

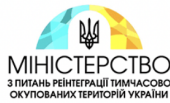
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МІНІСТЕРСТВО
ЕКОНОМІКИ
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МІНІСТЕРСТВО
З ПИТАНЬ РЕІНТЕГРАЦІЇ ТИМЧАСОВО
ОКУПОВАНИХ ТЕРИТОРІЙ УКРАЇНИ



МІНІСТЕРСТВО
ІНФРАСТРУКТУРИ УКРАЇНИ



Міністерство розвитку
громад та територій України

Assessment of damages in Ukraine due to Russia's military aggression as of September 1, 2022

September 2022

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INTRODUCTION

This report presents the results of the damage infrastructure assessment of Ukraine, incurred as a result of Russia's military aggression. **The report covers the period from February 24 to September 1, 2022.**

The damage assessment was carried out within the framework of the National Council for the Recovery of Ukraine from the Consequences of the War by the analytical team of the Kyiv School of Economics (KSE) together with the Ministry of Community Development and Territories of Ukraine, the Ministry of Infrastructure of Ukraine, the Ministry of Health of Ukraine, under the coordination of the Ministry of Reintegration Temporarily Occupied Territories of Ukraine and in cooperation with other relevant ministries and the National Bank of Ukraine.

The overall damage assessment was carried out in accordance with the methodology of the World Bank, and in close cooperation with the specialized team of the World Bank, considering the significant amount of micro-data collected by the specialized authorities, local civil-military administrations since the beginning of the full-scale war.

The assessment methodology involves the use of indirect methods, statistical data and certain assumptions, in particular, regarding the amount of damage in territories where active hostilities are still ongoing, physical inspection of which is limited due to danger (for example, mining of territories), or which are located in territories occupied by the aggressor. To calculate the value indicators of damaged and/or destroyed assets, averaged values are used, calculated on the basis of data from the State Statistics Service, relevant ministries, Prozorro tenders, etc., and correction coefficients according to the level of damage to objects. Financial reporting information, relevant at the latest available date, is used to calculate the value indicators of damaged or destroyed assets of large commercial objects, identified institutions.

At the same time, the receipt of information about the actual (compared to the previous assessment) state of damage to objects in the liberated and controlled territories of Ukraine is used as a proxy to refine assumptions about the level of damage and the extent of destruction.

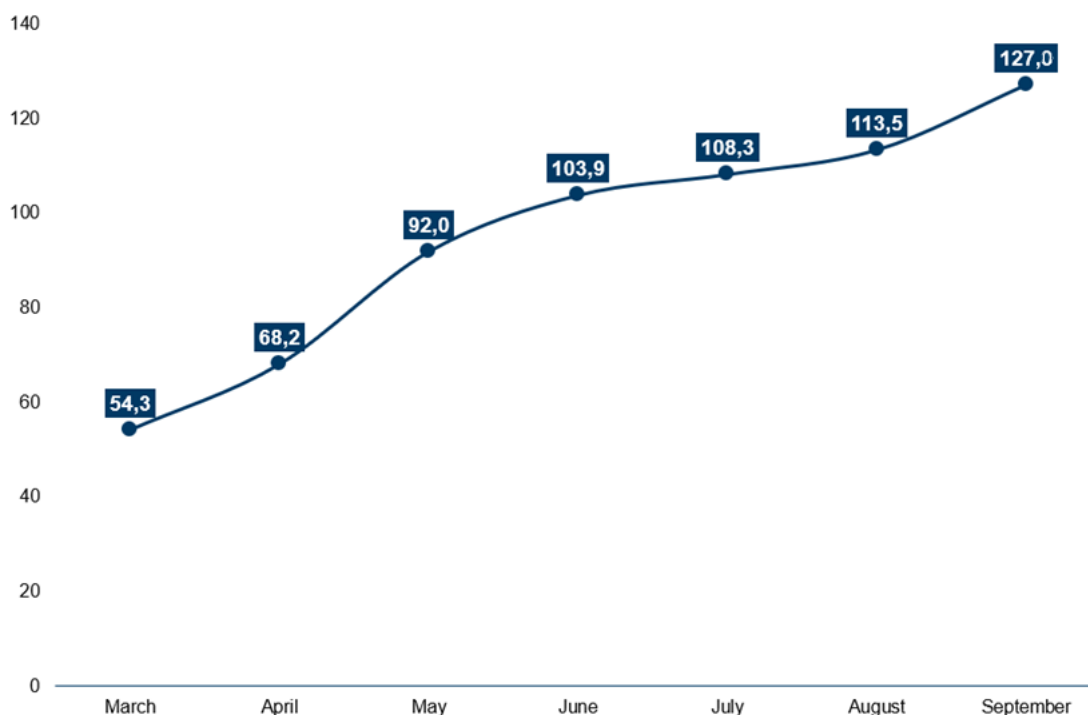
The research methodology is described in more detail in the materials of the working group "Audit of Damages Incurred as a Result of the War" at the link: <https://www.kmu.gov.ua/storage/app/sites/1/recoveryrada/ua/audit-of-war-damage.pdf>.

The calculation does not take into account damages caused after September 1, 2022, including those that occurred as a result of actions to de-occupy the territory of Ukraine. According to the data of the Ministry of Defense of Ukraine, from September 6, 2022, in particular, in the Kharkiv region, the armed forces of Ukraine liberated about: 8,500 square kilometers of territory, 388 settlements, and 150 thousand people.

Direct losses of the Ukrainian economy due to damages to infrastructure. Main conclusions

As of September 1, 2022, the total amount of direct documented damage to residential and non-residential real estate, other infrastructure amounted to more than \$127.0 billion (at replacement cost).

Dynamics of the aggregate damage assessment of Ukraine, \$ billion

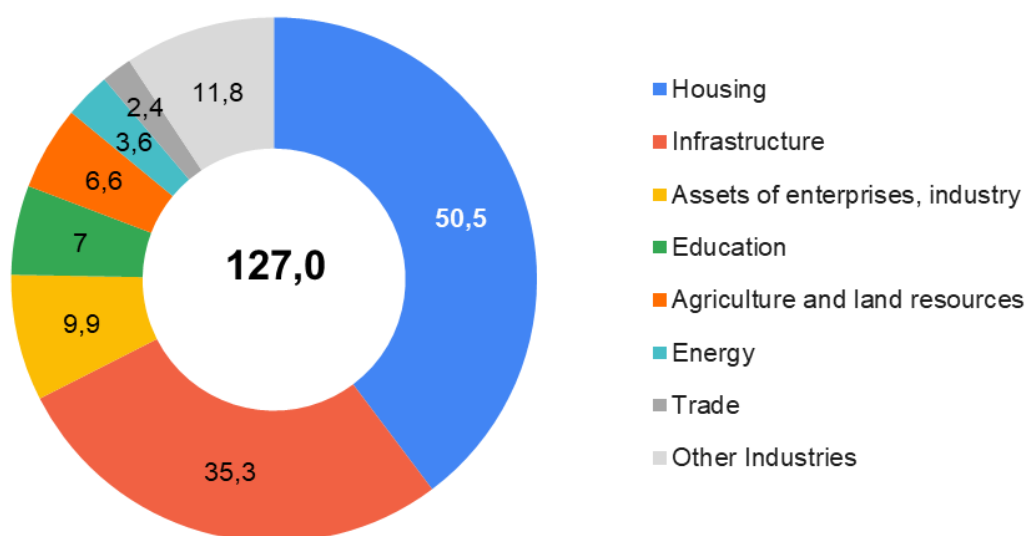


Source: Kyiv School of Economics

The largest share in the total volume of damages belongs to residential buildings (39.7% or \$50.5) and infrastructure (27.7% or \$35.3 billion). Business asset damages are at least \$9.9 billion and growing rapidly. Another \$6.9 billion are damages to the agricultural sector as a result of the war.

Cumulative direct losses from the destruction and damage of public sector objects (social objects and institutions, educational, scientific and health care institutions, cultural buildings, sports facilities, administrative buildings, etc.) amount to about \$11.6 billion.

Damages by type of property, \$ billion



Source: Kyiv School of Economics

In the first weeks of the war, at the end of February and the beginning of March, hostilities were conducted on the territory of 10 regions. As of early September 2022, hostilities continue in Kharkiv, Luhansk, Donetsk, Kherson, Mykolaiv, Zaporizhia, and Dnipropetrovsk regions. The most affected are the regions of Ukraine in which hostilities were directly fought: Donetsk, Kharkiv, Luhansk, Mykolaiv, Zaporizhzhya, Kyiv and Chernihiv regions. Among the cities that suffered the most during the war, Mariupol, Kharkiv, Chernihiv, Severodonetsk, Lysychansk, Sumy, Rubizhne, Izyum, Mykolaiv, Bakhmut, and Volnovakha.

Total damage assessment in monetary terms as of September 1, 2022.

Property type	Damage assessment, \$ billion	Share of damages by type of property, % of the total amount
Residential buildings	50,5	39,7%
Infrastructure	35,3	27,8%
Enterprise assets, industry	9,9	7,8%
Agriculture and land resources	6,6	5,2%
Social sphere	0,2	0,1%
Vehicles	2,7	2,1%
Education	7,0	5,5%
Trade	2,4	1,9%
Energy	3,6	2,8%
Health care	1,6	1,3%
Utilities	2,3	1,8%
Culture, tourism, sports	2,0	1,6%
Administrative buildings	0,8	0,7%
Digital infrastructure	0,6	0,4%
Financial sector	0,1	0,1%
Environment	1,5	1,2%
Total	127.0	100%

Source: Kyiv School of Economics

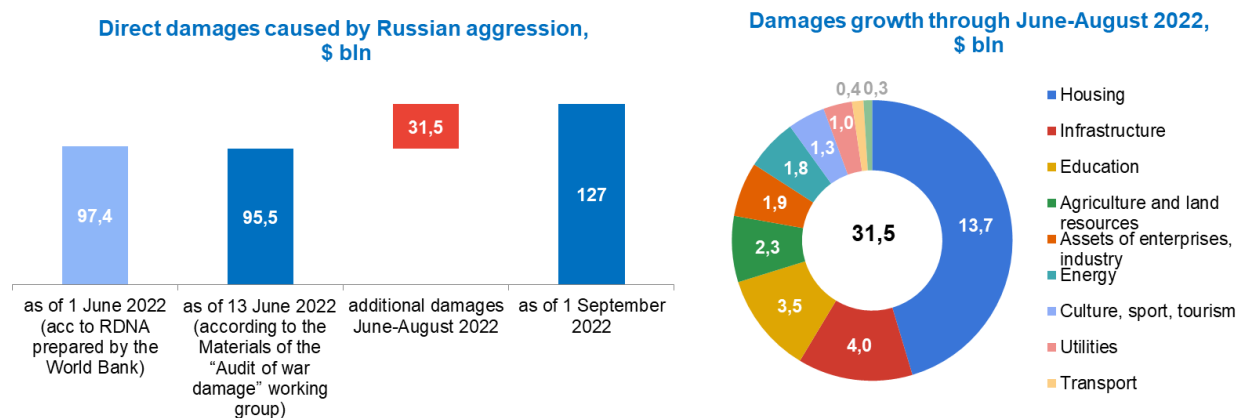
Analysis of the growth factors of damages to physical infrastructure for June-August 2022

The continuation of the Russian Federation aggression in the summer of 2022 led to an increase in the damage amount caused both by missile strikes on the country's infrastructure, as well as shelling of cities and towns, and by active hostilities in the south and east of Ukraine. Regular monitoring of losses for June-August 2022, conducted by civil-military administrations and ministries, allows for a regular assessment of the current state of losses from Russian aggression. In June-August 2022, Ukraine additionally suffered more than \$30 billion in losses to its assets.

