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## NORDIC COOPERATION AND UKRAINE'S ENERGY TRANSITION: GREEN FINANCING, SUSTAINABLE DEVELOPMENT, AND POST-WAR RECONSTRUCTION

**Summary.** The article is devoted to the study of Nordic cooperation in the context of Ukraine's energy transition, green financing, and post-war reconstruction. The key aspects of financial assistance provided by Nordic institutions, including the Nordic Environment Finance Corporation (NEFCO), the Nordic Investment Bank (NIB), and the Nordic Climate Facility (NCF), are examined. The role of these organizations in supporting Ukraine's renewable energy sector, energy efficiency projects, and climate resilience initiatives is analyzed.

The impact of green financing and public-private partnerships on Ukraine's economic recovery and integration into the European energy market is explored. It is determined that Nordic countries, as leaders in environmental sustainability, contribute significantly to Ukraine's sustainable development through financing and implementing green projects. The mechanisms of Nordic green financing, the allocation of grants and low-interest loans, and their impact on Ukraine's energy transformation are examined. Special attention is given to the challenges of implementing such projects, including regulatory barriers, governance structures, and financial sustainability issues.

The RePower Ukraine Initiative is analyzed as a crucial effort by Nordic institutions and European partners to restore and modernize Ukraine's energy infrastructure with a focus on renewable energy sources. The decentralization of the power grid, smart energy solutions, and climate adaptation strategies are highlighted as key components of Ukraine's post-war green reconstruction. The role of Nordic expertise in improving waste management, reducing industrial pollution, and enhancing biodiversity conservation is also considered, emphasizing the broader environmental benefits of Nordic-Ukraine cooperation.

It is established that despite the significant contributions of Nordic partners, challenges remain regarding governance, long-term sustainability, and the effective allocation of resources. The need to strengthen legal frameworks, improve coordination between Ukraine and Nordic donors, and ensure efficient management of financial aid is substantiated.

It is concluded that Nordic cooperation plays a vital role in Ukraine's path toward energy independence, climate resilience, and integration into the European energy network. The recommendations focus on enhancing financial mechanisms, streamlining policy frameworks, and promoting innovation through public-private partnerships. By leveraging Nordic green financing and technical expertise, Ukraine can accelerate its transition to a low-carbon economy, strengthen its energy security, and contribute to global climate commitments. The findings of this research provide valuable insights for policymakers, investors, and organizations engaged in Ukraine's sustainable development and post-war recovery.

**Key words:** Nordic cooperation; green financing; sustainable development; Ukraine; energy transition; renewable energy; post-war reconstruction; climate resilience; energy efficiency; financial law; international organizations.

**Problem Statement.** How is Ukraine supposed to ensure sustainable energy and economic self-sufficiency post-war? Especially at a time when the country is hoping to integrate into Europe? It is safe to say that Ukraine is in deep trouble. The devastating conflict has greatly destabilized the region with increased energy sources, a decarbonization strategy, and diversification of energy sources being a priority. Even without considering the war, the region is still grappling with environmental degradation, vulnerability of their energy infrastructure and security, and the clear over-dependence on fossil fuels, all of which are surely counterproductive.

While attempting to navigate through the geopolitical mess, Ukraine is struggling financially due to the lack of investment in green technology, gaps in policies and reasoning for European climate standard consideration, and finally, insufficient green financing options. To further complicate the issue, funding is provided by numerous international organizations, but the effective allocation of the resources is where the glass ceiling lies.

USAID partnered with Denmark, Finland, Iceland, Norway, and Sweden to effectively plan how to tackle these complex issues. For decades, the Nordic countries have been frontrunners in sustainable development, renewable energy, and protecting the environment and extend their financial assistance, technical skills, and policy support to the countries undergoing energy transformation. The Nordic Cooperation, through NEFCO, NIB, and NCF, provides loans, grants, and technical assistance for energy efficient infrastructure, renewable energy and environmental sustainability projects. However, the governance, sustainability, and scalability of the Nordic funded programs in Ukraine, remain concerns.

This is a study of the aspects of development within the effectiveness of Ukrainian-Nordic cooperation in the field of green investments, energy transition, and post-war reconstruction processes in Ukraine. The all-encompassing innovation and public-private partnerships in Ukraine are also subject of study in implementing the sustainability of Ukraine. This research also seeks to identify such areas that constitute effective Nordic-Ukraine collaboration and suggest how to improve the Nordic support for Ukraine's energy and stronger economic sustainability in the long term.

