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Ukraine Reform Tracker: Energy and Environment Reforms

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About the report

Maintaining momentum in Ukraine's ambitious reform programme will be essential to the nation's recovery after the war. With the aim of stimulating and supporting discussion on this matter at the 2022 Ukraine Recovery Conference (URC), Economist Impact presents the *Ukraine Reform Tracker*.

The *Ukraine Reform Tracker* analyses the state of reforms across four key areas: **economic reforms, environmental** and **energy reforms, social reforms and governance reforms** (mirroring the key themes of the 2022 URC). Economist Impact has produced a policy brief for each reform area, with an assessment of: 1) reform progress since 2014; 2) the resilience of reforms in 2022, in particular given the stresses of the ongoing war with Russia; and 3) the outlook for reform, with a focus on the role that reforms will play in facilitating Ukraine's recovery. These policy briefs are accompanied by an interactive data story that visualises the key trends in Ukraine's reform progress since 2014.

Importantly, the *Ukraine Reform Tracker* does not attempt to provide a wholly comprehensive account of every reform that has been implemented in Ukraine since 2014. Instead, the tracker focuses on the most salient components of Ukraine's reform programme, which will best support an understanding of the contribution of reform to Ukraine's past, present and future development.

Progress since 2014

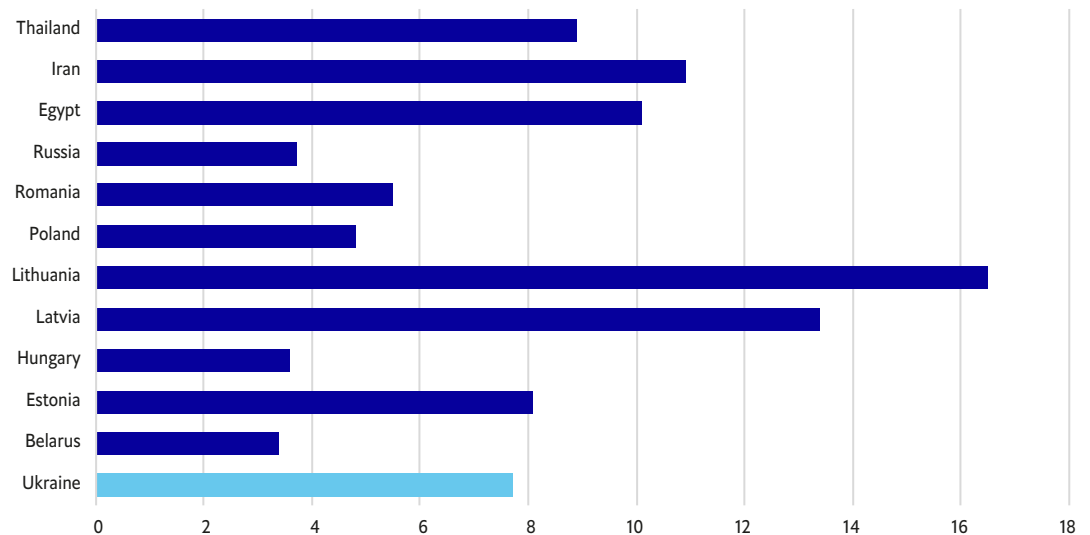
Environmental and energy reforms are key to assuring the long-term security and sustainable growth of the Ukrainian state. While Ukraine has made some progress towards facilitating its green transition (the transition towards an economy that is sustainable, resource efficient and carbon neutral), particularly through efforts to foster renewable energy production, its broader climate policy achievements remain relatively limited. A programme of energy reforms sought to integrate Ukrainian energy and electricity networks with the EU and reduce the energy intensity of the Ukrainian economy, reflecting the critical imperative to safeguard the country’s energy security. Despite some progress

in ensuring the sustainable management of Ukraine’s forests and the expansion of national nature reserves, significant challenges remain in terms of environmental protection. These include insufficient protections for water resources and unaddressed shortcomings in Ukraine’s waste management practices.

Green Transition

Ukraine’s ambitions for its green transition were laid out in the government’s ‘Low Emission Development Strategy of Ukraine until 2050’, published in 2017, which declared

Climate Change Performance Index: Climate Policy (0 to 20, 20 = good)



decarbonisation of the energy system to be one of the main objectives of government policy.¹ In line with this policy, the 'State Environmental Policy of Ukraine up to 2030'² set ambitious goals of achieving a 12% renewable share in Ukraine's total energy mix by 2025, and 17% by 2030, while the 'Energy Strategy of Ukraine until 2035' envisioned that renewables would make up 25% of the nation's total energy mix by 2035.³ To achieve this goal, the government introduced initiatives to boost renewable energy production, including the use of generous 'feed-in' tariffs (initially legislated for in 2008, but only properly implemented in 2015),⁴ under which the state purchases electricity at a higher price from individuals and legal entities that use renewable sources for electricity production. As such, Ukraine has managed to rapidly increase the share of its energy supply from renewable sources every year since 2014, rising from 2.6% to 6.6% in 2020.⁵ While this growth is impressive, it is important to note that Ukraine's renewable energy production started from a very low base and it continues to lag behind many of its neighbours (the equivalent figure for Poland in 2020, for example, is 16.1%).⁶ While ongoing steps to introduce a new renewable energy auction system and develop new avenues for greener energy production (including green hydrogen⁷ and biogas⁸) may facilitate further progress,

Ukraine is likely to struggle to meet its ambitious goal of achieving a 12% renewable share in its total energy mix by 2025.

