

5. The basis for the design and implementation of real design systems of state policy in the field of ensuring energy security and environmental protection.

The implementation of ERD involves data identification to determine key entities in energy security and environmental protection, relationship mapping to visualize interactions between these entities, and structural analysis to understand the system's structure. Linear Programming includes defining objectives like cost minimization or efficiency maximization, identifying constraints such as budget limits and technical capabilities, formulating the model to incorporate these aspects, and finally, employing linear programming techniques for solution optimization. In ERD, the data encompasses information on energy resources, infrastructure, and policies, while linear programming might involve cost data, energy output, and technical specifications. The data source includes government reports, environmental studies, and industry databases.

The next method that was used in the context of our study is the linear programming method. Linear programming itself is a specific mathematical method for optimizing processes in various areas of social life, which is used to find the most optimal and rational way to use resources in the context of achieving a set goal. Today, linear programming is an important tool in the process of making certain management decisions. In the field of public policy to ensure energy security and environmental protection, linear programming will allow us to determine the most optimal balance between the use of various energy sources, taking into account various types of factors: economic, environmental, technical and other factors, while guaranteeing a high level of energy security.

Features of linear programming in the field of ensuring the effectiveness of public policy in ensuring energy security and environmental protection are:

1. Taking into account a huge number of restrictions. In the context of ensuring the effectiveness of public policy in ensuring energy security and environmental protection, such

limitations may be the existing budget, technical capabilities, and current regulations.

2.Objectivity. Decisions made on the basis of linear programming are based on specific data and mathematical calculation methods, eliminating subjectivity as much as possible.

3. Flexibility. All solutions generated on the basis of linear programming can be changed in accordance with current changes in the energy infrastructure or the prevalence of certain energy carriers.

Like all methods, this method has its drawbacks. The main disadvantage of this method is its linearity, which assumes that all relationships in the processes under study must be linear. This situation may be a minor limiting factor in some aspects of the formation of public policy in ensuring energy security and environmental protection.

Thus, using the linear programming method in the field of ensuring the effectiveness of public policy in ensuring energy security and environmental protection, it will allow central and local government and self-government bodies to form long-term strategies for ensuring the energy security of a city, region or country, providing for resource needs, possibly technological ones. breakthroughs and changes in environmental and energy regulations.

While ERD and Linear Programming have distinct advantages, the rationale for their selection over other methods lies in their specific applicability to the study's objectives. ERD is particularly suited for visualizing the complex interrelationships inherent in public policy for energy security and environmental protection. Its ability to structure large datasets and clarify intricate relationships makes it superior to other data visualization tools in this context. Linear Programming, on the other hand, is chosen for its precision in optimization and resource allocation, crucial for policy modeling. Unlike other mathematical models, it allows for the direct incorporation of various constraints and objectives, providing clear, objective solutions in the policy-making process.

The implementation of ERD will follow these steps: identification of key entities and their attributes relevant to energy policy, mapping of relationships and dependencies among these entities, and the creation of a diagrammatic representation to visually analyze these relationships.

For Linear Programming, the process will include defining the objective function (such as minimizing cost or maximizing efficiency), identifying and quantifying constraints, formulating the linear programming model based on these objectives and constraints, and then using linear programming techniques to find the optimal solution.

4. RESULTS OF RESEARCH

As already noted, the first method that will be used in the research process is ERD methodology.

So, Figure 3 depicts the scheme of state policy in the field of energy security and environmental protection, taking into account the key elements of this issue. It is worth noting that this model is simplified and demonstrates only the basic structure of such a complex phenomenon as state policy in the field of energy security and environmental protection.