The biggest growth is related to the increase in housing damages. Over the past three months, this amount increased to \$50.5 in September. The three most affected areas, in addition to the destruction of the residential sector, include the area of infrastructure with damages amounting to \$35.3 billion and industry and damaged enterprises — for \$9.9 billion. For another \$6.95 billion, Russia destroyed and damaged educational institutions in which Ukrainians and pupils and students from other countries studied. Damages caused to land resources and agriculture during the period of the active phase of armed aggression from February 24, 2022 are estimated at \$6.9 billion.

Compared to the beginning of June 2022, there was a significant increase in the number of destroyed and damaged infrastructure objects: from 121,000 to 136,000 objects, the number of residential objects affected by the war increased from 777 to 978 - medical facilities, from 111 to 616 — administrative buildings, from 105.2 thousand to 188.1 thousand — private cars.

Analysis of the growth of damages to residential and non-residential buildings, other infrastructure of Ukraine for June-August 2022



Source: Kyiv School of Economics

A final assessment of the amount of damages and destructions is possible only after the end of hostilities on the territory of Ukraine.

The report is structured according to the sectoral principle: a general assessment of damages is provided for each sector. At the end of the report there are summary tables with data for each sector/industry.

SOCIAL SECTOR

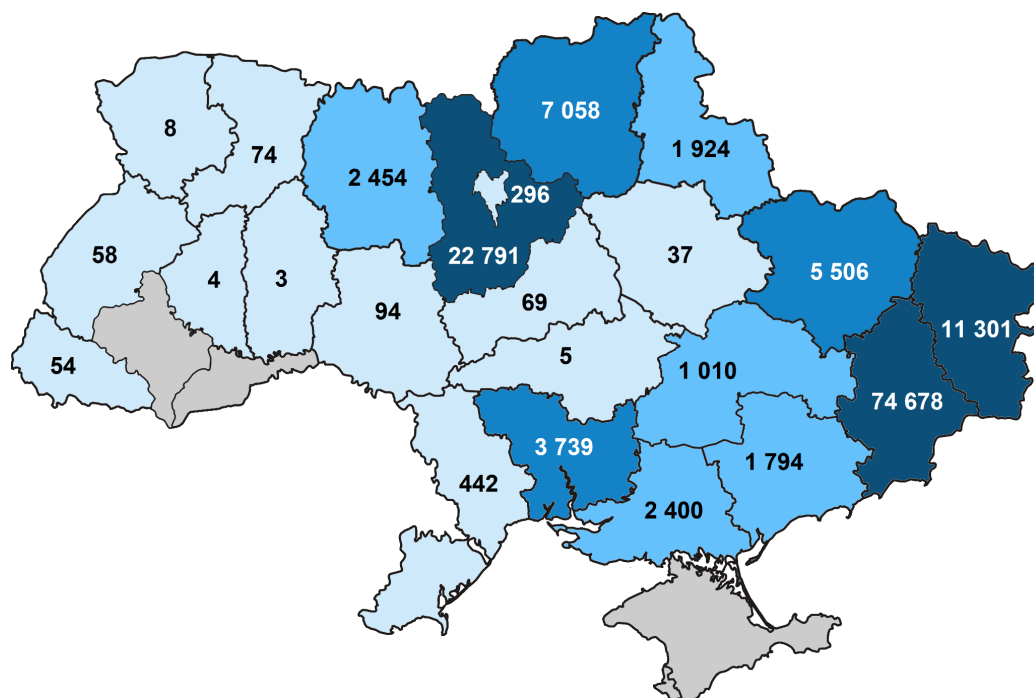
Housing and administrative buildings

Active rocket and artillery shelling of cities, as part of the tactics of fighting, leads to massive destruction of the housing in cities, especially those located near/on the front line. According to preliminary estimates, as of September 1, 2022, more than 50% of the entire housing stock was damaged or destroyed in a significant number of cities and towns as a result of hostilities of the Russian Federation. This creates a need not only for the reconstruction of individual buildings, but also for the comprehensive reconstruction of cities, the development of new urban planning documentation, etc.

The housing of such cities as Mariupol, Kharkiv, Chernihiv, Severodonetsk, Rubizhne, Lysychansk, Popasna, Izyum and Volnovakha suffered the greatest destruction. For example, according to preliminary estimates, 90% of the housing stock in Severodonetsk was damaged. At the same time, the number of damaged residential buildings (both multi-story and individual buildings) is increasing every day due to the continuation of active hostilities in the territories of Kharkiv, Luhansk, Donetsk, Zaporizhzhia, Kherson, and Mykolaiv regions and the temporary occupation of part of the territory of Ukraine.

According to preliminary data of the regional military administrations, as of September 1, 2022, the total number of destroyed or damaged housing stock is about **135.8 thousand buildings**, among them 119.9 thousand are private (individual) houses; 15.6 thousand — multi-apartment buildings; 0.2 thousand - dormitories.

Regional distribution of the number of destroyed or damaged objects of the housing stock



Source: Kyiv School of Economics

The total area of damaged or destroyed objects is 74.1 million square meters, which is 7.3% of the total area of Ukraine's housing stock. According to preliminary estimates, 18,600 residential buildings (with a total area of 16.3 million sq. m.) were partially damaged (the degree of destruction is less than 10%). 45,100 residential buildings (their total area - 27 million sq. m.) were medium damaged (degree of destruction - more than 10%, less than 40%); 72.1 thousand residential buildings (their total area - 30.8 million sq. m.)¹ were completely destroyed (the degree of destruction is more than 40%). According to the results of detailed object-by-object technical

¹ The distribution of data on degrees of damage was carried out on the basis of analysis of object-by-object data and expert assumptions.

inspections of buildings, this ratio may change. According to the results of detailed object-by-object technical inspections of buildings, this ratio may change.

So, the housing of about 1.2 million households (about 3 million people) is damaged or destroyed.

According to preliminary estimates, the value expression of damages for the housing stock is \$50.5 billion.² This is more than a third of the total damages of Ukraine as of September 1, 2022.

Only in order to return housing to its previous state, it will be necessary to spend in the following areas:

- ongoing repair of residential buildings;
- major repair or reconstruction of residential buildings;
- new construction;
- restoration of the adjacent territory near residential buildings (fences, benches, landscaping, children's and sports grounds, etc.);
- purchase of durable goods (furniture, household appliances).

In addition, according to preliminary data, 616 administrative buildings were destroyed as a result of hostilities, of which: 595 - buildings of state and local government bodies; 21 — centers for the provision of administrative services. According to preliminary estimates, the value expression of damages for administrative buildings is \$0.8 billion

Health care

Documented damages of healthcare facilities amount to \$1.6 bn. In total, since the beginning of the war, at least 978 health care facilities have been damaged or destroyed.

The health care facilities whose damage is assessed as part of the project include hospitals, polyclinics, dentistry, consulting and diagnostic centers, medical offices, paramedics and midwives stations, dispensaries, rehabilitation and health centers, laboratory centers and blood centers, outbuildings of health care facilities health. Losses from destruction caused to private medical facilities are calculated separately.

Data on the destruction of healthcare facilities was obtained from the Ministry of Health (for public facilities), microdata (for private facilities) and from open sources.

Information on the number and cost of beds, area of the objects, the cost of square meter and cost of similar objects in the Prozorro public procurement system, as well as data from open sources on the degree of damage to objects is used to calculate losses.

Damages to healthcare facilities account for about 1.3% of the total cost of losses in Ukraine. Dispensaries (356) and hospitals (289) are the most destroyed or damaged types of facilities, while hospitals accounted for more than 80% of the cost of all damages in the industry. As of September 1 at least 24 private medical facilities were damaged. However, the documented losses include primarily state institutions.

Educational institutions and objects of scientific infrastructure

One of the biggest victims in terms of the number of destroyed, damaged and lost infrastructure objects is the field of education. In total, more than 2,000 educational facilities were damaged as a result of the war. Additionally, the war interrupted the educational process, and the state was forced to reduce budget expenditures in this field to direct part of the "educational" funds to more urgent needs of the state (primarily defense, addressing the consequences of damages and increased need for social protection).

² При розрахунку прямих збитків як базові використовувались значення опосередкованої вартості спорудження житла за регіонами України станом на 01 січня 2022 р, затвердженої [наказом Мінрегіону від 17 лютого 2022 р. №53](#), а також інші складові вартості заміщення, що були розраховані на основі ринкових вартостей та експертних припущень.

Direct documented damages from the destruction of educational institutions amount to \$6,95bln. In total, as a result of hostilities, at least 810 were destroyed and 1865 objects of educational infrastructure and 1693 were damaged.

The educational institutions whose damages are assessed as part of the project include preschool (kindergartens), secondary (schools), extra-curricular, pre-higher (colleges and technical schools), higher (institutes, universities, academies) and specialized education institutions.

The main damages in the field of education concern secondary, pre-higher and technical schools, due to their prevalence and attractiveness to be used during hostilities by the aggressor's manpower. Despite active fighting took place in 11 regions, educational institutions were damaged in 18 regions. There are no losses from the damages and destruction of educational institutions in the Volyn, Zakarpattia, Ivano-Frankivsk, Poltava, Ternopil, and Chernivtsi regions.

The largest number of destroyed educational institutions was recorded in Donetsk, Kharkiv, Luhansk and Kyiv regions. Among the damaged and/or destroyed educational facilities, the largest number belongs to schools (1270) and kindergartens (786).

Objects of scientific infrastructure

At the time of preparation of this report, there is only limited data on damages to scientific infrastructure facilities.

