

Influence of current trends on the sustainable development of power industry in Russia

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Abstract. The relevance of the research is the need of forming of measures for the accelerated transition to a more effective steady power in the conditions of the world economic crisis. The current trends and challenges of the development of the power industry of Russia, aimed at the revision of the principles of their construction, creation of the distributed architecture, integration of technology systems and technologies are revealed on the basis of the conducted research. The analysis of modern trends in energy development indicates the need for an integrated approach to solving external and internal problems. The matters of power transition, its motivating factors aimed at the satisfaction of the requirements in energy without any damage to the environment are studied. Recommendations for the more effective use of innovations in the sphere of green power, taking into account economic and environmental problems are made. Realization of the issues of sustainable development of the power industry of Russia will demand forming the measures promoting the accelerated transition to the more effective power industry, steady against the challenges and threats.

1 Introduction

The economic conditions and political environment of a particular area are crucial factors that drive innovation and technological progress in various sectors, impacting the well-being of residents. In recent decades, there have been profound changes that have propelled this evolution, such as the growing concern over global warming and rising levels of greenhouse gas emissions. These factors have influenced the development of new energy sources and the adoption of energy-efficient technologies, leading to a transformation in production methods and lifestyles. The integration of cutting-edge energy and information technologies is revolutionizing industries and communities, accelerating the transition towards more sustainable practices.

The obstacles involved in creating a plan to change power dynamics are wide-ranging, encompassing everything from concerns about economic expansion to the importance of

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sustaining overall macroeconomic stability. promoting fair allocation of resources and leveraging technology to solve societal problems are vital for societal advancement. It is imperative to harmonize political and economic tactics to tackle these issues effectively. Incorporating industrial strategies, embracing technological advancements, and adopting new technologies are essential for creating robust plans in the power sector. Establishing a distinct, inventive, and well-backed national socio-economic agenda is crucial for successful national growth and progress.

Explore the most recent studies by international experts like Gielen D., Boshell F. [1], E. Foster, M. Contestabile, J. Blazquez, B. Manzano, M. Workman, N. Shah [2], L. - N. Sassenou, L. Olivieri, F. Olivieri [3], Ali Q. Al-Shetwiab [4], G.Yilmaz [5], Yanzhiu Tao [6], Wei Han [7], Bernd Bonfert [8], Bartolucci L., Cordiner S. [9], and others, delving into topics such as energy sector development, climate change, sustainability, and environmental challenges. Additionally, in-depth discussions on future scenarios in global and Russian power development can be found in works by Degtyarev K.S. [10], Bashnikov I.A. [10], Porfiryev B.N., Shirov A.A. [12], Timokhin D. [13], Esyakov S.Ya. [14], Myshkina L. S. [15], O. Fokina [16], and O. Savelyeva [17], A.Urekeshova [18], E. Bratukhina [19], A. Kifyak [20], M. Vysochina [21], A. Gagarova [22]. This study explored current challenges and their potential impacts

2 Materials and Methods

This research is based on the theoretical model created by a mix of local and global experts in the energy sector.

In the research, a blend of theoretical frameworks for examining cognition (such as analysis and modeling) and practical methodologies (such as comparison and experimentation) were employed.

3 Results and Discussion

Sustainable development has emerged as a key focus in Russia's social and economic policies, emphasizing the importance of balancing environmental protection with long-term economic growth. Energy is seen as both a crucial driver of progress and a major source of pollution, underscoring the need for strategic planning to achieve sustainable development goals.

Recognizing the urgent need for Russia to adapt its power development strategies in response to a changing global economic environment is crucial. The current foreign policy landscape, particularly the effects of sanctions, is significantly influencing power development. The destabilizing factors outlined in Figure 1 are hindering economic progress and highlighting the necessity for a revised approach to power development.