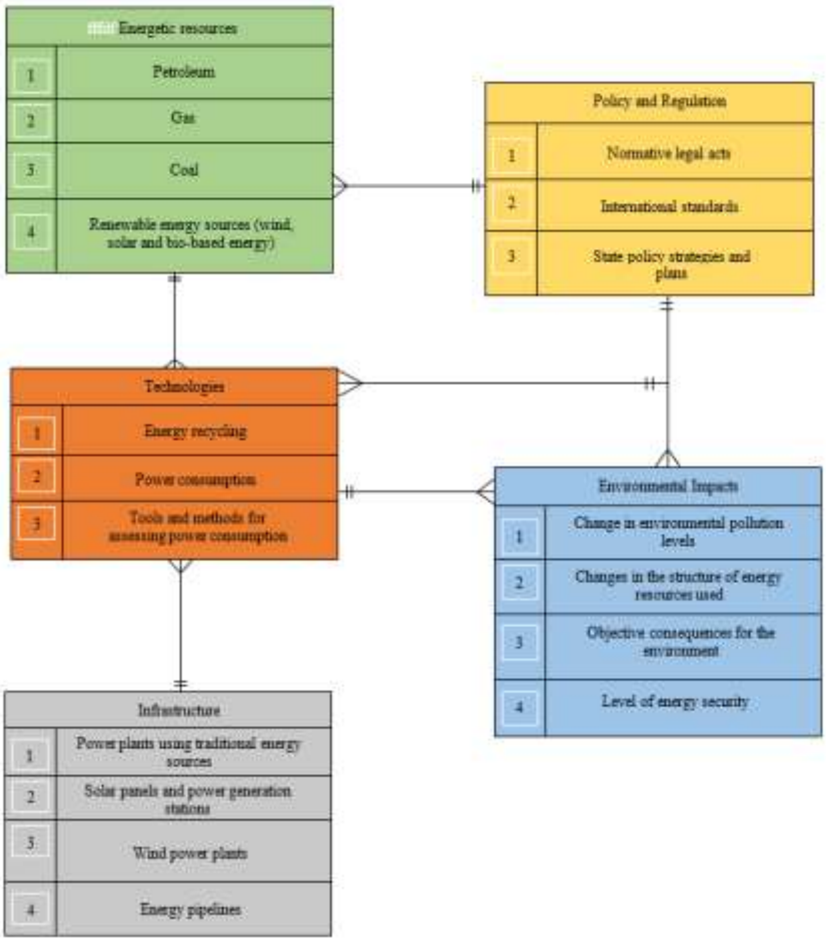

Figure 3. Scheme of state policy in the field of energy security and environmental protection

The connection lines are presented in Figure 3, demonstrating the connection between the blocks that are the result of the modeling. So, as we can see from Figure 3, the diagram we formed includes five elements. The structure of each element also includes a list of key components that today are decisive in the process of energy supply, ensuring energy security and environmental protection.

For a better understanding of the current scheme, we will describe the relationships between the elements, their features and essence.

1. Communication "Energy resources – Technologies". The essence of the relationship is many to many. Available energy resources can be used to implement various technologies in the production of energy and energy resources. Moreover, each technology can use different types of energy resources.

2. Connection "Technology – Environmental Impact". The essence of the relationship is many to many. Each of the selected energy production technologies can have a single and complex environmental impact on the environment, depending on the specifics of its implementation. For example, the technology for producing energy from coal increases carbon dioxide emissions.

3. Communication "Policy and Regulation – Technologies – Energy Resources". The essence of the relationship is one to many. Separate regulatory legal acts and directions for the implementation of state policy may establish certain standards for the use or prohibition of energy production technologies and energy resources. At the same time, directly or indirectly, government policy can regulate the degree of use of certain energy resources.

4. Communication "Infrastructure – Technologies – Energy Resources". The essence of the relationship is one to many. Energy infrastructure uses various technologies to generate energy. Moreover, the structure and types of technologies used directly depend on the existing state policy on energy efficiency and energy security.

5. Link "Policy and Regulation - Environmental Impact". The essence of the relationship is one to many. Appropriate government policies and regulations should establish optimal standards and regulations aimed at minimizing negative environmental impacts, as well as rationalize energy consumption. For example, the target direction in this relationship could be legislative limitation and monitoring of negative emissions of combustion products and other harmful substances formed during the energy production process.

For better objectification of the research and clarity, we used a specific mathematical method-linear programming, the advantages of which in ensuring the effectiveness of public policy in ensuring energy security and environmental protection were described in the methodology section.