According to preliminary calculations, 117 objects of movable and immovable property of 34 institutes and other institutions of the National Academy of Sciences of Ukraine were destroyed, damaged and seized for the needs of the Armed Forces of Ukraine. The preliminary total estimate of losses of scientific institutions of the National Academy of Sciences only amounts to \$ 7,8 million.

Social services

Due to large-scale hostilities in various regions of Ukraine, social facilities, including social protection institutions, geriatric institutions, sanatoriums, children's camps and orphanages, and boarding schools, institutions for work with the homeless were damaged.

Damages of social networks amount to \$0.2bln (in replacement prices, at the hryvnia exchange rate as of December 31, 2021).

This includes the destruction and damage of social infrastructure facilities under the Ministry of Social Policy. The assessment was made on the basis of data on the destruction and damage of social objects provided to the Ministry of Community and Territory Development.

The largest share in the total number and cost of damages belongs to social centers, sanatoriums and boarding schools.

Among social objects, the least number of destroyed or damaged institutions were documented compared to other infrastructural objects in the country. The destroyed objects of the social sphere are located in the Luhansk, Donetsk, Zaporizhzhia, Kyiv, Mykolaiv, Sumy, Kherson, Chernihiv regions and Kyiv. The damaged objects of the social sphere are located in Kyiv and the following regions: Kyiv, Donetsk, Dnipropetrovsk, Zhytomyr, Zakarpattia, Zaporizhzhia, Luhansk, Mykolaiv, Sumy, Odesa, Kharkiv, Kherson, Chernihiv.

Culture, sports, tourism

Culture, sports and tourism have suffered significant as a result of the war, not only in terms of their size in the total loss, but also in terms of moral value. The cultural sphere is a special part of the national identity and therefore the restoration of damaged cultural institutions and objects will play an important role in rebuilding the country in the postwar period. At the same time, the tourism sector is one of the important areas in the development of the country's attractiveness, both from the point of view of the economy and the promotion of the country's integration into the world and European space.

Due to the high intensity of hostilities in eastern and southern Ukraine, as well as regular rocket fire throughout its territory, most cultural, sports, and religious institutions have ceased operations or significantly reduced them. As a result, 12.5 million residents of at least 6 regions of the country (Donetsk, Zaporizhzhia, Luhansk, Mykolaiv, Kharkiv, and Kherson regions) have lost access to cultural services, and other 13 million people from 7 regions have limited access to them.

Losses of national cultural heritage are difficult to assess in terms of not only the physical value of objects, but also due to their cultural value. [The Hague Convention](#) of 1954, to which Ukraine joined in 2020, obliges countries to refrain from committing a hostile act against cultural values during an armed conflict.

According to the national cultural heritage registers, there are about 15,500 objects of cultural heritage in Ukraine, of which about 1,200 - national importance objects and 14,300 - local importance. These objects are arranged according to eight types: historical, architectural, archaeological monuments, landscape, objects of monumental art, objects of urban planning/urban development, objects of garden and park art, and objects of science and technology.

In general, as a result of the hostilities since the beginning of the full-scale invasion, important cultural and religious objects have been destroyed, including the Holy Dormition Sviatohirska Lavra, the Mariupol Drama Theater, the National Literary and Memorial Museum of Grigory Skovoroda, the Museum of Antiquities in Chernihiv, the Kharkiv "Slovo" building and others. In addition, some art collections were lost, in particular, a [collection](#) of Scythian gold discovered by archaeologists in the 1950s, which was probably taken by the occupation authorities from the Melitopol Museum of Local Lore.

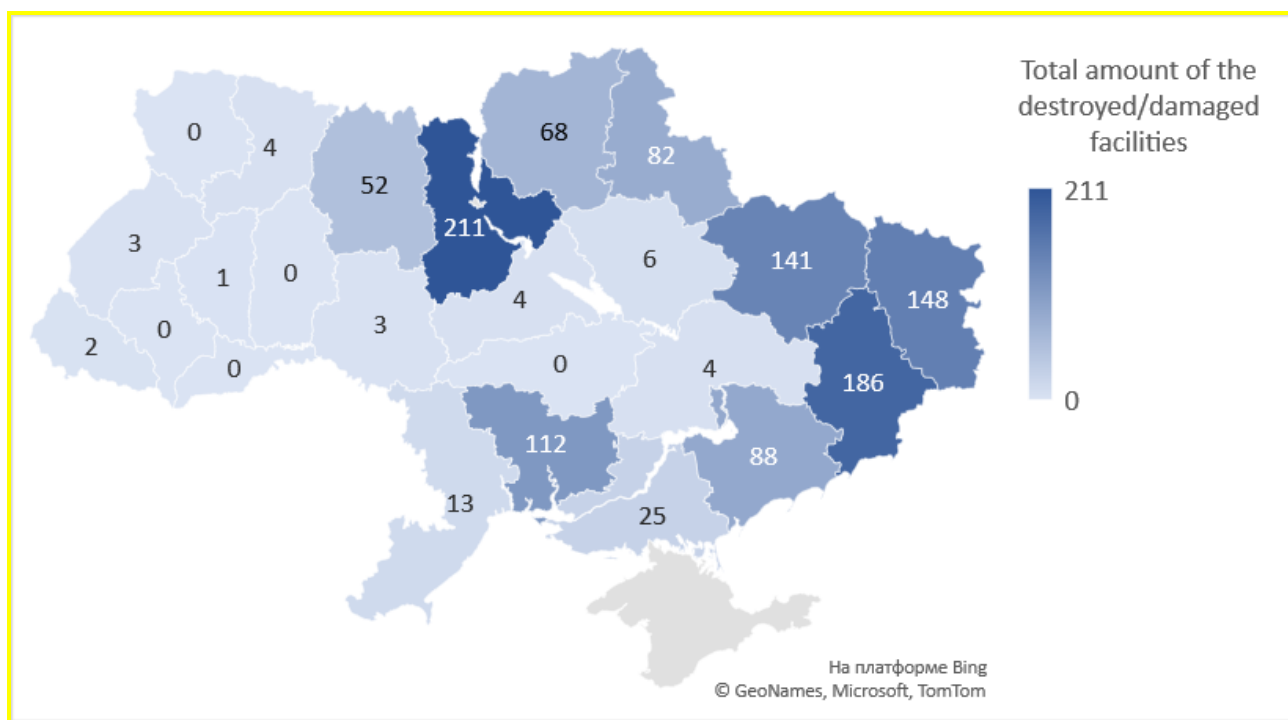
Currently, the assessment of cultural heritage damages is based on data on the object-by-object list of damaged/destroyed objects provided by witnesses and local administrations, which creates risks of incompleteness of data. Due to the lack of access to most of the affected facilities due to their location in the war zones, the list is incomplete and continues to grow.

According to the estimates of the World Bank, as of the end of July, the loss of immovable cultural heritage is estimated at more than \$900 million, movable - \$200 million.

Since the beginning of Russia's military aggression, according to the documented losses, 77 temples/churches, 335 houses of culture/palaces of culture, 59 sports schools, 33 museums, and 149 tourist facilities have been damaged in Ukraine, which are mainly located in 14 regions of the country: Dnipro, Donetsk, Zhytomyr, Zaporizhzhia, Kyiv, Luhansk, Lviv, Mykolaiv, Odesa, Sumy, Kharkiv, Kherson, Chernihiv and Kyiv.

As of September 1, the share of direct damage caused to the infrastructure of culture, sports, and tourism is \$2 billion. In total, since the beginning of the war, at least 775 cultural objects, 80 religious buildings, 149 — tourism, and 153 — sports have been damaged or destroyed.

The number of destroyed/damaged cultural objects, units



Source: Kyiv School of Economics

An important methodological limitation of this assessment is that the financial value of the objects is calculated without actual cost of their cultural value due to the difficulties in its remote calculation as well as the absence of a single and integral register of cultural buildings, which would contain detailed data on cultural heritage, art objects. Given this limitation, damages to libraries and museum collections, costs for relocation of museum funds, etc. are not included into the damages assessment at the current stage. Projects of restoration, conservation, museification of cultural heritage sites are developed individually for each site, taking into account a set of survey data and world best practices, which requires the involvement of international experts. The valuation of such projects takes time and is based primarily on the results of a comprehensive survey and careful documentation.

The assessment of the value of damaged or destroyed cultural objects is complicated by the difficulties with indirect assessment of the value and value of the interior decoration of religious and other cultural institutions, objects of art, decorations, exhibits, icons, frescoes, etc. contained in the buildings. Accordingly, the value of damaged objects that have cultural value can be changed in accordance with the establishment of the possibility of restoration of these objects and its cost.

PRODUCTIVE SECTOR

Industry and business services

The total damage to the assets of enterprises is estimated at \$9,9 bln. In total, at least **412** enterprises have been damaged or destroyed since the beginning of the war. Probably, the actual figure is higher, because not all companies have information, especially when it comes to the temporarily occupied territories.

Enterprises can be divided into two groups. The first are destroyed accidentally or as a collateral damage during the shelling of military units and settlements. The second are destroyed deliberately, as part of targeted strategic missile strikes. In addition to the transport and energy infrastructure facilities described in the relevant departments, these are primarily military and dual-production use facilities. Unlike the first group, which is concentrated in the frontline regions, the second is evenly distributed throughout Ukraine.

Damages include:

- Damage to property, plant and equipment (initial valuation is taken because it is not possible to acquire an asset at its book value in most cases);
- Damage to unfinished capital investments;
- Damage to inventories of finished goods and intermediate materials (we assume that in most cases the stocks were located near the main production facilities).

Depending on the availability of data, losses are calculated in one of the following ways:

- For private enterprises for which the owner has reported her own estimate of losses, after verification, such estimate is used;
- For large and medium-sized private enterprises, for which the level of damage is known, the financial statements are taken as of the last available date. We distinguish between destruction (100%) and partial damage (40%).
- For the enterprises of the state sector the estimations provided by the ministries and agencies whom respective enterprises report to (if available, otherwise we use financial reports, as in the case of private enterprises).
- For small private enterprises, an indirect calculation based on of the level of damage on housing in each oblast as a proxy, was done.
- For private entrepreneurs we estimate their assets (using ratios of revenues to assets for legal entities), then damages are calculated similar to small private enterprises.

The main conclusions about the losses of enterprises are as follows:

1. Enterprise assets are the third largest item of damages. It accounts for almost 8% of the total damages.
2. In terms of industries, metallurgy suffered the most. In particular, two enterprises were destroyed, which are the largest in the list of damaged / destroyed - Azovstal and MMK. Ilyich (both - Mariupol, see the list in Annex 7I).
3. In terms of regions, the Donetsk region suffered the most, accounting for almost half of the total damages of enterprises. Also significant losses in Kharkiv, Luhansk and Kyiv regions.

