

Ukraine's Energy Sector Security and Sustainable Development in Light of the War with Russia

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We are swiftly nearing the end of the decade since the United Nations General Assembly adopted a resolution that endorsed an all-encompassing action plan for sustainable development up to the year 2030. The final document, titled "Transforming our World: The 2030 Agenda for Sustainable Development," delineates 17 Sustainable Development Goals (SDGs) and 169 targets, representing an unparalleled global commitment to sustainable collaborative endeavors aimed at a comprehensive and universally synchronized international cooperation initiative. This international commitment seeks to yield advantages for everyone, spanning current and forthcoming generations, while upholding the rights and responsibilities of nations as dictated by international law. Ukraine, as a forward-thinking nation aspiring to integrate seamlessly into the rapidly evolving European and global community, lends its support to the pursuit of the SDGs. Consequently, acknowledging the distinctive context of our country's progress, Ukraine has crafted the "Sustainable Development Goals: Ukraine" National Report. In December 2020, the Cabinet of Ministers of Ukraine underscored the significance of incorporating the SDGs into the conception and execution of all pertinent facets of state policy. As a result, the SDGs have evolved into guiding tenets on the domestic stage, molding both programmatic and anticipatory documents. The latest energy security assessments by the United Nations Development Programme (UNDP) underscore the substantial repercussions stemming from disruptions to pivotal substations and major generation facilities, including thermal power plants and combined heat and power plants (CHPs), on critical urban infrastructure. The centralized generation framework also poses obstacles to consumption regulation and hampers the assimilation of renewable energy sources, such as solar and wind, which are pivotal for curtailing carbon dioxide emissions.

To tackle these issues, coupled with the devastating effects of Russian military aggression, it is crucial to develop additional maneuvering capacities within the power system. Constructing modern, highly maneuverable, and environmentally friendly generation facilities, including thermal biomass plants, electricity storage systems, and hydroelectric storage facilities, dispersed throughout the territory, will enhance system flexibility and promote the utilization of renewable energy sources. Increasing the share of renewables in the power system is a priority. Implementing strict regulations on solar power plant construction without energy storage devices and coordinating the development of wind generation capacities with the expansion of flexible power generation capacities are necessary steps to achieve sustainable growth in the energy sector.

Keywords: wartime sustainable development, UN 2030 Agenda, UNDP assessment, infrastructure damage and innovation, decarbonization of the energy sector.

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Introduction

As global attention turns increasingly towards sustainable development and mitigating the impacts of climate change, the energy sector plays a pivotal role in shaping the trajectory of a greener future. However, in conflict and post-conflict settings, where infrastructure has been severely damaged and socio-economic stability remains fragile, the pursuit of sustainable energy transitions presents unique challenges. This article aims to shed light on the capacity of such settings to draw investments and implement sustainable energy developments, going beyond mere charitable relief programs. Additionally, it explores the long-term potential of renewable energy investments in conflict and post-conflict regions, specifically when viewed through the lens of the United Nations sustainable development goals (SDGs).

Post-war countries often face numerous obstacles when attempting to attract investments and rebuild their economies. At the same time, the energy sector holds the promise of driving both economic growth and environmental sustainability. With proper planning and strategic investments, it can facilitate a transition towards decarbonized energy systems, which aligns perfectly with the United Nations' sustainable development goals International Agenda 2030. In particular, renewable energy, such as solar, wind, and hydropower, holds enormous potential in such settings due to its adaptability and the abundance of untapped natural resources. Hence, this research will attempt a foray into this topic, highlighting the role of international collaborations, public-private partnerships, and innovative financing mechanisms in driving these projects forward (Pohodenko, 2023). While charitable relief programs are crucial for addressing immediate humanitarian needs, they are often short-lived and insufficient for driving sustainable development in conflict and post-conflict regions. This research, therefore, emphasizes the importance of providing for energy security, fostering economic stability, and creating employment opportunities for local communities. In particular, the article will highlight the potential for win-win scenarios where investors can benefit from profitable ventures while contributing to the social and environmental betterment of the region.

Investing in the energy sector in conflict and post-conflict settings is not without challenges. The article will delve into the obstacles, such as political instability, security risks, and regulatory uncertainties, while examining the role of capacity-building initiatives, policy frameworks, and risk mitigation strategies in creating an enabling and fruitful environment for sustainable energy capacity development.

As the world strives to achieve the United Nations sustainable development goals, energy transitions in conflict and post-conflict settings emerge as crucial opportunities for progress. By examining successful examples of renewable energy developments in such regions, this research demonstrates that sustainable investments in the energy sector can be a catalyst for long-term growth, environmental preservation, and socio-economic stability. Collaborative efforts from governments, international organizations, and private investors are essential to harness the untapped potential of these settings and pave the way for a greener and more sustainable future (Vinuales, 2023).

