DESTRUCTION OF THE BUILT ENVIRONMENT AND CONSEQUENCES OF THE WAR IN UKRAINE

PREPARED BY UNIARC S.R.O., CZECH REPUBLIC, MAY 2023

CONTENT

FOREWORD

Prospects for construction depend on the existing situation in the Ukrainian market as a result of the destruction of residential, non-residential, and engineering infrastructure, and the end of hostilities with the possible economic recovery.

The total area of damaged or destroyed housing is 74.1 million sq.m (7.3% of the total area of Ukraine's housing stock), a number which, unfortunately, grows every day. Restoring the housing stock will become a key issue for Ukraine after the war ends.

Energy infrastructure remains the top priority for recovery, as nearly 40% of the energy system has been destroyed.

The main prerequisite for the post-war economic recovery is for Ukraine to receive reliable security guarantees that hostilities will not resume on her territory. In the absence of this, private investment will be reduced to zero, economic activity will be stifled, and security costs will have to be relied on by businesses, raising the cost of economic activity and undermining competitiveness.

Key goals of the post-war economic recovery should be:

i) real estate and infrastructure destroyed or damaged in the war should be restored;

ii) economic activity should resume swiftly;

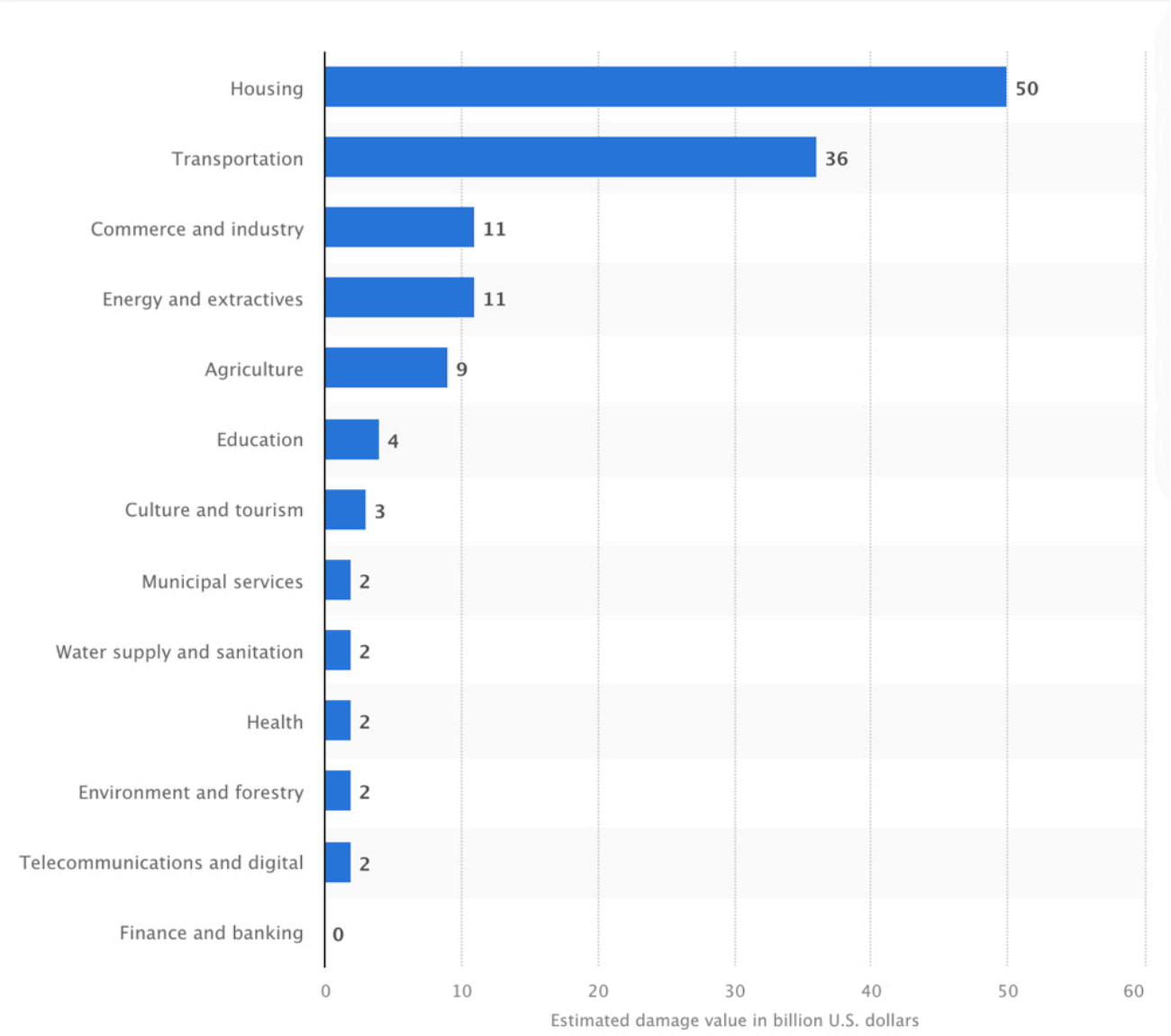
iii) refugees and internally displaced persons should return and be involved in economic processes, and

iv) foundations for sustainable economic growth should be established.

In the long run, rebuilding and restoring Ukraine will cost at least USD 600 billion, including not only the restoration of infrastructure but also the development of a new economy and new European institutions.

DESTRUCTION TO INFRASTRUCTURE, INDUSTRY, AND RESIDENTIAL BUILDINGS

Infrastructure war damage in Ukraine 2022-2023, by sector



The damage to housing facilities from the Russian invasion of Ukraine was estimated at 50 billion U.S. dollars between February 24, 2022, and February 24, 2023. Further 36 billion U.S. dollars were recorded in losses from damages to infrastructure. The total war damage to Ukraine was estimated at 135 billion U.S. dollars over that period.[1]

[1] Published by Statista Research Department, Apr 5, 2023

DAMAGE TO UKRAINE'S POWER, GAS, AND HEATING INFRASTRUCTURE

Relentless attacks on Ukraine's energy infrastructure have caused over $10 billion in damages and left over 12 million people with no or limited electricity, while also disrupting water supply and heating systems, according to a comprehensive Energy Damage Assessment[2] from the United Nations Development Programme (UNDP) and the World Bank.

The assessment provides the most detailed overview of the catastrophic damage to Ukraine's **energy infrastructure,** with emergency repairs estimated to reach $1.2 billion.

"Currently, we are focused on implementing projects that meet the urgent needs of the population and the economy, said Oleksandr Kubrakov, Vice Prime Minister for Restoration of Ukraine – Minister for Communities, Territories and Infrastructure Development of Ukraine. "UNDP's Energy Damage Assessment shows just how massive these needs are. We expect the international community will use this report to provide additional assistance."

The largest share of damage is in the power sector – close to US$6.5 billion – while damage to nuclear plants reached about US$770 million. With whole communities having faced weeks without power in below-freezing temperatures over the recent winter, the assessment also highlights the need for urgent emergency planning for the 2023/2024 winter season, which is estimated will cost approximately US$1 billion.

"Right now, **the priority is to keep the lights on and the heat flowing**. This will be a momentous task, as our new assessment shows that emergency repairs will cost at least $1.2 billion, with a key focus being to secure power supply for critical infrastructure in big cities and in war-affected areas damaged beyond recovery," explained Jaco Cilliers, UNDP Resident Representative in Ukraine.

"But we also cannot wait for the war to end before we start laying the groundwork for longer-term recovery. This energy assessment provides critical data that can support Ukraine in its transition towards a greener, more sustainable, and more resilient energy infrastructure," he continued.

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[2] UNDP UKRAINE ENERGY DAMAGE ASSESSMENT

Overall, damage to the country's energy infrastructure is estimated to be more than five times greater than in June 2022, according to preliminary estimates. As a continuation of the damage assessment, the next phase should estimate the loses and needs to build back better, including transitioning to green technology.

"The costs of repairing and restoring the energy sector continue to mount," said World Bank Operations Manager for Eastern Europe Gevorg Sargsyan. "Recovery and reconstruction present an opportunity for Ukraine to achieve a more resilient and green energy future. This will require balancing the immediate need for fast provision of services with the importance of building back better. Careful planning will be needed to ensure thoughtful investments and to simplify processes to attract financing from a range of public and private sources."

A new joint assessment released in March 2023 by the Government of Ukraine, the World Bank Group, the European Commission, and the United Nations, estimates that the cost of reconstruction and recovery in Ukraine has grown to US $411 billion (equivalent to €383 billion). The estimate covers the one-year period from Russia's invasion of Ukraine on February 24, 2022, to the first anniversary of the war on February 24, 2023. The cost of reconstruction and recovery is expected to stretch over 10 years and combines both needs for public and private funds. [3]

This **second Rapid Damage and Needs Assessment (RDNA2)** provides a comprehensive evaluation of war impacts across twenty different sectors. It quantifies the direct physical damage to infrastructure and buildings and describes the impact on people's lives and livelihoods. The RDNA2 also includes the amounts needed for recovery and reconstruction. The RDNA2 estimates Ukraine will need $14 billion for critical and priority reconstruction and recovery investments in 2023. Meeting these needs will require $11 billion in financing beyond what the government has already addressed in its 2023 budget, including $6 billion in unfunded budget needs and another $5 billion in financing to support state-owned enterprises (SOEs) and catalyse the private sector.

"Conducting the second Rapid Damage and Needs Assessment is an important element in Ukraine's reconstruction strategy. We are grateful to the World Bank for an up-to-date and thorough analysis, which will become an important tool for us and our partners in the implementation of recovery projects - recovery that has already begun. Energy infrastructure, housing, critical infrastructure, economy, and humanitarian de-mining are our five priorities for this year. Part of the reconstruction work has already

[3] Damage to Ukraine's power, gas, and heating infrastructure

been done, and I am grateful to our partners from the EU, the USA, and the World Bank. The amount of damage and recovery needs currently do not include data on the loss of infrastructure, housing, and businesses in the occupied territories. When the defence forces release them, we expect that the data will be supplemented, and the Government will immediately begin restoration work in these territories," said Prime Minister of Ukraine Denys Shmyhal.

Commissioner for Neighbourhood and Enlargement Olivér Várhelyi said: "Each day that goes by, Russia's war of aggression against Ukraine is taking a heavy toll on the people of Ukraine and the socio-economic fabric of the country. The Rapid Needs Assessment will help donors channel funds to the priority sectors on the ground. **It is important to ensure fast recovery and basic services for the population, namely energy, education and health infrastructure, and housing.** The EU will continue supporting Ukraine, now a candidate country, with all its tools and instruments at its disposal."

The RDNA2 assessment finds the total estimated reconstruction and recovery needs to be US$411 billion, 2.6 times the country's estimated 2022 GDP. The needs – estimated for the next decade – consider inflation, market conditions, surge pricing in areas of mass construction, higher insurance premiums, and a shift in the future towards lower energy intensity and more resilient, inclusive, and modern design. The highest estimated needs are in transport (22 percent), housing (17 percent), energy (11 percent), social protection and livelihoods (10 percent), explosive hazard management (9 percent), and agriculture (7 percent). The largest proportionate increase in damages was in energy, where damage was more than five times greater than in June 2022. The geographic areas with the greatest increase in needs are frontline regions of the war: Donetska, Kharkivska, Luhanska, and Khersonska.

"Ukraine's recovery and reconstruction will take several years but the good news is that the country's resilience and determination as well as partner support during the invasion is containing damages and reducing the needs," said World Bank Vice President for Europe and Central Asia Anna Bjerde. "Continued support for Ukraine is an investment in both the country and the global economy. **Development partner support for public investment needs to be complemented by significant private investment to increase the available financing for reconstruction**."

The estimates from both Rapid Damage and Needs Assessments issued to date should be considered as minimums as needs will continue to rise as long as the war continues. But the damages since the release of RDNA1 have not escalated as much as

could have been expected due to several factors. First, the most intense conflict has remained constrained to areas that already faced significant damage. Also, some of the country's needs have been met by the Government of Ukraine with the support of its partners. For example, in the health sector over 500 affected healthcare facilities have been partially or fully repaired; the energy and transport sectors have benefited from the provision of equipment, materials, and financing to make rapid repairs. In addition, the ability to keep the government functioning and essential services flowing has helped to limit the escalation of recovery and reconstruction costs.

The report finds direct damages to buildings and infrastructure comes to more than US$135 billion across the following most affected areas: housing (37 percent), transport (26 percent), energy (8 percent), commerce and industry (8 percent), and agriculture (6 percent). Energy, housing and transport sectors have seen the greatest increase in direct damages, since the RDNA1 estimates. Agricultural damage is also significantly higher, reflecting both increased asset destruction and more precise data.

The RDNA2 also focuses on the human impact of the war and how the loss of lives, livelihoods, incomes, and assets has pushed 7.1 million people into poverty and reversed 15 years of development progress. The report also highlights that the impacts of the war have exacerbated inequalities and in particular affected women, children, and people with disabilities and resulted in dramatic setbacks in the Sustainable Development Goals, especially those related to poverty, health, education, economic growth, energy, peace, and justice.

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UNDP

UKRAINE
Energy Damage Assessment

EXECUTIVE SUMMARY March 2023

Completely destroyed 330kV 200M VA auto-transformer

Disclaimer: The Ukraine Energy Damage Assessment Report was jointly prepared by the United Nations Development Programme (UNDP) and the World Bank with input from the Government of Ukraine. The report is based on data collected between 24 February and 31 December 2022, produced in a short timeframe to ensure the relevance of the damages. Given the ongoing nature of the war and the lack of access in territories temporarily not under government control, the data collection is primarily remote-based but validated through ground-based information. In-depth efforts have been made to check the accuracy of the information that was collected, analysed, and verified to the extent possible, including through site visits and satellite imagery. Given the constraints, the authors of the report cannot guarantee the absolute accuracy of the data included in this work. Boundaries, colours, denominations, and other information presented in this report do not imply any judgment on the part of the UNDP and World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Completely destroyed combined heat and power plant

Damaged wind power plant

UNDP Ukraine and the World Bank, in cooperation with the Government of Ukraine, have carried out an Energy Infrastructure Damage Assessment for Ukraine. This Energy Damages Assessment follows the Rapid Damages and Needs Assessment (RDNA) methodology that was globally established and recognized as Damage and Loss Assessment (DaLA) methodology jointly developed by the European Union, the World Bank Group, and the United Nations, which has been applied globally in post-disaster and conflict contexts to inform recovery and reconstruction planning. The report consolidates data from 24 February to 31 December 2022.

Context

Russia's invasion of Ukraine has resulted in civilian casualties, the displacement of millions of people, and widespread and significant destruction to homes, businesses, social institutions, and productive and economic activity. Recorded civilian casualties amounted to 22,209 as of 20 March 2023, including 8,317 deaths and 13,892 injuries.[1] The invasion of Ukraine has also triggered the largest human displacement crisis in the world. Since the onset of the war, approximately 5.4 million people have been displaced within Ukraine and over 8.1 million have moved to neighbouring countries.[2] Ukraine's Gross Domestic Product (GDP) contracted by about 30 percent[3] in 2022, with economic activity scarred by the destruction of productive capacity, damage to arable land, and reduced labour supply. Poverty is estimated to have increased from 5.5 percent in 2021 to 25 percent[4] in 2022 and headline inflation hit 24.9 percent[5] in September 2022, with high food price inflation hurting the poor. The impact of the invasion will be felt for generations, with families displaced and separated, and deep disruptions to human development.

Baseline

Before the war Ukraine had a highly developed physical and social infrastructure. The energy sector played a key role in Ukraine's economic growth, and supported the country's goal to modernize the economy. The energy supply sector represented 17 percent of GDP. One hundred percent of the population had access to electricity, and 94.9 percent had clean cooking fuel.[6] Central heating had high penetration (ca. 47 percent), particularly in the bigger cities. The gas distribution network covered 74 percent[7] of the population and 89 percent had clean water thanks to pumped water distribution systems.

Description of damages

Ongoing war and targeted attacks on energy infrastructure have caused extensive damage across the country. Since 10 October 2022, Government of Ukraine estimates refer to more than 1,500 missiles and drones, as well as shelling and grenades, targeting the energy infrastructure of Ukraine, out of which more than 100 missiles are estimated to have hit large energy facilities. **In the electricity sector**, **the generating capacity has been reduced by 61 percent, due to damages from Russian Federation missiles or drone attacks.** In 2022, the available capacity[8] of Ukrainian power plants dropped from 36.0 GW to 13.9 GW.[9] About 10 GW of installed capacity remains in the territories under temporary military control of Russian forces and is not delivered to the grid, including a 6 GW Zaporizhzhia nuclear power plant.

Ongoing war has destroyed almost the entire 750 kV high-voltage power grid used for power delivery from the Zaporizhzhia nuclear power plant in areas currently under the military control of the Russian Federation. This creates significant problems for covering power consumption in the country and complicates the transmission of electricity from the western regions to the east. A total of 41 out of 94 crucial high-voltage transforming substations located in government-controlled territories have been damaged or destroyed by missiles or drones. More than half of these 41 substations have been hit more than once. The destruction of the high-voltage grid makes it impossible to fully cover needs.

1 https://www.ohchr.org/en/news/2023/03/ukraine-civilian-casualty-update-20-march-2023#:~:text=Related&text=From%2024%20February%202022%2C%20which,8%2C317%20killed%20and%2013%2C892%20injured

2 https://www.unocha.org/ukraine

3 https://www.worldbank.org/en/country/ukraine/overview#3

4 https://thedocs.worldbank.org/en/doc/d5f32ef28464d01f195827b7e020a3e8-0500022021/related/mpo-ukr.pdf

5 https://tradingeconomics.com/ukraine/inflation-cpi

6 Source: The World Health Organization (WHO) and the Global Health Observatory (2022)

7 Source: State Statistics Service of Ukraine

8 Generation capacity, available for usage within IES

9 Source: Ukrenergo. Does not include RES and small regional CHP

The gas sector infrastructure has also suffered significant damages. The main gas pipelines with a total length of 27 km have been damaged or destroyed, of which 15 km have been restored, and about 20 km of branch gas pipelines have been damaged or destroyed (of which 17 km have been restored). Three compressor stations were damaged or destroyed (one of which was restored). Also, 175 gas distribution stations were disconnected (of which 92 gas distribution stations were restored). A total of 23 gas control stations were damaged and disconnected (of which 4 units were repaired).

A large part of the district heating infrastructure in war-affected areas is damaged beyond recovery. In addition, a large number of combined heat and power plants have been targeted, putting at risk district heating in the affected cities. The overall **value** of the damage (**$1.2 billion**) is highly likely to be **underestimated**, considering lack of reliable information from areas, which are under the military control of the Russian Federation, where it is believed that district heating has been damaged or destroyed.

As for the coal and mining sector, approximately a quarter of Ukrainian state-owned mines are located in territory currently under military control of the Russian Federation. A significant problem is uncontrolled flooding of individual mines, which, according to the results of 2021, provided 3.2 percent of total production. The coal and mining sector damage was not quantified due to the lack of data. A summary of the damages to the key energy assets in physical terms is provided below.

KEY ASSETS DAMAGED (PARTIAL OR TOTAL)

Type of energy assets	*units*	Baseline (before the war)	Currently working/ available	Damaged	Damages to the baseline, in %
Power generation plants, total	*GW*	36	14	22	61.4%
Thermal Power Plants and Combined Heat and Power Plants	*GW*	16	5	11	71.5%
High-voltage transforming substations	*Stations**	94	53	41	43.6%
Heat-only boiler houses and central heating points	*Units (houses and points)*	24,548	23,968	580	2.4%
Gas distribution stations	*Stations*	1,389	1,366	23	1.7%

** Only those located in government-controlled areas.*

Losses

The damages to the energy infrastructure since October and the loss of access to the assets located on the in the territories under temporary control of Russian forces have led to over 12 million people suffering from energy supply disruptions. Continuous and regular waves of attacks on energy infrastructure continue to cause destruction and have already left 12 million people across Ukraine with no or limited electricity, disrupting internet communications as well as water supplies and heating systems at a time when temperatures had fallen below zero in most parts of the country. The average Ukrainian household had to endure five cumulative weeks without electricity from 10 October 2022, to the end of December 2022, according to estimates based on Ukrenergo data. Resulting disruptions to gas and district heating networks and to electricity supply have also significantly affected the delivery of water in major cities,[10] as well as having a significant impact on the telecommunication and banking sector, e.g., processing of payments. The attacks also negatively affected the operational viability of the country and led to economic stagnation.

[10] Power cuts have been one of the major reasons for at least 4.6 million Ukrainians being deprived of access to safe water.

Preliminary quantification of damages

Preliminary estimates based on information shared by the Government of Ukraine, energy companies and other sources indicate that damage to energy infrastructure is more than 5 times greater than at the beginning of June 2022. Damage to power, gas, and heating infrastructure and coal mining is **above $10 billion** versus the $2 billion estimated to 1 June, 2022 (including estimated damage to some assets located in territories temporarily not under government control).[11] The largest share of damage is in the power sector (close to $6.5 billion). Within the power sector, the largest contributor to damages is the generation sector ($3.9 billion) followed by transmission (about $1.9 billion). Damage to nuclear plants reached about $770 million, mostly at Zaporizhzhia nuclear power plant.[12] Damages to the power distribution sector are estimated at about $404 million (without including assets located in territories temporarily not under government control). The lack of data in this category has likely led to underestimation. The gas sector damage estimates are around $1.2 billion (vs the $500 million estimated by 1 June 2022), which comprises damage to gas distribution infrastructure as well as those reported by the Gas Transmission System Operator. Damage to the oil sector, including fuel depots and fuel stations are estimated at close to $1.7 billion. Damages to the coal and mining sector are not included in these estimations as they have not yet been fully quantified, because many of the mines are in the territories under the military control of the Russian Federation or combat zones. Damage in the district heating sector was based on estimates and previous data provided by the government and compared with previous estimations in some cities. Further verification would be needed for greater precision.

Needs

Preparation for the 2023/24 winter season need to primarily focus on restoring access to electricity supply for millions of Ukrainians as well as to critical social infrastructure, including heating, potable water, wastewater treatment and communication. Immediate needs to cover this are around $1 billion and it is critical to provide funding as soon as possible to technically prepare for the upcoming winter.

Among the many needs, two areas are particularly important:

(a) High voltage transmission equipment. Expedited procurement and installation of the high-voltage equipment required to fully restore the capacity of the transmission network. The equipment required includes the following: (i) ca. 60 autotransformers (750…110 kV ratings); (ii) ca. 340 current and voltage transformers and phase shifting and regulating transformers; (iii) auxiliary equipment for high voltage transformer substations.

(b) Additional generation and heating capacity for the most vulnerable cities. Expedited design, procurement and installation of reserve/ additional capacity in the most vulnerable cities is critical to ensuring non-stop operation of district heating, water supply and sewage systems during blackouts or periods of deep power supply limitations, as well as to provide additional flexible capacity for the grid, thus increasing overall stability and resilience of the Integrated Energy System of Ukraine. Between 300 and 500 MW of installed capacity of gas turbines and/ or gas piston engines are crucial for the 2023-2024 winter season.

In the medium-term, reducing gas consumption will be a primary lever to establish Ukraine's energy independence as a part of the country's post-war recovery. To reach energy self-sufficiency, Ukraine needs to implement decisive simultaneous actions in three directions:

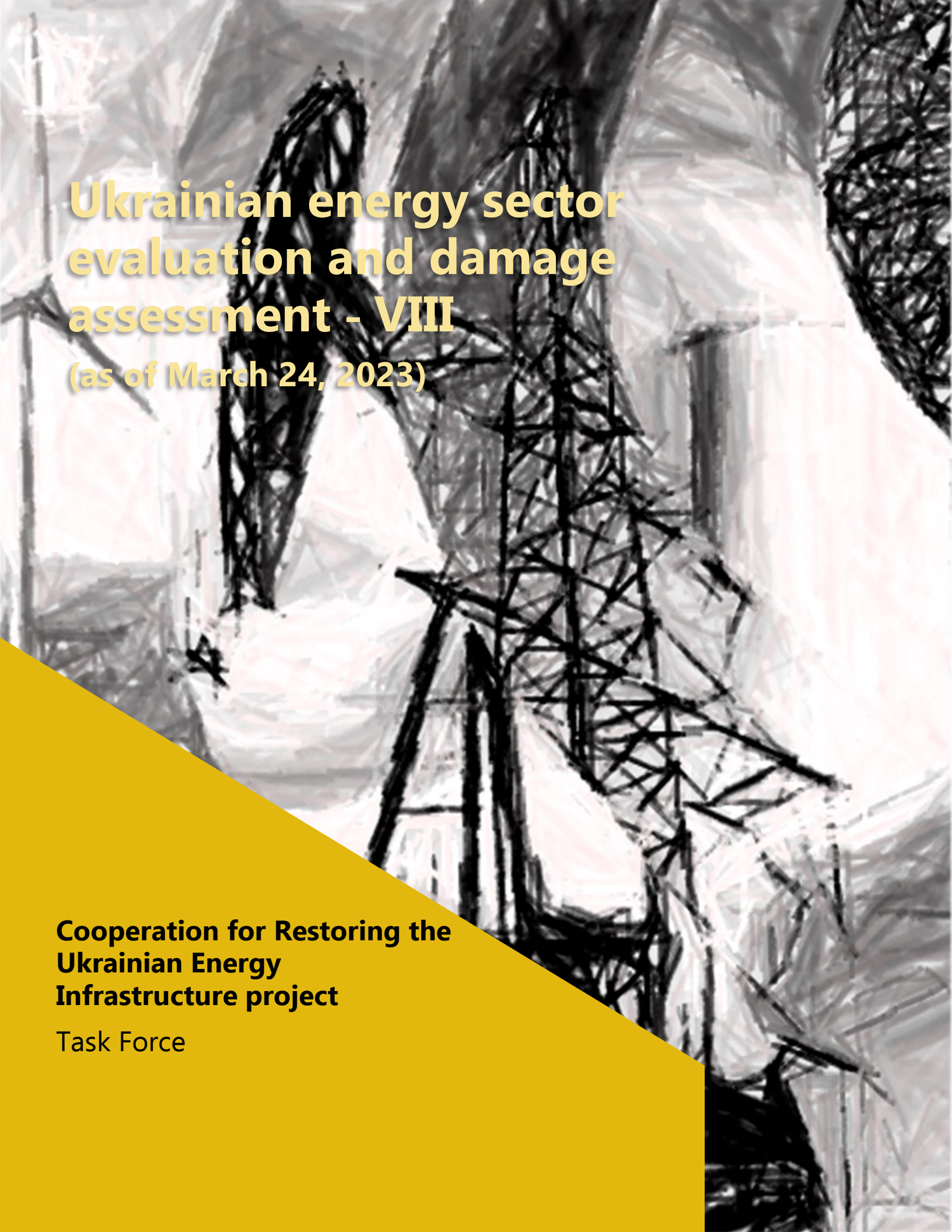
- The immediate recovery of damaged or destroyed gas extraction facilities to limit the reliance on gas imports in the short-term;
- The further promotion of energy efficiency, particularly, for combined heat and power generation and municipal energy systems;
- The further development of decentralized power generation based on renewable energy sources incl. biomass, biogas, and waste to energy.

Next steps

The damage and loss numbers will continue to grow as the war continues. It is forecasted that the **Ukraine Energy Damage Assessment may be periodically updated**. In addition, the conclusions of the report will inform a forward looking analysis related to the energy sector, with the view of providing policy recommendations and a mid- to long-term green outlook.

[11] Assets located in territories temporarily not under government control are estimated to be partially damaged (50 percent). It is likely that some of the assets are completely destroyed while others are almost intact. There is limited ability to verify those damages at this point.

[12] Source: Energoatom's telegram channel. https://t.me/energoatom_ua/10475



Ukrainian energy sector evaluation and damage assessment - VIII

(as of March 24, 2023)

Cooperation for Restoring the Ukrainian Energy Infrastructure project

Task Force

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INTRODUCTION

The full-scale military aggression by the Russian Federation launched on February 24, 2022 has had a significant negative impact on the Ukrainian energy sector. Due to their economic, humanitarian and geopolitical importance, energy infrastructure facilities have been among the primary targets for the Russian army.

The first Ukrainian energy sector evaluation and damage assessment report was published on August 24, 2022, on the six-month anniversary of Russia's full-scale invasion[1]. Since then, the Task Force regularly provided the international community with reliable information on key energy sector damages on a monthly basis[2]. This is the eighth edition of the document that provides a concise overview of key attacks and damages inflicted on the Ukrainian energy infrastructure from February 25 to March 24, 2023.

Russia occupied, damaged or destroyed about 50% of the country's installed power capacity, thousands of km of electric, gas and heat networks, transformers, compressor stations, heat-only boilers and other infrastructure facilities. The oil refining industry was destroyed. Electricity and natural gas consumption decreased by 30-35% compared to 2021. As of March 2023, Ukraine has temporarily lost 43% of its nuclear, 75% of its thermal and 33% of its combined heat and power (CHP) generating capacities.

As of March 2023, the direct losses of the Ukrainian energy sector, including utilities and district heating sectors, were estimated at **$9.5 bln** by the Kyiv School of Economics[3] and **$10.6 bln** by the World Bank[4]. It is expected that the actual damages may be higher, as there is no complete information on energy facilities located in the temporarily occupied territories, and considering the current restrictions on publishing detailed information on the damages caused to the country's energy infrastructure facilities.

The damage assessment report was developed by the Task Force comprised of representatives of Ukrainian authorities and the Energy Charter Secretariat, established under the project "Cooperation for Restoring the Ukrainian Energy Infrastructure" and in cooperation with other Ukrainian and international organisations. The general objective of the project is to assist the Government of Ukraine in the cost-effective restoration of energy infrastructure, taking into account the clean energy transition while ensuring energy security. The project is funded by the European Commission and implemented by the Energy Charter Secretariat.

[1] Task Force, "Ukrainian energy sector e valuation and damage assessment – I (as of August 24, 2022)", 2022, https://www.energycharter.org/fileadmin/DocumentsMedia/Occasional/20220829_UA_sectoral_evaluation_and_damage_assessment_final.pdf

[2] Task Force, "Ukrainian energy sector evaluation and damage assessment – II (as of September 24, 2022)", 2022, https://www.energycharter.org/fileadmin/DocumentsMedia/Occasional/2022_09_30_UA_sectoral_evaluation_and_damage_assessment_Version_II.pdf
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Task Force, "Ukrainian energy sector evaluation and damage assessment – VI (as of January 24, 2023)", 2023, https://www.energycharter.org/fileadmin/DocumentsMedia/Occasional/2023_01_24_UA_sectoral_evaluation_and_damage_assessment_Version_VI.pdf
Task Force, "Ukrainian energy sector evaluation and damage assessment – VII (as of February 24, 2023)", 2023, https://www.energycharter.org/fileadmin/DocumentsMedia/Occasional/2023_02_27_UA_sectoral_evaluation_and_damage_assessment_Version_VII.pdf

[3] Report on the direct damage to the infrastructure from the destruction caused by Russia's military aggression against Ukraine a year after the start of the full-scale invasion, https://kse.ua/wp-content/uploads/2023/03/UKR_Feb23_FINAL_Damages-Report.pdf

[4] Rapid Damage and Needs Assessment, February 2022 – February 2023, https://documents1.worldbank.org/curated/en/099184503212328877/pdf/P1801740d1177f03c0ab180057556615497.pdf

KEY CHANGES IN THE UKRAINIAN ENERGY SECTOR (February 25 – March 24, 2023)

As outlined in the third report[5], on October 10, 2022, the Russian Federation's changed its tactics and resorted to a massive attack on critical energy infrastructure facilities aiming at two main goals:

1) to leave Ukrainian citizens without electricity, heat and hot water supply during the 2022/2023 heating period;

2) to stop electricity export and worsen the energy crisis in the European countries, i.e. the energy crisis that was primarily caused by the deliberate disruption of natural gas supply to the EU market by Russia.

As a result of the massive attacks, the Ukrainian energy system faced the most challenging winter season in the last 30 years. The damages to the power sector also resulted in the decision of the Ukrainian Government to stop electricity export to the European Union (EU) on October 11, 2022, and start electricity import from January 2023. The occupation and destruction of energy infrastructure facilities led to a significant electricity deficit, especially during the peak hours of the 2022/2023 heating season.

Comparison of households' electricity consumption in Kyiv in winter 2022 and 2023, million kWh

Source: DTEK, YASNO

From February 25 to March 24, 2023, the power deficit has been significantly decreased, even though multiple power units of thermal power plants (TTPs) and combined heat and power plants (CHPs) were still under emergency repair or could not operate due to damages to the power grid. As outlined in the seventh report[6], a stable decrease in power deficit was achieved as a result of multiple factors, including but not limited to:

1. The efficient repairs of critical energy infrastructure facilities by the energy sector employees;
2. International assistance to Ukraine's energy sector;
3. Mild weather conditions;
4. Implementation of energy efficiency measures and
5. Increased effectiveness of the Ukrainian defense forces intercepting up to 80-90% of Russia's missiles and drones targeting critical energy infrastructure facilities.

[5] Task Force, "Ukrainian energy sector e valuation and damage assessment – III (as of October 24, 2022)", 2022, https://www.energycharter.org/fileadmin/DocumentsMedia/Occasional/2022_10_24_UA_sectoral_evaluation_and_damage_assessment_Version_III.pdf
[6] Task Force, "Ukrainian energy sector evaluation and damage assessment – VII (as of February 24, 2023)", 2023, https://www.energycharter.org/fileadmin/DocumentsMedia/Occasional/2023_02_27_UA_sectoral_evaluation_and_damage_assessment_Version_VII.pdf

From February 25 to March 24, 2023, the Russian Federation continued targeting power plants, high-voltage substations and other critical elements of the power sector as their damage and destruction had the most devastating effect on the civilian population, especially during the heating season, i.e. power outages directly caused the disconnection from cold and hot water and heat supply. Russian military forces also continued their hideous tactics to inflict more damage on critical energy infrastructure facilities. As outlined in the previous reports, most attacks were launched during the night and at extremely low altitudes to mitigate the detection of drones and missiles by the Ukrainian defense forces, while multiple attacks targeted the personnel of the energy companies performing emergency repairs to inflict the maximum casualties on the energy sector employees and reduce Ukraine's ability to efficiently restore the power supply.

Apart from missile and drone attacks, Russian military forces attacked the energy infrastructure facilities in the frontline Ukrainian regions almost daily using artillery and rocket launcher systems. The information below provides a concise overview of key attacks and damages inflicted on the Ukrainian energy infrastructure from February 25 to March 24, 2023.

On February 27, 2023, an accident inexplicably occurred at the high-voltage line in the Odesa region. As a result, the city of Odesa and the whole region were temporarily disconnected from the power supply.

On February 28, 2023, the Russian military forces shelled critical infrastructure facilities in the Kherson region. In total, there were 86 attacks during the day. As a result, 26,000 consumers were disconnected from the electricity supply.

Damaged energy facility in Kherson region

Source: president.gov.ua

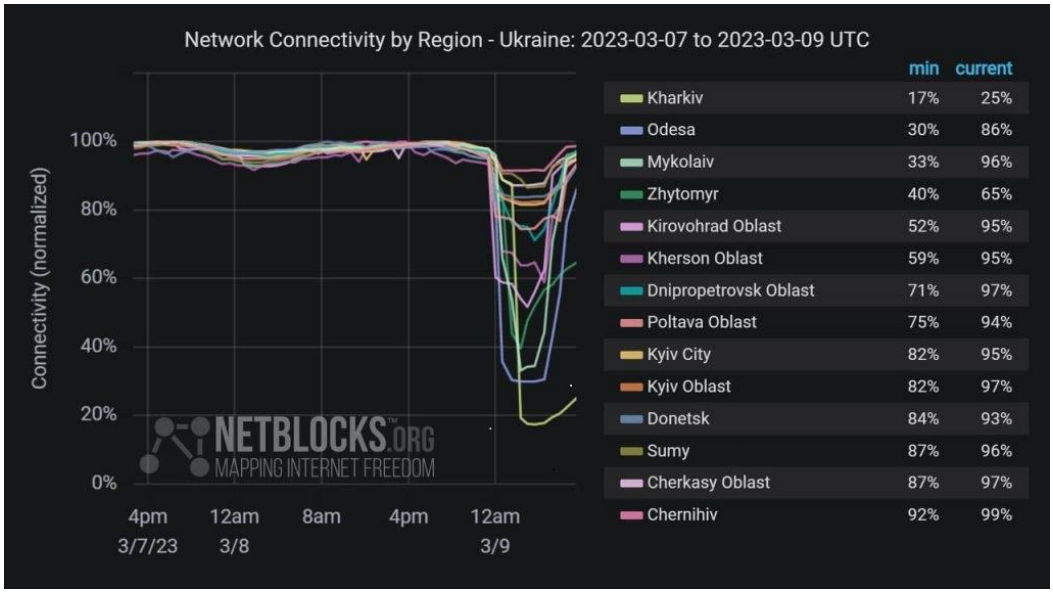
On March 1, 2023, due to the massive shellings, electricity supply restrictions were introduced in Kharkiv, Poltava, and Sumy regions. The high-voltage power line was damaged in the Sumy region.

On March 2, 2023, the Russian military forces shelled the Nikopol district of the Dnipropetrovsk region. As a result of the attack, residential buildings, power lines and water pipes were damaged.

On March 9, 2023, Russia launched a new massive attack, simultaneously targeting energy infrastructure facilities in ten Ukrainian regions, using 81 long and short-range missiles. During this massive attack, Russia launched a new tactic of using different types of missiles, i.e. air-based and sea-based missiles, including cruise missiles Kh-22 and Kh-47 "Kinzhal" that cannot be intercepted by Ukrainian Air Forces. In the pause between the missile waves, Russia also launched at least 8 kamikaze drones.

Three thermal power plants were damaged due to the massive attack. All nuclear power plants were forced to reduce their power generation and the government of Ukraine introduced new restrictions to mitigate further damages due to the massive attack on energy infrastructure facilities. As a result of shellings, the last overhead line supplying electricity to Zaporizka nuclear power plant was damaged. Therefore the station worked on diesel generators for several hours.

It also should be mentioned that Russia's attacks targeting energy infrastructure facilities not only affect cold and hot water and heat supply but telecommunications and internet connection. For example, the massive attack on March 9, 2023, caused significant disruptions in internet connectivity and access to information in multiple regions of Ukraine.



Source: NetBlocks

On March 10, 2023, Russian forces attacked energy facilities in Dnipropetrovsk and Zaporizhzhia regions resulting in power outages in multiple communities.

On March 13, 2023, the Russian Federation launched an attack on the personnel of the energy companies performing the emergency restoration of the power supply after previous shellings in the Kherson region.

On March 23, 2023, Russia attacked the personnel of the energy company in Vovchansk, a border town located in the Kharkiv region.

To reduce the effects of attacks on critical energy infrastructure facilities, the government of Ukraine (GoU) continued working in several directions: increasing and decentralising energy generation and distribution, stimulating electricity imports, implementing energy efficiency measures and enhancing international cooperation.

As outlined in the previous reports, the GoU started a pilot program on replacing old incandescent bulbs with LED lamps for residential consumers in six regions. As of March 10, 2023, Ukrainian consumers replaced about 12 million LED lamps. The highest number of lamp exchanges occurred in the Kyiv region (1.5 million), followed by the Dnipropetrovsk region (1.2 million), the Lviv region (990 thousand) and the Kharkiv region (over 715 thousand).

In March 2023, Ukraine received a powerful autotransformer from Lithuania. Its transportation was the largest logistical operation ever coordinated by the EU Civil Protection Mechanism. The transformer will be installed at a high-voltage substation of the power transmission system. It transforms the voltage from the main line to the distribution level and can provide power to up to 200,000 households.

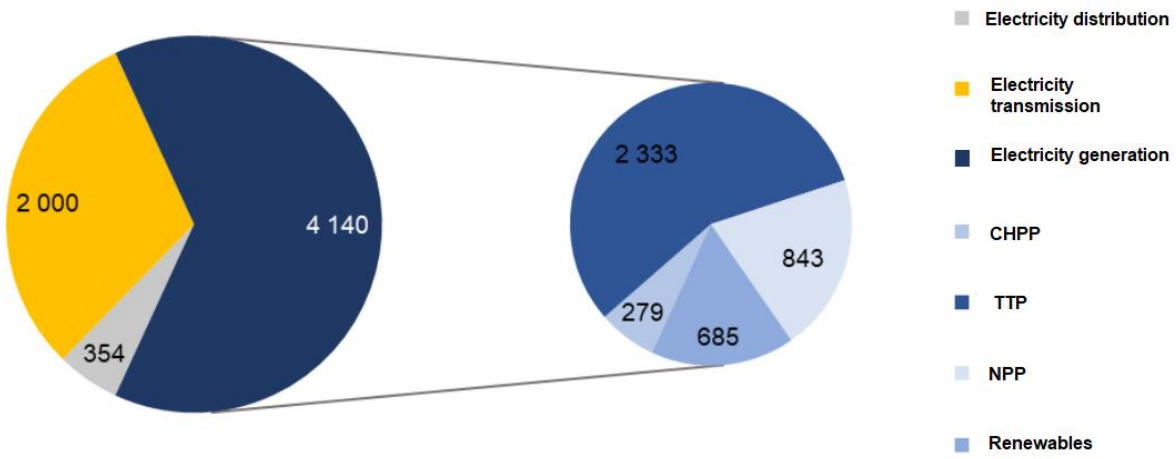
DAMAGES AND LOSSES OF THE ENERGY INFRASTRUCTURE

The full-scale military aggression by the Russian Federation caused significant damages to the Ukrainian energy sector. As of March 24, 2023, there were two up-to-date key studies estimating damages and losses in the Ukrainian energy sector:

- Report on the direct damage to the infrastructure from the destruction caused by Russia's military aggression against Ukraine a year after the start of the full-scale invasion, as of March 2023, by the Kyiv School of Economics (KSE) [7];
- Rapid Damage and Needs Assessment (RDNA), February 2022 – February 2023, as of March 2023, by the World Bank[8].

According to the KSE's assessment, the damages to the Ukrainian energy sector, were at least **$9.5 bln,** including **$8.1 bln** in the energy sector and **$1.4 bln** in the utility infrastructure (including the district heating, water supply and drainage, and household waste management facilities).

Direct damages to Ukrainian energy infrastructure, $ mln



Source: KSE

Direct losses from damages to hydropower plants (HPP) and pumped storage hydropower plants (PSHPP) are estimated at $464 million. According to Ukrhydroenergo, the total losses of the hydropower sector are about $1 billion, including losses of the Kakhovska HPP and the energy supply system of Zmiiny Island (about $400 million). The direct losses of renewables (excluding large HPP and PSHPP) are estimated at $220 million.

According to RDNA, damage to the energy sector of Ukraine is estimated at **$10.6 billion**, including **$6.5 billion** damage in the power sector only. The total needs for recovery and reconstruction of the energy sector are estimated at **$47 billion**.

It should also be noted that the actual damages and losses most likely will be higher as there is no complete information on Ukrainian facilities located in the temporarily occupied territories and no publicly available information on the detailed damages caused to the country's energy infrastructure facilities.

[7] Report on the direct damage to the infrastructure from the destruction caused by Russia's military aggression against Ukraine a year after the start of the full-scale invasion, https://kse.ua/wp-content/uploads/2023/03/UKR_Feb23_FINAL_Damages-Report.pdf

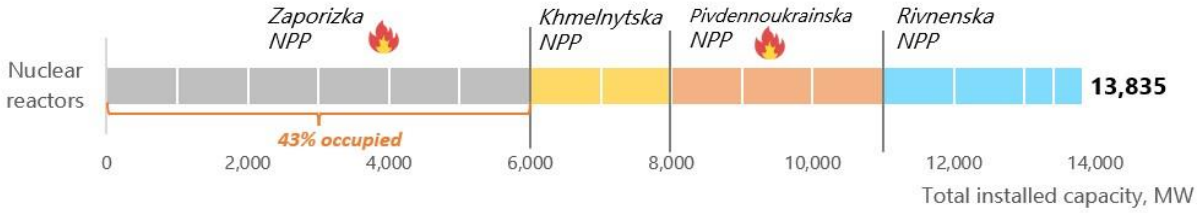
[8] Rapid Damage and Needs Assessment, February 2022 – February 2023, https://documents1.worldbank.org/curated/en/099184503212328877/pdf/P1801740d1177f03c0ab180057556615497.pdf

GENERAL SITUATION

Power sector

Nuclear energy

Nuclear energy provides a reliable base load and covers more than half of the electricity production in Ukraine (55.5% in 2021). There are four operating NPPs in Ukraine with a total installed capacity of 13,835 MW (15 reactors in total, including 13 reactors with a capacity of 1,000 MW and two reactors with a capacity of 415 MW and 420 MW, respectively.



Source: Energy Charter Secretariat (ECS) based on publicly available data

Zaporizka NPP (ZNPP), the largest nuclear power plant in Europe and the fifth largest in the world (Power Technology, 2019)[9], has been occupied by the Russian military forces since early March 2022. The installed power capacity of the plant is 6,000 MW, which is 43% of Ukraine's total nuclear power installed capacity. Before the Russian large-scale military invasion of Ukraine, the plant covered about 25% of electricity production in Ukraine. Since September 11, 2022, the operation at ZNPP was suspended. Pivdennoukrainska NPP was shelled. Khmelnytska NPP and Rivnenska NPP were also affected due to attacks on transmission system infrastructure.

State Company (SC) Energoatom, the operator of all Ukrainian NPP's, conducted a preliminary analysis of the damages inflicted by the Russian military forces on the ZNPP. According to the analysis, the estimated value of destroyed and damaged assets as of March 2023 was about $0,8 bln. The final amount of losses and damages inflicted by Russia on the ZNPP will be determined after the liberation of the plant.

In March 2023, Russia increased its military formations at ZNPP, interfered with ZNPP's heating and power supply systems, constructed unauthorized structures on the station's territory and stole station equipment. Moreover, as a result of the Russian occupation and the repression against the workers who refused to sign contracts with pro-Kremlin organizations, ZNPP faced a shortage of professional personnel.

According to Energoatom, after the liberation of the Zaporizhzhia NPP and the satellite city of Energodar, it would take at least two months to defuse the explosive devices installed by the Russian military Forces, check the condition of equipment related to the safe operation of the plant, facilities and the surrounding area.

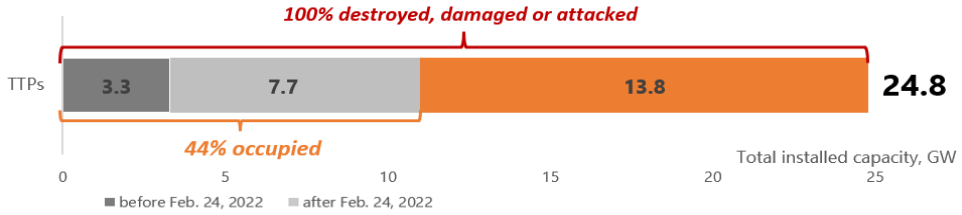
Thermal energy

At the beginning of 2022, there were 12 TPPs in Ukraine with a total installed power capacity of 21.5 gigawatts (GW) (excluding the plants located in the territories temporarily occupied by Russia before February 24, 2022). Most TPPs are using coal as a primary fuel. In 2021, the TPPs' share in electricity production was 23.8%. Since 2014, two TPPs with an installed capacity of 3.3 GW have been located in the occupied Donbas region.
After February 24, 2022, Russian military forces occupied three TPPs (Zaporizka TPP, Luhanska TPP, and Vyglehirska TPP) with a total installed capacity of 7.7 GW. As of today, Ukraine has lost about 75% of its thermal power capacities, including 44% of TPP capacities currently located on the temporarily occupied territories.

[9] "Top ten nuclear power plants by capacity", Power Technology, 2019, https://www.power-technology.com/analysis/feature-largest-nuclear-power-plants-world/

All TPP's under Ukrainian control before February 24, 2022 were either destroyed or damaged (see figure below). The majority of TTP's were attacked more than one time. Almost twenty TPP power units remain damaged due to constant attacks.

DTEK Energy, the leading thermal power plant operator in Ukraine, approximates Russian attacks on these plants caused damages amounting to $160 million.



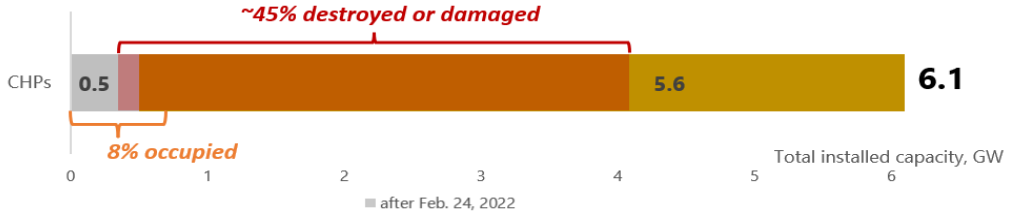
Source: ECS based on publicly available data

Combined heat and power

At the beginning of 2022, the total installed power capacity of combined heat and power plants (CHPs) was 6.1 GW (excluding the plants located in the territories temporarily occupied by Russia before February 24, 2022). Most CHPs are using natural gas as a primary fuel. In 2021 the share of CHPs and cogeneration units in electricity production was 5.5%.

As of today, around 8% of the installed capacity from CHPs is under occupation, while about 45% of installed capacities are either destroyed or damaged as a result of Russian attacks (see figure below).

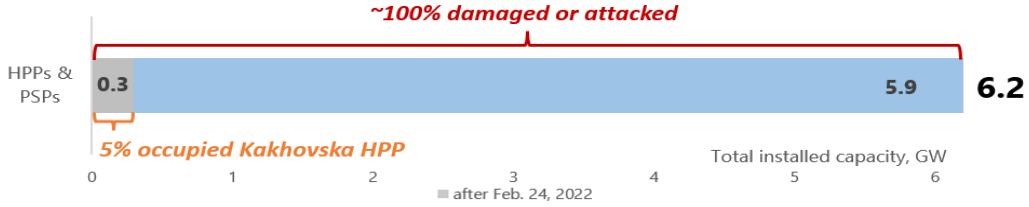
According to preliminary estimates, during the period of the full-scale invasion, five CHP located near the frontline were completely destroyed, while eight CHPPs in Kharkiv, Sumy, Mykolaiv, and Kyiv regions were damaged.



Source: ECS based on publicly available data

Large hydropower

At the beginning of 2022, there were ten large hydropower plants (HPPs) with a total installed power capacity of about 4.7 GW (101 units in total). Three pumped storage plants (PSPs) with an installed capacity of 1.5 GW (11 units ranging from 33 MW to 324 MW per unit) (see Annex 1 for more details). Hydropower plays a crucial role in the functioning of the Ukrainian power system, as HPPs and PSPs are the main providers of auxiliary services to meet the peak demand of the power system and balance intermittent RES capacities. PSPs also contribute to flattening the night "gaps" of electricity consumption. In 2021, the share of HPPs and PSPs in electricity production was 5.8% and 0.8%, respectively. All of the Ukrainian hydropower facilities were either damaged or attacked.