Ukraine devoted less policy focus to reducing the carbon intensity of other sectors of the economy than it has to boosting renewable energy production.⁹ While 'Ukraine's 2050 Green Energy Transition Concept'¹⁰ highlights the need for Ukraine to decarbonise transport, for example, evidence for the implementation of this in practice is scarce. Similarly, little has been done to decarbonise the steel sector, a cornerstone of Ukrainian industry. As Low Carbon Ukraine reports, 'CO₂ emissions of the Ukrainian steel sector are substantial', and a product of 'relatively unmodernised, Soviet vintage plants'.¹¹ Despite Ukraine's stagnation in this policy agenda, there has been a consistent decrease over time in the carbon intensity of the Ukrainian economy. According to the International Energy Agency, while Ukraine produced 2.3kg of carbon dioxide per unit of GDP (measured in 2015 US\$) in 2014, this figure was just 1.7kg in 2020.¹² Unfortunately, this trend likely reflects a general decline in industrial production in the country, rather than the impact of government reforms. Looking forward, it is important to note that while government intervention will be crucial in encouraging the modernisation and

¹ https://unfccc.int/sites/default/files/resource/Ukraine_LEDS_en.pdf

² <http://extwprlegs1.fao.org/docs/pdf/ukr190982.pdf>

³ <https://www.kmu.gov.ua/en/news/250210653>

⁴ <https://www.hg.org/legal-articles/feed-in-tariff-reform-in-ukraine-37965>

⁵ State Statistics Service of Ukraine. 'Energy Consumption from Renewable Sources for 2007-2020'. www.ukrstat.gov.ua

⁶ https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics

⁷ <https://balkangreenenergynews.com/cms-ukraine-overview-of-the-hydrogen-power-industrys-prospects-in-ukraine/#:~:text=Green%20hydrogen%20is%20now%20set%20to%20become%20one,with%20a%20high%20potential%20for%20producing%20low-carbon%20hydrogen.>

⁸ <https://www.ukrinform.net/rubric-economy/3500644-ukraine-can-completely-abandon-gas-imports-due-to-own-production-operator-chief.html>

⁹ <https://climateactiontracker.org/countries/ukraine/2021-12-13/policies-action/>

¹⁰ Ministry of Energy And Environmental Protection of Ukraine. January 2020. 'Green Energy Transition of Ukraine until 2050'. <http://uwea.com.ua/en/news/entry/ukraina-planiruet-osuschestvit-zelenyj-energeticheskij-perehod-k-2050-godu/>

¹¹ <https://www.lowcarbonukraine.com/wp-content/uploads/Towards-a-decarbonisation-of-Ukraines-steel-sector.pdf>

¹² International Energy Agency Data Service. <https://www.iea.org/data-and-statistics/data-browser/?country=UKRAINE&fuel=CO2%20emissions&indicator=CO2ByGDP>

decarbonisation of the economy, the role of the private sector will also be key in driving progress.

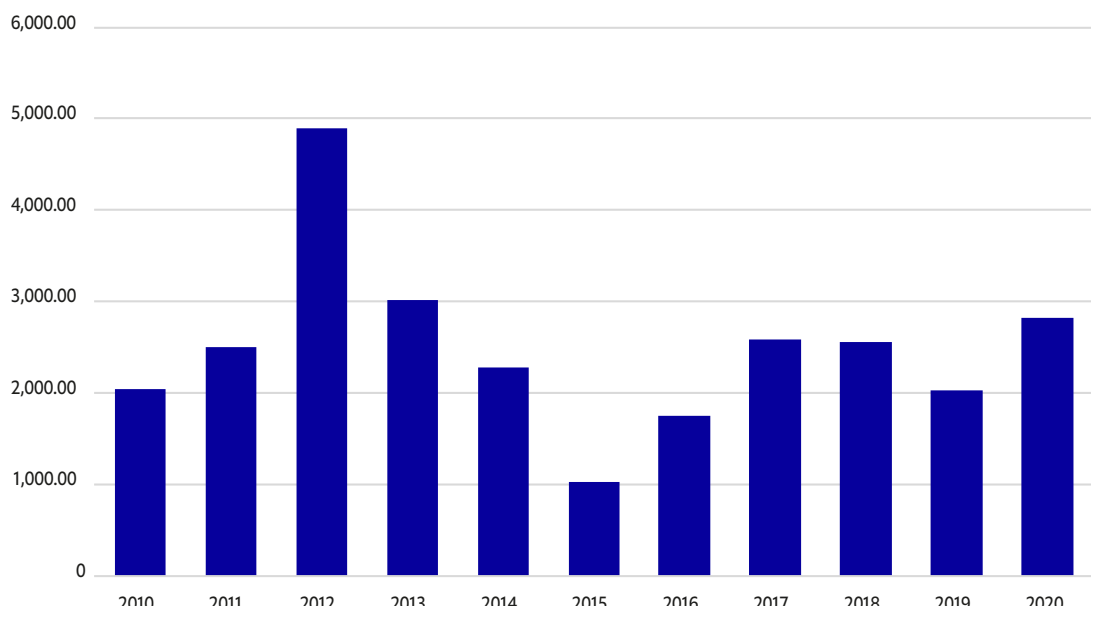
Ukraine’s partial success in encouraging renewable energy production has not been reflected in the country’s broader climate policy achievements. A number of domestic policy interventions contradicted Ukraine’s stated climate ambitions, which include the commitments outlined in the Second Nationally Determined Contribution (to reduce greenhouse gas emissions by 65% compared to 1990 by 2030 and reach carbon neutrality by 2060).¹³ For example, while Ukraine set goals to reform the coal industry by closing loss-making, heavily subsidised mines, little progress was achieved in reality, with inefficient mines continuing to be subsidised.¹⁴ Furthermore, the government’s inability to keep up with payments to renewable energy producers under the feed-in tariff scheme, as well as the