The building blocks of the energy transition agenda

The invasion of Ukraine occurred during a critical juncture marked by insufficient progress towards achieving the net-zero transition. Economic challenges were hindering the acceleration of this transition, while mounting physical risks underscored the urgency of addressing climate change. Even before the invasion, despite increasing public- and private-sector commitments in 2021, the world was not on track to achieve net-zero greenhouse gas emissions by 2050. Even if all existing commitments were met, global warming temperatures would still surpass the desired stabilization target of 1.5°C. Moreover, many of these commitments lacked the necessary financial backing and execution plans (Samandari et al., 2022).

Prior to the invasion, the global economy was grappling with multiple preexisting conditions. The COVID-19 pandemic, a once-in-a-century crisis, caused an estimated 25 million deaths and significantly impacted the world economy, increasing global public debt and leading to a decline in global GDP. As a result, supply chains were strained, energy markets were tight, and commodity prices had soared to ten-year highs. Russia's invasion of Ukraine further exacerbated these trends, posing a threat to lives, livelihoods, energy security, and food affordability for vulnerable populations worldwide (Ibid).

At the same time, the effects of climate change were becoming increasingly apparent, with extreme heat waves in India and worsening droughts in the American West. The United Nations Intergovernmental Panel on Climate Change Sixth assessment report, released shortly after the invasion, issued a dire warning that climate change was already having significant impacts on human and natural systems. It emphasized the urgent need for action to avert the most catastrophic consequences of continued warming. At the global scale, as we assess the potential impact of the ongoing conflict on climate action, it is crucial to recognize that the absence of climate action could, in turn, escalate the risks of future conflicts, both within and between nations, as competition over scarce resources such as food and water intensifies.

In light of these challenges and the interconnectedness of the said global issues, addressing climate change and promoting sustainable practices becomes more imperative than ever in that there is a pressing need for the international community to come together in order to build resilient and equitable strategies that not only mitigate the effects of climate change but also foster stability and cooperation in the face of mounting geopolitical challenges. Only through concerted efforts can we hope to secure a sustainable and prosperous future for all.

The transition towards a sustainable energy system relies on three main physical building blocks: technology innovation, the establishment of efficient supply chains to facilitate the deployment of new technologies, and access to crucial natural resources (Ibid). However, recent developments such as disruptions to production and distribution centers in Ukraine, economic sanctions against Russia, and reduced international cooperation have impacted these underlying sustainability foundations. Accordingly, in the short term, technological innovation is likely to accelerate as stakeholders seek more cost-effective alternatives to mitigate the effects of rising energy and commodity prices. Additionally, there is an increasing recognition of the importance of measures such as carbon capture and sequestration. As a result, renewable energy funds have experienced a notable influx of capital, reversing a previous downward trend (Galeta, 2022).

Conversely, challenges may arise in executing the scenario whereby we expand net-zero infrastructure to accommodate logistical stresses resulting from market reorganization due to sanctions and soaring energy prices. These pressures can strain the intricate multinational

supply chains essential for net-zero technology and cause a nationwide energy sector crisis. However, the most significant negative near-term impact on the physical building blocks is expected to stem from reduced access to key natural resources. Russia's dominant position in crucial minerals like copper, nickel, and silicon has already caused a significant supply-side shock. These materials are vital inputs for essential net-zero technologies such as onshore and offshore wind turbines, solar panels, electric vehicles, and battery storage. The war in Ukraine could lead to shortages, exacerbating an already strained renewables supply chain, which has seen long-term contracts for wind and solar generation increase by 19% and 12%, respectively, over the past year (Ukraine Energy Damage Assessment, 2023).

The interplay between technology innovation, supply chains, and access to natural resources remains critical in the ongoing energy transition. While some areas may experience positive developments, the challenges brought about by geopolitical and economic disruptions necessitate careful consideration and strategic planning to ensure a successful and sustainable transition to a net-zero energy future.

UN sustainability benchmarks

Published in 2017 United Nations report presents the adapted results of 17 global Sustainable Development Goals (SDGs) in the specific context of Ukraine. Taking into account the long-term global sustainability agenda, national forecasts up to 2030 were developed using multifaceted scenario approaches to chart the country's protracted development trajectory. The Data for this report was sourced from the State Statistics Service of Ukraine and included valuable contributions from other relevant line ministries.

