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## **GENERAL PRINCIPLES OF ALTERNATIVE ENERGY DEVELOPMENT AS A BASIS FOR SUSTAINABLE BUSINESS DEVELOPMENT**

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## **ЗАГАЛЬНІ ЗАСАДИ РОЗВИТКУ АЛЬТЕРНАТИВНОЇ ЕНЕРГЕТИКИ ЯК ОСНОВИ ДЛЯ СТАЛОГО РОЗВИТКУ БІЗНЕСУ**

*Alternative energy is gaining increasing importance in the modern world, particularly in the context of sustainable business development. The development of this sector is important due to its impact on the ecological sustainability, economic efficiency, and social significance of business development. In accordance with the above provisions, the purpose of the article is to highlight the general principles of alternative energy development that can form the basis for sustainable business development. The results of the study confirmed that the development of alternative energy is an integral part of sustainable business development. It allows businesses to achieve environmental sustainability, economic efficiency, and social significance, ensuring long-term success and prosperity. This is possible due to a significant reduction in the environmental impact of the business on the local ecosystem; the proven economic efficiency of each renewable energy project; the significant social impact of the business; and its overall compliance with international standards and obligations. So, it has been proven that the development of alternative energy forms the basis for sustainable business development, as it allows to significantly reduce its negative impact on the environment. This is achieved by reducing greenhouse gas emissions, reducing air and water pollution, and using natural resources more efficiently. The development of alternative energy forms the basis for sustainable business development if it allows for a significant economic return on investment in relevant energy projects. This return is associated with a reduction in energy costs, increased energy independence, the creation of new jobs, and the attraction of investments. The development of alternative energy forms the basis for sustainable business development if it allows for a positive impact on society. This is achieved by creating new jobs, improving the quality of life of the local population, providing access to energy for remote communities, and contributing to the conservation of natural resources. Thus, the prospects for further research lie in determining the mechanisms of alternative energy development when it transforms business into one that is not only environmentally responsible, but also economically profitable and socially significant.*

*Альтернативна енергетика набуває дедалі більшого значення в сучасному світі, зокрема в контексті сталого розвитку бізнесу. Розвиток цього сектору є важливим через його вплив на екологічні, економічні та соціальні аспекти розвитку бізнесу. Відповідно до наведених вище положень, метою статті є виділення загальних засад розвитку альтернативної енергетики, які можуть стати основою для сталого розвитку бізнесу. За результатами дослідження було встановлено, що проєкти з альтернативної енергетики дозволяють суб'єктам бізнесу досягати екологічної, економічної та соціальної стійкості, забезпечуючи довгостроковий успіх і процвітання. Це досягається коштом значного зменшення екологічного впливу на місцеві екосистеми, високої економічної ефективності відновлюваної енергії, значного соціального впливу від діяльності підприємства, а також відповідності міжнародним стандартам та зобов'язанням у сфері сталого розвитку. Так, доведено, що розвиток альтернативної енергетики формує основу для сталого розвитку бізнесу, якщо дозволяє суттєво зменшити формований ним негативний вплив на довкілля. Це досягається коштом зниження викидів парникових газів, зменшення забруднення повітря та води, а також більш ефективного використання природних ресурсів. Розвиток альтернативної енергетики формує основу для сталого розвитку бізнесу, якщо дозволяє забезпечити значну економічну віддачу від інвестицій у відповідні енергетичні проєкти. Така віддача зумовлена зниженням витрат на енергоресурси, підвищенням енергетичної незалежності, створенням нових робочих місць та залученням інвестицій. Розвиток альтернативної енергетики формує основу для сталого розвитку бізнесу, якщо дозволяє забезпечити позитивність впливу на суспільство. Це досягається шляхом створення нових робочих місць, покращення якості життя місцевого населення, забезпечення доступу до енергії для віддалених громад та сприяння збереженню природних ресурсів. Таким чином, перспективи подальших досліджень полягають у визначенні механізмів розвитку альтернативної енергетики, коли вона перетворює бізнес*

у такий, що є не лише екологічно відповідальним, але й економічно вигідним та соціально значущим.

**Ключові слова:** енергетичне споживання; екологічна нейтральність бізнесу; розвиток підприємницьких проєктів; екологічна стійкість; економічна ефективність; соціальна значущість.