**Research review.** The topics concerning energy transition, green financing, and sustainable development have received attention across academic literature, policy documents, and international

development programs. Economists and experts have assessed the contribution of renewable energy, energy efficiency, and climate change adaptation to economic development expansion. In terms of Ukraine, the majority of projects have been focused on energy security, European integration, and international aid impact on the Ukrainian energy industry.

Reports by the International Energy Agency, World Bank, European Bank for Reconstruction and Development, and certain Nordic countries shed light on the issue of Ukraine's energy policy, investment climate, and other transition problems. Scholars noted the need to upgrade Ukraine's energy infrastructure in order to meet the requirements of European Union Paris Agreement and European Green Deal.

The Nordic Cooperation Organization together with its organizations such as Nordic Environment Finance Corporation, Nordic Investment Bank, and Nordic Climate Facility have been instrumental in funding renewable energy projects, green infrastructure, and energy efficiency improvements. Some studies and reports have evaluated the effectiveness of the Nordic-backed initiatives, underlining its contribution to the solar and wind energy development, municipal energy conservation programs, and green reconstruction in post-war Ukraine.

However, these initiatives are lacking in long-term sustainability, scalability, and governance. Many analyses have been conducted regarding the effect of Nordic financing on Ukraine's energy sector, however there needs to be more focus on the policy implementation challenges, financial sustainability, and overall integration with Ukraine's economic recovery strategy. Furthermore, examining the use of public-private partnerships, innovation funding mechanisms, and institutional cooperation in regards to amplifying collaboration between the Nordics and Ukraine is a relatively unexplored area.

This article seeks to address the aforementioned issues by focusing on the different Nordic financial instruments, their consequences on Ukraine's energy transition, and the barriers to implementation. The research also provides policy suggestions that would facilitate collaboration between the Nordic countries and Ukraine in achieving a sustainable economy and energy sufficiency.

**The main aim.** The purpose of this article is to evaluate the activities of the Nordic Cooperation Organization regarding Ukraine's energy transition and sustainable economic development. The purpose of the study is to analyze the effectiveness of green financing, public-private partnerships (PPPs), and other innovations on Ukraine's economic transformation towards a low-carbon powered energy economy.

Specifically, the research seeks to:

1. Determine the financing provided by Nordic financial institutions including Nordic Environment Finance Corporation (NEFCO), Nordic Investment Bank (NIB), and Nordic Climate Facility (NCF) towards the development of renewable energy and the improvement of energy usage efficiency in Ukraine.

2. Assess the impact of Nordic supported developments in Ukraine's energy infrastructure modernization, solar, wind and biomass energy, as well as smart buildings and municipalities features on the public and municipal energy marketing activities.

3. Investigate the involvement of Nordic public-private partnerships (PPPs) in urban sustainability including waste management, environmental protection, and investment in non-governmental organization for development (NGO-D) for sustainable development initiatives.

4. Investigate the focus areas of the post-war reconstruction spent by, or financed by, other Nordic countries, in terms of green approach to reconstructing the energy, security and climate in war-torn parts of Ukraine.

5. Determine the most significant challenges and obstacles to utilizing the Nordic funding available to Ukraine such as policy compliance requirements, financing gaps, institutional silos, and long-term project sustainability.

Suggest solutions that would deepen Nordic-Ukrainian synergies, improve the effectiveness of financial and technical support, and facilitate the implementation of green energy policies as part of Ukraine's national development strategy.

Through these aims, the article targeting these objectives seeks to advance sustainable energy transitions, regional cooperation as well as post conflict economic rebuilding, which showcases how Nordic Ukraine relations can evolve in such a way that Ukrainian economic growth is achieved through climate friendly self sustaining development.

**Presentation of the Main Material.** Belonging to the Nordic nations Denmark, Finland, Iceland, Norway and Sweden, the Nordic Cooperation Organization serves as one of the sustainable development regional cooperation examples. The achievements of economic and environmental sustainability within the member and partner states have enabled the organization to become a frontrunner in environmental protection, energy efficiency, and innovation. The partnership of Ukraine and Nordic institutions has also enabled the country to foster initiatives for renewable energy, environmental protection, and energy efficiency in line with its broader European integration goals. This section describes the activities undertaken by the Nordic Cooperation Organization as an economic instrument for aiding environmentally sustainable development, focusing on the enhancement of Ukraine's environmental and energy goals.