In particular, the Ministry of Economic Development and Trade of Ukraine spearheaded this participatory process in 2016, engaging in discussions on SDGs within various groups that included a wide range of sustainability topics touching on equitable social development, sustainable economic growth and employment, effective and accountable management, putting an impartial judicial system in place, as well as striving towards environmental equilibrium and sustainable development. In total, over 800 leading experts in the variegated thematic SDG areas contributed proposals and actively participated in establishing national tasks to ensure efficient strategies are pursued with sufficient oversight and unbiased assessments. To this end, a vast majority of experts represented relevant ministries, government agencies, UN agencies in Ukraine, international organizations, the business community, expert groups, public organizations (with a focus on representing vulnerable groups' interests), as well as representatives of the broader civil society (Sustainable Development Goals, 2017). As a result, the process received unilateral support from all UN agencies in Ukraine, especially the United Nations Development Programme (UNDP), which took on the task of providing secretarial support.

As a result, the report is a fruitful cumulative outcome of this participatory and inclusive process, offering a roadmap for Ukraine's development 10+ years ahead up to the year 2030 based on 17 specific goals. Of particular importance to us are goals 7, 9, 11 and 12. Hence, the decarbonization of the energy system stands as one of the most significant and urgent challenges of the 21st century. As the energy sector contributes approximately two-thirds of global CO₂ emissions, the imperative to develop a climate-friendly energy system based on renewable sources becomes paramount in combating climate change. This profound transformation extends beyond technical infrastructure and holds far-reaching economic and societal implications, making it a crucial area of study for transformative research at RIFS (Ibid).

The energy transition not only drives the adoption of renewable technologies but also sparks the emergence of innovative business models and organizational forms. It leads to the development of new practices and ways of life, redefines responsibilities, reshapes governance structures, and redistributes power dynamics. Within RIFS, five research groups investigate these change processes within the context of the energy transition, collaborating with societal stakeholders to devise sustainable solutions.

A particular emphasis of this research lies in exploring the social, political, and institutional dimensions of the energy transition. Researchers delve into the multifaceted evaluation of socio-technical options to foster a low-carbon economy. The institute's work involves considering the broader implications of these options, acknowledging the interconnectedness of social and technical aspects (Ibid). Internationally, various European and global research groups are dedicated to studying the social sustainability of the energy transition. Additionally, they focus on examining the potential transformation of international governance and cooperation in the context of a global energy transition. This collaborative effort aims to address the complexities and challenges associated with transitioning to a more sustainable and climate-resilient energy system on a global scale.

Another related crucial aspect of this involves cooperation between Ukrainian researchers and their European and international counterparts. Together, they investigate the potential benefits and risks associated with conflict and post-conflict settings capacity to attract investments and undertake sustainable energy transitions. This collaboration aims to surpass purely charitable relief programs, offering insights into how these settings can navigate their energy needs in a way that ensures long-term sustainability and resilience (Towards a Green Transition, 2023).

Overall, the work being conducted at RIFS and among international partners underscores the urgency of addressing the energy transition and its multi-dimensional impact. By studying diverse aspects of this transformative process, researchers strive to shape a future characterized by a low-carbon economy and a more sustainable and equitable energy system.

UNDP data assessment and sustainability forecasting

The obsolescence of coal-fired generation presents a unique opportunity for the acceleration of the energy sector green transformation, recovery, and decentralization in Ukraine. This entails phasing out coal and distributing generation capacities, requiring a combination of advanced technology, a greener energy mix, improved governance, and access to financing. Considering limitations on grant financing availability, infrastructure projects funded by international partner grants should serve as pilot project testing ground. These projects can then be expanded through private and blended private-public financing, becoming key elements in a multi-step transformation.

To achieve a greener energy mix, adopting superior technologies such as upgrading standards and high voltage transmission and developing decentralized generation for power backup and enhanced flexibility is crucial. The introduction of energy storage systems can catalyze the development of wind and solar capacities. Hence, measures like raising alternative energy capacity potential through support for biomass-fired generation, as well as investing in green technologies like wastewater treatment, coal phase-out, and reducing CO₂ and methane emissions, further promotes sustainable energy practices (Ukraine Energy Damage Assessment, 2023).

Infrastructure investments must be accompanied by consistent efforts to strengthen governance and transparent access to financing. Establishing an “Accelerator” will prioritize and upscale prioritized projects to enhance and bolster Ukraine’s recovery efforts. Institutional partnerships should unite investment attraction and infrastructure project implementation while enhancing good governance. Improving management capacity, with particular emphasis put on municipal utilities, making sure the private sector is fully engaged in recovery, as well as taking advantage of various risk mitigating mechanisms while promoting decarbonized energy sector development are essential steps in this process.