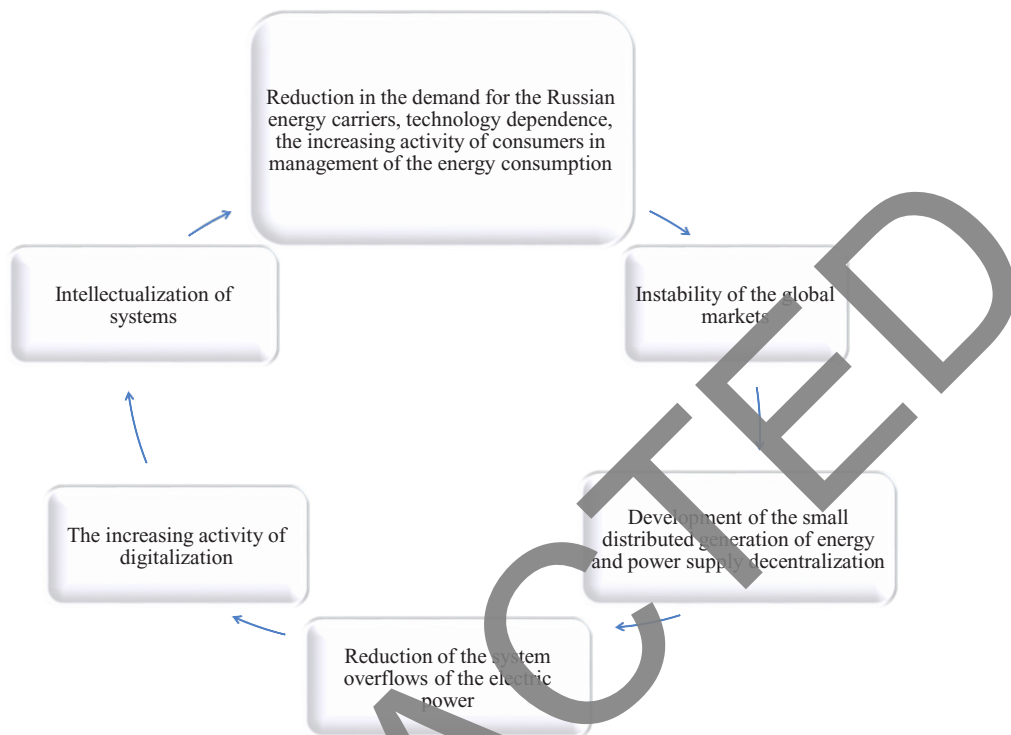


Fig. 1. Barriers impacting the advancement of energy development in Russia

Upon closer inspection of the current state of energy markets and socioeconomic development, it becomes clear that the Russian fuel and energy industry is currently encountering substantial obstacles stemming from various internal and external factors. These challenges are exacerbated by the swift transformations taking place in the worldwide energy sector.

Figure 2 illustrates a combination of external and internal requests.

External factors- challenges:

- low growth rates and the current recession of the Russian economy, which significantly slow down the growth of domestic demand for fuel and energy, and a decrease in investment activity in the fuel and energy complex;
- deterioration of the resource base of the fuel industries as existing deposits are depleted, reduction in the size and quality of new geological discoveries;
- the technological lag of the Russian fuel and energy complex from the level of developed countries and a high level of dependence on imports of certain types of equipment, materials and services, which, in the face of sanctions, may affect the implementation of investment projects;
- excessive dependence on unstable external energy markets;
- limited opportunities to attract available long-term financial resources

Internal factors- challenges:

- compression of the European energy market
- price pressure
- reduction of equipment supply opportunities
- decarbonization and energy
- transfer development of renewable energy and distributed generation
- development of new deposits (rare earths, lithium, gold, coal, gas, oil, etc.)
- active development of energy markets in the Asia-Pacific region
- significant opportunities for the development of the energy complex in the eastern regions of Russia

Fig.2 Current obstacles in the modern energy industry

The decline in exports, lack of growth in economic measures, and rising signs of resource and technological potential in the energy industry have emphasized the necessity for a change in the energy development approach. This shift prioritizes worldwide creativity, rapid integration of digital technology, organizational changes, and enhanced operational effectiveness within fuel and energy firms.

