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STRATEGY FOR TRANSITING THE REGIONAL ENERGY SECTOR TO LOCAL FUEL RESOURCES: SUBSTANTIATION OF INVESTMENT PROJECTS

СТРАТЕГІЯ ПЕРЕХОДУ РЕГІОНАЛЬНОГО ЕНЕРГЕТИЧНОГО СЕКТОРУ НА МІСЦЕВІ ПАЛИВНІ РЕСУРСИ: ОБГРУНТУВАННЯ ІНВЕСТИЦІЙНИХ ПРОЄКТІВ

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Abstract. *Highlighting the strategic importance of energy independence, this paper substantiates the shift toward local fuels within regional heat and power networks. Through a detailed analysis of Ukrainian peat resources, the study addresses the balance between energy needs and environmental constraints. A novel methodology is introduced to justify investment projects, based on a hierarchy of indicators that capture both sectoral efficiency and regional socio-economic growth. Data from the Rivne region illustrates the practical application of this approach, showing a viable extraction scale of 100–180 thousand tons per year for fuel processing. The findings prove that current extraction targets remain well within environmentally permissible limits, offering a sustainable alternative for heat supply. The research provides a robust framework for monitoring project success through comparative indicator analysis.*

Keywords: *regional heat and power industry, peat extraction, sustainable energy, socio-economic development, fuel briquettes, environmental permissible scale, energy indicators, decarbonization, Ukraine's energy sector, resource potential.*

Introduction

Energy security stands as a fundamental pillar of national stability. While Ukraine possesses substantial reserves of coal, natural gas, and oil, the energy potential of its peat resources is often overlooked due to its relatively smaller scale. Nevertheless, for the Northwestern regions and Ukrainian Polissya, peat remains a vital asset for driving local economic growth and supporting socio-cultural infrastructure. The global discourse on peat utilization is characterized by diverging perspectives on economic efficiency and environmental impact. For instance, Paul et al. (2022) highlight India's strategic interest in expanding peat-based power generation to bolster its energy sector. Conversely, research by Javanshir et al. (2022) reflects a shift in municipal heating strategies toward wind energy and biofuels as alternatives to traditional peat use.

A critical dimension of this transition is biodiversity. Vainio et al. (2024) and

Statistics Finland (2021) note that while Finland has significantly increased its reliance on wood fuels, such transformations require rigorous assessment models to prevent negative ecological consequences. This underscores the necessity of modern frameworks for evaluating energy safety and sector transformation (Sotnyk et al., 2021; Nifatova et al., 2024). [1]

From a business perspective, converting regional heat and power systems to local fuels is increasingly categorized as environmentally friendly investment (Ushakova et al., 2021). Building upon previous work regarding environmental scorecard indicators (Kovshun et al., 2024), this study aims to develop a comprehensive set of metrics to justify the transition to peat, aligning with global sustainability goals.

Methodologically, the Analytic Hierarchy Process (AHP) has proven to be a robust tool for evaluating energy alternatives. Originally pioneered for the energy sector in Pakistan by Amer & Daim (2011), this approach allows for a flexible analysis of technical, economic, social, and environmental criteria. Similarly, research in Bangladesh (Amin et al., 2023) and other regions confirms that AHP, often combined with FTOPSIS or Fuzzy AHP models, is essential for optimizing the location of power plants and ranking investment alternatives (Mohsin et al., 2019; Alghassab et al., 2022). [2]

In summary, justifying a shift to local fuel sources requires a multi-criteria approach. Whether through hybrid quantitative-qualitative methodologies used in Australia (Elavarasan et al., 2024) or SWOT-integrated AHP models in Pakistan (Wang et al., 2020), the goal remains the same: balancing economic feasibility with environmental stewardship. For specific peat-focused projects, technical parameters such as calorific value, moisture content, and ash percentage remain the definitive factors for proving the effectiveness of these alternative energy sources (Monir et al., 2023; Al Tanjil et al., 2020).