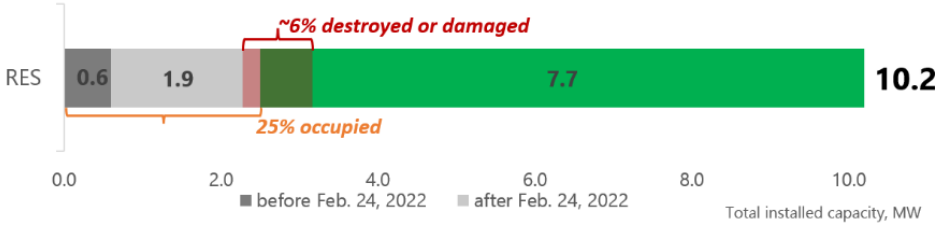
Source: ECS based on publicly available data

Since the first day of the war, Kakhovska HPP (343.2 MW or about 5% of installed capacity) has been occupied and damaged by the Russian army. Public Joint Stock Company (PJSC) "Ukrhydroenergo", the main operator of HPPs and PSPs in Ukraine, has already filed a claim at the European Court of Human Rights regarding the damages caused to the Kakhovska HPP and the unfinished wind power plant on Zmiiny Island. The total amount of the claim is above $0.5 bln.

Renewable energy (excluding large HPP)

Ukraine has the highest technical RES potential among other countries in Southeast Europe - 874 GW[10], including solar - 83 GW, onshore wind - 438 GW, and offshore wind - 250 GW. Due to its high RES potential and efficient support mechanisms, Ukraine's renewable energy sector has been developing rapidly, with the share of RES in electricity production increasing from 1.8% in 2018 to 8.2% in 2021. At the beginning of 2022, the total installed RES capacity (all grid-connected) reached 9.5 GW (excluding 0.6 GW of RES capacities located in the territories temporarily occupied by Russia before February 24, 2022). About $12 bln was invested in the Ukrainian RES sector during 2009-2021.

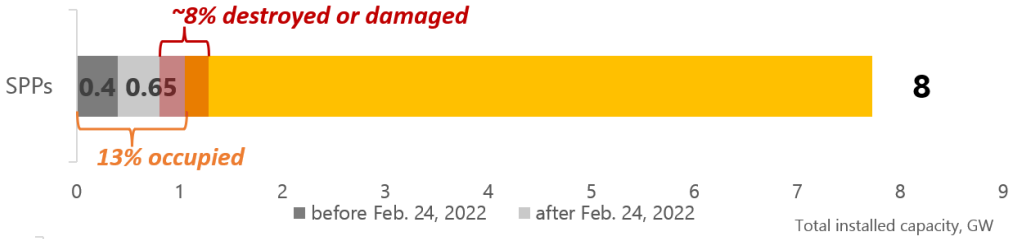
As of today, 2.5 GW (25%) of RES facilities are under occupation. About 6% of the total installed RES capacity has been destroyed or damaged.



Source: ECS based on publicly available data

Solar

The photovoltaic (PV) sector had the highest growth rate among other renewable energy sources in Ukraine during 2019-2021. At the beginning of 2022, the total installed PV capacity (excluding 0.4 GW located in the territories temporarily occupied by Russia before February 24, 2022) reached 7.6 GW or 80% of the total RES installed capacity in Ukraine (including 45,000 prosumer installations with a total capacity of 1.2 GW). In 2021, Ukraine was ranked 7th in Europe for the development of solar generation (IRENA, 2022).[11]



Source: ECS based on publicly available data

Currently, about 13% of Ukrainian PV capacities are under occupation. About 8% of the total installed solar capacity has been destroyed or damaged, including hundreds of prosumer installations.

As outlined in the previous report[12], after the liberation of territories temporarily occupied by the Russian Federation, RES facilities were gradually put into operation. For example, the results of the preliminary inspection indicate that about 20% of the solar panels at the liberated Tryfonivska SPP were damaged. As of January 31, 2023, the liberated

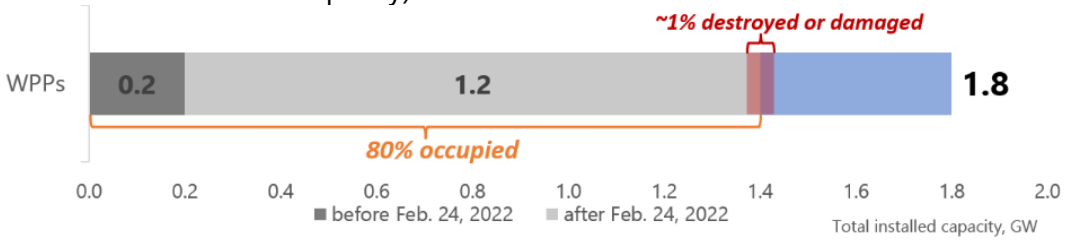
[10] "Renewable energy sources of Ukraine", National Academy of Sciences of Ukraine, 2022, https://www.ive.org.ua/wp-content/uploads/atlas.pdf
[11] "Renewable Energy Statistics 2022", IRENA, 2022, https://www.irena.org/publications/2022/Jul/Renewable-Energy-Statistics-2022
[12] Task Force, "Ukrainian energy sector evaluation and damage assessment – VI (as of January 24, 2023)", 2023, https://www.energycharter.org/fileadmin/DocumentsMedia/Occasional/2023_01_24_UA_sectoral_evaluation_and_damage_assessment_Version_VI.pdf

SPP gradually resumed the production of electricity and contributed to meeting the energy needs of the Kherson region.

Wind

At the beginning of 2022, Ukraine's total installed capacity of wind power plants (all onshore) was 1.6 GW (excluding 0.2 GW located in the territories temporarily occupied by Russia before February 24, 2022). Almost all wind power plants in Ukraine were built in the southern regions nearby the Azov and Black seas coasts (Kherson and Zaporizhzhia regions), where natural conditions for wind power plants are the most favourable.

Currently, the Russian Federation occupies the south of Ukraine, where the highest wind potential is available. Thus, approximately 80 % of wind generation capacities are located in the occupied territories. As of today, at least seven wind turbines are known to be damaged or destroyed as a result of the hostilities by the Russian army (about 1 % of the total installed wind capacity).

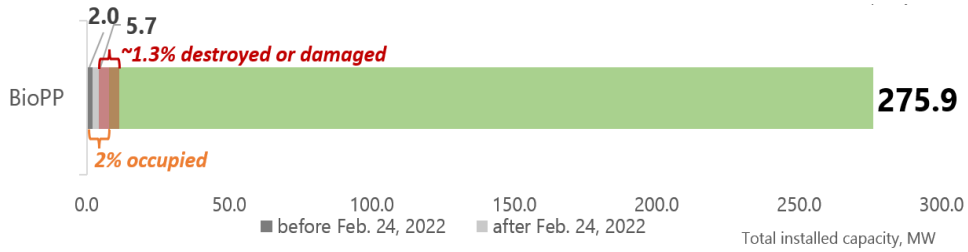


Source: ECS based on publicly available data

Bioenergy

At the beginning of 2022, the total installed capacity of bioenergy power facilities was 273.9 MW (excluding the 2 MW biomass power plant located in the territories temporarily occupied by Russia before February 24, 2022). In 2021, the share of bioenergy in electricity production was 0.6%.

As of today, 5.7 MW (1.3%) of bioenergy facilities are under occupation. It is known that at least four plants were shelled and damaged.

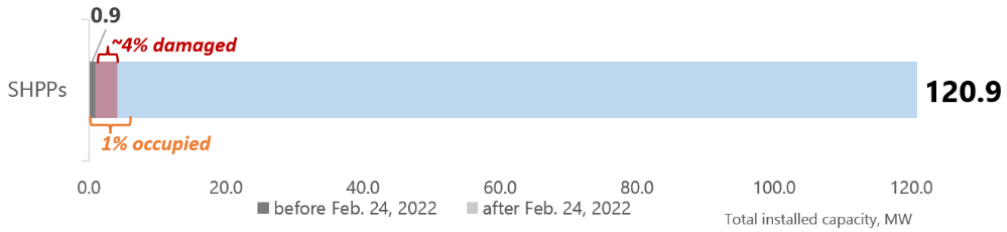


Source: ECS based on publicly available data

Small hydro (<10MW)

At the beginning of 2022, there were 177 small hydropower plants (SHPPs) in Ukraine with an installed capacity of 120 MW (excluding one SHPP (0.9 MW) located in the territories temporarily occupied by Russia before February 24, 2022). In 2021, the share of SHPPs in electricity production was 0.1 %.

Due to the liberation of Ukrainian territories in November, 2022, all SHPPs occupied by the Russian Federation after February 24, 2022, returned under the control of Ukraine.



Source: ECS based on publicly available data

Storage

In 2021, the first pilot energy storage facility with an installed capacity of 1 MW was built at the Zaporizka TPP, while at least 212 MW of storage capacities were at different stages of development.

Nowadays, the only electricity storage facility in Ukraine is under occupation, and the implementation of all planned projects has been temporarily suspended.

Transmission system

The Ukrainian electricity transmission system includes 23,600 km of overhead lines and 141 substations with a voltage of 110–750 kV operated by the Ukrainian transmission system operator (TSO) National Energy Company (NEC) "Ukrenergo". 25% of transmission substations were located in the territories temporarily occupied by Russia before February 24, 2022 and 12% were occupied after. Due to Russian targeted attacks on transmission system infrastructure, about 45 % of controlled transmission substations were destroyed or damaged. Some of the substations were attacked more than one time.

On March 16, 2022, Ukrainian and Moldovan Power Grids successfully synchronised with the Continental European Grid (ENTSO-E) in response to Russia's invasion of Ukraine. On June 30, 2022, Ukraine started commercial electricity export to the EU countries. Within 10 months in 2022, Ukraine exported electricity worth $542.5 mln. The massive attack and consequential damages to the power sector also resulted in the Ukrainian government's decision to stop electricity export to the European Union (EU) starting from October 11, 2022.

As of February 2023, Ukraine continued importing small volumes of electricity from continental Europe's power system (ENTSO-E). On February 14, 2023, the Transmission System Operators of Continental Europe agreed to increase the day-time electricity trade capacity to Ukraine/Moldova from 600 MW to 700 MW.

Distribution networks

The electricity distribution systems in Ukraine include more than 800 thousand km of overhead and cable lines with 0.4–150 kV voltage and about 200,000 6-150 kV transformer substations operated by 32 distribution system operators (DSOs).

As of the beginning of January 2023, more than one thousand overhead lines (6-150 kV) and more than eight thousand transformers (6-150 kV) were damaged or disconnected due to continuous shelling and hostilities (not including power infrastructure disconnected due to emergencies).

Demand and supply

At the beginning of 2022, there were 17.7 mln electricity consumers in Ukraine, including 17.2 mln households and 0.5 mln commercial customers.

As a result of hostilities, electricity demand decreased by 30-35% compared to 2021. The consumption pattern also changed due to the shutdown of industrial enterprises and the massive displacement of consumers from Eastern to Western Ukraine. It is foreseen that the total electricity generation in 2022 will be 25% less than the "pre-war" forecast due to Russian military aggression. Since February 24, 2022, almost all consumers have been temporarily disconnected from the electricity supply.

Ukrainian TSO and DSO's restore electricity supply where possible, but regular attacks by Russian forces lead to new damages and destructions.

Natural gas sector

Natural gas production

Ukraine has Europe's third-largest natural gas reserves (up to 719 bln cubic meters (bcm)) (EY, 2020)[13]. The largest reserves are located in the Poltava, Kharkiv, and Lviv regions and on the Black and Azov Seas shelf. In 2021, there were about 542 issued licenses and 25 large companies operating in the oil and gas exploration and production sector, including three state-owned and 22 companies with Ukrainian and foreign investments. Over the last 20 years, the volume of natural gas production in Ukraine was about 20 bcm/year (about 55 mln cubic meters (mcm)/day). Ukraine's main gas production regions (excluding the temporarily occupied territories by Russia before February 24, 2022) are the Poltava and Kharkiv regions (about 90% of total production).

After February 24, 2022, approximately 15% of the country's natural gas reserves are under Russian occupation. More than 150 gas production facilities, primarily located in the Kharkiv region, were suspended because of hostilities. Therefore, the average daily production decreased by almost 11% (about 49 mcm/day).

At the end of October 2022 JSC "Ukrgazvydobuvannya" restored the operation of several infrastructure facilities in the de-occupied territory of Ukraine and has been preparing to launch others. The result will be additional production of about 0.5 mcm/day. However, in mid-November 2022, Russia started attacks on natural gas production infrastructure. The information on damages to natural gas production facilities is restricted.

Since the beginning of the Russian full-scale military aggression, 350 gas and oil facilities of the Naftogaz group were destroyed. The number of damaged Naftogaz facilities significantly increased in October-December 2022.

In 2022, about 18.5 bcm of natural gas was produced in Ukraine or only 6% less than in 2021 (19.8 bcm) However, it was lowest level of Ukraine's natural gas production over the last 20 years[14].

The main reason for the reduction in production is the full-scale war that Russia started in Ukraine at the end of February 2022. The occupation of part of the territory of Ukraine (especially the Kharkiv region, where significant reserves and gas production capacities are concentrated) had a negative impact on gas production in these regions and near-front line.

As of February 2023, state-owned company Naftogaz estimated its war-related damages of gas infrastructure at $1 bln.

Underground gas storage

Ukrainian underground natural gas storages (UGS) are the largest in Europe and 3rd in the world after the US and Russia (Cornot-Gandolphe, 2018)[15]. There are 13 UGS facilities in Ukraine with a total working gas storage capacity of 31.95 bcm/year (including two UGS with a total capacity of 1.4 bcm/year located in regions temporarily occupied by Russia before February 24, 2022), with maximum gas injection and withdrawal capacities of above 250 and 260 mcm/day, respectively. Most UGS capacities are in Western Ukraine (25.32 bcm/year or 79%).

After February 24, 2022, the operation of one UGS in the East (0.42 bcm/year) was suspended due to hostilities,

[13] "National report of Ukraine 2020", EY Extractive Industries Transparency Initiative, 2020, https://www.geo.gov.ua/wp-content/uploads/presentations/en/UA_EITI_Report_2020_EN.pdf
[14] https://expro.com.ua/novini/ukrana-v-2022r-skorotila-vidobutok-gazu-na-6-do-185-mlrd-kub-m

[15] Sylvie Cornot-Gandolphe, "Underground gas storage in the world - 2018 status", *Cedigaz Insight ed. 31*, November 2018, https://cdn2.hubspot.net/hubfs/1982707/Overview%20of%20underground%20gas%20storage%20in%20the%20world%202018%20(1).pdf

and one UGS in the central part of Ukraine (capacity 0.31 bcm/year) was damaged. Thus, about 8% of UGS capacities remain unavailable, including 5.7% (1.82 bcm/year) in the temporarily occupied territories, and 2.3% are damaged. There is no information about damages and losses on UGS located in the temporarily occupied territories and areas close to active hostilities.

As of March 2023, the Ukrainian UGS system stored approximately 10 bcm of natural gas.

Gas transmission system

The Ukrainian natural gas transmission system (GTS) is one of the most developed in Europe, with a total length of more than 38,000 km and interconnections with the following EU member states Poland, Slovakia, Hungary and Romania. The total capacity of the GTS "entry" points is 281 bcm/year (770 mcm/day) and "exit" points – 146 bcm/year (400 mcm/day). 41.6 bcm of Russian natural gas transited via Ukraine GTS to Europe in 2021.

From May 2022, the volume of transit of Russian gas through Ukraine to EU consumers decreased by approximately 30% due to the interruption of gas transit through the "Sokhranivka" gas metering station (GMS) located on the territory temporarily occupied by Russia. As a result, from May to November 2022, the gas transit through Ukraine's territory decreased to 40-42.5 mcm/day or 37-39% of the capacity contracted by Gazprom (109 mcm/day). About 200 km of gas pipelines and equipment are known to be damaged due to Russian hostilities. Despite the damages, the Ukrainian TSO expressed its readiness to increase transit volumes to the EU via GMS "Sudzha" (capacity 77-244 mcm/day), while Gazprom reduced transit volumes.

Despite the suspension of natural gas transit via the Nord Stream 1 pipeline and increased demand on EU gas markets in August-November 2022, the Russian Federation did not increase the transit via Ukraine's GTS. On the contrary, Russia cut its natural gas production and increased flaring to keep EU market prices high.

In December 2022, the average volume of gas transit through the territory of Ukraine was 42.6 mcm per day which corresponded to 39% of the capacity officially contracted by Gazprom (109 mcm per day). It should also be noted that there is a high risk of a further reduction or suspension of gas transit via Ukraine's GTS due to the explosion of the "Urengoy-Pomary-Uzhhorod" gas pipeline located on the territory of the Russian Federation on December 20, 2022[16]. The pipeline crosses the Russian-Ukrainian border through the "Sudzha" gas measuring station, currently the only entry point for transiting natural gas from Western Siberia to Europe. The explosion further influenced the gas exchange prices on the European market. For example, the Dutch natural gas futures went up from €106.6/MWh to €115/MWh on the same date of the explosion in Russia[17].

At the end of December 2022, all heat only boilers in Donetsk region were forced to shut down as a result of the damage to the main gas pipeline in Kharkiv region, caused by the shelling, the main gas pipeline was damaged..[18]

In 2022, Russia transported about 20.35 bcm of natural gas via the Ukrainian gas transportation system. This was the lowest level of transit flow since Ukraine became an independent state in 1991. Compared to the previous year, the volume of transit of Russian gas decreased by more than two times, i.e. from 41.6 bcm in 2021 to 20.35 bcm in 2022.[19]

In 2022, Gazprom reduced gas supplies to Europe by 45%, or from 185 bcm in 2021 to 100.9 bcm in 2022, the lowest level in the history of Russian Federation. The sharp reduction in Russian gas supplies is directly related to the Russian invasion of Ukraine and the response of EU Member states reducing the dependence on Russian gas import. In addition, Russia reduced gas supplies to "unfriendly countries" that refused to pay for gas in rubles.

On January 7, 2023, as a result of the explosion of the main gas pipeline in the city of Lutugino in the Luhansk region

[16] Mind.ua, https://mind.ua/news/20250978-v-rosijskij-chuvashiyi-vibuhnuv-gazoprovid-cherez-ce-u-evropi-rizko-pidskochili-cini-na-gaz
[17] Trading economics, https://tradingeconomics.com/commodity/eu-natural-gas
[18] https://expro.com.ua/novini/na-harkvschin-poshkodjeno-magstralniy-gazoprovd-gazov-koteln-donechchini-zupinen
[19] https://expro.com.ua/novini/tranzit-rosyskogo-gazu-cherez-ukranu-vpav-do-storichnogo-mnmumu-20-mlrd-kub-m-u-2022r

(under temporary occupation), about 13,000 consumers were left without natural gas supply. According to "Operator GTS of Ukraine" LLC, the explosion had no effect on the transportation of natural gas from the Russian Federation through Ukraine[20].

In January 2023, Moldova officially allowed for all companies to use virtual natural gas reverse flow. It opened opportunities for both Ukrainian (gas imports from Greek and Turkish LNG terminals through the Trans-Balkan Corridor in reverse mode) and foreign (gas transmission via the same route to Ukrainian storages) system users.

On January 19-21, 2023, the volume of gas transit through the territory of Ukraine ranged 24.5-24.7 mcm per day, i.e. only 22-23% of the capacity contracted by Gazprom (109 mcm/day). On February 22, 2023, Gazprom increased transit through the Ukrainian GTS to 42,2 mcm per day, i.e. about 40% of the contracted capacity. As of March 7, 2023, the volume of transit was 42,37 mcm per day.

Gas distribution networks

About 290,000 km of gas distribution networks are operated by 45 gas distribution system operators (DSOs) in Ukraine.

Since February 24, 2022, more than 7,000 km of distribution networks in Eastern and Southern Ukraine have been destroyed or damaged (approximately 12% of the distribution networks in Eastern and Southern Ukraine). More than 5,000 gas distribution control units were either suspended or damaged.

Demand and supply

At the beginning of 2022, there were 12.6 mln of natural gas consumers in Ukraine, including 12.5 mln households and 0.1 mln commercial customers.

As a result of the hostilities and damaged infrastructure, natural gas consumption decreased by more than 30% compared to daily consumption in 2021. As of January 24, 2023, about 600 thousand households were without the gas supply (5% of the total). Due to damages, natural gas consumers of the Donetsk region are almost entirely disconnected from the gas supply. Kherson, Dnipropetrovsk, Luhansk, Zaporizhzhia, Mykolaiv and Kharkiv regions had the most challenging situation. DSOs regularly restore gas supplies where possible, but regular attacks by Russian troops lead to new damages and destructions.
According to experts estimates, the consumption of natural gas in Ukraine in 2022 is expected to be 30% lower than in 2021, or 8.7 bcm less below the level of 202. The volume of gas imports from the EU to Ukraine in 2022 decreased by 42%.

Oil & petroleum products

Oil production

Ukraine's oil reserves are estimated at approximately 85 mln tons (EY, 2020)[21]. More than 51% of the total reserves are concentrated in the North and Central regions, 36% in the Western and 13% in Southern Ukraine. Oil and gas condensate production in 2021 amounted to 2.4 mln tons (6.66 thousand tons/day). In 2021, 25 large companies were operating in the oil and condensate exploration and production sector, including two state-owned (that produced about 80% of total oil production) and more than 20 companies with Ukrainian and foreign investments (up to 20% of total oil production).

After February 24, 2022, almost 10% of the country's oil reserves are located in temporarily occupied territories. The

[20] https://expro.com.ua/novini/na-magstralnomu-gazoprovod-v-lugansky-oblast-stavsya-vibuh

[21] "National report of Ukraine 2020", EY Extractive Industries Transparency Initiative, 2020, https://www.geo.gov.ua/wp-content/uploads/presentations/en/UA_EITI_Report_2020_EN.pdf

volume of oil production in areas close to active hostilities and under the constant threat of occupation has decreased significantly. The information on damages to oil production facilities is restricted.

According to Ukrnafta, the largest oil extraction company in Ukraine, the company's oil production decreased by 8.6% in 2022 compared to 2021. There is no publicly available data about the overall reduction of oil production in Ukraine in 2022.

Oil transmission system

In 2021, the oil transmission system of Ukraine included 19 oil pipelines with a diameter of up to 1,220 mm, a total length of 3,506.6 km and 176 pumping stations. The total capacity of the tank park was 1,083 thousand cubic meters. The total capacity of the oil transmission system at the "entry" points was 114 mln tons/year at the "exit" points - 56.3 mln tons/year in 2021.

The system transmitted oil from Ukrainian oil fields and seaports, i.e. imported by sea transport (including for the needs of the refinery of Belarus), as well as transited Russian oil through the "Druzhba" oil pipeline to Slovakia, the Czech Republic, and Hungary. In 2021, the Ukrainian oil transmission system transported 15.7 mln tons, including 12.7 mln tons of transit of Russia's oil and 3.0 mln tons to local refineries.

After February 24, 2022, a significant amount of principal and auxiliary equipment was damaged at three oil transmission facilities, including three cases of damage to cable communication systems. It is estimated that oil transit and transportation volume will be significantly reduced due to destroyed oil transmission facilities and Ukrainian refineries and the reduction/suspension of transit to Belarus in 2022.

On November 15 and November 23 2022, the oil transportation to Hungary, Czechia, and Slovakia via "Druzhba" oil pipeline was suspended due to the damages inflicted on the substation powering the pipeline by the Russian military forces. However, the oil pipeline operation was restored the same day due to Ukraine's coping mechanisms and the efforts of the power sector employees.

Oil refinery and gas processing

In 2021, there were six refineries and one gas processing plant (GPP) in Ukraine, with a total designed oil processing capacity of over 50 mln tons/year[22]. Still, the actual production capacity was about 7.5 mln tons/per year. It was mainly based on the capacities of two plants: Kremenchuk Refinery (up to 7 mln tons/year) and Shebelynka Gas Processing Plant (about 0.5 mln tons/year). The two plants covered about 25% of the needs of the Ukrainian demand for oil products, which was 12.35 mln tons in 2021.

After February 24, 2022, the work of the Shebelynka GPP was suspended due to Russian hostilities and the plant was later damaged by a missile attack. In September 2022, the Russian military forces continued regular shelling of the Shebelynka GPP and its fuel reservoirs. Multiple missile attacks destroyed the Kremenchuk Refinery (in total, Russia shot 32 missiles at the Kremenchuk Refinery) and damaged the facilities of Odesa and Lysychansk Refineries (the latter is owned by the Rosneft - the second largest Russian state-controlled Company after Gazprom).

As a result, the Ukrainian oil refinery industry has been destroyed, and the country is almost 100% dependent on imported petroleum products. According to the State Customs Service, Ukraine imported 5.8 mln tons of petroleum products (gasoline, diesel fuel, fuel oil, jet fuel, etc.) in January-October 2022, which is 13.1% less than in the same period last year (6.67 mln tons). Despite the reduction of the import volume, the costs of the imported oil products were 70.2% higher than in January-October 2021. On December 20, 2022, Russia attacked oil and gas infrastructure facilities in the Kharkiv region. As a result of the attack, the fire spread to the area of 4,500 square meters[23].

On February 16, 2023, Russian forces launched 15th massive attack, primary targeting oil refinery infrastructure.

[22] Note: Starting from 2014, only two out of six oil refinery and gas processing plants remained active in Ukraine, mainly due to changes in the structure of the owners as well as ageing refinery equipment.

[23] Video of the explosion, NJSC "Naftogaz of Ukraine" https://www.naftogaz.com/news/rosiya-vkotre-obstrilyala-ob-ekty-grupy-naftogaz-video

Multiple missiles hit Kremenchuk and Drohobych oil refinery plants although plant in Kremenchuk had not been operating due to the damages inflicted during the previous attacks, and plant in Drohobych had been stopped about 10 years ago. Apart from large refineries and other energy facilities, the massive attack also targeted mini refineries, one of which was damaged in the Kyrovograd region.

KSE estimates damages and losses at Kremenchuk oil refinery at $405 million and at Lysychansk (LYNIK) - $126 million[24]. Equipment of both plants was seriously damaged due to Russians attack at the first months of the war.

Oil products storage (oil depots)

Since oil product storage capacities were among the primary targets for Russian military forces, the information about the total number of oil depots and "pre-war" status is restricted.

Since February 24, 2022, more than 30 oil depots have been destroyed or significantly damaged in almost all regions of Ukraine.

According to the Ministry of Environmental Protection and Natural Resources of Ukraine, the destruction of oil depots by the Russian military forces resulted in the additional emission of 499,000 tons of pollutants into the atmosphere. For comparison, the emissions of Ukraine's largest industrial polluter are estimated at 220,000 tons annually. The additional emissions pose substantial risks for neighbouring countries as, depending on the wind direction, dangerous pollutants from burnt oil products may move to the territories of other countries and fall there as acid rain. Since the beginning of Russia's invasion, the estimated volume of pollutants emissions has reached 46 mln tons. For comparison, this indicator was ten times lower in 2019 - about 2.4 mln tons, and in 2021 - 2.25 mln tons (Krechetova, 2022)[25].

Fuel stations

In 2021, there were more than 7,500 fuel stations in Ukraine, including petroleum, natural gas and electricity charging stations. The vast majority of stations belong to private companies.

Since the beginning of the full-scale invasion, Russia's attacks either destroyed or damaged more than 300 fuel stations[26]. It is impossible to accurately estimate the number of fuel stations damaged or destroyed due to occupation and ongoing hostilities.

Coal

Coal production

Ukraine is a coal-rich country with the largest coal reserves in Europe (TheGlobalEconomy.com, 2022)[27]. According to various estimates, the total proved coal reserves are about 38 bln tons (including the coal reserves located in the territories temporarily occupied by Russia before February 24, 2022). About 92.4% of total coal reserves are located in the Donetsk hard coal basin (Donbas). In 2021, Ukraine produced about 29 mln tons of hard coal. For comparison, the average coal production before Russia occupied Donbas's territories in 2014 was 80 mln tons per year.

Currently, about 60% of the country's coal deposits are temporarily occupied by Russia. As of March 2023, Ukrainian companies accumulated about 1 mln tons of coal reserves in their warehouses.

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[24] Damages caused to Ukrainian business as a result of Russian aggression are estimated at $13 billion — Kyiv school of economics, 2023 https://kse.ua/ua/about-the-school/news/zbitki-zavdani-ukrayinskomu-biznesu-vnaslidok-rosiyskoyi-agresiyi-otsinyuyutsya-v-13-mlrd/

[25] Diana Krechetova, "How did the destruction of oil depots and Russian missile attacks affect air pollution? The Ministry of Environment is in charge", Life Pravda, 2022, https://life.pravda.com.ua/society/2022/09/13/250436/

[26] "The total amount of damage caused to Ukraine's infrastructure is more than $136 billion" — Kyiv school of economics, 2022, https://kse.ua/about-the-school/news/as-of-november-2022-the-total-amount-of-losses-caused-to-the-infrastructure-of-ukraine-increased-to-almost-136-billion/

[27] "Coal reserves Europe – Country rankings", TheGlobalEconomy.com, 2022, https://www.theglobaleconomy.com/rankings/coal_reserves/Europe/

Coal mines

There were 151 coal mines in operation in 2013 (before Russia temporarily occupied the Donbas region in 2014) and only 47 coal mines in 2021 (before the full-scale invasion of the Russian Federation of Ukraine on February 24, 2022).

Currently, 95 mines are located in the Ukrainian territories temporarily occupied by Russia, including 28 privately owned and 67 state-owned mines. According to publicly available data, at least six coal mines are flooded, threatening an ecological disaster in the region.

In the occupied city of Dovzhansk (Luhansk region), Russia suspended activities and transferred industrial equipment from the Chervonyi Partyzan and Kharkivska mines to the Krasnoyarsk region, the Russian Federation[28]. At the end of January 2023, Russia also closed down coal mines named after Zasiadko, Academician Skochynskyi and Kalynovska-skhidna which were also located on the territories temporarily occupied by the Russian Federation[29].

Uranium (mines and refinery)

There are three uranium mines and uranium refinery capacities in Ukraine located in Dnipropetrovsk and Kirovograd regions. In 2021, the domestic mining, processing of uranium ores and nuclear fuel production covered about 40% of the country's needs. In 2021, Ukraine commissioned the centralised storage of used nuclear fuel in the exclusion zone of the Chornobyl NPP. The life cycle of the storage is at least 100 years.

The exclusion zone of the Chornobyl NPP was under occupation from February 24 to March 31, 2022. As a result of the occupation, the Russian military forces looted and destroyed the newest Central Analytical Laboratory in Chornobyl, a unique complex with powerful analytical capabilities that could provide services related to radioactive waste management (from conditioning to disposal, as well as at the stage of research and development of technologies).

Ammonia

Ukraine's ammonia pipeline is the fifth largest in the world. Ammonia is transferred from the Russian chemical enterprise in Tolyatti to the Odesa Port Plant in Yuzhny city. The length of the pipeline is 2,417 km, of which 1,021 km passes through the territory of Ukraine. The capacity of the ammonia pipeline is up to 2.5 mln tons per year.

Even if there is no supply of ammonia from the territory of Russia, the pipeline has the potential to be used to transport ammonia converted from "green "hydrogen.

On February 24, 2022, the first day of the Russian invasion of Ukraine, the transit of ammonia through the pipeline was stopped. On May 30, 2022, the Russian military forces damaged the ammonia pipeline branch in the Bakhmut district of the Donetsk region.

The UN calls for the restoration of the Tolyatti-Odesa ammonia pipeline. The President of Ukraine, Volodymyr Zelenskiy, said that Ukraine would agree to resume the supply of Russian ammonia through the pipeline through Ukraine only if Russia returned the Ukrainian prisoners of war.

Lithium

According to preliminary estimates, Ukraine's total lithium resource potential is relatively high (approximately 500,000 tons of lithium oxide) (Vasylenko & Uliana, 2022)[30]. This ultra-light metal is a critical element for the future

[28] Luhansk Regional Military Administration, https://t.me/luhanskaVTSA/6977

[29] https://ru.slovoidilo.ua/2023/01/25/novost/obshhestvo/okkupanty-donbasse-zakryli-shaxtu-im.-zasyadka

[30] Vasylenko, Svitlana & Uliana, Naumenko. (2022). PROSPECTS OF DEVELOPMENT OF LITHIUM RESOURCE BASE IN UKRAINE. InterConf. 10.51582/interconf.19-20.02.2022.072.

of the Ukrainian power system as it is widely used to make power batteries, including energy storage and electric vehicles. There are two explored deposits and two pre-explored areas of lithium ores in Ukraine.

As of today, at least two lithium deposits are located in the territories temporarily occupied by Russia in Zaporizhzhia and Donetsk regions.

District heating

Thermal energy is mainly produced by CHPs (described above) and heat-only boilers (HOBs) in Ukraine. In 2021, there were 19,025 HOBs in Ukraine from which the thermal energy was transported by 1.9 mln km of pipelines and distributed through 5,523 central heating points. The energy balance in the district heating sector consists of gas and coal, which together make up 90%, and about 10% of bioenergy.

At end of November, 444 HOBs, 128 central heating points and more than 200 km of district heating networks were either destroyed or damaged. At the same time, 316 damaged facilities were restored[31]. Since the local district heating infrastructure has been severely damaged due to Russian hostilities, there are no heating season in some regions of Ukraine.

Electric vehicles

In 2021, there were 33,522 electric cars in Ukraine or about 1% of the total car fleet. Despite the energy crisis provoked by Russian attacks on energy infrastructure facilities in Ukraine, the demand for electric vehicles continues to grow. During November 2022, 1,447 battery electric vehicles (BEVs) were added to the car fleet of Ukraine, which is 60% more than last year but 10% less than in October this year.

Since the beginning of 2022, more than 12,500 cars with battery power sources have been registered for the first time in Ukraine, which is one and a half times more than in the same period of 2021. The total fleet of electric cars and hybrids in Ukraine exceeded 100,000 cars[32].

Climate impact

Among other aspects, Russia's attacks significantly affected and negatively impacted the global efforts to reach the objectives of the Paris Agreement. According to the latest study, greenhouse gas (GHG) emissions caused by Russia's full-scale invasion of Ukraine totaled at least 100 mln tons of CO2e (carbon dioxide equivalent) from February 24 to September 24, 2022[33]. This is the equivalent of the total GHG emissions of The Netherlands over the same period. These figures are likely even higher considering the massive attacks from September 25 to November 24. Therefore, the more Russia continues its aggression, the higher the negative impact on climate will be.

Since the beginning of the war, in 2022 about 2,300 crimes against the environment have been recorded. The damage caused to the environment has already exceeded $46 bln. The material damage from air pollution amounts, including but not limited to burning oil products and forest fires, is estimated at $25 bln[34].

Cyber security

From February 24 2022, more than 1.2 mln cyberattacks have been carried out on energy infrastructure facilities. In comparison, there were 0.9 mln of cyber-attacks in 2021. It should also be mentioned that Russia began intensive cyber-attacks on the Ukrainian energy sector even before the full-scale invasion on February 24, 2022.

[31] The Ministry of Communities and Territories Development of Ukraine, https://www.minregion.gov.ua/press/news/minregion-vidbulos-11-zasidannya-shtabu-z-pidgotovky-do-opalyuvalnogo-sezonu/

[32] Ukrainian Motor Vehicle Manufacturers Assosiation, https://ukrautoprom.com.ua/statystyka-prodazhiv-avtomobiliv-u-lystopadi-2022

[33] Initiative on GHG accounting of war, CLIMATE DAMAGE CAUSED BY RUSSIA'S WAR IN UKRAINE, 2022, https://climatefocus.com/wp-content/uploads/2022/11/ClimateDamageinUkraine.pdf

[34] Ministry of Environmental Protection and Natural Resources of Ukraine, January 13, 2024, https://mepr.gov.ua/news/41091.html

Namely, from December 2021 to February 2022, Russia repeatedly tried to inflict maximum damage to the work of Ukrainian energy companies, including interfering with the work of dispatch centres and smart grids[35].

In 2022, more than 3 million cyberattacks were carried out on Naftogaz's network infrastructure or 12 times more than in 2021.

Information security

Since the beginning of Russia's full-scale military invasion of Ukraine, Russia has fabricated a set of false narratives and used disinformation and propaganda to inflict damage on the Ukrainian energy sector.

Even before the massive attacks on energy infrastructure, Russian media was trying to spread panic not only in Ukraine but in Moldova and EU member states. Another example of Russia's disinformation is fake news about GoU's request to citizens in March 2022 to turn off the lights in the evening. This information attack was aimed at complicating power system balancing, mainly when the Ukrainian power system was operating in an autonomous mode before joining ENTSO-E.

Since October 2022, Ukrainian citizens have been living under conditions of scheduled rolling and emergency blackouts. At the same time, Russia's false narratives, disinformation and propaganda are aimed at increasing public dissatisfaction and undermining citizens' trust in energy companies and Ukrainian authorities. Through manipulation and false narratives, Russia attempts to shift the responsibility for the blackouts and energy crisis from Russia to Ukraine, both in Ukrainian and European media.

For example, on December 18, 2022, Russian media launched an information attack by distributing a fake letter allegedly sent to the Ministry of Energy (MoE) by the CEO of NEC Ukrenergo. The fake letter allegedly requested the MoE to decrease the power supply to some Ukrainian regions to resume electricity exports to the EU countries. Thus, Russian media attempted to create fake narratives and to shift the responsibility for power outages from Russia to Ukraine, i.e. to convince the audience that blackouts were caused by allegedly deceptive decisions of the Ukrainian decision-makers rather than by the nine massive Russian missile attacks damaging energy facilities. The DTEK group also informed its clients that dozens of fake accounts using the company's name were created on social networks for disinformation, manipulation of public opinion and spreading panic among Ukrainian citizens.

[35] Ministry of energy of Ukraine, https://www.mev.gov.ua/novyna/z-pochatku-viyny-zafiksovano-ponad-12-mln-kiberatak-na-enerhosektor-farid-safarov

UKRAINE
RAPID DAMAGE AND NEEDS ASSESSMENT

FEBRUARY 2022 – FEBRUARY 2023

WORLD BANK GROUP

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ABBREVIATIONS AND ACRONYMS

ACLED	Armed Conflict Location and Event Data
CCI	cultural and creative industries
CHA	Confirmed Hazardous Areas
DALY	disability-adjusted life year
DDP	Digital Development Partnership
DFC	International Development Finance Corporation
DG NEAR	Directorate-General for Neighborhood and Enlargement Negotiations
DGF	Deposit Guarantee Fund
EBRD	European Bank for Reconstruction and Development
EE	energy efficiency
ERW	explosive remnants of war
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FPI	Service for Foreign Policy Instruments (European Commission)
GDP	gross domestic product
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	greenhouse gas
GIS	geographic information system
GMI	Guaranteed Minimum Income
ha	hectare
HACC	High Anticorruption Court
HUS	Housing Utility Subsidy
I&D	irrigation and drainage
IDP	Internally Displaced Persons
IFC	International Finance Corporation
IFI	international financial institution
ILO	International Labour Organization
INFF	Integrated National Financing Framework
IOM	International Organization for Migration
IT	information technology
ITU	International Telecommunication Union
KSE	Kyiv School of Economics
LGBTI+	Lesbian, Gay, Bisexual, Transgender, and Intersex
MCTID	Ministry for Communities, Territories and Infrastructure Development
MIGA	Multilateral Investment Guarantee Agency
MoF	Ministry of Finance
MSME	micro, small, and medium enterprises
NABU	National Anticorruption Bureau of Ukraine
NACP	National Agency for Corruption Prevention
NBFI	nonbank financial institution
NBU	National Bank of Ukraine
NMAA	National Mine Action Authority of Ukraine
NPL	nonperforming loan

NTS	nontechnical survey
OHCHR	Office of the High Commissioner for Human Rights
OPG	Office of the Prosecutor General
PEACE	Public Expenditures for Administrative Capacity Endurance
PHC	primary health care
PPP	public-private partnership
RDNA	Rapid Damage and Needs Assessment
SAPO	Special Anticorruption Prosecutor's Office
SDGs	Sustainable Development Goals
SECO	Swiss Secretariat for Economic Affairs
SESU	State Emergency Service of Ukraine
SMEs	small and medium enterprises
SoB	state-owned bank
SoE	state-owned enterprise
TPP	Thermal power plant
TS	technical survey
TSO	transmission system operator
UCPM	Union Civil Protection Mechanism
UN	United Nations
UN Women	United Nations Entity for Gender Equality and the Empowerment of Women
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFPA	United Nations Population Fund
UN-Habitat	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations International Children's Fund
UNMAS	United Nations Mine Action Service
UNODC	United Nations Office on Drugs and Crime
UNOPS	United Nations Office for Project Services
URC2022	Ukraine Recovery Conference
UVF	Ukrainian Veteran Fund
WFP	World Food Programme
WHO	World Health Organization
WRM	water resource management
WSS	water supply and sanitation
YoY	year-on-year

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On the part of the Government of Ukraine, the RDNA2 was led by the Ministry for Communities, Territories and Infrastructure Development (MCTID) of Ukraine. All relevant line ministries have participated in the assessment, with support also from the Kyiv School of Economics (KSE).

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FOREWORD

This Rapid Damage and Needs Assessment (RDNA2) is part of an ongoing effort—undertaken jointly by the World Bank, the Government of Ukraine, the European Commission, and the United Nations, and supported by other partners—to take stock of Ukraine's damage and losses from Russia's invasion. Just as importantly, it aims to assess the scale of economic and social needs for Ukraine's survival during the war and its prospering afterward.

Considering a full year of war, as of February 24, 2023, direct damage in Ukraine has reached over **US$135 billion**, with housing, transport, energy, and commerce and industry the most affected sectors. Damage is concentrated in the frontline oblasts, particularly Donetska, Kharkivska, Luhanska, Zaporizka, Khersonska, Mykolaivska, and in oblasts that were brought back under government control, such as Kyivska and Chernihivska. Disruptions to economic flows and production, as well as additional expenses associated with the war, are collectively measured as losses and amount to some **US$290 billion**. Ukraine's gross domestic product (GDP) shrank by 29.2 percent in 2022, and poverty increased from 5.5 percent to 24.1 percent in 2022 (based on the poverty line of US$6.85 per person per day).

Reconstruction and recovery needs, as of February 24, 2023, are estimated at about **US$411 billion**. Integrated into these needs are critical steps toward becoming a modern, low-carbon, disaster- and climate-resilient country that has aligned with European Union policies and standards in view of being ready to join the European Union, and where the population's vulnerabilities are addressed and people live in prosperity. While the financing envelope is overwhelming, experience from other countries shows that a phased approach to reconstruction is critical.

The report also estimates the implementation priorities for 2023 at around **US$14 billion**. These are focused on the most urgent needs, including restoration of energy, housing, critical and social infrastructure, basic services for the most vulnerable, explosive hazard management, and private sector development. Around US$9 billion in direct government expenditure will lay the groundwork for a safe, prioritized, achievable, and efficient reconstruction and recovery. This will be complemented by investments by state-owned enterprises (SOEs) and support to sustain and catalyze the private sector, including de-risking investment and trade. While the government has already taken steps to meet some of these needs, this report identifies a need for an additional US$11 billion in financing, including around US$6 billion in further funding of the government budget and close to US$5 billion to facilitate critical investments by SOEs and the private sector.

This report offers a strong analytical foundation for a comprehensive financial and operational strategy and plan to support the early recovery and long-term reconstruction of Ukraine, to which we are strongly committed. This next phase of planning should consider the options for scaling up absorptive and institutional capacity of national and subnational authorities in Ukraine so it is commensurate with financing availability, the development of common systems and processes to ensure maximum efficiency, the development and expansion of the managerial and technical capacity of implementation units, the mobilization of funds for project preparation, the development of private and public financial strategies for different sectors, and long-term planning and financing frameworks.

The World Bank Group	Government of Ukraine	Directorate General for Neighbourhood Policy and Enlargement Negotiations	United Nations

EXECUTIVE SUMMARY

Mykolaiv Oblast State Administration building. Photo from Mykolaiv City Council.

The Russian Federation's invasion of Ukraine, which began February 24, 2022, has caused significant civilian casualties and damage to infrastructure and productive assets, and has taken a severe human, social, and economic toll. The early months of the war were characterized by battles in critical cities, such as Mariupol, and around Kyiv, areas where the Government of Ukraine temporarily did not have control of significant territory. However, starting from April 2022, the government brought more than half of this territory back under its control, with limited loss of control in new areas. On the other hand, since September 2022, there has been an increase in damage due to the use of remotely delivered explosives (e.g., missiles, drones) to target critical infrastructure, such as energy. These shifts in the trajectory of war are reflected in the updated assessment of damage and needs presented here, and in the changes since the first damage and needs assessment (RDNA1), which assessed impacts up until June 1, 2022.[1]

The second Rapid Damage and Needs Assessment (RDNA2)—jointly developed by the World Bank Group, the Government of Ukraine, the European Commission, and the United Nations—presents an assessment of one year of war impacts, in line with a globally accepted methodology. The assessment quantifies direct physical damage to infrastructure and buildings and quantifies the needs as the costs for recovery and reconstruction. To support the Government of Ukraine and partners with urgent recovery and reconstruction planning, the RDNA2 also estimates 2023 implementation priorities and costs, which consider urgent recovery and reconstruction needs, government priorities, absorptive and implementation capacity of different sectors, and to some extent available financing. Due to the ongoing war, there are inherent data limitations and assumptions, which are noted in the report.

The full year of war has resulted in more than US$135 billion in direct damage to buildings and infrastructure. The most affected sectors have been housing (38 percent), transport (26 percent), energy (8 percent), commerce and industry (8 percent), and agriculture (6 percent). Donetska, Kharkivska, Luhanska, Zaporizka, Kyivska, and Khersonska oblasts have sustained the greatest direct damage (Figure 1). The energy, housing, and transport sectors have had the greatest increase in direct damage since the RDNA1 estimates, commensurate with the trajectory of war since June 1, 2022.[2] Agricultural damage is also significantly higher, reflecting both increased asset destruction and more precise data. But the damage since June 1, 2022, has not escalated as much as could have been expected. This is because despite notable intensification of the war in frontline regions—with Kharkivska, Khersonska, Donetska, and Zaporizka oblasts having sustained the greatest increase in both war events and damage (Figure 2)—there has been much more limited change in frontline areas than in the first three months of the invasion, as reflected in RDNA1.[3]

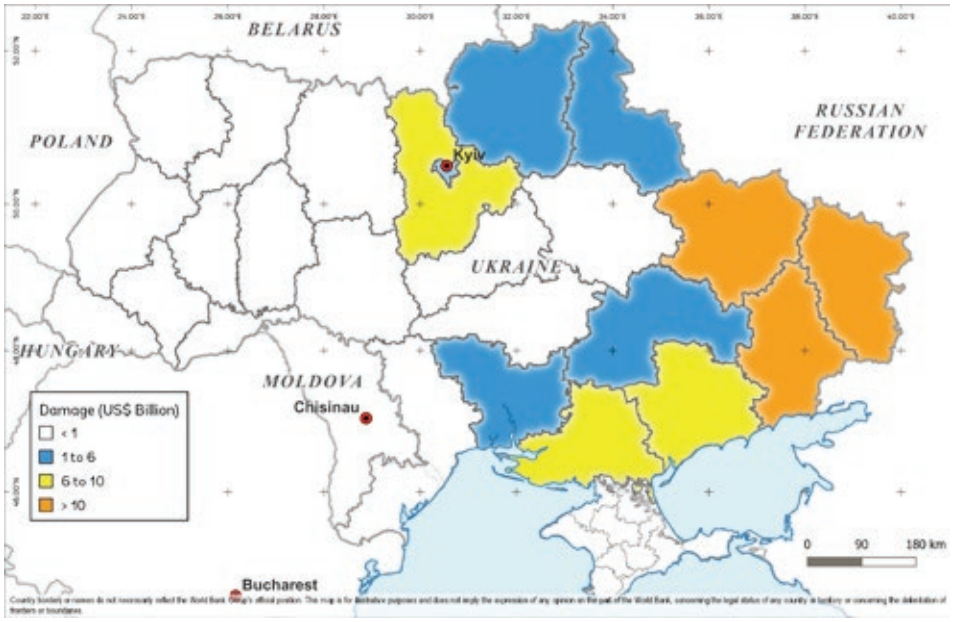
Total estimated reconstruction and recovery needs exceed US$411 billion (Figure 3, Figure 10), which is 2.6 times the actual GDP of Ukraine in 2022. Costs — estimated for 10 years — consider inflation, market conditions, surge pricing in construction commonly seen in areas of mass construction, higher insurance premiums, and a shift toward lower energy intensity and more resilient, inclusive, and modern design. The highest estimated needs are in transport (22 percent), housing (17 percent), energy (11 percent), social protection and livelihoods (10 percent), explosive hazard management (9 percent), and agriculture (7 percent). The needs for explosive hazard management have decreased since RDNA1, due to an improved assessment of the land area considered as potentially contaminated by explosives, clearance of some areas, and a shift toward more cost-efficient approaches given the significant contaminated area. Other areas — such as human development sectors (including health and education) as well as commerce and business — contribute substantially to the remaining needs. Across all sectors, the cost of debris clearance and management (and demolition where needed) exceeds US$5 billion. Since June 2022, sectors with the greatest increase in needs are energy, social protection and livelihoods, transport, agriculture, and housing. The geographic areas with the greatest increase in needs are Donetska, Kharkivska, Luhanska, and Khersonska.

1 World Bank, Government of Ukraine, and European Commission, "Ukraine Rapid Damage and Needs Assessment," August 2022, *Link.*

2 Between RDNA1 and RDNA2, there was a 25 percent decrease in the exchange rate, so that Ukrainian hryvnias translate to fewer US dollar equivalents; this means that the changes between RDNA1 and RDNA2 are more significant than the absolute numbers show.

3 For example, many of the roads and fields completely damaged by heavy and/or tracked vehicles in the early months of the war and counted in RDNA1 are not double-counted under RDNA2.

