



ASSESSMENT REPORT



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DIDIER ISSEN / ELECTRICIANS WITHOUT BORDERS

UKRAINE'S ENERGY CHALLENGES FOR WINTER 2023-2024



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Founded in 1993, Groupe URD is an independent think-tank specializing in the analysis of practices and the development of policies for humanitarian action and the management of fragility. Its multi-disciplinary expertise, nurtured by constant return visits to crisis and post-crisis areas, enables it to understand the workings of the sector as a whole. Committed to the exchange of knowledge and collective learning, he supports aid workers in the process of improving the quality of their interventions.

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SUMMARY

EXECUTIVE SUMMARY.....	4
INTRODUCTION.....	6
1. UKRAINE'S ENERGY SITUATION BEFORE THE WAR.....	7
2. THE WAR'S IMPACT ON THE ENERGY SITUATION	9
3. COMMENTSONTHERESPONSETOWINTER2022-23	11
4. RECOMMENDATIONS	15
4.1. PROTECT.....	15
4.2. STORE	15
4.3. ENSURING MAINTENANCE	17
4.4. REPAIR.....	17
4.5. REDUCING RISKS AND LIMITING VULNERABILITY	17
4.6. REPLACE.....	18
CONCLUSION.....	19
APPENDICES.....	20
APPENDIX 1: TERMS OF REFERENCE FOR THE ASSIGNMENT	20
APPENDIX 2: MISSION ITINERARY AND SCHEDULE	24
APPENDIX 3: LIST OF DOCUMENTS CONSULTED AND WEBSITES OF INTEREST	26

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EXECUTIVE SUMMARY

In 2022 and 2023, Ukrainians and international players made considerable efforts to deal with the dramatic situation caused by Russian bombardments on energy infrastructures and to reduce the dramatic impact of energy cuts on the population.

All the players targeted the needs of individuals and essential structures such as hospitals, schools and social institutions. However, actions in non-traditional humanitarian aid sectors have been of very variable quality. To go beyond the provision of classic winterization products and strategically address the issue of energy, it would undoubtedly have been necessary to devise a mechanism outside the Cluster system as defined by the United Nations, as numerous initiatives linked to Ukrainian and French NGOs, local authorities, the diaspora, etc. have done. In fact, while the massive deliveries of generators were decisive in this "winter battle", they also revealed "areas for improvement" in terms of technical aspects (choice of models), organization (maintenance, repairs), economics (where to find the money to run the generator?) and, more generally, coordination within the "energy" sector.

The proposals that emerge from this mission are organized around several axes:

- Protecting equipment and people;
- Storing energy, fuels and equipment, particularly as part of contingency plans;
- Equipment maintenance;
- Ensuring repair capacity ;
- Reducing risks and limiting vulnerability ;
- Develop mechanisms and capabilities to replace what cannot be repaired.

The unknowns hanging over the coming winter are considerable, and can be summed up in a few major questions, each of which is rooted in an analysis of the response to the past winter, and attempts to explore the uncertainties for the winter to come:

- After a series of rather moderate winters, what will the weather be like in winter 2023-24?
- Having seen the effects of last winter's targeted strikes on Ukraine's energy infrastructure, and the depletion of resources to repair it, is Russia preparing a new winter campaign to destroy critical infrastructure (they know exactly where and how, as little has changed in terms of critical infrastructure since Ukraine's independence in 1991)?
- Can these critical infrastructures be rebuilt if last winter's situation is repeated for the winter of 2023-24?

What is quite clear at the end of this mission is that the efforts made by the Ukrainians and the international community to prepare for the coming winter are already well underway, but include a number of blind spots and areas where resources are still inadequate.

On a subject as technical as energy in crisis response, a number of theoretical confusions about the "humanitarian-development" link were noted during the mission, confusions which can ultimately reduce the margins and areas of action for humanitarians. In the context of war and potentially harsh winter conditions, repairing heating plants is not a development issue, but a humanitarian response. At the same time, all those involved - and Ukrainian officials in particular - are aware of the need to work in two phases:

- That of the wartime period, which is that of urgency and maintaining the population's quality of life by conservating existing facilities and distributing products and equipment to get through the winter;
- The post-war period, with the modernization of facilities, the implementation of "green" energy strategies to reduce carbon footprints and bring Ukrainian systems into line with European standards.

Despite these challenges, it is still possible to innovate in a crisis with new approaches, but also when it comes to repairing bombed-out power plants or investing in energy mixes and hybrid systems proposed by Electriciens sans frontières and a few other players to increase the resilience of people and services in the context of high-intensity conflict.



