Modern priorities in the development of Ukraine’s energy industry

Abstract. The article investigates the strategic process of integrating Ukraine’s energy system with the European one to ensure energy security in the context of various global factors, such as the COVID-19 pandemic and Russia’s invasion of Ukraine. Emphasis is placed on the importance of implementing priority investment projects of energy companies at the regional level. The authors use current data to conduct a qualitative risk analysis of the investment program of the private joint-stock company Lvivoblenergo. The method of fuzzy logic is used to assess to what extent certain economic indicators of energy enterprises in different regions of Ukraine contribute to achieving a high level of efficiency. The authors argue that the energy industry’s investment attractiveness and the implementation of investment projects by energy companies is becoming relevant from the perspective of future economic recovery and becoming part of the European energy system.

Keywords: energy system, energy security, European integration, investment attractiveness, investment project

1. Formulation of the problem

The development of the energy sector in Ukraine today is associated not only with aspects of ensuring the investment attractiveness of the industry and individual projects related to energy efficiency and energy saving, European integration processes, but also work in wartime. February 24, 2022 was the day of the beginning of the Russian invasion of Ukrainian territory for our country, although on the same day an isolated mode of operation of the domestic power system was planned and actually implemented to prove its self-sufficiency and stability.
2. Aims and methodology of the study

Our research is devoted to assessing the effectiveness of investment projects on the example of the energy supply Privat Joint-stock Company (PJSC) of the Western region of Ukraine “Lvivoblenenergo” to further outline the prospects for the development of the entire industry in the new geopolitical and economic conditions caused by Russian aggression.

3. Main results of the study

For a long time, our country has been fulfilling the strategic task of integrating into the European energy system. In the process of preparation, the following was implemented: technical separation of the United Energy System of Ukraine (UES) and its synchronization with the European network (2002); raising the issue of full integration with the European energy system (2005); reforming the domestic electricity market according to European standards; signing an agreement on the terms of the future merger (2017). According to the signed agreement, a joint regulatory unit with the Republic of Moldova was created, energy units were tested, the stability of the United Energy System of Ukraine was studied, and Ukrenergo was certified in accordance with EU requirements (Pavlenko & Serebrennikov, 2022). We unequivocally agree that such measures ensure the energy security of the energy system and eliminate the negative impact of unfriendly neighboring countries. Therefore, the further development of Ukraine’s energy systems is closely linked to the European direction.

The active Agreement “About an Association EU-Ukraine,” which lays the legal basis for systemic reforms in various fields, includes Article 388 “Objectives and Directions of Ukraine-EU Cooperation in the Energy Sector,” which provides for measures to promote energy efficiency and energy efficiency, development and support for renewable energy, approximation of national energy legislation to EU norms, scientific and technical cooperation and exchange of information with a view to improving technologies in the field of production, transportation and energy consumption (Kuzio et al., 2022). It should be noted that certain provisions of energy cooperation are related to other areas, such as industrial policy, technical regulation, sustainable development, etc. The importance and priority of achieving the above requirements of the national economy is especially relevant in the context of European integration of our country; implementation of relevant EU directives; realization of opportunities for emergency assistance from the EU in wartime; strengthening the interest of potential investors in the energy sector of Ukraine; increasing the level of openness, transparency and accessibility of the system; informatization regarding EU rules and norms; increasing the volume of
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electricity trade. At the same time, we suppose that at the regional level the first steps in the direction of realization of the set tasks must be the continuation of the implementation of investment projects by energy companies.

We will consider investment projects on the example of the most illustrative energy supply enterprise of the Western region of Ukraine PJSC “Lvivoblenergo,” a company that supplies electricity to consumers in the Lviv region and transfers electricity to regional (local) power grids. We take into account that electricity is a special type of product whose properties are determined by physical characteristics, technical characteristics of supply to a certain group of consumers, as well as features related to changes of loading of electroconsumption during the day.

The activity of the researched enterprise was characterized by the following components:

1. Types of sales: sale of electricity to consumers; provision of electricity transit services to electricity suppliers at unregulated tariff; other services.

2. Organization of sales, which occurred in accordance with the geographical location of the corresponding subdivisions (Lvivoblenergo, 2020a).

