

## THE CONCEPT OF SUSTAINABLE DEVELOPMENT IN THE CONTEXT OF ENERGY SECURITY

<https://doi.org/10.5281/zenodo.18754160>

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### **Abstract**

This article examines the theoretical and conceptual aspects of sustainable development in relation to energy security. Energy is analyzed as a key factor in economic progress and the provision of sustainable development, highlighting conceptual ambiguities between its goals and implementation approaches. The stages of forming the concept of sustainable development, from the adoption of the United Nations framework and international discussions including the Club of Rome to the introduction of concepts such as “green economy” and “sustainable growth,” are analyzed. The impact of the 2008–2009 global financial and economic crisis on the revision of energy policy and the strengthening of energy security is demonstrated. The authors justify the necessity of forming a comprehensive theoretical assessment of sustainable development in the context of energy security, emphasizing the integration of social, economic, and environmental components as the foundation of this process.

### **Keywords**

sustainable development, energy security, energy sector, green economy, sustainable growth, energy sustainability, national security, energy policy, financial and economic crisis, socio-economic-environmental components.

Energy is an important factor in economic progress and sustainable development; however, there is conceptual ambiguity between the goals and the approaches used to achieve them. The issue of sustainable development in the energy sector has become a significant topic in many studies, with some authors proposing the development of accelerated strategies and technologies [1], while

others call for new theoretical approaches to policy formation. Insufficient attention to shortcomings in this field may lead to drastic and costly measures to prevent the social consequences of climate change.

Research on energy security and sustainable development issues is still characterized by a fragmented nature. Although a sufficient number of scientific works exist on the components of the concept of sustainable development, energy security, resource security, and national security, the problems are not comprehensively addressed, and there is an inadequate approach that clearly expresses the meaningful integrity of the combination of these two concepts.

The purpose of our scientific study is to develop a comprehensive theoretical assessment and to identify the characteristics of the sustainable development process in the context of energy security.

The concept of sustainable development (SD) has gone through three conditional stages in its evolution. The emergence of the concept began with environmental foundations. The United Nations Conference on the Human Environment (1972) and reports to the Club of Rome (1970s) are considered significant events that became sources of discussion and debate in scientific, political, economic, and public spheres.

Environmental debates in favor of sustainable development remain important in all areas of activity, as existing foundations do not correspond to contemporary challenges.

The first stage in the formation of the conceptual foundations of sustainable development dates back to the early 1990s, when an understanding of the relationship between economic and environmental development emerged. As a result, the existing concept of sustainable development was revised. It came to mean progress capable of fully satisfying the needs of people living in the present while not threatening the ability of future generations to meet their own needs [4,5].

Since then, sustainability has been understood not as a static state but as a specific process involving a number of changes: the scale of resource use is coordinated, directions of capital investment are diversified, the direction of technological development changes, and investment transformations occur in relation to current and future needs [6].

Subsequently, as a result of interpreting documents of the United Nations (UN), the concept of sustainable development (SD) came to include a social factor, which received considerable attention because for developing countries, acute problems of poverty and hunger are more pressing than environmental issues. Thus, the shift in emphasis and expansion of the sustainable development concept led to the emergence of its socio-environmental dimension.

The end of the second evolutionary stage and the beginning of the third is associated with the Global Financial Crisis of 2008–2009 [7]. The crisis prompted the development and modernization of more comprehensive approaches to assessing the role of energy security and energy sustainability in enhancing national competitiveness. At this stage, the transition to sustainable development was complicated by economic instability. The concept of sustainable development (SD) came to be understood as a complex comprising three components: social, environmental, and economic.

Understanding sustainable development (SD) from the perspective of these three aspects introduced new approaches into economic policy, reflected in the documents of the UN and the Organisation for Economic Co-operation and Development (OECD). The terms “green economy” (in UN documents) and “green growth” (in OECD documents) [8,9,10] were introduced. Conceptually, the “green economy” does not replace the concept of sustainable development. In the UN interpretation, a “green” economy is one that improves people’s well-being, ensures social equity, and reduces environmental risks [11].

Today, almost all international corporations and many leading national companies publish sustainability reports. Scholars and researchers continue to study the complex process of sustainable development and define it in new ways.