Thus, in the context of the linear programming method, we will study the processes and decisions of public policy to optimize the distribution of resources in the energy sector while simultaneously ensuring environmental safety and energy security.

For example, a city in the Czech Republic was chosen - Brno. The reason for choosing the city was the direct presence of the study authors in this city and the opportunity for consultative cooperation with local governments and government institutions responsible for ensuring energy security and the environment.

In the context of the limited scope and scope of this study, we will present the process of optimizing resources for a given city in the context of three main energy sources: coal, wind energy, solar energy.

Let us present the energy source data in the form of the following variables:

X_1 – amount of energy obtained from coal (in MW);

X_2 – amount of energy received from wind turbines (in MW);

X_3 – amount of energy received from solar panels (in MW).

The key function of using this method in this context is to maximize energy production while minimizing the negative impact on the environment. Let us assume that the state policy of the city of Brno in the context of ensuring energy security and environmental protection puts forward the need to optimize its own energy sources.

According to the program and scientific-methodological documents that were provided by local governments and the city energy supply institute, we have the following input data:

- coal can produce a maximum of 500 MW at a cost of 3 dollars/MW and an impact on the environment of 10 units/MW.
- wind energy can provide a maximum of 300 MW at a cost of $4/MW and an environmental impact of 1 unit/MW.
- solar energy can provide a maximum of 200 MW at a cost of $5/MW and an environmental impact of 0.5 units/MW.

Accordingly, the objective function will look like this:

$$Z = 10X_1 + X_2 + 0.5X_3$$

In this case, the restrictions will look like this:

$$\begin{gathered} X_1 + X_2 + X_3 \geq 800 \\ X_1 \leq 500 \\ X_2 \leq 300 \\ X_3 \leq 200 \\ X_1, X_2, X_3 \geq 0 \end{gathered}$$

To simplify the mathematical calculations for solving the minimization issue, let us turn this problem into a maximization problem. To do this, multiply the objective function by Eq. (1):

$$Z' = -10X_1 - X_2 - 0.5X_3 \tag{1}$$

Since the method requires equality in constraints, we will add slack variables to convert inequalities to Eq. (2):

$$\begin{gathered} X_1 + X_2 + X_3 + S_1 \geq 800 \\ X_1 + S_2 = 500 \\ X_2 + S_3 = 300 \\ X_3 + S_4 = 200 \end{gathered} \tag{2}$$

Now, having these formulas for calculations, it becomes possible to use the simplex method to solve this problem.

To calculate the optimal solution to a real energy resource optimization problem, we used specific software.

But based on the conditions, the best way to provide 800 MW with minimal environmental impact would be to use as much power as possible from wind and solar, and get the rest from coal.

Given the limitations, we get the following results:

X_1 = 300 MW from coal;

X_2 = 300 MW from wind energy;

X_3 = 200 MW from solar panels.

This solution provides us with 800 MW of energy with minimal environmental impact.

To enhance clarity, we present the calculation results in Table 1.

Table 1. Results of using the linear programming method in the context state policy in the field of energy security and environmental protection

Parameters	Coal	Wind Energy	Solar Energy	Amount/Max Power
Cost (USD/MW)	3	4	5	
Impact on the environment (units/MW)	10	1	0.5	
Available power (MW)	500	300	200	
Power used (MW)	**300**	**300**	**200**	**800**
Cost (total, dollars)	900	1200		3100
Impact on the environment (total, units)	3000	300	100	3400

Given the above conditions and solution, the optimal way to obtain 800 MW with minimal environmental impact and at an acceptable cost is to use 300 MW from coal, 300 MW from wind and 200 MW from solar panels.

The total environmental impact would be 3,400 units at a total cost of 3,100 USD.

It should be noted that these expenses will go only to energy production. In reality, other costs may arise. These may include operating, maintenance, and depreciation costs for energy production and distribution equipment. In our example, we only considered the cost of energy production.