ex-post curtailment of the tariffs in 2020,¹⁵ have threatened future growth in investment in renewables. These deficiencies in Ukraine’s climate policy are reflected in its performance in the Climate Change Performance Index, an independent monitoring tool for tracking climate protection performance. In 2022, the index ranked Ukraine at 38th out of 60 countries on its climate policy metric. While this placed Ukraine above Hungary, Belarus and Russia, it still lagged far behind many other emerging economies, including Egypt, Iran and Thailand.¹⁶

Energy Reform

The Ukrainian energy reform programme, launched in 2014, was formally conceptualised in 2017 with the adoption of the ‘Energy Strategy of

Quantified fossil fuel subsidies (US\$, million)



¹³ <https://unfccc.int/NDCREG>

¹⁴ Damir Miljevic. December 2020. Investments into the Past: An Analysis of Direct Subsidies to Coal and Lignite Electricity Production for the period 2018–2019 in the Energy Community Contracting Parties.

¹⁵ <https://home.kpmg/ua/en/home/insights/2020/08/fit.html>

¹⁶ Climate Change Performance Index 2022. <https://ccpi.org/download/climate-change-performance-index-2022-2/>

Ukraine until 2035', which, among other things, aims to enable stable market development, achieve energy security and independence, integrate the state's gas and electricity networks into the EU energy system, transform the coal industry and encourage energy efficiency.¹⁷ This was due to be updated with a revised 'Energy Strategy until 2050', which has unfortunately been postponed due to the war. Reforms have also been driven by the 2017 EU-Ukraine Association Agreement, which includes a number of provisions related to energy, energy security and harmonisation of the Ukrainian legislative framework on energy with that of the EU.

Ukraine enjoyed some significant successes in its energy market transformation. In particular, the unbundling of Ukraine's gas transmission system was completed in 2020, with the goal of boosting market competition and increasing the number of domestic gas suppliers.¹⁸ Similarly, a competitive electricity market was launched in 2019, in line with the EU's third energy package directives.¹⁹ Market reforms also included the partial abolition of cross-subsidies,²⁰ whereby electricity prices were kept low for households at the expense of enterprises, thus easing the burden on businesses. This progress in market transformation helped to align Ukraine's energy system with EU standards, as provided for in the EU-Ukraine Association Agreement.

Ukraine made substantial progress in the realm of energy security. Most notably, Ukraine managed

to wean itself off Russian gas by importing reverse-flow gas from Poland, Slovakia and Hungary.²¹ Furthermore, Ukraine succeeded in diversifying its sources of nuclear fuel and decreasing its dependence on Russian fuel to roughly 50% by replacing it with American fuel supplied by Westinghouse.²² However, insufficient modernisation of Ukraine's energy infrastructure and lingering legal hurdles have slowed Ukraine's progress in integrating into the EU's gas (ENTSO-G) network.

As measured in terms of transmission and distribution losses, the quality of Ukrainian energy infrastructure has deteriorated over time. Although these losses stayed relatively constant between 2015 and 2017, they have risen rapidly since then, and in 2020 accounted for 4.2% of the total primary energy supply.²³ This reflects an urgent need to repair or replace a large portion of Ukraine's power transmission and distribution grids, which are outdated and in poor condition. As posited by the International Energy Agency, stagnation in the quality of Ukrainian energy infrastructure is a result of chronic underinvestment, outdated technologies and inadequate maintenance.²⁴ Underinvestment can be attributed to Ukraine's 'cost-plus' system for regulating tariffs for electricity transmission and distribution services, which provided no incentive for operators to invest in infrastructure improvements.²⁵ The introduction of the new 'Regulatory Asset Base' model in 2021 may go some way in ameliorating this.²⁶

¹⁷ <https://www.kmu.gov.ua/en/news/250210653>

¹⁸ <https://hmarochos.kiev.ua/2020/12/16/anbandling-navishho-v-ukrayinskij-energetytsi-zbilshuyut-konkurenciyu/>