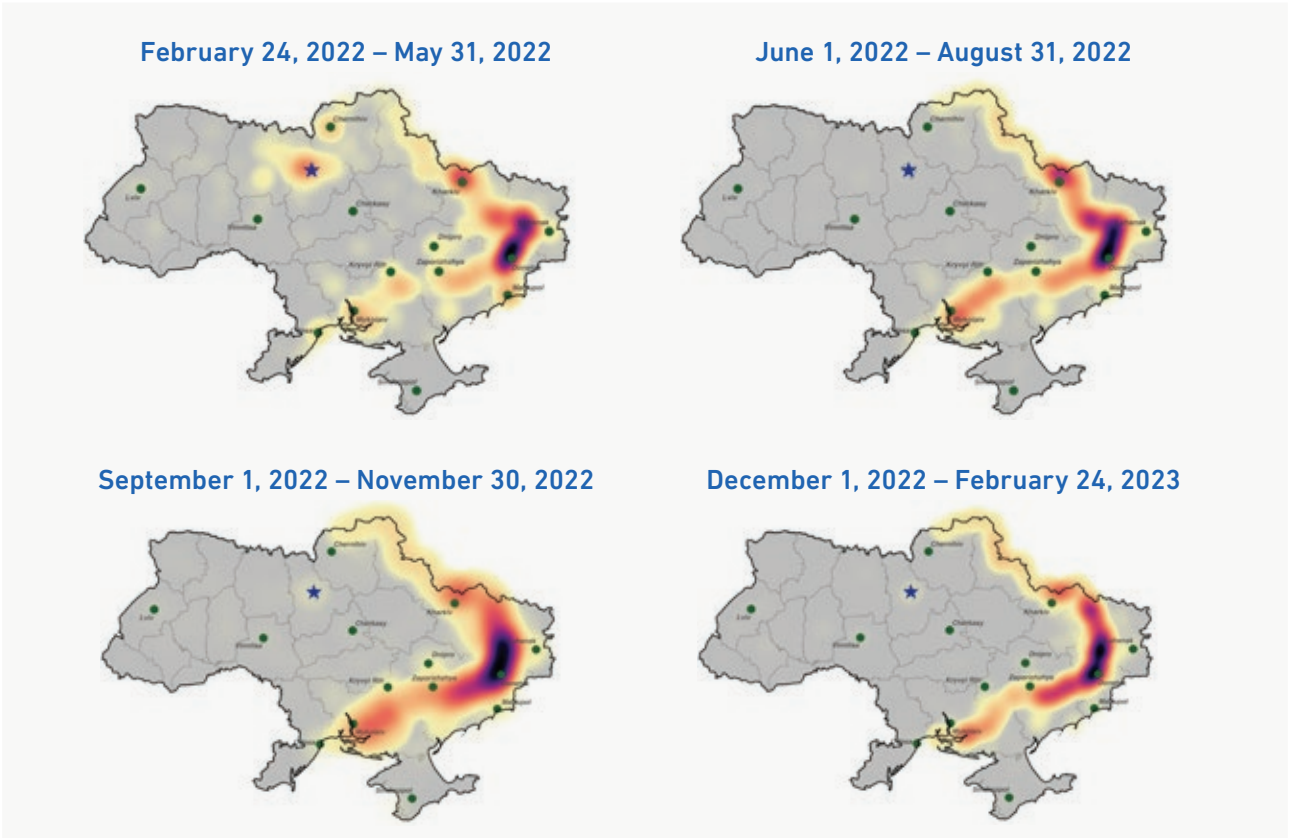
Figure 1. Extent of damage by region as of February 24, 2023



Source: Assessment team.

Note: The map draws on damage data as collected and assessed under the RDNA2. There were data limitations for certain regions, including Khersonska oblast.

Figure 2. Spatial evolution of the war between February 2022 and February 2023



Source: Armed Conflict Location and Event Data Project (ACLED), processed by assessment team. For ACLED, see Clionadh Raleigh et al., "Introducing ACLED-Armed Conflict Location and Event Data," Journal of Peace Research 47, no. 5 (2010): 651–60, *Link*.

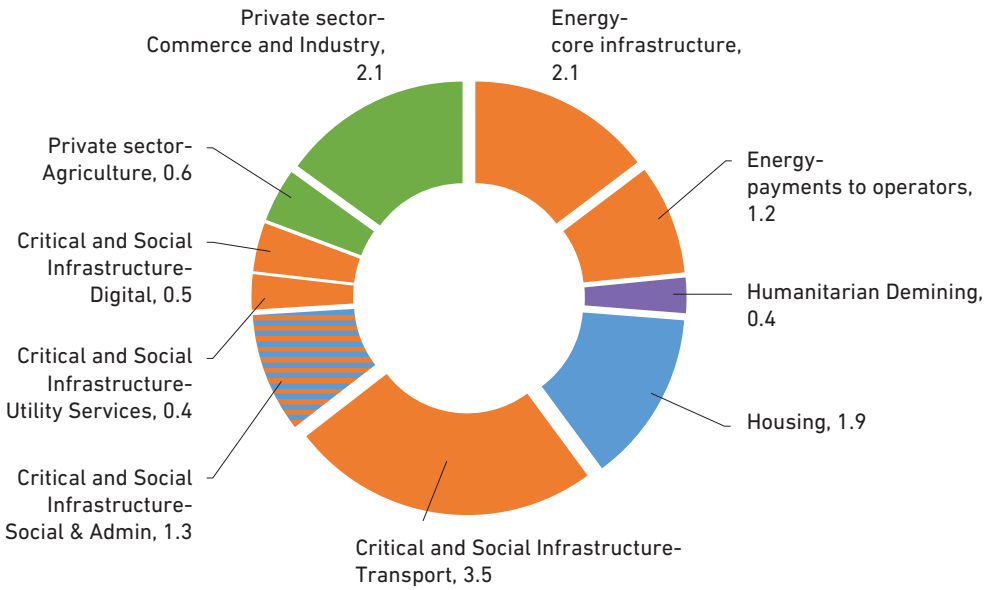
Note: Conflict events include battles and explosions/remote violence as classified per ACLED methodology.

It is also important to recognize that since RDNA1, some of the needs have been met by the Government of Ukraine with the support of its partners. For example, in the health sector over 500 affected assets have been partially or fully repaired; and the energy and transport sectors have benefited from the provision of equipment, materials, and financing to make rapid repairs. The Government was also supported with a significant humanitarian response of US$3.4 billion in 2022.[4]

Meeting the overall estimated needs will be critical for the long-term recovery, but all needs cannot be immediately met. The timeframe will depend on the availability of financing, but also on the absorptive capacity of the Ukrainian budget, implementation capacity and coordination among line ministries, subnational authorities, civil society, and community-based organizations, and other implementing agencies; the readiness of the private sector to support and help implement capital investments; the availability of materials and labor; and the future trajectory of the war. However, there will be a tremendous social and economic cost, borne especially by the poorest and most vulnerable, if the most urgent needs are not met in the short term.

Considering urgent needs and implementation capacities, and aligning with the government's recovery and reconstruction priorities, the RDNA2 estimates implementation priorities for 2023 at around US$14 billion, or close to 3.5 percent of total needs identified (Figure 5). The total needs for 2023 across all RDNA2 sectors covered are close to US$18 billion. But the government has already taken steps to provide for the urgent needs of its citizens through its budget, most notably supporting IDPs and the broader provision of social protection and has established a core set of investment priorities for 2023. Taking account of these government priorities as of March 2023, the RDNA2 identifies US$14 billion in implementation priorities for 2023. Three sectors dominate investment needs: transport, energy, and housing (Figure 4). Beyond these sectors, significant support (US$2.7 billion) is prioritized to catalyze investment from the private sector, including agriculture, to sustain productive capacity and catalyze recovery and reconstruction. This support includes a combination of grants and subsidized credit along with guarantees and insurance instruments to de-risk private investment and trade.

Figure 4. Priority investments for 2023 (US$ billions): US$14 billion



Source: Assessment team.

Note: Sectoral definitions used in this figure are aligned with government priorities and do not match exactly with the structure of the RDNA2; colors of sectors are aligned with RDNA definitions.

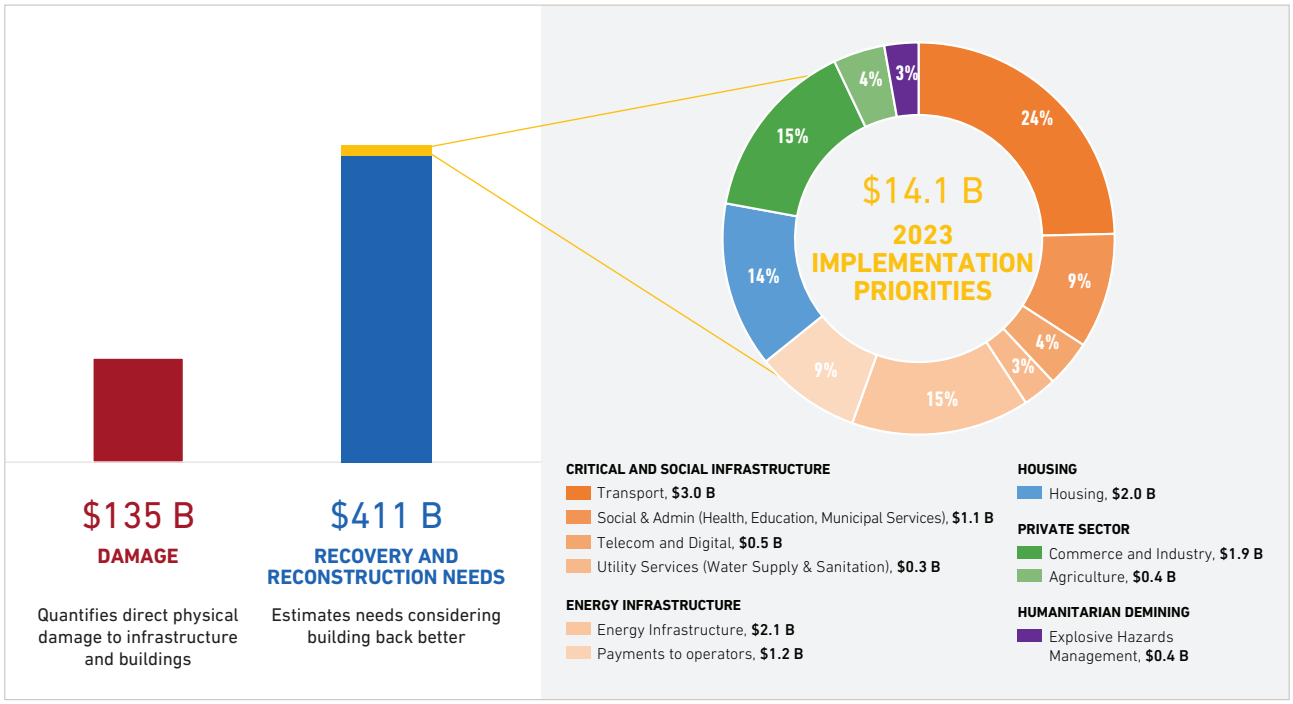
4 United Nations Office for the Coordination of Humanitarian Affairs (OCHA) Ukraine. Ukraine: 2022 Flash Appeal Funding Snapshot - 21 February 2023. *Link*.

Meeting the 2023 priorities will require close to US$11 billion in additional financing. This includes US$6 billion in unfunded direct budget needs and nearly US$5 billion in financing needs to support SOEs and catalyze the private sector. Of the US$14 billion in priorities identified, US$9.3 billion require direct government spending through capital and current expenditures and transfers. Of this US$9.3 billion, US$3.3 billion can be addressed through existing provisions in the 2023 budget. This leaves US$6 billion in unfunded government-implemented and -financed priorities. Government will also need to support financing of SOEs, which require a further US$3.3 billion, while another US$1.5 billion is needed to support financing mechanisms to sustain and de-risk private investment.

The scale of investment required for Ukraine's reconstruction will be substantial and will necessitate leveraging limited public and donor funding with private investment. Development partner support for public investment is key, but this public investment will have to be complemented by significant private investment to maximize the available financing for reconstruction. Some sectors and situations could deploy scarce public funding to leverage additional private investment. An opportunity exists to develop innovative financing structures to mitigate risks and enable more private finance.

The July 2022 Lugano Declaration for the Reconstruction of Ukraine outlined guiding principles for recovery and reconstruction.[5] Based on international experience, this report highlights principles that complement those outlined in Lugano, including (i) ensuring a pragmatic, differentiated, and flexible approach to balancing the most urgent needs with what can be achieved in the medium term, considering the impact of war in different geographic areas; (ii) focusing on building back better for a more sustainable future, including harmonization of Ukraine's legislation and policies with European Union law and standards and the *acquis communautaire*; and (iii) ensuring the readiness of Ukrainian institutions, systems, and regulations for transparent and efficient long-term recovery and reconstruction programs, taking into consideration external and private support and the still recent reforms on the devolution of power and decentralization in Ukraine.

Figure 5. RDNA2 key results: damage, needs, and 2023 priorities



Source: Assessment team.

Note: US$14billion reflects 2023 investments in government-prioritized sectors. Total 2023 implementation needs across all RDNA2 sectors is US$18 billion.

5 URC2022, "Lugano Declaration," 2022, *Link.* The Lugano Declaration's principles include partnership, reform focus, transparency, accountability, and rule of law; democratic participation; multistakeholder engagement; gender equality and inclusion; and sustainability.

INTRODUCTION

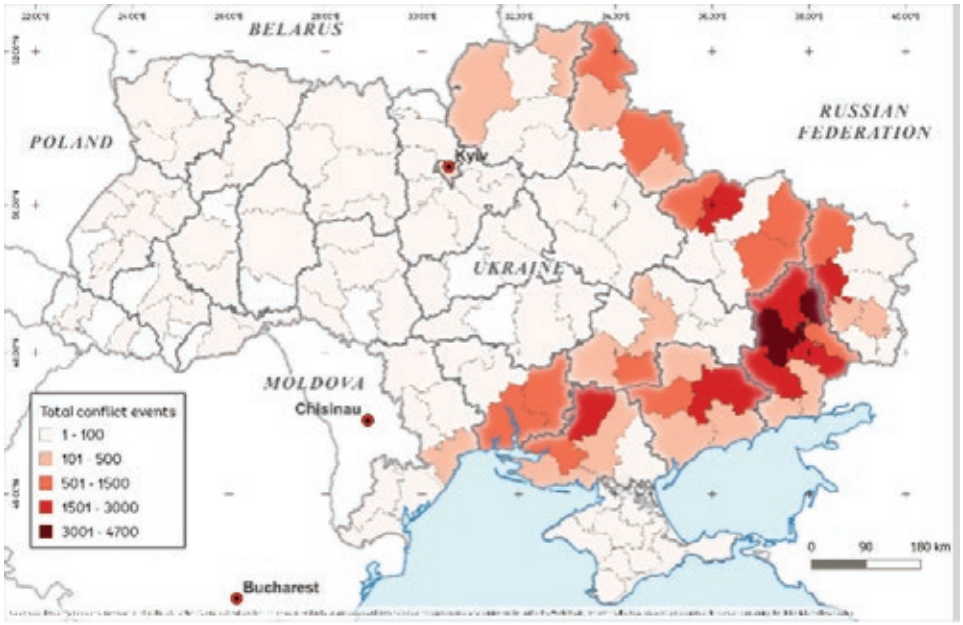
2022 Invasion of Ukraine

Russia's invasion of Ukraine in February 2022 has caused widespread civilian casualties and significant damage to infrastructure. The war has brought hardship for the population, as livelihoods have been lost and access to basic services, such as healthcare and education, have been severely disrupted. The 2022/2023 winter has posed significant challenges for the population, especially for those affected by the ongoing fighting in the eastern and southern regions. The invasion has caused economic disruption, job loss, and low investor confidence, affecting public and private financing. Given the scale of destruction and disruptions, the war is expected to have far-reaching human development impacts.

There have been different phases of war intensity. The initial months of the 2022 invasion included a high number of war-related events, correlated with large-scale destruction and disruption across several regions and different sectors. Missile and drone attacks on Ukrainian critical infrastructure, especially on energy infrastructure and housing, started in early October 2022 and continued through the autumn and winter of 2022/2023, resulting in power outages across the country and shortages of food, heating, and water. Since winter, active warfare has been concentrated mostly in the eastern and southern areas, and the Government of Ukraine has regained control over several regions — approximately one-quarter of the land previously not under government control.[6] War intensity over the year is illustrated in Figure 6. The change in war intensity since June 1, 2022, is highlighted in Figure 7.

6 Data are from Institute for the Study of War and American Enterprise Institute's Critical Threats Project, as presented in the Washington Post, February 21, 2023, *Link*.

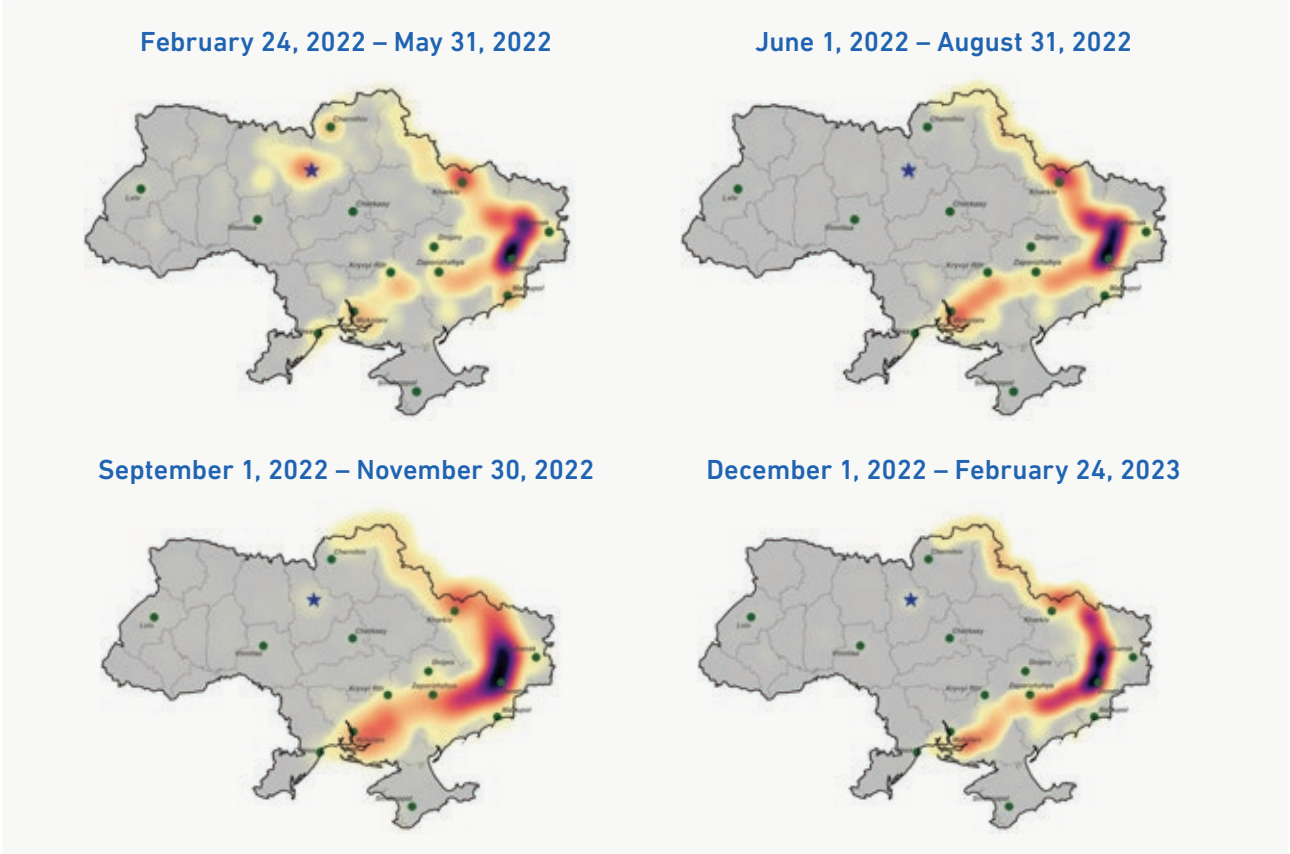
Figure 6. War intensity between February 24, 2022, and February 24, 2023



Source: Assessment team.

Note: Map is based on ACLED, considering average monthly conflict events. For ACLED, see Clionadh Raleigh et al., "Introducing ACLED-Armed Conflict Location and Event Data," Journal of Peace Research 47, no. 5 (2010): 651–60, *Link*.

Figure 7. Spatial evolution of the war between February 2022 and February 2023



Source: ACLED, processed by assessment team. Violent events include battles/remote violence and violence against civilians as classified per ACLED methodology.

Note: Conflict events includes battles and explosions/remote violence as classified per ACLED methodology.

RDNA2 Objectives and Methodology

This second Rapid Damage and Needs Assessment (RDNA2) considers social, infrastructure, and productive sectors as well as cross-cutting sectors and issues. The RDNA2 assesses the impact between February 24, 2022, and February 24, 2023. In doing so, it builds on the foundations and analytics of RDNA1, which covered the period between February 24 and June 1, 2022, and which estimated US$97 billion in direct damage, US$252 billion in losses, and US$349 billion for Ukraine's recovery and reconstruction needs.[7]

The RDNA2 follows a globally established and recognized methodology jointly developed by the World Bank, the European Union, and the United Nations. This approach has been applied globally in post-disaster and war contexts to inform recovery and reconstruction planning. The report uses standard terminology, with key terms highlighted in Box 1. The use of the global approach and standard terminology facilitates any future assessments. Building back better and principles of green, resilient, inclusive, and sustainable recovery and reconstruction form an integral part of the assessment across all sectors.

Complementary to the standard methodology and the estimation of short- and long-term needs, this RDNA2 report also includes an estimation of realistic implementation priorities for recovery and reconstruction investments for 2023. This estimation considers government strategic priorities, delivery instruments, market and institutional constraints to implementation at the sector level, and the degree to which financing is already available to facilitate implementation. This initial estimate, to be monitored and refined over time, can further inform investment planning, mobilization of resources, and implementation. The RDNA2 also includes an overview of key risks related to engagement of the private sector in recovery and reconstruction efforts.

The RDNA2 faced several constraints and relied on several specific assumptions. The sector assessments were produced in a short time frame with sometimes significant limitations related to data availability (such as for data related to the private sector or geographic areas, or for data related to environmental impacts) and data sensitivity (such as for critical energy infrastructure). Field verification was not possible due to the ongoing war. To ensure the relevance of the estimations, substantial efforts have been made to improve to the extent possible the accuracy of the information that was collected, analyzed, and verified. The RDNA2 does not provide asset-level information. Damage to asset types considers three levels: fully destroyed, damaged, and no/minor damage. Since loss is typically measured until "normality" is restored, the calculation includes an additional 18 months following the 12 months between February 24, 2022, and February 24, 2023. The report's assumptions will have to be carefully reviewed and validated in the case of future assessments. The geographic scope includes all areas under government control on February 1, 2022. The RDNA2 is not intended for legal or compensatory claims. While the assessment considers human impacts of the war, there are many gaps and the report can serve as basis for further analysis. Future analyses may also consider assessing in more depth the deterioration of infrastructure and services in areas with limited or no fighting and increased investment needs, both of which are beyond the scope of this assessment.

The exchange rate used in RDNA2 is significantly different from that in RDNA1. The RDNA1 report used the exchange rate of US$1 = UAH 27.28, which was the exchange rate in December 2021. The RDNA2 report uses the exchange rate of US$1 = UAH 36.5686, given devaluation of the hryvnia in July 2022 of 25 percent. The change of value affects calculations for the period between February 24, 2022, and June 1, 2023, in those sectors that used unit costs in hryvnia. For those affected sectors, all values have been recalculated with the RDNA2 exchange rate for the period February 2022–February 2023.

In the report, regions are organized according to groupings presented by the Government of Ukraine at the Ukraine Recovery Conference in Lugano, Switzerland, in July 2022, updated based on the current situation. Frontline regions are those areas temporarily not under government control and/or areas of active war; support regions are those providing logistics for defense and humanitarian cargo; backline regions are those protecting export/import logistics hubs and evacuated enterprises; and regions where the government has regained control are areas recovering from sustained damage.

7 World Bank, GoU, and EC, "Ukraine Rapid Damage and Needs Assessment," August 2022, *Link.*

Box 1. RDNA2 definitions

Damage: Direct costs of destroyed or damaged physical assets and infrastructure; valued in monetary terms with costs estimated based on replacing or repairing physical assets and infrastructure, considering the replacement price prevailing before the war.

Loss: Changes in economic flows resulting from the war; valued in monetary terms, for example, increased operating cost, loss of revenue for authorities/private sector, etc.

Needs: Value associated with the resumption of prewar normality through activities such as repair and restoration, including a premium linked to building back better principles (e.g., improved energy efficiency (EE), modernization efforts, and sustainability standards), as well as factors such as global inflation, surge pricing due to volume of construction, higher insurance, and so forth. Needs are expressed in monetary value according to market prices prevailing as of February 24, 2023. Needs do not equal the sum of damage and losses.

Build back better: Relates to measures that the government decides should be integrated into rehabilitation and reconstruction of damaged assets, including improved functionality, EE, universal access, disaster and climate resilience, and critical modernization measures, including right-sizing and right-siting of infrastructure and services. This costing is added in the needs calculation, and each sector uses appropriate standards and costing assumptions.

Implementation priorities for 2023: The estimation considers government strategic priorities, delivery instruments, market and institutional constraints to implementation at the sector level, and the degree to which financing is already available to facilitate implementation.

SUMMARY OF DAMAGE, LOSSES, AND NEEDS

Borodyanka City, Kyiv Oblast. Photo by Julia Burlachenko.

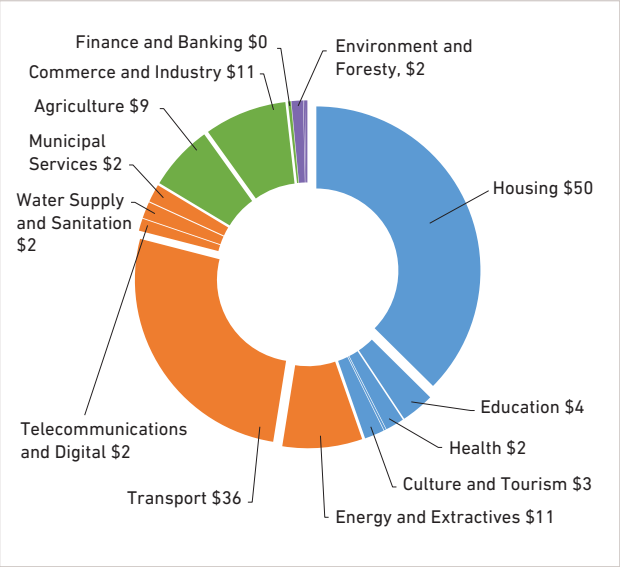
The total damage across sectors covered in the RDNA2 is estimated at approximately US$135 billion (Figure 8, Table 1). The most damage-affected sectors are housing (38 percent of total damage), transport (26 percent), energy (8 percent), commerce and industry (8 percent), and agriculture (7 percent). The most affected oblasts are Donetska, Kharkivska, Luhanska, Zaporizka, Kyivska, and Khersonska (Table 2, Figure 11).

The sectors with largest increases compared to the RDNA1 results include energy, housing, and transport, reflecting the number of attacks, but also agriculture, given increased destruction of assets as well as improved information. Geographic areas where damage has increased the most since June 1, 2022, are Kharkivska, Donetska, Khersonska, and Zaporizka regions, which are considered frontline and/or have faced the most attacks on energy infrastructure (Figure 11).

Aggregate economic, social, and other monetary loss totals almost US$290 billion (Table 1, Figure 9). Loss is dominated by commerce and industry (30 percent of total loss), explosive hazard management (covering landmines and unexploded ordnance, 13 percent), transport (11 percent), agriculture (11 percent), and energy (9 percent). Across all sectors, debris clearance and management (and demolition where needed) exceeds US$5 billion. It should be noted that losses in one sector flow into and intersect with those in other sectors, though calculations avoid double-counting. For example, reduction in agricultural production affects transportation needs, and loss of electricity affects commerce and industry in areas that are otherwise unaffected by the war. Under total loss figures, household income loss valued at US$61.5 billion is not included to avoid potential double-counting in relation to other sectors.

Compared with RDNA1 results, the energy sector and commerce and industry sector have seen a significant increase in losses. For the energy sector, RDNA2 estimated U$27 billion in losses compared to US$12 billion in RDNA1, corresponding to the targeting of energy infrastructure facilities since autumn 2022. For the commerce and industry sector, RDNA2 estimated U$86 billion in losses, linked also to disruptions in utilities services, compared to U$48 billion in RDNA1. Notable net changes in losses for regions are recorded for Kyiv City and Kharkivska and Donetska oblasts.

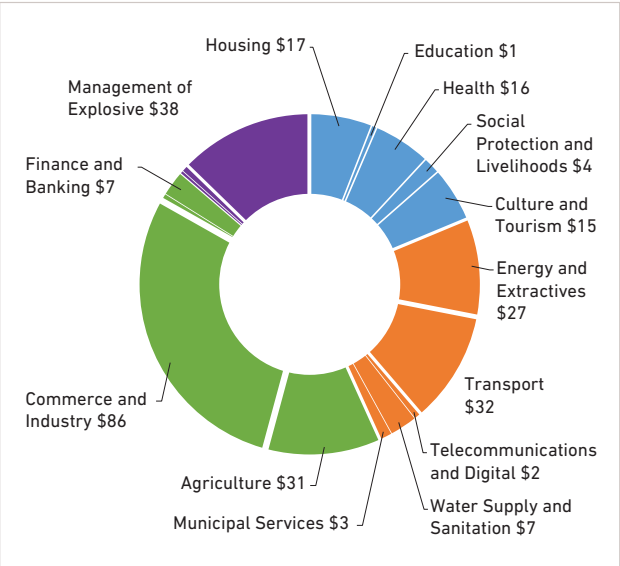
Figure 8. Total damage (US$ billion): US$135 billion



Source: Assessment team.

Note: Damage covers the period February 24, 2022, to February 24, 2023.

Figure 9. Total loss (US$ billion): US$290 billion



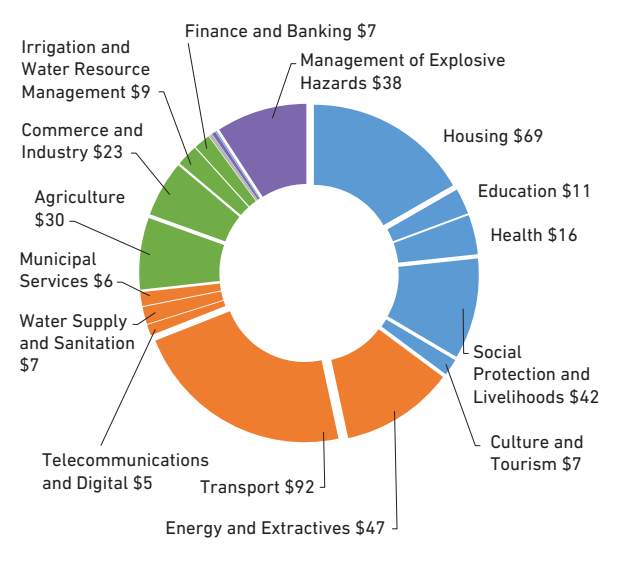
Source: Assessment team.

Note: Loss includes an additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023. Under social protection and livelihoods, household income loss valued at US$61.5 billion is not included to avoid potential double-counting in relation to other sectors.

The total reconstruction and recovery needs are estimated at about US$411 billion (Table 3). The considerable magnitude of the needs arises from a war that has spanned a large geographical area (including urban areas). As shown in Figure 10, the sectors with the highest estimated needs are transport (22 percent of total needs), housing (17 percent), energy (11 percent), social protection and livelihoods (10 percent), explosive hazard management (9 percent), and agriculture (7 percent). Other sectors, including commerce and industry (6 percent), health (4 percent), and education (3 percent) contribute substantially to the remaining needs.

Since the RDNA1, sectors that have faced the most significant increase in needs are energy, social protection and livelihoods, transport, agriculture, and housing. The geographic areas with the greatest increase in needs are Donetska, Kharkivska, Luhanska, and Khersonska as a result of the war since June 1, 2022, but also as a result of improved data collection in some areas. It is also important to recognize that since RDNA1 some of the needs have been met by the Government of Ukraine with the support from its partners, for example, as regards to the ongoing repairs in the energy and transport sectors.

Figure 10. Total recovery and reconstruction needs (US$ billion): US$411 billion



Source: Assessment team.

Note: Needs relate to total estimated needs covering the period 2023–2033.

Meeting the overall estimated needs will be critical for the long-term recovery from the war, but all needs cannot be met immediately. The timeframe for covering these needs will depend on the availability of financing, but also on the absorptive capacity of the Ukrainian budget, and implementation capacity and coordination among line ministries, subnational authorities, civil society and community-based organizations, and implementing agencies; the readiness of the private sector to support capital investments; and the trajectory of the war. The critical role of private sector investments in meeting these needs should be noted; further information is provided in the final chapter. An estimation of implementation priorities for 2023 is discussed in the next section.

The war has had widespread macroeconomic and social impacts. The war inflicted significant losses of jobs and income in the private sector, loss of purchasing power, and loss of assets among Ukrainians, particularly the most vulnerable. Ukraine's GDP shrank by 29.2 percent in 2022. 9,655 civilians have lost their lives, including 461 children; thousands have been injured; 13.5 million people have been displaced within Ukraine and across Europe; and millions have lost their homes. 7.1 million people have been pushed into poverty,[8] as poverty increased from 5.5 to 24.1 percent, reversing 15 years of progress. The impacts of war are uneven, with the greatest effects on women, children, and people with disabilities. Overall, there have been dramatic set-backs on many of the Sustainable Development Goals (SDGs), especially those related to poverty, health, education, energy, industry, peace and justice (see Box 2).[9]

8 Based on the global poverty line of US$6.85 per person per day.

9 United Nations, Our Work on the SDGs in Ukraine, *Link*.

Table 1. Total damage, loss, and needs by sector (US$ billion)

Sector	Damage	Loss	Needs
Social sectors			
Housing	50.4	17.2	68.6
Education and science	4.4	0.8	10.7
Health	2.5	16.5	16.4
Social protection and livelihoods	0.2	4.2[a]	41.8
Culture and tourism	2.6	15.2	6.9
Infrastructure sectors			
Energy and extractives	10.6	27.2	47.0
Transport	35.7	31.6	92.1
Telecommunications and digital	1.6	1.6	4.5
Water supply and sanitation	2.2	7.5	7.1
Municipal services	2.4	3.0	5.7
Productive sectors			
Agriculture	8.7	31.5	29.7
Commerce and industry	10.9	85.8	23.2
Irrigation and water resource management	0.4	0.3	8.9
Finance and Banking	0.0	6.8	6.8
Cross-cutting sectors			
Environment, natural resource management, and forestry[b]	1.5	0.5	1.5
Emergency response and civil protection	0.2	0.5	1.5
Governance and public administration	0.3	1.4	0.6
Explosive hazard management	-	37.6	37.6
Total	**134.7**	**289.1**	**410.6**

Source: Assessment team. *Note:* Damage covers the period February 24, 2022, to February 24, 2023; loss includes an additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023; needs relate to total estimated needs covering the period 2023–2033.

a. Under social protection, household income loss valued at US$61.5 billion is not included to avoid potential double-counting in relation to other sectors.

b. Under environment and forestry, due to data limitations, only damages, losses and needs related to forest fires and mined forest areas, along with needs related to capacity building for environmental governance are included.

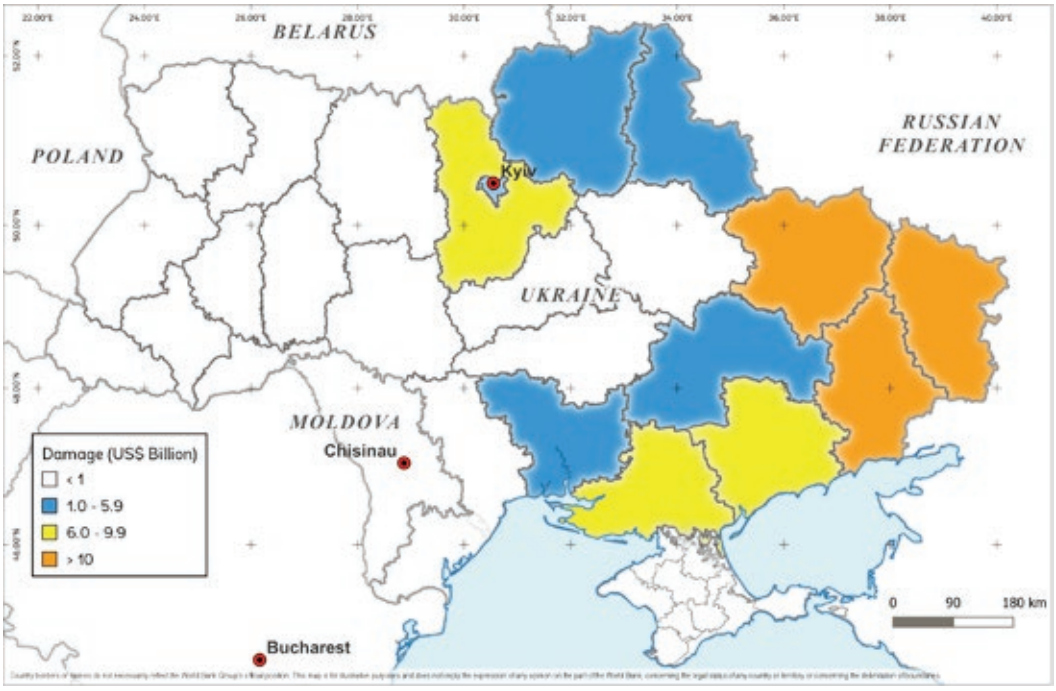
Table 2. Damage, loss, and needs by oblast for select sectors (US$ billion)

Oblast	Damage	Loss	Needs
Frontline regions, subtotal	**103.5**	**133.2**	**231.8**
Donetska	35.2	43.1	67.4
Zaporizka	9.7	15.7	29.0
Luhanska	18.1	17.9	41.6
Mykolaivska	5.6	7.6	13.7
Kharkivska	25.8	36.5	50.2
Khersonska	9.1	12.4	29.8
Support regions, subtotal	**2.7**	**22.3**	**15.9**
Vinnytska	0.2	3.8	2.6
Dnipropetrovska	1.7	7.0	6.0
Kirovohradska	0.1	2.5	1.6
Odeska	0.6	4.8	3.7
Poltavska	0.1	4.1	2.2
Backline regions, subtotal	**0.4**	**16.8**	**11.4**
Volynska	0.1	1.4	1.2
Zakarpatska	0.0	1.0	0.9
Ivano-Frankivska	0.0	1.3	0.9
Lvivska	0.1	3.9	1.9
Rivnenska	0.1	1.5	1.3
Ternopilska	0.0	1.6	1.0
Khmelnytska	0.0	2.2	1.7
Chernivetska	0.0	0.9	0.7
Cherkaska	0.1	3.1	1.7
Regions where government has regained control, subtotal	**19.8**	**60.4**	**56.4**
Kyiv City	1.3	15.8	6.1
Zhytomyrska	0.8	2.9	3.7
Kyivska	9.2	19.8	20.4
Sumska	2.8	7.5	9.3
Chernihivska	5.7	14.5	16.8
Not specified—nationwide, subtotal	**8.3**	**56.5**	**95.1**

Source: Assessment team.

Note: Damage covers the period February 24, 2022, to February 24, 2023; loss includes an additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023; needs relate to total estimated needs covering the period 2023–2033. Loss and needs are not quantified for all sectors in the assessment; and for Kyiv City, not all sectors separate damage, loss, and needs.

Figure 11. Extent of damage by region as of February 24, 2023



Source: Assessment team.

Note: The map draws on damage data as collected and assessed under the RDNA2. There were data limitations for certain regions, including Khersonska oblast.

Table 3. Total recovery and reconstruction needs by sector (US$ billion) as of February 24, 2023

Sector	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Social sectors			
Housing	31.5	37.1	68.6
Education and science	4.3	6.4	10.7
Health	3.6	12.7	16.4
Social protection and livelihoods	17.8	24.0	41.8
Culture and tourism	2.3	4.6	6.9
Productive sectors			
Agriculture	10.2	19.5	29.7
Irrigation and water resource management	0.1	8.8	8.9
Commerce and industry	12.1	11.1	23.2
Finance and banking	6.5	0.3	6.8
Infrastructure sectors			
Energy and extractives	5.7	41.3	47.0
Transport	**14.1**	**78.0**	**92.1**
Telecommunications and digital	3.0	1.5	4.5
Water supply and sanitation	3.9	3.3	7.1
Municipal services	1.7	4.0	5.7
Cross-cutting sectors			
Environment, natural resource management, and forestry	0.4	1.0	1.5
Emergency response and civil protection	0.5	1.0	1.5
Justice and public administration	0.2	0.4	0.6
Explosive hazard management	10.0	27.6	37.6
Total	**128.0**	**282.6**	**410.6**

Source: Assessment team.

Box 2. War's human impacts and impacts on select SDGs

SDG 1: No poverty: Poverty increased from 5.5 percent in 2021 to 24.1 percent in 2022, pushing an additional 7.1 million people into poverty and setting back 15 years of progress. War-affected regions are expected to experience higher poverty rates, with the highest monetary poverty rates in Odeska, Luhanska, Khersonska, and Kharkivska regions.[10] The projected share of children living below the national definition of poverty increased from 43.5 percent to 65.2 percent in 2022.[11]

SDG 2: Zero hunger: The share of households with insufficient food consumption increased over 2022. By the end of 2022, the share of households with insufficient food consumption was around one in four for nondisplaced households and one in three for displaced households.[12]

SDG 3: Good health and well-being: Per official records, the war has led to the death of 9,655 civilians, including 461 children, and has injured 12,829 civilians.[13] There are 24,613 families and facilities being supported by the government to provide care for orphaned children. The RDNA2 estimates a loss of US$13.2 billion in DALYs, for 12 months since the invasion and additional 18 months following, resulting in the estimated loss from additional health burden more than tripled compared to RDNA1. Per World Health Organization estimates, up to 10 million Ukrainians are at risk of some form of mental disorder, from anxiety and stress to a more severe condition.

SDG 4: Quality education: At least 2 million children have left Ukraine and are expected to remain abroad in other countries in Europe, contributing to brain drain of human resources. The war's impact on education will negatively affect Ukraine's human capital, with Harmonized Learning Outcome scores potentially declining from 481 to 420 points. This translates to future earnings losses estimated to be in the trillions of dollars.

SDG5: Gender equality: Assessed female-headed households were more likely to report "extreme" or "extreme+" needs (46 percent), compared to male-headed households (38 percent).[14] A Regional Gender Task Force found that pregnant and breastfeeding women, young single women, and women from minority groups (such as Roma and stateless women) are particularly vulnerable to protection risks, gender-based violence, and security risks during displacement.[15] Among those receiving State Employment Service support with the status of unemployed, the majority were women (68 percent in January 2023). The share of male internally displaced persons (IDPs) relying on regular wages as the main source of income declined from 50 percent to 38 percent between August 2022 and January 2023. The conditions for women are much worse as only 25 percent of women rely on regular wages as their main source of income.[16]

SDG 16: **Peace, justice, and strong institutions:** The war has exacerbated preexisting vulnerabilities of certain large social groups: There are about 13.5 million IDPs, including 8.1 million displaced across Europe and 5.4 million internally displaced within Ukraine.[17] People with disabilities number 3 million, and veterans number 1 million, and the latter group is expected to triple in size during the course of war. According to the Office of the Prosecutor General of Ukraine, as of February 22, 2023, the war has led to the death of 9,655 civilians, including 461 children; 12,829 injured civilians, including 926 children; and more than 68,000 war crimes, including 2,600 committed against children.[18] The National Information Bureau has reported that as of February 2023, the total number of deported and illegally displaced citizens of Ukraine was 143,239, including 16,221 children.[19] The war has also had an impact on access to information and freedom of expression. UNESCO reported that 10 journalists have lost their lives in the exercise of their profession in Ukraine since February 2022.[20]

10 UNDP, "Ukraine: A Rapid Assessment of the Impacts of the War on Poverty and its Mitigation Potential," Development Future Series, Policy Brief, Forthcoming.
11 UNICEF, "Child Poverty: Initial Estimates of the Impact of the War on the Situation of Households with Children," 2023.
12 IOM, "Ukraine Internal Displacement Report: General Population Survey, Round 12 (16–23 January)," Link.
13 Government of Ukraine, press conference on the work of the prosecutor's office, February 22, 2023, Link.
14 REACH and World Food Programme, "2022 MSNA Bulletin: Ukraine," February 2023, Link.
15 Regional Refugee Response for the Ukraine Situation, "Making the Invisible Visible: An Evidence-Based Analysis of Gender in the Regional Response to the War in Ukraine," October 2022, Link.
16 IOM General Population Surveys.
17 UNHCR Operational Data Portal for Ukraine, Link; IOM, "Ukraine Internal Displacement Report: General Population Survey, Round 12 (16–23 January 2023)," Link.
18 Government of Ukraine, press conference on the work of the prosecutor's office, February 22, 2023, Link.
19 The bureau was established in March 2022; see Cabinet of Minister Decree #228-□ as of March 17, 2022, Link.
20 UNESCO Observatory of Killed Journalists, as of 15 March 2022, Link

ESTIMATION OF 2023 IMPLEMENTATION PRIORITIES

State University, Irpin City, Kyivska Oblast. Photo by Julia Burlachenko.

Meeting needs in Ukraine will require financing on a very large scale, but an organized, sequenced response can help ensure immediate needs are met, while also setting the groundwork for recovery. To this end, RDNA2 assesses the urgent implementation priorities for 2023, taking into consideration government strategic priorities and existing financing and implementation capacity.[21]

With large needs across all sectors of the economy and members of society, the Government of Ukraine is making hard choices to prioritize spending to safeguard lives and welfare and support the economy. In this context, the top priority is to ensure the government is able to finance its core functions and provide critical services to its citizens, including delivering fully on the social protection needs identified in the RDNA2. Beyond this, focus is on five key recovery and reconstruction investment priorities:

1. **Energy infrastructure**, including restoration and repair of transmission and distribution lines and restoration and decentralization of generation capacity, including development of renewables and protection of the power grid
2. **Humanitarian demining**,[22] with a focus on building the strategic and operational capacity for demining operations (in particular the governance and implementation of survey, clearance, and land-release operations)
3. **Housing**, including light repair and capital repairs
4. **Critical and social infrastructure**[23] and basic service delivery to vulnerable populations, including renewal of provision of utilities services, repair and reconstruction of transport infrastructure (roads, railways, bridges, ports), and repair and reconstruction of schools, health facilities, and other social and administrative infrastructure
5. **Private sector development,**[24] including grants, credit lines, and risk facilities to support small and medium enterprises (SMEs), microenterprises, agriculture sector, and exports

The RDNA2 estimates implementation priorities for 2023 at US$14 billion, or close to 3.5 percent of total needs identified in the RDNA2. The total needs for 2023 across all RDNA2 sectors covered are close to US$18 billion. However, as noted above, government has already taken steps to provide for the urgent needs of its citizens, most notably supporting IDPs and the broader provision of social protection (US$3.5 billion in transfers identified in the RDNA2), as well as ensuring the ongoing government activity, through the existing budget. Moreover, given the focus on a core set of investments for 2023, another US$0.5 billion in RDNA2-identified needs are not included in the 2023 priorities.[25]

of the majority of 2023 priorities are expected to be executed directly through the state budget[26], but SoEs and the private sector will also carry out a significant share of investments. Implementation of the 2023 priorities is expected to be distributed as follows:

- US$7.8 billion in capital investments and other project-type expenditures[27] for restoring services and initiating reconstruction, mainly in critical and social infrastructure, housing, and energy (Figure 12).
- US$1.5 billion in current expenditures, consisting mainly of grants and subsidies to facilitate investment from the private sector.
- US$1.2 billion in payments to energy operators, including a provision of US$1 billion for gas

21 The analysis aims to identify the urgent priorities that can be implemented in 2023, considering factors such as instruments (e.g., projects requiring complex procurement at one end of complexity versus cash transfers at the other); absorption capacity of implementing agencies; supply-side and demand-side constraints in the market; geographical constraints to implementation (i.e., the inability to implement projects in zones where war is ongoing); typical project implementation timelines; and likelihood of private financing and implementation.

22 Referred to as explosive hazard management in this report.

23 Note that this definition is based on the scope of activities planned for support under the government's priorities for "critical and social infrastructure" and is not based on any legal definition of "critical infrastructure" or "social infrastructure" in Ukraine. It covers the following RDNA2 sectors: transport; education; health; water supply and sanitation; telecom and digital; and municipal services.

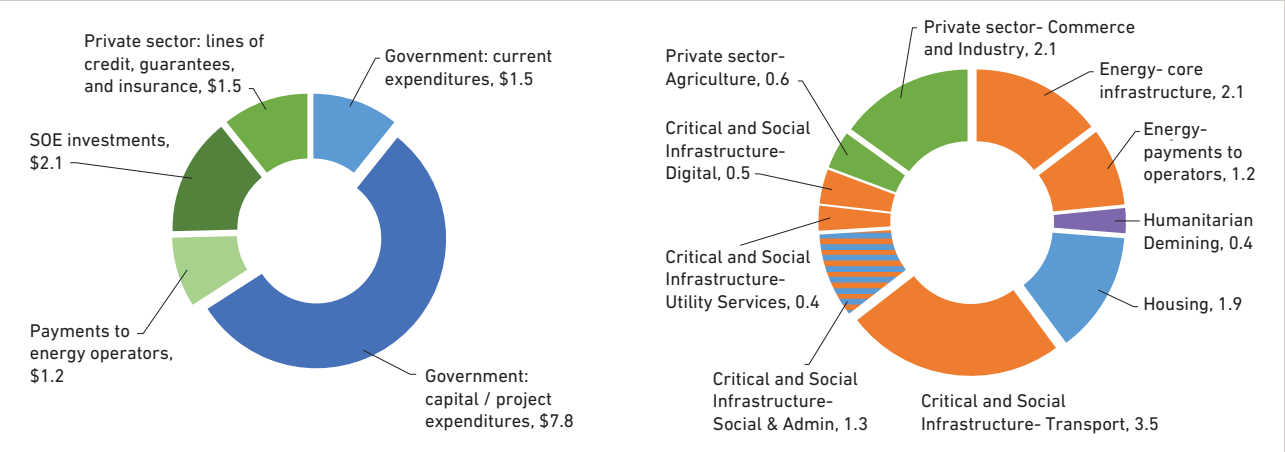
24 Includes agriculture and commerce and industry in this report.

25 These include culture and tourism; irrigation and water resources management; finance and banking; environment and forestry; justice and public administration; and emergency response and civil protection.

26 There may be cases where donors provide in-kind machinery, equipment, and other materials that would be off-budget, but for the purposes of the RDNA2, it was assumed that public sector executed activities would be financed through the state budget.

27 This report refers to "capital expenditures" in a broad sense to encompass all types of project-type expenditures; it is not restricted to acquisition of tangible assets.

Figure 12. Priority needs for 2023 by expenditure type and sector (US$ billions)



Source: Assessment team.

Note: Sectoral definitions used in this figure are aligned with government priorities and do not match exactly with the structure of the RDNA2; colors of sectors in the figure on right are aligned with RDNA2 definitions.

purchase for the winter heating season[28] and additional provisions to purchase electricity and to meet liquidity needs of systems operators; payments to energy operators would not be on the government budget but likely require government support, for example, through guarantees.

- US$2.1 billion in investments to be implemented by SoEs; investment by SoEs is not on the government budget but likely require government support, for example, through guarantees.
- US$1.5 billion[29] to support financial instruments, including credit lines, guarantees, and risk instruments to provide the private sector with access to working capital and to de-risk private investment and trade.