A general consensus on the essence of the concept of sustainable development (SD) has not yet been formed, as it encompasses three dimensions (social, economic, and environmental), and the views of academic, political, and business communities do not fully coincide. Moreover, the complexity of the concept lies in the fact that it combines the notions of “sustainability” and “development,” which may appear mutually contradictory, since development cannot exist in relation to sustainability if development itself implies the absence of stability. Other researchers emphasize that sustainability does not hinder qualitative development. We analyzed various scientific approaches to defining the term “sustainable development” (Table 1).

**Table 1. Definitions of the term “Sustainable Development”**

Author / Source	Definition of Sustainable Development
Report of the Brundtland Commission (1987)	Development that enables present generations to meet their needs without depriving future generations of the ability to meet their own needs.
Koptuyug V.A. [12]	A model of social development aimed at satisfying the basic needs of present and future generations.
World Conservation Strategy [13]	Development that ensures real and potential improvement in people’s quality of life while simultaneously preserving the Earth’s

	natural diversity.
World Bank [14]	Management of the overall capital of society to preserve and enhance human potential.
Ursul A.D. [15]	Development that is manageable, systematically balanced, and socio-natural in nature, does not destroy the environment, and ensures safe existence, enabling the indefinite longevity of civilization.
Kuvshinov M.A. [16,17]	A purposeful process of managing the socio-economic system of education, country, or region, ensuring stable interconnections among system elements and structures aimed at improving the population’s quality of life in balance with the environment.
Davydova N., Timofeeva O.	Development that does not imply negative changes in the environment or human habitat.
Pchelintsev O.S. [18]	A continuous transition from a resource-extractive economy to a system of resource reproduction.
Moiseev N.N. [19]	Implementation of a human strategy, a path toward the noosphere era, i.e., achieving a state of co-evolution of society and nature.
Tsvikilevich A.V. [20]	A process aimed at maintaining permanent dynamic balance through the purposeful use of opportunities and potential external environmental conditions.

The analyzed definitions of the term sustainable development (SD) differ in their emphasis on specific problems, the most important of which include:

- ✓ protection of the environment and natural resources;
- ✓ creation of a balance between economic activities and the state of nature;
- ✓ ensuring the sustainable development of economic systems;
- ✓ establishment of interregional relations, etc.

All the definitions presented are united by a common objective – satisfying the needs of society and human aspirations.

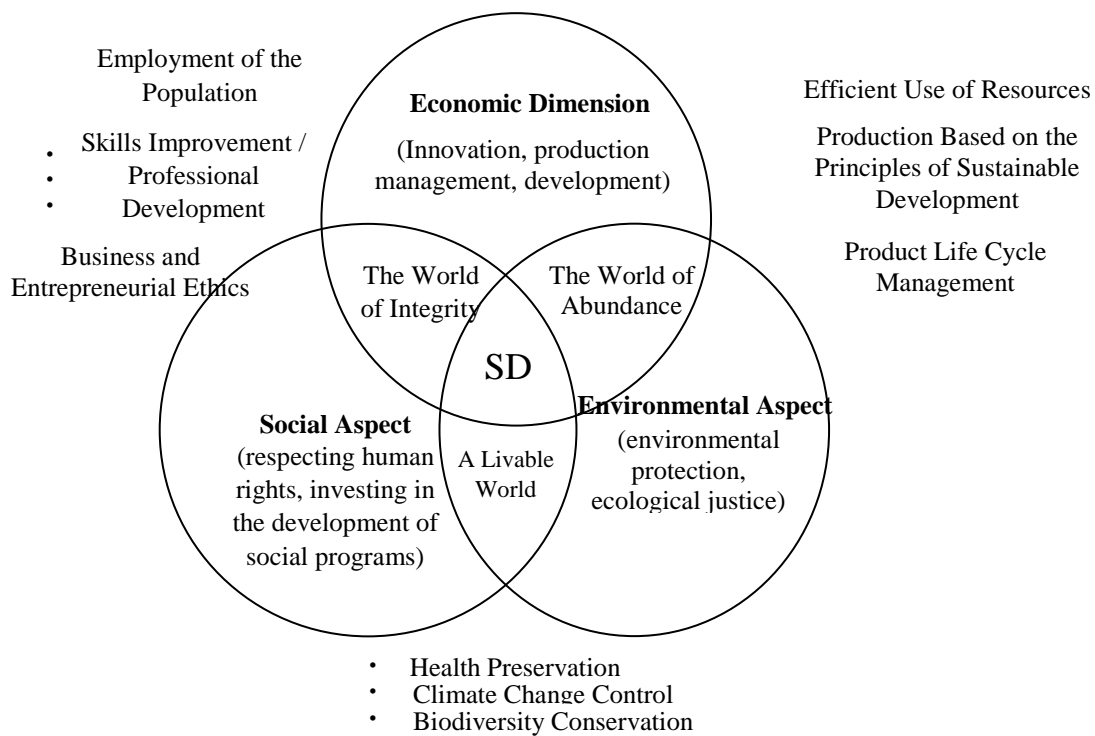
Sustainable development is aimed at ensuring the possibility of meeting the most essential life needs for all people, as well as providing equal opportunities for everyone to do so. Some researchers focus on economic growth in relation to sustainable development and emphasize that these concepts are not mutually exclusive, and that achieving the goals of sustainable development (SD) does not require reducing production or consumption [21]. The author notes that views differ regarding the global nature of sustainable development (SD), since its goals can only be achieved through global efforts at an appropriate level [22].