¹⁹ https://www.german-economic-team.com/wp-content/uploads/2021/12/GET_UKR_NL_146_2020_en.pdf

²⁰ <https://www.epravda.com.ua/columns/2021/10/1/678326/>

²¹ <https://foreignpolicy.com/2021/11/17/ukraine-energy-diversification-russia-gazprom/>

²² <https://suspilne.media/206675-cornobilska-zona-ta-aes-ci-gotovi-voni-do-mozlivogo-vijskovogo-vtorgnenna/>

²³ State Statistics Service of Ukraine: Energy balance data time series for the period of 1990-2020. www.ukrstat.gov.ua

²⁴ <https://www.iea.org/reports/ukraine-energy-profile/energy-security>

²⁵ <https://www2.deloitte.com/ua/en/pages/press-room/deloitte-press/2020/RAB-in-Ukraine.html>

²⁶ https://www.asterslaw.com/press_center/legal_alerts/ukraine_approves_rab_tariff_for_distribution_system_operators/#:~:text=The%20RAB%20tariff%20will%20be%20valid%20for%20all,of%20natural%20monopolies%20in%20the%20field%20of%20electricity%22%3B

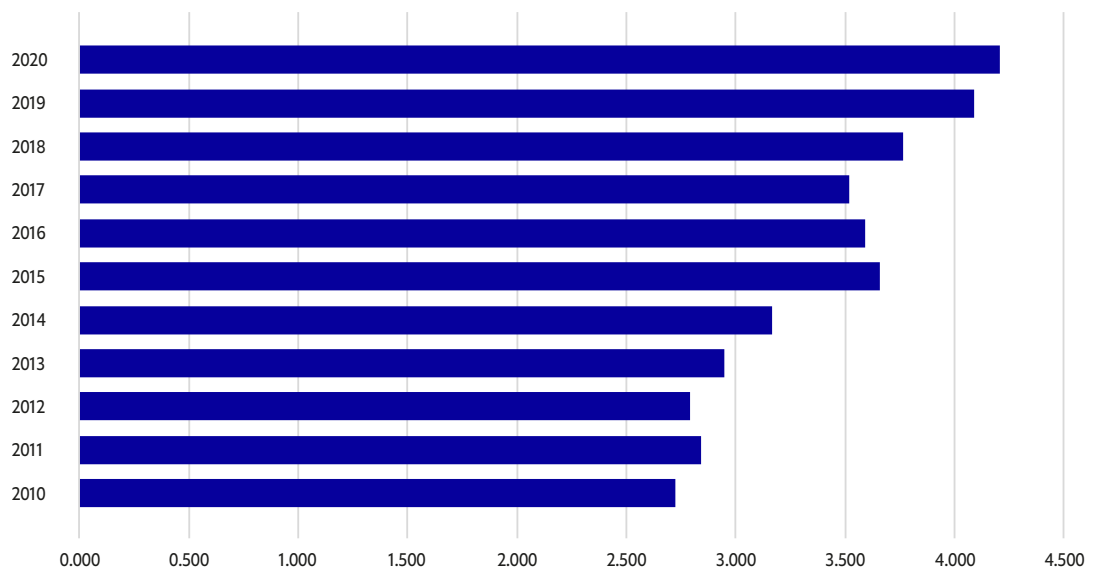
Ukraine’s economy has long been extremely energy-intensive, consuming considerably more energy per unit of GDP than most of its peers. Government reforms to improve the energy efficiency of the economy included the partial deregulation of pricing in wholesale and retail gas markets in 2015,²⁷ to tackle overconsumption. A ‘Warm Loans’ programme was established in October 2014 to enable housing cooperatives and individuals to obtain loans for energy efficient measures;²⁸ similarly, a dedicated ‘Energy Efficiency Fund’ was launched in 2019.²⁹ While these measures had some impact on the energy intensity of the Ukrainian economy—total energy consumption (measured in tonnes of oil equivalent) per unit of GDP (measured in 2005 US\$m) fell from 1185.7 in 2014 to 953 in 2020³⁰—it is likely that a decline in industrial production’s contribution

to the economy (following a slump in exports to Russia, a significant market for Ukrainian industrial products) played a larger role.³¹

Environmental Protection

Ukraine’s environmental policy was set out in the government’s ‘State Environmental Policy of Ukraine up to 2030’, published in 2019.³² This document outlines the key priorities for environmental protection and sustainability in Ukraine, including protection of water resources and forests, and effective waste management. In line with this strategy, Ukraine made some tangible progress in reforming the forestry market, however, significant challenges remain for the protection of water resources and waste management.