Based on the use of the above methods and the results obtained, at the level of formation and implementation of state policy in the field of optimizing energy security and minimizing the impact on the environment, we have formed the following recommendations and measures:

1. Stimulating and strengthening investment in the field of alternative and renewable energy sources. In particular, we are talking about increasing investment activity in solar and wind energy, as well as increasing funding for scientific research in the field of renewable energy sources.

2. Development of the practice of subsidizing companies and other entities that decide to use renewable energy sources in their private or commercial activities.

3. Formation of relevant regulatory legal acts. These may include regulations related to restrictions on excessive emissions of harmful substances due to the operation of traditional energy infrastructure. At the same time, new regulations may concern the creation of quotas for the use of renewable energy sources.

4. Stimulation and implementation of educational programs among various segments of the population in the field of rationalization of energy consumption, greening of energy infrastructure, compliance with the principles of energy efficiency at the population and enterprise level.

5. Promoting energy efficiency in households and commercial activities. In this context, public policy should provide incentives for businesses and households to switch from outdated energy infrastructure to energy efficient equipment. In addition, it is important to formulate state-level energy efficiency standards.

6. Justification and laying down of appropriate material and human resources for the construction of new infrastructure for renewable energy sources, such as wind farms, solar stations and energy storage networks.

In this way, with the help of selected methods, wehave formed a scheme for implementing state policy in the field of energy security and environmental protection, the most optimal method of energy use was calculated, and also, based on the generated calculation models, a recommendation list was proposed for optimizing modern state policy in the field of energy security and environmental protection.

Focusing on energy production cost is due to its direct impact on policy decisions and economic feasibility. The significance of the research under this condition can be evaluated by how it optimizes costs while maintaining energy security and environmental standards.

The results obtained from linear programming, which identify the most optimal methods of energy use, have significant implications beyond mere numerical outputs. They offer strategic insights into how resources can be allocated efficiently while balancing the twin goals of energy security and environmental protection. For instance, the optimization of energy resources usage can lead to reduced reliance on non-renewable energy sources, thereby contributing to environmental sustainability. Moreover, these results can inform decisions on investments in renewable energy sources and energy-efficient technologies, which are crucial for long-term environmental health.

5. DISCUSSIONS

When discussing the results of your own research, you should compare them with similar ones. So, for example, other scientists [13, 14] have considered and as a result presented trend models. With the help of the constructed models of primary energy supply and final energy consumption, the forecasting of the needs for energy resources of the economy of the EU countries is greatly simplified, which will contribute to their effective planning in the implementation of economic policy in the energy sector of the EU countries.

Another group of scientists [15, 16] will present in the results a model of the development of the energy market in Europe. The energy market is a complex and dynamic economic system, the study of which requires the use of adequate methods in order to identify a combination of factors of influence (internal, external) on the functioning of the market, as well as to establish the main trend of its development to ensure the energy security of the environment. Given the high level of risk inherent in this market, the market forecasting system and its consideration in the formation of the country's energy policy and ensuring a high level of energy (and, consequently, economic and national) security are of great importance.

As a result, scientists [17, 18] will present a planning model for ensuring the energy security of the environment. The result of energy planning should be the formulation of long-term goals and the adoption of a long-term policy. In the EU countries, it has not yet been possible to formulate a long-term policy, since the adoption and revision of energy strategies occur quite often, and the main planned indicators change dramatically, which indicates a low level of efficiency in the adoption of previous long-term policies and a discrepancy between planned indicators and the real state of the industry.

Another group of scientists [19-21], through modeling, presented a model for improving the efficiency of energy auditing for environmental protection. When conducting an energy audit, it is necessary to calculate the energy consumption of various objects (equipment, devices, etc.) and compare it with standard values, distribute the costs of energy resources in proportion to their use among consumers, draw up a detailed energy balance, compare energy consumption with other performance indicators (in including the results), compare the level of energy consumption with industry standards, indicate the reason for the identified deviations and propose and justify directions for energy saving. Conducting a comprehensive energy audit will identify ways to save energy (carrying out maintenance, upgrading equipment, restructuring energy consumption).