At the beginning of 2021 PJSC “Lvivoblenergo” sold products (electricity, goods, services) in the amount of 3 884 781 thousand UAH and received income from the distribution and sale of electricity in the amount of 2 760 510 thousand UAH (Lvivoblenergo, 2020b). In 2021 in the general structure of sale the volume of electricity sold to legal entities (industrial and non-industrial consumers) was 55%, to household consumers – 45%.

The investment program of energy enterprise provides for:

- development of applications (mobile applications) for inputting meter readings;
- installation of burglar alarm systems on separate energy objects;
- increase of reliability and capacity of power grids;
- introduction of new transformer capacities to increase the reliability of electricity supply and ensure the annual growth of electricity consumption;
- replacement of technologically outdated meters;
- major overhaul of power grids;
- increasing the reliability of power supply within the program “Safety above all!” (removal of power lines from the territories of schools, kindergartens and hospitals).

The main directions of investment we can see in Table 1.

In 2021, the Ukrainian economy tended to decline, including declining real GDP, and showed a weakening of the national currency against the US dollar and the euro compared to the average of the previous year. Ukraine continues to limit its political and economic ties with Russia, given the annexation of Crimea, an autonomous republic within Ukraine, and the armed conflict in some areas of Luhansk and Donetsk regions. In September 2020, the credit rating agency Fitch
Table 1. Report on the implementation of the investment program of PJSC “Lvivoblenergo” for 2021

<table>
<thead>
<tr>
<th>Target programs</th>
<th>Planned for the forecast period, UAH thousand (excl. VAT)</th>
<th>Funded for the reporting period (cumulative total), thousand UAH (excl. VAT)</th>
<th>Percentage of funding for the reporting period</th>
<th>Remained unfunded, thousand UAH (excl. VAT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction, modernization and reconstruction of electrical networks and equipment</td>
<td>293497.57</td>
<td>82404.18</td>
<td>329.62</td>
<td>–57404.18</td>
</tr>
<tr>
<td>Measures to reduce non-technical electricity costs</td>
<td>103790.70</td>
<td>4638.94</td>
<td>21.58</td>
<td>16855.82</td>
</tr>
<tr>
<td>Introduction and development of automated systems of dispatching and technological control</td>
<td>58482.07</td>
<td>24910.00</td>
<td>166.47</td>
<td>–9946.70</td>
</tr>
<tr>
<td>Introduction and development of information technologies</td>
<td>6199.92</td>
<td>0.00</td>
<td>0.00</td>
<td>796.40</td>
</tr>
<tr>
<td>Implementation and development of communication systems</td>
<td>38171.21</td>
<td>0.00</td>
<td>0.00</td>
<td>10943.54</td>
</tr>
<tr>
<td>Modernization and purchase of wheeled vehicles</td>
<td>34829.95</td>
<td>0.00</td>
<td>0.00</td>
<td>34829.95</td>
</tr>
<tr>
<td>Total</td>
<td>534971.42</td>
<td>111953.12</td>
<td>517.67</td>
<td>–3925.17</td>
</tr>
</tbody>
</table>

Source: own elaboration.
reaffirmed Ukraine’s long-term foreign currency default rating (IDR) at “B” with a stable outlook. In September 2020, the National Bank of Ukraine (NBU) decided to keep the discount rate unchanged at 6% per annum. Maintaining a soft monetary policy aims to support economic recovery in the face of moderate inflation and high levels of uncertainty in the aftermath of the pandemic (COVID-19) in Ukraine and around the world. The main assumption for the application of a soft monetary policy by the NBU remains the continuation of cooperation with the International Monetary Fund.

In early 2020, a new coronavirus (COVID-19) began to spread rapidly around the world, prompting the World Health Organization to announce a pandemic in March 2020. The global spread of COVID-19 has created significant volatility, uncertainty and economic downturn during 2020, which affected the activities of energy companies.

The discounted cash flows method is used to estimate the effectiveness of cash projects. This method has become widespread in the West because it can take into account future development prospects. In general, cash flow is equal to the amount of net income and amortization minus the increase in net working capital and capital investments. The method is used in cases where it is expected that future levels of cash flow will differ materially from current ones and where the company is a large multifunctional commercial entity. The discounted cash flows method is the best, however, it is very labor-consuming.

