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## MEZZANINE FINANCING OF UKRAINE'S ENERGY INFRASTRUCTURE IN THE POST-WAR RENEWAL

**Background.** *The Government of Ukraine has developed the Energy Strategy up to 2050, which aims to strengthen energy security and resilience and introduces targets for energy efficiency, environmental safety, reducing carbon emissions, etc. Post-war recovery combined with simultaneous modernization of Ukraine's energy sector will require the mobilization of significant financial resources, highlighting the importance of examining advanced global experience in attracting investment to energy infrastructure. The aim of the article is to substantiate promising methods of financing energy facilities for their implementation and application in the Ukrainian economy during the post-war renewal period.*

**Methods.** *Employed in the study include factual and situational analysis, synthesis, deduction, systems approach method, and theoretical generalization.*

**Results.** *The article analyzes global experience in applying and combining methods of financing energy infrastructure. It formulates the key principles for mobilizing investment in modern energy. The study provides analytical conclusions with justifications regarding the prospects and relevance of implementing and applying mezzanine financing for the post-war renewal of Ukraine's energy sector. The most priority and optimal mezzanine forms of attracting investments to the energy sector are identified.*

**Conclusions.** *The study distinguishes the key principles for mobilizing investment in the energy sector, namely: consideration of energy security and socio-economic stability aspects, mobilization of non-state financing, minimization of the cost of capital, harmonization of the project's cash flows, fair risks and returns allocation. Based on global experience, a comparison of primary capital mobilization methods for energy infrastructure (from the state/IFIs, equity, debt, mezzanine) is performed. The prospects and relevance of mezzanine financing for implementation and application in the Ukrainian economy are substantiated. The most optimal forms of mezzanine financing for the energy sector are identified as securitization with tranching and subordinated debt financing. It is determined that Ukraine's institutional framework for these capital raising instruments has the potential for improvement and represents a promising direction for further researches. The study recommends the prompt implementation and institutionalization of mezzanine financing in the Ukrainian economy.*

**Keywords:** *mezzanine financing; energy infrastructure financing; forms of mezzanine financing; post-war recovery of Ukraine's energy sector; securitization with tranching; subordinated debt.*

### Background

The energy sector constitutes the most important part of critical infrastructure, since energy functions as a primary resource for all industry branches, transport, telecommunications, and the service sector, while the availability of a stable energy supply is a prerequisite for ensuring the basic sanitary and household needs of the population. Consequently, the systematic destruction of energy generating and distribution facilities due to military actions poses not only a short-term threat but also a long-term negative strategic impact on Ukraine's recovery and sustainable development, thereby necessitating urgent and comprehensive restoration of energy facilities.

In response to the challenges, the Government of Ukraine has developed the Energy Strategy to 2050 (Ministry of Energy of Ukraine, 2023) (the full text is temporarily unavailable in open access). The Strategy considers the consequences of a full-scale war and envisages a strengthened role for energy security and decentralization to enhance the resilience of the energy system. It also foresees the introduction of advanced technologies (such as the use of hydrogen in energy, small modular nuclear reactors, etc.) and sets the requirements for energy efficiency, environmental safety, and reduction of carbon emissions in accordance with EU regulations and Ukraine's international obligations. The Strategy aims to achieve its objectives through the development of nuclear generation, renewable energy sources, modernization, and automation. Undoubtedly, along

with setting strategic guidelines and current objectives, there arises a need to mobilize financial resources for their implementation. At the same time, the global level of recognition and implementation of the Sustainable Development Goals (SDGs) and ESG criteria is growing: investors are increasingly and more strictly adhering to the principle that financial results should be achieved with minimal negative impact. Consequently, energy sector post-war reconstruction and development will only take place in light of, and with due regard to, the SDGs and ESG principles, which, in turn, will necessitate the attraction of additional financing. Moreover, the challenge of securing investment is deepened by global political and economic instability and uncertainty, as well as by Ukraine's historically high country risk premium, which is now approximately 17% (Naumenkova, Mishchenko, & Tishchenko, 2024) due to the ongoing war.

Ukraine traditionally operates under a banking model of financial intermediation. However, as of September 1, 2025, the portfolio of loans issued by the banking system to business entities amounts to about USD 22 billion (Total assets of banks in Ukraine (2008–2025), 2025), which is insufficient compared to the overall forecast investment needs of the economy, estimated at USD 750 billion (Ministry of Economy of Ukraine, 2023). Additionally, to ensure financial stability, the banking system must comply with regulatory requirements regarding capital adequacy, liquidity, loan loss provisions, risk concentrations, and other prudential limits. These factors indicate the inherent

limitations of relying solely on traditional bank lending to finance large-scale infrastructure projects, in particular the energy sector.

Therefore, the study and analysis of global experience in attracting investment into energy infrastructure, particularly with respect to legal structuring and financing mobilization mechanisms, have become increasingly relevant for determining promising energy financing practices suitable for subsequent implementation in the Ukrainian economy.

One of the widely used methods of attracting investment in energy facilities in the world is mezzanine financing, the forms of which simultaneously have the features of debt and equity financing. Mezzanine forms of raising capital meet the needs of energy facilities for flexible long-term financing and hence may serve as a strategic mechanism for the recovery and development of Ukraine's energy infrastructure.