Currently, the proposed strategies aim to tackle the impact of both external and internal factors.

1. Measures implemented to enhance and clarify the standards for energy development.
2. Development of a collection of innovative approaches, techniques, and tools to improve energy expansion.
3. Examining the basics of generating energy and its evolution.

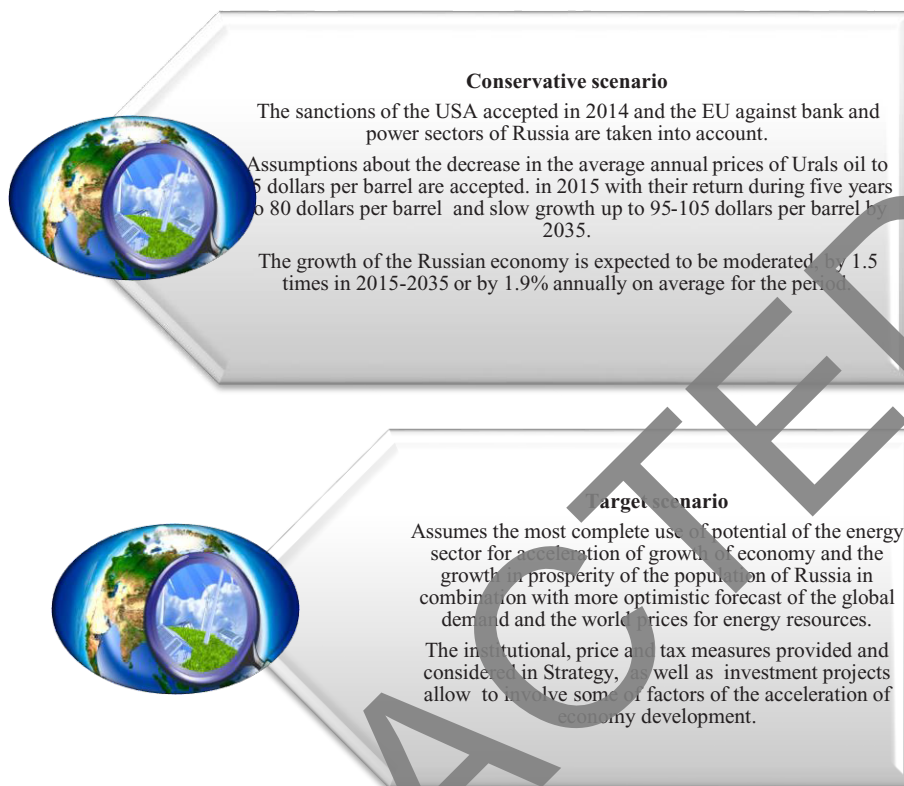


Fig. 3. The main objectives, expected calculations, and forecasts for reaching the goals set forth in the Energy development plan.

There are two distinct perspectives ("conservative" and "target") that have been formulated to assess the proposed strategies and the future of the energy sector. The diagram in Figure 2 delineates the primary objectives, expected outcomes, and estimated schedules for each phase, considering variables like emerging technologies, essential technologies, necessary funding, and anticipated sources of funding.

Certainly, the fuel and energy industry has long been a vital pillar of the Russian economy, playing a substantial role in the country's GDP and generating a majority of federal income (fig. 3).

The fuel and energy sector accounts for approximately a quarter of the nation's economic output, employing a substantial number of workers. Making up 3.7% of the total population, these people are actively engaged in the labor force.