Commerce

The total damages to the retail are estimated at **\$2.4bln.**³ During the fighting, 2,910 retail outlets with a total area of 1.6 million square meters were severely damaged. It is difficult to calculate the final number of damaged objects at this time due to the continuation of active hostilities in Kharkiv, Luhansk, Donetsk, Zaporizhzhia, Kherson, Mykolaiv regions and the temporary occupation of some territories.

The following establishments and objects were included in the objects of the branch:

- Warehouses (excluding wholesale warehouses),
- Pharmacies,
- Shops,
- Gas stations.

Information on the destruction of these facilities was obtained from members of the Association of Retailers of Ukraine and the Ukrainian Council of Shopping Centers, the professional community, and from open sources.

Damage assessment was performed according to the expert method of standardized interviews and online surveys of owners and top managers of retail companies, taking into account the area and nature of damage to the building, based on the cost of construction and repair work, equipment and inventory. The survey involved 295 leading network companies that represent about 1000 brands and have 28,5 thousand outlets with a total area of 15,4 million square meters.

The calculation includes: the cost of restoration of buildings owned by companies, the cost of repairs, utilities, the cost of store equipment and inventory, the cost of warehouses owned by companies, warehouse inventories, and vehicle fleet.

This does not include enterprises with less than three outlets, merchants in the street markets, warehouses of wholesalers and manufacturers, stores that have suffered only minor damages.

Damages and losses of **shopping centers**, which are not participants of the retail market themselves, but provide space for such participants, are calculated separately. **Damages to shopping centers amounted to \$362 million.**

Shopping center status is granted to commercial real estate objects that are considered shopping centers according to the ICSC European classification of shopping centers. According to this classification, a shopping center is an architectural structure with a lease area of more than 5000 square meters, which has a professional management company and at least 10 tenants. In total, there are 329 shopping centers in Ukraine, another 19 new ones were to open in 2022.

Estimation of damage was done by an expert method taking into account the area and nature of the damage based on the construction cost of \$ 800-1100 per m², depending on the type. The calculation does not include losses of tenants (equipment and goods), they are taken into account in the previous section.

³ Estimates were not updated from the previous report due to the reporting of new comprehensive data. Survey of market participants continues

Agriculture and farmland resources

As of September, the amount of damages to Ukraine's agro-industrial complex is \$6.9 bln.

Assessment of damages in Ukrainian agriculture includes the following main components: agricultural machinery, elevators, and other storage facilities; livestock and beekeeping; damage to perennial crops; damaged and stolen inputs, harvested grain, and oilseeds. The assessment of damages to the farmland will be provided in the following issues of the report.

The damages are estimated by an indirect method, using relevant state and regional statistics as well as the results of the farmers' survey. The survey conducted for the World Bank's Ukraine Rapid Damage and Needs Assessment by IPSOS was used as a principal input for damages estimation.

The single largest source of damages is destroyed and damaged agricultural machinery and equipment. This category's replacement and repair cost is estimated at \$ 3 bln. The second largest category of damages is damaged and stolen grain and oilseeds, with an estimated value of \$1.87bln.

The elevators and other storage capacities also suffered substantial damages, which noticeably limits Ukraine's ability to store the harvest. The combined capacity of the destroyed storage facilities is estimated at 6.5 million tonnes, while the combined capacity of the partially damaged storage facilities reaches 2.9 million tonnes. The estimated repair and replacement cost is estimated at \$1.1 bln.

INFRASTRUCTURE

Transportation infrastructure

Infrastructure facilities were one of the key areas that came under most attack by the aggressor with the deployment of a full-scale war against Ukraine. In particular, in the first weeks of the war, Russian forces carried out massive shelling of aviation infrastructure, primarily airfields not only for military, but also civilian and military-civilian (dual-use) purposes. Subsequently, railway infrastructure, including electrical substations, became the targets of active attacks.

But the greatest destruction of infrastructure, both in absolute terms and in terms of value, was to road infrastructure. Firstly, given that they naturally become targets of shelling during artillery attacks, and secondly, because it is Russian tanks that are actively moving along Ukrainian roads during the entire period of military aggression. In particular, lines of communication between Russian forces in Ukraine and their rear areas in Russia and Belarus are often run by the roads.

Since the war started, 19 airports and civilian airfields, at least 110 railway stations have been damaged. Total damages amount to \$35.3bln.

Road maintenance

A detailed analysis of the condition of damaged roads could be implemented only within a specialized technical survey, which is not possible until active fighting is still going on in a significant part of the territory of Ukraine.

However, a comparison of the map of combat operations with the infrastructure network allows making preliminary calculations as to what approximate length of roads has been damaged, both as a result of rocket fire and tank movements. According to the study 'Damaging effect of moving tank loads on flexible pavement', Journal of Engineering, 2010, the destructive effect of a tank can be as much as 2.36 times the destructive effect of a standard axle load from civilian vehicles. This study took T-72 tanks, which is a good approximation in the case of war in Ukraine since most tanks are similar in physical characteristics or even heavier. The surface layer of the roads suffers severe damage due to the metal tracks. The destructive effect of tank braking is 2.38 times more than the destructive effect of tank mass on road stretching. Finally, the destructive effect of tank manoeuvres is 1.22 times greater than the effect of the destructive effect of the tank mass on the stretching of the road. What is important - the stress effect from the tank is not only horizontal, but also vertical, and the maximum stress, according to the research, is at a depth of up to 3 meters, which affects the degree of destruction of not only the surface layer of the road.

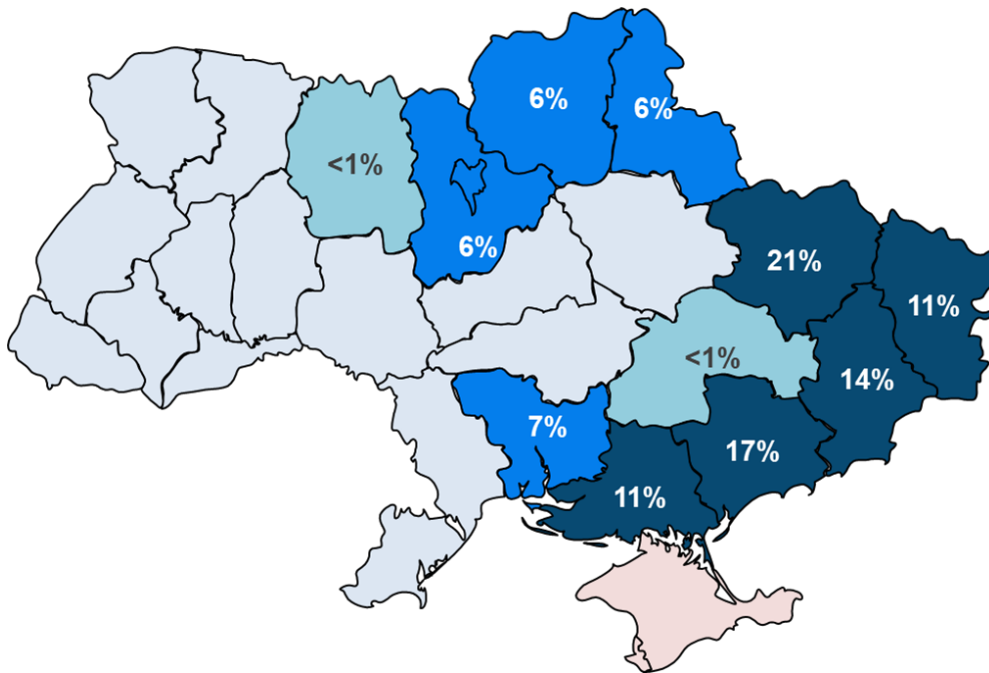
About 25.0 thousand km of roads and 315 of bridges and bridge crossings were damaged. According to the Ministry of Infrastructure, a preliminary review of road conditions in the de-occupied regions (Chernihiv, Kyiv, Sumy, Kharkiv regions) confirms preliminary estimates of significant damage to the road structure as a result of the passage of tanks and other heavy military equipment, which will require reconstruction of a large part of the damaged roads. Those preliminary estimates show that the share of damaged roads in the regions varies greatly (0-95%) and averages about 10% of total road length in regions that were/are occupied by Russian troops or where fighting took/takes place.

According to the state agency of automobile roads of Ukraine (Ukravtodor), the average weighted cost of reconstruction of roads in 2021 (taking into account different categories of roads) was approximately \$1.06 million per 1 km of road. Thus, preliminary estimates of the total damaged roads is \$26.6bln. An estimate of damages of bridges adds \$1.9bln.

Additionally the military aggression has led to significant losses in the road construction industry due to the cancellation of state capital investment in the planned roads building since the beginning of a war. Losses are estimated at \$5bln.

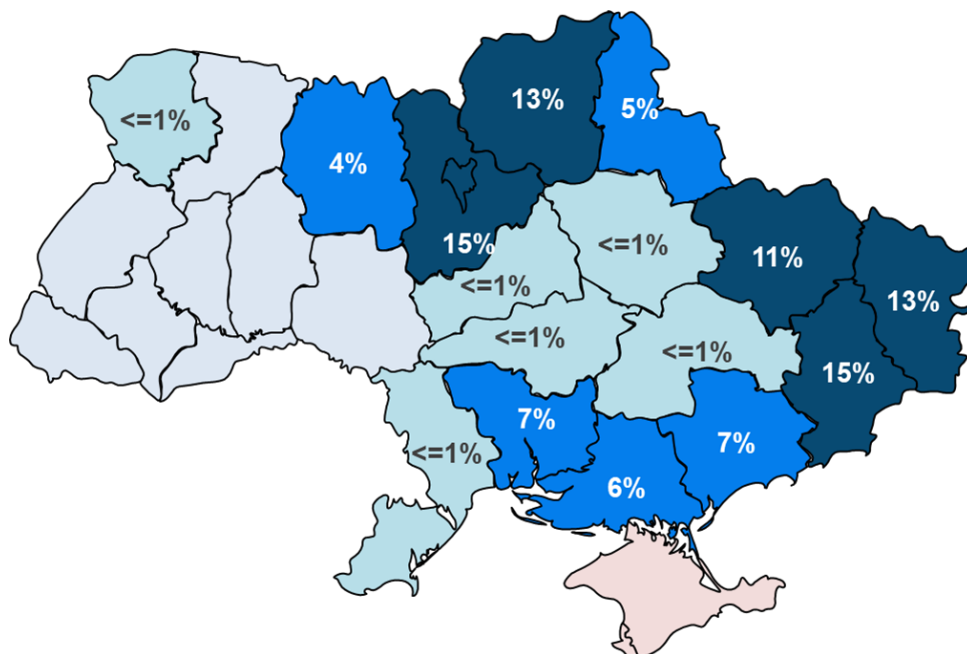
An important factor for the road reconstruction will be the disruption of supply chains; a decrease in the domestic supply of materials needed for reconstruction; a significant increase in competition for materials given the nationwide reconstruction needs; and risks of devaluation of the national currency.