*The paper aims* to examine advanced global experience in energy infrastructure financing and to justify promising forms of capital mobilization that are relevant for implementation and application in the Ukrainian economy in the post-war renewal period.

**Hypothesis:** Implementing and applying mezzanine financing mechanism will positively contribute to the successful post-war recovery and development of Ukraine's energy infrastructure.

**Literature review.** The body of research on strategies, methods, and instruments for mobilizing investment in energy or capital-intensive long-term infrastructure projects – including the energy sector – is largely comprised of specialized fundamental studies by researchers, in particular Weber, B., Staub-Bisang, M., Alfen, H., Halbout, J., Riboud-Seydoux, M.-N., and Nijs, L.; numerous publications by the OECD; analytical reports by consulting companies, in particular Deloitte; and publications by other authors that provide in-depth analysis of specific aspects of the issue. These sources examine the current state of infrastructure financing in developed and developing countries, highlighting issues related to access to finance, investment sources, risk factors, and risk allocation among stakeholders.

Generally, the literature distinguishes the following primary financing methods: 1) State/IFIs financing in the context of leveraging and unlocking private commercial investment, 2) Equity financing, 3) Debt financing, and 4) Mezzanine financing. Energy investments are considered solely within the scope of clean energy (including nuclear, which has been classified as part of the EU Taxonomy since 2023 (European Commission, 2022) and alignment with sustainable development goals and ESG principles.

Weber, Staub-Bisang, and Alfen (2016) in their foundational work, comprehensively analyze infrastructure investment trends in light of Sustainable Development Goals. Infrastructure is conceptualized as a distinct asset class, with investment risks categorized by the authors into 1) general risks (market, ESG, political and regulatory, etc.), 2) project- or asset-specific risks (construction, technical, financial, etc.), and 3) industry-specific risks. The authors provide detailed descriptions of core infrastructure sectors, including energy, highlighting technical and regulatory aspects. Substantial attention is paid to PPP as a vehicle of project finance (outlining its characteristics, principal stakeholders with their objectives and contributions, finance structuring, etc.). The primary methods of infrastructure financing identified are equity, debt, mezzanine financing, state/IFIs financing, and others.

Halbout and Riboud-Seydoux (2022) examine the financing of energy projects, focusing on various methods of capital raising and financial instruments. They emphasize

that no standardized approach applies, given the diverse geographical, technological, and technical contexts of the projects. The primary methods of capital raising identified are equity, debt, and mezzanine (hybrid) financing. Particular attention is drawn to mezzanine financing due to its flexibility, lower cost compared to equity capital, and reduced pressure on the project's cash flows. The authors identify project finance and corporate finance as the predominant financing models. The study further maps the most relevant capital providers and methods of finance mobilization across different stages of the energy project lifecycle (Exploration and Appraisal, Development and Production, Decommissioning).

Nijs (2014) in his comprehensive book, distinguishes between corporate and project finance of large infrastructure projects, which include energy in particular, and analyzes the respective advantages and drawbacks of each investment structuring approach. The author notes that capital is raised predominantly through debt instruments (70-80%), in contrast, employing equity financing beyond 20%-30% typically renders the project unattractive for capital providers, given the availability of more favorable alternatives. It is concluded that accurate risk identification and optimal risk allocation (each specific risk should be allocated to the party most capable of managing it at the lowest cost) contribute to reducing the project's weighted average cost of capital. It is further observed that projects with substantial capital requirements are typically resorted to using financing or guarantees (financial or non-financial) from sponsors, as well as mezzanine finance instruments. The book also examines the securitization of project finance loans, particularly through mezzanine and junior tranches, which carry higher risk exposure for investors compared with senior debt.

The OECD Policy Guidance (2015) analyzes financial markets in the context of investments in clean energy infrastructure, examines the barriers to accessing finance and sources of capital, and proposes measures to improve access to funding. Suggested instruments include partial credit guarantees, financing from IFIs, development of domestic financial markets and accessible financial instruments, and mobilization of institutional investors through a favorable regulatory environment. In the Study, the OECD (2018) further recommends that governments stimulate investment in low-carbon infrastructure by initiating the creation of public-private partnerships; deploying guarantees to reduce, mitigate, or reallocate investment risks among stakeholders; fostering the development of innovative financial instruments and the standardization of contracts, methods, and processes to reduce administrative and transaction costs and encourage securitization. The Guidance (2022a) notes that the clean energy sector in developing countries receives a significant share of its funding from donor contributions, however, the overall level of mobilized financial resources remains insufficient, leading to calls for a transition from traditional aid to blended finance. Blended finance is defined as a strategic combination of development finance (funds with a development mandate only) together with non-development finance (additional capital provided on commercial terms without an explicit development objective) aimed at supporting sustainable development in emerging economies. Thus, the use of blended finance is expected to amplify the impact of limited donor resources by redirecting funds into new projects as soon as existing investments become commercially viable. Complementary OECD Researches (2022b, 2024) examine and analyze country-