Transmission and distribution losses (thousand toe) as % of total primary energy supply



²⁷ <https://energypost.eu/ukraine-reform-gas-sector/>
²⁸ <https://climatepolicydatabase.org/policies/warm-loans-program>
²⁹ <https://eefund.org.ua/en>
³⁰ World Energy Council: Energy Trilemma Index. 2021. <https://trilemma.worldenergy.org/#!/energy-index>
³¹ <https://carnegieeurope.eu/2018/02/06/reforming-ukraine-s-energy-sector-critical-unfinished-business-pub-75449>
³² <http://extwprlegs1.fao.org/docs/pdf/ukr190982.pdf>

Prior to the publication of the 'State Environmental Policy of Ukraine up to 2030', Ukraine had already achieved some significant success in enhancing the protection of its natural environment. This was crucial given the manifold threats to Ukrainian nature, including deforestation, urban expansion and industrial activity. Particular progress was made from 2014 to 2016, when the area of protected land in Ukraine grew from 1,688,500 hectares to 1,997,400 hectares.³³ Unfortunately, the adoption of Ukraine's reformed state environmental policy in 2019, as well as the 2021 launch of a programme to plant one billion trees,³⁴ made little difference to the expansion of nature reserves and protected areas, which remain mostly unchanged since 2017.

Ukraine has significant natural resources, which have the potential to provide the country with high environmental, social and economic value. However, mismanagement of these resources poses an obstacle in realising this potential. In particular, corruption and illegal logging in timber supply chains have historically threatened the sustainability of the forestry sector. This corruption reflects systemic issues in forest governance; in fact, Earthsight labelled mechanisms for the sale of timber 'fundamentally flawed and non-transparent' in 2018.³⁵ Encouragingly, implementation of a new legislative and regulatory framework partially digitalised and opened up the forestry market, requiring electronic auctions for wood sales through ProZorro (an electronic system that enables open access to public procurement opportunities in Ukraine). These electronic auctions have, in the pilot phase, taken 25% of the wood

market out of the shadows,³⁶ though a resolution extending the pilot to the entire wood market has so far not been approved.

Less progress has been apparent in water protection. In June 2021, the Ministry of Environment published a draft "Strategy for the Development of Water Policy of Ukraine - Water Strategy of Ukraine", focused on meeting the economic needs of the population and industry. However, the strategy has not been adopted on the grounds of it failing to meet the formal requirements for this type of legislation.³⁷ While the Cabinet of Ministers' October 2021 'Strategy of Environmental Safety and Adaptation to Climate Change' set out intentions to improve the protection of water resources (for example, by reducing discharges of contaminated wastewater into water bodies),³⁸ implementation has been interrupted as a result of the current conflict.

Finally, progress in waste management reform has been slow. A package of laws related to waste management were still being prepared for their second reading in February 2022, despite their first reading taking place in 2020. Unfortunately, these laws include some highly controversial provisions that may have detrimental impacts on environmental protection; for example, they exclude the scrap metal market.³⁹ Nonetheless, one successful measure in the sphere of waste management has been the adoption of the Law "On Restrictions on the Circulation of Plastic Bags in Ukraine" in 2021;⁴⁰ implementation of this law began with a ban on the free distribution of plastic bags in December 2021.

³³ Statistical Yearbook of Ukraine. 2020. http://ukrstat.gov.ua/druk/publicat/kat_u/2021/zb/11/Yearbook_2020_e.pdf

³⁴ <https://open4business.com.ua/ukrainian-presidential-program-for-planting-1-blm-trees-in-ukraine-completed-by-3/>

³⁵ <https://www.earthsight.org.uk/media/download/784>

³⁶ <https://e-tender.ua/news/rinok-derevini-chi-dopustit-vlada-monopolizaciyu-prodazhu-981>

³⁷ <http://epl.org.ua/announces/analiz-proyektu-vodnoyi-strategiyi-ukrayiny/>

³⁸ <https://zakon.rada.gov.ua/laws/show/1363-2021-%D1%80#Text>

³⁹ <https://www.epravda.com.ua/columns/2021/10/20/678894/>

⁴⁰ <http://epl.org.ua/announces/oglyad-progresu-provedennya-osnovnyh-ekologichnyh-reform-za-pershyj-rik-roboty-mindovkilya-ukrayiny/>

Resilience in 2022

The state of reforms in the energy and environmental sectors during the war is a highly mixed picture. On the one hand, enhanced energy security resulting from diversified energy imports has been key to Ukraine's national resilience. Indeed, the integration of the electricity system with that of the EU has been significantly accelerated as a result of the Russian invasion. On the other hand, reforms in several important areas, including fossil fuel use and environmental protection, which were stalling before the war, were shelved or reversed once it broke out. Urgently addressing these once the war is over will be key to ensuring the sustainability of Ukraine's recovery.

Green Transition

Ukraine's green transition has been significantly undermined by the Russian invasion. Regarding legislation, the conflict interrupted the development of several ambitious new climate policies, including a framework law for the 'Low Emission Development Strategy of Ukraine until 2050',⁴¹ as well as a new 'Energy Strategy until 2050'.

According to the Ukrainian Association of Renewable Energy, the war also threatened Ukraine's decarbonisation efforts through the total or partial physical destruction of renewable

energy production facilities. The Association reports that, as of March 11th 2022, 47% of the installed capacity of renewable energy is located in areas where active hostilities are currently underway.⁴² For example, the Zaporizhia, Kherson, Mykolaiv and Odesa regions boast the greatest wind potential in Ukraine and are also focal points of the Russian attack. Some 89% of wind farms are in areas where fighting is taking place, and another 9% in close proximity. More than half of Ukraine's wind farms have already stopped operating, and cases of destruction of wind turbines, solar panels and power lines have been recorded.