To ensure effective planning and implementation of Ukraine’s energy sector recovery, data transparency and regular updates are vital. The UNDP supports the Government of Ukraine in setting up a centralized database to consolidate energy sector losses, cross-check data during the war, and monitor recovery efforts. Engaging in an initial assessment of the energy and critical municipal infrastructure’s current state is crucial, analyzing prerequisites for locally-led sustainable recovery goals at both national and local levels. The destruction of the Kakhovka Dam severely impacted critical infrastructure in the Kherson area, with reliable information regarding its effects on the national power system as a whole is still pending. Still, preliminary evaluations already suggest that over 200 distribution power substations and dozens of boiler houses were destroyed. UNDP has commenced data collection and will present its findings in the next RDNA report (Ukraine Energy Damage Assessment, 2023).

Solutions to the energy supply crisis

Enhancing the energy security of cities requires prioritizing power supply to critical infrastructure facilities during power grid failures. Presently, large cities and urban areas in Ukraine account for about 70% of the population, concentrating significant electricity, heat, water supply, and sewage systems within a relatively small area. Disruptions in electricity provision lead to the absence of essential services for the population. Ukraine’s power system (IPS) is a large centralized network with a concentration of generating capacities in specific regions, making it vulnerable to attacks. Damage to key substations and large generation facilities, such as thermal power plants and CHPs, significantly impacts critical city infrastructure. Centralized generation also poses challenges in regulating consumption and hinders the integration of renewable energy sources like solar and wind, crucial for reducing CO₂ emissions (Towards a Green Transition, 2023).

In order to effectively address these challenges, it is paramount that our government focuses on developing additional maneuvering capacities in the power generation system. Building modern, highly maneuverable, and environmentally friendly generation facilities, such as thermal biomass plants, electricity storage systems, and hydroelectric storage facilities, dispersed across the territory will improve system flexibility and enhance the use of renewable energy sources. Increasing the share of renewables in the power system is a priority. Strict regulations on constructing solar power plants without energy storage devices and coordinated development of wind generation capacities with increasing manoeuvring capacities are necessary for sustainable growth (Kuzmenko, 2022).

To ensure energy sustainability, there should be a gradual phase-out of coal generation. Existing coal-fired facilities are inefficient, outdated, and exceed their intended lifespan. The abandonment of coal will not only fulfill Ukraine’s international commitments to reduce emissions but also enhance environmental friendliness and efficiency. During the phase-

out of coal, the development of natural gas production can serve as a transitional substitute. Maximizing domestic gas production to meet demand will boost energy security, particularly during systemic power system failures. The engagement of private investors and modern technologies is crucial for developing domestic gas production (Ibid).

Nuclear generation remains a foundational power source, requiring gradual modernization of the reactor fleet and dispersed nuclear generation based on small modular reactor technology. Additionally, enhancing large hydropower, particularly pumped storage power plants, will increase hydropower generation capacity, contributing to power system balance. Overall, implementing these measures will foster a more secure, sustainable, and flexible energy sector in Ukraine, aligning with mid-term energy sector priorities.

Conclusions

In order to address these challenges, the development of added maneuvering capabilities within the power grid becomes imperative. The creation of contemporary, exceptionally adaptable, and eco-conscious generation infrastructures is essential. This encompasses advanced thermal biomass plants, electricity storage networks, and hydroelectric storage installations, strategically distributed across the region. This strategic placement will bolster the adaptability of the system and advance the utilization of renewable energy resources. Elevating the proportion of renewables within the power framework stands as a pivotal nationwide objective.

Enforcing stringent regulations regarding the establishment of solar power facilities devoid of energy storage mechanisms, alongside orchestrating the expansion of wind-generated power capacities in conjunction with the amplification of supply power generation capabilities, emerges as indispensable measures to attain sustainable progress within the energy domain.

Ukraine's aspirations aimed at integrating into the European and global community is fully synchronized with and supports the pursuit stated in line with the UN Sustainable Development agenda. Hence, by recognizing the unique context of our country's development reflected in the National Report on "Sustainable Development Goals: Ukraine" it is paramount to underscore the importance of considering the said SDGs in the formulation and implementation of all relevant aspects of state policy. Accordingly, the SDGs ought to become the guiding principles at the national level, with particular emphasis put on shaping the transformation and development of our energy sector as Ukraine attempts to transition to a higher level of a resilient carbon-free economy model, taking into account Russia's continued efforts to destabilize and destroy our energy system and infrastructure.

The author is convinced that amidst the many challenges posed by Russia's destabilizing activities our policy-makers, scientists, educators, and the general public must take all of the necessary steps to adapt to these shifting imperatives. This, in turn, calls for a more flexible strategic model of sustainable development, one that prioritizes socio-economic, environmental, and educational aspects. By adopting comprehensive EU policies that address these pressing challenges at the systemic level, Ukraine can cement its commitment to sustainable development in the face of current turbulent circumstances.

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