Transport, housing, and energy account for more than 60 percent of 2023 priorities, while significant support is needed to facilitate private investment (Figure 12). The largest expenditure priorities for 2023 are in transport (US$3.5 billion), energy (US$3.3 billion, including US$2.1 billion of capital investments), and housing (US$1.9 billion)—together, these sectors account for around 70 percent capital/project investments. Other areas that account for significant 2023 post-budget priority needs include: social and administrative infrastructure, mainly from education and health (US$1.3 billion); digital infrastructure (US$0.5 billion); utilities (US$0.3 billion); and humanitarian demining (US$0.4 billion). Beyond these infrastructure sectors, significant support (US$2.7 billion) is prioritized for sustaining productive capacity and for recovery and reconstruction of the private sector, including agriculture, which is critical to ensure a sustainable recovery for Ukraine. This support includes a combination of grants and subsidized credit but also includes guarantees and insurance instruments to de-risk private investment, given the challenging environment. Finally, it is important to emphasize that the figures presented in Figure 12 and Table 4 consider only sectors defined in the government priorities. Other sectors also have needs that are critical to support as soon as possible—for example, maintaining and reconstructing irrigation infrastructure and safeguarding cultural assets and the environment. Priorities in these sectors are included in the individual sectoral overviews in this report. Table 4 provides further details on 2023 implementation priorities by government-defined priority sectors by expenditure type.

Delivering on these urgent priorities in 2023 will require overcoming key market and institutional constraints. While the 2023 priorities account for a small subset of total needs, implementation will be challenging and the figures presented here likely represent the ceiling of what can be delivered on the ground in 2023. Significant supply-side constraints, including constraints on local manufacturing capacity, access to inputs, and in some cases contractors and labor, will limit implementation of infrastructure

28 Purchase of gas would need to be made by Naftogaz.

29 This figure does not include the capital provisioned by IFIs for lines of credit (IFC, EBRD) and reinsurance (Multilateral Investment Guarantee Agency (MIGA), Development Finance Corporation (DFC).

projects in some sectors. Early procurement, innovative approaches to materials management, and regional markets can help overcome supply-side constraints, while instruments to help de-risk trade and investment will be important to stimulate a response from the domestic and foreign private sector. Addressing institutional constraints that slow implementation will be even more important and urgent. The 2023 budget law allows a streamlined process for adoption of projects when donor funding is identified; this process will support a quick and flexible approach to initiating new projects. Further steps to speed procurement and implementation are needed, including reducing the barriers that slow the channeling of project funds for subnational implementation, reforming planning processes, and strengthening the capacity of local government institutions. Sectoral policies to drive recovery and reconstruction will also be needed. A housing recovery policy, for example, should set priorities for reconstruction of the housing stock while also setting the direction for key reforms and policy shifts in the housing, land, and property systems (including cadasters), in building regulations (in light of EU accession), and debris management. It is important to underline that the government is expected to increase its absorption capacity beyond the first year of reconstruction, which will allow for an acceleration of implementation over time.

Despite the implementation challenges, there are opportunities for all parties to help close the gap. While implementation in 2023 will be challenging, it is important to secure commitments against these priorities in order to mobilize investments, even if these are not fully implemented in 2023. It is also important also to emphasize that not meeting these urgent needs will have significant economic and social costs for Ukraine. While the government has already made significant efforts to finance some of the priorities discussed in this section, with the support of IFIs and donors, further support is needed to close the funding gap (*see next Chapter*).

Table 4. 2023 implementation priorities by sector and expenditure type (US$ billions)

	Priorities implemented and financed by the government		Priorities implemented by SoEs and the private sector				Total
	Govt-current[a] expense	Govt-capital[b] expense	Direct govt expense	SoE investment	Payments to energy operators	IFI lines of credit and insurance	
Energy infrastructure	-	0.7	-	1.4	1.2	-	3.3
Humanitarian demining	-	0.4	-	-	-	-	0.4
Housing	-	1.9	-	-	-	-	1.9
Critical and social infrastructure	0.3	4.8	-	0.7	-	-	5.8
Transport	-	2.8	-	0.7	-	-	3.5
Social and administrative infrastructure	0.1	1.2	-	-	-	-	1.3
Utility services	0.2	0.2	-	-	-	-	0.4
Digital infrastructure	-	0.5	-	-	-	-	0.5
Private sector	-	-	1.2	-	-	1.5	2.7
Agriculture	-	-	0.6	-	-	-	0.6
Commerce and industry	-	-	0.6	-	-	1.5	2.1
Total	**0.3**	**7.8**	**1.2**	**2.1**	**1.2**	**1.5**	**14.1**

Source: Assessment team.

Note: IFI = international financial institution. Sectoral definitions used in this table are aligned with government priorities and do not match exactly with the structure and nomenclature of the RDNA2.

a. Current expense considers social transfers, grants and subsidies, and other expenses.

b. Capital expense considers investments to acquire tangible assets as well as other project-type expenditures that do not involve asset acquisition as per the accounting definition of "capital expenditure."

MACROECONOMIC IMPACTS

Lyceum, Velyki Prohody Village, Dergachi Community, Kharkivska Oblast.
Photo by Roman Nesterenko, Dergachi City Council.

Summary

Ukraine's economic trajectory has been derailed by the Russia's invasion in February 2022, which has taken a severe toll on the population and resulted in the large-scale destruction of productive capital and infrastructure. Economic priorities have shifted, increasing demand for war-related goods and services while creating supply and production bottlenecks for other sectors. In mid-2022, as active combat became more localized in the east and south, economic activity stabilized at levels lower than prewar levels; but attacks on Ukraine's energy infrastructure from October 2022 onward have disrupted economic activities and undermined the potential recovery. GDP declined by 29.2 percent in 2022, and—with the continued duration of the war uncertain—is expected to grow by only 0.5 percent in 2023. With the support of the international community, Ukraine has been able to maintain macroeconomic stability and to deliver key social services. Going forward, Ukraine will need to build a strong foundation to accelerate reconstruction by focusing on a set of policies that catalyze external financing and enhance implementation capacity. Continued donor support will be fundamental to maintain these gains as well as ensure critical recovery needs are met.

Economic and poverty update

While Ukraine's economy has gradually adjusted to the wartime needs, attacks on the country's electricity network undermined a potential recovery. As a result of the invasion, Ukraine's GDP declined by 29.2 percent in 2022. Still, the economy contracted in 2022 by less than initially expected, as the UN-brokered Black Sea Grain deal and the return of nearly 4 million migrants helped to support economic activity in the third quarter. Proven adaptability of the private sector, which explored new logistic routes and reoriented supply to the wartime needs, also aided growth. While Ukraine's economy has gradually adjusted to the new conditions, attacks on the power infrastructure starting in October 2022 damaged the country's power grid significantly, thereby exacerbating production constraints for the key sectors. Significant production disruptions and rolling electricity blackouts led to a 31.4 year-on-year (YoY) contraction in the fourth quarter of 2022, while imposing additional external pressure by limiting export capacity and increasing demand for energy-related imports (Figure 13, Figure 14). Ukraine's economic outlook will depend on the evolution of the war and the country's ability to adjust to continued fighting. Currently, GDP is expected to grow by only 0.5 percent in 2023 as a recovery in domestic services and war-related industries is projected to be mostly offset by a 15 percent decline in agricultural output and continued low-level stagnation of metals and mining production.

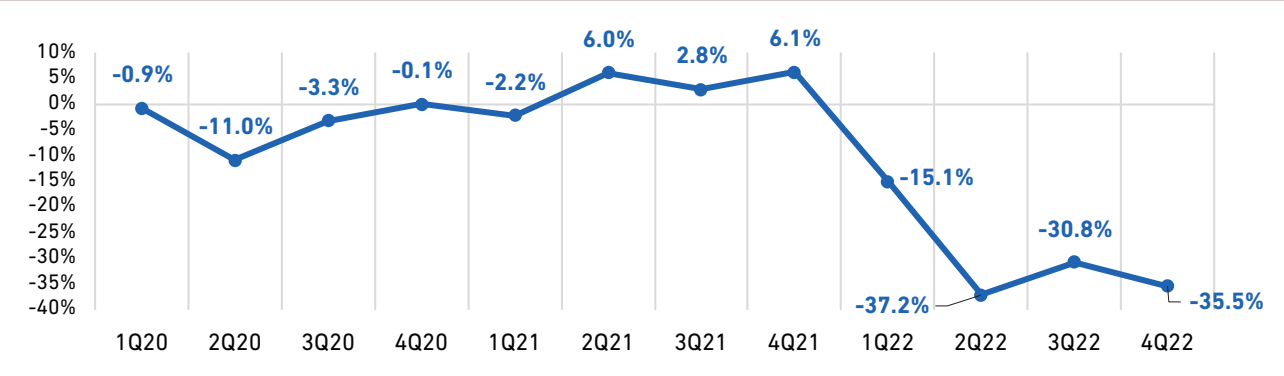
According to the World Bank's preliminary estimate and based on the global poverty line of US$6.85 per person per day, poverty increased from 5.5 percent in 2021 to 24.1 percent in 2022, pushing an additional 7.1 million people into poverty and setting back 15 years of progress. War-affected regions are expected to experience even higher poverty rates. The UNDP estimates the highest monetary poverty rates in Odeska, Luhanska, Khersonska, Kharkivska, and Rivnenska, which were among the poorest oblasts before the war. High inflation, particularly food inflation, eroded purchasing power disproportionately for low-income households, given food's large share in their budgets. In Khersonska oblast, for example, food and non-alcoholic beverage prices had increased by 73.5 percent YoY in December 2022, compared to 34.4 percent for Ukraine as a whole.[30] The war's impacts on child poverty could have long-term consequences if not mitigated. According to a UNICEF study,[31] the projected share of children living below the national definition of poverty (consumption below the actual subsistence minimum estimated at UAH 5,458 per person per month) increased from 43.5 percent to 65.2 percent in 2022.

War-related supply shocks drove inflation during 2022. Consumer prices grew by 26.6 percent YoY in 2022. Inflation was predominantly driven by supply-side factors, including higher production costs

30 Regional consumer price index data published by State Statistics Service of Ukraine, *Link*.

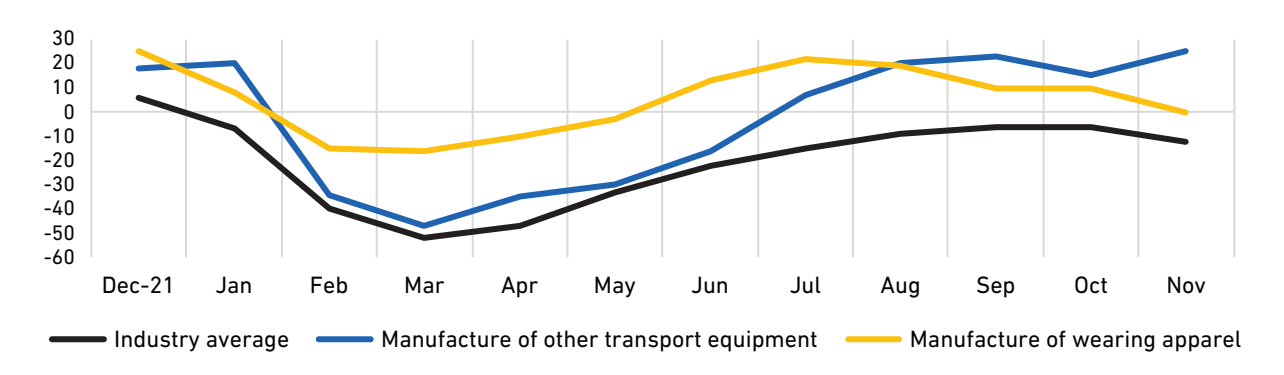
31 UNICEF, "Child Poverty: Initial Estimates of the Impact of the War on the Situation of Households with Children," 2023.

Figure 13. Ukraine GDP by quarter, year-on-year (YoY)



Source: State Statistics Service of Ukraine.

Figure 14. Assessment of industrial production performance, December 2021 – November 2022 (index)



Source: State Statistics Service of Ukraine.

related to logistical and energy disruptions and higher global commodity prices. Mitigating factors include the introduction of an exchange rate peg to the US dollar by the National Bank of Ukraine (NBU), thus providing for a nominal anchor, and unchanged energy tariffs. While the NBU monetized a large part of government spending, this step did not result in a significant increase in money supply; it effectively absorbed excess liquidity through the large-scale sale of certificates of deposit. Going forward, supply-side inflationary pressures are expected to remain elevated as the war continues to cause production and supply disruptions, whereas an end to monetization in 2023 and continued tight monetary policy will contain demand-side pressures.

Ukraine's external trade deficit broadened significantly in 2022 and was financed through large inflows of international aid. Ukraine recorded a current account surplus of 5.7 percent of GDP in 2022, with foreign grant inflows compensating for a rapidly growing trade deficit. The trade deficit grew to 16 percent of GDP, as annual exports declined by 30 percent compared to 2021 while imports only contracted by 4 percent. The export contraction was led by metals and minerals exports, which declined by 63 percent and 48 percent, respectively. While agricultural exports also contracted substantially immediately after the invasion, they recovered during the main export season following the Black Sea Grain Initiative, thus limiting their contraction to 16 percent. The decline in imports was led by machines and chemicals that are used as critical production inputs. By contrast, demand for war-related imports as well as fuel, diesel and energy equipment remained high. The capital and financial accounts, while initially bolstered through capital controls, have been under increasing pressure due to the withdrawal of foreign exchange by Ukrainian refugees and outflows of trade financing. This situation was counterbalanced by foreign loan inflows, which helped to restore international reserves to US$29.9 billion at the end of 2022, close to the prewar level. In 2023, exports are expected to

remain under the pressure due to weaker harvests and logistical problems, whereas imports will continue to grow due to higher demand for energy and equipment. In the medium term, limited exports and the economy's large need for imports to carry out reconstruction drive a projected higher current account deficit.

The war has generated unprecedent fiscal financing needs. The consolidated budget deficit excluding grants amounted to 26.5 percent of GDP in 2022. Tax revenue declined by 8 percent in nominal terms (30 percent in real terms) as proceeds from value added taxes and excises suffered sharp contractions of 13 percent and 39 percent, respectively. Expenditure grew by 65 percent in nominal terms (39 percent in real terms), with authorities prioritizing war-related spending as well as essential public and social services. By contrast, capital expenditure declined by 37 percent. Amortization payments for Ukraine's existing debt also add to financing needs, mostly for domestic debt, as commercial debt (Eurobonds) and official external public and publicly guaranteed debt are subject to a two-year moratorium (agreed to after the invasion).

Financing needs were covered by external financial assistance and NBU monetization, while domestic banks reduced their holding of government debt. Fiscal financing needs in 2022 reached US$54 billion equivalent. Ukraine has filled these needs from two sources: official bilateral and multilateral assistance through grants and loans; and the NBU, which has stepped up as a lender of last resort and has purchased any residual government bonds. By contrast, domestic banks have opted to roll over less than their existing holdings of government securities, even though they had large excess liquidity available. While the reliance on monetization has induced risks related to demand-side inflation pressure, the NBU has effectively managed to absorb the resulting excess liquidity in the economy through foreign exchange market interventions and the issuance of high-yielding overnight certificates of deposits. For 2023, a central challenge will involve increasing rollover rates for domestic banks to eliminate the need for monetization and to reduce the associated inflation risks.

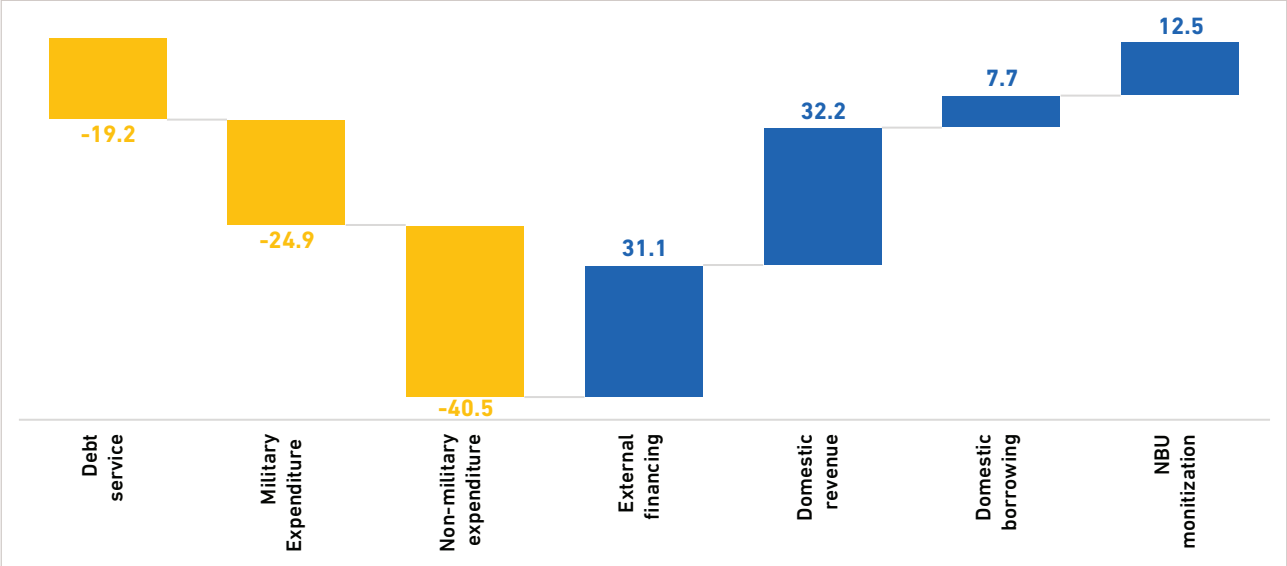
Macroeconomic Risks Overview and Policy Recommendations

Going forward, Ukraine will have to balance the need to sustain the war economy in the near term with the need to create conditions for a sustainable economic recovery in the future. The authorities have deployed resources to sustain essential public services (including social transfers) while maintaining broadly sound macroeconomic policies to avert the most immediate fiscal, monetary, and financial sector risks of the wartime economy. Yet Ukraine faces difficult decisions on how to fund other activities, including emergency restoration of critical infrastructure. Additional compression of social expenditures could risk breaking the social contract, already stretched to the limit amidst rising poverty and unemployment. At the same time, a successful transition toward a sustainable economic recovery will depend on a combination of targeted public investments to restore critical assets and policy interventions that reduce risks for donors and private investors.

In the near term, it is critical to maintain the stable functioning of the war economy. This involves identifying opportunities to finance the elevated fiscal deficit—driven by the need to ensure defense and social expenditure during a period of reduced tax collection—and debt amortization. Annual debt service payments (interest and amortization) remain high in 2023 at US$18 billion equivalent (Figure 15). As of March 2023, Ukraine will at least US$3 billion equivalent per months to close its fiscal deficit and meet debt repayment obligations. Any suspension or delay in external funding may lead to broad negative economic and social consequences. Continued reliable foreign grant and loan inflows are an essential lifeline, as they help meet financing needs, balance the current account, and provide a lever for Ukraine to control inflation.

In the medium term, Ukraine will need to set the necessary conditions for a sustainable economic

Figure 15. Fiscal financing needs and sources in 2022 by source (US$ billion)

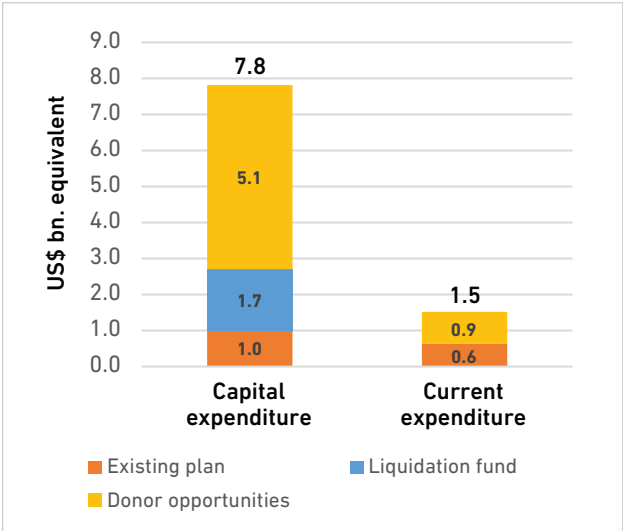


Source: World Bank estimates based on Ministry of Finance (MoF) data.

recovery in the future (Figure 16).[32] The RDNA2 identifies US$14.1 billion equivalent in priority expenditure to meet reconstruction and recovery needs in 2023, of which US$9.3 billion equivalent have a direct government spending implication. Of this, US$3.3bn equivalent are already included in the budget, including US$1.6 billion equivalent through allocated budget expenditures and US$1.7 billion equivalent through the fund for the liquidation of the consequences of the invasion ("Damage Liquidation fund"). A reprioritization of existing projects could potentially provide additional resources. The remainder can be met either by additional donor financing, the private sector or through SOEs, potentially facilitated through a donor or government guarantee. As such, the RDNA2 identifies a total of US$ 10.8 billion equivalent for additional support needs executed by government (US$6 billion equivalent) and non-government entities (US$ 4.8 billion equivalent).

Attracting this additional funding is critical, because if Ukraine's productive capacity is not sustained or even boosted during the war, the country risks settling into a situation of low or no growth and facing huge social challenges once the war ends. Public intervention may also be needed to restore private assets, including housing. Productive sectors such as agriculture may require additional public financing for recovery and the banking and financial sector may need capitalization to offset losses incurred during the war. Ukraine will not be able to cover immediate and long-term reconstruction needs without coordinated donor support. While international financing support is vital, Ukraine's government needs to ensure transparency and accountability of capital expenditure to bolster donor support as well as private sector participation.

Figure 16. RDNA2 priorities for government expenditure in 2023 (US$ billion equivalent)



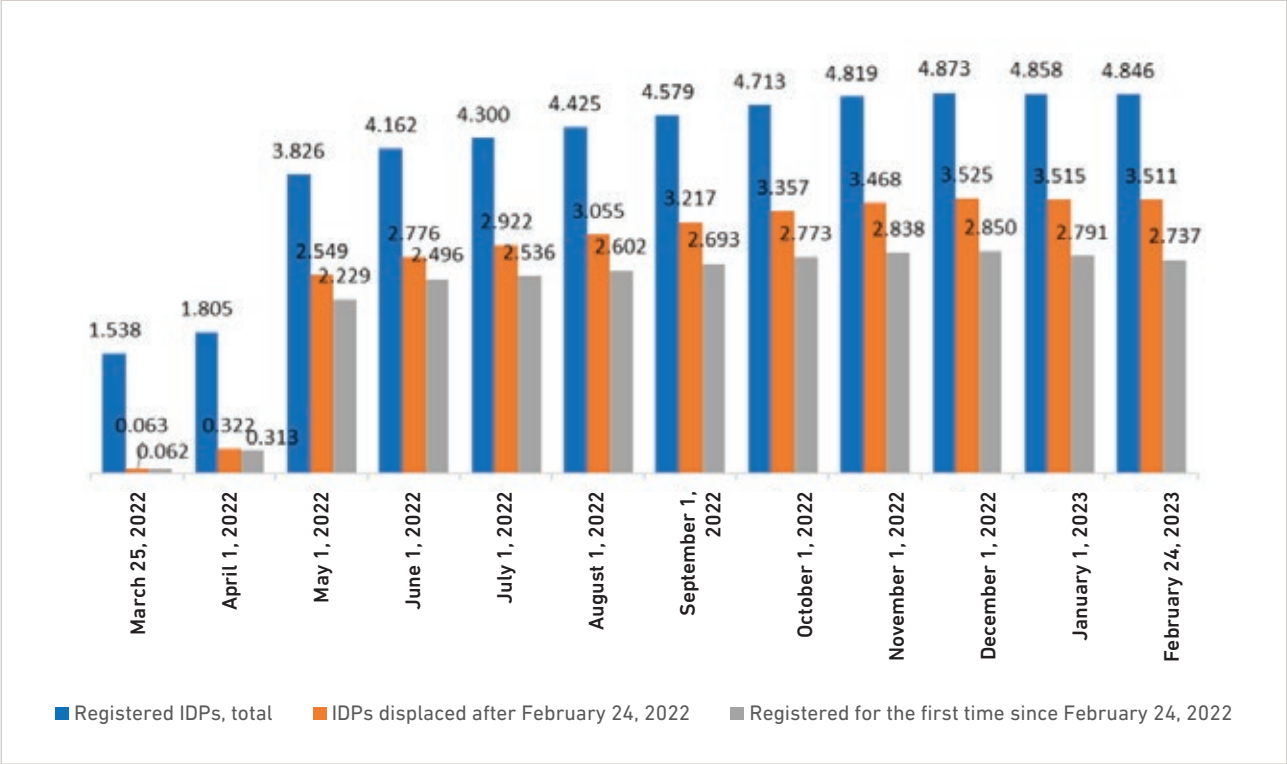
Source: World Bank estimates based on MoF data.
Note: US$ equivalent using the RDNA2 exchange rate.

32 For consistency with the report, this section uses the RDNA2 exchange rate of 1US$ = UAH 36.5686.

HUMAN IMPACT ASSESSMENT / VULNERABLE GROUPS

77-year-old Hanna spends her nights at a collective centre for displaced people in Chernihiv but comes back each morning to her yard where IOM's team is currently rebuilding her house. Photo IOM Viktoriia Zhabo.

Figure 17. Number of registered IDPs in Ukraine (million), March 25–February 13, 2023



Source: Ministry of Social Policy of Ukraine, "Dynamics of Key Indicators That Characterize the State of Registration, Re-registration and Record Keeping of Internally Displaced Persons for the Period of Martial Law."

Russia's invasion has affected all Ukrainians, whether directly or indirectly. According to the Office of the Prosecutor General of Ukraine, as of February 22, 2023, the invasion has led to the death of 9,655 civilians, including 461 children; has injured 12,829 civilians, including 926 children; and has been the occasion of more than 68,000 war crimes, including 2,600 committed against children.[33] The Office of the Prosecutor General is also investigating 171 cases of sexual violence; this figure includes violence against 39 men and 13 minors, including one boy.[34] The World Health Organization (WHO) estimates that up to 10 million Ukrainians (or a quarter of the population) are at risk of some form of mental disorder, ranging from anxiety and stress to a more severe condition. For children who have become orphaned since February 2022 or due to other circumstances before that time, the government is currently supporting 24,613 families and facilities to provide care.

Displaced Persons and Returnees

The UN High Commissioner for Refugees (UNHCR) estimates that 8.1 million people are displaced across Europe as of the end of February 2023.[35] According to the International Organization for Migration (IOM), an estimated 5.4 million people were internally displaced within Ukraine as of the end of January 2023, a decrease from 5.9 million as of December 5, 2022.[36] The estimated number of internally displaced persons (IDPs) in Ukraine has been steadily declining since August 2022. However, the number of individuals officially registered as IDPs with the Ministry of Social Policy has been increasing since February 2022, reaching a peak of slightly under 4.9 million in December 2022; after this the numbers have very slightly decreased (Figure 17).[37] Protracted displacement is becoming

33 Government of Ukraine, press conference on the work of the prosecutor's office, February 22, 2023, *Link.*

34 First Lady of Ukraine Olena Zelenska referred to this work by the Prosecutor General's Office in her remarks during the Uniting for Justice conference, March 4, 2023, *Link*.

35 UNHCR Operational Data Portal for Ukraine, *Link*.

36 IOM, "Ukraine Internal Displacement Report: General Population Survey, Round 12 (16–23 January 2023)," *Link*.

37 Whereas the IOM survey is an estimate of the total number of IDPs based on a survey of the population, the number of individuals registered with the Ministry of Social Policy is an actual number of individual registered to receive support from government as a result of their situation of displacement.

more prevalent, and 58 percent of all IDPs had been displaced for six months or more according to the January 2023 IOM report.

Displaced persons continue to face similar challenges over time, which partly differ from the challenges faced by the overall population and by people who have returned to their places of origin. Seventy-five percent of IDPs need cash support compared to 62 percent of the general population and 59 percent of returnees. Around one in four IDP respondents (24 percent) stated that monthly livelihood cash assistance for IDPs was their primary source of household income. While the share of households with insufficient food consumption increased among both displaced and nondisplaced people over 2022, the gap between the two groups has widened since the beginning of the winter season. In the fourth quarter of 2022, the share of households with insufficient food consumption was around one in four for nondisplaced people but was one in three for displaced people.[38] Finally, according to the January 2023 IOM General Population Survey, 17 percent of IDPs require accommodation, compared to 4 percent of the general population and 3 percent of returnees. Given that IDPs predominantly rent housing or stay with relatives and friends, only 18 percent of IDPs need construction supplies, compared to 26 percent of the general population and 23 percent of returnees.[39]

The National Information Bureau[40] has reported that as of February 2023, the total number of deported and illegally displaced citizens of Ukraine was 143,239, including 16,221 children. Since the first weeks of the invasion, 165 humanitarian corridors have been organized, through which more than 350,000 civilians—mostly women, children, and older persons—were evacuated between March and May 2022. In 2022, the Ministry of Reintegration of Temporarily Occupied Territories transferred more than UAH 190 million to those in captivity or formerly in captivity. More specifically, the Ministry directed UAH 144.8 million to persons who were released from captivity. Another UAH 46.2 million went to the families of illegally detained Ukrainian citizens. Altogether, 1,448 people released from captivity and 462 families of persons who were, or are, in captivity received one-time cash assistance of UAH 100,000.[41]

The number of collective centers across Ukraine has increased from 160 in 2021 to 7,200, with capacity to host almost 500,000 people.[42] These collective centers are based in educational or physical education/sports institutions, health camps, and sanatoriums belonging to communal owners (53 percent), state owners (28 percent), and private owners (19 percent). Older persons, persons with disabilities, and female-headed households are the most frequent users of the centers. Among collective centers in all oblasts, the reported top-three priority needs were generators (67 percent), food (35 percent), and kitchen appliances (25 percent); centers also needed washing machines or driers (22 percent) and repairs to water or sanitation systems (20 percent).

Gender-Specific Impacts

Among those receiving State Employment Service support with the status of unemployed, the majority were women (61 percent in December 2022 and 68 percent in January 2023). According to the IOM General Population Surveys, the share of male IDPs relying on regular wages as the main source of income declined between August 2022 and January 2023, from 50 percent to 38 percent. Among female IDPs, the share is only 25 percent in January 2023. In addition, female IDPs rely more frequently than male IDPs on monthly assistance (29 percent versus 10 percent). As of August 2022, larger shares of female IDPs than male IDPs reported reducing food and health expenditures in their households as a coping strategy for financial distress. Male IDPs were more likely to mention labor market coping strategies, including accepting a low-paid job (24 percent) or lower- qualified job (23 percent). In a November 2022 survey, the higher prevalence of health-related coping strategies among female IDPs was found to apply to returnee and nondisplaced women as well.[43]

38 World Food Programme, "Ukraine Food Security Trend Analysis: Key Trends 2022 (February 2023)."

39 IOM, "Ukraine Internal Displacement Report: General Population Survey, Round 12 (16–23 January)," *Link*.

40 The bureau was established in March 2022; see Cabinet of Minister Decree #228-р as of March 17, 2022, *Link*.

41 As of October 2022, 413 families had received payments, and an additional 49 additional families of individuals who were in captivity have received payments as of February 2023 according to the Ministry of Reintegration of Temporarily Occupied Territories, *Link*.

42 UN OCHA Camp Coordination and Camp Management (CCCM) as of February 11, 2023, *Link*

43 IOM, "Ukraine Internal Displacement Report: General Population Survey, Round 12 (16–23 January 2023)," *Link*.

In October 2022, a Regional Gender Task Force found that pregnant and breastfeeding women, young single women, and women from minority groups (such as Roma and stateless women) are particularly vulnerable to protection risks, gender-based violence, and security risks during displacement.[44] As of November 2022, 64 percent of collective center residents were female. In 70 percent of assessed collective centers, bathrooms and showers lacked separation and security, increasing the risk of gender-based violence, sexual exploitation, and abuse. An October 2022 survey by IOM on human trafficking revealed that one in two Ukrainians—53 percent of women—are ready to accept at least one risky job offer, which could lead to exploitation or violence across all population groups. An estimated 46,000 Ukrainians were trafficked during 2019–2021, 29,000 abroad and 17,000 in Ukraine. This situation is expected to have been exacerbated since February 2022.[45]

Massive and protracted displacement and conscription into military service have caused gendered impacts, led to the separation of families,[46] and increased the size of Ukrainian households. Many women have become the sole breadwinners and caregivers in their families, putting them in a vulnerable financial and social position. There has also been an effect on family composition: according to IOM, the average size of the Ukrainian household has increased since February 2022 (among host, IDP, and returnee populations), likely due to the reunion of the extended family members.[47] However, the absence of same-sex civil partnerships in Ukraine implies that the partners of Lesbian, Gay, Bisexual, Transgender, Queer, and Intersex (LGBTQI+)[48] soldiers cannot visit their loved ones in the hospital when they are wounded or retrieve their bodies when they have fallen.[49]

Persons with Disabilities

In April 2022, the UN Committee on the Rights of Persons with Disabilities warned that 2.7 million persons with disabilities in Ukraine were at risk of being abandoned in their homes or in residential care, with "no access to life-sustaining medications, oxygen supplies, food, water, sanitation, support for daily living and other basic facilities."[50] The task of caring for persons with disabilities has increased dramatically as casualties mount from combat, land mines, and attacks on civilians.

As of January 2023, roughly 1.3 million IDPs (25 percent of the total 5.4 million IDPs) report having one or more household members with a disability.[51] The lack of accommodations to meet the needs of IDPs with disabilities exacerbates their vulnerability, adding to the challenges of displacement. A majority (73 percent) of respondents to a survey on bomb shelters near their residences indicated the absence of accessible bomb shelters.[52] Accessibility of the newly available modular housing for IDPs is a growing concern. A study by civil society organizations League of Strong and Help Age International identified noncompliance on 10 out of 16 minimum requirements for accessible shelters developed by CBM International.[53]

44 Regional Refugee Response for the Ukraine Situation, "Making the Invisible Visible: An Evidence-Based Analysis of Gender in the Regional Response to the War in Ukraine," October 2022, *Link*.

45 IOM, "National Survey on Migration, Human Trafficking and Other Forms of Exploitation," *Link*.

46 More than a third of Ukrainians reported separation from their family, based on a SHARP, Wave 1, 2022 survey (pending publication).

47 The IOM reports that the average household size for IDP families increased from 3.21 as of October 27, 2022, to 3.30 as of January 23, 2023. This is in contrast to the average household size for all of Ukraine in 2021, which was 2.60. IOM, "Ukraine Internal Displacement Report: General Population Survey, Round 12 (16–23 January 2023),"*Link.*

48 Social tolerance toward minorities and marginalized groups, including LGBTQI+, seems to have increased in 2022. The tolerance score for LGBTQI+ was 5.1 out of 10 in 2022 compared to 3.7 out of 10 in 2021; see "Social Cohesion in Ukraine Part II: Towards a Tolerant, Cohesive and Inclusive society," 2022, *Link*.

49 See Berghof Foundation, "It Will Be Harder to Deny LGBTQI+ Members of the Military Equal Rights After They Have Risked Their Lives for the Country," February 22, 2023, *Link*.

50 Cited in European Parliament, "Russia's War on Ukraine: People with Disabilities," November 2022, *Link*.

51 IOM, "Ukraine Internal Displacement Report: General Population Survey, Round 12 (16–23 January 2023)," *Link*.

52 National Assembly of People with Disabilities Ukraine, "Analytic Report on the Results of the Survey on the Access of People with Disabilities to Various Types of Aid and Services Provided at their Permanent Places of Residence During the Wartime," *Link*.

53 HelpAge International, "Finding Housing for People with Disabilities Who Are Fleeing War: Humanitarian Needs of Men and Older Women among IDPs in Lviv and the Region" (in Ukrainian), October 2022, *Link*.

Veterans and Their Families

The number of veterans as of January 2022 was between 851,068 and 896,568, according to the official estimates of the Ministry of Veterans Affairs. The share of women among veterans was estimated at 9 percent. While official data on combatants and veterans who have participated in the war since February 2022 are not available, a survey administered by the Ukrainian Veteran Fund (UVF) in August 2022 found that nearly 60 percent of veterans were in active service, having returned to serve in the Armed Forces of Ukraine following the invasion.[54] The Ministry of Veterans Affairs expects the total number of veterans to triple to about 3 million at the war's end.

In the UVF survey, respondents identified the following needs as the most urgent: support to veterans' family (27 percent), help with housing (24 percent), legal support (22 percent), psychological support (17 percent), and medical assistance (15 percent). Among surveyed veterans, 23 percent indicated that they did not require any special support. Requests for support to veterans' families primarily related to the need for information on benefits and psychological support (39 percent and 38 percent respectively). Additional areas of support to families include financial support (21 percent), legal support (20 percent), and assistance with housing (15 percent).

According to the UVF survey, most veterans plan to return to their previous workplace after the completion of their service. However, a 2021 IREX study on veteran reintegration showed that more than a quarter of veterans' pre-deployment jobs were not secured for them; even among those who understood their jobs to be secure, only 70 percent were allowed to return. Among female veterans, only 45 percent were allowed to return.[55]

The UVF survey found that 17 percent of respondents were interested in psychological help, and 38 percent of the surveyed family members of veterans were in need of it. Conversely, only 14 percent of veterans and their family members indicated that they used psychological rehabilitation services.[56] According to the SCORE (2021) study, challenges that compound mental health issues for veterans include the complexity of returning to civilian life after combat, the inaccessibility of health care systems, and the lack of a comprehensive psychosocial rehabilitation policy.[57] It may be assumed that the need for mental health services is significantly underreported, and that information regarding the availability of such support is limited.

Recovery Needs, Including Building Back Inclusively

Priorities to address the needs identified for each impacted group described above is included in the "Towards Recovery and Reconstruction" Chapter.

54 The survey was conducted online among 469 veterans of the war in July–August 2022. UVF, "Portrait of a Veteran in Russian-Ukrainian War 2014–2022 pp.," 2022, *Link*.

55 IREX, "Veterans Reintegration Survey Results on Veterans' Current Employment Conditions, 2021, *Link*.

56 UVF, "Portrait of a Veteran in Russian-Ukrainian War 2014–2022 pp.," 2022, *Link*.

57 SCORE, "Reintegrating ATO & JFO Veterans ," 2021, *Link*.

SOCIAL SECTORS

Donetska Oblast. Photo by Yevgen Honcharenko, Donetsk Oblast State Administration.

HOUSING

Context

Housing has been one of the sectors most affected by the war. Ukraine had a total of around 18 million residential units prior to the war. Residential units are in multifamily apartment buildings, single-family houses, and dormitories, with considerable variation across urban and rural areas. Multifamily apartment buildings are predominant in urban areas and cater to almost 67 percent of the urban population, while in large cities, this share increases to 79 percent. Single-family houses, which include individual homes, dachas, garden houses, and country houses, are largely located in rural areas. In cities, single-family housing is limited to individual houses and garden houses and found only in areas zoned specifically for individual and blocked houses. Over 80 percent of multifamily apartment buildings in Ukraine was constructed during the Soviet era and is severely aging, and less than 20 percent was constructed after 1991. The aging building stock in Ukraine has also been contributing to high energy consumption, as aging soviet era buildings are non-thermo-modernized, and do not comply with energy-efficient standards. Almost 94 percent of the housing in Ukraine is privately owned, and only 3.5 percent of households live in private rental housing. In Ukraine, 93.7 percent of the housing stock was private as of 2013, a reflection of the privatization of housing stock that took place in the 1990s. As of 2013, only 3.4 percent of households lived in rental housing, though this number may not capture the actual rental market. Intention surveys of both Ukrainian refugees and IDPs show that after safety and security concerns, access to adequate housing is the second most prominent obstacle to return.[58]

Damage and Loss Assessment

The total cost of damage to the housing sector is estimated to be over US$50 billion (Table 5). Multifamily apartment units account for the largest share of damage at over 7 percent; since June 2022, when around 564,000 residential units were reported damaged, the toll has grown to an estimated 1.4 million units. An estimated 135,000 single-family houses have been damaged as well and account for around 9 percent of the total affected housing sector assets. The number of damaged dormitory units also increased, from 13,312 in June 2022 to 39,040 units. The most significant numbers of damaged residential units are in Donetska, Kharkivska, Luhanska, Kyivska, and Mykolaivska oblasts. Over one-third of the damaged units are destroyed (499,056 units), while two-thirds are partially damaged; of partially damaged units, 285,257 have minor damage (up to 10 percent damage) and 787,779 have moderate damage (between 10 percent and 40 percent damage).

Losses in the housing sector are estimated over US$17 billion, reflecting the cost of demolition, debris removal, and temporary rental, as well as mortgage and property tax losses. Net rental losses are estimated at US$11.4 billion. Due to the increase in the volume of damage in Ukraine, the total estimated cost of demolition and removal of rubble since June 2022 has increased by 20 percent. The loss estimation for the rental market has high uncertainty given the market's informality. Property tax losses are calculated at US$685 million, and bank losses related to mortgages at US$1.1 billion; these figures reflect the increase in the share of completely destroyed assets across the asset typologies.

Reconstruction and Recovery Needs, Including Build Back Better

The total needs for the housing sector are estimated to be around US$68 billion. Of these, US$31.5 billion is needed for the immediate and short term and around US$37.1 billion for the medium to long term. The primary focus in the first year should be on rapid repairs, along with planning, organization, and coordination between national and local levels for ensuing phases. These phases will include the launch of planning for large-scale reconstruction of severely damaged multifamily apartment buildings,

58 UNHCR, 2023, Ukraine Situation - Regional Refugee Response: Lives on Hold: Intentions and Perspectives of Refugees from Ukraine #3, *Link.*; UNHCR, 2023, Lives on Hold: Intentions and Perspectives of Internally Displaced Persons in Ukraine, *Link.*

which account for the largest share of the damage and which housed large numbers of Ukrainian families. The short term will expand activities and seek to reach households and communities both in terms of planning and direct reconstruction support (Table 6).

For short-term activities, most of the funds will be directed to repair and reconstruction, rental subsidies, organizational arrangements, technical assistance, and debris removal. This will allow the recovery phase to begin by refurbishing technically and economically viable buildings and demolishing noncompliant buildings. In parallel, urban planning for short- and medium-term recovery should be promoted. The Ukrainian national urban planning system requires a wide and complex structure of urban planning documentation (i.e., comprehensive recovery plans, general schemes of settlements, and comprehensive plans of the spatial development of the territory) and meeting these requirements will also entail significant funding.

The medium- to long-term reconstruction needs will be linked to the extensive restoration and construction, which will be associated with major funds. The build back better coefficient for the restoration and construction needs reflects the large share of obsolete and energy-inefficient Soviet era buildings. This stage will also include time-consuming activities with long preparation phases, i.e., comprehensive plans for the spatial development of territories and implementation of the mid- to long-term strategies. It is also likely that for some territories, property rights management and/or environmental restoration will be time-consuming.

2023 Recovery and Reconstruction Implementation Priorities

To effectively conduct designed priority activities for 2023, the housing sector will likely require some US$1.9 billion. Considering the percentage of damaged and destroyed housing units, 2023 will need to focus on the ongoing light and medium repairs, as the fastest way to make these assets available in the housing market and provide safe shelter for IDPs, people who have remained in their damaged homes, and returnees. Temporary accommodation for to IDPs, returnees, and families living in inadequate shelter is calculated at US$112 million. Demolition and debris removal is estimated at US$161 million (Table 7). It is also essential to develop a housing recovery strategy, including a housing recovery financial strategy, and to support local self-governments (hromadas) in building the capacity to assume their legislated roles in the selection, support, verification, and implementation of housing repair and reconstruction investments.

Limitations and Recommendations for Future Assessments

The asset typology in the housing sector remains unchanged since June 2022. The assets were broken down by the type of residential units, i.e., apartments units (in multifamily apartment buildings), single-family houses, and dormitory units. The single-family house group also includes dachas and garden houses, which are predominantly located in rural areas; a portion of these functioned as secondary homes, which significantly impacts the direct effects on households. The apartment units were divided into two groups: units in the predominant (and aging) Soviet era multifamily apartment buildings (pre-1991), which are estimated to constitute 88 percent of the apartment building stock; and units in more recent post-Soviet multifamily apartment buildings (post-1991), which are estimated to account for 12 percent of the apartment buildings in the country.

The ongoing fighting makes it difficult both to assess the level of damage (it is likely that these numbers will be obsolete by the time this report is published) and to estimate the costs linked to the needs. In addition to the fact that the war is severely hindering access to reliable granular information, the longer it continues, the more difficult it is to accurately assess the impacts and associated costs for rebuilding.

In terms of recommendations, a national program for the repair, reconstruction, and recovery of the housing sector is critical. Such a program will align all different stakeholders under a unified umbrella, one that could support Ukraine's agenda for European Union accession, facilitate return of IDPs and refugees, and ensure a healthy recovery of the housing sector.

Table 5. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	28.8	1.0	36.6
Chernihivska	1,833.9	84.6	2,329.9
Dnipropetrovska	1,060.2	23.0	1,346.9
Donetska	15,689.8	1,466.9	19,933.5
Kharkivska	14,022.8	1,257.2	17,815.5
Khersonska	1,136.9	66.9	1,444.4
Khmelnytska	21.8	0.1	27.7
Kirovohradska	2.0	0.2	2.6
Kyiv (City)	950.6	27.3	1,207.7
Kyivska	4,857.2	344.6	6,171.0
Luhanska	6,742.0	577.6	8,565.6
Lvivska	11.9	0.1	15.2
Mykolaivska	2,216.1	45.3	2,815.5
Odeska	143.1	5.0	181.8
Poltavska	69.0	0.6	87.7
Rivnenska	6.8	0.1	8.6
Sumska	382.7	15.4	486.3
Ternopilska	2.8	0.3	3.5
Vinnytska	81.2	1.4	103.1
Volynska	0.5	0.0	0.6
Zakarpatska	5.6	0.1	7.1
Zaporizka	942.5	71.1	1,197.5
Zhytomyrska	174.7	5.3	221.9
Nationwide (no specific region)	-	13,216.1	4,616.7
Total	**50,383.0**	**17,210.1**	**68,626.9**

Source: Assessment team.

Note: - = not assessed for Chernivetska and Ivano-Frankivska. Loss includes additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 6. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Technical assistance for immediate and short-term repairs and stabilization	11.3	3.8	15.0
	Historic housing (not included here)	-	-	-
	Rental support (VA and other)	2,333.3	2,041.6	4,374.9
	Demolition and debris removal	2,923.8	1,070.2	3,994.0
	Repair and reconstruction cost	25,672.7	33,240.2	58,912.9
Service delivery restoration needs	Housing assessments	468.3	643.4	1,111.6
	Organizational arrangements	20.0	18.3	38.3
	Coordination and technical assistance	94.3	86.0	180.3
Total		**31,523.5**	**37,103.4**	**68,626.9**

Source: Assessment team.

Note: - = not assessed.

Table 7. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	Current and major repairs of individual and multi-apartment buildings, including through the compensation mechanism	1436.3
	Development of design and estimate documentation for capital repairs of individual and multi-apartment buildings	186.6
	Development of programs for the comprehensive restoration of the territories of territorial communities and Comprehensive plans for the development of the territories of territorial communities	17.0
	Dismantling and removal, disposal of demolition waste, including purchase of special equipment	161.1
Service delivery restoration needs	Technical inspection of individual and multi-apartment buildings	15.0
	Costs for temporary accommodation of internally displaced persons	112.0
Total		**1,928.0**

Source: Assessment team.

EDUCATION AND SCIENCE

Context

After a year of war, Ukraine's education and science sectors have recorded substantial damage and losses, including losses in learning and scientific outcomes and in the psychosocial well-being of students, educators, and researchers. Schools have progressively resumed in-person education, but only under the condition that they are equipped with bomb shelters. Thus, a variety of schooling modalities—in-person, online, and blended—are in place, with wide variation depending on the local security situation. Returning to in-person education may improve learning and well-being, but remote learning will remain a defining feature for many students and will likely further exacerbate learning losses given recurrent power outages and air sirens.

For years, the Ukrainian education sector has been struggling to adjust to changing demographic dynamics, with a consistently declining student population over the past decades. At least 2 million children have left Ukraine, in addition to a significant number of educators and researchers, and many are expected to remain abroad in other countries in Europe, contributing to brain drain and future demographic challenges for the country. Prior to the war, Ukraine's learning achievement performance was fairly strong, particularly given its income level; but it had not yet reached the levels of achievement observed in the EU. The war's impact on education will negatively affect Ukraine's human capital, with Harmonized Learning Outcome scores potentially declining from 481 points to 420 points.[59] This translates to future earnings losses estimated to be in the trillions of dollars.

Damage and Loss Assessment

The war has caused at least US$4.4 billion in damage to education institutions across Ukraine. As of February 24, 2023, at least 2,772 education institutions were partially damaged and 454 were destroyed, amounting to around 10 percent of all education institutions (across all levels of education) in Ukraine. The most affected facilities are in eastern part of Ukraine: 64 percent of all education institutions in Donetska Oblast and 38 percent in Kharkivska Oblast are either damaged or destroyed (Table 8). These estimates do not include the destruction of educational equipment, so the true cost of damage is likely higher.

Ukraine's education sector has sustained at least US$0.8 billion in losses. For example, the war has led to decreased tuition collection for professional pre-higher and higher education institutions and to additional costs for education institutions that are used as IDP shelters or community centers. Also, some teachers have been unable to collect salary payments because they are in areas not under government control or because of technical issues with transferring funds from local budgets. Finally, the government has incurred additional expenses related to debris removal and demining of damaged education facilities.

Reconstruction and Recovery Needs, Including Build Back Better

The reconstruction of damaged education institutions is expected to cost US$7.8 billion with the largest portion required for secondary schools (Table 9). The reconstruction process must comply with the latest safety, sustainability, and quality standards established by the government. This requirement entails equipping all institutions with bomb shelters, readying them for winter (e.g., providing generators), and rehabilitating them with power/internet connectivity and modern educational equipment. Reconstruction of damaged assets must also align with demographic trends. In fact, the future education network will need to take into account the patterns of internal displacement and returns to Ukraine to ensure its sustainability and alignment with previous optimization efforts.

59 World Bank estimates of Harmonized Learning Outcomes are based on school closures and reduced effectiveness of online learning.

The costs of restoring education service delivery are estimated at US$1.4 billion. While 68 percent of all education institutions have been retrofitted with bomb shelters, a large share of the needs remain dedicated to their construction and renovation. In the interim, provisional measures—such as the organization of digital learning centers and school transportation services—are crucial to provide in-person learning. Measuring learning losses to provide evidence for catch-up programs and psychosocial support is also necessary at all educational levels. Finally, authorities must prioritize the provision of high-quality education by improving learning platforms, supporting teachers to deliver effective lessons, and continuing reforms. This includes the modernization of vocational and higher education curricula to respond to the needs of the post-war economy, as well as the restoration of Ukraine's scientific potential to spur growth and limit brain drain. Over the medium-term, this will entail development of university research facilities, research hubs with foreign universities, and academic mobility programs.

In line with Ukraine's National Recovery Plan, recovery and reconstruction priorities for the education sector include ensuring safe access to learning and ensuring the quality of the educational process. It is important that Ukraine continues pre-war reforms aimed at improving equity, resilience, and efficiency in education. This will provide an avenue to transition from emergency interventions to longer-term recovery efforts. It will also require close coordination between the Education Cluster and education sector working groups as well as better access to timely data for planning. Furthermore, inter-sectoral coordination for vital services including mental health and psychosocial support is crucial to respond to the immediate needs and to support the recovery of the education sector.