INTRODUCTION

Following several missions to Ukraine by each of the two organizations since the start of the war in February 2022¹, Electriciens sans frontières and Groupe URD have launched a joint learning and capitalization effort on energy and winter preparedness issues to improve the international response in Ukraine, as part of a project supported by the Centre de Crise et de soutien (CDCS) of the French Ministry of Europe and Foreign Affairs (MEAE)².

This assessment, aimed at gaining a better understanding of efforts to make Ukraine more resilient than last year in the energy sector to cope with the winter of 2023-24, covered a large part of the country: Kharkiv and Chernihiv Oblasts, Uzhhorod Region, Odessa City, Mykolaev, Kherson, Kropyvnytskyi, Dnipro Oblasts, Pavlograd, Zaporijjia and Nikopol zones. Wherever possible, field visits covered both urban and rural municipalities, some close to the front lines. Numerous discussions were held with mayors and other officials at oblast, *rayon* (urban) and *hromada* (rural) levels, as well as with numerous players in the health sector (hospitals and health centers), water (Vodakanal), the Ukrainian Ministry of Energy and those responsible for energy issues both in Kyiv and in the regions³.

This assessment mission was greatly facilitated by partners in the field, notably SAFE/CAMZ, the Fortechnyi Foundation and the Association Internationale de Coopération Médicale (AICM). Thanks also to the French-Ukrainian NGO Aide Médicale & Caritative France-Ukraine (AMC), which helped us meet key players in certain areas. The help of the town halls and officials of the oblasts visited was also essential to the success of this mission.

This evaluation encountered a number of limitations, linked to the extent of the area covered, constraints on the availability of players and security issues. The team did its best to ensure the widest possible coverage of situations and the best possible quality of consultations, by prioritizing the actors present in the field. The evaluation team would like to thank all the people we met.

This report is divided into three parts:

- The energy situation before the start of the war in February 2022;
- Lessons learned from the response deployed by both Ukrainian authorities and aid actors (national and international) to cope with winter 2022-23;
- A few recommendations to help Ukraine and its most "at-risk" populations cope with the winter of 2023-24.

¹ https://www.urd.org/fr/page-de-recherche/?zone_geo=ukraine
https://electriciens-sans-frontieres.org/type_pays/ukraine/

² The Terms of Reference are presented in Appendix 1.

³ The mission timetable is presented in Appendix 2.

1. UKRAINE'S ENERGY SITUATION BEFORE THE WAR

It's important to understand how critical the energy issue is for a modern, industrialized country with a continental climate. International humanitarian aid has found itself confronted with a situation which, in many ways, resembles that of the Balkans during the war of the early 90s. In fact, this aid was caught unprepared for challenges that could have been anticipated thanks to better dialogue among development players who had been working in Ukraine for years on energy issues (Swiss Cooperation, for example, had a very interesting program on energy-efficient cities). With the legacy of the Soviet period and developments since independence in 1991⁴ and above all the start of the march towards Europe after the Maidan events in 2014⁵, the production and distribution of energy, a central factor in the functioning of the economy and basic services, has become more complex. Three questions have emerged:

- How could Ukraine reduce its dependence on energy flows of all kinds (electricity, gas, oil) from Russia?
- How was Ukraine going to strengthen its connections with the European network, and come closer to European standards?
- How could Ukraine strengthen its energy autonomy in the face of climate change?

The energy system and the issues presented above are managed by a multiplicity of players, some state, some municipal, some oblast and some private (DTEK), with responsibilities shared between the state and the oblasts or municipalities, this sharing being complex depending on local rules and legislation.

According to Economist Intelligence⁶, Ukraine's energy sector had the following characteristics before the outbreak of war in February 2022:

Energy resources - Ukraine has abundant mineral resources, including oil, natural gas and coal, as well as great potential for hydroelectricity and biomass. Almost 65% of Ukraine's total energy demand is met by domestic production. According to the International Energy Agency, Ukraine has 34.4 billion tonnes of coal reserves, 1.1 billion cubic metres (tcm) of natural gas and 850 million tonnes of oil.

Ukraine's hydrocarbon resources are concentrated in 3 regions:

- the Carpathian region to the west;
- the Dniepr-Donetsk region to the east;
- the Black Sea-Sea of Azov region to the south.

According to the International Energy Agency (IEA)⁷, Ukraine relies on imports for around 83% of its oil consumption, 33% of its natural gas and 50% of its coal. The remaining third of total energy demand has traditionally depended heavily on Russian imports of natural gas, oil and coal.