The advantages of estimating a business by cash flows discounting are as follows. First, future business profits directly account only for the expected operating costs of production and sale of products, while future investments in maintaining and expanding the production or trading capacity of the business are only partially reflected in the profit forecast due to their current depreciation. Second, the lack of profit (loss) as an indicator in the investment calculations of a business valuation is also explained by the fact that profit, being an accounting reporting indicator, is prone to considerable manipulation. The declared value depends on the chosen method of accounting for the cost of purchasing resources in the cost of goods sold from the method of accelerated depreciation, on the criterion for the inclusion of products in sales, etc. The obtained results are given in Table 2 and Table 3.

If the value of the net present value of the NPV is $> 0$ for the individual project, then the project should be accepted or else rejected. If the internal rate of return of IRR exceeds the discount rate $r$, then the project is accepted. If the project profitability index is greater than one, then the project is effective and acceptable. Investment investments are considered appropriate if the auxiliary cash flow from the project implementation is sufficient to return the initial amount of capital investment and provide the required return on invested capital (Verba & Zagorodnikh, 2000). An important criterion for the adoption of this project within the region is the presence of a social component. The company policy is aimed
Table 2. Capital investment for capital repairs (thousand UAH)

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash flows</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Free cash flows</td>
<td>Discounted cash flows</td>
<td></td>
</tr>
<tr>
<td>Initial investment</td>
<td>200 000 000</td>
<td>200 000 000</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>199 201 470</td>
<td>187 925 915</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>130 720 850</td>
<td>116 341 091</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>151 158 440</td>
<td>126 915 541</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>179 956 688</td>
<td>142 542 70</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>25 946 200</td>
<td>19 388 510</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>53 846 100</td>
<td>37 959 376</td>
<td></td>
</tr>
</tbody>
</table>

Source: own elaboration.

Table 3. Integral indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Indicator Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount Rate ((r)) %</td>
<td>6%</td>
</tr>
<tr>
<td>PayBack Period ((t)), years</td>
<td>1 year</td>
</tr>
<tr>
<td>Net Present Value (NPV), thousand UAH</td>
<td>19 526 770</td>
</tr>
<tr>
<td>Internal Rate of Return (IRR), %</td>
<td>70%</td>
</tr>
<tr>
<td>Profitability Index (PI), fractions of units</td>
<td>2,513923517</td>
</tr>
</tbody>
</table>

Source: own elaboration.

at ensuring the production processes by skilled employees, implementation of the investment project should not lead to job cuts. The analyzed investment project is a clear example of real conditions of functioning of the energy company PJSC “Lvivoblenergo.” The calculations show that the project under consideration is appropriate for practical use, as evidenced by the values of the main indicators (NPV and IRR). The profit generated from the implementation of the investment project will be directed to the modernization and re-equipment of the company, as well as to the preparation and implementation of innovations, without which energy efficiency and energy saving cannot be achieved. The obtained results testify to the preliminary readiness of Ukrainian energy companies to achieve the strategic goal of full integration into the European energy system.

In order to consider in more detail the peculiarities of the functioning of energy industry enterprises (in terms of achieving of result of activity), we have selected ten regional institutions representing the western, eastern, southern and central regions of our country (PJSC “Lvivoblenergo,” OJSC “Ternopiloblenergo,” PJSC “Zakarpattjaoblenergo,” JSC “Poltavaoblenergo,” PJSC “Volynoblenergo,” PJSC “Rivneoblenergo,” PJSC “Vinnysiaoblenergo,” PJSC “Mykolaivoblenergo,” PJSC “Zaporizhzhyaoblenergo”) and the method of fuzzy logic is used, taking...
into account the difficulty of identifying cause-and-effect relationships, uncertainty (in quality and time) of result of activity.

The input variables are non-current assets ($y_1$), current assets ($y_2$), equity ($y_3$), average number of employees ($y_4$), output – activity ($z$), calculated as the arithmetic mean of the cumulative income ($y_5$), net income from sales of products and services ($y_6$), net profit ($y_7$), quantity of sales ($y_8$). The identified cause and effect relationships between the input and output variables reflect the “tree” of logical inferences (Fig. 1).