Implementation of key activities for recovery will necessarily involve local actors in a major role. Given the wide variation across localities—e.g., population dispersion, IDP concentration, extent of infrastructure damage, modalities of instruction—a multifaceted recovery approach will be needed. The reconstruction and recovery process should be aligned with the ongoing education decentralization reforms: while the Ministry of Education and Science will provide guidance for key reforms, local authorities should be granted the necessary responsibilities and mechanisms for planning and implementation.

2023 Recovery and Reconstruction Priorities

The estimated cost for ensuring safe access to education in 2023 is US$466.8 million (Table 10). The government should prioritize the return of in-person classes where the security situation allows, particularly for younger children. To achieve this, renovation of partially damaged assets in areas further away from the areas with active fighting should be prioritized, as well as the reconstruction of hub schools in combination with the organization of transportation, as they play an effective role in optimization of the school network and ensuring rational use of resources. Additionally, establishing shelters is essential to facilitate in-person education and minimize learning losses. In regions closer to the frontline, where education institutions cannot open for face-to-face classes, the priority should be to establish digital learning centers with shelters, which can provide students with safe access to online education and opportunities for socialization.

Key 2023 activities for ensuring quality in the education process will require an estimated US$130.8 million. In addition to protecting teachers' salary payments and offering other forms of support to mitigate further loss of teachers, it will be important to provide psychosocial support to both children and education personnel, particularly IDPs and those located in areas close to fighting. Schools should also focus on curricula aimed at the acquisition of foundational knowledge, the provision of digital devices and learning materials, as well as on nonformal academic catch-up programs and other targeted interventions to compensate for learning losses. This will be key to compensate for learning losses, but also to modernize teaching methods and initiate the development of an integrated education model for the recovery.

Limitations and Recommendations for Future Assessments

Little information on damage to research equipment was available, and calculations using the RDNA2 methodology do not reflect the true extent of estimated learning losses. Data on research infrastructure and especially on specialized and scientific equipment are not comprehensive, making it harder to estimate the needs for restoring Ukraine's research capacity. Also, the RDNA2's time-bound methodology limits the integration of learning losses into the calculations, since their effects are accrued throughout an individual's working life.

Table 8. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	9.6	14.1	121.7
Chernihivska	152.0	19.8	382.2
Chernivetska	0.0	13.6	105.7
Dnipropetrovska	220.1	38.6	496.8
Donetska	994.0	64.7	1,846.6
Ivano-Frankivska	0.0	14.0	105.7
Kharkivska	834.7	64.6	1,600.2
Khersonska	294.4	35.0	636.8
Khmelnytska	5.3	14.0	114.8
Kirovohradska	12.1	13.1	127.0
Kyiv (City)	113.3	106.7	301.6
Kyivska	250.6	42.9	596.8
Luhanska	284.7	28.0	615.1
Lvivska	1.4	17.9	108.4
Mykolaivska	350.8	32.5	732.3
Odeska	29.2	26.4	156.7
Poltavska	16.9	14.8	143.6
Rivnenska	2.3	13.8	109.7
Sumska	136.4	18.7	353.9
Ternopilska	0.0	13.7	105.7
Vinnytska	12.3	14.5	126.8
Volynska	0.0	13.9	105.7
Zakarpatska	0.0	13.5	105.7
Zaporizka	578.3	107.3	1,195.9
Zhytomyrska	104.6	15.6	288.1
Nationwide	-	37.0	97.4
Total	**4,403.2**	**808.9**	**10,680.6**

Source: Assessment team.

Note: - = not assessed. Loss includes additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 9. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Preschool education	495.8	743.7	1,239.6
	School education	1,589.3	2,383.9	3,973.2
	Extra-curricular education	126.2	294.6	420.8
	Vocational education	313.5	731.6	1,045.1
	Professional pre-higher education	123.6	288.3	411.9
	Higher education	153.7	358.6	512.3
	Specialized education	19.1	44.6	63.7
	Special education	21.4	49.9	71.2
	Adult education	1.7	3.9	5.6
	Research infrastructure	30.4	71.0	101.4
	Youth centers	1.1	2.6	3.8
Service delivery restoration needs	Ensuring safe access to education for all	976.2	823.9	1,800.0
	Tackling learning losses and trauma	241.2	241.2	482.5
	Providing quality education at all levels	164.9	384.7	549.6
Total		**4,258.1**	**6,422.5**	**10,680.6**

Source: Assessment team.

Table 10. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	Preschools	49.7
	Secondary schools	167.8
	vocational education and training institutions	26.4
	Pre-higher education institutions	10.3
	Higher education institutions	15.2
Service delivery restoration needs	Construction and renovation of bomb shelters	138.6
	Acquisition of additional school buses	27.3
	Establishment of safe digital learning centers	31.5
	Provision of digital devices for teachers and students	24.7
	Provision of mental health and psychosocial support for students and teachers	38.6
	Teacher training and education materials to focus on foundational learning	30.8
	Non-formal catch-up programs or accelerated learning for vulnerable students	36.7
Total		**597.7**

Source: Assessment team.

HEALTH

Context

Since February 24, 2022, there has been a massive detrimental impact not only on mortality and disability but also on the availability and accessibility of health services and infrastructure. The damage and losses have increased by approximately 79.2 percent and 157.7 percent, respectively, since June 1, 2022. The estimated recovery and reconstruction needs have increased by 8.6 percent over the same period. Although resources are constrained, the health system in Ukraine has shown tremendous resilience since the beginning of the war, and national health institutions have continued to function. But the risks for the population will escalate without targeted and urgent investments well aligned with the health reform visions of the Government of Ukraine.

Damage and Loss Assessment

The war has caused approximately US$2.5 billion in damage to the health sector infrastructure in Ukraine (Table 11). The Ministry of Health has been collecting data about damage to health facilities since the war started. According to MoH registry, there were 15,084 health facilities of different types and ownership, including 9,925 public facilities, in Ukraine before the war. Damage or destruction was reported in 15.9 percent of public facilities (1,574 facilities, or a total area of 1,791,608 m2) as of February 24, 2023; this represents nearly a tripling of the damage reported in RDNA1 (5.6 percent). The damage to health infrastructure is registered in 17 regions, and the largest share of damage is concentrated in the Donetska, Kharkivska, and Chernihivska oblasts. Of the damaged facilities, 596 are pharmacies (37.9 percent of the affected facilities)[60], 436 are general or mono-profile hospitals (27.7 percent of affected facilities and equivalent to 23.4 percent of all hospitals registered), and 297 are primary health care (PHC) centers (18.9 percent of affected facilities and equivalent to 4.3 percent of all PHC centers registered). Additionally, there were 3,118 ambulances prewar nationwide, of which 650 (20.8 percent) were damaged or stolen. The actual level of damage is likely higher, given incomplete or missing reports on private sector assets as well as damaged facilities located in the territories temporarily not under government control.

The total loss was estimated conservatively at US$16.5 billion, including the removal of debris and demolition of the destroyed facilities, loss of income of private providers, losses from the financing of facilities, and additional losses to the population's health due to forgone care and increased public health threats. Under the standard approach for the current estimate, assumptions for the removal of debris and demolition remained the same as in RDNA1. A share of additional expenditures paid under the Program of Medical Guarantees (PMG) to sustain health care providers' activities and salaries is also estimated as losses. The RDNA2 includes losses associated with the needed strengthening of the core essential public health functions. This new estimate includes increased expenditures and needs for surveillance, preparedness, and response to health emergencies, including increased expenditure for water quality monitoring, immunizations, and control of select communicable diseases. As in the RDNA1, the losses in population health were estimated using the DALYs concept.[61] The RDNA2 estimates a loss of US$13.2 billion in DALYs, for 12 months since the invasion and additional 18 months following, resulting in the estimated loss from additional health burden more than tripled compared to RDNA1.

Reconstruction and Recovery Needs, Including Build Back Better

The total reconstruction and recovery needs are estimated at US$16.4 billion for the next 10 years (Table 12). Out of these, US$3.6 billion is required to restore the health system and address increased health needs in the immediate to short term. This

60 In November 2021, there were 22,816 pharmacies registered in Ukraine. More recent baseline data for pharmacies is not available.

61 Disability-adjusted life years (DALYs) assess overall disease burden, expressed as the number of years lost due to mortality and morbidity. One DALY represents the loss of the equivalent of one year of full health.

amount includes the building of new infrastructure to replace destroyed facilities using the build back better approach as well as the immediate upgrading and recovery of partially damaged facilities. The new facilities may be relocated to serve larger catchment population groups, based on new models of care. A destroyed general profile hospital can be rebuilt as a more efficient facility to serve a minimum of 300,000 persons or, in some cases, can be rebuilt as a specialized hospital that serves up to 750,000 persons. PHC centers, or PHC+[62], can be rebuilt as comprehensive PHC centers that provide multidisciplinary care as well as extended diagnostic capacity and basic emergency services. An additional US$12.7 billion is required for medium- to long-term needs. Rehabilitation and mental health services as well as PHC and access to essential medicines should be strengthened and scaled up to address the impact of the war on the population of Ukraine. The estimate of the need includes costs of additional equipment to strengthen diagnostic and emergency services in hospitals within two ongoing World Bank-financed projects, and a new project providing US$500 million to support reconstruction and recovery.

It is critical to systematically identify and address disrupted services accumulated during the COVID-19 pandemic as well as since the invasion. There is a need to improve community-based health services, provide additional medicines in the Affordable Medicines Program,[63] and expand telemedical services. Major scale-up of services will require significant investments in building the capacity of medical staff and engaging additional lay workers who can proactively seek to identify people in need of services.

2023 Recovery and Reconstruction Priorities

Of the short-term needs, an estimated US$543.6 million is needed in 2023 (Table 13). Strengthening PHC as the foundation for people-centered services, along with making small-scale repairs to restore health facilities' functionality, should be an immediate priority, especially in territories that have recently been returned to the control of the Government of Ukraine. Such investments will help speed up the renovation of facilities damaged during the war and the reconstruction of outdated rehabilitation and mental health facilities that require refurbishment and upgrading. This amount also covers preparatory works and planning investments associated with major reconstruction and construction of facilities using the building back better approach. The number also includes the following: a further increase in financing of mental health services, including for veterans and victims of gender-based violence; scale-up of rehabilitation services, assistive technologies, and efforts to address the missed screening of non-communicable diseases; follow-up of people with chronic conditions; and scale-up of child and adult vaccinations. Given that this is a period of increased public health risks, increased focus on threats will be essential; this should include investments in appropriate epidemic surveillance, preparedness, and response mechanisms, as well as increased monitoring of water quality and other environmental risks to health.

Limitations and Recommendations for Future Assessments

The limited availability of reliable data sources continues to be a challenge. The baseline data relied on a single data source, the state registry of medical licenses. Although the registry is the most comprehensive source, its data are incomplete, and approximations were used in the estimates. In the future, however, the national e-Health system and independent verifications are likely to be used to triangulate the data on health facilities. RDNA2 also excluded data on the damage in private facilities as the data had not been updated since 2022. However, a survey of private sector providers is planned for 2023, and the findings will be reported in the course of 2023 by the World Bank. Health losses were estimated using key areas of disease burden that are most likely affected by the war. The methods may be further refined in future assessments.

62 The expanded PHC model, or PHC+, will cover the original scope of services delivered in PHC, but will also offer a range of additional services, such as outpatient specialist care and ambulatory physical therapy. In addition, PHC+ facilities will provide participants with health check-ups and access to a range of disease management programs, while also offering patients access to a broader range of competencies than the basic PHC team, which consists of general practitioners, nurses, midwives, and, in some cases, physical therapists.

63 Affordable Medicines Program is a medicines reimbursement program for outpatient prescriptions, launched in 2017.

Table 11. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	0.9	462.3	442.4
Chernivetska	0.0	302.4	339.4
Chernihivska	259.4	460.9	438.0
Dnipropetrovska	51.6	1,056.0	1,194.3
Donetska	785.8	1798.6	1,767.6
Ivano-Frankivska	0.0	458.9	515.1
Kharkivska	618.3	1,048.6	1,163.7
Khersonska	78.3	347.5	403.5
Khmelnytska	0.6	417.1	468.4
Kyiv (City)	69.0	1,710.7	1,144.8
Kyivska	101.3	802.4	713.3
Kirovohradska	0.0	351.9	344.2
Luhanska	188.2	914.1	854.4
Lvivska	0.0	841.3	944.5
Mykolaivska	211.0	391.1	475.1
Odeska	6.2	957.6	898.0
Poltavska	0.3	532.8	515.2
Rivnenska	1.5	387.8	435.6
Sumska	16.0	486.1	399.0
Ternopilska	0.0	346.9	389.4
Vinnytska	4.3	512.7	576.3
Volynska	0.0	346.8	389.4
Zhytomyrska	3.7	400.5	450.2
Zakarpatska	0.0	422.6	474.4
Zaporizka	57.8	650.1	640. 4
Nationwide	30.3	68.6	8.5
Total	**2,484.7**	**16,476.4**	**16,385.2**

Source: Assessment team.

Note: - = not assessed. Loss includes an additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 12. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Demolition and debris removal	242.1	0.0	242.1
	Investments to build new secondary care facilities	535.9	4,823.3	5,359.2
	Investments to build new secondary care facilities with centers of excellence	266.6	2,399.8	2,666.4
	Investments to reconstruct damaged secondary facilities	439.9	0.0	439.9
	Investments to refurbish and equip ambulance stations	4.5	0.0	4.5
	Investments to build new primary care facilities	82.1	0.0	82.1
	Investments to reconstruct damaged primary care	10.2	0.0	10.2
	Investments in the construction of new rehabilitation centers	0.0	495.0	495.0
	Investments in the reconstruction of rehabilitation centers	84.8	763.3	848.1
	Investments to upgrade specialized and primary mental health centers	192.7	449.6	642.3
Service delivery restoration needs	Additional primary health care services and medicines	1,190.6	2,778.1	3,968.8
	Health emergency preparedness and response	59.9	139.7	199.6
	Additional mental health needs	166.0	387.3	553.2
	Additional rehabilitation services	156.7	365.7	522.4
	Education needs	113.3	0.0	113.3
	Digitalization and telemedicine	60.0	140.0	200.0
	Investments in emergency care equipment	38.0	0.0	38.0
Total		**3,643.4**	**12,741.8**	**16,385.2**

Source: Assessment team.

Table 13. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	Demolition and debris removal	48.4
	Investments to reconstruct damaged secondary facilities	219.9
	Investments to refurbish and equip ambulance stations	4.5
	Investments to build new primary care facilities	16.4
	Investments to reconstruct damaged primary care	10.2
	Investments in the reconstruction of rehabilitation centers	42.4
	Investments to upgrade specialized and primary mental health centers	9.0
Service delivery restoration needs	Additional primary health care services and medicines	70.0
	Health emergency preparedness and response	12.0
	Additional mental health needs	20.0
	Additional rehabilitation services	20.0
	Education needs	22.7
	Digitalization and telemedicine	10.0
	Investments in emergency care equipment	38.0
Total		**543.6**

Source: Assessment team.

SOCIAL PROTECTION AND LIVELIHOODS

Context

Ukraine is showing resilience in the face of the ongoing war, but the impact on social protection and livelihoods remains very large. Nearly 5.56 million formerly displaced people have returned home, 20 percent of them from abroad.[64] However, the projected negative impact of the war is still significant. The incidence of monetary poverty in the country could return to levels observed 16 years ago, pushing more than 7.1 million Ukrainians below the poverty line and almost 3.7 million people into a state of "vulnerability to poverty." While the labor market has improved since the analysis was carried out for RDNA1 (June 2022), the projected adverse impact on the labor market remains immense. The International Labor Organization (ILO) estimates that employment in 2022 is 15.5 percent (2.4 million jobs) below the prewar level.[65] National surveys report that only 67 percent of those who were employed before the war still have a job.[66] Moreover, some formally employed people are receiving reduced labor earnings (as compared to February 2022) or not receiving earnings at all.[67] Only about 40 percent of people work as they used to before the war. In terms of employment by economic activity, the refugee outflux is likely to have had a disproportionately adverse effect on the workforce of Ukraine's wholesale and retail trade, education, and health and social services sectors, in which nearly 40 per cent of previously employed refugees were working prior to the February 2022.[68] In addition, in 2022 alone, the number of persons with disability status increased by at least 130,000 (as of December 1, 2022). Looking forward, the ILO projects only a minor improvement in the labor market situation for 2023. Assuming the security situation will remain broadly the same throughout the year, employment growth is forecast at only 0.5 percent, which equals roughly 70,000 jobs

In 2022, Ukraine spent around UAH 159 billion (US$4.3 billion) on social assistance. This includes Guaranteed Minimum Income (GMI), HUS (Housing Utility Subsidy), child and family benefits, disability and care benefits, benefits to IDPs, etc. Between June and December 2022, social assistance expenditures amounted to around US$3.4 billion. A social assistance program for IDPs to cover living expenses introduced in March 2022 provides monthly support to around 1.9 million beneficiaries (as of December 2022). Total spending on social assistance for IDPs in 2022 was UAH 53.5 billion (US$1.46 billion), which includes US$1.26 billion paid since June 2022. A wage subsidy program aimed at encouraging employers to hire IDPs was introduced in March 2022. By the end of 2022, over 16,500 IDPs had been hired under this program, with employers receiving over UAH 200 million (US$5.7 million). In 2023, 23,000 IDPs are expected to be employed with the support of this program.[69]

64 IOM, "Ukraine Internal Displacement Report: General Population Survey, Round 12 (16–23 January 2023)," Link.

65 ILO Monitor on the world of work. 10th edition. Multiple crises threaten the global labour market recovery. October 2022. Link.

66 Rating Sociological Group, "Legal Protection of Victims from the War Crimes of Russia (December 23–26, 2022)," February 2, 2023, Link.

67 Gradus Research Company, "Social Screening of Ukrainian Society During the Russian Invasion—The Twelfth Wave of the Study," October 2022, Link.

68 ILO; Report on developments relating to the resolution concerning the Russian Federation's aggression against Ukraine from the perspective of the mandate of the International Labour Organization; February 2023; Link.

69 Ibid.

Damage and Loss Assessment

Damage in the social protection area mostly consists of destroyed or partially destroyed infrastructure, such as residential care units, sanatoriums, or social service delivery centers. As of December 2022, damage to facilities providing social services was continuing; 158 social protection infrastructure assets were damaged or destroyed. The total amount of damage is about US$241 million (Table 14).[70]

Total losses for the social protection and livelihoods sector in Ukraine are estimated at US$65.7 billion. These very large losses stem from the loss of jobs and household income from wages, higher poverty, related increased expenditures under existing means-tested social programs, and additional needs for programs such as survivor's benefits or programs related to disability. The government has implemented a blanket energy subsidy by freezing energy tariffs, which reduces losses that accumulate in social protection by shifting them to the energy sector, as a measure aimed to prevent further increase of the vulnerability of the population in a situation when expansion of means-tested programs could become difficult.

The largest share of losses comes from the permanent loss of jobs and workers. While ILO estimates employment at 15.5 percent below the prewar level, of those employed prewar, 33 percent (5.1 million) report losing their job in national polls, while about 17 percent (2.6 million) report receiving no or partial labor earnings.[71] This shows that a significant number of people while formally being employed, suffer large livelihood losses linked to the war. Losses stemming from social protection programs are estimated at US$4.2 billion. The calculation of losses used the average monthly salary in Ukraine before the war (as of January 2022), US$534, and assessed the losses for 18 months.

Reconstruction and Recovery Needs, Including Build Back Better

Restoration of jobs remains the key priority for recovery. Permanently lost jobs will not be restored as part of reconstruction efforts, as they were lost because businesses ceased to exist and because there was a direct loss of the workforce. Nearly 19 percent of current refugees do not currently intend to return to Ukraine,[72] while according to the authorities, about 2 million people have been forcibly deported to Russia[73] and may not be able to come back. As of January 2023, among those who returned to their places of permanent residence, 34 percent reported having income per one household member per month equal to or below UAH 2,600 (≈ the subsistence minimum per one person per month).[74] The RDNA2 assessment estimates that about 10 percent (1.5 million) of all jobs may be lost permanently. Restoring these jobs would require additional efforts and costs (through mobility grants, skilling programs, settling-in grants, or wage subsidies and other types of support for employers to re-establish production, markets, and supply chains, as well as to ensure access to needed skills through return migration and immigration schemes). The cost of means-tested support is also expected to remain high during the reconstruction period, not only to support workers who temporarily lost their jobs, but because matching jobs and workers will also incur costs (e.g., insertion schemes, mobility incentives and retraining, much of which requires additional capacity of public employment services). Special programs are needed to bridge gaps created by geographical mismatches and changes in labor market needs due to structural change. The estimated needs in the social protection and livelihoods sector amount to US$41.8 billion over 10 years (Table 15).

70 For RDNA1 these numbers were respectively 56 infrastructure items and US$164.4 million of damages.

71 Calculation of losses uses the lowest number of people out of a job from the Rating Sociological Group and Gradus Research Company polls; the number of people receiving reduced income (including no income) is averaged. Resulting income for this category is assumed at 50 percent of prewar income. *See* Rating Sociological Group, "Legal Protection of Victims from the War Crimes of Russia (December 23–26, 2022)," February 2, 2023, *Link*.; Gradus Research Company, "Social Screening of Ukrainian Society During the Russian Invasion—The Twelfth Wave of the Study," October 2022, *Link*.

72 United Nations High Commissioner for Refugees, "Lives on Hold: Intentions and Perspectives of Refugees from Ukraine," September 2022, *Link*.

73 "President: Russia Deported about 2 Million People, Among Them Many Children" (in Ukrainian), *Ukrinform*, December 18, 2022, *Link*.

74 IOM, Ukraine Returns Report - (16 - 23 January 2023), *Link.*

The focus should be on the rehabilitation of war-affected groups, such as orphans, IDPs, and persons with disabilities. This approach is critical for the reintegration of war veterans into society and could efficiently respond to the multidimensional challenges faced by survivors. It could include the restructuring and modernization of the respective benefits, as well as services to reintegrate veterans into civil life (e.g., psychological support, physical rehabilitation to improve functionality, social rehabilitation to ensure inclusion in the community). To support IDPs' and returnees' integration into the local labor market, efforts to relocate businesses, capacities of private and public employment services and skills training for IDPs (particularly on entrepreneurship) needs to be supported. The budget for social protection of persons with disabilities, including rehabilitation and assistive technologies, increased from US$51 million in 2022 to US$94 million in 2023. The government intends to move from disability assessment based on the ability to work toward an assessment that takes into account the International Classification of Functioning, Disability, and Health (ICF) of the World Health Organization. This would allow the government to better assess the individual needs of beneficiaries and plan the rehabilitation interventions and expenditures needed to restore their ability to function and work.

In this recovery phase, the utilization of new technologies, including cloud-based and online solutions, should be expanded to strengthen the adaptability of the overall system. Ukraine has already appreciably invested in digital solutions such as the Diia platform, the Pension Fund digital platform, and the Unified Information System of the Social Sphere, which allowed digitization of the IDP and HUS program benefits. However, new solutions—such as skill-based job matching at scale—are needed. The Diia, with over 18 million users as of December 30, 2022, allows online enrollment for the unemployment benefit and for four social assistance programs, namely the IDP program, the HUS program, the birth grant program, and the Municipal Nanny program (which provides compensation for care services to children under three); together, the social assistance programs account for over 46 percent of all program beneficiaries. Over 1.4 million (60 percent) of the IDP support program beneficiaries applied for the benefits online. By the end of 2023, the government will launch online enrollment in additional programs to enhance access to benefits during the war. A welcome addition to facilitate online skills training in technical and vocational education and training was launched in December 2022 – the Professional Education Online Platform - which includes virtual reality modules to partially bridge the practical learning gap imposed by the war due to disruptions in schools and firms. It already covers 29 occupations and will be expanded by 60 more.[75]

2023 Recovery and Reconstruction Priorities

In the immediate to short term (2023–2026), there is a need to finance social expenditures that will protect vulnerable households and individuals from additional long-term harm—for example, by ensuring that they do not resort to adverse coping strategies. These expenditures include support through a GMI-type program that provides low-income families with the income to cover basic needs, and through housing and utility subsidies that aim to prevent energy poverty, especially during the heating season. Costs associated with these and other social programs (such as benefits to IDPs and restoration of social services) are expected to reach over US$3.6 billion (Table 16). This figure excludes energy subsidies, which will become part of social expenditures after the freeze on tariffs is lifted. However, this cost may grow in the event that additional territory is brought back under government control, welfare office operations resume, refugees return from abroad, and/or the freeze on tariffs is lifted. Adjusting tariffs alone could increase the needs for 2023 by about US$750 million.

75 ILO. One year of war in Ukraine: "Professional Education Online" – a new and innovative digital platform to sustain TVET education in Ukraine. *Link*.

Limitations and Recommendations for Future Assessments

This assessment does not incorporate the expected results of likely changes to social protection policies in the future aimed at higher efficiency of the public funds use. The Ministry of Social Policy prepared a concept note that identified key problems in social protection and suggested relevant reform priorities (listed below), noting that addressing the problems would impact the social protection needs in the future:

- **Social insurance (pensions).** Unify and simplify the different pension guarantees, revise criteria for disability, and prepare for the introduction of a funded pension scheme to respond to declining pension benefit adequacy.
- **Social assistance.** Transform the subsistence minimum into an anti-poverty tool (de-linking it from fees, fines, and penalties, as well as salaries in the budget sector); optimize the number of and algorithms for social benefits; separate social assistance payments from pensions; and strengthen labor incentives in social assistance programs to respond to insufficient targeting, weak behavioral incentives, and less-adequate support. A better-designed GMI-type program could integrate several less-effective benefits into the current Social Assistance to Low-Income Families.
- **Social services.** Expand the use of social services to help beneficiaries overcome difficult life circumstances; expand family-based and community-based modes of providing social services to respond to the underdevelopment of the social services system in Ukraine.

For social programs that depend on change in incomes and the cost of basic needs, there is high uncertainty beyond the immediate/short term. Expenditures for means-tested programs may change significantly depending on the change in household incomes and their relation to the cost of basic needs, expressed by the legislatively set income threshold.

Table 14. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Chernihivska	1.2	0.2	1.6
Dnipropetrovska	3.6	0.6	4.8
Donetska	43.0	6.1	58.1
Kharkivska	7.2	0.6	9.7
Khersonska	2.0	0.3	2.8
Kyiv (City)	68.8	9.3	92.9
Kyivska	10.7	0.7	14.4
Luhanska	30.5	3.3	41.2
Mykolaivska	8.8	1.1	11.9
Odeska	42.3	0.5	57.1
Sumska	12.4	1.8	16.8
Zakarpatska	0.2	0.0	0.2
Zaporizka	9.4	1.5	12.7
Zhytomyrska	0.5	0.1	0.7
Nationwide (no specific region)	-	65,712.8	41,458.1
Total	**240.6**	**65,738.9**	**41,782.9**

Source: Assessment team.

Note: No damage reported for Cherkaska, Chernivetska, Khmelnytska, Kirovohradska, Lvivska, Poltavska, Rivnenska, Ternopilska, Vinnytska, and Volynska. Loss includes an additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023. Note that household income loss valued at US$61.5 billion is not included in the RDNA2 overall figures to avoid potential double-counting in relation to other sectors.

Table 15. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Residential institutions for the elderly, persons with disabilities, and children	127.5	0.0	127.5
	Sanatoriums, children's camps	146.2	0.0	146.2
	Social service delivery centers	51.2	0.0	0.0
Service delivery restoration needs	Restoration of permanently lost jobs	3,495.3	6,116.7	9,612.0
	Means-tested benefits	7,590.9	14,180.0	22,522.9
	Benefits to IDPs	4,298.3	1,718.3	6,016.6
	Restoration of social services	900.0	0.0	900.0
	Military social assistance and other long-term benefits related to war	1,148.0	2,009.0	3,157.0
Total		**17,757.3**	**24,025.6**	**41,782.9**

Source: Assessment team.

Table 16. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	Residential institutions for the elderly, persons with disabilities, and children	1.1
	Sanatoriums, children's camps	112.7
Service delivery restoration needs	Restoration of permanently lost jobs	250.0
	Means-tested benefits	1,942.4
	Benefits to IDPs	1,576.4
	Restoration of social services	225.0
	Military social assistance and other long-term benefits related to war	287.0
Total		**3,644.2**

Source: Assessment team.

CULTURE AND TOURISM

Context

The war has significantly impacted the diversity and richness of culture and cultural heritage in Ukraine, causing damage to cultural infrastructure and assets, reducing livelihoods for cultural creators, bearers and practitioners, limiting access to culture, and impeding the exercise of cultural rights. Historic cities with heritage and monuments are under threat, and damage to museums and looting of collections have exposed the need for better inventory and collections management. Emergency measures were taken since the start of the war to secure movable cultural properties, though large-scale conservation treatments will be required due to unstable storage conditions. The war has also deeply affected the safeguarding of intangible cultural heritage and creativity, undermining the social fabric and interfering with the daily practices and livelihoods of living heritage practitioners, producers, community members, cultural professionals, and artists. Internal displacement and outflow of artists and cultural professionals have significantly reduced the diversity of cultural practices and expressions, particularly in eastern oblasts, and have diminished the ability of cultural institutions to cope with emergency needs. At the early stage of the war, there was a severe decrease in cultural activities and tourism. This resulted in substantial revenue losses in addition to the physical damage.

Since June 2022, some activities have gradually resumed. The market for artists and cultural professionals has shrunk, with a notable reduction in their incomes. Despite damage to the communication and broadcasting infrastructure, many media outlets and journalists have continued working to ensure access to information; many local and hyperlocal media outlets are facing severe financial constraints after a significant drop in advertising revenues and incomes. Tourism, especially international tourism, is still in decline in the country, but several religious sites and cultural institutions have reopened and are hosting temporary exhibitions, demonstrating the resilience of Ukraine's cultural sector and its importance for reestablishing a sense of normalcy and collective well-being. Due to the drop in national budget expenditure on culture, many cultural institutions are at risk of closure, with the independent sector the most impacted. However, civil society organizations, volunteers, artists, and cultural professionals have demonstrated unprecedented activism in supporting the preservation of Ukraine's culture during the war. The damage to cultural properties and looting of collections furthermore sparked public debates on national values and subsequent recovery.

Damage and Loss Assessment

As of February 24, 2023, the total damage cost from identified assets is estimated at US$2.6 billion, distributed as follows: historic cities, buildings, and sites imbued with recognized cultural/social values—US$1.7 billion; movable cultural properties and collections, repositories of culture—US$143 million; buildings/workshops/ateliers dedicated to cultural and creative industries (CCIs)—US$150 million; and tourism facilities—US$650 million. The most impacted oblast is Kharkivska (30 percent of damage), followed by Donetska (16 percent) and Luhanska (9 percent) (Table 17).

Losses are estimated at US$15.2 billion and include revenue losses from tourism, art, sports, entertainment and recreation, CCIs, and cultural education, as well as valued asset protection. The most critical losses are for CCIs (US$10.8 billion) and tourism (US$3.2 billion). Unlike damage, losses in revenue are highly concentrated in the capital; at US$7.3 billion, which represent about half of the total loss. Another US$4.6 billion in losses is not identified with specific oblasts but rather nationwide losses.

Reconstruction and Recovery Needs, Including Build Back Better

The total needs over the next 10 years for recovery and reconstruction, including service delivery restoration, amount to US$6.9 billion, with short-term needs (2023–2026) at US$2.3 billion and

medium- to long-term needs (2027–2033) at US$4.6 billion (Table 18). The early stage is expected to include damage assessment and documentation, emergency measures for cultural immovable and movable properties (including debris removal), stabilization and conservation measures for cultural assets, storage management, preparedness plans, and immediate conservation to prevent further loss and looting. This stage will also include support for CCIs, safeguarding of intangible cultural heritage, and restoration and reconstruction of about 30 percent of assets. The remaining restoration and reconstruction (including operational costs), along with further support for CCIs and safeguarding of intangible cultural heritage, are reflected in the medium- to long-term needs.

It is highly recommended to increase protection of cultural heritage and undertake preventive conservation of sites and assets that risk being further damaged or destroyed. This will entail identifying each cultural asset—such as historic cities, built heritage, museums, monuments, national/regional theaters, and religious sites—and recognize culturally valued movable assets temporarily secured or held in such buildings need to be protected and more systemically managed by designated authorities.

More fundamentally, a comprehensive recovery plan is needed to rebuild the sector. This plan should include alignment with international standards, enhanced legal protection and governance, the development of protocols and guidelines for protecting and recovering cultural heritage, and a comprehensive digital architecture to document and manage cultural property. Revisions to state policies are necessary to support cultural heritage preservation and safeguarding, build institutional capacity, and develop regulations, in particular to protect heritage from demolition and urban development pressures. Incentives and conditions for the resumption of cultural activities in safe territories and the return of cultural sector professionals to Ukraine, are crucial. All these priorities must also be accompanied by development and execution of an inclusive capacity-building program for the culture sector with a view to sustain the results achieved. The recovery plan will require significant funding, with an increase in cultural expenditures from local budgets; this process had started in 2019 but has been halted since the war. Decentralization and localization are necessary for the delicate recovery and reconstruction of the sector, and a strategic reengineering of the culture sector's architecture will be required. Funding schemes will also need to be rethought for post-war transitional and recovery scenarios.

2023 Recovery and Reconstruction Priorities

During 2023, physical recovery and reconstruction includes protecting and conserving valued assets, urgent repairs, and preventing demolition of sites/buildings of cultural significance (Table 19). For nonphysical but essential measures, 5-7.5 percent of all necessary restoration activities over the next 10 years is allocated to 2023 needs per component. These activities include (i) continued monitoring, assessment, and documentation of damaged cultural heritage using geographic information system (GIS) satellite imagery; (ii) enhancement of legal protection and normative frameworks for heritage; (iii) emergency management measures, inventories, storage management, preparedness plans, and urgent conservation to avoid loss and looting; (iv) repair of assets as feasible to restore function and preservation of heritage and cultural infrastructure to prevent demolition of assets of cultural significance; (v) support for CCIs to support broader access to cultural life, the continuation of artistic creation, resumption of cultural events, and development of community plans and practices for safeguarding intangible cultural heritage; and (vi) reinforcement of capacities of culture professionals. The total 2023 needs amount to US$108.5 million.

Limitations and Recommendations for Future Assessments

RDNA2 benefits from information improvements over RDNA1, including a more accurate overview of damage categories through a proxy calculation. RDNA2 includes communications and broadcasting,[76] CCIs, and partially also intangible cultural heritage. However, given the absence of on-site inspection, calculations of damage levels rely on reports from regions and relevant authorities, with some assumptions applied. Monitoring cultural properties in inaccessible areas, especially smaller-scale properties with local significance, remains

76 Culture and Tourism sector calculations included programming and broadcasting activities as part of losses; while Telecommunications and Digital included calculations of damage and needs related to broadcasting, and losses related to physical damage.

challenging. Assessing damage to underwater heritage is also difficult at this stage, given Ukraine's 2,700 km of coastline. Intangible cultural heritage losses have not been fully estimated. Additionally, quantitative data on the loss of human resources in the cultural sphere are not yet available, hindering the development of necessary restoration measures for cultural institutions. Loss data collection was more difficult compared to damage and needs, especially for revenue losses, as the most recent data were as of 2021, meaning that the finalization period was already affected by the war. Hence, 2020 and 2021 data to get counterfactual revenue, and assumed severity level to get losses. However, many assumptions had to be applied, and a more rigorous estimation based on more facts will need to be carried out in the near future.

Table 17. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	4.6	41.3	9.0
Chernihivska	96.7	72.1	246.9
Chernivetska	1.1	5.7	2.2
Dnipropetrovska	63.1	379.4	134.9
Donetska	414.4	172.1	1,007.3
Ivano-Frankivska	1.7	14.9	3.3
Kharkivska	809.9	1,017.5	2,194.5
Khersonska	87.3	59.8	191.1
Khmelnytska	5.3	11.0	12.2
Kirovohradska	1.9	9.4	3.7
Kyiv (City)	54.9	7,340.7	134.5
Kyivska	118.6	155.4	305.3
Luhanska	242.5	70.7	584.8
Lvivska	7.8	528.4	17.8
Mykolaivska	177.1	75.3	481.8
Odeska	132.8	205.3	349.0
Poltavska	4.6	31.7	9.0
Rivnenska	1.4	3.4	2.8
Sumska	86.6	38.8	227.1
Ternopilska	1.3	7.4	2.5
Vinnytska	16.0	143.4	42.9
Volynska	1.3	7.5	2.5
Zakarpatska	1.3	10.2	3.2
Zaporizka	138.1	122.6	317.6
Zhytomyrska	17.4	28.7	43.5
Nationwide (no specific region)	143.0	4,608.2	557.8
Total	**2,630.8**	**15,160.9**	**6,887.5**

Source: Assessment team.

Note: loss includes additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 18. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Damage assessment, detailed documentation, & harmonized digitalization	173.4	80.0	253.4
	Emergency measures for cultural immovable properties (shoring, propping, structural reinforcements, sheltering and protection measures, including debris removal) and movable properties (inventories, preparedness plans, storage management, etc.)	780.5	0.0	780.5
	Repair of assets as feasible to restore function and ensure preservation and restoration of built heritage, historic cities, and cultural infrastructures to prevent/mitigate demolition of sites/buildings of cultural significance	520.3	0.0	520.3
	Reconstruction/restoration of assets	260.2	3,483.7	3,743.9
Service delivery restoration needs	Strengthen legal protection of the cultural sector and normative frameworks during and after the war	29.1	10.1	39.2
	Reinforce capacities of professionals	204.0	201.3	405.3
	Support restoring the creative industry and safeguarding intangible cultural heritage	262.3	372.5	634.7
	Operational cost	87.4	422.8	510.2
Total		**2,317.3**	**4,570.3**	**6,887.6**

Source: Assessment team.

Table 19. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated Cost
Reconstruction needs	Damage assessment, detailed documentation, harmonized digitalization, and emergency measures, including debris removal	35.8
	Repair of assets as feasible to restore function and ensure preservation and restoration of built heritage, historic cities, and cultural infrastructures to prevent/mitigate demolition of sites/buildings of cultural significance	13.0
Service delivery restoration needs	Strengthen legal protection of the cultural sector and normative frameworks during and after the war	17.5
	Reinforce capacities of professionals	29.1
	Support restoring the creative industry and safeguarding intangible heritage	13.1
Total		**108.5**

Source: Assessment team.

PRODUCTIVE SECTORS

Donetska Oblast. Photo by Yevgen Honcharenko, Donetsk Oblast State Administration.

AGRICULTURE[77]

Context

Prior to the war, Ukraine's agriculture produced 10 percent of GDP, employed 14 percent of the labor force, and generated 41 percent of total exports. The war started just before the start of the 2022 spring planting campaign, hitting the agriculture sector very hard. The total planting area in 2022 declined by 20 percent compared to 2021 and 15 percent of agricultural capital stock was already damaged after the first three months of the war. The 2022 grain and oilseed harvests declined by 37 percent on a year-on-year basis. Along with the upward pressure on input prices, especially fertilizers and diesel, the lower agricultural production significantly reduced farm incomes. In the first months of the war, grain exports sharply dropped due to the blockade of the Black Sea, whose ports had supported 90 percent of the prewar agricultural export. In March 2022, the export of grain was only 0.3 million tons, compared with 5.4 million tons in January 2022. Although the alternative routes helped increase the grain export to 1.2 million tons in April and 2.7 million tons in June 2022, these volumes were still below the 5–6 million tons exported monthly prewar through Black Sea ports. As a result, the domestic farm gate prices for wheat and corn declined by 45 percent between January and June 2022, while globally they grew by 15 percent. The Black Sea Grain Initiative, which started in July 2022, substantially increased exports (to 6–7 million tons monthly), but the logistical costs remained very high and continued to put a downward pressure on farm gate prices. The pressure has been greatest for corn, which led to a delayed corn harvest; 6 percent of the corn crop remained unharvested in the field in February 2023. The winter wheat planting area in 2022 declined by 25 percent, and many farmers switched to oilseed crops, which will further reduce Ukraine's grain harvest and export in 2023. The low volumes of grain exports will further exacerbate global food insecurity, triggering the risk that the current crises of food access will become a crisis of food availability over the next several years.

Damage and Loss Assessment

The damage and losses for Ukrainian agriculture are estimated to reach US$40.2 billion, with losses accounting for 78 percent of the total (Table 20).

As of February 24, 2023, the war has resulted in total damage of US$8.72 billion for the agriculture sector, while the aggregate losses total US$31.50 billion. The damage includes partial or full destruction of machinery and equipment, storage facilities, livestock, fisheries and aquaculture, and perennial crops, as well as stolen inputs and outputs. The damage to machinery and equipment was the largest source of total damage (53 percent), followed by stolen inputs and outputs (23 percent) and damaged storage facilities (15 percent). The damage increased almost four times compared to June 2022, for several reasons: in the territories temporarily not under government control, assets that had previously been partially damaged became fully damaged; the value of stolen inputs and outputs increased; and the farm surveys conducted by the FAO and the World Bank (and used for this updated assessment) found that the actual damage was greater than previously assumed.

The war losses include the foregone farm income due to lower/forgone production volume (e.g., unharvested crops), lower farm gate prices (due to export logistic disruptions), higher additional farm production costs (e.g., fertilizers and fuel, the cost of affected land recultivation after survey, clearance and land-release, and the halt of fishing operations). [78] The losses add up to US$31.5 billion (Table 20). The largest loss, accounting for 46 percent of the total losses, resulted from the decrease in farm gate prices of export-oriented commodities such as wheat, barley, corn, and sunflower seeds. It

77 The agriculture sector includes crops, livestock, and fisheries/aquaculture. It excludes irrigation and forestry, as well as food industry and agro-logistics, which are included in other parts of the RDNA2.

78 This sectoral assessment includes under loss and needs the cost of recultivating and cleaning of land after demining. The losses from mines on agricultural land and the need for the survey, clearance and release of agricultural land are not included in the agriculture sector estimates. They are presented separately in the RDNA2 in the Chapter on Explosive Hazard Management.

is followed by losses from lower production of annual and perennial crops (44 percent), lower livestock and fishery production (6 percent), and higher farm production costs (3 percent). The estimated loss is only slightly higher, by 11 percent, than the June 2022 loss estimate.

Reconstruction and Recovery Needs, Including Build Back Better

The total reconstruction and recovery needs from the public sector are estimated at US$29.7 billion over 10 years (Table 21), including US$600 million in 2023 (Table 22).[79] For the agricultural sector to recover, drive the overall economic recovery, serve as a decent income source for farmers, and provide food for the Ukrainian population, the most pressing investments include rebuilding the damaged assets, helping agriculture bounce back by addressing liquidity (especially for smaller farms), investing in resilience to climate change and in integrated food-energy systems, and strengthening the agricultural public institutions to effectively support recovery and reconstruction.

The priority medium-term and longer-run needs (from 2024 to 2033) amount to US$29.1 billion or 98 percent of the total needs (Table 21), with the emphasis on the following areas:

- Completing reconstruction or replacement of the incurred war damage; building back better,
- Scaling up direct support to farmers and banks (through liquidity support for agricultural loans) during several production seasons to help agricultural production rebound,
- Supporting a longer-term rebound and recovery of agricultural production to increase its diversity, inclusiveness, climate resilience, food-energy integration, and environmental and social sustainability in line with the EU Green Deal requirements,
- Scaling up investment in agricultural public institutions for delivery of agricultural services (sanitary and phytosanitary measures, food safety, land monitoring and registration, soil testing for precision agriculture, agricultural research and extension services, training and retraining of farmers and staff of other agribusinesses, etc.), so that institutions can better support a climate-resilient recovery of the agricultural sector and also help farmers access the EU pre-accession funds, to be available in the near future, in order to converge with EU agriculture sector.

2023 Recovery and Reconstruction Priorities

The principal recovery and reconstruction focus for the first year includes the following measures, which take into account the implementation/ absorption capacity of the government:

- Provision of direct support to farmers through the public programs that were successfully implemented in 2022. To relaunch agricultural production, this support combines grants and inputs (for small farms) and interest rate compensation for agricultural production loans, coupled with partial credit guarantees for small farms; matching investment grants support energy alternatives for farmers and grain elevators and horticulture production.
- Clearing of mines (estimated separately, not included in Table 22) and recultivation of agricultural lands.

Limitations and Recommendations for Future Assessments

While most damage was assessed using the results of farm and fishery/aquaculture surveys carried out in 2022, some damage was estimated indirectly, including stolen inputs and outputs. These data will need to be reassessed in the future. More accurate estimates of farm gate prices, production costs, and logistical costs for various commodities will be required to improve the loss estimates. Including the estimates for agricultural land survey, demining and land-release operations, irrigation, irrigation, food processing, and agro-logistics, which are currently presented in other parts of the RDNA2, will help clarify the full extent of the agrifood sector losses and needs.

79 The estimate of the needs is based on the Government of Ukraine's Recovery Plan, FAO's Response Program for restoring Ukraine's food systems and protecting rural food security in 2023, and other sources.

Table 20. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	0.8	1,580.8	802.7
Chernihivska	230.8	1,889.3	1,321.1
Chernivetska	0.0	180.8	91.7
Dnipropetrovska	1.0	1,827.1	929.4
Donetska	959.5	1,446.6	2,290.0
Ivano-Frankivska	-	72.3	36.6
Kharkivska	1,206.9	2,984.8	3,449.0
Khersonska	1,410.7	2,136.7	3,296.9
Khmelnytska	-	1,044.4	529.4
Kirovohradska	1.1	1,552.6	788.9
Kyivska	457.0	1,777.7	1,616.3
Luhanska	2,499.8	1,167.3	4,448.4
Lvivska	-	384.5	194.9
Mykolaivska	385.9	1,686.4	1,477.1
Odeska	1.0	1,334.8	678.3
Poltavska	0.4	1,985.1	1,006.9
Rivnenska	-	483.6	245.1
Sumska	115.5	1,509.1	951.0
Ternopilska	-	771.4	391.0
Vinnytska	-	2,034.2	1,031.1
Volynska	-	353.3	179.1
Zakarpatska	-	44.8	22.7
Zaporizka	1,447.2	2,445.2	3,520.0
Zhytomyrska	0.0	795.1	403.0
Total	**8,717.7**	**31,487.7**	**29,700.6**

Source: Assessment team.

Note: Loss includes additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 21. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Reconstruction and replacement of damaged assets, machinery, inputs, and outputs	2,796.2	6,524.4	9,320.6
Service delivery restoration needs	Support for immediate production recovery	1,870.0	-	1,870.0
	Support for longer-term recovery of agricultural production	4,335.0	10,165.0	14,500.0
	Support to agricultural public institutions to accelerate recovery	1,203.0	2,807.0	4,010.0
Total		**10,204.2**	**19,496.4**	**29,700.6**

Source: Assessment team.

Table 22. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	Reconstruction and replacement of damaged assets, machinery, inputs, and outputs	50.0
Service delivery restoration needs	Support for immediate production recovery	490.0
	Support for longer-term recovery of agricultural production	50.0
	Support to agricultural public institutions to accelerate recovery	10.0[a]
Total		**600.0**

Source: Assessment team.

a. It is expected that about 50 percent of this amount is to be spend on public institutions in Kyiv City.

IRRIGATION AND WATER RESOURCES

Context

There has been notable damage and loss in the irrigation and water resources sector. Ukraine has 41 million ha of agricultural land, of which 33 million is under cultivation. Agriculture directly generates 10 percent of gross domestic product and 20 percent of export. Irrigation covers 1 percent of all agricultural land but is especially important for certain crops (e.g., 15 percent of potatoes; almost all tomatoes and rice) and for certain regions (e.g., 14 percent of Khersonska oblast), where it contributes to the rural economy. Drainage covers around 10 percent of agricultural land, mainly in the north and northwest, and makes a significant contribution to Ukraine's total production, including the national output of cereals and beef, by ensuring usable pastures and forage land.

Even before the war, the irrigation and drainage (I&D) sector, flood protection sector, and water resource management (WRM) sector were in transition. Prior to the war, Ukraine's delivery of I&D services faced persistent challenges, as the irrigation sector had collapsed after independence and required deep structural change to overcome the infrastructure barriers. Ukraine's I&D system was developed for state-run farms, but with the economic and political transition after the collapse of the Soviet Union, these large structures were broken up, creating an ownership and funding vacuum, and leading to widespread deterioration. These changes also had a dramatic negative impact on irrigated areas in Ukraine.

Damage and Loss Assessment

Damage to the irrigation and drainage sector[80] for several oblasts is estimated at US$380.5 million (Table 23). This includes damage to on-farm infrastructure, irrigation canals, embankments, buildings, and agency premises. This is a partial number representing damage to (i) areas that were previously not under government control and have recently been brought back under the control of Ukrainian authorities, (ii) areas that had damage due to bomb attacks, and (iii) areas that were flooded to protect against invasion.

The sector has suffered substantial operational losses (reduced revenues, fees, and taxes) among the different state entities. Loss as a result of reduced profit for irrigated areas are included in the loss assessment for the Agricultural sector (US$814 million) and thus excluded from this sector to avoid double counting. The initial aggregate losses accounted for thus far (data are not complete) are approximately US$282.5 million. The losses include operational losses based on lost profit as reported by the different operational entities in the Ukrainian water system and collected by the State Agency of Water Resources. Data on farm level and evaluation of losses categories for the irrigation and drainage systems use were obtained by the Institute of Water Problems and Land Reclamation and the nongovernmental organization, Primavera. There are multiple factors resulting in operational losses, depending on the region in the oblasts:

- **Losses due to flooding.** River basins in the northern regions of Ukraine were flooded to protect from invasion. This prevented crops from being cultivated and made agricultural production for 2022 and 2023 impossible in these regions.
- **Losses due to mining.** Some areas along the border (designated military areas) were mined to protect against the invasion. Because of the mining, these areas were excluded from agricultural production, resulting in operational losses. Demining needs to be accompanied by soil quality improvement, as mines and other

80 Damage in WRM was assessed to a very limited extent due to time constraints and lack of data at the moment of assessment. In particular, damage to such components as river basin management, flood risk and drought management planning, establishment of regimes for exploitation of reservoirs, provision of permits, and intersectoral and transboundary cooperation were not assessed and will need to be analyzed in future assessments. Damage to water monitoring was only partially assessed.

projectiles have contaminated the agricultural fields.

- **Losses due to damaged or limited power infrastructure.** Some areas have damaged or limited power infrastructure that does not allow water to be pumped from drainage areas or provide water for irrigation. The forced transition to rainfed agriculture and limitations to control flooding limit agricultural production and have reduced profits by 20–30 percent.
- **Losses due to damage to I&D infrastructure.** In some areas, I&D infrastructure has been destroyed and pipelines dismantled. There is confirmed damage to two reservoirs: Oskilske reservoir (Kharkivska oblast) and Karachunivske reservoir (Dnipropetrovska oblast).
- **Losses due to deterioration of the farm systems.** The lack of maintenance, lack of operations staff, lack of inputs, and lack of raw materials have led to deterioration of the farm systems and made it impossible for many farms to operate, resulting in significant losses.