1. Green Financing and Climate Funds: o The Nordic Environment Finance Corporation is an important player in fostering green investments. NEFCO provides loans and other forms of financial aid to deliver medium and small scale projects that result in positive environmental and climate impacts. Such projects tend to involve renewable energy generation, pollution reduction, and efficient resource use. o The Nordic Climate Facility provides support to implement innovative climate change adaptation and mitigation efforts in developing and transitional economies. NCF focuses on projects with replicable and scalable results through the use of their competitive grant system in meeting the SDGS. [1]

Public-Private Partnerships (PPPs): o Nordic countries use public private partnerships PPPs in order to achieve private funding for sustainable development. These types of collaborations use governmental funding combined with private sector funding to achieve projects in renewable energy, urban sustainability, and waste management. o For example, the Nordic Investment Bank NIB provides long term loans to infrastructure development projects that improve energy utilization and carbon emission reduction with low interest rates on projects that prove to be sustainable. [2]

3. Innovation Grants: The Nordic Innovation organization is committed to the promotion of new ideas and business ventures and provide grants to supports to provide startups and small businesses with green growth and circular economy solutions.

These instruments aim to encourage positive conduct in relation of nations, companies and the civil society, which results in raising the position of Nordic Cooperation as a top organization in climate

and environmental funding. Interaction with Ukraine: Participation in Environmental and Energy-Efficient Initiatives

The Nordic Cooperation Organization has responded actively to Environment issues and energy transition challenges in Ukraine by strengthening the collective action to support renewable energy and energy efficiency.

#### 1. Support for Renewable Energy Projects 1:

Ukrainian renewable energy projects have been significantly financed by Nordic Environment Finance Corporation (NEFCO). Starting from 2010, NEFCO invested in solar, wind and biomass energy projects in Ukraine to achieve energy diversification and diminish fossil fuel consumption.

Other initiatives involve financing for wind energy generation in coastal areas and solar farms placed in southern Ukraine. NEFCO provides funding through low interest loans combined with grants, which support the economic feasibility of these initiatives.[4]

#### 2. Energy Efficiency and Green Cities:

- The Nordic Cooperation Organization has funded efforts to enhance energy-saving measures in publicly used structures like schools, hospitals, and offices in collaboration with Ukrainian municipalities. Efforts NEFCO has done as part of the Energy Saving Credits Facility are enabling the installation of the modern technologies such as insulation, LED lighting, and smart heating systems into existing buildings.

- The CECU program has been subsidized by the Nordic Council of Ministers and offers technical support and funds to the municipalities for clean energy transitions in Ukraine [5].

#### 3. Environmental Protection and Climate Resilience:

- Ukraine has gained from Nordic skills in the areas of restoration of the environment and temperature change adaptability. Resource contributions from Nordic countries have been targeted at restoring unsightly polluted rivers, decreasing emission from industries, and improving conservation of biodiversity.

- For example, the Nordic-Baltic collaboration on waste management has helped Ukrainian cities apply Nordic standards in recycling wastes and converting it to energy.

#### 4. Post-War Green Reconstruction:

- As a response to the sustained conflict in Ukraine, Nordic countries have stressed the need for building green in the reconstruction of damaged infrastructures. This is in conjunction with renewable energy investments in areas that have been devastated by war and is in the company of NEFCO and the Nordic Investment Bank.

It was initiated together with NEFCO and other EU partners, seeking to reconstruct Ukraine's energy infrastructure by placing emphasis on renewable sources and strengthening the power grid's ability to withstand disruptive events. This is furthered by the RePower Ukraine Initiative which seeks to build Ukraine's power infrastructure.

**Conclusion.** The Nordic Cooperation Organization has provided invaluable support during Ukraine's transition to energy sustainability and economic growth via funds, technical assistance, expertise, and policy collaboration. Institutions such as the Nordic Environment Finance Corporation (NEFCO), the Nordic Investment Bank (NIB), and the Nordic Climate Facility (NCF) have made substantial contributions towards the advancement of renewable energy, energy efficiency, and environmental protection in Ukraine.

The study claims that green financing mechanisms, public-private partnerships (PPPs), innovation grants, and other forms of

assistance have proven crucial in reducing reliance on fossil energy, modernizing public infrastructure, and increasing climate adaptive capacity. Nordic-bloc countries have successfully financed and implemented solar, wind, and biogenic energy power plants in Ukraine, as well as smart energy public construction and sustainability projects in municipalities aimed at ameliorating the conditions of urban living.