![Fig. 1. Tree of logical conclusions](source: own elaboration).

The results show that in order to achieve a high level of activity, priority is given to a certain basic value of current assets, as opposed to non-current assets. Also, the number of employees to some extent is not as important for achieving efficiency as the size of fixed capital, preference is given to medium-high or high its quantitative dimension. Therefore, we suppose the development of energy companies in different regions based on attracting and using investment resources to optimize own funds a priority.

According to domestic experts, the country’s investment attractiveness is closely linked to the ease of doing business. Rating of the World Bank on the ease of doing business (Doing Business) among other components takes into account the indicator of ease of connection to the grid (Getting electricity). Note that in the ranking of Doing Business in 2016, Ukraine ranked 83rd, and according to Getting electricity – 137, that is, the process of improving the situation with connection to the grid allowed to introduce an updated model of the electricity market in Ukraine and increase the position of the rating in the already mentioned Doing Business rating in 2020 to 128 position (Pavlenko & Serebrennikov, 2020). Taking into account the difficult possibilities of implementing investment projects during the war, we note that the reconstruction of the economic system after the victory will increase the relevance of such processes.

Thus, our analytical results at the level of individual energy companies prove the importance of introducing modern practices of financial security and timely
use of various available sources of financial resources for: 1) renewal of current assets that are in constant circulation and are intended for production use (sale or consumption), which allows to increase the maneuverability of the enterprise in achieving certain goals; 2) optimization of own and potential use of diversified attracted resources aimed at strengthening the energy security of the country and energy companies of the regions; 3) replenishment of fixed capital, which is the long-term fixed assets of the company. Synchronization of the domestic energy system with European energy systems is also an example of a powerful investment project (Charts 1-2).

According to the statement of the Minister of Energy Herman Galushchenko, the energy system of Ukraine will not return to parallel work with the combined
energy system of Russia and Belarus. The operation of the Ukrainian power system during February 24-26, 2022 in autonomous mode proved its ability to work even in the face of rocket fire, fierce fighting and attempts by the enemy to attack critical infrastructure (Government portal, 2022). The order of the Ministry of Energy on refusal to connect to the power grid of the Russian occupiers was signed.

4. Conclusions

Full integration of the energy system of our country is provided by the Association Agreement between Ukraine and the EU. Therefore, the disconnection of the domestic energy network from the Russian and Belarusian energy network on February 24, 2022 was an important step towards achieving the goals of this program document. The Russian aggressor’s war against Ukraine, which began that day and created a number of risks, accelerated these processes, because today there can be no question of returning to the old system after undergoing testing in isolation, urgent accession to the European energy system has become a priority. In light of this, the issues of improving the efficiency of work and implementation of certain investment projects of energy companies in the regions of Ukraine will be relevant in the future.

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Aktualne priorytety rozwoju energetyki Ukrainy

**Streszczenie.** Artykuł poświęcony jest ocenie przebiegu strategicznego procesu integracji krajowego systemu energetycznego z systemem europejskim w celu zapewnienia bezpieczeństwa energetycznego w kontekście szeregu czynników globalnych, takich jak pandemia COVID-19 oraz inwazja Rosji na Ukrainę. Uwaga autorek skupia się priorytetowych projektach inwestycyjnych przedsiębiorstw energetycznych na poziomie regionalnym. Na podstawie aktualnych danych przeprowadzona została analiza jakościowa ryzyka programu inwestycyjnego prywatnego przedsiębiorstwa energetycznego Lvivoblenergo. Wykorzystując metodę rozmytej logiki, oceniono, w jakim stopniu niektóre wskaźniki ekonomiczne przedsiębiorstw energetycznych w różnych regionach Ukrainy wpływają na osiąganie wysokiego poziomu efektywności. Autorki wykazują, że atrakcyjność inwestycyjna branży i realizacja projektów inwestycyjnych przez przedsiębiorstwa energetyczne odgrywa ważną rolę z punktu widzenia przyszłej odbudowy gospodarki i przyłączenia do europejskiego systemu energetycznego.

**Słowa kluczowe:** system energetyczny, bezpieczeństwo energetyczne, integracja europejska, atrakcyjność inwestycyjna, projekt inwestycyjny