level experiences in financing energy infrastructure, specifically in India and the Philippines. Both publications underscore the positive role of blended finance application, particularly where development finance was deployed to reduce investment risks (i.e., first-loss or non-payment guarantees) for investors, thereby leveraging additional commercial capital. In Publication (2024), the Nuclear Energy Agency (NEA) analyzes the sensitivity of the cost of electricity generated by nuclear power plants to the cost of capital employed, using as case studies recently commissioned nuclear power plants as well as facilities planned for commissioning. The study identifies principal providers of equity (host country governments, equipment suppliers, energy companies (or combinations thereof) and debt financing (supplier country governments, host country governments, commercial banks, institutional investors). The analysis concludes reducing the cost of raising capital through de-risking construction, whereby electricity consumers and taxpayers (i.e., states) absorb these risks, as they are deemed best suited to bear low-probability but high-impact risks.

Deloitte (2023) examines the economic attractiveness of investment in clean energy, particularly in developing countries. It recommends governments to work towards developing financial mechanisms and methods capable of unlocking private capital while maintaining financing costs at an acceptable level. Recommended instruments identified are guarantee mechanisms, the development of capital markets, and the application of a blended finance approach that can mitigate the risks for commercial investors and mobilize private capital. The study concludes that capital-intensive clean energy projects in developing countries are disproportionately expensive due to the high cost of capital resulting from higher political, regulatory, currency, inflationary, and other risks. Accordingly, policy efforts in emerging economies should focus on project risk mitigation and removing barriers to private capital flows. The paper further highlights the role of the Climate Investment Fund (CIF), which provides resources for blended finance products for developing countries, thereby unlocking and catalyzing further private investment. The instruments employed include concessional senior loans, subordinated loans, and other mezzanine instruments designed to mitigate the default risk on senior debt. A follow-up Research (2024) identifies a range of economic and financial instruments to mitigate investment risks in energy assets: 1) Power purchase agreements - reducing market risks, effectiveness depends on the creditworthiness of the purchaser; 2) Tax incentives – fostering debt financing through enhancing project liquidity, particularly effective in developing countries; 3) Grants and concessional loans – effective in developing countries, but costly for taxpayers; and 4) Debt and equity subordination - reducing the investor's risk through mitigating the risk of default on senior debt and acts as an additional guarantee of returns. From the perspective of governments and donors, the costs incurred when using different instruments vary in nature, and not all transform into direct budget outlays. A distinction is made between hard, or direct, costs (grants), contingent hypothetical (guarantees), and lost future income (tax incentives), the latter does not cause government spending, since taxes could not have been collected in the absence of the project. The choice and combination of instruments depend on the geographical, market, and technological contexts; they should operate together with blended finance. Over time, reliance on these instruments is expected to diminish as projects mature and markets deepen.

Karakosta, Corovessi, and Vryzidis (2025) examine the financing of energy efficiency projects across five countries (Bulgaria, Croatia, Greece, Romania, and Slovenia) and identify the best practices for capital raising, including the application of debt financing from dedicated funds, guarantees, energy service contracts combined with grants, etc. The study assesses financing models, identifies barriers to private investment, and enhances understanding of effective strategies for attracting investment in energy efficiency and renewable energy by strengthening cooperation between public and private sectors. A key conclusion highlights the dependence of the development of sustainable financial instruments on political support and recognition of their importance by all stakeholders. González-Ruiz, Botero-Botero, and Duque-Grisales (2018) propose a framework for financing sustainable infrastructure facilities based on mezzanine financing forms (specifically convertible debt), whereby creditors have the option to convert debt into equity (share in the capital) upon achieving criteria linked to sustainable development goals. This financing approach deepens the nexus between finance and sustainable development and offers additional value for investors increasingly guided by sustainable development goals when choosing investment assets. Rajavuori and Huhta (2020) examine the impact of the US and EU national security investment screening framework on the energy sector. They illustrate how investment screening affects the energy sector and creates new challenges for international energy investment, as modern legislation framework increasingly focuses on critical infrastructure, data processing (including the personal data factor), and emerging new energy technologies. The authors emphasize that strengthening regulation negatively affects overall investment readiness in the energy sector.

It is important to note the existence of scientific publications that focus specifically on financing infrastructure and the energy sector in Ukraine.

Zatonatska et al. (2024) identify the key role of ESG principles in the development of the energy sector and justify the need to integrate these practices into Ukrainian legislation for a positive impact on energy efficiency and further sustainable development. Drawing on the example of the Russian-Ukrainian war, the authors conclude the necessity of a reliable and diversified energy infrastructure to mitigate geopolitical risks; consequently, it is recommended for Ukraine to stimulate investment in renewable energy and align post-war recovery with sustainable development goals. Petlenko (2024) examines the green energy financing in Ukraine in the context of establishing sustainable and resilient infrastructure and strengthening Ukraine's energy security. The study highlights that, despite governmental support, the transition to green energy is constrained by the high capital intensity of green technologies, which are often non-competitive without state subsidies. The author emphasizes the importance of attracting both public and private investment and the need to develop new financing instruments for the Ukrainian economy. Examined green energy financing instruments in Ukraine include government subsidies, private investment, and innovative financial solutions, particularly green credit guarantee schemes (Green Credit Guarantee Corporations, CGCs). The study contributes to a deeper understanding of ways and methods of attracting investment for green energy within the framework of post-war infrastructure recovery. The OECD Study (2020) provides a thorough analysis of infrastructure investment in the Eastern Partnership countries, including Ukraine. The