Among them, perhaps, one of the most important aspects of cooperation with the Nordic countries: Ukraine's post-war green reconstruction. Both the RePower Ukraine Initiative as well as other Nordic-supported undertakings arrange the construction of resilient, decentralized energy systems in a way that ensures compliance with European sustainable development requirements. Integrating renewable energy sources, smart grids, and energy-efficient technologies enhances energy security, while simultaneously fostering economic and environmental sustainability.

Certain problems persist associated with sustainability, governance, and scalability of these measures. The policies, finance, and institutions supporting Nordic Aid need to be better coordinated. Better legal frameworks, increased engagement from the relevant stakeholders, as well as greater effectiveness in the implementation of funded projects will be central for Ukraine's energy transition.

These reasons are sufficient to claim that Nordic-Ukrainian relations are a beacon of hope for collaboration in the region on issues of sustainable development. Ukraine needs to take advantage of Nordic aid to transition to a green economy, improve climate change mitigation capabilities, increase energy independence, and overall economic development to enhance European engagement.

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**Іванова Р. Північне співробітництво та енергетичний перехід України: екологічне фінансування, сталий розвиток та післявоєнна відбудова**

**Анотація.** Стаття присвячена дослідженню співробітництва Північних країн у контексті енергетичного переходу України, екологічного фінансування та післявоєнної відбудови. Розглянуто ключові аспекти фінансової допомоги, що надається Північними інституціями, зокрема Північною екологічною фінансовою корпорацією (NEFCO), Північним інвестиційним банком (NIB) та Північним кліматичним фондом (NCF). Проаналізовано роль цих організацій у підтримці відновлюваної енергетики, підвищенні енергоефективності та зміцненні кліматостійкості України.

Розглянуто вплив зеленого фінансування та державно-приватного партнерства на економічне відновлення України та її інтеграцію до європейського енергетичного ринку. Визначено, що Північні країни, як лідери у сфері екологічної стійкості, суттєво сприяють сталому розвитку України через фінансування та реалізацію зелених проєктів. Досліджено механізми північного екологічного фінансування, розподіл грантів і низьковідсоткових кредитів та їхній вплив на трансформацію енергетичного сектору України. Особливу увагу приділено викликам у реалізації таких проєктів, зокрема нормативно-правовим бар'єрам, управлінським структурам та питанням фінансової стійкості.

Проаналізовано ініціативу RePower Ukraine як важливий напрям співпраці між північними інституціями та європейськими партнерами для відновлення та модернізації енергетичної інфраструктури України із фокусом на відновлювані джерела енергії. Підкреслено значення децентралізації енергомережі, розумних

енергетичних рішень та кліматичної адаптації як ключових елементів післявоєнної зеленої реконструкції. Також розглянуто роль північного досвіду у вдосконаленні управління відходами, зниженні промислового забруднення та посиленні заходів зі збереження біорізноманіття, що підкреслює ширші екологічні вигоди північно-української співпраці.

З'ясовано, що попри значний внесок Північних країн, залишаються виклики, пов'язані з управлінням, довгостроковою стійкістю та ефективним розподілом ресурсів. Обґрунтовано необхідність посилення нормативно-правової бази, покращення координації між Україною та північними донорами та забезпечення ефективного управління фінансовою допомогою.

Зроблено висновок, що північне співробітництво відіграє важливу роль у забезпеченні енергетичної незалежності України, підвищенні кліматичної стійкості та інтеграції до європейського енергетичного простору. Надані рекомендації спрямовані на вдосконалення фінансових механізмів, оптимізацію політичних рамок та стимулювання інновацій через державно-приватні партнерства. Використовуючи північне екологічне фінансування та технічний досвід, Україна зможе прискорити перехід до низьковуглецевої економіки, зміцнити енергетичну безпеку та зробити свій внесок у глобальні кліматичні зобов'язання. Результати цього дослідження надають цінні висновки для політиків, інвесторів та організацій, які залучені до сталого розвитку та післявоєнного відновлення України.

**Ключові слова:** Північна співпраця; зелене фінансування; сталий розвиток; Україна; перехід енергії; відновлювана енергія; післявоєнна відбудова; кліматостійкість; енергоефективність; фінансове право; міжнародні організації.