Since 2014, Ukraine has diversified its imports, sourcing coal from Kazakhstan and the USA, as well as fuel from the European Union (EU). Since March 2022, Ukraine has been connected to the European electricity grid, offering opportunities for energy sales, as well as support through the supply of electricity in times of need. Ukraine remained dependent on Russian gas until the outbreak of war.

Nevertheless, while Ukraine no longer imports gas directly from Russia, the gas it buys from EU traders (representing over 30% of total gas supply in 2020) ultimately comes from Russian pipelines.

⁴ The Orange revolution.

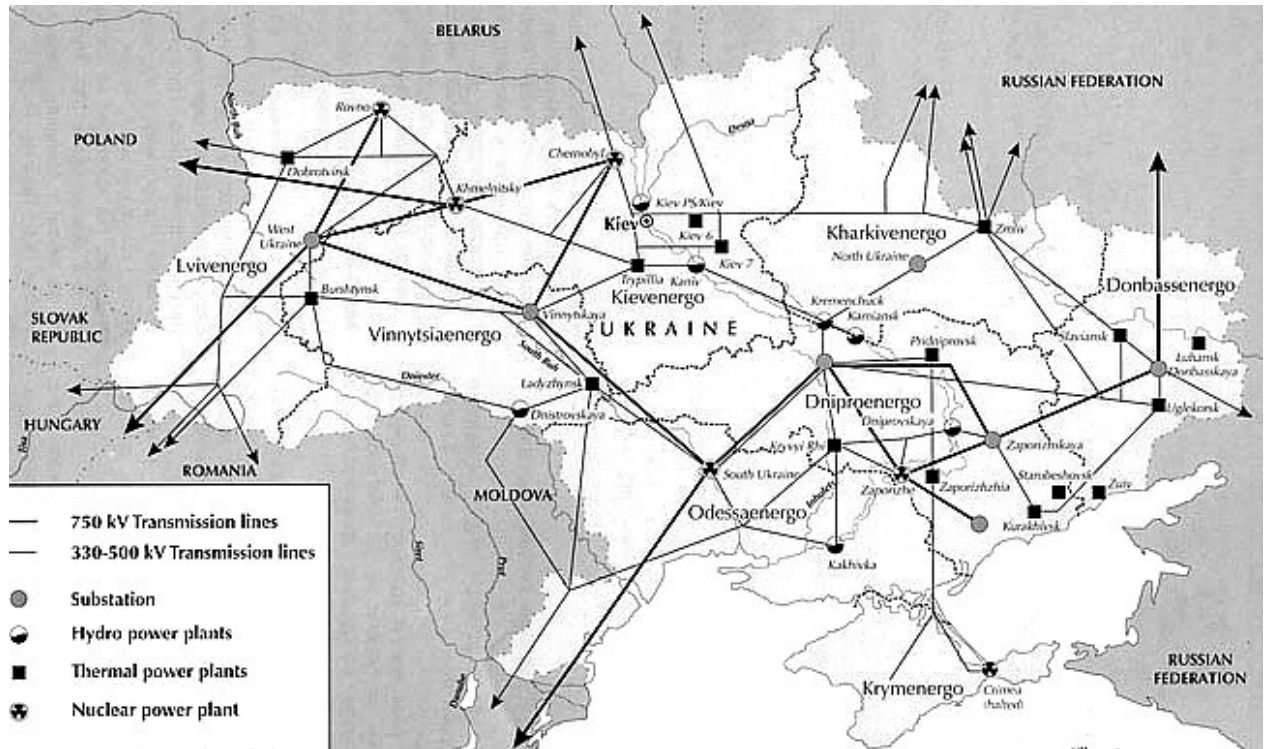
⁵ The revolution of dignity.

⁶ Powerpoint not published.

⁷ Ukraine energy profile IEA Sept. 2021, www.iea.org.

In terms of electricity, Ukraine's generating capacity in 2021 was 58.2 GW, made up of 49% thermal power plants, 22% nuclear and 3% hydroelectric, with the remainder made up of alternative sources (hydro storage, solar, wind and other small-scale, etc.). Ukraine's transmission network (lines from 220 kilovolts (kV) to 750 kV) represents 22,000 km of cables feeding a distribution network of over one million km of cables. Most thermal power plants use coal, but some (around 5.4 GW) burn gas or oil and are used at peak demand times. The 4 remaining nuclear power plants (after the Chernobyl disaster) comprise a total of 15 reactors and generate around 13.8 GW.