Other losses outside this assessment are also important to consider and will be included in future assessments:

- **Losses due to reduced or absent governance functions,** such as destruction of monitoring infrastructure (including laboratories), limitations to establish regimes for management of/provide permits for special water use for water bodies located in inaccessible territories, as well as to develop and implement river basin as well as flood and drought risk management plans, and to support and proceed with transboundary cooperation.
- **Losses of water resources due to their release/withdrawal** because of the destruction of hydrological facilities at large reservoirs and main irrigation canals. These categories of losses can be difficult to estimate in monetary values; however, they should not be neglected and should be assessed in the future.

Reconstruction and Recovery Needs, Including Build Back Better

The total reconstruction and recovery needs in the public sector are estimated at US$8.9 billion for a building back better approach to irrigation, drainage, and flood protection assets (Table 25). Some investments are needed to repair damaged systems, where possible under a build back better approach. Other programs are compensatory—that is, designed to maintain and improve production levels through improved drainage and expanded irrigation in different parts of the country that may have remained under government control.

2023 Recovery and Reconstruction Priorities

The most pressing investments involve restoration of destroyed hydraulic assets and water storage structures in areas that were recently brought back under government control and areas that did not face hostilities. These investments will help the WRM sector rebound by addressing the major gap: the lack of water supply and irrigation services to farmers (Table 26). These investments will start the restoration and building back better of on-farm structures in areas where Water User Associations are being formed (US$30 million), damaged movable property is being replaced and hydraulic structures restored (US$11 million), and the laboratory for monitoring the Eastern region waters is being relocated (US$0.5 million).

Limitations and Recommendations for Future Assessments

In consultation with the Ministry of Agrarian Policy and Food, the Ministry of Environmental Protection and Natural Resources, and the State Agency of Water Resources, the RDNA2 prioritizes oblasts in Ukraine according to six categories (as described in Table 23). Oblasts are categorized 1 through 6 depending on the degree of exposure to the war. A seventh category (Category 0) concerns those oblasts that are so far not affected by the war. For the areas in Category 3 (active hostilities) and Category 4 (temporarily not under government control), the inventory reporting is for obvious reasons incomplete; there is no (reliable) communication with the operating agencies.

This assessment benefited from field surveys that improved the understanding of the extent of damage and loss. More such surveys with a longer time frame should be part of future assessments. Future assessments could also pay more attention to the geographical reach of certain damage and losses; the RDNA2 depended on informed guesses for this information and risked over- or underreporting. Another recommendation is to gain a more detailed understanding of the needs in order to arrive at clear priorities for the building back better programs. It was not possible to provide monetary estimates

of damage, losses, and needs for water resource management, specifically in relation to governance functions and loss (release/withdrawal) of water resources, due to military activities as described in the section on losses. More effort and time should be devoted to this area in future assessments.

Table 23. Overview of prioritization categories and corresponding oblasts

Category of prioritization	Oblasts
1. Territories with highest priority for repair works after cessation of hostilities and return of areas to Ukrainian control	Chernihivska, Kharkivska, Kyivska, Sumska
2. Territories that were recently returned to Ukrainian control but are still under missile and drone attacks	Part of Kharkivska, Khersonska, and Zaporizka, Mykolaivska
3. Territories with ongoing hostilities and continuing missile and artillery attacks	Part of Khersonska and Mykolaivska, Donetska, Luhanska, Zaporizka,
4. Territories where hostilities have stopped but missile and drone attacks are continuing and there is significant damage to infrastructure	Kharkivska, part of Donetska, Khersonska, Mykolaivska, Zaporizka
5. Territories not currently under government control	Part of Donetska and Khersonska, Luhanska, Crimea
6. Territories with damage due to missile attacks, construction of fortifications, and flooding to protect against invasion	Kyivska, Mykolaivska, Rivnenska, Volynska, Zhytomyrska, Chernihivska
0. Territories relatively unaffected	Vinnytska, part of Chernihivska, Mykolaivska, Zhytomyrska, Ivano-Frankivska, Khmelnytska, Kirovohradska, Lvivska, Odeska, Poltavska, Ternopilska, Zakarpatska

Source: Assessment team.

Table 24. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	-	-	82.8
Chernihivska	90.2	36.0	415.1
Chernivetska	-	-	92.0
Dnipropetrovska	0.2	-	476.5
Donetska	0.7	-	154.4
Ivano-Frankivska	-	-	92.0
Kharkivska[a]	5.8	-	1.3
Khersonska[b]	3.6	22.2	181.8
Kirovohradska	0.0	-	62.8
Kyivska	57.3	19.4	787.6
Luhanska[c]	0.7	-	10.3
Lvivska	0.0	-	182.9
Mykolaivska	4.9	22.2	638.0
Odeska	0.0	-	336.6
Poltavska	-	-	152.8
Rivnenska[d]	58.6	46.8	419.1
Sumska	32.0	12.8	289.1
Vinnytska	-	-	230.0
Volynska[d]	62.5	50.0	435.1
Zakarpatska	-	-	150.0
Zaporizka[b]	-	22.2	184.2
Zhytomyrska[d]	63.9	51.0	440.1
Nationwide (no specific region)	-		2.605.6
Total	**380.5**	**282.5**	**8,891.2**

Source: Assessment team.

Note: No assessment was conducted for Khmelnytska, Kyiv City, and Ternopilska. Loss includes an additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

a. Data refer only to areas monitored.
b. Data are only for areas brought back under government control.
c. Almost all of the oblast (99 percent) is not under government control.
d. Flooded area protected by Ukrainian forces.

Table 25. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Reconstruction, overhaul, and modernization of state irrigation infrastructure	-	1,254.9	1,254.9
	Reconstruction of hydraulic structures and facilities of reservoirs for complex use	-	77.0	77.0
	Irrigation system upgrading and expansion in four priority systems: Kakhovska, Pivnichno-Rogachinska, Sirogozska, and Prinzovska	-	1,254.7	1,254.7
Service delivery restoration needs	Restoration and modernization of water management infrastructure	19.1	1,099.6	1,118.6
	Restoration of the functioning of the state water monitoring system	0.9	1.1	2.0
	Restoration and construction of centralized water supply of rural settlements using imported water	-	91.6	91.6
	Restoration of drainage systems	-	1,080.0	1,080.0
	Protection, restoration, and modernization of the drainage systems in the upper Dnieper River basin and Bug River	-	3,742.3	3,742.3
	Restoration of on-farm irrigation facilities	100.0	170.0	270.0
Total		**119.9**	**8,771.3**	**8,891.2**

Source: Assessment team.

Note: Although the activity of "Recovery and enhancement of integrated water resource management through development and implementation of river basin, flood risk and drought risk management plans and mechanisms for transboundary cooperation (incl. transboundary agreements and joint bodies), incorporating war impacts and recovery measures" could not have been assessed, it is very important for recovery and enhancement of water management, irrigation, and all infrastructure referred to in this section and should be analyzed in future assessments.

Table 26. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Service delivery restoration needs	Relocation of the laboratory for monitoring the waters of the Eastern region, arrangement of laboratory premises and communications, purchase of auxiliary equipment for monitoring additional indices	0.5
	Restoration of damaged hydraulic facilities and water management systems and buildings; replacement of movable assets, considering current needs	11.0
	Restoration of on-farm irrigation facilities	30.0
Total		**41.5**

Source: Assessment team.

COMMERCE AND INDUSTRY

Context

Industry and commerce accounted for about one-third of Ukraine's GDP in 2021 and about 7.2 million jobs in 2020.[81] Of approximately 700,000 active enterprises in Ukraine in 2021, the vast majority were micro or small enterprises, with fewer than 50 employees.[82] The biggest concentration of firms (19 percent) was in the city of Kyiv. Based on the 2019 Labor Force Survey, wholesale and retail trade had the most employees, followed by agriculture and industry.[83] Given Ukraine's location, human capital, and physical assets, the competitiveness of its commerce and industry had unrealized potential prior to the war. Reforms had been underway to improve the business and investment climate and specifically to allow greater competition, reform state-owned enterprises, and allow firms to move into higher-value-added segments of markets. Since RDNA1, the impact of the war on businesses has been significant through various channels, such as revenues, costs, availability of supplies, material damage, disrupted trade routes, and displaced customers.

Damage and Loss Assessment[84]

Total damage to the industry and commerce facilities is estimated at US$10.9 billion as of February 24, 2023 for the one year period since the start of the war (Table 27), a 12.4 percent increase from the RDNA1 estimate of US$9.7 billion from June 1, 2022. Most of the damage (77.9 percent) was to industry, with the rest to commerce. About half of the damage (50.2 percent) occurred to large and medium-size enterprises, both public and private. About 75.8 percent of the damage estimate for those firms (US$4.2 billion) was due to the destruction of two steel plants in Donetska oblast, the Azov Steel Plant and the Ilyich Iron and Steel Works in Mariupol.

Total losses across commerce and industry equal US$85.8 billion, estimated for 30 months, including the one-year period measured from the start of the war and an additional 18 months for continued losses. Losses for industry were calculated based on sales data from the latest available financial reports and increased to account for inflation. Commerce losses were reported from relevant business associations but also indicate estimations of counterfactual sales losses (estimated income if Russia's invasion of Ukraine had not occurred).[85] Sales losses were also calculated for subsectors or specific services that experienced nationwide impacts, such as car rental agencies and employment services.[86] Losses include agreed calculations for demolition and debris removal, calculated based on the damage. Total losses are about US$44.7 billion for industry and about US$41.1 billion for commerce. These calculations likely overestimate sales losses. However, sales losses were used as a proxy for other losses, such as productivity and need for rental fees, where no data were available. Also, the estimates assume that all damaged and impacted firms nationwide were not captured in the sales losses.

Reconstruction and Recovery Needs, Including Build Back Better

Total reconstruction and recovery needs for the commerce and industry sector are US$23.2 billion, estimated until 2033. Reconstruction needs for infrastructure and assets under a build back better approach are estimated in total as US$18.5 billion, evenly split between the short and medium/long term (Table 28). This means that 80 percent of the

81 Estimates are based on data from the State Statistics Service of Ukraine.

82 Data are from State Statistics Service of Ukraine. Of the 700,000 firms, almost half were not classified by size in the data, but most are likely individual entrepreneurs or small firms.

83 State Statistics Service of Ukraine, "Labor Force of Ukraine 2019: Statistical Publication," 2020, Link.

84 Data for damages and losses was primarily provided by the Kyiv School of Economics.

85 The Ukrainian Council of Shopping Centers and the Retail Association of Ukraine provided updated loss and damage data.

86 This does not include creative services or industries covered elsewhere, such as cinemas and advertising.

estimated needs for this sector are for rebuilding and modernizing buildings, equipment, and inventory. Many shops and retail stores have recovered to higher levels of sales, although not necessarily to prewar levels. Therefore, the build back better coefficient for commerce is slightly lower than for industry, 1.5 versus 1.75. Recovery needs to restore service delivery and to build back better total US$4.6 billion, with US$2.8 billion in the short term and US$1.8 billion in the longer term. Needs calculated for demolition and debris removal costs are included in the build back better coefficient.

Various surveys and studies[87] have captured major constraints and needs cited by firms. These include interruptions in electricity, water, or heat supply; rising prices of inputs; danger while working; supply chain disruptions; reduced demand; uncertainty about the future; lack of capital including credit and grants; high taxes and fees; and regulatory and fiscal obstacles. SMEs particularly noted that they could benefit from business reconstruction, grants for working capital or investments, opportunities for learning, and participation in international partnerships.[88]

Revitalizing the commerce and industry sector is a priority, given that millions depend on this sector for their livelihoods, and given its contribution to critical needs during reconstruction, such as construction, food industry businesses, and key manufacturing. The following are priority recommendations to support commerce and industry in the short term:

- Provide financial support to firms in the form of loans, grants, and guarantees to allow viable firms to survive, relocate if needed, and reconstruct and modernize assets, and to allow new entrants to emerge, in particular targeting small businesses of vulnerable categories such as displaced persons, women, and veterans.
- Support the retraining and upskilling of labor to address skills required by businesses to access new markets.
- Help firms access new markets with tools to meet standards in international markets, ease customs constraints, facilitate international partnerships and learning, and expand the availability of trade finance and insurance instruments.
- Rebuild the logistics infrastructure needed for access to inputs and markets.
- Streamline business regulations and tax requirements to make it easier to start and restart businesses and to enter into new product lines and delivery models.
- Facilitate domestic and foreign investment to rebuild key industries.
- Ensure private sector participation in reconstruction efforts and promote linkages with SMEs in priority sectors for recovery and investment, such as construction, transport, and logistics.

In both the short and medium to long term, efforts should continue to build back better, emphasizing green and digital technologies to build resilient businesses with products and processes aligned to EU standards. Financial support to firms, including efforts to facilitate access to credit, should also continue. Addressing business, investment, and trade climate obstacles that were present before the war — such as trade harmonization with the EU, competition issues, and SoE reform—should be a priority. Direct technical assistance, potentially focused on sectors critical to growth like agribusiness, metallurgy, machine-building, and IT, could help firms enter new markets, move into higher-value-added products, and adapt more sustainable practices. Women-owned and -managed firms could be targeted for financial and nonfinancial support.

2023 Recovery and Reconstruction Priorities

For 2023, the total priority needs are estimated at US$3.85 billion (Table 29), which is approximately one-third of the short-term needs identified until 2026 (Table 28). Most of those costs, US$3 billion, are for reconstruction needs, given that the sector's main priorities will be to repair buildings, invest in new equipment, improve processes, and start new businesses. Most firms, even those that suffered no physical damage, have seen revenue fall due to

87 "Study of the State of the Business in Ukraine." Research was conducted in January 2023 as part of the Initiative for the Recovery of the Economy, Development of Entrepreneurship and Export of Ukraine, implemented by the Center for the Development of Innovation Development Centers, the Office for the Development of Entrepreneurship and Export, and the national project Diiya Business together with Advanter Group, in cooperation with relevant ministries, State Regulatory Service, and Coalition of Business Communities for the Modernization of Ukraine. See also EBRD, "EBRD, USA and Sweden Assess Impact of War on SMEs in Ukraine," March 1, 2023, *Link*; Institute of Economic Research and Policy Consulting, "New Monthly Enterprises Survey," January 2023.

88 EBRD, "EBRD, USA and Sweden Assess Impact of War on SMEs in Ukraine," March 1, 2023, *Link*.

disrupted infrastructure, reduced domestic market with immigration, and broken supply chains. Thus, the remaining US$850 million under service delivery restoration costs seeks to address these issues by supporting system upgrades (e.g., digitalization), relocation, and other working capital needs, training and reskilling of employees, and investments in quality standards and certifications to access new markets. Some firms have already started changing their product lines or reaching new markets. Other firms need to start investing in process and equipment changes and upgrades, including efforts to meet EU and other international standards to reach new markets. Some firms, particularly in areas of active fighting, may be trying to stay afloat and require only working capital, either because they have lost their workforce or are facing huge uncertainty. Although firms will bear the cost of most investments, public sector support could help firms survive and make the investments needed to adjust to the new reality in 2023.

Both private and public contributions are included in the US$3.85 billion for 2023. For reconstruction activities, the public contribution, including from government, IFIs, and donors, for 2023 is estimated at US$2.2 billion (Table 29). The instruments identified in Table 30 are aligned with government priorities, keeping in mind the number of months remaining in 2023, whether funding has been secured, and institutional capacity. The priority instruments include grants and matching grants, particularly through the e-Robota program; subsidized lending through the 5-7-9 program; lines of credit and other support from the International Finance Corporation (IFC) and European Bank for Reconstruction and Development (EBRD); and guarantees, reinsurance, and export support programs through the Export Credit Agency and through donor programs. As possible, the government contribution through these instruments focuses on expected support for firms in commerce and industry but planned lines of credit and reinsurance programs are expected to support the wider private sector, including agricultural and infrastructure focused firms, and address significantly larger needs than identified in this RDNA2 chapter.

Limitations and Recommendations for Future Assessments

The definitions and assumptions used for the industry and commerce sector are the same as those used for RDNA1. Industry, as defined by this section, covers manufacturing and services not covered elsewhere in the report. It excludes manufacturing associated with transportation, military, and energy, but includes agro-industry from the processing stage. Services related to culture, tourism, finance, and creative industries, such as hotels, tour operators, and advertisers, are also excluded. Restaurant and food services are included under industry and commerce. Commerce covers wholesale and retail trade and warehousing. This section includes impacts on both public and private firms.

This analysis faced the following limitations, which hopefully can be addressed in subsequent analyses:

- Regional data were unavailable for some oblasts that likely suffered from the war.
- For commerce, no regional breakdowns of the data were available. An indirect method was used to assign damage and loss proportions based on the impacts on small firms, since most commerce outlets are small firms. February 2023 data were available only for retail shops; November 2022 data were used for shopping malls. No new data were available for warehouses, gas stations, or pharmacies.
- Damaged assets and values were not available for most firms, especially smaller ones. The assumptions used were based on financial reporting and led to best estimates.
- Losses were calculated based on sales losses, although inflated to account for other losses. For large and state-owned enterprises, the sales losses likely did not cover the full scope of losses, since firms that did not suffer any physical damage likely still suffered economic losses. Ideally, data for estimating losses in productivity and other indirect costs, like rental fees, could be collected for subsequent analyses.
- Sector breakdowns of small firms were not available and could not be indirectly estimated.
- Needs calculations were based on calculated damage to the sector. Given the immense nationwide losses faced by this sector, these calculations may be underestimated.
- A key recommendation is to establish an electronic system for registering damage, repairs, and losses. The system would ensure a transparent and verified method for reporting damage and assist the government and donors in aiding those in need, including businesses.

Table 27. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	-	42.6	-
Chernihivska	650.3	7,738.2	1,333.8
Chernivetska	-	9.1	-
Dnipropetrovska	0.0	255.0	0.0
Donetska	4,907.7	29,972.0	10,544.6
Ivano-Frankivska	-	17.5	-
Kharkivska	2,428.5	21,243.5	5,020.2
Khersonska	18.7	213.2	40.9
Khmelnytska	-	24.0	-
Kirovohradska	-	10.2	-
Kyiv (City)	35.0	2,377.7	71.7
Kyivska	579.1	5,762.4	1,228.3
Luhanska	884.2	6,101.0	1,835.2
Lvivska	9.5	218.2	20.7
Mykolaivska	542.1	3,865.8	1,171.0
Odeska	58.5	370.8	127.9
Poltavska	-	76.3	-
Rivnenska	-	10.8	-
Sumska	245.6	3,470.1	512.5
Ternopilska	-	11.8	-
Vinnytska	-	33.6	-
Volynska	-	2.0	-
Zakarpatska	-	9.0	-
Zaporizka	526.0	3,721.1	1,150.7
Zhytomyrska	58.0	285.1	125.5
Total	**10,943.2**	**85,841.0**	**23,183.0**

Source: Assessment team.

Note: - = not assessed; Loss includes additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 28. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/ investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Industry	7,460.6	7,460.6	14,921.3
	Commerce	1,812.6	1,812.6	3,625.2
Service Delivery Restoration needs	Industry	2,238.2	1,492.1	3,730.3
	Commerce	543.8	362.5	906.3
Total		**12,055.2**	**11,127.8**	**23,183.0**

Source: Assessment team.

Table 29. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	Repairs/rebuilding firms	1,500.0
	Repairs and investment in new/better machinery and equipment	1,000.0
	Starting a business	200.0
Service delivery restoration needs	Investments in upgrading service delivery systems to access new markets	500.0
	Working capital support	500.0
	Training/reskilling of employees	50.0
	Investments in quality standards, certifications, etc., to access new markets	100.0
Total		**3,850.0**

Source: Assessment team.

Table 30. Estimated government, IFI, and donor contribution to 2023 implementation priorities (US$ million)

Types of instruments	Estimated cost
Grants and matching grants for business repair, modernization, etc.	313.0
Subsidized lending through 5-7-9 program	300.0
Lines of credit	1,000.0
Guarantees and reinsurance to promote investment and exports	514.0
Total	**2,127.0**

Source: Assessment team, in consultation with the Government of Ukraine.

FINANCE AND BANKING

Context

The Ukrainian financial sector has been significantly impacted by the war. The banking system entered the war in relatively good condition and banks remain operational and very liquid.[89] Banks have generally remained profitable, with the system's return on equity amounting to 11 percent.[90] At the same time, loss of assets, collateral, and revenues is severely affecting banks' profitability and solvency. During March-December 2022, the banking sector accounted for US$2.8 billion of loan loss provisions for expected war-related credit losses.[91] Far-reaching emergency measures have been introduced under martial law to help preserve financial stability. It can be anticipated that the nonbank financial institution (NBFI) sector will also suffer significant losses as a result of the invasion on top of prewar vulnerabilities; however, data remain very limited. Given its small size, the NBFIs sector is not expected to have systemic impacts on the overall financial system.

Damage and Loss Assessment

Based on current conditions as of February 24, 2023, as well as available data, the total cost for damage is estimated at US$18.8 million, and losses are estimated at US$6.85 billion (Table 31). Damage was estimated using data on banks' fixed assets (in particular, bank premises and equipment) as well as the NBU bank survey on damage conducted in October 2022. The damage includes partial or full destruction of banks' fixed assets such as bank premises and equipment. The losses include loan losses and loss of cash, collateral, and investment property. Credit losses were estimated at 30 percent of the pre-war net loan portfolio in line with NBU's upper-range estimates outlined in its Financial Stability Report for the second half of 2022. It will take many months for the true extent of damage to the financial sector to become fully apparent/quantifiable. The quantification of losses also does not recognize the inherent risks posed to the gains made in recent years through reforms to the financial sector, such as relaxation of prudential rules as well as the state-owned bank (SoB) strategic framework; nor does it recognize the potential delays to the implementation of further reforms as a result of the need to address postwar problems first.

Reconstruction and Recovery Needs, Including Build Back Better

The total reconstruction and recovery needs from the sector are estimated at US$6.79 billion, with the most pressing needs relating to the provisioning of banks' credit losses. Critical actions are required to safeguard the financial system, maintain confidence, and minimize fiscal costs. At the same time, a solvent, liquid, and operationally sound financial sector will be key to provide financing to the economy during and after the war. Four key areas for financial sector policy reform are seen as critical: (i) preserving financial stability and maintaining public confidence, (ii) ensuring readiness for resolution, (iii) safeguarding institutional frameworks, and (iv) balancing the financial sector's contribution to addressing fiscal and private sector needs.

For the financial sector to recover and drive the overall economic recovery, a series of measures needs to be taken in different suggested time frames. The estimated reconstruction and recovery needs of the financial sector are estimated at US$6.5 billion in the short term and US$0.3 billion in the medium term (Table 32). In aggregate, total sector needs are US$6.8 billion (Table 32). Financial sector policy reforms should focus on the four areas listed above. Coordinated efforts by all financial market

89 The National Bank of Ukraine (NBU) has taken steps to address excess liquidity in the banking system, including through increased reserve requirements.

90 NBU, Financial Stability Report, 2022 (2H). *See* Link.

91 This amounts to around 13 percent of the net loan portfolio the banks held at the end of February 2022, while NBU states in its 2022 Financial Stability Report (2H) that losses might reach 30 percent.

players—financial institutions, the NBU, the National Securities and Stock Market Commission (NSSMC), and the Deposit Guarantee Fund (DGF) —along with the effective support of public authorities, in particular the MoF, are needed to ensure financial stability during the war and in the recovery/ reconstruction phase.

The priority medium-term and longer-run needs (from 2024 to 2033) amount to US$1.7 billion, or 25 percent of the total needs, with the emphasis on the following areas:

- **Continuation of financial sector health diagnostics and their implementation.** Financial institutions should be required to present plans on how they will recapitalize to meet prudential requirements. Using the results as a starting point, an assessment of individual institutions' viability on a forward-looking basis should be conducted.
- **Reform of nonperforming loan (NPL) resolution mechanisms** and creation of markets/ mechanisms for distressed assets.
- **Provision of financial support to corporates that have been affected by the war but remain viable** if going through a comprehensive and orderly corporate restructuring program. Such funding would need to have a transparent and clear governance mechanism and would need to be well integrated with the restructuring proceedings.
- **Development of assistance programs for insured parties.** These will be needed by those who have suffered significant losses, and where the obligations of insurers are uncertain or force majeure clauses have been enacted.
- **Development of well-designed, time-bound financial support programs** that target affected borrowers and sectors using transparent rules and governance mechanisms. Policy responses will need to minimize opportunities for moral hazard and rent-seeking and adhere to sound credit risk management practices and independent governance arrangements at SoBs, while facilitating the effective allocation of new credit. A special war insurance pool should be developed and the Partial Credit Guarantee Fund for small farmers operationalized.
- **Implementation of critical reforms in the financial sector in the medium term.** These should be continued in line with international standards and European Union directives and should aim at enhancing financial stability, facilitating sustainable development of the banking sector, and promoting digital financial services and sustainable financial system diversification and inclusion.

2023 Recovery and Reconstruction Priorities

In parallel to the investments listed in Table 33, the principal recovery and reconstruction focus for the first year (2023) includes the following measures:

- **Analysis of the impact of the war on the financial sector (asset quality reviews).** NBU should prepare and undertake an initial assessment of the losses of financial institutions followed by independent valuation of banks' assets when conditions allow.
- **Development and adoption of a financial sector strategy** with a focus on financial sector restructuring and NPL resolution. This should include modalities of governance, transparency, and financing.
- **Development of a carefully calibrated plan for phasing out special measures put in place during the war**. Such measures should be gradually replaced with standard measures or refined laws and regulations to address the changing situation.
- **Efforts to ensure the financial sustainability of the DGF.** The DGF will need sufficient funds to cover insured deposits at banks with the highest likelihood of becoming insolvent.
- **Creation of a development finance institution.** The benefits of creating a development finance institution, versus building on an existing structure, should be assessed; the goal is for a single institution to coordinate the utilization of reconstruction funds and to assure proper controls are in place so that both the government's and donors' priorities are met.

Limitations and Recommendations for Future Assessments

This financial sector needs assessment is based on a wide range of inputs and data from diverse sources, including NBU and surveys of financial sector institutions. The assessment also used expert opinions and secondary data where possible. However, as with the RDNA1, these estimates are based on currently available information, which is largely anecdotal and will need to be reassessed. More accurate estimates will be available once financial sector health diagnostics are completed. As indicated earlier, the quantification of losses also

does not recognize the inherent risks posed to the gains made over recent years by reforms to the financial sector, such as relaxation of prudential rules as well as the SoB strategic framework; nor does it recognize the potential delays to the implementation of further reforms as a result of the need to address postwar problems first.

Table 31. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	0.0	53.9	53.9
Chernihivska	0.4	29.5	30.1
Chernivetska	0.0	18.0	18.0
Dnipropetrovska	0.0	271.3	271.3
Donetska	2.8	229.3	233.2
Ivano-Frankivska	0.0	60.2	60.2
Kharkivska	6.0	1,120.9	1,129.4
Khersonska	1.4	241.3	243.4
Khmelnytska	0.0	56.9	56.9
Kirovohradska	0.0	36.8	36.8
Kyiv (City)	0.0	3,056.7	3,056.7
Kyivska	0.6	48.0	48.9
Luhanska	2.5	40.5	44.0
Lvivska	0.0	219.9	219.9
Mykolaivska	1.1	122.0	123.6
Odeska	0.0	272.2	272.2
Poltavska	0.0	70.3	70.3
Rivnenska	0.0	33.3	33.3
Sumska	0.3	50.1	50.5
Ternopilska	0.0	36.2	36.2
Vinnytska	0.0	58.7	58.7
Volynska	0.0	24.2	24.2
Zakarpatska	0.0	26.4	26.4
Zaporizka	3.6	549.1	554.2
Zhytomyrska	0.0	34.4	34.4
Nationwide (no specific region)	0.0	74.9	7.0
Total	**18.8**	**6,835.2**	**6,793.5**

Source: Assessment team.

Note: Loss includes additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 32. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Public sector banks (SoBs)	16.1	0.0	16.1
	Private banks (domestic and foreign banks)	12.1	0.0	12.1
Service delivery restoration needs	Public sector banks (SoBs)	2,356.8	123.8	2,480.6
	Private banks (domestic and foreign banks)	4,070.7	214.1	4,284.8
Total		**6,455.6**[a]	**337.9**	**6,793.5**

Source: Assessment team.

a. short-term service delivery restoration needs include already provisioned war-related credit losses, 90 percent of the remaining estimated credit losses, and investments to strengthen the resilience of banking operations (satellite terminals and generators). A total of US$2.8 billion of war-related credit losses were already provisioned for in 2022. Actual recapitalization needs can only be determined after the NBU resilience assessment to be conducted in 2023. Reconstruction Needs include the estimated cost of restoration of damaged and destroyed branches.

Table 33. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	Reconstruction of destroyed branches in reclaimed territories	13.1[a]
Service delivery restoration needs	Additional recapitalization needs and asset quality review costs	TBD[b]
	Investments to strengthen the resilience of banking operations (satellite terminals and generators)	7.0[c]
Total		**20.1**

Source: Assessment team. *Notes:*

a. Priority reconstruction needs relate to the damaged branches in territories brought back under government control (Chernihivska, Kharkivska, Khersonska, Kyivska, and Sumska oblasts).

b. Banking sector recapitalization needs estimates can only be determined after the NBU resilience assessment to be conducted in 2023.

c. NBU estimates.

INFRASTRUCTURE SECTORS

The historical building of the First Ukrainian Gymnasium named after Mykola Arkas. Mykolaiv City, Mykolaivska Oblast. Photo from Mykolaiv City Council.

ENERGY AND EXTRACTIVES

Context

Before the onset of the war, the energy sector played a key role in Ukraine's economic growth as well as its national security, and increasingly supported the country's goal to modernize the economy. The energy supply sector represented 7–8 percent of GDP,[92] with gas transit fees from Russia representing about 0.3 percent of GDP.[93] The entire population had access to electricity, and 94.9 percent had access to clean fuels for cooking.[94] Central heating had high penetration (about 47 percent), particularly in the bigger cities. The gas distribution network covered 74 percent of the population,[95] and 89 percent of the population had access to clean water, thanks to pumped water distribution systems.

Between February 2022 and September 2022, the energy sector suffered war-related (though mostly collateral) damage; but intensified attacks on energy infrastructure since early October 2022 have caused extensive damage across the country. In the last months, Ukraine's energy infrastructure has suffered multiple artillery attacks as well as cyberattacks on energy companies. The attacks resulted in significant damage to Ukraine's integrated energy system, including power generation and transmission infrastructure.

Damage and Loss Assessment

Preliminary estimates indicate that current damage to energy infrastructure is more than five times greater than in June 2022. Damage to power, gas, and heating infrastructure and coal mining, as of February 24, 2023, was above US$10 billion versus the US$2 billion estimated by June 1, 2022 (including estimated damage to some assets located in territories temporarily not under government control).[96] The largest share of damage is in the power sector (close to US$6.5 billion). Within the power sector, the largest contributor to damage is the generation segment (US$3.9 billion) followed by the transmission segment (about US$1.9 billion). Damage to the power distribution sector is estimated at about US$404 million (without including assets in territories temporarily not under government control). The lack of data in this category has likely led to underestimation. The gas sector damage estimates are around US$1.2 billion (vs. the US$500 million estimated in RDNA1); this comprises damage to gas distribution infrastructure as well as damage reported by the gas transmission system operator (TSO). Damage to the oil sector, including oil refinery facilities, fuel depots and fuel stations, is estimated at close to US$1.7 billion. Damage to the coal and mining sector could not be newly estimated because there is a lack of information from the mines located in territories not under government control; RDNA1 figures are used for this sector. An indicative breakdown of damage and losses by regions is provided in Table 34.[97]

92 National Institute for Strategic Studies under the Office of the President of Ukraine, 2023, Determination of the Level of Energy Security of Ukraine, p. 35, *Link.*

93 Gas transit via the territory of Ukraine has undergone substantial changes since independence. The construction of pipelines (Blue Stream in 2003, Nord Stream 1 in 2011, and TurkStream in 2020), gas disputes between Ukraine and Russia, and the development of the liquefied natural gas market have served to reduce gas transit through Ukraine over the last few years.

94 WHO, "The Global Health Observatory (2022)," *Link.*

95 State Statistics Service of Ukraine.

96 Assets located in territories temporarily not under government control are estimated to be partially damaged (50 percent). It is likely that some of the assets are completely destroyed while others are almost intact. There is limited ability to verify the damage at this point.

97 Given the sensitivity of the information, most of the damage is aggregated and presented as nationwide.

Estimated war-related revenue losses in the power, gas production, gas transit, coal mining, and fuel oil sectors exceed US$27 billion.[98] The revenue losses have been caused by regular attacks on energy infrastructure, which, as a result, have left 12 million households across Ukraine with no or limited electricity and with disrupted water supplies and heating systems at a time when temperatures have fallen below freezing in most parts of the country. Despite extensive restoration efforts,[99] the average Ukrainian household experienced five cumulative weeks without electricity, from October 10 to the end of December 2022. Most of the system continues to operate in a centralized manner (divided into eight subpower systems), thereby maintaining stability, but restoration of services is becoming more difficult after every attack. Among distribution networks in territories not under government control, the status varies, with some areas connected to Russia's network and others operating in island mode.[100] Resulting disruptions to gas and district heating networks and to electricity supply have also significantly affected the delivery of water in major cities and have had a significant impact on the telecommunications and banking sectors, in particular on the processing of payments.

Reconstruction and Recovery Needs, Including Build Back Better

Balancing short-term energy needs with long-term goals is very difficult in a context of high uncertainty. In the recovery phase, basic energy and utility services must be restored as quickly as possible, enabling the return of internally displaced persons—even if Ukraine's population and its spatial distribution will differ from what they were prewar. However, energy policy decisions made during recovery could impact long-term economic, energy security, and climate objectives. The postwar context will present an opportunity to rethink energy sector priorities in Ukraine, while also balancing the need for fast provision of enabling services with the need to build back better. The latter should also be aligned with systematic implementation of energy efficiency (EE) measures as part of the large-scale reconstruction, which will occur across all sectors—public and private, including households. Careful planning will be required to ensure no-regret investments, and institutional processes will need to be simplified to attract financing flows from different public and private sources. Any planning advanced during the war period will likely require adjustments and reconsideration during the recovery phase.

The total reconstruction and recovery needs in the public sector are estimated at almost US$47 billion (Table 34), including around US$5.7 billion for the immediate and short term (2023–2026) (Table 35). Because the energy sector provides critical services, reconstruction and recovery investments in this sector are all considered as pressing. In addition, addressing part of the losses can also be considered as pressing for the sector's short-term operations. This includes the need to close liquidity gaps in the power sector TSO (Ukrenergo), key state-owned gas supplier Naftogaz, and other stakeholders.

To enable economic recovery and meet long-term climate objectives[101] while ensuring energy security, Ukraine will need to rebuild its energy supply based on a model developed by the World Bank, specifically by reducing reliance on fossil fuels and rebuilding energy demand sectors to minimize energy consumption. On the demand side, Ukraine will need to promote electrification of the industrial, transport, and heating sectors. The heating and industrial sectors will need to reduce dependency on gas to avoid gas imports in the short term while setting the pace for decarbonization in the long term. With proper EE and electrification investments, primary energy demand could remain below prewar levels for decades, decoupled from economic growth. On the supply side, biofuels (including biomass, biogases, and hydrogen) will need to replace gas as a main fuel source in the industrial and heating sectors, even if the electrification of industry and heating contributes to the move away from gas.

98 The losses were estimated by comparing the level of production and revenues in 2021 and 2022 and taking into account the production decreases caused by the war.

99 The TSO, Ukrenergo, has organized 40 mobile repair crews with over 700 persons to rapidly fix damage to the network elements and restore the electricity supply.

100 Kherson was only intermittently connected to the Ukrainian system until July. Mariupol was never connected. Some populations in territories not controlled by the government are supplied by electricity from systems operating in local island mode, such as the Zuevsky plant near Donetsk.

101 Ukraine remains committed to the clean energy transition and its climate change international commitments in the medium and long term. Climate objectives are well aligned with the need to reduce energy dependence from imported gas and coal, which are strategic priorities.

The power system is expected to remain unified and synchronized with the European Network of Transmission System Operators (ENTSO-E), though ideally key subsystems could operate in island mode if needed. Additional redundancy measures may be required to increase resilience, including alternative decentralized networks in cities to provide backup support. In some areas, networks may need to operate in isolated mode for an interim period. Regarding generation, assuming a reference decarbonization scenario that would meet the net zero target by 2060, several points are relevant: (i) the rebuilding of new coal power plants would be uneconomical; (ii) a rapid scale-up of renewables and storage would be needed to replace thermal and renewable generation destroyed during the war, and to phase out coal generation by 2035; (iii) existing nuclear generation would need to be restored and play an important role till at least 2040, when several nuclear power plants will need to be decommissioned and renewable energy investments will be increased; and (iv) full decarbonization would imply substantial electrification of the energy demand over the years, hence the need for much higher generation capacity by 2060 than in a business-as-usual scenario. Electricity and ancillary service trade with Europe could be a significant revenue source for the country during recovery and reconstruction, increasing the economic incentive to promote EE, even if further work would be needed to analyze potential scenarios.[102]

The immediate focus after the war will be restoring services and energy security for the next heating season, i.e., ensuring enough gas and electricity supply are available, and that the basic infrastructure is rebuilt to ensure an adequate level of services to the residential and key infrastructure sectors (hospitals, airports, schools, railway facilities, etc.). In the first year after the war, the country should seek to increase energy trade with the European energy markets and implement measures to improve the financial situation of the sector (phasing out price caps, Public Service Obligations, and war emergency measures) and to increase sectoral resilience (improved cybersecurity, regulating back up generation and storage, grid operational procedures, etc.).

During reconstruction, Ukraine will need to adopt a build back better approach with policies that align its energy model with the EU energy strategy and move toward a decarbonized economy. Decarbonization efforts are critical to meet the requirements under the EU accession and to increase energy security. Critical reforms will include the transposition of the Clean Energy Package with support from the Energy Community Secretariat, correction of institutional and market-related breaches, and the adoption of the Repower EU approach to increase energy security. To meet this last goal, Ukraine should focus on (i) diversifying gas supply and promoting green gases and electrification when economically feasible; (ii) accelerating decarbonization of the power sector and implementing a just transition roadmap toward renewable energy generation; and (iii) boosting EE in demand sectors (housing, industrial, transport). Building on advances in digital development before and during the war, the reconstruction should take advantage of opportunities and synergies to decarbonize and digitalize the energy sector, thereby increasing its resilience to cybersecurity attacks and natural hazards. These policies will also help attract support from donors, financiers, and investors to accelerate the restoration and reconstruction.

Given the need to balance short-term needs with long-term goals, Ukraine must focus first on policies that minimize fiscal liabilities in the sector, catalyze external financing, and enhance transparency and internal implementation capacity. It must not allow short-term emergency and recovery actions to impede progress on long-term international climate commitments and EU accession requirements.

2023 Recovery and Reconstruction Priorities

Preparation for the 2023/2024 winter season should focus on restoring access to electricity supply for millions of Ukrainians and for critical social infrastructure, including heating, potable water, wastewater treatment, security of high-voltage transformers, and others. Immediate needs to cover these areas are around US$2.1 billion. These activities are considered part of the overall short-term (2023 to 2026) needs described above, in the amount of US$5.7 billion. In addition, Table 36 includes liquidity needs for purchasing gas and importing electricity for the next heating season.

102 Modeling limited trade of power. No trade of biofuels or hydrogen was included in the model.

Limitations and Recommendations for Future Assessments

The main shortcoming of the analysis is that it is based on limited information in some subsectors and regions:

- Power sector damage estimates in areas not controlled by the government are inaccurate. In areas partially controlled by the government, the accuracy of estimates varies. Full estimation of power sector damage in areas not fully controlled by Ukraine should be done later.
- The power TSO data are aggregated at the country level due to the extra sensitivity of the information.
- The gas sector does not include damage in the gas production sector. If the government provides data on this category, damage could be quantified.
- District heating data must be specified as a whole and by region.
- The coal mining sector was not quantified in detail due to the lack of data.

The assessment includes a range of assumptions in addition to the general RDNA2 assumptions of geographic scope and timeline:

- Damage includes damage in both territories fully or partially controlled by Ukraine and in territories temporarily not under government control. Damage for distribution system operators and district heating is provided only for territories controlled by Ukraine. Damage in territories temporarily not under government control is estimated based on information from the government and other sources on actual damage to facilities. Assets in territories temporarily not under government control are not considered as definitely lost unless there is certainty that they have been completely destroyed.
- Damage quantification in the power sector is estimated as replacement cost (with similar equipment quality).
- Power generation damage is based on conservative assumptions and fragmented information—damage to thermal power plants (TPPs) may be larger. Some assets have been damaged and repaired multiple times.
- The transmission damage is calculated based on estimates from Ukrenergo that combine preliminary and actual estimates. The former applies until the end of hostilities and is based on available information from technical personnel (witnesses) on the asset's condition, degree of damage, and the possibility of recovery. The latter is based on actual inspection, technical inspection, and full inventory in areas controlled by Ukraine where inspections are feasible. Ukrenergo has operational data on damage to the network and inspects and repairs damaged assets.
- Given government restrictions on data sharing, direct detailed information on damage to distribution networks could not be obtained. In the future, the actual extent of damage will have to be assessed, and a power sector model will be needed to refine the needs estimates.
- Damage in the gas transmission sector is estimated as the book value provided by the gas TSO. Additional specifications were made to specify the values.
- Damage in the district heating sector was based on previous data from the government and compared with previous estimations in some cities. Further verification is needed for greater precision.
- The quantification of the fuel oil sector is based on estimations provided by the Kyiv School of Economics, complemented by additional modeling by the World Bank. With additional data, these estimates could be refined and verified.
- Where possible, damage to assets in areas temporarily not under government control has been estimated assuming partial damage instead of 100 percent damage. This should be better quantified at a later stage.

Table 34. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Chernihivska	86.8	1.6	173.5
Dnipropetrovska	72.8	1.1	137.5
Donetska	751.8	13.1	1,486.1
Kharkivska	303.3	5.1	592.3
Khersonska	82.0	1.4	160.4
Kyiv (City)	24.4	0.4	48.6
Kyivska	131.9	1.9	246.0
Luhanska	170.0	3.1	342.5
Lvivska	12.0	0.2	25.0
Mykolaivska	112.9	1.6	208.0
Odeska	13.8	0.2	25.0
Poltavska	34.2	0.6	69.6
Sumska	251.8	3.4	456.7
Vinnytska	12.0	0.2	24.4
Zakarpatska	16.4	0.3	33.4
Zaporizka	423.4	5.3	751.9
Zhytomyrska	5.9	0.1	12.0
Nationwide (no specific region)	8,083.1	27,119.3	42,192.3
Total	**10,588.3**	**27,159.1**	**46,985.2**

Source: Assessment team.

Note: Oblasts not assessed include Cherkaska, Chernivetska, Ivano-Frankivska, Khmelnytska, Kirovohradska, Rivnenska, Ternopilska, and Volynska. Loss includes an additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 35. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Power sector reconstruction, including transmission system operator, distribution system operators, power generation facilities	2,962.7	34,070.8	37,033.5
	District heating reconstruction, including heat supply networks, heating points and heat-only boiler houses, combined heat and power generation facilities	747.4	1,743.9	2,491.3
	Gas transportation system reconstruction, including gas transmission system operator and distribution system operators	377.1	2,136.7	2,513.7
	Fuel oil sector reconstruction, including oil refinery facilities and distribution networks	339.5	3,055.4	3,394.8
	Coal mining sector (urgent closure works on flooded mines, not currently under government control)	48.0	272.0	320.0
Service delivery restoration needs	Power sector liquidity needs	200.0	-	200.0
	District heating sector liquidity needs	-	-	-
	Gas purchasing and gas system liquidity	1,032.0	-	1,032.0
Total		**5,706.6**	**41,278.8**	**46,985.4**

Source: Assessment team.

Note: - = not assessed.

Table 36. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	Ukrenergo's emergency equipment needs (in government-controlled areas)	466.0
	Development of secure power grid (protected substations of Ukrenergo)	500.0
	Statcoms to enhance import-export operations	40.0
	Building of transmission connections with EU/Slovakia	30.0
	Building of transmission connections with EU/Romania	60.0
	Large Hydro Power Plants restoration for season 2023/2024	63.0
	TPP restoration for heating season 2023/2024	167.0
	Small-scale/distributed generation	275.0
	Electricity supply (including distribution stations, overhead power lines)	193.0
	Emergency equipment for heating infrastructure (mobile units)	200.0
	Heat supply (including heat-only boiler houses, district heating network, heating points, combined heat and power)	81.1
Service delivery restoration needs	Gas purchasing needs for the next heating season	1000
	Electricity import purchasing needs for the next season	200
	Other gas system liquidity needs	31.8
	Other power sector liquidity needs	-
	District heating liquidity needs	-
Total		**3,306.9**

Source: Assessment team.

Note: - = not assessed.

TRANSPORT

Context

Since completion of RDNA1, the context for transport sector damage, loss, and needs in Ukraine has changed, specifically due to the return of certain territory to government control, intensive fighting in southern and eastern frontline cities, the Black Sea Grain Initiative, and the "Solidarity Lanes." In oblasts that are back under government control, the transport networks have been exposed to additional movements of heavy weaponry and supply vehicles as well as military actions aimed at disrupting retreat or advance of opposing forces. Positional fighting in eastern and southern frontline cities has brought further military strikes against the essential logistics infrastructure. In these cities, concentrations of troops and heavy weapons along with intensive use of artillery during protected positional fighting has increased the strategic importance of road and rail linkages used for supplies. Key logistics nodes that connect with frontline areas have been intensively shelled. In addition, the urban transport infrastructure in frontline cities themselves (e.g., Kupiansk, Soledar, Bakhmut, Orikhiv, Huliaipole) is substantially destroyed.

The Black Sea Grain Initiative, the Solidarity Lanes initiative, and most importantly the ability of Ukraine's transport sector institutions to make emergency repairs have mitigated transport sector losses. The Black Sea Grain Initiative has allowed approximately 22 million tons of Ukrainian grain (about half of annual prewar Black Sea grain exports) to move via Ukraine's ports since August 3, 2022. Similarly, the Solidarity Lanes initiative has successfully helped to scale transport via westward logistics chains that run through the EU. Solidarity Lanes remain the only option for export of Ukrainian goods other than grain (e.g., steel, manufactured products, ore) and for import of critical needs (e.g., fuel, humanitarian aid). Between May 2022 and the end of January 2023, the total value of trade via the Solidarity Lanes is estimated at around €65 billion. Beyond these key initiatives, the resilience of transport sector institutions and their ability to undertake rapid emergency repairs of damaged assets have significantly mitigated losses, as described below.

Damage and Loss Assessment

Total transport sector damage is estimated at US$35.7 billion (Table 37). The largest concentrations of damage are (i) local oblast, village, and communal roads combined (32 percent); (ii) motorways, highways, and other national roads (21 percent); and (iii) railway infrastructure, rolling stock, equipment, and other assets combined (19 percent). Damage to transport infrastructure is not evenly distributed and appears correlated to changes in war intensity. Severe damage is concentrated around settlements where more protracted fighting took place.

The largest contributors to increased damage relative to RDNA1 were urban transport infrastructure and rolling stock (nearly five times greater than in RDNA1), Ukraine's railway network (more than three times greater), and communal roads (roughly a 50 percent increase). Increased railway and local road infrastructure damage reflects increased levels of destruction in frontline areas subject to positional fighting as well as damages to the critical logistics infrastructure used for supply of frontline areas. Since June 2022, Donetska, Luhanska, Zaporizka, Khersonska, and Kharkivska oblasts have experienced damage to an additional 88 rail stations, more than 400 railway bridges, 28 bridges on the national road network, 76 bridges on the oblast and village roads, and more than 250 bridges and other artificial structures on the communal road network. The US$ 1.4 billion increase in damage to urban transport infrastructure and rolling stock likely reflects improvements in data availability in areas returned to government control, theft of mobile assets by retreating forces, and collateral damage due to increased targeting of civilians in urban areas. Damage to bridge infrastructure across national, local, and communal road networks and Ukraine's railway remains significant (roughly US$4.4 billion, or 12 percent of all damages in the transport sector).

Transport damage is greatest in oblasts that have experienced protracted positional fighting; Donetska, Luhanska, Khersonska, and Zaporizka together account for over 70 percent of damage. Among these oblasts, Donetska, Khersonska, and Zaporizka have seen the largest increase in damage since June 2022 (an additional US$3 billion, US$2.2 billion, and US$1.0 billion respectively). In the case of Khersonska, the natural barrier provided by the Dnipro River has also resulted in a static front line throughout late 2022 and early 2023. The remaining and returning populations (about 160,000 people[103]) in approximately 200 settlements throughout Khersonska subject to artillery and missile attacks which have further damaged local and urban transport infrastructure.

Transport sector losses for the period projected (through August 24, 2024) are estimated at US$31.6 billion, dominated by continued disruption to Black Sea maritime transport. The largest concentrations of losses are attributable to (i) disrupted Black Sea port access (64 percent); (ii) closure of Ukraine's aviation industry and loss of overflight revenues (21 percent combined); (iii) disruptions to road transport (7 percent); and disruption to rail transport (7 percent). The RDNA2 has considered the positive impact of the Black Sea Grain Initiative, which helped unlock maritime transport routes for approximately 22 million tons of Ukrainian grain shipments between August 3, 2022, and February 24, 2023. Over this period, the initiative mitigated approximately US$1.3 billion in losses by providing maritime transport access for grain shipments. The Black Sea Grain Initiative does not include maritime cargoes other than grain, which historically were about three times larger by tonnage than Ukraine's grain exports. The EU's Solidarity Lanes initiative has therefore been critical to facilitating alternative trade routes for these cargoes, though RDNA2 analysis has not segregated out the attributable impact of the Solidarity Lanes at this stage.

The ability of Ukraine's transport sector institutions to implement emergency repairs is mitigating about 30–40 percent of potential losses that would otherwise have accrued due to disrupted road and rail transport. The State Agency for Restoration and Development of Infrastructure of Ukraine has completed or is currently executing emergency repairs on roughly half of damaged national roads in territories brought back under government control. Ukrzaliznytsia (Ukrainian Railways) has been able to reconnect service along the majority of mainline track in territories brought back under government control. Most emergency repairs made to date cannot be considered permanent, but they are proving adequate to restore lifeline transport connections temporarily while Ukraine's fiscal and institutional capacity remains highly constrained by war. The clear exception within the transport sector is aviation, where full airspace closure to civilian flights results in losses (22 percent of all transport sector losses considered) that cannot be mitigated across the industry.

Reconstruction and Recovery Needs, Including Build Back Better

Reconstruction and immediate recovery needs are estimated to be US$92.1 billion (Table 38). The largest concentrations of reconstruction needs are in (i) railways infrastructure, rolling stock, equipment, and other assets combined (30 percent); (ii) motorways, highways, and other national roads (29 percent); and (iii) local oblast, village, and communal roads combined (16 percent). Within this larger set of needs is a program to expand western logistics linkages and an emergency program to repair and restore essential transport services during 2023. Expanding westward logistics chains could provide both short- and long-term benefits (as described in the next section). In contrast, expenditures on emergency repairs and service restoration would be aimed at mitigating the impact that damaged transport infrastructure and disrupted services have had on Ukraine's population and economy during wartime. More permanent reconstruction activities are envisaged to start after 2024, given the need for complex project preparation and the likelihood that government's institutional and fiscal capacity will be absorbed by the scale and scope of emergency repair and service restoration needs for the immediate future.