**Keywords:** energy consumption; ecological neutrality of business; development of entrepreneurial projects; ecological sustainability; economic efficiency; social significance.

**Problem statement.** Alternative energy is gaining increasing importance in the modern world, particularly in the context of sustainable business development. The development of this sector is important due to its impact on the ecological, economic, and social aspects of business development. So, the use of traditional energy sources (such as coal, oil, and natural gas) by businesses is accompanied by significant greenhouse gas emissions, which contribute to the acceleration of global warming and climate change. At the same time, the transition of business to alternative energy sources helps to reduce the environmental impact and reduce carbon dioxide emissions and other harmful substances into the environment. Investments in alternative energy create new jobs, stimulate the development of high-tech businesses, and promote economic growth. Additionally, in this context, the prospect of reducing energy costs for businesses in the long term is being formed, which can increase the competitiveness of businesses. The use of clean energy sources contributes to the improvement of public health by improving air quality and reducing the incidence of diseases related to environmental problems.

In this context, a scientific article dedicated to the general principles of alternative energy development as a basis for sustainable business development is extremely relevant. It allows for a deeper understanding of the key factors contributing to the development of this sector, identifying potential barriers, and suggesting ways to overcome them. This, in turn, contributes to the formation of effective business

development strategies focused on the sustainable use of resources and environmental conservation.

***The analysis of recent researches and publications.*** The issue of alternative energy development and its impact on business development as a whole and in individual industries is sufficiently represented in the scientific literature. So, the issues of the impact of alternative energy on the environmental aspects of business were studied by Kasich A.O., Lytvynenko Ya.O., Melnychuk P.S. The issue of the impact of alternative energy on the economic aspects of business was studied by Ryazanova N. O., Lishchuk V.I., Lishchuk M.E., Moskovchuk A.T. Some issues of the impact of alternative energy on the social responsibility of business were specified by Bondaruk T. G., Bondaruk I. S.

In general, the general aspects of the development of alternative energy as the basis of sustainable business development are also covered by a sufficient number of scientific sources (in particular, in the works of Kasich A.O., Kruglov V.V., etc.), which, however, are mainly devoted to the practical implementation of the outlined ideas in Ukraine.

***Goal setting (formulation of goals of the article).*** In accordance with the above provisions, the purpose of the article is to highlight the general principles of alternative energy development that can form the basis for sustainable business development.

***The paper main body with full reasoning of academic results.*** Currently, governments of many countries are viewing alternative energy as a key factor in ensuring sustainable business development. This is because the use of renewable energy sources (such as solar, wind, hydro, and geothermal energy) provides significant benefits for businesses, helping them to simultaneously achieve ecological, economic, and social goals [3-4].

For example, the government of India launched a large-scale solar energy development program called "National Solar Mission" (through subsidies, tax breaks, and investment incentives for green power plant owners). As a result, by the beginning of 2024, large Indian companies (such as Tata Power Solar and Adani

Green Energy), actively investing in the development of solar power plants, have achieved both a reduction in energy costs and a decrease in CO2 emissions, as well as a reduction in their negative impact on the local ecosphere (for example, Tata Power Solar and Adani Green Energy have reduced CO2 emissions by millions of tons per year just through their solar projects).

Another example of sustainable business development through the development of alternative energy is the example of large US corporations (including Google, Amazon, and Microsoft) currently investing in renewable energy sources to power their operations. For example, in 2017, Google became the first major company to offset 100% of its energy consumption with renewable energy by signing long-term contracts for the supply of solar and wind energy. Also, Amazon and Microsoft's solar energy production projects have allowed them to reduce their energy costs by 85%, lower their CO2 emissions by 90%, and boost their reputation among consumers.

Another example is the sustainable development of business in Denmark, which has become a global leader in wind energy thanks to the government's policy aimed at supporting the development of this sector. Danish businesses have achieved complete decarbonization of their operations. In addition, Ørsted (formerly known as DONG Energy) has not only become an exemplar of environmental cleanliness but also the largest operator of offshore wind farms globally.

The company has built and operates several large projects, such as the Horns Rev and Anholt wind farms. In 2020, Ørsted completed the construction of the world's largest offshore wind farm, Hornsea One, in the UK, with a capacity of 1.2 GW, which provides electricity to over a million households. In Denmark, companies such as Vestas Wind Systems, Siemens Gamesa, Ørsted, and others are actively working on wind energy development, implementing advanced technologies and environmentally friendly solutions, and providing over 90% of their energy consumption through such projects.