authors note the multiplicative effect of infrastructure investment and the significant role of the private sector in financing the renewable energy development in Ukraine. They identify the priority of developing domestic private financing, which necessitates establishing infrastructure as a distinct asset class. Investment needs in energy and transport infrastructure are recognized as a priority. To enhance private sector participation, the government is recommended to create a favorable regulatory environment, employ risk mitigation instruments (e.g., guarantees), and focus on a blended finance approach to attract private capital. The OECD Review (2021) analyzes Ukraine's energy investment. It concludes that the country lags behind developed economies in establishing effective modern energy infrastructure, and attracting private investors is one of the necessary steps for the energy sector modernization. The government is advised to develop and improve the mechanisms for facilitating public-private finance. The study highlights that long-term investment in Ukraine's energy infrastructure, which can be attracted from the private sector, is a priority for the country's development. It also identifies the potential for renewable energy expansion (including biomass, wind, and solar). Energy infrastructure projects are noted to require the mobilization of significant financial resources upfront, while generating returns only in the medium- and long-term. Finance resources are constrained by the fact that investors perceive the risks to be too high, which can be partially mitigated through the development of the financial market (depth and liquidity). The OECD identifies foreign and domestic private investors, state-owned enterprises, banks, and international financial institutions as the main providers of investment in Ukraine's energy infrastructure.

#### Methods

The study utilized **methods** of factual and situational analysis to examine advanced global experience in energy infrastructure financing; synthesis and deduction to formulate the key principles for mobilizing investment in energy infrastructure and to substantiate the high potential and relevance of mezzanine financing for its implementation in Ukraine's economy in the context of post-war recovery; a systems-based approach to justify the impact of mezzanine financing on ensuring the full volume of capital mobilization at an acceptable weighted average cost of capital, and on the allocation of risks and returns among stakeholders; and theoretical generalization to identify the most relevant forms of mezzanine financing for their implementation, institutionalization, and application in Ukraine's economy for financing energy infrastructure.

#### Results

Energy infrastructure in Ukraine and globally constitutes one of the principal sectors of critical infrastructure (Cabinet of Ministers of Ukraine, 2020; Kudrjashov, 2021; Verkhovna Rada of Ukraine, 2021a). It should be noted that over the past decade, both worldwide and in Ukraine, the development of the environmental component of the energy sector has not only gained significant momentum, but has also become a determining factor influencing attracting investment into energy infrastructure. In 2015, the Paris Agreement (United Nations, 2015) was signed (ratified by Ukraine in 2016), an international treaty aimed at preventing global warming and climate change by reducing greenhouse gas emissions. The international community is committed to significantly reducing carbon emissions in pursuit of climate neutrality.

In 2019, the European Union introduced the European Green Deal (European Commission, 2019), a comprehensive set of policy initiatives through which it aims to achieve carbon

neutrality by 2050. Within the framework of this initiative, mandatory ESG reporting for companies and financial institutions was established, along with the development of the EU Taxonomy – a fundamental document, that clearly defines economic activities aligned with the objectives of achieving net-zero emissions by 2050, thereby attracting investment in relevant sectors of the economy.

In 2022, in the context of the war in Ukraine and the energy crisis in the EU, the role of nuclear and gas energy was reassessed, and through a dedicated Complementary Delegated Act (European Commission, 2022), certain activities in the sector of nuclear and gas energy were, with specific reservations, included in the list of economic activities covered by the EU taxonomy. This change has a positive impact on Ukraine's energy sector, given that a significant share of energy generation in the country relies on nuclear power plants.

In 2023, the Cabinet of Ministers of Ukraine, upon the submission of the Ministry of Energy, approved the Energy Strategy of Ukraine to 2050 (Ministry of Energy of Ukraine, 2023), which sets the objective of achieving net-zero emissions by 2050 and formulates requirements regarding energy efficiency, environmental safety, and carbon emissions reduction in accordance with EU standards and Ukraine's international obligations. The consistency of the Energy Strategy of Ukraine with the European Green Deal is justified (Soboliev, & Zatonatska, 2024), which appears to be a logical consequence of Ukraine's European integration trajectory.

Undoubtedly, the post-war recovery of Ukraine's infrastructure must align with global trends, particularly ensuring strict alignment with the Sustainable Development Goals (SDGs) and ESG criteria; otherwise, the mobilization of private capital is unlikely, and the risks of litigation (Zatonatskiy, & Chernyak, 2023) regarding the non-compliance of energy projects with the country's international obligations arise. Simultaneously, as it was justified (Zatonatska et al., 2024), the integration of ESG principles into the financing of Ukraine's energy infrastructure, along with the harmonization of national policy with European standards, should create the foundation for a reliable and sustainable energy economy and strengthen energy security, which is especially important in the context of geopolitical and military risks in the post-war period.