2023 Recovery and Reconstruction Priorities

During 2023, an estimated US$3.5 billion is needed for urgent expansion of westward logistics chains, high-priority emergency repairs, and restoration of services—before reconstruction. Despite overall resilience among transport sector institutions, three factors hinder Ukraine's ability to undertake major transport infrastructure reconstruction within 2023:

103 Ministry of Internal Affairs of Ukraine, November 23, 2022, *Link*.

(i) limited project readiness and the absence of ready designs for reconstruction projects; (ii) severe fiscal constraint; and (iii) uncertainty in both transport demand and the market for contractor services because of the dynamic security situation created by war. The key priorities during 2023 instead focus on addressing immediate emergency needs (Table 39), including the following:

- **Accelerating survey, demining, and land-release in territories brought back under government control to avoid delays in restoring access.** The need for extensive survey and demining operations has emerged as a key constraint to emergency network repairs in territory brought back under government control. For example, contamination with mines and explosives along the road corridor between Kyiv and Chernihiv delayed the start of emergency repair works for over a month. While demining is not a function of Ukraine's transport sector institutions, these institutions could more effectively mitigate losses by scaling up support for accelerated survey, demining and land release operations.
- **Providing fiscal and technical capacity for emergency repairs.** Such repairs are urgently needed on both national and local segments of Ukraine's transport network to reestablish a minimum level of transport connectivity, which is critical for meeting basic needs of the population, enabling Ukrainian businesses to function, and sustaining government services. Ensuring essential connectivity also requires reinforcing and sustaining transport infrastructure that has not been directly damaged by fighting. Reduced network redundancy, increased criticality of remaining infrastructure, and increased intensity of use along selected transport corridors (especially those linking to EU neighbors and Moldova) are creating urgent maintenance needs.
- **Reinstating lifeline transport services in war-affected communities.** Urban public transport, school transport, and regional passenger connectivity are urgently needed in war-affected communities but face several challenges. Firstly, physical assets like rolling stock fleets, depots, and street-level infrastructure have been heavily damaged and, in some cases, there have been reports about theft of functioning rolling stock (e.g., school buses in Khersonska oblast). Secondly, population levels in areas that were temporarily not under government control are roughly 20 percent of prewar levels, so that there is less potential for cost recovery and greater need for fiscal support to deliver services. Finally, because much of Ukraine's public transport services depend on electricity (e.g., trams, trolleybuses, metros), they are vulnerable to disrupted power supply. A national program aimed at providing lifeline rolling stock (primarily diesel powered) accompanied by fiscal support to sustain services could offer a way to address these constraints in the near term.
- **Expanding capacity of westward transport linkages further.** Expanded westward transport linkages are essential in both the short and long term. In the short term, they will mitigate the losses imposed by disrupted Black Sea access and airspace closures. In the long term, they will facilitate convergence with Europe's single market, which will entail physical integration with the Trans-European Transport Network (TEN-T). Expanding capacity along westward transport linkages and the measures already underway via the Solidarity Lanes represent no-regret investments that are urgently needed and well aligned with Ukraine's future within the EU.

While emergency repairs and restoration of basic connectivity will likely dominate 2023, there is an urgent need to mobilize project preparation for reconstruction and to prepare teams for delivery. Reconstruction projects in the transport sector are technically complex and engineering intensive. Some will require environmental assessments and/or land acquisition along with public consultation. Alignment with EU peers will also require Ukraine to apply standards that differ from or modify those previously used. Ukraine's own domestic standards will eventually need amendments to align with the EU acquis. Project preparation tasks will likely cost 2–10 percent of total civil works investment (roughly US$2–10 billion during reconstruction). Preparing for no-regret high-priority investments will help ensure that Ukraine can absorb reconstruction funding effectively. Equally important will be developing the skills and experience of project implementation units within the State Agency for Restoration and Development of Infrastructure of Ukraine, Ukrainian Railways, Ukrainian Seaports Authority, State Service of Maritime and River Transport, oblast administrations, and local government bodies. Immediate engagement by development partners on this agenda could help make project delivery during reconstruction more effective.

Limitations and Recommendations for Future Assessments

RDNA2 considers roads, railways, bridges, aviation, ports, inland waterways, and urban public transport as part of the transport assessment. Specific limitations in the approach include the following:

- **Data sets and completeness.** Like RDNA1, RDNA2 calculates damage to road, rail, aviation, and urban transport assets using data provided by Ukraine's MCTID, Ukrainian Railways, the State Agency for Restoration and Development of Infrastructure of Ukraine, oblast administrations, and municipal authorities. The accuracy of these data varies according to the security situation—that is, according to whether government representatives can access sites and validate (at least approximately) locations and actual levels of damage. Government access has improved considerably since June 2022, but precise data on damaged assets in areas not currently under government control remain unavailable. Hence the resulting analysis of damage and needs is inherently uncertain.
- **Indirect losses.** With the exception of aviation, loss calculations do not currently consider indirect losses. This limitation may be most relevant to lost Black Sea access for goods other than grain, where specific industry clusters near port agglomerations were likely predicated on transport via the Black Sea and would not otherwise be competitive. Disruptions to specific road or rail linkages may have similar effects on industries with rigid mode requirements, where switching to alternative forms of transport may not be possible. Given these limitations, the scale of losses suffered due to transport sector disruptions is likely underestimated, though some of these effects may be captured in analysis by other sectors.
- **Cost estimates.** Estimates for reconstruction needs use unit costs or approximations for specific assets rather than detailed engineering assessments; actual costs would vary by the extent of damage, location within Ukraine, and market factors that may affect pricing of works at the time of reconstruction. Unit costs also reflect assumptions regarding the nature of works required for reconstruction, and actual technical solutions may differ from those assumed. The detailed site-by-site engineering analysis that would substantially reduce uncertainty may not take place in the near future, given wartime constraints on budgets and capacity.
- **Assumptions regarding extent of damage.** As with RDNA1, the assessment of damage has not included detailed engineering work or testing. Definitive assessment of damage levels is needed to determine appropriate mitigation strategies; for example, some assets assumed to be fully damaged might turn out not to require full replacement/rehabilitation. While the extent of Ukrainian territory under government control has expanded since June 2022, remaining security threats and budgetary constraints have prevented detailed engineering assessments in most instances.
- **Continuation of lost Black Sea access and airspace closure.** Loss calculations from RDNA1 assumed that Ukraine's Black Sea access would remain fully impeded, and that Ukraine's airspace would remain fully closed until December 2023. These assumptions have been revised. The Black Sea Grain Initiative is assumed to continue, and RDNA2 analysis has used 2022 data to project Black Sea Grain Initiative tonnage by month until August 2024. It is further assumed that Ukraine's airspace will remain fully closed during this time. These assumptions are inherently linked to Ukraine's military gains or the effectiveness of international diplomacy efforts, both of which are outside the scope of RDNA2 analysis. Projected losses incurred or avoided are accordingly subject to high levels of uncertainty.

The foremost recommendations going forward are as follows: (i) once security conditions allow, intensify field-level investigations and engineering work needed to identify and classify damage; and (ii) in parallel with field validation of data, expand consideration of indirect losses, which will require more complex calculation methodologies.

Table 37. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	28.1	771.3	81.8
Chernihivska	1,661.2	897.8	6,022.1
Chernivetska	2.0	293.4	30.8
Dnipropetrovska	151.7	2,886.6	725.7
Donetska	9,254.5	1,819.4	20,250.5
Ivano-Frankivska	5.0	645.5	22.6
Kharkivska	3,679.9	2,101.5	9,387.9
Khersonska	5,363.0	703.9	14,044.5
Khmelnytska	9.8	616.2	36.8
Kirovohradska	48.9	528.2	115.1
Kyivska (includes Kyiv City)	1,981.4	8,837.3	5,344.4
Luhanska	5,358.7	464.8	13,073.0
Lvivska	19.2	1,584.7	68.9
Mykolaivska	1,277.6	829.5	4,407.7
Odeska	130.3	1,488.7	402.3
Poltavska	7.9	1,379.1	52.7
Rivnenska	2.4	498.8	19.8
Sumska	1,315.7	728.5	4,231.1
Ternopilska	-	410.8	15.1
Vinnytska	48.1	968.3	313.4
Volynska	1.9	560.2	27.3
Zakarpatska	2.7	440.1	22.6
Zaporizka	5,076.9	1,468.4	12,331.4
Zhytomyrska	249.6	687.5	1,050.3
Total	**35,676.6**	**31,610.6**	**92,078.0**

Source: Assessment team.

Note: Loss includes an additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 38. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Road bridges (national roads)	872.5	6,398.2	7,270.6
	Road bridges (local roads)	91.2	668.9	760.2
	Motorways, highways, and other national roads	3,171.0	23,254.0	26,425.0
	Oblast and village roads	636.7	4,669.0	5,305.6
	Communal roads	1,013.3	7,430.6	8,443.8
	Airports	201.3	1,476.2	1,677.5
	Railway track, bridges, stations, and electrical	2,792.7	20,479.9	23,272.7
	Railway rolling stock	294.3	2,157.9	2,452.2
	Railway equipment and other assets	171.7	1,259.0	1,430.7
	Private vehicles	819.0	6,006.2	6,825.2
	Ports and inland waterway infrastructure	39.7	291.3	331.0
	Urban public transport rolling stock, infrastructure, depots, maintenance vehicles	529.0	3,879.5	4,408.5
Service delivery restoration needs	National road and bridge repair	1,498.6	-	1,498.6
	Local road and bridge repair	324.8	-	324.8
	Communal road and bridge repair	176.4	-	176.4
	Railway infrastructure emergency repair	524.4	-	524.4
	Railway rolling stock and equipment	169.6	-	169.6
	Urban transport repairs	23.5	-	23.5
	Urban transport rolling stock and equipment	173.4	-	173.4
	Ports repair	4.6	-	4.6
	Border crossing point expansion	51.0	-	51.0
	Inland waterways infrastructure repair & Danube River port expansion	30.0	-	30.0
	Equipment for repair and maintenance of urban transport infrastructure	29.9	-	29.9
	Equipment for repair and maintenance of national and regional roads and bridges	68.8	-	68.8
	Maintenance of road and bridge infrastructure affected but not damaged by war	399.9	-	399.9
Total		**14,107.3**	**77,970.6**	**92,078.0**

Source: Assessment team.

Note: - not relevant.

Table 39. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	*Expected after 2023*	-
Service delivery restoration needs	National road and bridge repair	1,498.6
	Local road and bridge repair	324.8
	Communal road and bridge repair	176.4
	Railway infrastructure emergency repair	524.4
	Railways rolling stock and equipment	169.6
	Urban transport infrastructure repair	23.5
	Urban transport rollick stock and equipment	173.4
	Ports repair	4.6
	Border Crossing Point (BCP) expansion	51.0
	Inland waterways infrastructure repair and Danube River port expansion	30.0
	Equipment for repair and maintenance of urban transport infrastructure	29.9
	Equipment for repair and maintenance of national and regional roads and bridges	68.8
	Maintenance of road and bridge infrastructure affected but not damaged by war	399.9
Total		**3,475.0**

Source: Assessment team.

TELECOMMUNICATIONS AND DIGITAL[104]

Context

Ukraine's telecom and digital sector plays an outsized role in enabling Ukraine's service sector, particularly the IT industry and the start-up scene. Widespread access to mobile and fixed broadband was one of the key drivers of the country's economic growth prewar.[105] Ukraine's postal service was instrumental to the growth of e-commerce in Ukraine.

One year into the war, the Ukrainian telecommunications sector has proven resilient. Despite the increased war intensity since June 2022, telecommunication operators, postal service providers and broadcasters have adapted to the war conditions and managed to provide telecommunication services and ongoing maintenance of infrastructure amidst missile strikes on civilian assets.

Damage and Loss Assessment

Since the start of the war through February 24, 2023, the estimated accumulated damage to the telecommunications sector is US$1.6 billion. Fixed broadband providers sustained accumulated damage of US$0.8 billion, mobile operators sustained US$0.6 billion, postal service providers US$0.2 billion, and broadcasters US$0.05 billion (Table 40). The damage has been concentrated in areas of intensive fighting in the country's eastern and southern regions: Kharkivska Oblast accounts for 20 percent of the sector damage, Donetska for 19 percent, Zaporizka for 15 percent, and Khersonska for 13 percent.

As of February 24, 2023, the estimated accumulated loss to the Ukrainian telecommunications sector is US$1.55 billion. Fixed broadband providers sustained accumulated losses of US$0.1 billion, mobile operators sustained US$0.3 billion, postal service providers US$1.1 billion, and broadcasters US$0.02 billion. The losses have been concentrated in Kyivska Oblast (37 percent of the telecommunications sector losses), Kharkivska (19 percent), and Donetska (17 percent).

Reconstruction and Recovery Needs, Including Build Back Better

The priority short-term recovery needs amount to US$3.1 billion; of this amount, US$1.8 billion is for reconstruction needs, and US$1.3 billion is for needs related to service delivery restoration. These estimates incorporate the build back better premium of 40 percent above the damage estimates (Table 41).

The key recommendations for recovery and reconstruction include prioritizing electricity back-up (generators and other energy equipment) for telecom operators. These efforts will have immediate effect on humanitarian relief and access to information. In the short-term repair work, providing telecommunication operators with power generators and fuel is of high importance. Because of sustained damage to Ukraine's electricity grid from shelling, the telecommunications sector is relying extensively on generators and other energy equipment to maintain service provision.

2023 Recovery and Reconstruction Priorities

The 2023 recovery and reconstruction priorities are estimated to require at least US$602 million, which should focus on maintaining the telecom and postal infrastructure and covering the immediate

104 This sectoral assessment benefited from the Interim assessment on damages to telecommunication infrastructure and resilience of the ICT ecosystem in Ukraine developed by the ITU Office for Europe.

105 As of December 2019, the wireless penetration was 131 percent per capita, which was the second highest performance among the Eastern Partnership (EaP) countries. The mobile telecommunications market was competitive, and mobile internet generally affordable to an average Ukrainian. The wireless market in Ukraine displayed levels of competition similar to comparable European markets.

operational expenses related to generators and other energy equipment for mobile and fixed broadband. Table 42 summarizes the priorities and provides estimates of associated budgets.

Limitations and Recommendations for Future Assessments

The key data used for these estimations are from the Government of Ukraine (sourced from postal service providers, public broadcasters, and internet service providers) and from the Kyiv School of Economics. The figures for the period June 1, 2022, to February 24, 2023, rely on extrapolations in case of postal services, while figures for broadcasting are available from the government. The figures for telecommunications are partially available from operators and partially extrapolated from the RDNA1 assessment, using the data on war intensity by oblast. The damage and loss to media outlets were not quantified in this sectoral assessment which focused on providers of fixed broadband, mobile operators, postal service, and public broadcasting infrastructure.

Table 40. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	-	1.2	21.6
Chernihivska	102.3	71.6	219.3
Chernivetska	0.9	1.0	5.5
Dnipropetrovska	6.4	6.0	70.8
Donetska	309.2	263.8	757.7
Ivano-Frankivska	1.0	2.2	81.3
Kharkivska	323.4	297.8	824.7
Khersonska	215.8	50.2	311.5
Khmelnytska	0.2	0.8	1.6
Kirovohradska	0.2	0.9	18.3
Kyivska	155.9	572.2	1,214.5
Luhanska	138.6	65.4	253.5
Lvivska	0.5	2.5	25.9
Mykolaivska	69.1	86.4	188.8
Odeska	14.5	2.8	25.2
Poltavska	0.2	1.8	3.3
Rivnenska	0.5	1.1	22.6
Sumska	44.9	30.7	58.2
Ternopilska	0.2	1.0	2.1
Vinnytska	1.4	1.9	5.2
Volynska	0.2	1.4	2.7
Zakarpatska	0.7	1.8	50.6
Zaporizka	241.4	85.5	348.2
Zhytomyrska	0.6	1.3	2.7
Total	**1,628.0**	**1,551.2**	**4,515.7**

Source: Assessment team.

Note: loss includes additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 41. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Telecom	1,469.8		1,469.9
	Post	247.8	12.2	260
	Broadcasting	72.2		72.2
Service delivery restoration needs	Telecom	320.4	480.6	800.9
	Post	926.5	959.9	1,886.4
	Broadcasting	10.9	16.6	27.3
Total		**3,046.7**	**1,469.0**	**4,515.7**

Source: Assessment team.

Table 42. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Cost in US$ million
Reconstruction needs	Telecom	215.9
	Post	60.7
	Broadcasting	17.7
Service delivery restoration needs	Telecom	78.4
	Post	226.9
	Broadcasting	2.7
Total		**602.2**

Source: Assessment team.

Note: Figures in this table do not match those in Figure 4 (US$0.5 billion) as it is estimated that approximately 10 percent of telecom investments will be undertaken by the private sector and that these private sector investments will only require a small public contribution (e.g., through provision of access to subsidized loans under the 579 program).

WATER SUPPLY AND SANITATION

Context

Before the war, access to centralized piped water supply in the country was estimated to be at 70 percent, and access to centralized wastewater collection and treatment services at around 50 percent;[106] approximately 10 million people lack access to safely managed water services and 20 million people lack access to centralized wastewater collection and treatment services. There are significant inequalities between urban and rural areas in piped water access (80 percent in urban areas versus 34 percent in rural areas), flush toilet access (86 percent versus 26 percent), and sewer connections (75 percent versus just 8 percent). In addition, the water supply and sanitation (WSS) sector governance framework is highly fragmented, with administrative and legislative shortcomings that limit coordination and efficiency between national and local administration efforts.

Due to the ongoing war, the WSS sector has experienced damage and losses and has struggled to provide essential services in extremely difficult circumstances. The mass drone and missile attacks on critical civil infrastructure at the end of 2022 and beginning of 2023 significantly affected WSS service provision. WSS infrastructure was damaged both in territories still under government control and in those not under government control, but most importantly the ongoing power outages and intermittent electricity supply have significantly affected these services. Water and wastewater facilities, pumping stations, etc. are all highly dependent on and require constant electricity supply. Despite the ongoing efforts of emergency and communal service providers, millions of Ukrainians continue to receive intermittent WSS services.

Damage and Loss Assessment

The estimated aggregate physical damage for the WSS sector stands at US$2.2 billion (Table 43); of this amount, around US$0.9 billion was due to damage between June 1, 2022, and February 24, 2023. Bearing in mind the various challenges in data collection (especially in oblasts with ongoing military actions and those that are not currently under government control), this is a conservative figure and could underestimate actual damage by up to 30 percent; however, it provides a fair assessment of the magnitude of WSS infrastructure damage up to this point. Based on the received data, the most affected oblasts are Kharkivska, Luhanska, Chernihivska, Kyivska, and Donetska. Acquisition of data and information for Khersonska oblast was not possible, but it is believed that this oblast has experienced a similar level of WSS damage. It is also expected that a sizable increase in damage will be found in Luhanska and Donetska oblasts once they are accessible to the government and damage can be safely reassessed. In terms of infrastructure, most of the damage has been observed in larger physical infrastructure like wastewater treatment plants, water supply and wastewater collection networks, and drinking water treatment plants and facilities. Significant numbers of water and wastewater pumping stations, which are critical for functioning WSS systems, have been damaged as well, but utilities are constantly working to fix those to ensure basic provision of WSS services.

Losses have been estimated at approximately US$7.5 billion, noting even bigger challenges in collecting reliable data for this assessment. With support from the MCTID, other development partners, and ongoing consultancy services procured by the ministry, the RDNA2 provides information on losses, but only at the national level. More than 40 percent of the total losses are from the lost revenues of WSS services provision. The war significantly reduced water consumption, as millions of people

106 According to Government of Ukraine. National report on the quality of drinking water and the state of drinking water supply in Ukraine for 2020, 2021, *Link*.

fled the country and many industries temporary closed or significantly reduced their water usage. In addition, the collection rate (especially in war-affected oblasts) fell to an extremely low level and is still recovering quite slowly. The next biggest loss category is additional costs for WSS service provision due to increased energy costs; energy is the second biggest cost component (at around 30 percent) for Ukrainian WSS utilities, after staff costs. The rest of the economic losses are associated with increased fuel consumption, increased prices of materials and equipment, lack of required repairs, tariff deficits, water losses, increased costs for chemical reagents, and required demolition and debris management.

Reconstruction and Recovery Needs, Including Build Back Better

The needs assessment applied a limited building back better approach for the reconstruction of the damaged/destroyed WSS assets. The needs are assessed as reconstructing or rebuilding the damaged WSS infrastructure to its initial functionality, but considering new capacity requirements, materials and technologies (Table 44). This approach does not seek to achieve immediate and full compliance with SDG 6 (Clean Water and Sanitation) or the EU Water Directives but would set a foundation for potential compliance in the medium term.

The WSS needs assessment is split between short-term and medium- to long-term expenditures, which allows for prioritization of the investment efforts and preparation of the sector for the required infrastructure development. While the war continues, most of the efforts should be focused on maintaining the condition of WSS infrastructure to the extent possible to ensure provision of basic WSS services for both the population and industries and to minimize service interruption. This is particularly relevant for the areas directly exposed to war activities, but due to the nature of the war, the entire territory of Ukraine suffers from war damage. Emergency equipment such as generators, water trucks, etc. should be available for emergency response. In the short term, the focus should be first on water supply, including systems to monitor water quality and quantity, before moving toward improving wastewater services and environmental protection. Moreover, the existing national and local budget support to WSS utilities (especially in war-affected oblasts) needs to be continued in order to keep service providers afloat and ensure service provision. This support for operating costs is the biggest chunk of the required short-term funding needs, but without it the most war-affected WSS utilities will not be able to cover the basic needs and provide WSS services.

Sector reforms and strong support will be needed to deliver the ambitious medium- to long-term plan for the WSS, which entails investing around US$3.3 billion. Some of the reforms could be prepared and agreed on while the war is ongoing to save time on the required upstream sector work, which should be based on a strategic approach and reconstruction plan for the immediate postwar period.

In prioritizing WSS sector needs, the Government of Ukraine should apply a staged approach to the required investments; it should focus on ensuring provision of basic, safe WSS services before revising existing targets and setting new national targets under the UNECE-WHO/Europe Protocol on Water and Health[107] or applying the EU environmental *acquis***.** Accordingly, the recovery plan for the sector should define investments required to restore basic WSS services, guided by technical recommendations toward putting in practice the build back better concept. Additional guidance and capacity development will be required to support Ukraine as it works to get closer to EU standards, doing so in a phased manner, in alignment with its capacity, and with required risk management mechanisms in place.

In addition, due to its low administrative capacity and limited investment experience, the WSS sector is not ready for large-scale investments, and both the national and local governments should encourage the receipt technical support to prepare for and cover such significant WSS needs. Significant support and coordination is required if the calculated medium- to long-term investments are to be timely implemented. This process can be accelerated by involving all development agencies having a presence in Ukraine beyond the emergency response period.

107 The UNECE (United Nations Economic Commission for Europe)/WHO (World Health Organization) Protocol on Water and Health provides a platform for an integrated analysis of the priorities and needs of the WSS sector, with a focus on universal access and climate resilience. For additional information, see UNECE, "About the Protocol on Water and Health," *Link*.

Reconstruction efforts should be paired with a reform agenda to ensure sustainable operation and maintenance of the newly developed infrastructure. Significant institutional and normative work is required to meet several goals, including building the capacity of utilities, aggregating them, strengthening regulation, and allowing for private sector participation. Only through such reforms can the sector deliver investments worth billions of dollars in the next 10 years. In addition, the planning of WSS infrastructure reconstruction in Ukraine should consider the broader water challenges in the country, such as water resources availability and vulnerability (notably vulnerability to contamination by industrial activities), climate change effects, and more frequent droughts and floods; doing so will help ensure that the modernization of WSS services implements innovative, sustainable, green, and resilient options, like nature-based wastewater solutions. It is also important to emphasize that reconstruction of such magnitude is a historic opportunity to build back better (both system and infrastructure), apply international best practices, and incorporate key aspects of EE and sustainability principles that would bring significant economic benefits.

2023 Recovery and Reconstruction Priorities

While efforts in 2023 should focus on infrastructure recovery and ensuring WSS service provision (Table 45), there should also be efforts to prepare a project pipeline for the required investments, aligned to the phased approach recommended above. Recovery and reconstruction efforts should make use of the building back better approach to deliver better results and ensure sustainability of WSS assets and services. In addition, some of the upstream work on reforming the sector should be initiated. The World Bank WSS sector Policy Note[108] can be used as a basis for tackling some of the key bottlenecks: (i) improving governance to increase access, transparency, and accountability; (ii) enhancing regulation to improve performance and service quality; and (iii) reforming the funding approach to ensure cost recovery and sustainability, as well as to diversify funding options.

Limitations and Recommendations for Future Assessments

Although the work on RDNA1 increased MCTID's capacity to deal with data collection and address WSS sector issues, the ministry still lacks the information system needed to collect key data, make informed decisions, and act as a policy maker for the WSS sector. In this regard, the RDNA2 WSS exercise is useful, but it needs to be further refined through additional and more in-depth needs assessments, some of which have already been initiated. The ongoing decentralization in Ukraine should not mean that all WSS responsibilities are transferred to the local level and that the national government has no further obligations; rather, a mechanism should be developed to ensure that national policies trickle down and are implemented at local level, thus contributing to the national targets and expected results for the sector. This goal requires establishing or strengthening institutions (e.g., the national association of vodokanals) to better link and harmonize work between the national and the decentralized level.

108 World Bank, "Ukraine Water Supply and Sanitation Policy Note," World Bank, Washington, DC, 2021, *Link*.

Table 43. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Chernihivska	310.1	47.8	582.6
Donetska	161.7	8.0	287.0
Kharkivska	811.9	124.4	1,525.0
Kyivska	192.4	28.6	360.5
Luhanska	505.7	80.7	953.1
Mykolaivska	46.9	3.0	84.0
Odeska	63.0	10.1	118.8
Sumska	40.2	4.3	73.7
Ternopilska	0.0	0.0	0.1
Zaporizka	51.4	7.9	96.5
Nationwide (no specific region)	-	7,178.1	3,063.8
Total	**2,183.4**	**7,492.9**	**7,145.0**

Source: Assessment team.

Note: Note: - = not assessed. The following oblasts were not assessed or had no available data: Cherkaska, Chernivetska, Dnipropetrovska, Ivano-Frankivska, Khersonska, Khmelnytska, Kirovohradska, Lvivska, Poltavska, Rivnenska, Vinnytska, Volynska, Zakarpatska, and Zhytomyrska. Loss includes additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 44. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Water treatment facilities	81.0	324.0	405.0
	Sewage treatment plants	171.0	684.0	855.0
	Water pumping stations	38.5	154.1	192.7
	Sewage pumping stations	52.9	211.7	264.6
	Water supply networks	156.0	624.0	780.1
	Sewer networks	147.2	588.7	735.9
	Wells	1.2	4.7	5.9
	Laboratories	0.3	1.4	1.7
	Clean water tanks	4.9	19.6	24.5
	Water towers	2.0	7.8	9.8
Service delivery restoration needs	Demolition and debris management	63.0	251.8	314.8
	Facility operational costs	98.3	393.0	491.3
	Operating costs coverage	3,063.8	-	3,063.8
Total		**3,880.1**	**3,264.9**	**7,145.0**

Source: Assessment team.

Note: - = not assessed.

Table 45. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	Water treatment facilities	48.6
	Sewage treatment plants	34.2
	Water pumping stations	19.3
	Sewage pumping stations	10.6
	Water supply networks	31.2
	Sewer networks	36.8
	Wells	1.2
	Laboratories	0.3
	Clean water tanks	4.9
	Water towers	2.0
Service delivery restoration needs	Demolition and debris management	15.7
	Facility operational costs	19.7
	Increased energy/fuel consumption support	170.2
Total		**394.6**

Source: Assessment team.

MUNICIPAL SERVICES

Context

The ongoing war has not only resulted in continuing damage to communal infrastructure and widening gaps in service delivery but has also exponentially strained the capacity of local governments. As of February 24, 2023, damage to communal infrastructure had increased since June 1, 2022; but this increase can be considered an underestimation given the lack of access to damage data in frontline regions and the limited data collection on asset types covered by the sector.

Prior to the war, utilities' service provision across all regions was irregular, and coverage rates were low. The waste management sector was especially in need of investment and reforms, with coverage of only an estimated 79 percent.[109] The gaps in infrastructure and service delivery can also be seen in commonly delayed repairs to local roads,[110] low maintenance rates for public green spaces (only 50 percent),[111] the need for 500 cemeteries in urban areas,[112] and the need for better streetlighting coverage and sidewalk quality. Local governments in Ukraine, responsible for delivering a wide range of services and infrastructure, faced numerous capacity constraints.[113] Overall regulatory functions are at the local level in Ukraine and directly impact the quality of life of citizens, local economic development, and sustainability. With the war, the burden on local governments has greatly escalated, as they are expected to implement emergency recovery works, ensure continued service delivery to residents (despite damaged communal infrastructure and disruptions in service delivery networks), create conditions for resilience, and develop urban recovery plans for coordinated recovery at the local level.

Damage and Loss Assessment

As of February 24, 2023, the war is estimated to have caused at least US$2.3 billion in damage to the municipal infrastructure and services sector. For the purpose of the RDNA2, the municipal infrastructure and services sectoral assessment covers five categories of assets:[114] solid waste management; public spaces, infrastructure and amenities; local administrative buildings; sports facilities; and local mobility assets.[115] Local mobility assets (sidewalks and streetlights) had the highest share of damage at 38 percent. This was followed by the public spaces and facilities category, which accounted for 25 percent of the total damage and included important assets such as cemeteries and parks; these respectively contributed 20 percent and 10 percent of damage within this category. Local administrative buildings and centers that house municipal service functions and operations also suffered damage, valued at US$204 million.[116] Damage to the solid waste management sector was significant at US$99.9 million and resulted in disruption of the entire waste management service network, which had been severely strained even prior to the war. Damage is estimated to be highest in the Luhanska, Donetska, Kharkivska, Khersonska, and Zaporizka oblasts. Table 46 shows the damage across all oblasts.[117]

109 MCTID, "State of the Field of Household Waste Management in Ukraine for 2021," May 19, 2022, Link.
110 MCTID, "Analysis of the State of the Road and Bridge Industry in 2021," June 6, 2022, Link.
111 MCTID, " State of the Field of the Green Economy for 2021," May 13, 2022, Link.
112 MCTID, "State of the Burial Industry in Ukraine in 2020," April 1, 2022, Link.
113 Local governments deliver "hard" municipal services (like local roads, solid waste management, utilities, public facilities, and urban amenities) along with social services, while also fulfilling their civil and environmental protection duties.
114 Utilities and housing are covered by infrastructure and housing sections, respectively.
115 Asset types under each category are not exhaustive due to data limitations, but they reflect a range of infrastructure and services.
116 Administrative buildings do not include health and education facilities.
117 The accuracy and coverage of regional damage data differ depending on asset type and region due to limitations in on-ground data collection and verification, the evolving situation of territories, and war-related disruptions. Data gaps were addressed by leveraging informed assumptions and extrapolations, based on reports of prewar baseline information, limited satellite imagery of visible damage, data on location of war events, and anecdotal evidence from local experts and authorities. The estimated value of damage is not precise but rather indicative of the damage magnitude.

Sectoral loss was estimated at a significant US$2.9 billion and included demolition and debris removal, revenue losses, and increased expenditures incurred by local governments and waste collection entities.[118] Estimations of revenue losses for local governments incorporated both local shares of personal income taxes[119] and own-source revenues[120] and were approximated for one year of the war and then projected over the subsequent 18 months. A significant 88 percent of the total loss value is municipal revenue loss, highlighting the need to fiscally equip local governments so they can continue to deliver municipal services in coming months. Revenue losses of household waste management entities (public utilities and private companies) were estimated at US$32 million between March 2022 to February 2023, while local governments' additional service delivery burden for housing and utilities services was US$18 million during this same period.[121]

Reconstruction and Recovery Needs, Including Build Back Better

For the municipal sector to recover and in turn facilitate local reconstruction and recovery, the estimated needs amount to US$5.7 billion (Table 47). The estimated needs factor in costs associated with inflation and building back better in alignment with Ukraine's reconstruction strategy, which prioritizes decarbonization as well as reforms and institutional capacity building to meet European Union accession criteria.

The role of local governments in recovery and reconstruction is vital and goes beyond just municipal assets. Local governments are critical for the implementation, coordination, and planning of measures stipulated by individual functional sectors and line ministries. This reality necessitates an integrated and place-based approach at the local level. In addition, to overcome the likely challenges of resource constraints and unstable cash flow during the recovery period, local governments—especially cities—will need to undertake evidence-based identification of prioritized needs and associated sequencing of recovery and reconstruction measures. Local implementation capacity must be enhanced to ensure that recovery and reconstruction efforts can be initiated.

The short-term needs total US$1.7 billion and emphasize maintaining service delivery, including in IDP hubs, and strengthening local technical and operational capacity to allow for subsequent reconstruction. A first step will be to establish the necessary architecture and institutional arrangements for the implementation of follow-on reconstruction works. For example, debris removal and demolition—which is necessary across all sectors for initiating recovery and reconstruction—falls within the mandate of local governments and is directly linked to the solid waste sector capacity. The most pressing needs in the short term therefore relate to (i) the upkeep of service delivery, which could also include repair and reconstruction of critical assets such as cemeteries, administrative service centers, sidewalks, and streetlights, (ii) rapid scale up of investments in the waste management sector, and (iii) formulation of local reconstruction and recovery strategies and action plans. Initiating recovery and reconstruction also hinges on the explicit prioritization and sequencing of investments based on technical assessments and data collection at the local level, and on an enabling institutional and legal environment for implementing plans.

2023 Recovery and Reconstruction Priorities

For meeting urgent needs as well as for preparing necessary conditions for subsequent investments, US$200 million is required (Table 48). In 2023, urgent needs include the continuation of services in IDP hubs such as Kharkiv and Dnipro. It will also be important to procure assets (collection trucks, container bins) so local governments can continue to

118 Loss estimates do not account for the increased costs related to increased costs of fuel.

119 During the period March–December 2022, local revenues increased relative to the same period in 2021. This increase can be attributed to increases in the personal income tax component of the local revenues across 20 oblasts (i.e., there was no loss in such revenues). The substantial increases in salaries in the defense and IT sectors and a corresponding increase in military enrollment are likely explanations.

120 Municipal own-source revenue is composed of local taxes and fees (e.g., single tax, land and property tax and fees), nonutility user fees, administrative fees, and any local capital revenue. Losses in local revenues are predominantly from losses in own-source revenues stemming from reduced likelihood of payment and collection of local taxes and fees, decline in the provision of local administrative services, and exemptions, waivers, and restrictions imposed by the military budget code that remained valid during the assessment period.

121 The loss estimates relied on available local budget data and assumptions derived from analysis of war intensity, military budget code, and prewar baseline information on household waste collection and disposal tariffs and volumes.

provide waste management services, and to channel resources to ensure sanitary and safe operation and management of dump sites and landfills. Investment in waste management assets is vital for continued debris removal efforts, especially in frontline regions that also host large shares of IDPs; these areas require urgent debris removal and have additional waste management needs. Needs for 2023 also consider costs for establishing the foundational architecture and groundwork to commence recovery and reconstruction and include essential activities such as technical and engineering studies, updating of spatial plans, and recovery planning and prioritization at the local level.

Limitations and Recommendations for Future Assessments

Future data collection efforts and assessments would benefit from segregating infrastructure assets into urban and rural, and from regularly aggregating locally verified data at the national level. Infrastructure and service needs, delivery approaches, and costs in urban areas widely differ from those in rural areas. More importantly, cities' capacities are substantially different from those of smaller settlements or rural areas. Categorizing data by the degree of urbanization would yield a better understanding of context-specific policy and financing requirements. Strengthening collection of data on locally maintained and owned assets for regular aggregation at the national level could also be beneficial. Better coordination between local and national levels would help ensure the success of subsequent recovery works. Regular data collection from local level, disaggregated between urban and rural areas, would improve monitoring of local service delivery and investment prioritization at the national level. For this assessment, the data were in most cases either incomplete or not verified, suggesting data-reporting systems for communal assets could be improved. The damage and losses presented were to a large extent extrapolated from analyzing the severity of the war across regions and based on informed assumptions and information from multiple sources. The estimated numbers are indicative and not to be taken as precise values.

Table 46. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	7.6	69.6	19.7
Chernihivska	116.3	47.7	277.6
Chernivetska	4.2	16.3	10.4
Dnipropetrovska	37.8	245.2	93.3
Donetska	477.5	584.8	1,146.9
Ivano-Frankivska	0.6	16.2	3.5
Kharkivska	178.9	448.7	428.4
Khersonska	239.3	234.1	571.0
Khmelnytska	1.7	18.5	5.3
Kirovohradska	12.0	17.0	30.2
Kyiv (City)	18.1	235.5	45.6
Kyivska	147.1	140.3	348.6
Luhanska	628.5	236.5	1,504.3
Lvivska	7.8	50.8	21.4
Mykolaivska	156.3	54.2	370.6
Odeska	14.2	89.0	35.2
Poltavska	7.0	32.5	19.0
Rivnenska	1.3	14.9	3.8
Sumska	95.7	43.0	224.4
Ternopilska	-	12.3	1.2
Vinnytska	11.2	24.7	28.5
Volynska	1.0	13.3	3.2
Zakarpatska	0.8	16.6	4.1
Zaporizka	171.3	284.8	411.4
Zhytomyrska	42.2	40.5	99.6
Nationwide (no specific region)	10.0	-	24.1
Total	**2,388.5**	**2,987.0**	**5,731.3**

Source: Assessment team.

Note: - = not assessed. Losses include an additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 47. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Reconstruction of assets	315.3	3,257.2	4,030.6
	Technical works including planning documents and enhancements in institutional processes	240.8	171.4	
	Debris processing and disposal	45.8	-	
Service delivery restoration needs	Upkeep of services and increased service delivery in IDP hubs	129.3	116.6	1,700.7
	Repair and stabilization of prioritized public and service delivery infrastructure	429.9	175.0	
	Coordinated and efficient debris removal and enhanced waste management capacity	259.7	-	
	Operational costs—goods, equipment, and infrastructure	298.6	291.6	
Total		**1,719.4**	**4,011.9**	**5,731.3**

Source: Assessment team.

Table 48. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	Repairs to critical mobility and communal infrastructure including critical administrative service centers	16.0
	Technical support for local recovery planning (including spatial planning, land management, feasibility and engineering studies, etc.)	70.2
Service delivery restoration needs	Continuation of basic services in frontline regions, regions brought back under government control, and IDP hubs	41.4
	Investment in equipment to continue solid waste management service delivery	30.1
	Debris removal for continuation of services	42.9
Total		**200.6**

Source: Assessment team.

CROSS-CUTTING AREAS

Residential Building. Mykolaivska Oblast. Photo from Mykolaiv City Council.

ENVIRONMENT, NATURAL RESOURCE MANAGEMENT, AND FORESTRY

Context

The war has continued over the past 12 months, and damage to the environment has aggravated what was identified in the RDNA1. Practically all environmental components—including air, water, soil, and biota—have been further impacted. Damage to infrastructure—including hazardous industrial facilities and energy installations (e.g., power plants, oil storage depots, and refineries) and residential and commercial buildings potentially containing asbestos—all contribute to war-related burden of environmental pollution. Agricultural lands, forests, and aquatic and other ecosystems have been directly and indirectly impacted, including through the presence of minefields or unexploded ordnance, cratering from extensive shelling, forest fires, and lack of access and management.

The war exacerbated existing environmental challenges in Ukraine. Prior to the war, Ukraine's National Environmental Strategy–2020[122] identified the following major environmental challenges: air pollution; quality of water resources and land degradation; solid waste management; biodiversity loss; and human health problems.

Damage and Loss Assessment

Damage in the forestry sector is estimated at over US$1.5 billion, and losses are estimated at US$523 million. The fire damage covers 183,181 ha,[123] mostly in the oblasts of Donetska, Kharkivska, and Luhanska, where it drives the high assessment of damage to forest growing stock and roads. At 43.1 million m3, growing stock damage is equivalent to over two years of national harvesting and accounts for 93 percent of the US$1.5 billion in financial damage (Table 49). In addition, approximately 275 km of road are estimated as requiring repair. An estimated 1.8 million ha, or 20 percent of the forest, is now inaccessible due to mine laying. This accounts for 62 percent of the estimated US$523 million in financial losses, with the balance relating to the inability of the forest to deliver a variety of ecosystem services.

Damage related to GHG emissions exceeds US$3 billion. Using the Intergovernmental Panel on Climate Change coefficients and the hectares of forests and "natural landscapes" affected by fires, the total emissions of CO2eq (carbon dioxide equivalent) are estimated at 28,468,136 tons and 528,471 tons respectively. At a current carbon price of €100.34,[124] this equates to a cost of US$3,083 million for GHG released. Losses to the ecosystem services, caused by fires in "natural landscapes" only, are calculated based on the scale of fires reported on the monthly Fire Bulletins and a value of US$337 ha-1 for non-market ecosystem services for grassland in

122 Government of Ukraine, "National Environmental Policy 2011–2022," *Link*; see also FAO Aquastat, "Country Profile: Ukraine," 2015, *Link*.

123 Fire damage in the forestry sector (183,181 ha) is based on Fire Bulletin data for all Oblasts, except for Mykolaivska, for which State Forest Resource Agency's data has been used.

124 Ember, "Carbon Price Tracker" (accessed February 21, 2023), *Link*.

Ukraine.[125] At over 440,000 ha of natural landscapes burnt, the annual losses come to US$148 million, or US$371 million over the 30-month loss period used here.

Overall losses from air pollution are estimated at US$14 billion, with the majority coming from PM2.5 pollution from forest and grassland fires (US$ 13.9 billion), followed by fires in oil depots (US$122 million) and destruction of armed vehicles (US$2 million). Emission volumes are determined in accordance with the Technical Manual for the Preparation of National Emission Inventories (EEP/EEA Guidelines),[126] and are multiplied by coefficients considering the hazard, environmental impact and scale of event, and a unit cost. The unit cost corresponds to the tax rate for emissions from stationary sources (Order 04/13/2022 No. 175[127] and Article 143 of the tax code[128]).

Reconstruction and Recovery Needs, Including Build Back Better

Recovery and reconstruction needs have been updated for the forestry sector and estimated for capacity building in environmental management (Table 50). Forestry sector needs alone are estimated at over US$1 billion for building back better over the period 2023–2033, mostly related to reforestation, reconstruction staffing and maintenance, harvesting and transport equipment, and road repair. Capacity-building activities for strengthening environmental governance will require an estimated US$420 million, mostly for emergency containment and clean-up of environmental pollution. While the needs associated with atmospheric pollution are not assessed, the RDNA2 shows that the scale of estimated damage and losses will translate into significant reconstruction needs, to be assessed at a later stage. Importantly, reconstruction efforts will need to reflect the need for Ukraine to transform to a green and net-zero economy, harmonized with EU environmental and climate goals.

Forestry sector needs are largely twofold. First, harvesting and wood-processing supply chains need to be reestablished in the 2023–2026 period to supply vital raw materials to export-oriented, rural employment–sustaining, and value-adding firms. Adequate resources remain in the forest, which is still accessible; but sophisticated software and management systems will be needed to ensure sustainability. Second, the forest itself needs to be restored during the entire 2023–2033 period in a way that maximizes its ecosystem services, including the provisioning services that can generate revenues and provide renewable and low-carbon raw material with a view to build back better principles. Preparation for such reforestation should begin immediately with the restoration and expansion of a network of modern closed-root nurseries.

Capacity-building activities should focus on training Ukrainian personnel on the following directions: (i) the reestablishment of environmental monitoring networks as well as laboratory infrastructure to analyze key environmental media (air, surface water, groundwater, soils, etc.); (ii) prioritized environmental cleanup actions to remove contamination sources and eliminate contaminant pathways for the sensitive receptors; (iii) the construction and commissioning of environmental pollution control infrastructure (for example, hazardous waste treatment facilities, engineered landfills, wastewater treatment plants) following the principles of build back better and using green technologies; and (iv) the establishment of a follow-up environmental monitoring program to assess remediation effectiveness.

125 I. Soloviy et al., "Integrating Ecosystem Services Valuation into Land Use Planning: Case of the Ukrainian Agricultural Landscapes," *Forests* 12, no. 11 (2021): 1465, *Link.*

126 European Environment Agency, "EMEP/EEA Air Pollutant Emission Inventory Guidebook 2019: Technical Guidance to Prepare National Emission Inventories," EEA Report No. 13/2019, 2019, *Link*.

127 *Link.*

128 *Link.*

2023 Recovery and Reconstruction Priorities

Forestry sector: In 2023, salvage of existing equipment and its relocation to safer zones should be prioritized. The forest planning unit "Ukrderzhlisproekt" VO should be re-established or relocated, as needed. It should be strengthened in its support of centralized strategic forest planning to minimize the long-term impact of the war on forest and ecosystem resources. In coordination with strategic planning, modern closed root nursery capacity should be re-established or relocated as necessary with a focus on balanced recovery and addressing the long term needs of the wood processing sector, and the provision of other climate resilient ecosystem services. The administrative functioning and mobility of staff should begin to be addressed, including in the repair and provision of office, vehicles, and equipment. While 2023 should be used to lay the foundations for sustainable long-term planning, it may be possible in 2024 to rebuild the harvesting fleet with modern machinery.

Capacity building and environmental assessments: The immediate priorities include (i) addressing the environmental emergencies to contain and clean up hazardous materials and pollution posing an imminent risk; (ii) undertaking preliminary field-based assessment of 5-7 priority contaminated sites posing greatest risk to human health and sensitive ecosystems; and (iii) providing capacity-building support for addressing environmental contamination and impacts of the war (Table 51).

Limitations and Recommendations for Future Assessments

This update considers needs related to forestry and capacity-building. Needs related to natural landscape fires can be assessed only after a detailed damage assessment. Estimating the needs for reducing air pollution requires further evaluations for each sector (energy, transport, extractives, metallurgy, chemical, urban, etc.) based on the planned application of best practices and modern technologies. The capacity-building analysis is largely qualitative but provides some estimates for future needs.

The RDNA2 is hampered by gaps in the data on various aspects of war-related environmental impacts in Ukraine. The data available are incomplete or lack validation of field data integrity. This means that it was not possible to assess the damage and needs due to pollution of soil, water, and ecosystems, including the marine environment, or the long-term consequences for climate change and biodiversity. It was also not yet possible to assess actual health costs of pollution, including air pollution or asbestos, since no data on exposure are known. In assessing forest fires, the RDNA1 relied on data gathered through remote sensing. However, field verification data by the State Forest Resources Agency of Ukraine showed much lower damage from forest fires, in some cases by several orders of magnitude, including in areas where the agency's access was not impeded. This discrepancy shows the importance of ground-truthing as a validating factor wherever possible in determining the extent of damage and recovery needs. Efforts are underway to progressively improve the forest fire estimates in Ukraine caused by the ongoing war.

It is essential for the Government of Ukraine to identify environmental hazards from the war, and to prioritize and implement options to minimize environmental risks to public health. This will require an assessment of hazardous environmental pollutants that impact the health of Ukrainians, as well as the identification of those environmental hazards that require immediate attention. Such a framework will help identify priority needs for clean-up and include no-regret measures that can be implemented during the war.

Table 49. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	-	-	5.9
Chernihivska	67.9	102.7	50.2
Chernivetska	-	-	4.4
Dnipropetrovska	-	-	3.3
Donetska	322.3	55.6	182.8
Ivano-Frankivska	-	-	10.7
Kharkivska	444.0	79.1	254.1
Khersonska	106.0	31.2	61.1
Khmelnytska	-	-	4.9
Kirovohradska	-	-	3.1
Kyivska	183.9	63.2	114.5
Luhanska	326.0	87.4	186.8
Lvivska	-	-	11.6
Mykolaivska	19.1	4.6	12.5
Odeska	-	-	3.8
Poltavska	-	-	4.6
Rivnenska	-	-	13.6
Sumska	1.0	53.5	8.5
Ternopilska	-	-	3.4
Vinnytska	-	-	6.5
Volynska	-	-	11.7
Zakarpatska	-	-	12.3
Zaporizka	15.5	15.1	10.5
Zhytomyrska	51.9	30.8	47.6
Nationwide (no specific region)	-	-	425.0
Total	**1,537.7**	**523.2**	**1,453.3**

Source: Assessment team.

Note: - = not assessed. Loss includes additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 50. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/ investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs in the forestry sector	Reforestation, equipment, road repair, and forest nurseries	274.5	582.7	857.2
Service delivery restoration needs in the forestry sector	Reconstruction staffing & maintenance, capacity building, forest information system	67.1	108.9	176.1
Reconstruction needs for capacity building	Environmental assessment, training, and cleanup	90.2	329.8	420.0
Total		**431.8**	**1,021.5**	**1,453.3**

Source: Assessment team.

Table 51. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated Cost
Reconstruction needs in the forestry sector for building two nurseries and procuring harvesting equipment	Reconstructing/relocating modern closed root nursery capacity	0.5
Service delivery restoration needs in the forestry sector	Repairing/reconstructing offices, assets, and vehicles, reestablishing "Ukrderzhlisproekt" VO forest planning unit	6.1
Reconstruction needs for capacity building and environmental assessments	Assessing 5-7 contaminated sites, capacity building for addressing environmental contamination, clean-up activities	5.0
Total		**11.6**

Source: Assessment team.

EMERGENCY RESPONSE AND CIVIL PROTECTION

Context

The Emergency Response and Civil Protection sector, along with other relevant actors, has been at the forefront in responding to immediate needs resulting from war-related damage. Since the beginning of the war, the State Emergency Service of Ukraine (SESU) has been actively providing essential and immediate support to vulnerable populations. SESU is the main institution responsible for civil protection and disaster risk management in Ukraine and is coordinated by the Ministry of Internal Affairs.[129] SESU's area of operations is defined by the Civil Protection Code and includes emergency response, search and rescue, evacuation, firefighting and hydrometeorological services.[130]

The war has exacerbated existing challenges in the sector. Even before the start of the war in February 2022, SESU's machinery and vehicles were reported to be outdated; such equipment has been pushed to its limit while also facing the effects of the war. The speed and effectiveness of Ukraine's emergency response activities have also been hampered by lack of funding, which has resulted in aging and poorly maintained facilities, an overstretched workforce, and outdated technical equipment for emergency response. In addition, the country's aging infrastructure stock is a significant driver of risk.

Damage and Loss Assessment

The aggregate damage recorded within emergency response/civil protection services amounts to US$179.7 million (Table 52), an 80 percent increase from the RDNA1 period. The majority of damage (US$170.5 million) is related to either damaged or destroyed buildings, mostly property of regional SESU units. Damage in this category increased 93 percent as compared with the RDNA1 period. The increase in damage to buildings did not result from damage to new buildings but rather from an increase in the share of buildings that were destroyed relative to the share of those that were damaged (45 percent vs. 55 percent respectively). In terms of territorial distribution, damage to buildings is mostly recorded in the Luhanska, Kharkivska, Zaporizka, and Donetska regions. The damage related to seized or destroyed vehicles amounts to US$8.3 million, with more than 60 percent of damage related to vehicles in Donetska oblast.