Therefore, coordination of efforts among the countries of the world is a mandatory condition for achieving development sustainability. While there may be debates about the substantive components of the definition of sustainable

development (SD), with new interpretations and semantic meanings proposed, there is general agreement among both theorists and practitioners regarding its defining aspects. In the course of its evolutionary development, three key dimensions of sustainable development (SD) have gradually been distinguished [23,24]:

- **Economic dimension** – capital and resources necessary for production must be preserved and replenished [25,26];
- **Environmental dimension** – aimed at preserving ecosystems and natural resources by limiting overall resource demand [27,28];
- **Social dimension** – focused on ensuring social equity and meeting basic needs in healthcare and education [29].

The consistency of these dimensions with practical measures at each level is ensured, as illustrated in Figure 1.



**Figure 1.** The Three-Dimensional Concept of Sustainable Development  
(Source: Grigoreva, A.A., Pirogova, O.E. The Three-Dimensional Concept of Enterprise Sustainable Development. *In: Contemporary Economic Issues*, 2015, №28(1), pp. 17-22. ISSN 1818-3395.)

This figure illustrates the interconnection between the three components of the sustainable development (SD) concept. The economic and social aspects, when interacting, perform the following functions: achieving a fair social relationship within a generation, assisting low-income and disadvantaged populations. At the

level of interaction between economic and environmental aspects, innovative ideas emerge regarding the valuation of resources, accounting in corporate financial reporting, and the ecological impact of activities related to economic operations. The relationship between the social and environmental aspects relates to issues of intra- and intergenerational equity, compliance with and implementation of future generations' rights, and active societal participation in specific decision-making processes.

To address these issues within these interconnections, states must eliminate interstate conflicts and, based on the establishment of multilateral international cooperation, create conditions for collaboration and solidarity to adapt to modern challenges. Governments of most countries have recognized that global efforts are necessary to integrate the elements of the international economic system with human needs under favorable and safe natural conditions. In recent years, the concept of sustainable development (SD) has become a central ideology for humanity in determining the global future. In fact, it represents an official framework for global development in the 21st century. Alongside various theoretical and scientific studies, the concept has served as a basis for practical decision-making by international organizations and many countries when developing long-term national programs.

Within the scope of this dissertation research, we study the development of the country's energy sector based on sustainable development (SD) principles, taking into account the concept's guidelines. The national energy strategy of the country should make the best contribution to social, economic, and environmental development. The country adapts and modifies its response measures to enhance sustainability. The limitations and opportunities it faces are constantly changing.

The concept of energy sustainability stems from the sustainable development goals developed by the United Nations. Among these, Goal 7, "Ensure access to affordable, reliable, sustainable, and modern energy for all," is dedicated to the energy sector. Moreover, among the pathways for transitioning to a green economy identified by the UN Environment Programme (UNEP), reforms in the energy sector and improving energy efficiency in the economy and its sectors are of primary importance. This highlights the undeniable connection between energy and the sustainable development process and lays the groundwork for new definitions of energy security. Special attention to the phenomenon of energy sustainability has emerged in recent years due to the intensification of climate change challenges.