Based on the critical analysis of the literature (Deloitte, 2023, 2024; González-Ruiz, Botero-Botero, & Duque-Grisales, 2018; Halbout, & Riboud-Seydoux, 2022; Karakosta, Corovessi, & Vryzidis, 2025; NEA, 2024; Nijs, 2014; OECD, 2015, 2018, 2020, 2021, 2022a, 2022b, 2024; Petlenko, 2024; Rajavuori, & Huhta, 2020; Weber et al., 2016; Zatonatska, & Osypenko, 2025; Zatonatska et al., 2024), we formulate the key principles for mobilizing financing in energy infrastructure (beyond the principles of ESG compliance and alignment with the SDGs) as follows:

1. Principle of considering energy security and maintaining socio-economic stability aspects. The state is expected to retain ownership rights and/or exercise additional control over energy facilities, associated technologies and data, given their social function and impact on national security and the economy.

2. Principle of mobilizing non-state financing. The predominant part of investment in the energy sector should be private commercial financing, whereas limited **state/IFIs financing** should be channeled through financial instruments and mechanisms to leverage sufficient volumes of private commercial investments from capital markets.

3. Principle of minimizing the cost of investment capital. The cost of capital raised must be kept to a minimum, since it significantly affects the final cost of generated energy, which in turn directly affects the competitiveness of other sectors of the national economy. For instance, under conditions of a weighted average cost of capital (WACC) of a nuclear power plant at 12% annually, the cost of electricity generation increases by more than 3.4 times compared to interest rates approximating 1% per annum (calculated by the authors based on NEA, 2024).

4. Principle of harmonizing cash flows from financial activities with those from the operational activities of an energy facility (debt maturity and the timing and conditions of interest payments). Capital should be raised in substantial amounts and on a long-term basis, whereas the commencement of interest payments should be aligned with the energy project's cash flows, which are typically absent during the design and construction phases.

5. Principle of a fair and relevant allocation of risks and returns (each specific type of risk should be managed by the

party most competent and best adapted to handle it). Energy projects are subject to additional construction and technical risks, which are further exacerbated in developing countries by political, regulatory, and currency risks. Consequently, the financing structure should ensure a fair balance of risks and returns among stakeholders.

We examine the global experience of financing energy infrastructure. The key investment providers in the energy sector traditionally included: the host-country government of the energy facility, the supplier/constructor country government of the energy facility, the energy company (the owner of the energy facility), the equipment supplier/constructor company, IFIs, commercial banks, and institutional investors. Legally, such investments are typically structured as either corporate finance or project finance, implying the project has a separate balance sheet. Public-private partnerships are classified as a form of project finance. Contemporary global practices are summarized in Table 1.

Table 1

Contemporary Global Practices in Energy Infrastructure Financing

Key Investment Providers	Host country government, energy project supplier/constructor country government, energy facility-owning company, equipment supplier/constructor company, IFIs, commercial banks, and institutional investors			
Legal Investment Structure	Corporate Finance & Project Finance (incl. PPT)			
Financing Mobilization Mechanisms	State and IFIs support*	Equity Financing	Debt Financing	Mezzanine Financing
Financing Forms and Instruments	Power purchase agreements, tax incentives, guarantees, grants, concessional loans under blended finance principles, mezzanine financing instruments (first-loss absorber)	Equity placement, direct investments	Loans, bonds	<b>Mezzanine equity:</b> 1) Silent participation; 2) Preferred shares; <b>Mezzanine debt:</b> 3) Participating loans; 4) Participating bonds; 5) Subordinated loans; 6) Subordinated bonds; 7) Convertible loans; 8) Convertible bonds; 9) Bonds with warrants; 10) Securitization with junior (mezzanine) tranches
Risk Exposure for State/IFIs	Moderate	None	None	None
Financing Cost for Energy Project (Investor's Return)	Low or negligible, reduces WACC	High	Medium	High/Moderate, reduces WACC
Financing Duration	Long/medium	Long	Long/medium	Long/medium
Investment Share (% of Total Project)	≤ 20%, positively leverages debt mobilization	10–30%	60–80%	≤ 20%, positively leverages debt mobilization
Capital Raising Without Control Loss	Yes	No	Yes	Yes
Impact on Balance Sheet Structure/ Creditworthiness/Credit Rating, and Ability to Raise New Debt	Positive	Positive	Negative	Positive
Obligation for Regular Interest Payments	Yes/No	No	Yes	Yes/No
Project Implementation Phases	Exploration and Appraisal, Development and Production, Decommissioning	Exploration and Appraisal, Development and Production, Decommissioning	Development and Production, Decommissioning	Development and Production, Decommissioning

\* Cases of direct equity participation or classical debt financing are not considered.