The Share of Road Damages (in Value Terms) by Regions



Source: Kyiv School of Economics

The Share of Bridge Damages (in Value Terms) by Regions



Source: Kyiv School of Economics

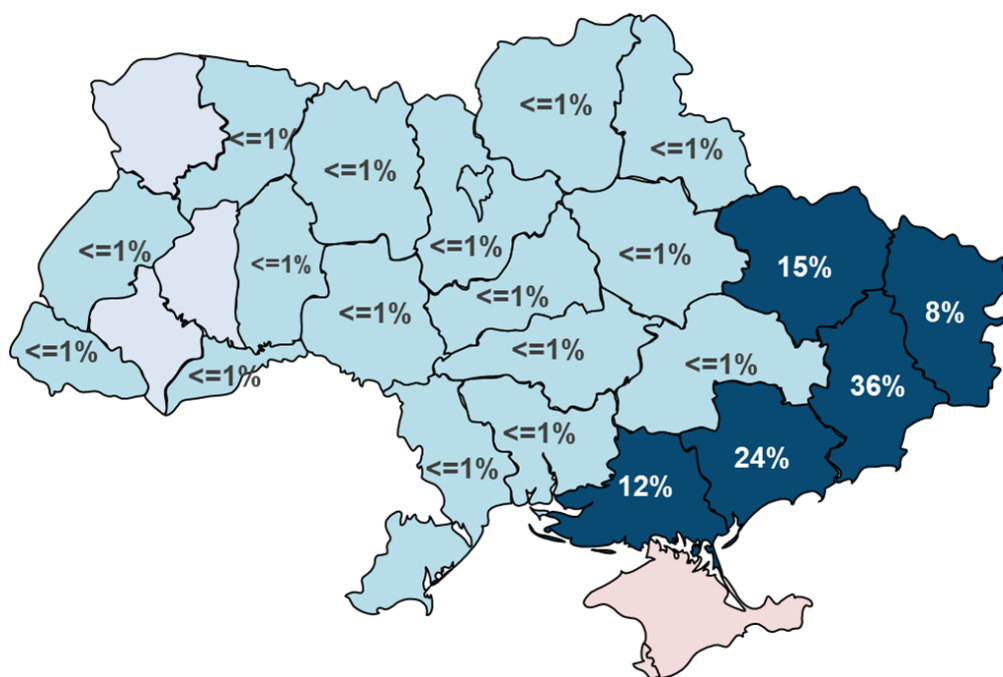
Railroad Infrastructure

With the outbreak of war, the Ukrainian railroad took the brunt of the free of charge evacuation of millions of Ukrainian citizens (as well as a large number of businesses) caught up in the war zone; as well as the delivery of critical supplies and equipment to those regions. In response, the Ukrainian railroad has become an active target of Russian shelling and attacks.

The total damaged railroad bed is up to 500 km; the number of damaged railway stations and stations is at least 110. As of September 1, more than 1,000 km of railroad tracks are located in the temporarily occupied (after 24.02.) territory. There is reason to believe that all movable property of "Ukrzaliznytsia" (UZ), which was not removed from such territories in time, can be considered as completely lost (destroyed or stolen by the troops of the aggressor country).

Thus, the total damages of the railroad are estimated at \$4.3bln as of August 26.

The Share of Railroad Infrastructure Damages (in Value Terms) by Regions



Source: Kyiv School of Economics

Aviation industry

The aviation industry began to suffer losses from the military aggression even before it had actually started. On February 12, global insurance companies informed Ukrainian carriers that they had stopped insuring aircraft due to the high threat of invasion by Russia. This led to the risk of cancellation of flights of international air carriers to Ukraine. To counter this a working meeting with the leadership of the Office of the President of Ukraine, the State Aviation Service, SE "Ukraerorukh", SE IA "Borispol" and Ukrainian airlines was held and the government expressed its willingness to support air carriers by providing additional financial guarantees to the aviation market.

With the outbreak of the war, the airspace over Ukraine was immediately closed and air traffic ceased. Russian forces began active rocket attacks on all key airfields in Ukraine in an attempt to deprive it of its ability to provide air defense. As a consequence, 19 airfields were damaged out of 35, including 12 civilian and 7 dual-purpose airfields (not including military airfields). Some of the airfields were hit several times each.

As in the situation with roads, detailed information on the state of damage / possibilities for repairing airfields at most airports can be established only after detailed technical surveys, which, in turn, are possible only after the end of active hostilities in the area where the airports are located (for those with of them located in the central, southern, eastern, and northern parts of Ukraine) However, according to preliminary estimates, the total amount of damage to the aviation industry (airports, airfields, aviation equipment) is about \$2.14 billion.

Water transport

The total damage to water transport infrastructure is estimated at \$496 million. This estimate includes both seaport infrastructure and inland water transport facilities destroyed during the war.

At least four ports have had property destroyed or damaged since the war began. For example, the grain terminal at the Nikolaev port of Nika Terra was destroyed, damages were done to now occupied ports in Mariupol, Berdyansk and several others and some damages were recorded in Odesa ports.

The moderate destruction of ports is due to two factors. Firstly, the port is quite a complex and spacious facility, consisting of many large parts. So it is impossible to completely destroy such an object with a few precise missile strikes. Second, the aggressor seized or used its own and friendly cargo ships in order to export grain, ferrous metals, etc., for which it needed operating ports (on occupied territories).

For example, the Metinvest group reported the enemy's plans to remove 200,000 tons of metal products worth \$170 million from the Mariupol plants. In turn, regarding grain, it was reported that 400-500 thousand tons (worth hundreds of millions of dollars) were stolen from the four occupied southern regions, which is more than a third of the local reserves. It is expected that the aggressor will try to sell these stocks through partners in the Middle East, particularly through Syria. (Clarification: stolen stockpiles of goods are not included in the above figure, they are accounted for in the losses of the relevant industries).

The ports of Mariupol, Berdyansk, Skadovsk and Kherson are occupied. The ports of Mykolaiv and a few other cities are shut down. There is no traffic on the Dnipro due to the blockage of the lower part of the river. Only the ports on the Danube River work, their turnover increased fourfold compared to the pre-war period.

Current Situation of Ukrainian Ports

UKRAINIAN PORTS DURING THE WAR

TOP
LEAD

Almost all Ukrainian ports are closed due to occupation, blockade, mine danger, and the danger of the piracy by Russia.

- 1 Will work as a logistics center
- 2 Entry and exit is not possible
- 4 Don't work
- 5 Occupied since 2014
- 3 Work as usual
- 3 Partially resumed work



Source: UA War Infographics

Postal operators

Total damages to postal operators are estimated at **\$11 million**. The amount is calculated based on data from Ukrposhta and Nova Poshta, which account for the lion's share of the market. A total of several hundred post offices, dozens of terminals/depots and vehicles, as well as a large number of parcels, for which the operators are financially responsible, have been destroyed or damaged since the beginning of the war.

Vehicles

In the territories and cities where heavy fighting took place, both public and private vehicles were severely damaged. **The direct damage to both municipal and private carriers is \$0.66bln, which we calculate as replacement costs for destroyed trolleybuses, trams and buses. Damages of private cars (we estimate at 188 thousand vehicles) is estimated at \$1.7bln. Also 623 firefighting vehicles worth \$30 million were damaged/lost**, excluding other specialized equipment and trucks (to be calculated at the later stages). Damages to private cars are calculated based on available data of the officially registered cars and excludes cars that are not registered and customs cleared in Ukraine.

Damages to municipal transport vehicles are calculated using both indirect methods and micro data available on damaged/destroyed municipal property provided by regional military administrations.

The greatest damage to municipal property, which includes municipal (public) transportation, was inflicted in Luhansk and Donetsk regions, as well as in Kharkiv. This is related to the fact that the Russian aggressor used heavy military equipment/artillery to damage civilian infrastructure. That resulted in c. 60% of damages, according to the estimates, to public transportation in the Donetsk region and over 70% in the Luhansk region. We estimate that the public transportation sector (both municipal and regional) is de facto ruined in these two regions. These two regions also account for the biggest part of damages/losses of private cars among all Ukrainian regions.

The vehicles damaged include the destroyed "Mriya" aircraft, with the damage estimate, according to "Ukroboronprom", at \$0.3bln (replacement costs are expected to be much higher). Although damages to air passenger transport are likely to be higher due to the possible destruction of another civilian/cargo aircraft during shelling of Ukrainian airports; however, in the absence of detailed information on the location of such aircraft at civilian airfields, such assessment will be carried out at later stages.

Digital infrasturture

The total damages to telecom operators are estimated at **\$566 млн.**⁴ The sector of electronic communications includes:

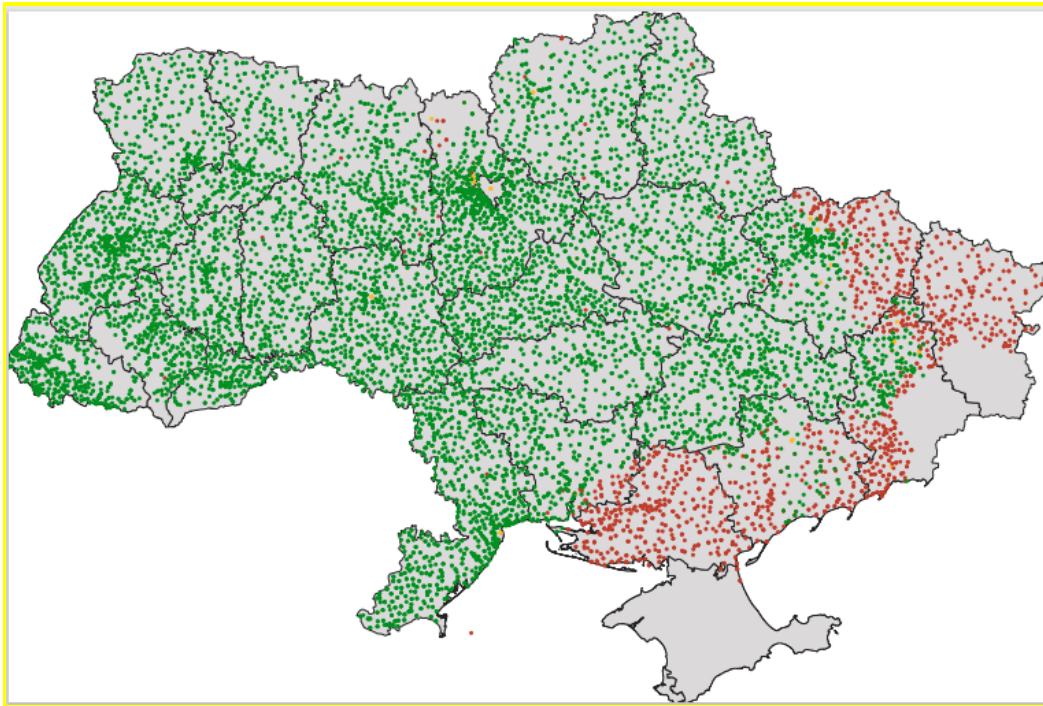
- Internet networks of fixed-line operators;
- Radio networks of mobile operators;
- Backbone/core networks;
- Technical and related means of electronic communication.