Based on the analysis of modern research, the following basic guidelines can be identified that transform the development of alternative energy into the foundation of sustainable business development, including:

- Significant reduction of the environmental impact of business on the local ecosystem;
- Demonstrated economic efficiency of renewable energy projects;
- Significant social impact.

Let's consider the outlined aspects in more detail.

So, by a significant reduction in the environmental impact of business on the local ecosystem from alternative energy projects, we mean the complete neutrality of the impact of activities on the local ecosystem. This is achieved through the development of entrepreneurial projects in alternative energy, which further contribute to environmental sustainability (namely, minimizing water, air, and soil pollution from the activities of business entities, according to the following specifics).

In particular, such projects should include [2-3]:

1. Wind power plants do not produce harmful emissions into the air, reducing pollution and improving air quality.
2. Solar panels, which allow the use of solar energy without greenhouse gas emissions, help to reduce global warming.
3. Biomass power plants, which use organic waste to generate energy, reduce the amount of waste going to landfills.
4. Geothermal power plants, which use the Earth's heat to generate energy, do not produce emissions and don't affect air and water quality.
5. Hydroelectric power plants harness the energy of water to produce electricity without producing harmful emissions. However, it is important to consider their impact on water ecosystems and take measures to minimize any negative effects.
6. Land and forest restoration projects help restore natural ecosystems and absorb CO<sub>2</sub>, which helps reduce a business's overall carbon footprint.
7. Innovative energy storage technologies (such as batteries and hydrogen-based energy storage systems) and production allow more efficient energy production, use of renewable energy sources, and reduce dependence on fossil fuels.

The development of own alternative energy projects is a key step for businesses on the path to transitioning to a state where their activities cause no harm to the

environment [3; 2]. This means that businesses not only minimize their negative environmental impact, but also actively work to restore and improve ecosystems, meeting a number of signs that are specified in Table 1.

**Table 1 - Basic signs of complete ecological neutrality of busines**

Sign of business complete ecological neutrality	Characteristic of the sign business complete ecological neutrality	The result of demonstrating signs of environmental neutrality.
Zero greenhouse gas emissions	The business fully offsets its greenhouse gas emissions by investing in renewable energy projects or reforestation.	Manifestation of business environmental neutrality is achieved through transitioning to environmental responsibility, which can attract more clients and provide market advantages
Zero water and soil pollution	The business does not discharge harmful substances into water and soil and takes measures to clean up contaminated areas	
Zero use of non-renewable resources	The business completely transitions to using renewable resources such as solar and wind energy, biomass, etc	
Biodiversity restoration	The business actively works to restore natural ecosystems and preserve biodiversity	
Circular economy	The business implements the principles of a circular economy, i.e. it reuses, recycles and recovers resources, minimizing the amount of waste	

*Source: formulated by the author based on [2-3]*

By high economic efficiency of alternative energy projects, we mean the ability of these projects to bring financial benefits to businesses in the long term (which manifests itself through cost reduction, increased energy independence, and the creation of stable energy prices [5]). In particular, such projects should include those that provide [6; 5]:

1. Low operating and maintenance costs compared to fossil fuel power plants.
2. Stability of energy prices. It should be noted that this is possible if the cost of the energy used does not experience price fluctuations in the market that are relevant to fossil fuels such as coal, oil, and natural gas.
3. Investment incentives that exist when governments offer tax breaks, subsidies, and other incentives for investments in renewable energy.



4. Reduction in electricity costs. It should be noted that this is possible if a business that uses its renewable energy sources experiences a decrease in electricity costs, and thus a positive impact on its financial stability.
5. Additional opportunities for profit maximization that are formed if the development of renewable energy projects provides opportunities for the commercialization of technologies and the supply of energy and other services, which contribute to the economic growth of the business. For example, businesses can sell their technologies, knowledge, and experience to other businesses or households looking for clean energy transition solutions.
6. Increase in the net asset value of the business. Note that this is possible if ownership of renewable energy infrastructure (such as wind turbines or solar panels) provides an increase in the total value remaining after deducting all debts and liabilities of the company from its total assets.

The development of alternative energy projects is a key step for businesses on the path to transitioning to a state where their activities lead to an ecologically clean increase in economic income. This means that the business minimizes its negative impact on the environment, contributes to its improvement, while receiving financial benefits, corresponding to several signs that are specified in Table 2.