Main text

When justifying business projects, classical quantitative performance indicators are the basis for decision-making. Indicators of efficiency of fuel and energy resources use can be direct and indirect. Direct indicators directly determine the efficiency of the

use of fuel and energy resources (EUFER), while indirect indicators include those in which the EUFER is not directly reflected, but depends on the level and structure of their use. Direct indicators include energy intensity of gross domestic product and gross value added, output of certain types of products, etc., specific costs per unit of products (works, services), energy efficiency, efficiency of certain units, etc. Indirect indicators include labour productivity, capital equipment, energy efficiency, production profitability, etc. Indicators of the EUFER can be generalised (ener-gy intensity, fuel and energy efficiency, etc.) and local (fuel intensity, electricity intensity, heat and energy intensity, etc.). Direct indicators of the EUFER can be divided into energy and economic. [3]

Strategic Context and Energy Security. Ukraine possesses substantial peat reserves, the strategic importance of which has surged following the temporary occupation of major coal-producing regions in the East (Ratskyi, 2023). This geopolitical shift has necessitated a rapid diversification of the national energy balance, placing a premium on locally sourced solid fuels. Within this context, the Rivne region stands out as a critical hub for energy decentralization. Its significant peat deposits serve as a foundational element for the regional fuel and energy complex, offering a viable alternative to natural gas and imported coal for communal heating and industrial applications (Trachenko et al., 2021).

Resource Distribution and Geological Characteristics. Estimates suggest that the region holds approximately 180 million tons of peat, accounting for 30% of its total mineral resource base. This geographic concentration allows for the establishment of specialized industrial clusters. Primary industrial deposits—such as Morochne, Dubniaky, and Kreminne—are concentrated in the northern lowland marshes (the Polissia zone). These sites are characterized by high density and significant accumulation, making them ideal for large-scale mechanized extraction.

Beyond the northern strongholds, the resource map extends into the Small Polissia area, where medium-sized deposits like Verba, Maidan, and Stupne provide essential energy support for local communities. In the forest-steppe zones, smaller deposits are found in river floodplains. Although the thickness of these floodplain layers is

relatively modest—typically ranging from 1.5 to 2.5 meters—their proximity to agricultural and residential consumers reduces logistics costs, enhancing the economic feasibility of small-scale extraction projects. [4]

Qualitative Advantages and Industrial Potential. A defining characteristic of Rivne's peat is its superior quality, which distinguishes it from many European counterparts. The energy efficiency of this resource is evidenced by its relatively low ash content, generally fluctuating between 5% and 28%. Such a low mineral residue not only increases the calorific value during combustion but also minimizes the environmental load regarding waste disposal and atmospheric emissions.

The high quality of the raw material creates extensive opportunities for high-value processing. Beyond direct combustion, these deposits are suitable for the production of:

- High-calorie fuel briquettes for household and municipal heating;
- Lump peat for specialized industrial boilers;
- Peat-based substrates for the agricultural sector, leveraging the region's organic wealth for soil restoration.

Conclusion for Regional Development. The integration of these resources into the regional energy strategy provides a dual benefit: it mitigates the risks associated with fossil fuel volatility and stimulates the local economy through job creation in the extraction and processing sectors. Given that the environmentally permissible scale of extraction in the Rivne region is estimated to exceed 600,000 tons annually, the current reserves provide a robust long-term horizon for sustainable energy investment. [5]

To evaluate the functioning of the peat industry in pre-war Ukraine, we will present its individual characteristics. As of 2021, the peat extraction industry was represented by 30 enterprises. Peak peat production in Ukraine was observed in 2017-2018 and amounted to 600 thousand tons per year. By 2020, production had roughly halved (Table 1).

Industry Performance and Operational Challenges. As of early 2021, an operational analysis of the State Concern "Ukrtorf" revealed a systemic underperformance across the sector. [6] Total peat production reached only 290.5

thousand tons, achieving just 72.6% of the annual target. This stagnation was unevenly distributed among state enterprises:

- SE "Volyntorf": Produced 111.2 thousand tons (62.1% of plan).
- SE "Chernihivtorf": Produced 52.1 thousand tons (71.3% of plan).
- SE "Rivnotorf": Stood out as the sole outperformer, producing 127.2 thousand tons (101.8% of plan).

Table 1 - Peat extraction by state-owned enterprises-members of the «Ukrtorf» concern in 2017-2020

No. s/n	State-owned enterprise	Peat extraction (thousand tons)				Production of peat briquettes (thousand tons)			
		2017	2018	2019	2020	2017	2018	2019	2020
1	State Concern «Ukrtorf»	515.9	522.5	500.6	290.5	254.0	259.1	234.7	144.9
2	State Enterprise «Volyntorf»	236.9	237.9	227.1	111.2	132.9	135.7	119.6	57.5
3	State Enterprise «Rivnetorf»	177.3	171.7	177.0	127.2	93.1	98.2	92.5	74.6
4	State Enterprise «Zhytomyrtorf»	31.1	45.5	-	-	-	-	-	-
5	State Enterprise «Chernihivtorf»	70.6	67.4	67.1	52.1	28.0	25.2	22.6	12.8

Source: developed by the authors on the basis of (Ukrtorf, 2025).