Hydropower (dams on the Dnieper and Dniester rivers) is an important part of the strategy to offset the difficulties faced by some of the country's ageing thermal power plants. Renewable energy production has been growing rapidly since 2018-19, accounting for around 4% of Ukraine's overall energy production.



Main Electricity Transmission Lines 2020

(Source: ECS based on information from Ukrainian operators and open-access data)

2. THE IMPACT OF WAR ON THE ENERGY SITUATION

The war's impact on energy is huge, and it began as early as the 2013-2014 war in Donbass and Donetsk. Indeed, Russia's occupation of Ukrainian territories reduced access to important domestic reserves. At the time, the Dnieper-Donetsk region possessed 80% of proven reserves (including most of the coal) and around 90% of gas production, but the war in Ukraine severely restricted access to these reserves. Since 2014, the occupation of the Black Sea region and Crimea has in fact caused the country to lose access to 80% of its offshore hydrocarbon deposits. The damage caused by the conflict to coal mines and energy-intensive industries in Donbass and Donetsk has been extensive. From October 2022 onwards, Russia's military strategy evolved and a massive campaign of bombing energy infrastructure was launched. This winter war, with its increased cold and lightless days, had considerable humanitarian consequences for the Ukrainian population.

By the end of August 2023, Ukraine estimates that more than 800 kamikaze missiles and drones had hit energy facilities, and that 60% of the country's energy infrastructure had been damaged. According to the Ukrainian Ministry of Energy, taking into account the occupied areas, Ukraine lost :

- 44% of its nuclear production;
- 76% of the output of its thermal power plants ;
- 40% of its co-generation units (heat and electricity). To date, according to the Ministry of Energy, over 1,200 overhead lines and more than 8,000 transformers have been damaged or disconnected as a result of incessant bombing and hostilities⁸ . Tens of thousands of Ukrainians were regularly cut off from all sources of energy, and *blackouts* lasting several hours were a daily occurrence for many Ukrainians. The biggest problem for some regions still subject to power cuts in September 2023 is the damage caused to distribution networks, forcing outages to rotate supplies over several zones.

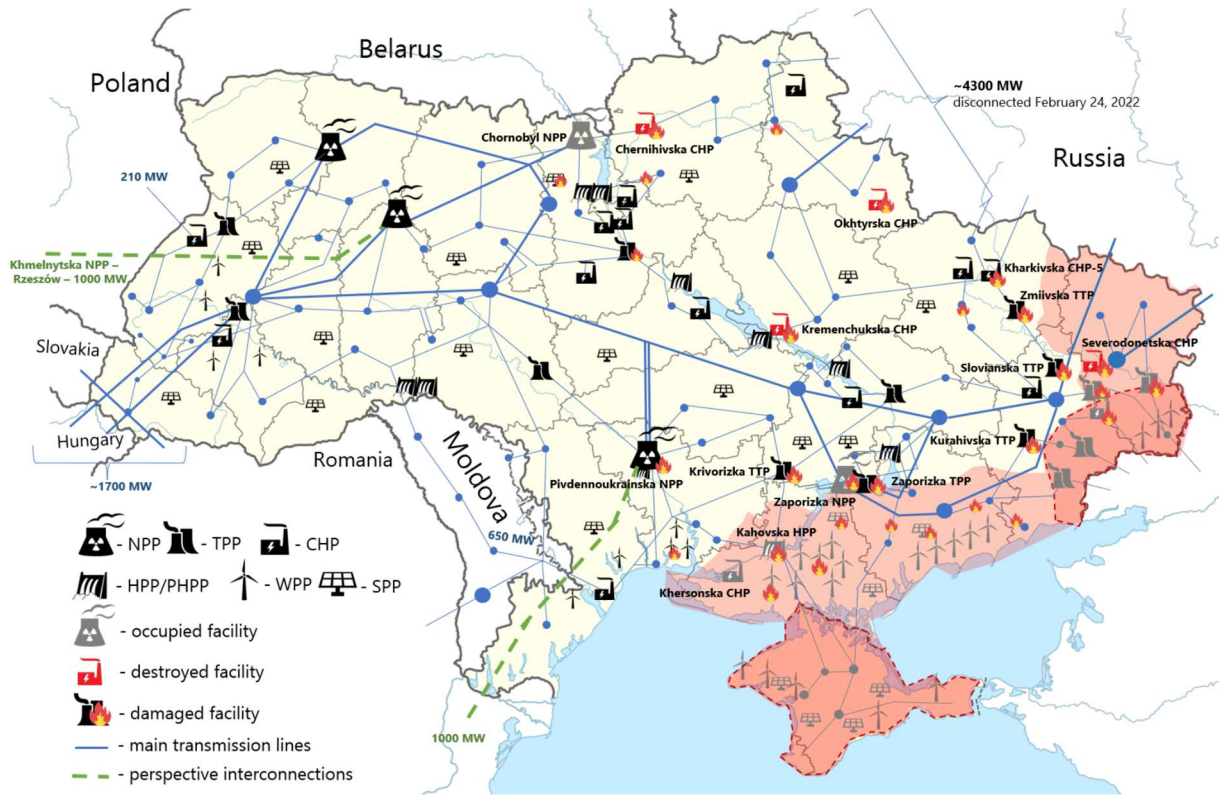
Teams from the companies responsible for electricity production/distribution facilities were permanently mobilized to try to restore electricity and heating as quickly as possible. In February 2023, the Ukrainian Minister of Energy stated that Ukraine was making every effort to meet the needs of the population and the economy by producing and importing electricity.