Source: developed by the authors based on Deloitte, 2023, 2024; González-Ruiz, Botero-Botero, & Duque-Grisales, 2018; Halbout, & Riboud-Seydoux, 2022; Karakosta, Corovessi, & Vryzidis, 2025; NEA, 2024; Nijs, 2014; OECD, 2015, 2018, 2020, 2021, 2022a, 2022b, 2024; Petlenko, 2024; Rajavuori & Huhta, 2020; Weber et al., 2016

The primary mechanisms for mobilizing financing include State/IFIs support, Equity, Debt, and Mezzanine financing. While states/sub-states/IFIs/Funds can act as shareholders or creditors, such cases should be regarded as a specific instance of equity or debt financing with the state or IFI/Fund acting as a commercial investor. Accordingly, this study does not consider cases of direct finance or commercial loans from states/IFIs. Instead, the rather limited resources available through the state/IFIs support mechanism, in accordance with the principles of blended finance (OECD, 2022a), should stimulate and unlock private commercial investment and expand the investor base (Symonenko, & Tsyganov, 2024). The key instruments employed for this purpose include power purchase agreements, tax incentives, credit and other guarantees, grants, concessional loans, and mezzanine financing instruments (such as loans with a first loss absorption function), among others. The application of these support mechanisms significantly mitigates market, credit, and other project risks and improves its financial indicators, in particular the debt burden in the context of a senior commercial debt. Consequently, investment risks become acceptable to providers of the bulk of financing, thereby enabling private investment inflow into the project (i. e., unlocking investment). Ideally, the role of states and IFIs is limited to addressing specific risks that commercial investors are reluctant to assume, namely those inherent in large-scale energy projects (construction and technical risks) and developing countries (political and regulatory risks), among others.

Equity financing typically accounts for 10-30% of the total investment and can be employed at all phases of an energy project, including the earliest phase - exploration and appraisal (where it is most commonly raised). This financing method does not require regular payments, does not increase the debt burden, and has a positive impact on the credit rating and balance sheet structure. However, its application is relatively limited, and in most cases, attracting additional equity financing dilutes the governance and ownership rights of other shareholders.

Debt financing accounts for up to 80% of the energy project investment. It is employed at later phases of project implementation compared to equity financing and is characterized by a rigid schedule of interest and principal payments. Debt financing may require collateral, increases the debt burden, and negatively affects the creditworthiness and balance sheet structure of the energy project. Creditors, however, do not acquire ownership or governance rights over the facility.

Mezzanine financing constitutes up to 20% of the total financing. It is a flexible method of capital raising, which combines features of both equity and debt and occupies an intermediate position between them. Mezzanine financing positively impacts the balance sheet structure and

creditworthiness of the project (in the context of its senior debt). This effect results from subordinating debt financing and/or reducing interest payments on senior debt, as long as the debt provider has the right to benefit from the project's value growth (equity upside) or a share of its profits. Although mezzanine financing accounts for up to 20% of the total capital expenditure of an energy project, it remains one of the key methods of raising capital, and its application enables the project to secure the full investment volume at an acceptable weighted average cost of capital. This process occurs through the mitigation of investment risks (and the reduction of investor returns) via their absorption by mezzanine instruments, thereby reducing them to a level acceptable to the primary capital providers. Consequently, it becomes possible to secure the bulk of project financing at relatively low rates, characteristic of issuances with high credit ratings.

We argue that in the context of requirements for capital raised for energy infrastructure assets, mezzanine financing largely meets the above-stated, rather contradictory principles for attracting investment in the energy sector. Moreover, it facilitates securing the bulk of financing, while ensuring some degree of compliance with these requirements. The alignment of mezzanine financing with the principles of securing investment in energy infrastructure is summarized in Table 2. Specifically, 1) Most forms of mezzanine financing do not entail transferring control or ownership of the energy project to the investor, which allows the government to retain control over strategically important facilities, if necessary. 2)–3) Mezzanine instruments offer investors higher returns compared to conventional debt instruments. Nevertheless, they serve as a leverage mechanism, enhancing the creditworthiness of an energy facility and its ability to attract new private commercial financing at a lower cost and, consequently, reducing the weighted average cost of capital, thereby positively affecting the cost of energy. 4) Forms of mezzanine financing allow for flexible structuring of the timing and conditions of investor remuneration, facilitating alignment of payments and investment returns with the energy project's cash flows. 5) The mezzanine capital provider usually occupies an intermediate position between shareholders and debt investors in terms of risk and return allocation, which is important for maintaining a fair balance among stakeholders. It should be noted that mezzanine investors are not appropriate parties to assume construction and technical risks inherent in energy projects, nor the political and regulatory risks inherent in developing countries. The handling and mitigation of these risks remain the prerogative of states and IFIs; however, this does not exclude the use of mezzanine instruments by these entities for such purposes (for instance, in the form of subordinated loans).

Table 2

The Alignment of Mezzanine Financing with Principles of Securing Investment in Energy Infrastructure	
Principles of Securing Investment in Energy Infrastructure	Characteristics of Mezzanine Financing
1. Principle of considering energy security and maintaining socio-economic stability aspects	Most forms of mezzanine financing do not involve transferring control or ownership over the energy project to the investor
2. Principle of mobilizing non-state financing	Mezzanine financing instruments enhance the creditworthiness, positively leverage debt financing, and reduce weighted average cost of capital (WACC) of the project
3. Principle of minimizing the cost of investment capital	
4. Principle of harmonizing cash flows from financial activities with those from the operational activities of the energy facility	Forms of mezzanine financing provide the ability to flexibly structure flexibly the timing and terms of investor remuneration payments and investment returns
5. Principle of a fair and relevant allocation of risks and returns (each specific type of risk should be managed by the party most competent and best adapted to handle it)	The mezzanine capital providers typically occupies an intermediate position between shareholders and debt investors in terms of risk and return allocation

Source: developed by the authors.