A similar trend was observed in peat briquette production, which reached 140 thousand tons (84.2% of the target). While SE "Rivnotorf" significantly exceeded its briquette quota (124.3%), other enterprises struggled due to financial instability and a lack of modern investment (Prokopenko et al., 2024).

Strategic Shift: Privatization and Market Reform. The persistent gap between targets and actual output, coupled with limited investment attractiveness, prompted a pivotal government shift toward privatization. Although the Cabinet of Ministers initiated the sale phase in late 2022, the most significant milestone occurred in July 2023 with the privatization of SE "Rivnotorf". The enterprise was sold as a single

property complex for UAH 205 million—more than four times its starting price—demonstrating strong private sector interest in local energy resources. [7]

Current Capacity and Future Outlook. Now operating as Land Grow LLC, the former "Rivnotorf" remains a cornerstone of the Rivne region's energy landscape. Its current industrial capacity allows for:

- Annual Extraction: 100,000 – 180,000 tons of raw peat.
- Processing Output: Up to 20,000 tons of lump peat and approximately 75,000 tons of peat briquettes annually.

Strategic Conclusion. The transition from state-managed stagnation to private-sector efficiency marks a new era for Ukraine's peat industry. Given the current transformation of the national energy balance, utilizing peat as a localized resource for heat supply is not merely an economic alternative but a strategic necessity for regional energy resilience and security.

Ukraine has developed an Energy Strategy for 2050, which provides for the transition of the sector to market principles, elimination of dependence on energy supplies, and improvement of energy security. Accordingly, it is expedient for Land Grow LLC to implement business projects for the transition of regional heat and power to the use of peat as a local fuel. In the context of the transition of regional heat and power industry to the use of local fuels, assessing the effectiveness of solving this complex task becomes relevant. To this end, to substantiate business projects for the transition of regional heat and power generation to the use of local fuels, we have developed a system of indicators that takes into account energy and economic aspects. The indicator framework developed in this study builds upon international approaches to energy efficiency assessment as outlined by Sala et al. (2024) and Shkola et al. (2021). The development of the program's indicator system was based on the achievement of socio-economic and environmental effects, energy efficiency, and technological improvements. The system of indicators can include groups of economic and energy efficiency indicators, which in turn are divided into subgroups of general and partial indicators (Shkola et al., 2021). General indicators characterize the overall effects achieved from the conversion of the regional economy to local fuels, while

partial indicators reveal certain aspects of performance in ensuring sustainable heat supply and region's development. The group of energy efficiency indicators includes such general indicators as an increase in the share of local fuel in the fuel and energy balance, a reduction in fuel supplies from outside the region, and a decrease in the specific energy intensity of the gross regional product. he classification and grouping of energy efficiency indicators follow the methodology proposed by Sala et al. (2024) and applied in the regional context (Ladonko et al., 2022). In the subgroup of partial indicators, it is proposed to distinguish the following: indicators of heat supply, energy saving, and reliability of energy supply (Table 2). [8]

Table 2 - Indicators of energy efficiency of the transition of regional heat and power to the use of local fuels

General indicators	Partial indicators
1. Increasing the share of local fuel 5. Reducing the growth rate of heat energy tariffs 6. Reduction of fuel losses during transportation (storage)	1. Heat supply 1.1. Balancing the growth of heat production and consumption 1.2. Temperature conditions in heating networks 1.3. Ratio of source power to heat load
2. Reduction of fuel supplies from outside the region	2. Energy saving 2.1. Reducing losses of fuel and energy resources 2.2. Fuel savings by reducing the specific fuel consumption for heat supply 2.3. Coverage of commercial heat metering systems 2.4. Reduction of fuel consumption for the production of 1 Gcal of heat energy 2.5. Reduction of unproductive losses of heat energy in main heating networks
3. Reducing the specific energy intensity of the gross regional product	3. Reliability of energy supply 3.1. Reduction of heat and fuel losses 3.2. % of heat loss in emergency situations 3.3. Reducing the frequency of failures in the heating system