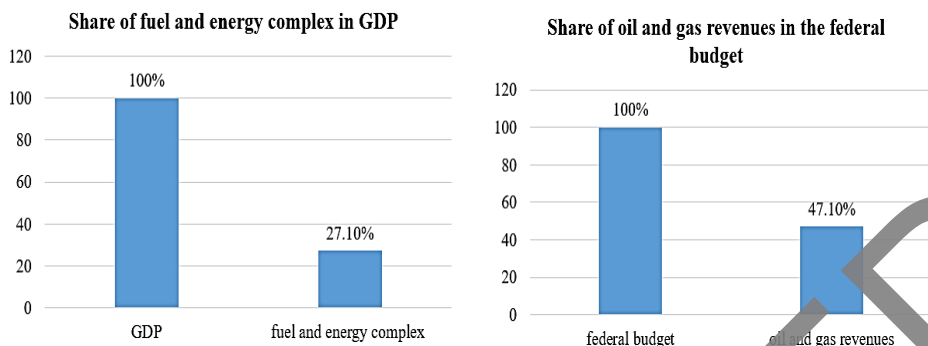


Fig. 4. Share of fuel and energy complex by 2023, it is anticipated that the Russian Federation's economy will see a boost from the rising contribution of oil and gas revenues.

The energy sector in Russia is a significant driver of the country's social and economic development, with around one-third of fixed capital investments, federal budget revenue, and 70% of exports by value coming from this industry.

Figures 5, 6 present data on the key performance indicators for the operational success of energy sector divisions in the upcoming years of 2022 and 2023.

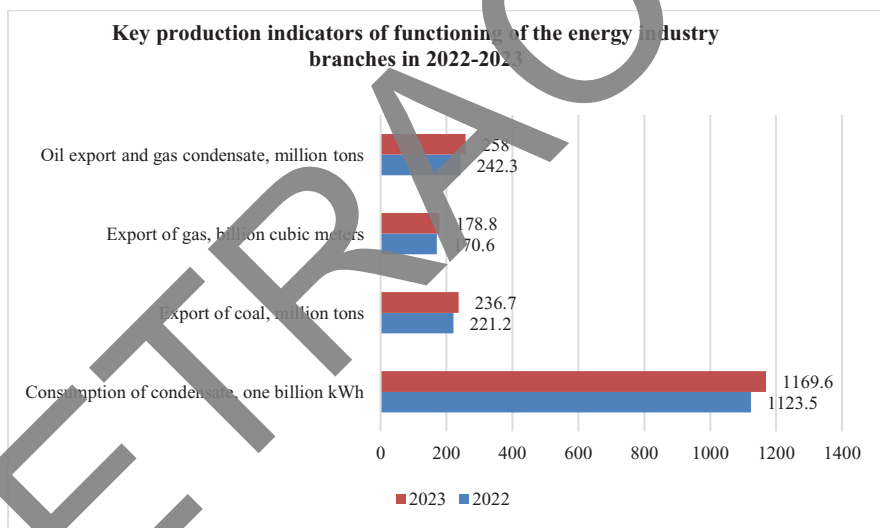


Fig. 5. Monitoring key performance indicators in the fuel and energy industry throughout the year 2022 to 2023.