At least 726 fixed-line electronic communication operators have suffered damages as a result of hostilities. After the de-occupation of settlements, the destruction of networks reaches 100%. Across the country, the quality of data transmission over fixed-line Internet access networks decreased by an average of 13% (estimated as of May 01, 2022).

⁴ Estimates were not updated compared to the previous report due to the lack of new comprehensive data.

In 12,2% of settlements there is no access to mobile communication; in 3,1% it is partially accessible. 3534 base stations of mobile operators do not work, which is almost 11% of their total number. Over the last month, the total number of non-operating base stations increased by 700. Across the country, the quality of data transmission over mobile Internet access networks decreased by an average of 26% (estimated as of May 01, 2022).

Breakdown of non-operating mobile base stations



Source: Kyiv School of Economics

Determining the cost of losses to owners of electronic communications network infrastructure or its components (including the objects under construction) of various categories differs. The following classification is used:

- National companies, electronic communications operators that provide electronic communication services to citizens of Ukraine throughout its territory;
- Medium-sized companies that provide electronic communication services in several regions;
- Small companies that provide electronic communication services within the region.

For national companies, damages are calculated based on the results of inspections to the destroyed or damaged objects of electronic communications network infrastructure, if they are accessible (even, if possible, in the temporally occupied territories). The amount of damage is set in physical units (km, pieces, etc.), and it is also calculated in money terms based on an approximate estimate of the cost of restoration works.

For medium-sized and small companies, damages are calculated based on the estimated cost of restoration/reconstruction of networks or based on the average subscription fee for 24 months.

There are also a number of following problems. Operators whose networks are completely or for the most part located in the occupation or in the combat zone, if possible, support the networks so that the citizens of Ukraine continue to use access to the Internet from the free territory. Incomes in this case are close to zero, and expenses remain.

At the same time, some of these operators have bank loans. They cannot pay interest for the use of the loan or repay the body of the loan. At the same time, banks charge penalties for overdue payments, and also submit them to credit bureaus as improper borrowers.

Energy

As of September 1, direct damage to the infrastructure of the Ukrainian energy sector, according to preliminary estimates, amounts to \$3.6 billion.

Both direct and indirect methods of calculating the value of destroyed and damaged objects were used in the assessment of damage in the energy sector. The cost of restoration of energy facilities was estimated, in particular, the original book value, the cost of current repairs, and the replacement cost.

The main information on damages in the energy sector is provided by the Ministry of Energy of Ukraine. An individual approach is used to evaluate individual objects in accordance with information from open sources and from business owners and managers. Damage data is aggregated due to the high risk of information dissemination regarding the state of the industry in wartime.

The damage assessment of energy is at the "initial stage" due to the lack of accurate data on objects that are in private ownership, access to objects that are in the combat zone and in the temporarily occupied territories of Ukraine.

More than 10 thermal power plants are considered completely destroyed or damaged. In general, about 50% of thermal generation has been destroyed or is located in the occupied territories.

The largest nuclear power plant in Europe — Zaporizhzhya — is located in the occupied territory with limited access to its proper maintenance, and although it works in the energy system of Ukraine, it is under constant pressure from the Russian occupiers. Zaporizhzhya TPP, Luhansk TPP are also located in the occupied territories, and fierce battles are taking place around Vugleghirskaya TPP. Kakhovskaya HPP remains captured.

According to the Energy Charter Secretariat, 18% of solar generation is located in the occupied territories of Kherson and 6% was damaged or destroyed; about 80% of wind generation is located in the occupied territories and part of it was damaged by shelling; 3.5% of bioenergy facilities are under occupation and at least 4 plants have been destroyed.

In addition, according to a report prepared by the Energy Charter Secretariat, the only electricity conservation project launched in 2021 is also under occupation.

Utilities

The infrastructure of utilities, which is an important part of the life support systems of settlements, became one of the targets of missile and artillery strikes of the Russian Federation. Constant shelling and hostilities made it impossible or significantly complicated to carry out repair work, which caused the disconnection of heat and water supply systems. In some cities, residents still do not receive utilities and do not have proper access to drinking water.

For example, since April 12, due to damage to the water supply, most districts of the city of Mykolaiv remain without centralized water supply, which cannot be repaired due to constant shelling from the Russian Federation. As of September 1, 2022, only technical water is available in the city, and bottled drinking water is still delivered from other cities through a retail network.

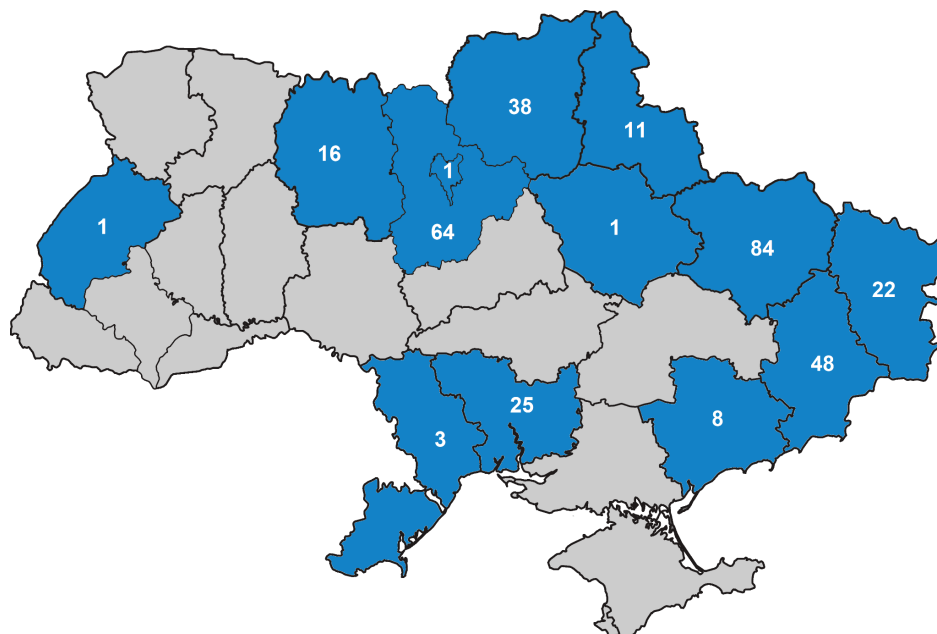
According to preliminary estimates, as of September 1, 2022, the cost measurement of direct losses to heat supply facilities (excluding CHP), water supply and drainage, and household waste management facilities is \$2.3 billion.

According to preliminary estimates, during the period of the full-scale invasion, **4 thermal power plants were completely destroyed** in the territories where hostilities are taking place (Okhtyrka, Sumy Region, Kremenchuk, Poltava Region, Severodonetsk, Luhansk Region, and Chernihiv) and **another 8 were damaged**: Zelenodolsk, Dnipropetrovsk region, Avdiivka and Mykolaivka, Donetsk region, Eskhar settlement, Kharkiv region, Sumy, Mykolaiv and Kharkiv (2 thermal power plants). For example, the destroyed Kremenchuk thermal power station (Poltava region) covered about 70% of the city's needs, which is about 180,000 residents of the community, who may be left

without heat and hot water for the next heating season. The cost measurement of damages caused by the destruction or damage of the CHP is taken into account in the "Energy" section.

In addition, according to preliminary data of the regional military administrations, as a result of hostilities, 322 boiler houses were partially damaged or completely destroyed, most of them in the Kharkiv, Kyiv, Chernihiv, Donetsk, and Mykolaiv regions. 99 centralized heating points were partially damaged or completely destroyed, more than 222 linear km of heating networks were completely destroyed.

Regional distribution of the number of destroyed or damaged boiler houses



Source: Kyiv School of Economics

According to a preliminary estimate, more than 827 linear km of water supply networks were destroyed, 13 water treatment plants were partially damaged or completely destroyed. Also, 71 water pumping stations were destroyed/damaged. Of them, 34 - in Kharkiv region, 12 - in Luhansk region, 11 - in Donetsk region. In addition, 35 wells are destroyed or damaged, most of which are located in Luhansk region.

Laboratories that analyzed the state of water supply in the region were also destroyed or damaged. So, preliminary calculations indicate that about 5 such objects were destroyed/damaged.

According to preliminary estimates, more than 244 linear km of sewage networks were destroyed, 64 sewage pumping stations were partially damaged or completely destroyed, most of which are located in Kyiv, Kharkiv and Chernihiv regions. 23 sewage treatment facilities are also considered destroyed or damaged.

According to preliminary estimates, as a result of the invasion of the Russian Federation into Ukraine, 16 landfills for the disposal of household waste were destroyed/damaged. Also, 3 garbage sorting lines and 3 biogas plants were completely destroyed. The transport that provides waste removal was also destroyed, in particular, 180 garbage trucks were destroyed.

FINANCIAL SECTOR

The full-scale war had a great impact on the financial sector, primarily on its main component — banks. They have been affected both directly and through problems with the business of their customers (especially borrowers). Damages of the financial sector, including damage to real estate, amounted to **\$69.4 million**.

At first, banks were forced to reduce the activity of branches in territories where there was a threat to the safety of personnel. According to the [Financial Stability Report](#) for June 2022, at the beginning of March, only 21% of branches of systemically important banks were operating in or near the war zone, and 60% in Ukraine as a whole. But thanks to the de-occupation of the northern regions, as of mid-June, 85% of branches were already working.