The combination of loss of territory with the occupations of 2014 and recent destruction in frontline areas, but also in the interior of the country, has considerably reduced Ukraine's access to essential energy sources. The Ukrainian authorities claim that major efforts are being made to ensure that energy production can continue at most of the country's power plants, with the exception of those located in areas where fighting is taking place.

The situation has become extremely complex for the Ukrainian government to manage, with several maps superimposed on each other:

- That of new demographic distributions, with many areas in the north, east and south, with a sharply declining population caused by the exodus of 2022, and other areas located between 100 and 200 km from the front line that have received uprooted populations following this exodus;
- Energy production and distribution structures (gas, hot water, electricity);
- The areas that are being "de-occupied" (liberated) as Ukrainian troops advance, and which need to be supplied with energy quickly.

⁸ Ministry of Energy - system situations published with weekly frequency: <https://www.mev.gov.ua/novyna/sytuatsiya-v-enerhosystemi-na-2-zhovtnya-vyshov-z-remontu-cherhovyy-blok-teplovoyi>



Map of the effects of war on Ukraine's energy infrastructure

(Source: ECS based on information from Ukrainian operators and open-access data, 2023)

3. COMMENTS ON THE RESPONSE TO WINTER 2022-23

This mission enabled us to analyze one of the keys to Ukraine's winter resistance strategy during the war. It revealed the many positive contributions, but also the difficulties encountered by international aid in its efforts to help Ukraine get through the winter. Here are some initial observations:

- **The importance of mobilizing Ukrainian authorities and institutions** to protect the population and guarantee basic services. On the one hand, elected representatives and officials at *oblast* and town hall level, already in the front line of humanitarian response since the start of the war in February 2022, had to organize a new form of response in the face of Russia's "energy war". Efforts were aimed at organizing the protection of populations with "shelters" and invincibility centers that were centralized at local level, but also efforts to mobilize resources to repair what had been destroyed and find the funding needed to keep facilities running (e.g. fuel for electric generators). Entity managers and technical teams were on the front line to ensure that as many facilities as possible could be maintained and repaired despite the destruction; and many of these people paid with their lives for their commitment to their fellow citizens.
- **On the other hand, it is also clear that air defense, a key element in the protection of critical infrastructure, has been essential** in Russia's "winter war" against civilians. An important part of resilience in the face of winter will depend above all on deliveries of air defense systems by Western allies. The latest announcements by several countries suggest that these weapons will be prioritized to create a security dome over part of Ukraine, which would inevitably make energy production and distribution facilities less vulnerable. However, contradictions and uncertainties about deliveries (what, where, when?) abound within the international community, and Ukrainians still have plenty to worry about this winter.
- **Gas remains an essential resource for heating, but alternative fuel sources have had to be developed:** in 2021, Ukraine consumed 27.3 billion m³ of gas. Households used 32% of the gas consumed, heat producers 24%, and the army and other consumers 44%. Gas storage has become a key element in Ukraine's energy strategy. According to the IEA, during the cold season, Ukraine normally consumes around 140 to 150 million cubic meters (a combination of its own production and gas stored underground). In August 2022, Ukraine had around 13 billion cubic meters in storage. The government was aiming for 19 billion cubic meters of gas. Gas consumption over the coming winter is likely to be lower, as many areas have been emptied or switched to other energy sources as a result of the conflict.
- **Difficulties encountered in recovering energy infrastructures: during the period 2022-23,** Russia considerably damaged Ukrainian energy infrastructures through hundreds of missile and drone strikes. As a result, of the 18.7 GW of power generation capacity available in the controlled territory, only 11.8 GW remain operational. Forecast consumption for the coming winter season is estimated at 13.9 GW⁹, but with morning and evening peaks, demand could reach 16.7 GW. As part of the recovery, Ukrainian energy companies are making major efforts to overcome the challenges of the next winter season by recovering energy infrastructure and adding generation and balancing capacity to the system. However, the enormous level of destruction caused to the energy infrastructure is making the recovery process difficult, jeopardizing the preparation and efficient running of the next winter season. Indeed, this enormous damage combines with a whole series of factors:
 - the lack of liquidity of Ukrainian institutions (both public and private) to carry out repair/maintenance operations efficiently and independently;
 - the scarcity of financing (subsidies/loans) for part of the implementation of thermal generation;