Generally, the main forms of mezzanine financing are classified (Kurylek, & Porebski, 2022; Nijs, 2014; Tetreova, & Svedik, 2018; Zatonatska, & Osypenko, 2025) into: Mezzanine equity: 1) Silent participation; 2) Preferred shares; Mezzanine debt: 3) Participating loans; 4) Participating bonds; 5) Subordinated loans; 6) Subordinated bonds; 7) Convertible loans; 8) Convertible bonds; 9) Bonds with warrants; 10) Securitization with tranching (utilizing senior and junior (mezzanine) tranches with different priority in receiving payments and repayment of investments).

We argue that securitization with tranching and subordinated debt financing (subordinated loans and bonds) are the most promising and relevant mezzanine financing instruments for application in energy facilities.

Securitization structured into senior and junior (mezzanine) tranches, which have different priorities in receiving payments and repayment of investments. Securitization is the conversion of assets (in the context of energy, this means cash flows generated by an energy facility) into bonds backed by these assets (asset-backed securities). Typically, it is structured through a special-purpose vehicle (SPV), which holds the rights to the project's cash flows and issues several tranches of bonds with varying priorities of claims and orders of loss absorption. The proceeds are then transferred to the investment project. Energy projects typically feature stable, long-term, and predictable cash flows secured by appropriate purchase agreements, while simultaneously requiring significant upfront capital investment. Securitization enables an energy facility to raise the required capital immediately by issuing bonds backed by future operational revenues. The use of tranches with different claim priorities allows for flexible risk management, attracting capital from investors with varying risk tolerance, and employing limited funding from the states or IFIs to buy out the youngest tranches (first-loss absorption), which constitute the smallest part of the issuance. Consequently, it facilitates the mobilization of the bulk of financing from private commercial investors, who are averse to high investment risks. Senior tranches with high credit ratings (and correspondingly low interest rates) and long tenors are particularly appropriate for institutional investors, such as pension funds or insurance companies.

Subordinated loans and bonds are forms of mezzanine financing that provide investors the right to receive interest income (the presence or absence of which may additionally depend on certain conditions – triggers); however, in the case of bankruptcy, their rights to the liquidation assets have a lower priority than other "senior" creditors. Under certain conditions, subordinated debt may be written down ahead of equity capital (serving as a first loss absorber). Energy projects typically require significant debt financing, yet most investors may be reluctant to assume the associated risks, especially at the early phases of project development. Securing a limited portion of financing from private investors ready to assume high risk in return for suitable reward or from the state/IFIs on concessional terms through subordinated debt instruments, improves the project's balance sheet structure and enhances the credit rating of senior, non-subordinated emissions. This, in turn, enables the full debt volume mobilization and positively affects the project's weighted average cost of capital, since the bulk of financing is raised at comparatively low interest rates, characteristic of issuances with high credit ratings.

In Ukraine's regulatory framework, securitization is currently regulated only in the context of mortgage bonds (Laws of Ukraine "On Mortgage Bonds" (Verkhovna Rada of Ukraine, 2005) and "On Capital Markets and Organized

Commodity Markets" (Verkhovna Rada of Ukraine, 2006). The regulatory framework for bonds backed by other assets (e.g., project future cash flows), as well as for the issuance of tranching securities with different seniority levels, is still in the initial formation stage. Subordinated loans are regulated only fragmentarily (Laws of Ukraine "On Financial Services and Financial Companies" (Verkhovna Rada of Ukraine, 2021b) and "On Banks and Banking Activities" (Verkhovna Rada of Ukraine, 2000)), simultaneously subordinated bonds are not explicitly addressed in the Law "On Capital Markets and Organized Commodity Markets". We conclude that the regulatory framework necessary for implementing and applying securitization with tranching and subordinated debt financing in Ukraine's economy has a significant potential for further improvement and constitutes a promising direction for future researches.

Considering the advanced global experience of applying the mezzanine method of attracting investment, its prevalence and importance for energy facilities financing, we argue that the introduction and implementation of mezzanine financing in Ukraine's economy is essential for the post-war recovery and further development of the energy sector. This capital mobilization method has the potential to become one of the key instruments, along with debt, equity, and state/IFIs financing. Moreover, it will expand the range of instruments available for state/IFIs support, as they will be able to employ mezzanine financial instruments alongside other financing tools. Considering the justification of mezzanine financing alignment with the key principles for mobilizing investment in the energy sector, we argue that this financing method is promising and relevant in the context of its implementation and application in Ukraine for the energy sector recovery and development. In particular, the priority mezzanine forms are securitization with tranching and subordinated debt financing (subordinated loans and bonds), for which Ukraine's institutional framework is still being established, reflecting the early stage of institutional development of these areas.