By significant social impact from alternative energy projects, we mean any positive impacts that the projects have on society and people [1]. In particular, such projects should include those that provide [1; 5]:

1. Creation of new jobs in the production, construction, and maintenance of infrastructure. Note that this is possible if such jobs are permanent, thus contributing to the reduction of unemployment and improving the well-being of the population.
2. Improving the quality of life of the local population. In particular, this is possible if the use of alternative energy sources improves air quality and the health level of the local population. The implementation of the project mustn't be accompanied by emissions of harmful substances into the environment.

**Table 2 - Basic signs of a business transition to ecologically clean economic income growth**

Signs of ecologically clean economic income growth for businesses	Characteristic of the sign of ecologically clean economic income growth for businesses	The result of the manifestation of environmentally sustainable economic growth traits
Increased revenue from the sale of environmentally friendly products and services	Expansion of the range of environmentally friendly goods and services. It means that the business is actively developing and offering products and services on the market that have a minimal negative impact on the environment throughout their life cycle - from production to disposal.	The result of demonstrating signs of environmentally sustainable economic growth in income lies in the ability of businesses to transition to environmentally sustainable economic development and sustainable resource use
Improved reputation and brand image	Attention to environmental responsibility, which is an important factor for consumers and investors. At the same time, a business that cares about the environment can strengthen its reputation and brand.	
Attracting investments to improve the economic efficiency of alternative energy projects	Investors are increasingly paying attention to the environmental aspects of business activities if they demonstrate growing economic benefits from their own alternative energy projects.	

*Source: formulated by the author based on [1; 5-6]*

3. Access to energy for remote and marginalized groups. In particular, this is possible if alternative energy projects facilitate access to energy for households in remote or hard-to-reach areas where other energy sources are unavailable or expensive.
4. Conservation of natural resources and biodiversity. In particular, this is possible if alternative energy projects help reduce the consumption of non-renewable natural resources and reduce pressure on natural ecosystems. This is important for the preservation of biodiversity.

The development of in-house alternative energy projects is a key step for businesses on their path to achieving social significance (characterized by creating permanent jobs, contributing to solving social problems, and supporting the

community (see Table 3)), as their activities lead to the resolution of several important social issues.

**Table 3 - Basic signs of social significance of business**

Characteristic of a socially responsible business	Characteristics of a socially impactful business	The result of the manifestation of social significance traits
Generating sustainable jobs	Providing a stable income for employees and their families, which contributes to improving the standard of living and well-being of the community	The essence of the social significance of business lies in its contribution to the social development of communities
Helping to solve societal challenges	Attracting investments, creating jobs, increasing tax revenues to local budgets	
Supporting the local community	Supporting local initiatives in the field of energy efficiency, environmental education, and the development of renewable energy.	

*Source: formulated by the author based on [1]*

It's important to note that businesses investing in alternative energy demonstrate their commitment to the principles of sustainable development and adherence to international standards and obligations in the field of environmental protection.

***Conclusions from this study and prospects for further exploration in this direction.*** The research findings confirm that the development of alternative energy is an integral part of sustainable business development. It allows businesses to achieve environmental sustainability, economic efficiency, and social significance, ensuring long-term success and prosperity. It is possible due to a significant reduction in the environmental impact of the business on the local ecosystem, the proven economic efficiency of each renewable energy project, the significant social impact of the business, and its overall compliance with international standards and obligations.

Therefore, among the key findings of the study are the following:

1. The development of alternative energy forms the basis for sustainable business development, as it allows for a significant reduction in the negative impact it has on the environment. It is achieved by reducing greenhouse gas emissions, decreasing air and water pollution, and more efficiently using natural resources.

2. The development of alternative energy forms the foundation for sustainable business development if it provides a significant economic return on investment in relevant energy projects. This return is associated with reduced energy resource costs, increased energy independence, the creation of new jobs, and the attraction of investments.

3. The development of alternative energy forms the foundation for sustainable business development if it ensures a positive impact on society. It is achieved by creating new jobs, improving the quality of life for local populations, providing energy access to remote communities, and promoting the conservation of natural resources.

Thus, the prospects for further research lie in identifying the mechanisms for the development of alternative energy that transform business into one that is not only environmentally responsible but also economically beneficial and socially significant.

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