High dependency on fossil fuels, including imported commodities and products, proved to be a source of vulnerability during the conflict. The fuel shortage in Ukraine—a result of Russian attacks on the Kremenchuk Refinery and a number of large oil depots, the blockade of sea routes and the suspension of supplies from Belarus—highlighted the insufficient level of decarbonisation of the energy sector, as well as Ukraine's continued dependence on imports of refined products. Rebuilding and further expanding low-carbon capacities and continued progress on decreasing carbon intensity will be critical for fuelling the post-conflict recovery while progressing towards the key climate objectives and targets outlined in Ukraine's Second Nationally Determined Contribution.

⁴¹ <https://www.rnbo.gov.ua/ua/Ukazy/4856.html>

⁴² <https://uare.com.ua>

Energy Reform

The Russian invasion put Ukraine's energy system under significant pressure. Critical infrastructure has been damaged, while the budget saw shortfalls amounting to €200m as, according to Ukraine's energy minister, 30% of households and 40-50% of enterprises did not pay their energy bills over the first months of the war.⁴³ At the same time, lack of reform in the coal industry placed additional pressure on Ukraine's strained budget, with the state continuing to subsidise unprofitable coal mines. Many mines suspended operations due to the hostilities; the majority of coal mines are located in the Donetsk and Luhansk regions and are now heavily affected by the conflict.

However, progress in energy reforms generally supported Ukraine's resilience during the war. The transition to imports of reverse-flow gas from Europe yielded positive results, as it shielded Ukraine from abrupt interruptions in gas supply. Similarly, diversification of nuclear fuel sources helped Ukraine's nuclear industry withstand the shock posed by the war and ensured the uninterrupted supply of electricity to the population. This was despite the Russian occupation of one of Ukraine's four nuclear power plants, Enerhodar (as well as, temporarily, the decommissioned Chernobyl facility). Ukraine's progress towards increasing energy efficiency also continued, with the Energy Efficiency Fund providing grants worth more than UAH180m (approximately US\$6m) to Ukrainian households over the first three months of the war.⁴⁴

Most importantly, the war accelerated Ukraine's integration into the EU's single electricity

network, ENTSO-E. Initially, Ukraine was expected to join ENTSO-E by the end of 2022, after a series of isolated mode periods. Russia started the invasion hours after the state's energy system entered a planned three-day isolated mode. Given that Ukraine was not able to reconnect with Russia's energy system at the end of the trial, the European Commission launched emergency synchronisation, making Ukraine's power system part of ENTSO-E ahead of schedule.⁴⁵ Accelerated integration into the unified European electricity system constitutes a large leap towards energy independence from Russia and Belarus and grants the country's electricity producers access to European markets. In particular, initiation of electricity exports to Europe provided strong evidence of the resilience of the Ukrainian electricity sector, and its potential to contribute to European energy security in future.⁴⁶

Environmental Protection

Unfortunately, the war has exacerbated deficiencies in environmental reforms in Ukraine. In fact, the conflict directly contributed to the degradation of natural resources and the pollution of the environment, threatening Ukraine's long-term sustainable development and the resilience of achievements made so far. The Ukrainian government worked to record environmental crimes committed by Russian troops in Ukraine. A digital resource has been created to inform the population about the quality of air and water, as well as the level of radiation in areas where relevant monitoring can be carried out.⁴⁷ The

⁴³ <https://forbes.ua/inside/defitsit-benzinu-obval-energorinku-ta-zupinka-tranzitu-rosiyskogo-gazu-yak-vse-tse-polagoditi-intervyu-ministra-energetiki-germana-galushchenka-14052022-6004?fbclid=IwAR3WD3emOnv8iTVMG0GtgQ-BPIWViT-VSiDZMZ6lCgnPdMNoEL7bVMimGcp4>

⁴⁴ <https://eefund.org.ua/za-period-dii-voennogo-stanu-fond-energoefektivnosti-kompensuvav-uchasnikam-programi-energo-dim>

⁴⁵ <https://www.epravda.com.ua/news/2022/03/16/684140>

⁴⁶ <https://ukranews.com/en/news/861811-entso-e-agrees-on-phased-expansion-of-ukrainian-electricity-exports-to-europe>

⁴⁷ <https://www.dw.com/uk/defitsyt-palnoho-v-ukraini-pid-chas-viiny-abo-koly-znyknyt-cherhy-na-zapravkakh/a-61834974>



public can also use the platform to submit and record information about potential threats to the environment. This resource, therefore, provides a quantitative assessment of the environmental consequences of the invasion, which will allow Ukraine to hold Russia to account in the future.