Accordingly, the Hypothesis of this study has been confirmed – the implementation and application of mezzanine forms of capital raising will have a positive impact on the post-war recovery and development of the Ukrainian energy infrastructure. We recommend prompt implementation and institutionalization of mezzanine financing instruments in Ukraine's economy, while further steps and measures for their institutionalization may serve as direction for future research.

### Discussion and conclusions

The study demonstrates the significant impact of the environmental component on attracting investment in the energy sector and justified that the recovery of Ukraine's energy infrastructure should be pursued in alignment with the Sustainable Development Goals and ESG criteria.

It is substantiated that the key principles for mobilizing investment in the energy sector are: 1) principle of considering energy security and socio-economic stability aspects, 2) principle of mobilizing non-state (private) financing, 3) principle of minimizing the cost of investment capital, 4) principle of harmonizing cash flows from financial activities with those from operating activities of an energy facility, 5) principle of fair allocation of risks and returns (each specific type of risk should be managed by the party most competent and best adapted to handle it).

The study examined advanced global experience in financing energy infrastructure facilities, assesses the primary methods of capital mobilization (state/IFIs financing, equity, debt, and mezzanine), and proved that mezzanine

financing demonstrates significant relevance to the energy investment mobilization key principles.

It is justified that applying the mezzanine financing, which absorbs most of the default risks, enables the full volume of capital mobilization at an acceptable weighted average cost of capital. This phenomenon occurs due to a reduction to investment-grade level of both credit risks and the cost of senior debt financing, which in turn constitutes the bulk of the project's capital.

The study substantiates the high potential and relevance of the mezzanine financing for its implementation in Ukraine's economy with a view to post-war recovery and the sustainable development of energy facilities. The most relevant forms of mezzanine financing for implementation, institutionalization, and application in Ukraine's economy are identified as securitization with tranching and subordinated debt financing (subordinated loans and bonds). It is demonstrated that these mezzanine financial instruments can be employed both for raising capital from private investors on commercial terms and from the state/IFIs, with the subsequent unlocking of private investments in accordance with the principles of blended finance.

It is justified that the institutional framework for securitization with tranching and subordinated debt financing has the potential for further improvement and constitutes a promising area for future research.

It is recommended to ensure the prompt implementation and institutionalization of mezzanine financing forms in Ukraine's economy.

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## МЕЗОНІННЕ ФІНАНСУВАННЯ ЕНЕРГЕТИЧНОЇ ІНФРАСТРУКТУРИ УКРАЇНИ У ПЕРІОД ПОВОЄННОГО ВІДНОВЛЕННЯ

**Вступ.** Урядом України розроблено Енергетичну стратегію до 2050 р., що передбачає посилення енергетичної безпеки та незалежності й запроваджує цілі щодо енергоефективності, екологічної безпеки, зниження вуглецевих викидів тощо. Повоєнна відбудова з одночасною модернізацією енергетичного сектору України вимагатиме мобілізації значних фінансових ресурсів, тому актуалізується питання дослідження провідного міжнародного досвіду залучення інвестицій в енергетичну інфраструктуру. Метою статті є обґрунтування перспективних методів фінансування енергетичних об'єктів для впровадження та використання в українській економіці в період повоєнного відновлення.

**Методи.** Фактологічний і ситуаційний аналіз, синтез, дедукція, методи системного підходу та теоретичного узагальнення.

**Результати.** Проаналізовано світовий досвід застосування і поєднання методів фінансування енергетичної інфраструктури. Сформульовано основні принципи залучення інвестицій у сучасну енергетику. Дослідження містить аналітичні висновки з обґрунтуваннями щодо перспектив і актуальності впровадження та застосування в Україні мезонінного фінансування для повоєнного відновлення та розвитку енергетики. Особливо визначено найбільш пріоритетні й оптимальні мезонінні форми залучення інвестицій у енергетичний сектор.

**Висновки.** Визначено основні принципи залучення інвестицій в енергетичний сектор, а саме: врахування аспектів енергетичної безпеки та соціально-економічної стабільності, мобілізація недержавного фінансування, мінімізація вартості капіталу, гармонізація грошових потоків енергетичного проєкту, справедливий розподіл ризиків і доходу. На основі світового досвіду виконано порівняння основних методів мобілізації капіталу в енергетичну інфраструктуру (від держави / МФО, акціонерний, борговий, мезонінний). Обґрунтовано перспективність і актуальність мезонінного фінансування для впровадження і використання в українській економіці. Найоптимальнішими формами мезонінного фінансування для енергетики визначено сек'юритизацію з траншуванням і субординоване боргове фінансування. Встановлено, що інституційне забезпечення цих інструментів залучення капіталу має потенціал для вдосконалення, та є перспективним напрямом подальших досліджень. Рекомендовано якнайшвидше впровадження й інституціалізацію мезонінного фінансування в українську економіку.

**Ключові слова:** мезонінне фінансування, фінансування енергетичної інфраструктури, форми мезонінного фінансування, повоєнне відновлення енергетичного сектору України, сек'юритизація з траншуванням, субординований борг.

Автори заявляють про відсутність конфлікту інтересів. Спонсори не брали участі в розробленні дослідження; у зборі, аналізі чи інтерпретації даних; у написанні рукопису; в рішенні про публікацію результатів.

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