An assessment of an alternative scenario for the development of the region's heat and power industry (excluding the construction of a peat-fired CHP plants) indicates

that the region's own generating capacity is insufficient to meet its heating needs. Thus, if the construction of new heat sources using local fuels is abandoned, the capacity of boiler houses and existing power plants will have to be utilized at almost 100%, which is unlikely in the context of war and post-war reconstruction. Energy independence cannot be achieved without the use of local resources. [9]

It should be noted that in the scenario without peat-fired CHP plants, heat production increases due to the increased load on power plants and boiler houses, which is not envisaged by the Energy Strategy until 2050 and is also associated with a significant increase in the consumption of natural gas and secondary fuel and energy resources. At the same time, in accordance with the state energy policy, the task is to reduce the share of natural gas in the fuel and energy balances, which is compensated by the consumption of renewable energy sources and local fuels. This will contribute to Ukraine's transformation into a European energy hub, which will help the continent finally break its dependence on Russian fossil fuels thanks to the clean energy produced in Ukraine. Significant economic benefits from the use of peat-fired CHP plants will be achieved due to the expected increase in prices for primary energy sources.

The current geopolitical and economic landscape in Ukraine has created a critical imperative for the revitalization of the peat industry. Once a secondary resource, peat has now emerged as a strategically vital asset capable of strengthening national energy independence. The transformation of this sector into a modern, efficient mining and processing industry offers a multi-dimensional impact on the country’s stability:

1. Energy and Social Resilience: The development of peat resources provides a stable source of cost-effective fuel, specifically tailored for public sector infrastructure (schools, hospitals, and municipal heating) and vulnerable socio-economic groups. In the face of volatile fossil fuel markets, local peat production ensures energy affordability and regional self-sufficiency.

2. Agricultural and Industrial Synergies: Beyond its energy applications, the peat industry serves as a catalyst for diverse economic sectors. High-quality peat is essential for enhancing soil fertility, supporting large-scale horticulture, mushroom farming, animal husbandry, and floriculture. This makes the industry a cornerstone for both the

energy transition and the agricultural "green" recovery.

3. Methodological Contribution: This study introduces a robust system of indicators designed to substantiate business projects for transitioning regional heat and power systems to local fuels. Unlike traditional models, this framework accounts for the interplay between energy output, economic viability, and environmental sustainability.

4. Strategic Monitoring and Forecasting: The proposed assessment system is recommended for integration into regional development programs. It provides local authorities and private investors with a reliable tool for:

- Monitoring the progress of the regional economy's transition to local resources;
- Forecasting energy demand and supply capacities;
- Ensuring rigorous control over the achievement of energy security targets at the regional level.

In conclusion, the transition to local fuels, supported by the privatization of key assets like "Rivnotorf," marks a shift toward a more resilient and decentralized energy model. The implementation of the proposed indicators will ensure that such investment projects are not only economically profitable but also aligned with the long-term strategic interests of Ukraine's energy and environmental security.

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Анотація. *У статті підкреслено стратегічну важливість енергетичної незалежності та обґрунтовано доцільність переходу регіональних теплоенергетичних мереж на використання місцевих видів палива. На основі детального аналізу торф’яних ресурсів України у дослідженні розв'язано питання балансу між енергетичними потребами та екологічними обмеженнями. Запропоновано авторську методологію обґрунтування інвестиційних проєктів, що базується на ієрархії показників, які охоплюють як галузеву ефективність, так і показники соціально-економічного розвитку регіону. Практичне застосування даного підходу ілюструється на прикладі Рівненської області, де визначено життєздатний масштаб видобутку на рівні 100–180 тис. тонн на рік для потреб паливної промисловості. Результати дослідження доводять, що поточні обсяги видобутку залишаються в межах екологічно допустимих норм, що створює підґрунтя для формування сталої альтернативи в системі теплопостачання. Робота пропонує надійний інструментарій для моніторингу успішності проєктів через порівняльний аналіз планових та*

фактичних показників.

Ключові слова: *регіональна теплоенергетика, видобуток торфу, стала енергетика, соціально-економічний розвиток, паливні брикети, екологічно допустимі масштаби, енергетичні показники, декарбонізація, енергетичний сектор України, ресурсний потенціал.*

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