Despite the threat to environmental protection efforts posed by the war, the Ukrainian government continued its legislative work in this area. For instance, the government continued work on the draft law 'On the National Register of Emissions and Transfer of Pollutants',⁴⁸ which Ukraine was required to pass when it ratified

the Kyiv Protocol to the Aarhus Convention. This committed Ukraine to pursuing its environmental policy openly, interacting with citizens and involving them in the policymaking process. However, under the auspices of martial law, the Verkhovna Rada (Ukrainian Parliament) also introduced measures that may be detrimental to environmental protection, with the intention of supporting the state's defence capabilities and the rapid recovery of infrastructure. These include the partial suspension of the environmental tax⁴⁹ and the abolition of environmental impact assessment procedures for nominated activities.⁵⁰

⁴⁸ <https://mepr.gov.ua/news/39191.html>

⁴⁹ <https://cms.law/en/ukr/publication/ukraine-tax-relief-measures-for-businesses-introduced-for-the-duration-of-martial-law>

⁵⁰ <https://ecopolitic.com.ua/en/news/verhovna-rada-sprostila-ekologichne-zakonodavstvo-na-period-voienno-go-stanu-3/>

Outlook

The Russian invasion threatened much of the progress Ukraine has made in its reforms of the energy and environmental sectors. It also diverted the government's attention from policy areas that had already been long neglected, such as environmental protection. However, Ukraine's post-war recovery will present an unprecedented opportunity, and ample incentives, to pursue a broad, ambitious reform agenda across these sectors. Expanding renewable energy production capacities and exploring hydrogen cooperation with the EU will bring the country closer to carbon neutrality. Encouraging energy-efficient reconstruction will bolster Ukraine's energy security and resilience in the face of possible future tensions with Russia and Belarus. Finally, initiatives to protect the environment, such as through reforms in forestry and waste management, will ensure that economic recovery is sustainable in the long term. Crucially, given likely constraints on public funds after the war, Ukraine's success in these reforms will be contingent on effective collaboration with the private sector, whose investment in Ukraine's recovery will be integral to its success. Attracting private investment will require innovative government policy, such as new approaches to encouraging public-private partnerships in green infrastructure projects.

Green Transition

The war in Ukraine and its consequences for the country's energy sector focused attention on the country's overreliance on fossil fuels. Now, more than ever, clear incentives exist to encourage the development of new, greener sources of energy. For instance, Ukraine could consider, in line with EU trends, exploring the role of hydrogen in decarbonising the economy.⁵¹ The EU's Hydrogen Strategy already notes that Ukraine is a priority partner in this area, given its high potential for producing low-carbon hydrogen.⁵² Indeed, as the initiation of electricity exports to the EU following ENTSO-E integration demonstrated,⁵³ growth in the green hydrogen industry, through the framework of EU-Ukraine cooperation, has the potential to foster a new source of income for the Ukrainian economy.⁵⁴

The production of large volumes of «green» hydrogen requires an increase in the share of renewables in electricity production and in the energy mix more broadly. Given the devastating effect of the Russian invasion on Ukrainian renewable energy production capacities, rebuilding these capacities will likely emerge as a key focus area of Ukraine's reconstruction effort. As well as restoring lost and damaged capacity,

⁵¹ https://www.energypartnership-ukraine.org/fileadmin/user_upload/ukraine/media_elements/Green_Hydrogen_in_Ukraine.pdf#:~:text=Green%20hydrogen%20is%20now%20a%20priority%20of%20Ukraine%E2%80%99s,and%20as%20such%20decarbonize%20the%20national%20energy%20system.

⁵² https://ec.europa.eu/energy/sites/ener/files/hydrogen_strategy.pdf

⁵³ <https://ukranews.com/en/news/861811-entso-e-agrees-on-phased-expansion-of-ukrainian-electricity-exports-to-europe>

⁵⁴ <https://ukraineinvest.gov.ua/news/06-06-22-2/>

accelerated expansion of the renewable energy sector beyond what previously existed should also be prioritised. This will play a crucial role in ensuring the sustainability of Ukraine's economic development, as well as safeguarding its future energy independence and security. To this end, Ukraine must encourage private investment in increasing the storage capacity of the Ukrainian electricity grid—a key infrastructure enabler for renewable energy—through initiatives like public-private partnerships. The establishment of transparent market relations and fair competition in the renewable energy market will also create additional incentives for the development of renewable energy sources and bring Ukraine closer to the goal of carbon neutrality.

Post-war reconstruction will create an opportunity for Ukraine to prioritise tackling climate change, with more resources dedicated to the implementation of thus-far declarative objectives. In particular, Ukraine must make tangible progress towards achieving its ambitious Second Nationally Determined Contribution objectives. This will help the country to secure further international support and investment for the reconstruction effort by showcasing Ukraine's commitment to the global fight against climate change. In a similar vein, introducing an emissions trading system (ETS)—on which consultations were announced by the Ministry of Ecology and Natural Resources in December 2021—could constitute the first real step towards the decarbonisation of Ukrainian industry. This would promote a gradual transition from an environmental tax to the allocation of limited quotas to key industries (energy, metallurgy, chemistry, etc.), following the example of the European Union's ETS.