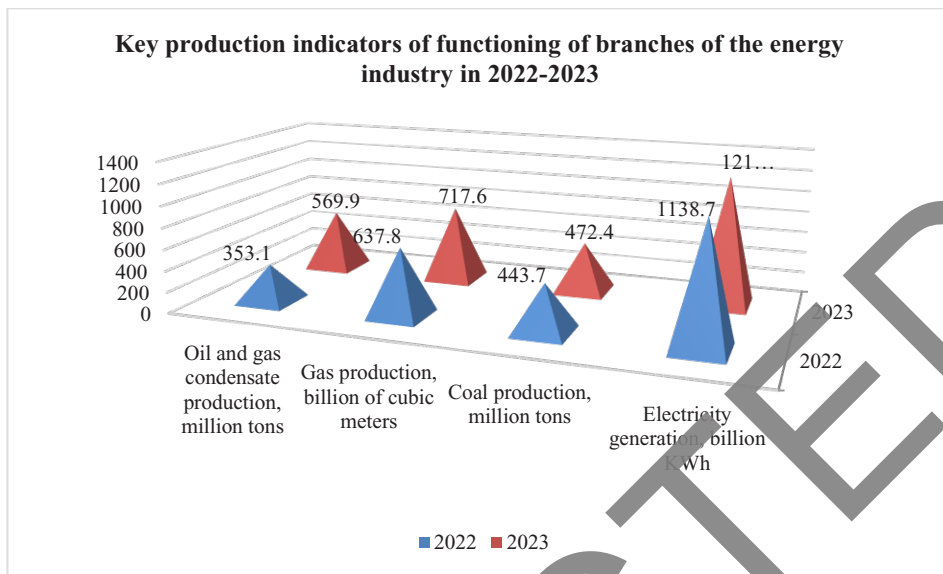


Fig. 6. Tracking the essential indicators of the fuel and energy industry for the years 2022 through 2023.

Given the persistent challenges both from outside and within, the government remains committed to rolling out programs to bolster different segments of the energy sector. Figures 6 and 7 provide a snapshot of the economic and sector-specific actions taken by the state in 2023 to fortify the energy industry against external pressures.

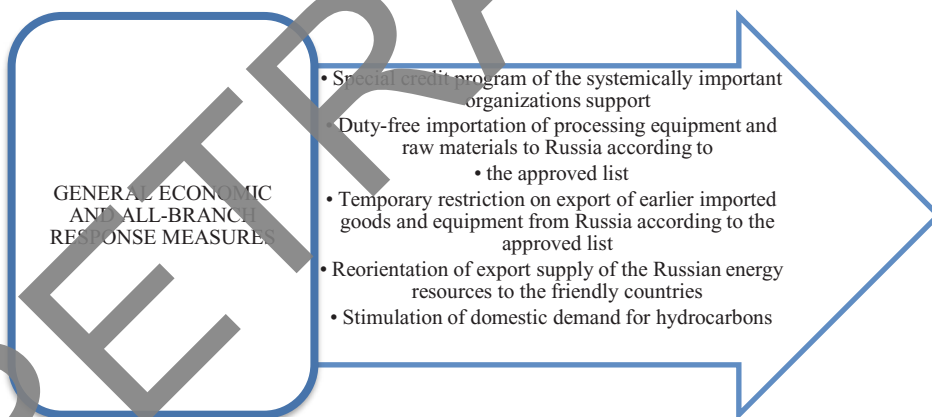


Fig. 7. The general economic metrics of the area offer support.

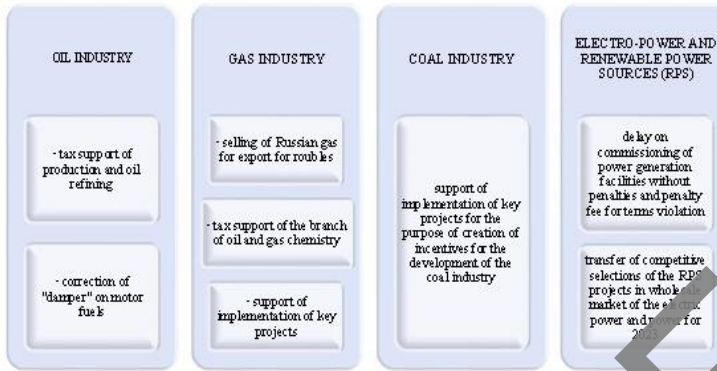


Fig.8. Diverse actions taken by government branches to offer assistance to the state.

In support of government initiatives to drive progress in renewable energy, we are committed to fostering projects that stimulate the development of scientific technology and digital transformation in the energy industry. Our primary goal is to champion innovation and technological growth in various energy sectors, driving their digital evolution forward in today's dynamic landscape of renewable energy advancement.