In a dedicated UN Conference document on sustainable energy, a central place is assigned to energy, since access to modern, sustainable energy services

contributes to poverty eradication, improved living standards and health, and meeting people’s needs. In our view, a dual understanding of sustainable development challenges emerges. On one hand, there is a need to ensure energy resources; on the other, climate protection. The UN Conference does not specify in which form energy resources should be made available to the “entire world,” since for environmental preservation, the process should be as ecologically friendly as possible. From this, it follows that sustainable energy includes the following components:

- renewable energy and energy efficiency. Decisions should focus on identifying sustainable energy sources and efficient methods for energy conversion and usage.

The World Energy Council has formulated the so-called "energy trilemma" as a response to the triple challenge of energy (security, safe and clean access, and ecological sustainability). The trilemma is designed to implement sustainable energy activities and consists of:

- ✓ energy security;
- ✓ reliable energy infrastructure;
- ✓ energy supply sources capable of fully meeting demand;
- ✓ energy equity;
- ✓ environmental sustainability.

The energy trilemma is necessary to ensure balance through the mutual integration of energy systems. Achieving balance among the trilemma components is feasible under ideal conditions of international cooperation at various levels and in the processes of advanced integration in the energy sector.

To achieve energy security, sustainable energy development must continue in the following areas: energy supply transformation, expanding energy access, conservation, improving energy efficiency, better demand management, and decarbonization of the energy sector (Table 2).

**Table 2. Directions of Progress in the Energy Trilemma**

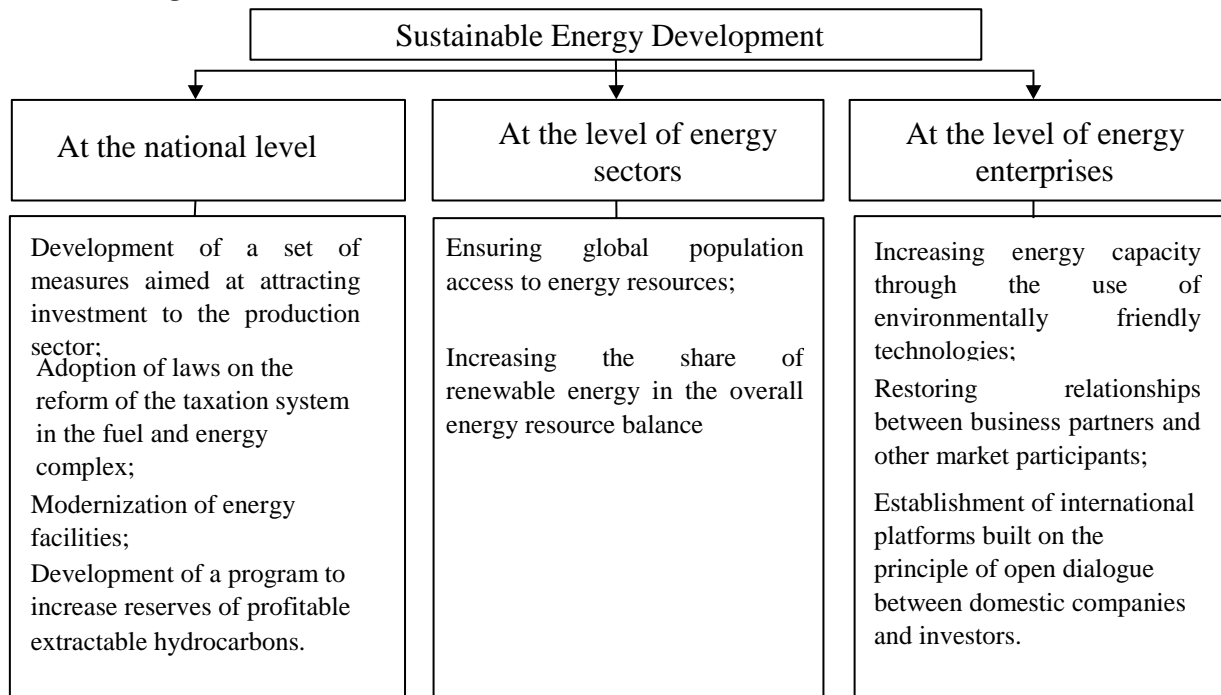
<b>Direction</b>	<b>Concept</b>
<b>Transformation of Energy Supply</b>	Decision-makers in this field must set clear energy objectives and achieve broad consensus for transitioning to relevant energy demand and supply.
<b>Expansion of Energy Access</b>	Increasing private sector investment in infrastructure development and modernization. Countries reform the regulatory framework to reduce production costs and enhance competitiveness in the electricity market. In the future, energy generation should be distributed using