The property of the banks came under fire. According to the results of bank surveys conducted by the NBU, as of July 1, the residual value of bank property that was damaged, destroyed, or over which control was lost amounted to \$46 million. Approximately half of it is real estate, and another half is other property (ATMs, furniture, computers, etc.). In addition, banks recorded damages of \$5.3 million (mainly related to property in areas where hostilities are not taking place). The financial institution does not have accurate information about the destruction or loss of the rest of the property. The final damage assessment will be possible only after the end of the war or at least after the liberation of the territories.

Russians robbed banks in the occupied territories. By the beginning of May, the amount of lost banknotes due to robbery or seizure of branches amounted to UAH **470 million**. About 60 million hryvnias of national currency banknotes were destroyed by banks and taken away for further exchange at the NBU.

Damages in the non-banking financial sector are not known with certainty due to a lack of data. However, in August it [became known](#) that as of the end of the 1st quarter (that is, a month and a week after the beginning of the invasion), a significant number of participants in this market stopped or significantly reduced their activities; the demand for their services also decreased significantly.

ENVIRONMENT

As of September 1, the State Environmental Inspectorate recorded 330 events that pose a threat to the environment in Ukraine. Some damages to natural ecosystems and unique natural objects are already irreparable. The restoration of other damages (soils, forests, natural resources of flora and fauna in some areas) will take decades.

As a result of hostilities, 812 wildlife sanctuaries of Ukraine are in danger. It is about 20% of the area of all protected territories in Ukraine. Hostile actions of the Russian Federation threatened to destroy 2.5 million hectares of protected areas:

In total, almost 3 million hectares of forest in Ukraine have been engulfed in war since the start of a full-scale Russian military invasion. It is the size of Belgium. As of September 2022, 600 thousand hectares of forest in Ukraine and 149 forests remain under occupation.

The number of forest fires caused by hostilities is 487; their area is 7109 hectares. The damage caused to state-owned forestry enterprises as a result of Russian military aggression is estimated at **\$433 million**.

Russian troops are carrying out targeted strikes on the infrastructure of water intake, treatment and supply, as well as sewage treatment plants. Water supply and sewerage facilities were significantly damaged in Donetsk, Zaporizhzhia, Kharkiv and Mykolayiv region. As a result of the war, more than 4.6 million people in Ukraine have problems with access to drinking water (for more details, please see the section on utilities).

Pollution occurs due to the destruction of transport and industrial infrastructure, which leads to large-scale spills of petroleum products and other hazardous substances.

The war damaged or destroyed at least 412 enterprises, plants and factories, including chemical enterprises. The activity of a number of mining enterprises had stopped, which led to a shortage of salt, coal and other minerals; the status of deposits and the possibility of their further development is questionable now.

There is a significant threat to nuclear and radiation safety due to the damaged nuclear and radiation-hazardous facilities (namely, due to the temporary occupation of the Zaporizhzhia Nuclear Power Plant). In the Exclusion Zone, the radiation monitoring system was destroyed; eight objects were destroyed and 142 objects were damaged. The aggressor's troops destroyed almost 100 units of valuable analytical equipment, which has no analogues in Europe.

276 real estate objects of the State Forest Agency and 296 objects of the State Water Agency were destroyed or damaged. 194 minerals mining sites were seized. Moreover, 28 of such sites were destroyed or damaged.

Destruction of military equipment, explosions of ammunition, burning of petroleum products, forest and residential fires, industrial enterprises fires, etc., led to the large amount of hazardous substances into the air - at least 87 thousand tons from destroyed enemy equipment, 2.7 million tons from forest fires and industrial facilities fires without taking into account greenhouse gases (estimated according to the EMEP methodology).

Damage from emissions must be compensated in amounts that will allow for equivalent measures to clean up air, as well as measures to prevent and adapt to climate change.

DEMINING

Since the beginning of the war around 270,000 square kilometers of Ukrainian territory were affected by the war, either via active military actions, mining of combat areas, or as a result of artillery strikes, shelling etc. Mines, other explosive objects and their remnants pose a direct threat to the life and health of Ukrainian citizens and prevent normal economic activity in the affected areas.

Based on estimates of the State Emergency Service of Ukraine (SESU), about 185,000 square kilometers or approximately 30% of the territory of Ukraine could potentially be contaminated by mines and other explosive objects, must be surveyed and cleared. Since the beginning of the invasion, some 704 square kilometers have been surveyed and cleared by the State Emergency Service, mainly in the Kyiv and Chernihiv regions that have been deoccupied since April 2022, with around 200,000 explosive objects have been liquidated. Based on the areas surveyed and cleared to date, some 284 explosive items were identified per one square kilometers of cleared territory. However, the density of mining pollution could be significantly higher in areas of prolonged active hostilities.

Residential housing

Type of losses	Unit	Baseline, units	Damages, units	Damages, \$ bln
Damages				
Destroyed				
Apartment buildings	pcs.	178 921	6 153	29,812
Private houses	pcs.	8 984 976	65 847	4,644
Dormitories	pcs..	7 114	85	0,296
Damaged				
Apartment buildings	pcs.	178 921	9 490	13,986
Private houses	pcs.	8 984 976	54 069	1,570
Dormitories	pcs.	7 114	155	0,174
Total damages		x	x	50,482

Source: State Statistics Service, Ministry of Communities and Territories Development (Ukraine), Order of the Ministry of Regions dated February 17, 2022 No. 53, data of regional military administrations, official currency exchange rates of the NBU, market data; calculations of the Ministry of Regions and KSE

Health Care Sector

Type of losses	Unit	Baseline, units	Damages, units	Damages, \$ bln
Damages				
Destroyed				
Hospitals	pcs	1135	66	0,91
Polyclinics and RCDGP	pcs	1131*	13	0,04
Outpatient clinics	pcs	1131*	93	0,05
Blood centres	pcs	28	2	0,01
Other (medical offices, laboratories, medical warehouses, dormitories, forensic medical examination bureaus)	pcs		69	0,08
Damaged				
Hospitals	pcs	1135	223	0,40
Polyclinics and RCDGP	pcs	1138*	53	0,04
Outpatient clinics	pcs	1138*	263	0,03
Blood centres	pcs	28	5	0,00
Other (medical offices, laboratories, medical warehouses, dormitories, forensic medical examination bureaus)	pcs		191	0,07
Total damages	x	x	x	1,6

Source: Data on the number of damaged state-owned health care facilities – Ministry of Health; Data on the number of damaged private health care facilities – public sources; Data on the cost of replacing one health care facility is calculated with several methods: (1) for facilities for which the number of square meters and/or beds is known, data of the Ministry of Regions is used on the average cost of construction of 1 square meter of health care facilities; (2) for institutions for which the number of square meters and/or beds is unknown, the results of tenders in the Prozorro system are used for the cost of ordering the construction of similar health care institutions in 2020-202; estimate of indirect losses in the sector calculated on the State Statistics Service database; as well as the decisions of the CMU regarding the redistribution of budget funds.

*total for Polyclinics and Outpatient clinics

Social sector

Type of losses	Unit	Damages, units	Damages, \$ bln
Damages			
Destroyed			
Children's homes	pcs	5	0,001
Orphanages	pcs	29	0,045
Institutions for the elderly	pcs	8	0,006
Social centres	pcs	44	0,024
Sanatoriums/resorts	pcs	45	0,078
Children's camps	pcs	9	0,015
Institutions for work with the homeless	pcs	1	0,0001
Total damages	x	x	0,2

Source: the number and cost of damaged facilities – Ministry of Regions; the amount of needs for additional expenditures on social protection – Ministry of Social Policy; KSE calculations

* The number of damaged facilities and their estimated value according to the Ministry of Communities and Territories Development

Educational institutions and scientific infrastructure

Type of losses	Unit	Baseline, units	Damages, units	Damages, \$ bln
Damages				
Destroyed				
Institutions of secondary education	pcs	13991	379	1,474
Pre-school education institutions	pcs	15335	211	0,455
Vocational schools	pcs		23	0,246
Institutions of higher education	pcs	515	183	2,127
Institutions of professional pre-higher education	pcs	129	1	0,004
Institutions of extracurricular education	pcs		1	0,004
Institutions of specialized education	pcs		12	0,055
Damaged				
Institutions of secondary education	pcs	13991	891	1,386
Pre-school education institutions	pcs	15335	575	0,495
Vocational schools	pcs		26	0,110
Institutions of higher education	pcs	515	112	0,521
Institutions of professional pre-higher education	pcs	129	9	0,018
Institutions of extracurricular education	pcs		8	0,018
Institutions of specialized education	pcs		18	0,033
Scientific institutions	pcs	213*	90**	0,008
Total damages		x	x	6,95

Source: Ministry of Education and Science; Ministry of Regions; National Academy of Sciences of Ukraine; calculations of KSE

* the number presented is according to the State Register of scientific institutions that receive state support; the list is not complete. <http://rnib.rit.org.ua/rni?page=4>

** currently, it includes assessment only of damaged institutions of National Academy of Sciences of Ukraine; the assessment of losses of other scientific institutions will be carried out during the next steps

Culture, religion, sports, and tourism

Type of losses	Unit	Baseline, units	Damages, units	Damages, \$ bln
Damages				
Destroyed				
Religious institutions	pcs	no data	17	0,0
Sports facilities	pcs	161991656	56	0,4
Cultural sector	pcs	2135	211	0,2
Tourism	pcs	1876	48	0,0
Damaged				
Religious institutions	pcs	no data	63	0,0
Sports facilities	pcs	161991656	97	0,8
Cultural sector	pcs	2135	564	0,5
Tourism	pcs	1876	101	0,1
Total damages	x	x	x	2,0

Source: Data of the Ministry of Regions on the number and value of damaged objects; Data of State Statistics Service on the initial number of objects; other – calculations of KSE

Extra amount of funds to cover social payments based on the calculations per month, based on the number of additional recipients of social aid as a result of the war, as of September 1, 2022

Name of the budget program	Number of recipients of social aid; thousands of people	Extra amount of funds, UAHbln
CPCEC 2501030 "Payment of certain types of benefits, compensations, financial support and payment of services to certain categories of the population"	8,5	0,014
CPCEC 2501150 "Annual one-time monetary assistance to war veterans and victims of Nazi persecution and social assistance to persons who have special and special labour merits to the Motherland"	63,4	0,003
CPCEC 2501480 "Provision of monthly targeted assistance to internally displaced persons to cover living expenses, including payment of housing and communal services"	562	0,287
Total	633,4	0,304

Source; Ministry of Social Policy of Ukraine

The largest affected industrial assets (according to available information on the damaged assets)