The novelty of our methodological approach lies in the unique combination of ERD (Entity Relationship Diagram) and Linear Programming, applied specifically to the context of optimizing state policy in energy security and environmental protection. Unlike the trend models [13, 14], which primarily focus on forecasting energy needs, our approach integrates complex data visualization (ERD) with optimization techniques (Linear Programming). This integration allows for a more holistic analysis, capturing not only trends but also the interdependencies and potential efficiencies within the system. Unlike the models presented before [15-18], which either focus on market dynamics or long-term planning, our approach combines these aspects into a comprehensive framework that aids in both strategic planning and operational decision-making. Our methodology also goes beyond the scope [20-25] energy auditing model by incorporating broader policy implications and environmental considerations.

The findings from our study have significant practical implications for policymakers and practitioners. The integrated ERD and Linear Programming approach provides a tool for visualizing the complex dynamics of energy systems and environmental policies, enabling policymakers to identify key leverage points and areas for intervention. The optimization aspect helps in formulating policies that are not only environmentally sustainable but also economically viable. This dual focus is crucial in today's context where the balance between ecological preservation and economic development is paramount. Practitioners can use these findings to develop more targeted and effective strategies for energy conservation, resource allocation, and environmental protection.

However, the results of our study have both similarities and differences compared to others, as illustrated in Table 2.

Table 2. Similarities and differences in our study results

Similarities	Differences
1. Similarity of views regarding the fact that it is impossible to ensure the energy security of the environment without an effective state policy	1. The difference in the proposed methodological approach to modeling and mathematical calculations
2. The similarity of the idea of modeling the process of increasing efficiency to ensure the energy security of the environment	2. The difference in the technology of reflection of the process of ensuring the energy security and environmental protection

The novelty of the article is revealed in the proposed methodological approach to the presentation of the system for optimizing modern state policy in the field of energy security and environmental protection. The study has its limitations.

The innovation resides in the novel application of established methods (ERD and Linear Programming) in a new context, or in providing a more comprehensive analysis than previous studies. The research can be significant for other cities, especially in the EU, as it offers a model for balancing energy efficiency, cost-effectiveness, and environmental impact, providing a potentially adaptable framework for different urban contexts and energy systems.

6. CONCLUSIONS

To summarize, it should be noted that the public policy system in the context of ensuring rational energy use, ensuring energy security and environmental safety is a multifactorial model in which both objective and subjective factors are important. Considering a significant number of elements, our modeling and mathematical calculations presented in the article were intended to systematize and improve the process of implementing public policy to optimize energy use, ensure energy security and environmental protection, and not make a forecast.The main results of the study in the article are presented in Figure 4.

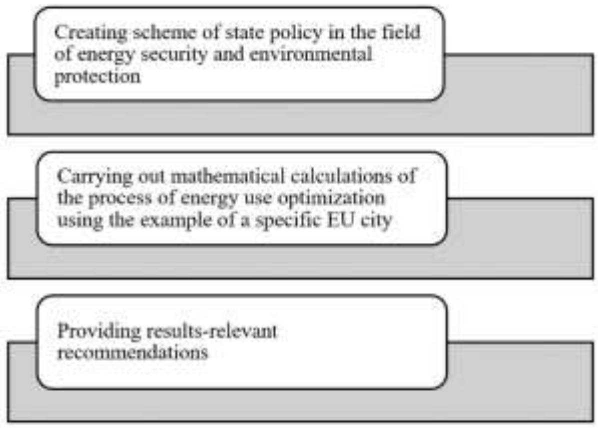

Figure 4. The main results of the study in the article

As a result of using the above methodology, a scheme for implementing state policy in the field of energy security and environmental protection was formed, the most optimal method of energy use was calculated, and also, based on the generated calculation models, a recommendation list was proposed for optimizing modern state policy in the field of energy security and environmental protection. The obtained results of the research have practical value and can be used by the politicians of the EU country to ensure the energy security of the environment.

The study has its limitations. The current scheme takes into account only the basic elements of state policy in the field of energy security and environmental protection. All calculations carried out in the study relate to a single city in the Czech Republic. In the future, it is planned to expand the list of elements of the scheme for state policy in the field of energy security and environmental protection and unify existing mathematical calculations for other countries.

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