	<p>solar and wind sources to ensure access in remote areas that are not economically connected to the grid. Governments should focus on innovative mechanisms enabling people to access modern energy, thereby benefiting from economic activities.</p>
<p><b>Conservation</b></p>	<p>Many countries with limited resources and low capital positions struggle to ensure accessible energy supply, while simultaneously investing and creating investment conditions to support infrastructure expansion. In the short term, state subsidies may be considered, which can be crucial for low-income countries. However, energy subsidies can be costly and, in the long term, tend to reduce overall efficiency within the energy trilemma. Recent trends indicate that prolonged subsidies may decrease utility profitability, reduce energy infrastructure levels, and encourage inefficient energy use.</p>
<p><b>Improving Energy Efficiency and Demand Management</b></p>	<p>Energy efficiency and demand management are recognized globally as priority areas for capacity improvement. Regulatory authorities should align the interests of asset owners, consumers, and regulators, implementing a comprehensive set of energy efficiency standards, performance assessments, labeling programs, and incentive schemes. They should also raise awareness across all industrial sectors and encourage consumers to pay</p>

**Source:** Compiled based on: Shilets, E.S., Kravchenko, V.A., Lukyanenko, T.V. Energy Security – The Basis for Sustainable Development of the Fuel and Energy Complex. In: Bulletin of the Institute of Economic Research, 2017, № 3 (7), pp. 27-34.

To reduce the impact of obstacles and ensure continued progress in development according to the directions of the energy trilemma, an appropriate energy regulation policy must be developed, and a system of energy management for the country should be established. This system should facilitate achieving a strong energy trilemma regardless of resource availability or the country's geographical position. Progress in this area should be guided by the principles of security, equity, sustainability, resilience, and competitiveness to meet the contemporary demands of consumers.

Thus, based on the studied perspectives of specialists and energy sector researchers, the author concludes that sustainable energy development is one of the sustainable development (SD) goals. The degree, speed, and efficiency of achieving absolute sustainability will be accessible to those countries that are open to international dialogue and integrate elements of sustainable energy development into their strategic programs. The level of sustainable energy development is illustrated in Figure 2.



**Figure 2.** Diagram of Levels of Sustainable Energy Development (Source: Shilets, E.S., Kravchenko, V.A., Lukyanenko, T.V. Energy Security as the Basis for Sustainable Development of the Fuel and Energy Complex. In: Bulletin of the Institute of Economic Research, 2017, No. 3 (7), pp. 27-34. ISSN 2519-2019.)

The understanding of energy sustainability at the national level depends on energy enterprises and their activities. Currently, scientific sources do not provide a precise definition of sustainable state energy development. However, state energy is often considered as a guarantee of energy resources for future generations, enabling them to live under conditions that minimize the welfare deprivation of the current generation.

This definition generally follows the core concept of sustainable development. Another definition of sustainable energy at the national level is associated with goals such as ensuring access to energy resources, implementing the latest production methods and technologies, eliminating inequalities, protecting the environment, consolidating financial resources, and strengthening the institutional

and labor capacity of the country. This definition emphasizes social and environmental aspects.

Based on the synthesis of studied expert opinions, the author has formulated their own definition of sustainable energy development at the national level: a system capable of natural development and self-regulation, aimed at providing energy security for the population by the state while ensuring social equity and environmental protection through their rational use.

Sustainable development in the energy sector depends on the current state of energy enterprises and the overall level of national development. Researchers define sustainable development in the energy sector as a continuous process of seeking and achieving goals to balance the changing environmental conditions with the available capabilities of energy system companies, enabling them to fulfill state objectives.

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