Losses are primarily related to the extensive involvement of SESU in war-related rescue and response operations, which have led to additional expenses in the amount of US$473.3 million. Since the beginning of the war, SESU has been involved in 82,007 emergency actions to respond to shelling damage and has extinguished 14,008 fires caused by shelling. While providing immediate support to vulnerable populations, SESU rescued 3,935 persons and provided psychological support to 203,485 persons. Given that this extensive work has been undertaken with no increase in staff, the losses related to payments for extra hours worked (UAH30,000 applied until February 2023 as per martial law) have been doubled.

The war has caused vast infrastructural damage that has significantly aggravated the risk of industrial accidents, which could also affect neighboring and/or riparian countries. Major industrial accidents, including war-induced ones, pose significant risks in Ukraine and could have severe and long-term consequences that exacerbate human suffering and cause serious environmental and economic harm. The ongoing war has already destroyed numerous

129 SESU is the competent authority of Ukraine under the UNECE Convention on the Transboundary Effects of Industrial Accidents. SESU also cooperates actively with United Nations Office for Disaster Risk Reduction (UNDRR) in implementing the Sendai Framework for Disaster Risk Reduction 2015–2030.

130 As part of SESU, 25 oblast-level bodies govern emergency response services, including firefighting, rescue units, and operation-communication centers. The early warning system under SESU is supported by the Ukrainian Hydrometeorological Center and covers both hydrometeorological conditions and geophysical processes. There are 59,039 personnel in SESU (including 36,000 first responders), of whom 12,469 (21 percent) are female and 46,570 (79 percent) are male.

industrial installations, resulting in the release of oil and other hazardous chemical substances.

Reconstruction and Recovery Needs, Including Build Back Better

The majority of needs in this sector are related to the overall improvement of the civil protection service. Given that the war is ongoing, SESU continues to provide immediate support to citizens as part of search and rescue operations. Thus, priority short-term measures must be connected to the procurement of new emergency response and firefighting vehicles to make up for the vehicles that were seized or destroyed (Table 53).

In the medium to long term, the focus should be on providing support to the civil protection system which has been burdened by inadequate and obsolete technical equipment. Equipment to support development of river/sea rescue teams, mobile command-control posts, and mobile decontamination units will be necessary. Additional vehicles, such as heavy emergency response trucks and firefighting trucks with ladders that can extend 30–50 m, are also needed for the complex emergency operations. At the 12th meeting of the Conference of the Parties of the UNECE Convention on the Transboundary Effects of Industrial Accidents (November 30–December 1, 2022), Ukraine presented its current needs and challenges related to prevention of, preparedness for, and response to industrial accidents. Specifically, Ukraine seeks to ensure power supply to hazardous installations; obtain special emergency and rescue equipment; receive expert support to further align national legislation with the convention, following Ukraine's recent accession;[131] benefit from technical missions to support implementation; continue cross-border cooperation in basins, such as the Danube delta; restore critical infrastructure; and address urgent environmental protection problems in the Dniester basin.

Among the facilities that were damaged or destroyed by shelling, SESU and hydrometeorology service buildings should have priority for reconstruction and repair. It will also be necessary to improve the system by developing new training centers, logistic hubs, platforms and hangars for helicopters, and shelters in civil protection facilities.

Finally, while focusing on the need to render immediate support, it is also critical to maintain and strengthen SESU's capacity. SESU must not only be able to respond to and mitigate impact from war-related damages but must also continue engaging in overall prevention and preparedness efforts, on national and regional levels. This entails strengthening national governance, legislation, and policy making for disaster risk management and mitigation, including risk and vulnerability assessments, and devising respective measures.

2023 Recovery and Reconstruction Priorities

Given that the civil protection system's priority now is to provide immediate support to citizens during the ongoing war, the urgent needs consist primarily of emergency rescue and firefighting vehicles. The number of such vehicles has been reduced due to destruction and seizure, while the demand has increased due to requests for support in emergency rescue operations. Therefore, the priority intervention in 2023 is to procure vehicles in the amount of US$117 million (Table 54). On top of this, debris should be removed from affected SESU buildings to ensure normal functioning of all the SESU units (US$13 million).

The process of budgeting the 2023 needs in civil protection should take into account that 48 partially damaged SESU buildings have been repaired to make them usable (the amount invested was US$0.3 million). Furthermore, a total of 115 vehicles have been procured (in the amount of US$23.6 million) and 291 have been donated as part of international humanitarian assistance (value of US$12.1 million).

Limitations and Recommendations for Future Assessments

This assessment follows the same principles and assumption as RDNA1. The baseline data and damage and loss figures were provided by the SESU. Given the continuation of the war, the continuing attacks on infrastructure, and hence the increased number of emergency operations conducted by SESU, this assessment takes into consideration the pressure and complexity under which this sector is functioning.

131 In 2022, Ukraine became a party to the UNECE Convention on the Transboundary Effects of Industrial Accidents. The accession culminated years of work in the area of industrial safety, seen as extremely important given Ukraine's high level of industrialization, sizable chemical industry, and rich mineral resources. UNECE, "Ukraine Joins UNECE Convention on the Transboundary Effects of Industrial Accidents," July 14, 2022, *Link*.

Table 52. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	-	13.4	28.4
Chernihivska	5.4	11.2	29.6
Chernivetska	-	10.3	21.8
Dnipropetrovska	1.0	34.0	58.8
Donetska	24.1	47.1	164.4
Ivano-Frankivska	-	15.6	16.3
Kharkivska	37.3	30.5	111.4
Khersonska	2.9	12.0	135.9
Khmelnytska	-	14.2	25.3
Kirovohradska	-	10.4	19.7
Kyiv (City)	1.1	34.0	42.4
Kyivska	9.7	20.8	78.2
Luhanska	48.4	30.6	229.2
Lvivska	-	28.6	53.6
Mykolaivska	8.9	12.7	83.9
Odeska	0.6	27.1	30.1
Poltavska	1.1	15.6	24.8
Rivnenska	-	13.2	34.4
Sumska	3.9	12.0	23.4
Ternopilska	-	11.8	22.2
Vinnytska	-	17.4	26.3
Volynska	-	11.8	15.6
Zakarpatska	-	14.4	11.3
Zaporizka	34.7	24.2	202.2
Zhytomyrska	0.8	13.6	16.2
Total	**179.7**	**486.5**	**1,505.1**

Source: Assessment team.

Note: - = not assessed.

Table 53. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Buildings	0	258.8	258.8
	Debris removal	13.2	0	13.2
Service delivery restoration needs	Vehicles	469.8	0	469.8
	Service improvement	0	763.2	763.2
Total		**483.0**	**1,022.1**	**1,505.1**

Source: Assessment team.

Table 54. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Types of priority activities/investments	Estimated cost
Reconstruction needs	Debris removal	13.2
Service delivery restoration needs	Emergency response vehicles	117.5
Total		**130.6**

Source: Assessment team.

JUSTICE AND PUBLIC ADMINISTRATION

Context

Despite the ongoing war, Ukraine's justice sector, courts, prosecutor's offices, and State Customs Service have continued to function. Those elements of the justice and anticorruption sector that were created and significantly reformed before the war—including the National Anticorruption Bureau (NABU), the Special Anticorruption Prosecutor's Office (SAPO), the High Anticorruption Court (HACC), and the National Agency for Corruption Prevention—have continued to operate as effectively and efficiently as possible under the circumstances. The new NABU director was appointed. 88 percent of Ukraine's courts continued to function over the past year.[132] Over 100,000 online hearings were held and rulings continue to be issued. While 38 courts are not controlled by Ukrainian authorities, their judges and staff have been reassigned to work in other courts. Ukraine's judges are being trained in how to conduct war crimes trials. Justice sector reform is ongoing. A renewed High Council of Justice restarted its operations with a quorum of 15 members after the Ethics Council completed its initial work reviewing candidates for professional ethics and integrity requirements. The High Qualification Commission of Judges is still not operational, though the Selection Commission began interviews with approved candidates in early 2023. Over 2,000 vacancies in the judiciary remain unfilled. The HACC issued 19 decisions during 2022, including decisions on the confiscation of Russia's citizens' assets under Ukraine's new Law on Sanctions, and it heard over 3,000 pretrial motions. The Customs Service in Ukraine has suffered significantly because of the war. Many customs posts were significantly damaged or even destroyed. Revenues from customs duties fell substantially due to a significant reduction in trade and turnover, an embargo on all imports from the Russian Federation, and changes to customs policy triggered by the new economic realities. Since the start of the war, the Ukrainian penitentiary system has faced extraordinary challenges. According to the Ministry of Justice data, in 2022, every third Ukrainian penitentiary was in an active combat zone, and one in 10 were in areas not under government control.

Damage and Loss Assessment

The war has had a significant impact on Ukraine's justice and public administration sectors. While the courts, anticorruption agencies, prosecutors', and Customs Service have been able to continue providing services, they have each suffered damage and losses of critical human and physical resources. Penitentiaries and probation institutions have also suffered extensive damage. Total damage since February 2022 is estimated at US$290 million. Kharkivska and Donetska oblasts have suffered the greatest damage (29.5 percent and 21.7 percent respectively). Loss totals US$1.4 billion (Table 55). Losses are concentrated in Kyiv and Kharkivska oblast, which account for 59.9 percent and 22 percent of total losses respectively. Further details on damage and loss in the various justice and public administration institutions are provided below.

Prosecution service. Since February 2022, 67 buildings have sustained partial damage and seven buildings of the prosecution service have been destroyed out of a total of 784 buildings. The total damage for the Office of the Prosecutor General (OPG) amounts to almost US$22 million. The damage cost was US$5.1 million for completely destroyed buildings and US$14.82 million for partially damaged buildings. The regions most affected by damage to buildings were Kharkivska, Khersonska, and Donetska oblasts. The greatest total damage and loss was identified in Kharkivska (US$7.9 million in damage and US$0.7 million in losses). This result for Kharkivska may stem from the return of part of this region to government control, making identification of damage and losses to the OPG easier. The infrastructure of SAPO was not damaged as a result of the war.

132 According to the United States Agency for International Development's Justice for All program.

Judiciary. Total damage for the judiciary since the start of the war is US$119.1 million, covering damaged and destroyed buildings plus damaged and destroyed vehicles, furniture, and other inventory. The greatest damage to courthouses occurred in the Donetska, Kharkivska, and Mykolaivska oblasts. Total losses for the judiciary, primarily the cost of demolition and removal of debris, are US$15.2 million.

Institutions under the Ministry of Justice (penitentiaries and probation institutions*).* Total damage is US$125.3 million, with most of the damage incurred by penitentiaries (US$123.8 million). The most affected regions were Kharkivska, Khersonska, and Zaporizka. Out of 3,556 buildings, 311 were partially damaged and 43 destroyed. The damage to buildings amounts to US$124.9 million (US$88.9 million partially damaged and US$36.02 destroyed). Losses amount to US$7.4 million, mainly due to costs of demolition and debris removal.

State Customs Service. Since the start of the war, the Customs Service has lost 43 buildings and had another 273 partially damaged. Chernihivska oblast suffered the greatest number of destroyed buildings (21), while Kharkivska oblast had 173 partially damaged buildings. Total damage for the Customs Service amounts to US$23.6 million, of which almost US$16 million is for partially damaged and destroyed buildings and US$7.6 million is for damage to vehicles, furniture, and other inventory. Completely destroyed buildings account for US$7.6 million and partially damaged buildings account for US$8.4 million. Total Customs Service damage was greatest in Sumska, Kharkivska, and Chernihivska oblasts.

Total losses for the justice and public administration sectors are US$1.4 billion. These include US$15.6 million for the judiciary, US$1.8 million for the prosecution service, US$1.4 billion for the Customs Service, and US$7.4 million for penitentiaries and probation institutions. The largest portion of the customs losses, US$1.4 billion, is for loss of fees from customs services (drop in customs revenues from the supply of gas, petroleum products, and electricity amount to more than US$850 million), with an additional US$1.4 million for removal of debris and demolition of damaged and destroyed buildings. The bulk of the losses in the judiciary are costs for removal of debris and demolition of damaged and destroyed buildings. The majority of losses in the prosecutors' offices were for removal of debris and demolition and the cost of purchasing furniture, equipment, and other inventory for repaired premises.

Reconstruction and Recovery Needs, Including Build Back Better

Total recovery and reconstruction needs for the justice and public administration sectors are US$646.9 million (Table 56). This includes approximately US$220.6 million in short-term needs and US$426.2 million in medium- and longer-term needs. The Kharkivska and Donetska oblasts account for the largest share of both short-term and medium/long-term needs. The judiciary accounts for US$265.3 million in total needs (US$90.2 million in short-term needs and US$175.1 million in medium/long-term needs), while the OPG accounts for US$60.2 million in total needs (US$27.9 million in short-term needs and US$32.3 million in medium/long-term needs). The Customs Service accounts for US$50.9 million in total needs (US$16.2 million short-term needs and US$34.7 million in medium/long-term needs). The needs of the penitentiary system and probation institutions amount to US$270.5 million (US$86.3 million in short-term needs and US$184.1 million in the medium/long-term needs). The greatest need in both the short and long term is reconstruction and rehabilitation of courthouses and of prosecution service and Customs Service buildings. The Customs Service will also need to increase its capacity in western oblasts, given the reorientation of trade routes toward the EU. Finally, the Customs Service will face a large need for funding to replace lost and damaged vehicles, furniture, and other inventory.

2023 Recovery and Reconstruction Priorities

In 2023, given the damage situation and the needs of institutions in this sector, the priority activities should include debris removal (US$25 million) and initiation of reconstruction (US$58.3 million) (Table 57). Some resources, albeit smaller (US$1.6 million), are also required for service delivery restoration needs.

Limitations and Recommendations for Future Assessments

The lack of data on assets in territories not under government control poses a great challenge to assessing damage and determining future reconstruction needs. Even after Sumska, Chernihivska, and most of Kharkivska oblasts were returned to government control, it has been practically impossible to access customs facilities for a thorough assessment of damage to buildings and movable property.

This analysis includes only partial data from institutions under the Ministry of Justice. Penitentiaries and probation institutions are included.

Data pertaining to other institutions under the Ministry of Justice and to the State Tax Service has not been integrated in this analysis. This gap could be addressed in future assessments.

Table 55. Damage, loss, and needs by oblast (US$ million)

Oblast	Damage	Loss	Needs
Cherkaska	0.5	0.0	1.0
Chernihivska	15.4	71.7	33.4
Dnipropetrovska	4.2	0.6	9.5
Donetska	62.8	8.5	141.0
Kharkivska	85.6	314.5	191.0
Khersonska	42.0	84.6	96.6
Kyiv (City)	0.1	853.6	0.2
Kyivska	5.8	0.5	12.9
Luhanska	9.4	0.9	21.9
Lvivska	5.1	0.1	10.9
Mykolaivska	14.2	1.0	30.8
Poltavska	2.6	0.0	5.5
Sumska	9.1	37.1	20.2
Zaporizka	29.4	52.3	63.3
Zhytomyrska	3.8	0.4	8.5
Total	**290.0**	**1,425.9**	**646.9**

Source: Assessment team.

Note: No damage reported for Chernivetska, Ivano-Frankivska, Khmelnytska, Kirovohradska, Odeska, Rivnenska, Ternopilska, Vinnytska, Volynska, and Zakarpatska. Loss includes an additional 18 months beyond the 12 months between February 24, 2022, and February 24, 2023.

Table 56. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/ investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Reconstruction needs	Judiciary	61.3	143.1	204.4
	Ministry of Justice	65.6	153.0	218.5
	Prosecution	10.5	24.4	34.9
	Customs	8.4	19.6	28.0
Service delivery restoration needs	Judiciary	28.9	32.0	60.9
	Ministry of Justice	20.8	31.2	52.0
	Prosecution	17.3	7.9	25.2
	Customs	7.8	15.1	22.9
Total		**220.6**	**426.2**	**646.9**

Source: Assessment team.

Table 57. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Priority activity/investment	Cost in US$ million
Reconstruction needs	Debris Removal	25.0
	Reconstruction initiation	58.3
Service delivery restoration needs	Vehicles	1.6
Total		**84.9**

Source: Assessment team.

EXPLOSIVE HAZARDS MANAGEMENT

Context[133]

The clearance of explosive ordnance (landmines, unexploded ordnance and improvised explosive devices) is a precondition to safe rebuilding, resumption of service provision, and return to normality in Ukraine. Effective and efficient mine action efforts, in particular nontechnical survey (NTS),[134] technical survey (TS),[135] and clearance,[136] are an essential part of land release. The "Five Pillars of Mine Action," described by the United Nations Mine Action Service (UNMAS), also include activities beyond survey and clearance which are critical to manage risks from explosive ordnance.[137] The extent of contamination from cluster munition remnants in Ukraine has not been quantified but is considered extensive. Ukraine also has unexploded ordnance and abandoned explosive ordnance remaining from the two World Wars and from Soviet military training and stockpiles. In addition to the presence of explosive ordnance as an impediment to access and recovery, there is a cost to support and rehabilitate survivors of accidents. Documentation from Office of the High Commissioner for Human Rights indicates that as of February 15, 2023, there were 632 civilian victims of mines and explosive remnants of war, 413 of whom survived and will need assistance and rehabilitation. The costs of supporting those injured are included within the Social Protection and Livelihoods chapter.

Reconstruction and Recovery Needs, Including Build Back Better

The National Mine Action Authority (NMAA) of Ukraine considers that 25 percent of Ukraine's territory has been exposed to the war (Figure 18), and although survey activities will continue to better define the true nature and extent of contamination, the cost for clearance of explosive ordnance across Ukraine is currently estimated at US$37.6 billion (Table 59). Within this figure are costs needed for significant investments in equipment, training, and salaries to expand strategic planning capability and the operational work force in the country. It will be essential to increase survey activities so as to enable early cancellation of non-contaminated areas and the prioritization of areas requiring the most urgent clearance, such as highly contaminated areas with a high concentration of civilian populations, and areas that are critical for restoring production and economic flows. Costs for NTS amount to US$200 million, for TS to US$9.8 billion, and for full clearance operations to US$27.6 billion (Table 58). These costs include procurement of demining machines, mine detection dogs, metal detectors, drones, personal protective equipment, vehicles, and other specialized equipment. Such investments will need scaled-up capacity to respond to additional demands in areas where government control has been restored and where active military actions have ceased.

133 In RDNA1, this sectoral assessment was labeled "Land Decontamination."

134 NTS is the starting point for identifying, accessing, collecting data on, reporting, and using information to define where mines/explosive remnants of war (ERW) are to be found, as well as where they are not. It also aids in identifying Suspected Hazardous Areas (SHA) and Confirmed Hazardous Areas (CHA) where further investigation and/or clearance need to take place.

135 TS techniques and methods involve a physical intervention and, use survey or clearance assets to enter a hazardous area to: (i) confirm the presence, or absence, of mines/ERW and identify the type of hazards present; (ii) better define the boundaries of the SHA or CHA that requires clearance; and (iii) collect information to support land release decision-making. TS can be broadly characterized as either targeted or systematic depending upon the information gathered about hazard and threat. TS assets must provide a high probability (near certainty) that the presence of expected hazard items will be indicated by the equipment and methodology in use and that TS personnel are safe to conduct the activity.

136 The most familiar and visible part of mine action is the clearance of mines and ERW. It is also the most expensive. Clearance refers to an intrusive information-gathering and threat removal process that fully defines a hazardous area while removing explosive hazards.

137 UNMAS, "5 Pillars of Mine Action," *Link*.

Figure 18. Reference map and areas exposed to war used as baseline

Source: Secretariat of NMAA and Mine Action Center.

2023 Recovery and Reconstruction Priorities

Explosive hazards management is an enabler of recovery and reconstruction, and thus the targeting of demining operations will be determined by other recovery and reconstruction priorities. Priorities in 2023 will include responding to the humanitarian needs outlined in the Humanitarian Response Plan 2023, and a focus on priority areas determined by the Secretariat of the NMAA: (i) residential areas; (ii) electricity and heating infrastructure; (iii) roads, bridges, and railways; and (iv) agricultural land. The total priorities for 2023 are estimated at US$397.1 million for NTS, TS, and mine clearance, including for four regions (Chernihivska, Kyivska, Sumska, and Zhytomyrska) with the equipment costs as part of mine clearance calculations (Table 60).

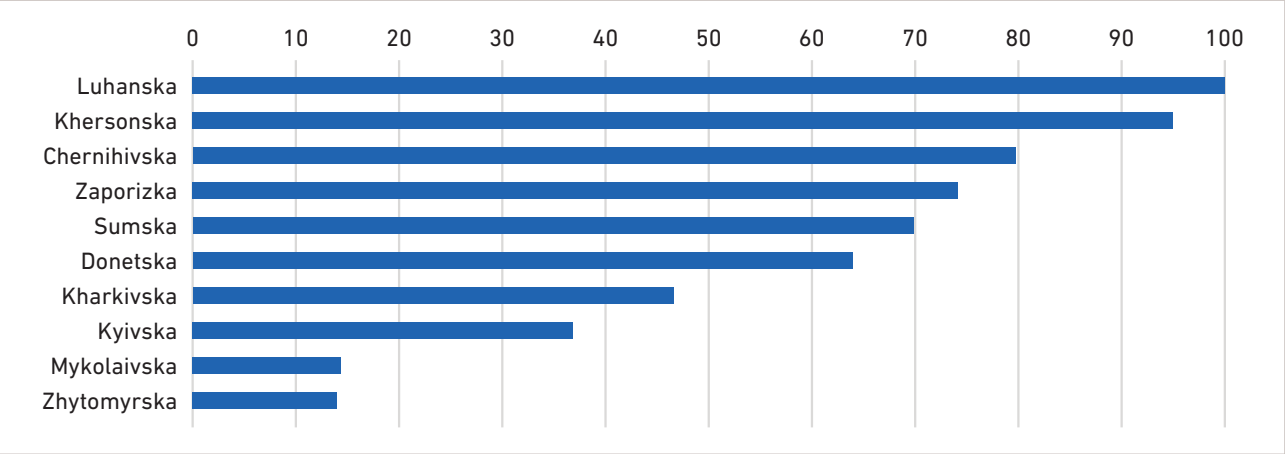
Limitations and Recommendations for Future Assessments

The estimated costs reflect some changes from RDNA1: (i) a reduction in the reported area considered as exposed to war (decreased from 267,638 km2 for RDNA1 to 187,732 km2) and therefore potentially contaminated[138] (Figure 19); and (ii) the introduction of a significant "cancellation of hazardous area"[139] component through NTS, applied differentially between northern and eastern oblasts. The estimated costs for survey and clearance activities consider the increased price of clearance from US$2 to US$3 per m2. As NTS activities are expanded, the nature and extent of the contamination will be better defined, and the projected "cancellation of hazardous area" component of the land release process will continue to gain accuracy.

138 The area of 187,732 km2 refers to the areas for NTS (165.44 km2), TS (13.2 km2), and clearance (9.18 km2), consistent with calculations under RDNA1 for the total area exposed.

139 This refers to "a defined area concluded not to contain evidence of explosive ordnance contamination following the non-technical survey of a SHA/CHA." See IMAS (International Mine Action Standards) 04.10, "Glossary of Mine Action Terms, Definitions and Abbreviations," 2nd. ed., January 1, 2003, *Link*.

Figure 19. Oblast exposure to war (percentage)



Source: Assessment team.

The operational costs are overly simplified but still represent an average. In reality, there is a phased approach to land release, in which the Ministry of Defense and the SESU units first conduct emergency clearance of non-surveyed areas ("spot tasks"), followed by more systematic area clearance in accordance with international standards conducted by additional operators. In addition, while the area used in the calculations incorporates both land and aquatic settings, no differentiation between terrestrial and underwater clearance approaches is made. Costs of equipment should also be assumed to be included in the square meter rate used.

Demining and the management of risks from explosive ordnance will be required over decades. Costs associated with the removal of anchored and floating sea mines in the Black Sea are yet unquantified. However, until the clearance of the Black Sea and Ukraine harbors is completed, (re) insurers of shipping vessels will continue to charge high and even historic levels for insurance—a cost that will eventually be passed on to consumers, a particularly significant issue in relation to grain exports.

Table 58. Explosive ordnance contamination and estimated clearance cost (US$ million)

Oblast	Km² thousand					US$ million			
			Estimated area			Estimated Cost for humanitarian mine action			
	Oblast areaa	% land exposed to war	Non-technical survey	Technical survey	Clearance	Non-technical survey	Technical survey	Clearance	Total
Cherkaska	20.9	0	0	0	0	0	0	0	0
Chernihivskaa	31.9	80	25.5	1.3	637	30.8	955.5	1,911.0	2,897.3
Chernivetska	8.1	0	0	0	0	0	0	0	0
Dnipropetrovska	31.9	0	0	0	0	0	0	0	0
Donetska	26.5	64	17.0	1.69	1.27	20.5	1,270.5	3,810.0	5,101.0
Ivano-Frankivska	13.9	0	0	0	0	0	0	0	0
Kharkivska	31.4	46	14.4	1.4	1.1	17.5	1,083.0	3,249.0	4,349.5
Kherson	28.4	95	27.1	2.7	2	32.8	2,030.2	6,090.0	8,153.0
Khmelnytska	20.6	0	0	0	0	0	0	0	0
Kyivskaa	28.1	37	10.4	520	260	12.6	390.0	780.0	1,182.6
Kirovohradska	24.6	0	0	0	0	0	0	0	0

Oblast	Km² thousand					US$ million			
	Oblast areaa	% land exposed to war	Estimated area			Estimated Cost for humanitarian mine action			
			Non-technical survey	Technical survey	Clearance	Non-technical survey	Technical survey	Clearance	Total
Luhanska	26.7	100	26.7	2.7	2.0	32.2	2,000.2	6,000.0	8
Lvivska	21.8	0	0	0	0	0	0	0	0
Mykolaivska	24.6	14	3.4	170	85	4.2	127.5	255.0	386.7
Odeska	33.3	0	0	0	0	0	0	0	0
Poltavska	28.7	0	0	0	0	0	0	0	0
Rivnenska	20.0	0	0	0	0	0	0	0	0
Sumskaa	23.8	70	16.7	417	208	20.2	312.7	624.0	956.9
Ternopilska	13.8	0	0	0	0	0	0	0	0
Vinnytska	26.5	0	0	0	0	0	0	0	0
Volynska	20.1	0	0	0	0	0	0	0	0
Zakarpatska	12.8	0	0	0	0	0	0	0	0
Zaporizka	27.7	74	20.1	2	1.51	24.3	1,507.5	4,521.0	6,052.8
Zhytomyrska[a]	29.8	14	4.2	208	104	5.0	156.0	312.0	473.1
Ukraine	**575.5**		**165.44**	**13.1**	**9.18**	**200.2**	**9,833.2**	**27,552.0**	**37,585.4**
US$/sq.km.						**1,210**	**750,000**	**3,000,000**	

Sources: Oblast area and percentage of land exposed to war: official/public information; European Space Agency WorldCover 2020 Land Cover, Link. Estimated NTS cancellation of hazardous areas percentage and operational costs: assessment team. War area: Information Management System for Mine Action (IMSMA) database, February 22, 2023.

a. Among northern oblasts, 95 percent of area is estimated to be canceled through NTS, leaving 5 percent for TS; 50 percent of that area is foreseen for full clearance. Among eastern oblasts, 80 percent of area is estimated to be canceled through NTS, leaving 10 percent for TS; 75 percent of that area is foreseen for full clearance.

Table 59. Recovery and reconstruction needs (US$ million) as of February 24, 2023

Category	Types of activities/ investments	Short term (2023–2026)	Medium to long term (2027–2033)	Total (2023–2033)
Service delivery restoration needs	Non-technical survey	80.1	120.1	200.2
	Technical survey	1,475.0	8,358.2	9,833.2
	Mine clearance	4,132.8	23,419.2	27,552.0
Total		**5,687.9**	**31,897.5**	**37,585.4**

Source: Assessment team. *Note:* Equipment to be procured in the amount of US$372 million for the short and US$400 million for the long-term needs (total of US$772 million) is considered as a prerequisite for mine clearance and therefore already included as part of the unit costs for NTS/TS and demining.

Table 60. Estimated 2023 implementation priorities (US$ million) as of February 24, 2023

Category	Priority activity/investment	Estimated cost
Service delivery restoration needs	Non-technical survey	34.3
	Technical survey	181.4
	Mine clearance	181.4
Total		**397.1**

Source: Assessment team.

TOWARD RECOVERY AND RECONSTRUCTION

Borodyanka City, Kyivska Oblast. Photo by Julia Burlachenko.

Emergency and Humanitarian Response

Since February 2022, the Government of Ukraine has taken the lead in coordinating humanitarian support to the war-affected regions and population. Online humanitarian aid platforms have been established to provide services, coordination, and support to Ukraine; these are operated by state authorities and volunteers. To support the population of IDPs,[140] a large-scale IDP program under the Office of the President of Ukraine has been put in place to provide cash assistance to households. This represents the main source of sustenance for the IDPs.

As of February 2023, the total support to Ukraine from the EU, its member states, and European financial institutions amounts to approximately €50 billion[141] (equivalent to US$53 billion).[142] In addition, the EU takes care of 4 million Ukrainians who fled their country and found shelter in EU member states. This brings the overall EU support to Ukraine and to Ukrainians in the EU to around €67 billion (US$71 billion). Through the Union Civil Protection Mechanism (UCPM), the EU has deployed *rescEU* assets, including power generators, medical equipment, temporary shelter units, and other specialized equipment, and has coordinated the medical evacuation of over 1,700 Ukrainian patients in urgent need of treatment. EU Logistics Hubs have been established in Poland, Romania, and Slovakia.

In response to the war, the Humanitarian Country Team, inclusive of UN entities, non-governmental organizations, and other partners have scaled up their presence in Ukraine and delivered in 2022 assistance to 16 million people through US$3.4s billion worth of assistance, including cash, food, medicine, generators, and winter supplies.[143]

The UN development system has supported the government's emergency early recovery efforts by mobilizing US$1 billion for technical assistance at strategic and sectoral levels and providing basic services to vulnerable people and local communities. It has also assisted with high-voltage energy equipment, critical infrastructure reconstruction, debris removal and demining, support for relocation of businesses and people's livelihoods, and strengthening of national and local authorities' crisis management capacity and ability to respond to population needs and vulnerabilities.

Since February 2022, the World Bank Group has mobilized over US$18 billion in financial support to Ukraine.[144] The World Bank's flagship financing instrument for Ukraine, the Public Expenditures for Administrative Capacity Endurance (PEACE) Project, enables international donors to provide support.[145] The World Bank also supports preparation and implementation of framework projects.[146]

Recovery and Reconstruction

The government is leading the country toward recovery and reconstruction. In April 2022, the National Council for the Recovery of Ukraine from the War was established, cochaired by the Prime Minister and the Office of the President.[147] This institution is charged with developing proposals for priority reforms and the postwar recovery and development plan. In July 2022, at the international Ukraine Recovery Conference (URC2022) held in Lugano, the Government of Ukraine presented a comprehensive US$750 billion Recovery Plan,[148] with targets for 2032 that focus on addressing war effects and impacts as well as broader economic development. To support the achievement of these targets, 15 national programs have been developed aimed at meeting targets in the short-, medium-, and long-term targets.[149]

140 The number of IDPs was 5.4 million as of January 23, 2023, as reported by IOM, "Ukraine International Displacement Report: General Population Survey, Round 12 (16–23 January 2023)," *Link*.

141 European Commission, "EU Solidarity with Ukraine," 2023, *Link*; Consilium, "EU-Ukraine Summit, 3 February 2023," *Link*; Consilium, "EU Response to Russia's Invasion of Ukraine," 2023, *Link*.

142 Using exchange rate of February 28, 2023, where €1 = US$1.06.

143 OCHA Ukraine. Ukraine: 2022 Flash Appeal Funding Snapshot - 21 February 2023. *Link*.

144 World Bank, "World Bank Financing Support Mobilization to Ukraine Since February 24, 2022," January 12, 2023, *Link.*

145 World Bank, "Supporting Ukraine through the War," 2023, *Link.*

146 World Bank, "World Bank Approves Initial $50 Million Grant to Help Repair Transport Infrastructure in Ukraine," February 10, 2023, *Link*.

147 Government Portal, "About the National Council for the Recovery of Ukraine from the War," *Link*.

148 Recovery.gov.ua, "Recovery of Ukraine," *Link;* URC2022, "Recovery Plan," 2022, *Link*

149 See Government of Ukraine, "Plan for the Recovery of Ukraine (□□□□ □□□□□□□□□□□ □□□□□□□□)," 2022, *Link*.

Several institutional and policy reforms have been implemented to support the recovery and reconstruction process. The Ministry of Infrastructure and Ministry of Communities and Territories Development were merged into the Ministry for Communities, Territories and Infrastructure Development (MCTID) to allow for better coordination and to make reconstruction of war-affected regions more efficient.[150] To support a more systematic approach to planning the restoration of Ukraine, the position of Deputy Prime Minister for Restoration of Ukraine was established; the minister in parallel heads the MCTID. The government is also advancing the completion of reforms in the construction sector, decentralization reform (which should include the promotion of locally driven recovery and reconstruction efforts), and implementation of the energy efficiency policy.

International partners are supporting recovery and reconstruction efforts. At the URC2022, international community representatives adopted the Lugano Declaration with a commitment to 12 actions, including establishing an effective coordination platform, fostering innovative approaches to recovery, and inviting the private sector, academia, civil society, subnational-level actors, and others to engage in the process.[151] In line with these commitments, in December 2022, the government and international development partners launched in thematic sector working groups, based on the chapters of the Recovery Plan, to jointly identify key principles and priority actions in each sector and to promote aid coordination and effectiveness. In January 2023, the EU facilitated the launch of a Multi-agency Donor Coordination Platform to support Ukraine's repair, recovery, and reconstruction process and to help bridge the gap between needs and resources.[152] The platform supports coordination among donors and financial organizations. The first meeting of the platform brought together high-level officials from Ukraine, the EU, and G7 countries, as well as financial institutions such as the European Investment Bank, the European Bank for Reconstruction and Development, the International Monetary Fund, and the World Bank Group. In December 2022, the Ukraine Relief, Recovery, Reconstruction and Reform Trust Fund (URTF) was set up by the World Bank to channel donor support.[153] Through the Economic Resilience Action Program, the International Finance Corporation provides for the immediate needs of Ukraine's private sector with a US$2 billion package to help build the Ukrainian private sector's resilience and support livelihoods.[154]

Guiding Principles for Recovery and Reconstruction

Guiding principles have already been identified and adopted by the Government of Ukraine and the international community. The key guiding principles of the government's Recovery Plan are to start now and ramp up gradually; grow prosperity in an equitable way; integrate into the EU and be consistent with and supportive of the accession path; build back better (for the future); and enable private investment and entrepreneurship.[155] The July 2022 Lugano Declaration for the Reconstruction of Ukraine outlines several guiding principles for recovery and reconstruction.[156] These include partnership, reform focus, transparency, accountability, and rule of law; democratic participation; multi-stakeholder engagement; gender equality and inclusion; and sustainability.

150 Government Portal, "Oleksandr Kubrakov Appointed Deputy Prime Minister for Restoration of Ukraine – Minister for Communities, Territories and Infrastructure Development of Ukraine," December 1, 2022, *Link*.

151 URC2022, "Lugano Declaration," 2022, *Link.*

152 European Commission, "Ukraine: Multi-agency Donor Coordination Platform for Ukraine Kick-starts Work," January 26, 2023, *Link*.

153 World Bank, "New Multi-Donor Trust Fund Established to Channel Donor Support to Ukraine," press release, December 16, 2022, *Link*.

154 International Finance Corporation, "IFC Launches $2 Billion Response Package to Support Ukrainian Private Sector," December 15, 2022, *Link.*

155 See Government of Ukraine, "Plan for the Recovery of Ukraine (ПЛАН ВІДНОВЛЕННЯ УКРАЇНИ)," 2022, *Link*.

156 URC2022, "Lugano Declaration," 2022, *Link.*

The RDNA1 proposed a set of complementary guiding principles that are based on international experience within post-conflict and post-disaster recovery and reconstruction efforts. These are confirmed based on the results of RDNA2, and the following principles are highlighted as the most relevant in the context of Ukraine:

- **Leadership and coordination by the government and partners**. This principle includes setting up common systems and processes for coordination, oversight, and so on as well as enhancing institutional, managerial, and technical capacity of implementing agencies /stakeholders to ensure mobilization and absorption of financial resources, including external and private support. These actions are critical to address implementation challenges and continue to enhance absorptive and implementation capacity of authorities and other stakeholders. These actions should also support implementation of recovery and reconstruction in a transparent and efficient manner that meets the established goals, avoids duplication of efforts led or financed by different actors, and is fully aligned with the still recent reforms on the devolution of power and decentralization in Ukraine.

- **Balancing urgent needs and medium- to long-term goals.** Overarching, sector-specific, and region-specific strategies can help guide efforts to meet immediate needs, including prioritizing the most vulnerable groups, supporting livelihoods and communities as well as safety and economic activity, and addressing through recovery and reconstruction the root causes of vulnerability and risks. This approach can simultaneously create conditions for planning of investments for medium- to long-term recovery and reconstruction. Strategic prioritization of reconstruction across all sectors and locally driven reconstruction efforts should be adopted to ensure best use of resources and interlinkages across them, and principles for recovery and reconstruction should be applied consistently.

- **Differentiated approaches that prioritize impact and needs and that promote decentralization**. Investments should reflect the specific needs of communities, oblasts, regions, and stakeholders. Local development plans should be encouraged and developed through subnational authorities to establish inclusive local-level recovery coordination mechanisms that ensure community participation and that engage a range of key stakeholders. These local mechanisms can support convening of authorities, civil society, community members, and private sector actors to design and provide tailor-made support for the needs of local communities and facilitate return and integration of refugees and IDPs. The approach should ensure focus on local governance and community needs and participation, and it should promote decentralization in line with the subsidiarity principle.

- **Resilience and building back better for a more sustainable future.** Recovery and reconstruction efforts should aim at rebuilding a prosperous and modern Ukraine. Investments should be made in sustainable solutions to reduce depletion of natural resources, cut emissions and waste, and protect people and the environment. Nature-based solutions and landscape restoration should be adopted to enhance adaptation and resilience building. Investments should flow alongside continued decentralization and reforms that will foster social cohesion and that will allow Ukraine to harmonize legislation and policies in line with the EU law, including EU standards and the *acquis communautaire*.[157]

- **Durable solutions for return of refugees and integration of displaced people, prioritizing their needs for housing, access to basic services, social protection, and livelihoods.** Partnership between central and local-level authorities, civil society, academia, and the private sector can help to design and deliver durable solutions with tailor-made packages of support to communities. These could include housing, access to basic services, social protection, mental health and psychosocial support, assistance with livelihoods and business financing, and technical assistance to facilitate return and integration of refugees and IDPs.

- **Continuous data collection.** All central- and local-level authorities, and other relevant stakeholders should continue to be engaged and coordinate for the purpose of continuous data collection and record keeping related to all damage, loss and impacts of the war, with a focus on vulnerable groups. They should also participate in the collection of information on ongoing/completed/planned repairs and reconstruction efforts to

157 EUR-Lex, "Acquis," *Link.*

help identify needs for 2023 and for future years. The overarching goal for improved data collection and processing is to enable further assessments of impacts and estimation of recovery and reconstruction needs. This information is critical to inform efforts at national and international levels and to provide timely, continuous, and local context–specific support to the affected communities.

Building Back Inclusively

Priorities to address the needs identified for each impacted group include the following:

Displaced persons. While most IDPs have secured some form of private accommodation, there is a need to support host family arrangements so they are retained over a longer period, to provide more affordable housing options, and to improve collective centers so they can respond to changes in demand over time, particularly for more vulnerable groups. Cash support is also important for IDPs as well as returnees without significant income sources, though efforts are also needed to provide more job opportunities in order to reduce the need for cash support. The rehabilitation of social and economic infrastructure to a standard comparable to that of European and other host counties and the provision of mental health and psychosocial support is an important dimension to attracting refugees to return to and stay in Ukraine.

Gender-specific impacts. It will be important to focus on female IDPs' need to generate income—both to ensure that immediate cash needs are met and to promote financial self-sufficiency. Pregnant and breastfeeding women, young single women, and women from minority groups (such as Roma and stateless women) require protection from gender-based violence, sexual exploitation, and abuse. While not included in this assessment report, a costing of the economic impact of gender-based violence could be planned in future, using accepted methodologies and calculating its direct and indirect tangible and intangible costs.

Persons with disabilities. Any new buildings, including shelters and modular homes, should be built in an accessible manner. Accessibility is more critical than ever, as the number of disabled persons (and likely their share in the total population) is climbing as a result of the war. Collective centers should be made more accessible, and capacity building should be provided for center staff to promote integration of people with disabilities. Training in digital literacy should be provided to enhance the use of e-services. Longer-term investments are needed in community-based inclusive development and rehabilitation approaches that apply across health, education, employment, and other sectors, and that promote the participation of persons with disabilities in decision-making on recovery, reconstruction, and responsive communities. Persons with disabilities who return after displacement in Europe will also bring back with them the valuable experience of accessible infrastructure and services, and these can inform reconstruction.

Veterans and their families. The Law on the Status of War Veterans and Guarantees of Their Social Protection includes 109 distinct benefits and subsidies, but veterans do not always take advantage of these. Improved information and outreach systems are needed to increase the uptake of services, possibly through one-stop shops. At the same time, assessing the financial implications of a significant increase in eligible beneficiaries and uptake in services will be important, since these increases will surely place increased strain on limited fiscal resources. Options for deferred forms of payments to beneficiaries could be explored to alleviate the short-term pressure on budgetary resources. Difficult choices may be necessary to reduce the number of benefits provided so that the most important benefits can be offered to all beneficiaries. The highest priorities for support are housing, pensions, medical assistance, legal services, employment support (including entrepreneurship), and mental health services. Facilitating the transition to civilian life will require building social cohesion and integrating veterans into recovery efforts. Comprehensive assistance to veterans should support their success in civilian life after military service while also addressing their combat injuries and losses.

Maximizing Private Financing for Green and Resilient Reconstruction

The scale of investment needed for Ukraine's reconstruction will be substantial and will require leveraging limited public and donor funding with private investment. Development partner support for public investment is key, but this public investment will have to be complemented by significant private investment to maximize the available financing for reconstruction. Some sectors and situations could deploy scarce public funding to leverage additional private investment. An opportunity exists to develop innovative financing structures to mitigate risks and enable more private finance once the situation has stabilized sufficiently for investing in reconstruction. As of February 2023, support is needed to keep the private sector functioning and able to sustain provision of basic goods and services.

The private sector remains the main engine of the economy. Prior to the war, the private sector accounted for 60–70 percent of Ukraine's economic output. However, GDP contracted by an estimated 29.2 percent in 2022. Merchandise export values contracted by 35 percent. Services export values fell by 12 percent. According to the RDNA2 estimates, the cost of direct losses of commerce and industry businesses, including SoEs and individual entrepreneurs' enterprises, stands at a nominal US$85.8 billion. The ILO estimates that around 2.4 million jobs have been lost, representing about 15.5 percent of pre-war employment. About 80 percent of employment and 60 percent of gross sales are provided by micro, small, and medium Enterprises (MSMEs) and there is evidence that they have been less resilient than large enterprises during the war.[158] The damage to the energy, transport, agriculture, and manufacturing sectors has been particularly extensive. While the banking sector has displayed considerable resilience, asset quality has significantly deteriorated.[159] The information technology sector continues to perform relatively well under the circumstances.

A private sector–led economic recovery requires sequential public policy decisions. Public policy could consider following the World Bank Group's approach to maximizing private financing for development (Box 3). This approach can be used to identify private opportunities across key sectors, as well as regulatory obstacles and post-war conditions that pose execution and commercial risks. Post-war, risks will decline gradually, supported by guarantees and risk-sharing instruments. Public resources can leverage the impact of sector reforms and risk mitigation instruments.

Some private financing will be immediately available for commercial reconstruction opportunities that do not require significant policy changes, and policy reforms will increase the amount available. Post-war private sector investment, including from retained earnings, will provide some resources to repair/replace damaged assets, for example in agriculture, industry and commerce, and telecommunications. Reconstruction will open private sector opportunities in logistics and construction companies. Investments will increasingly spread beyond damaged assets after the war ends and as policy reforms are continued. A transparent land market and effective land management system will boost agricultural growth and demand for private financing but will require work on the State Land Cadaster. Industry (such as pharmaceuticals and agro-processing) and commerce will benefit from an improved business

158 Every fifth business from the MSME sector had ceased operations by mid-April 2022; the share of large enterprises that did so was smaller. The situation has been improving, however, as MSMEs adapt to the new environment and resume their operations. See UNDP, "Rapid Assessment of the War's Impact on Micro, Small and Medium Enterprises in Ukraine," October 2022, *Link*. This finding aligns with a European Business Association survey showing that companies are adjusting to the war conditions. European Business Association, "Presentation of the Study Results: Small Business Sentiment Index 2022," *Link*. European Business Association, "83 percent of EBA companies experienced a drop in business performance for 2022," *Link*.

159 The regulatory capital adequacy ratio was 19.8 percent as of February 1, 2023, up from 16.7 percent as of June 1, 2022. Non-performing loans were 38.2 percent of total loans as of February 1, 2023, up from 26.6 percent as of March 1, 2022 (National Bank of Ukraine data).

Box 3. Maximizing private financing for development in the Ukraine context

Following the cascade principle, private finance will be prioritized where possible before exploring public sector solutions, as follows:

Commercial financing: Private financing has been flowing during the war to the Ukrainian private sector, such as the IT sector, albeit in volumes that are much smaller than needed. After the war ends, it remains to be seen whether commercial financing will be cost-effectively mobilized for sustainable investment, and if so at what scale and in which sectors.

Need for strengthened public sector capacity to support implementation of reforms: Upstream reforms addressing market failures are expected to support private sector development in the context of a reconstruction program that maximizes the development impact of Ukraine's limited public sector capacity. Reforms that address market failures —for example, country and sector policies, regulations and pricing, institutions, capacity, and so on—need to take into account the constrained regulatory and implementation capacity. While private investment can be expected to cover a significant part of post-war reconstruction needs, strengthened public sector capacity would critically enable a meaningful scale-up over the longer term.

Public and concessional resources for risk instruments and credit enhancements: Risks are elevated and thus risk management tools will be needed. The government and donors will have to innovate with these tools and compare the value for money they offer versus direct public investment. The cost-effectiveness (in terms of fiscal cost) of de-risking instruments and credit enhancements may need to be evaluated continuously over time as risks moderate. Rising levels of income will reduce the need for availability payments for social infrastructure. Even so, significant public resources may be needed to finance de-risking instruments during the immediate post-war period. If this is not feasible, public and concessional financing could be considered.

Public and concessional financing, including subsovereign financing: Using public resources—for example, development banks, sovereign wealth funds, multilateral development banks, and development finance institution—to address development objectives will require careful prioritization and sequencing, as short-term needs could overwhelm the available resources, in particular during the immediate post-war period.

Source: Adapted from World Bank, "World Bank Group Strategy for Fragility, Conflict, and Violence 2020–2025," 2020, *Link*.

climate, including streamlined regulations to make it easier to start and restart businesses.[160] Normalization of post-war business conditions will take time, and operational risks are projected to initially remain high; de-risking instruments financed by development partners may be needed even after the war ends.

The financial sector poses sector-specific challenges. Banks account for 89 percent of financial sector assets, and state-owned banks account for about half of all banking assets.[161] Damage and loss in the sector illustrate the importance of the sector for the economic recovery. Trade finance guarantees and risk-sharing facilities offer a short-term solution but cannot substitute robust financial sector service delivery. MSMEs are disproportionally underserved by banks.[162] Resolution of non-performing loans and restructuring/recapitalization of some banks may be necessary for ensuring sustainability of the financial sector and promoting large-scale investments in the sector. An emerging fintech sector may further

160 Prior to the war, it took an average of 61.5 days to obtain a construction-related permit. This is below the Europe and Central Asia region's average of 93.1 days, but represents an area of opportunity to support reconstruction efforts. In manufacturing, construction-related permits took an average of 101 days (region's average was 95.6 days). World Bank Enterprise Survey, 2019.

161 World Bank, GoU, and EC, "Ukraine Rapid Damage and Needs Assessment," August 2022, *Link.*

162 In 2018, the MSME finance gap was estimated at 36.5 percent of GDP (32.3 percent of GDP if only small and medium enterprises are considered). SME Finance Forum, MSME Finance Gap Database, 2018, *Link.* A European Business Association survey found that almost 60 percent of respondents consider bank loans to be difficult to get or inaccessible (n = 325 small businesses in Ukraine). European Business Association, "Presentation of the Study Results: Small Business Sentiment Index 2022," *Link*.

augment private sector financing opportunities, leveraging the government's expected digital targets for 2025.[163]

Policy measures are needed to make large-scale private financing available for the energy and transport sectors. The state has a large presence in both sectors. Private financing to restore the massive damage in these sectors requires a stronger public-private partnership (PPP) framework to enable greater private participation in infrastructure, completion of energy market reforms, and improved governance and performance of SoEs. These reforms and the preparation of PPP transactions will take time and likely prolong the period before substantial private investment in infrastructure can be expected. The need to rebuild offers an opportunity to invest in green resilient infrastructure. As a first step, the private sector might engage with SoEs if the government demonstrates a firm commitment to reforms.

Large-scale private financing in the social and utility sectors will require targeted consumer subsidies or availability payments to suppliers. The damage to housing, health, and education infrastructure requires urgent investment to provide services to existing and returning populations. Attracting private financing at scale will require revenues that are beyond the population's capacity to pay at this stage. Efficient use of public resources will depend on competitive performance-based contracts and transparent and fair communication with private firms and the population.

Public support will be needed even in sectors that would be commercially viable in normal circumstances, especially in eastern and southern oblasts. Public guarantees will need to compensate for Ukraine's near-default sovereign risk rating, which is projected to improve only gradually. Commercial risk will vary by sector and oblast and is projected to decline as income levels recover and markets stabilize. Post-war conditions in areas with widespread damage will pose challenges. To attract private investors to these areas may require targeted policy interventions that go beyond compensation for commercial risk and cover execution risk.

Private sector and community-based initiatives have provided important financing and in-kind contributions in response to the impact of the war. Going forward, community-based stakeholders will be an important source of social capital for the success of local-level recovery and reconstruction efforts and will also play an important role in oversight and accountability.

In line with the guiding principles and the build back better approach, it will be important to consider as part of the recovery process how to mobilize and align public and private financing toward longer-term sustainable development priorities for the future and ensure transparent and participatory planning.

163 Among the digital targets are these: the IT sector contributes 10 percent to Ukraine's GDP; 95 percent of the population has access to high-speed internet.

ANNEX 1. RDNA2 TEAM

The RDNA2 team would like to express its deep appreciation to all individuals and organizations who contributed to this assessment (listed below and in Table 61).

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