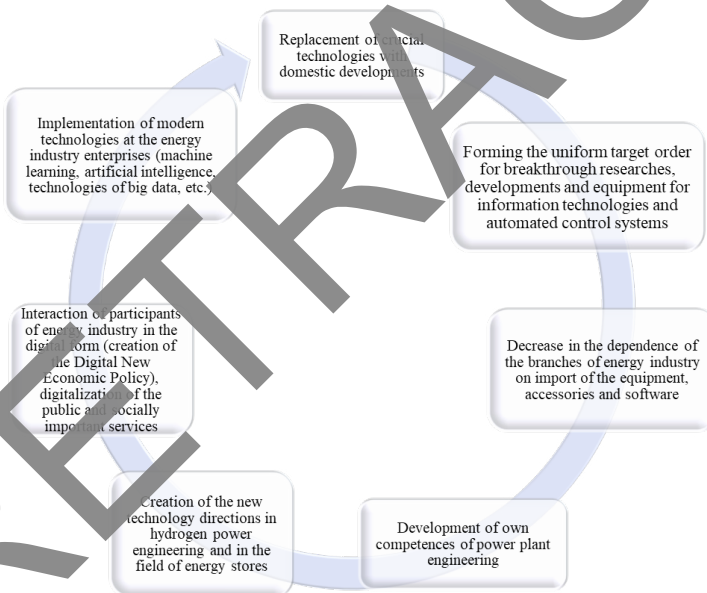


Fig. 9. The energy sector is being transformed by the digital revolution and advancements in science and technology.

The strategies mentioned, innovations in power generation, and changing dynamics in energy development are often discussed subjects that merit deeper exploration. In the global energy industry, current trends, evolving advancements, and holistic approaches to energy progress remain ongoing topics of conversation that call for further study.

Overall, the results of this research indicate that the development of worldwide impact can be linked to four specific elements in recent years, as depicted in figure 9.

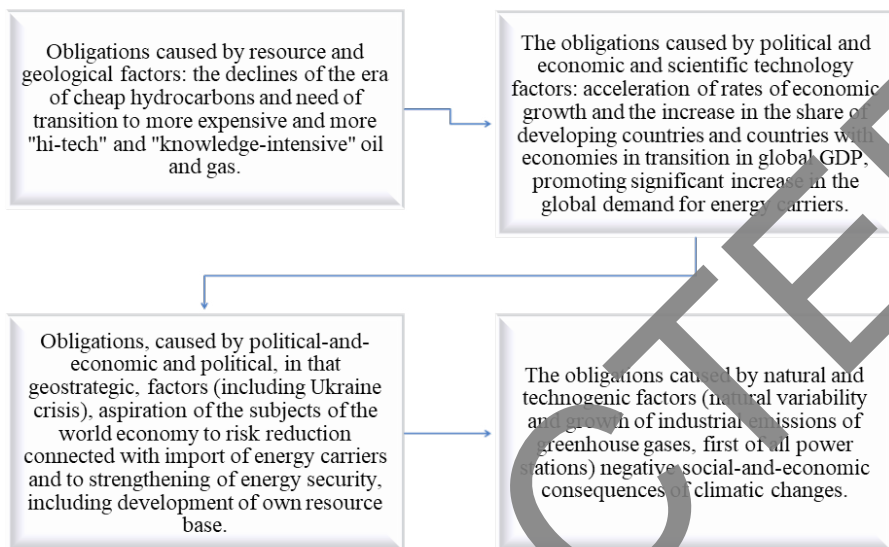


Fig. 10. The combined duties that are shaping the expansion of worldwide impact.

4 Conclusions

According to the results of the research, it is essential to improve specific measures to influence the existing trends in global development and advancement.

- indications of an increase in efforts towards energy preservation;
- indications of utilizing alternative energy sources;
- indications of the utilization of intellectual networks for dispersing authority.

Various factors are behind the changing power dynamics on a global scale, as the shift moves away from traditional monopolies towards a focus on renewable energy sources and cutting-edge technologies. This transition signifies a shift towards a more eco-friendly and effective energy supply system.

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