№	Enterprise	Industry	Status	Damages, \$ bln
1	Ilyich Iron and Steel Plant	Metallurgy	Destroyed	2 030
2	Azovstal	Metallurgy	Destroyed	1 549
3	Motor Sich	Machine engineering	Damaged	414
4	Ukrtatnafta	Oil refining	Destroyed	401
5	Ukrainian Energy Machines	Machine engineering	Damaged	179
6	Antonov	Aircraft engineering	Damaged	165
7	Philip Morris Ukraine	Production of cigarettes	Destroyed	161
8	Avdiiv Coke Chemical Plant	Coke and chemical	Damaged	147
9	Zorya – Mashproekt	Machine engineering	Destroyed	147
10	Lysychansk Oil Investment Company	Oil refining	Destroyed	124
11	Organic Systems	Food Processing	Destroyed	108
12	Novokramatorsky Machine Building Plant	Machine engineering	Damaged	100
13	Dniprospetsstal	Metallurgy	Damaged	94
14	Rubizhansky Cardboard and Packaging Mill	Paper production	Destroyed	88
15	Sandora	Food Processing	Damaged	77
16	Energomashspetsstal	Machine engineering	Damaged	77
17	Odesa Oil Refinery	Oil refining	Damaged	73
18	Severodonetsk Association “Azot”	Chemical industry	Damaged	69
19	Coca-Cola Beverages Ukraine	Production of beverages	Damaged	64
20	Pharmak (products warehouse)	Pharmaceuticals	Damaged	55
21	Zaporizhzhia Iron Ore Plant	Ore extraction	Stock only	51
22	Optimusagro Trade	Food Processing	Damaged	51
23	Kub-Gas	Gas production	Destroyed	50
24	Mondelēz Ukraine	Food Processing	Damaged	45
25	Kharkiv Tractor Plant	Machine engineering	Damaged	44

Sources: calculations of KSE, information on the destruction of individual facilities, open source data

Annex 8.

Industry and business services

Type of losses	Unit	Baseline, units	Damages, units	Damages, \$ bln
Damages				
Destroyed				
Large and medium-sized private enterprises	pcs	5270	14	4,7
Small private enterprises	pcs	78060	no data	2,1
State-owned enterprises	pcs	1665	18	0,2
Damaged				
Large and medium-sized private enterprises	pcs	5270	30	1,6
Small private enterprises	pcs	78060	no data	0,7
State-owned enterprises	pcs	1665	330	0,6
Total Damages	x	x	x	9,9

Sources: information on the destruction of individual facilities, municipality (level of destruction in the cities), State Statistics Service; calculations of KSE

Retail Sector

Type of losses	Unit	Baseline, units	Damages, units	Damages, \$ bln
Damages				
Destroyed				1,4
Shops	pcs	26000	796	0,9
Shops	pcs	no data	9	0,1
Gas stations	pcs	7000	123	0,092
Pharmacies	pcs	12400	238	0,0
Shopping malls according to ICSC classification	pcs	329	8	0,256
Damaged				1,1
Shops	pcs	26000	1195	0,9
Warehouses	pcs	no data	5	0,0
Gas stations	pcs	7000	182	0,1
Pharmacies	pcs	12400	355	0,0
Shopping malls according to ICSC classification	pcs	329	15	0,106
Total damages	x	x	x	2,42

Sources: State Statistics Service, Ukrainian Council of Shopping Centers, Retail Association of Ukraine

Agricultural sector and land resources

Type of losses	Unit	Baseline, units	Damages, units	Damages, \$ bln
Damages				
Totally Damaged				
Agricultural machinery	pcs	764323	58882	2,7
Storage facilities	volume, thousands of tons	75084	6501	1,0
Livestock (including poultry)	heads, thousands	203292	12487	0,3
Destroyed beehives	bee colonies	2272740	110375	0,0
Perennial crops	ha	197100	14340	0,3
Destroyed and stolen inputs	ton	962951	135993	0,1
Destroyed and stolen grain and oilseeds	ton	25486613	4037542	1,9
Partially Damaged				
Killed and missing bees	bee colonies	2272740	25194	0,2
Agricultural machinery	pcs	764323	29162	0,3
Storage facilities	volume, thousands of tons	75084	2916	0,1
Total damages	x	x	x	6,9

Source: calculations of KSE's Agrocenter (Food and Land Use Research Center)

Vehicles

Type of losses	Unit	Baseline, units	Damages, units	Damages, \$ bln
Damages				
Damaged/Destroyed				
Trolleybuses*	pcs	2 980	341	0,03
Trams*	pcs	1 922	151	0,21
Buses	pcs	241 426	9 535	0,4
Passenger cars **	pcs, million	10,10	188 118	1,7
Fire trucks	pcs	4 216	623	0,03
An-225 Mriia aircraft	pcs	1	1	0,3
Total damages	pcs	x	198 769	2,7

Source:

The number of cars registered in Ukraine https://dostup.pravda.com.ua/request/statistika_kilkosti_zarieiestrov;

Data on losses of municipal transport for four regions (Kharkivska, Donetska, Luhanska, Dnipropetrovska) – information of military-civilian administrations; for other areas – KSE's assumptions

data on the trolleybus and tram fleet http://www.ukrstat.gov.ua/druk/publicat/kat_u/2021/zb/10/zb_Transpot.pdf

data on the bus fleet https://dostup.pravda.com.ua/request/statistika_kilkosti_zarieiestrov

Data on the cost of restoration of the Mriia aircraft – data of Ukroboronprom

**only officially registered private cars are taken into account, excluding cars imported without customs clearance into the territory of Ukraine

***at the current stage, the following are not taken into account: (1) loss of trucks; (2) loss of other transport vehicles, in particular those belonging to authorities; (3) loss of aircrafts (except for the Mriia aircraft, the information on its loss is publicly available)

The assumption for the calculation is that the average cost of replacing one unit of public transport is 1/3 of the replacement cost (the cost of purchasing similar objects on Prozorro tenders in 2021, at the exchange rate valid at the end of 2021). For buses: we take the average between the cost of a bus and a minibus as the exact structure of the bus fleet (distribution between large buses and minibuses) is not known.

Damages to Infrastructure

Type of losses	Unit	Baseline, units	Damages, units	Damages, \$ bln
Damages				
Destroyed				
Airports	pcs.	34	9	1,5
Property of postal operators	x	x	x	0,002
Damaged				
State public roads	km	47 ths km	8 746	9,3
Local public roads	km	120 ths km	8 595	9,1
Communal/municipal roads (in the cities and other settlements)	km	270 ths km	7697	8,2
Bridges and overpasses	pcs.	11 076	315	1,9
Assets of Ukrainian Railways	various	no data	-	4,3
Infrastructure of seaports and inland water transport (ports; wharves; warehouses; terminals; movable property)	various	no data	-	0,5
Airports	pcs	34	9	0,3
Air bases	pcs	1	1	0,04
Ukraerorukh	pcs	no data	1	0,2
Property of postal operators	x	x	x	0,01
Total damages	x	x	x	35,3

Source: Road management – calculations of KSE; Railway transportation – data and calculations of UR, calculations of KSE; Aviation industry – official statistical data, public data, calculations of KSE; Infrastructure of sea ports and inland water transport - MIU data; Postal operators – Nova Poshta, Ukrposhta; calculations of KSE.

Digital infrastructure Damages

Type of losses	Unit	Baseline, units	Damages, units	Damages, \$ bln
Damages				
Damaged				
Fixed-line operators	pcs	4162	726	0,3
Mobile operators	x	x	x	0,2
Total damages	x	x	x	0,6

Source: Ministry of Digital Transformation, NKRZI (the National Commission that carries out state regulation in the field of communication and informatization), communication operators

Damages to Financial Sector

Type of losses	Damages, \$ bln
Damages	
Destroyed/ Damaged*	
Immovable property of state owned banks	0,012
Immovable property of privately owned banks	0,012
Other property of state owned banks	0,018
Other property of privately owned banks	0,004
Bank property has already been written off as losses	0,005
Cash in the bank branches	0,018
Total damages	0,069

Source: National Bank of Ukraine; Financial Stability Report, June 2022

https://bank.gov.ua/admin_uploads/article/FSR_2022-H1.pdf?v=4

* at the current stage, only data on bank losses are included in the Section, excluding direct and indirect losses to other financial institutions

Damages to Utilities Sector

Type of losses	Unit	Baseline, units	Damages, units	Damages, \$ bln
Damages				
Destroyed				
CHPP	pcs	87	4	included in another section
Boiler/heating premises	pcs	19 025	50	0,024
Thermal networks	thousand running meters	18 987 083 000	222 714	0,486
Central thermal points	pcs	5 523	0	0,000
Water treatment facilities	pcs	400	4	0,100
Sewage treatment facilities	pcs	967	9	0,270
Water pumping stations	pcs	5 646	21	0,037
Sewage pumping stations	pcs	2 908	20	0,060
Water supply networks	thousand running meters	98 076 470	827 314	0,414
Sewage networks	thousand running meters	37 053 200	244 589	0,367
Wells	pcs	22 134	18	0,002
Laboratories	pcs	no data	3	0,001
Clean water reservoirs	pcs	2 129	19	0,019
Water towers	pcs	6 947	22	0,004
Containers for collecting household waste	pcs	no data	18 787	0,012
Garbage trucks	pcs	3 669	180	0,036

Landfills for disposal of household waste	pcs	5 969	10	0,030
Garbage sorting lines	pcs	34	3	0,005
Container sites	pcs	no data	293	0,000
Biogas equipment/premises	pcs	18	3	0,005
Damaged				
CHPP	pcs	87	8	
Boiler/heating premises	pcs	19 025	272	0,053
Thermal networks	thousand running meters	18 987 083 000	0	0,000
Central thermal points	pcs	5 523	99	0,017
Water treatment facilities	pcs	400	9	0,090
Sewage treatment facilities	pcs	967	12	0,144
Water pumping stations	pcs	5 646	50	0,035
Sewage pumping stations	pcs	2 908	44	0,053
Water supply networks	thousand running meters	98 076 470	-	
Sewage networks	thousand running meters	37 053 200	-	
Wells	pcs	22 134	17	0,001
Laboratories	pcs	no data	2	0,000
Clean water reservoirs	pcs	2 129	8	0,003
Water towers	pcs	6 947	10	0,001
Containers for collecting household waste	pcs	no data		0,000

Garbage trucks	pcs	3 669		0,000
Landfills for disposal of household waste	pcs	5 969	6	0,007
Garbage sorting lines	pcs	34	0	0,000
Container sites	pcs	no data	110	0,000
Biogas equipment/premises	pcs	18	0	0,000
Total damages		x	x	2,276

Source: data of the State Statistics Service, data of the Ministry of Communities and Territories Development (Ukraine), data of regional military administrations, official currency exchange rates of the NBU, market data, expert assumptions, etc.