Energy Reform

Improving energy efficiency remains key to making Ukraine's post-war economy less energy-intensive, more sustainable and more competitive in EU and international markets. Once the war is over, Ukraine can focus on accelerating progress towards long-standing efficiency goals. Strictly applying energy efficiency standards when reconstructing buildings affected by the war will help to reduce overall energy consumption. In fact, rebuilding from scratch will give Ukraine the opportunity to take much more ambitious strides in improving the energy efficiency of buildings: the structures destroyed by Russian forces have largely been relatively energy-inefficient, with most of them having been built at least four decades ago.⁵⁵ By using the most energy-efficient building materials and construction methods, a large portion of infrastructure and housing stock can be rapidly modernised. Furthermore, the resumption and expansion of Ukraine's 'Warm Loans' programme could encourage Ukrainians to invest in the energy efficiency of their own households, such as through the purchase of efficient heating equipment.^{56,57} Such initiatives will help Ukraine to satisfy more of its energy demand through domestic production, contributing to Ukraine's energy security post-conflict, and bolstering its resilience to potential renewed stress from Russia and Belarus.

Profound reform of the coal industry will help to alleviate the pressure on the state budget from subsidising loss-making coal mines. The reorganisation of state-owned enterprises, liquidation of loss-making mines and privatisation and modernisation of profitable coal mines will increase the sector's competitiveness and contribution to the economy. In fact, this process

⁵⁵ <https://www.rand.org/blog/2022/04/rebuilding-ukraine.html>

⁵⁶ <https://www.ukrinform.net/rubric-economy/3226668-more-than-2000-ukrainian-families-take-advantage-of-warm-loans-program-this-year.html>

⁵⁷ <https://voxyukraine.org/en/energy-efficiency-of-residential-buildings-there-are-successes-but-they-are-few/>



has arguably already begun. Many outdated mines have been destroyed as a result of the war: some will need to close permanently, while those that can be rebuilt will naturally be modernised and developed to be less carbon-intensive. As set out in the Cabinet of Ministers' 2021 'Concept of the State Target Programme for Fair Transformation of Coal Regions up to 2030',⁵⁸ these changes will need to be accompanied by measures to mitigate their adverse socio-economic impacts. These should include programmes to retrain coal mine staff and invest in the diversification of local economies. While coal is not a sustainable source of energy and Ukraine will undoubtedly seek

to reduce its role in its energy mix in the long term, the modernisation of profitable coal mines will also help Ukraine to safeguard its energy independence in the short- and medium-term.

Investment into oil refineries will similarly help Ukraine decrease its reliance on imports of refined oil products (from Russia and Belarus), thus preventing fuel shortages should imports come under stress in the future. Further diversification of the sources of nuclear fuel and significant investment into nuclear waste management will also help decrease the state's dependence on other countries and strengthen the industry's resilience to external shocks.

⁵⁸ <https://www.ukrinform.net/rubric-economy/3380501-two-projects-on-transformation-of-coal-regions-to-be-implemented-this-year.html#:~:text=As%20reported%2C%20on%20September%2022%2C%202021%2C%20the%20Cabinet,in%20Volyn%2C%20Dnipropetrovsk%2C%20Luhansk%2C%20Donetsk%2C%20and%20Lviv%20regions.>

Environmental Protection

Resumption of the waste management reform, stalled prior to the war, will play an important role in Ukraine's recovery. The war has exacerbated pre-existing problems with waste management: large amounts of damaged and destroyed military equipment are now scattered across the country in places where hostilities took place, along with construction waste from destroyed buildings. Ukraine's Law on Scrap Metal⁵⁹ does not prohibit selling scrap metal of military origin, and licensing for the collection and selling of scrap metal has long been abolished. Given the hazardous nature of military waste, amendments to the relevant legislation indicating that all such waste is the property of the state and outlawing its handling without permission will help prevent casualties. Construction waste, on the other hand, has the potential to be reused in the restoration of damaged structures and manufacture of building materials, an idea the Ukrainian government is already looking into, according to the Minister of Communities and Territories Development of Ukraine.⁶⁰ Initiatives to assure the safe storage and disposal of waste that is not suitable for reuse will be critical in minimising the environmental impacts of the war in the long term.

Finally, the expansion of Ukraine's forestry reform would, in the spirit of the fight against corruption, help to strengthen trust with Western partners contributing to Ukraine's reconstruction. Expanding the ProZorro timber sale system will minimise the risks of corruption and ensure equal access to all participants in the wood market, which boasts total annual sales of UAH12bn (approx. US\$410m).⁶¹

The war with Russia has threatened the progress of Ukraine's environmental and energy reform agenda. However, as was demonstrated by the Ukrainian electricity grid's recent integration with ENTSO-E, the appetite for continued reform remains. In fact, Ukraine's reconstruction effort will establish numerous incentives and opportunities for progress. Effective implementation of the reform agenda will ensure Ukraine's long-term sustainable development, as well as its resilience in the face of potential future stresses. In particular, tackling climate change, improving energy efficiency and protecting the environment will be critical in securing international support and investment—a crucial enabler of Ukraine's recovery from the current crisis.

⁵⁹ <https://zakon.rada.gov.ua/laws/show/619-14#Text>

⁶⁰ <https://www.facebook.com/oleksiy.chernyshov/posts/390985999698369>

⁶¹ <https://e-tender.ua/news/rinok-derevini-chi-dopustit-vlada-monopolizaciyu-prodazhu-981>

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