⁹ Source: DTEK, Ukraine's largest private electricity supplier

- the lack of equipment reserves needed to restore production and distribution infrastructures, particularly as much of this equipment dates back to the Soviet period and spare parts are only available in the former USSR, despite the "cannibalization" efforts (recovery of spare parts from other machines) that have spread throughout the country and sometimes even to neighboring countries;
 - long lead times for the production of equipment for medium- and high-voltage units in European countries (e.g. 12 to 15 months for the production of high-voltage transformers, which were often damaged/destroyed during the bombing raids) considerably delay the recovery process, jeopardizing the preparation and efficient running of the next winter season.
- **Restoring the energy infrastructure will probably not be enough to cover electricity demand for the coming winter:** even assuming a successful repair schedule with no further damage, available capacity could reach 14.7 GW, and there could still be a shortfall of up to 2 GW. In fact, it will take a combination of rebuilding power generation infrastructure, expanding cross-border connections (to ensure sufficient energy import capacity) and developing decentralized power generation to try to meet energy demand for the winter.
- **The scale, diversity and impact of international mobilization in the face of winter: in the** face of a situation that was ultimately little mastered in terms of needs and existing capacities, and given the urgency of the situation, international aid (UN agencies, bilateral donors, a wide variety of NGOs including Electriciens sans frontières, one of the few NGOs specializing in energy issues in the humanitarian sector, the Ukrainian diaspora, international local authorities, etc.), mobilized in a fairly significant way and in two stages:
- **planned "classic winterization" aid**, with the supply of blankets, comforters, wood-burning stoves, various types of fuel (wood, briquettes), generators, mobile air heaters and electric heaters, in addition to relatively standard repair work when part of the housing is affected: doors, windows, tarpaulins, various beams, etc. This aid enabled many Ukrainians to face the winter in basic conditions, even if the most sensitive areas - close to the front lines and in the process of liberation - were still poorly covered by aid agencies. Thanks to this aid, many Ukrainians have been able to tackle the winter in basic conditions, even if the most sensitive areas - close to the front line and in the process of liberation - are still poorly covered by international actors (security problems), and the bulk of the work is carried out by Ukrainian volunteers in difficult-to-access conditions. In front-line suburbs and villages, as well as in newly "de-occupied" areas, 50-80% of houses have been damaged or destroyed;
 - **unplanned aid, which began after the launch of the Russian army's bombing campaign against energy structures at the beginning of October 2022:** This phase saw the dispatch of thousands of generators of all models and powers (with numerous problems of availability, as the stocks available in many countries were very quickly depleted by the very high demand), the reinforcement of additional distributions of warm clothing, blankets and heating systems, lighting blocks and cables, and the emergence of two original mechanisms for protecting populations:
 - **invincibility centers", an initiative launched by the Ukrainian Presidency¹⁰.** These centers have been set up almost everywhere (schools, hospitals, town halls, subways, etc.), with a great deal of attention paid to the needs of children, in particular so that they can sleep, have fun, follow courses at a distance, etc.). As well as providing protection against the cold caused by the destruction of energy infrastructures, they are designed to provide access to water, light and healthcare, and to help people cope with the fear of time passing without knowing what's going on outside. People can use them to keep warm, charge their phones, access hot water and heat food;

¹⁰ <https://nezlamnist.gov.ua/>

- **air-raid shelters**", essential for hospitals and compulsory for schools and kindergartens, to protect the population and enable these establishments to function. These shelters represent a key element in the "resistance" strategy of institutions, enabling them to shelter patients and pupils in the event of a threat. Health care facilities (surgery, gynecology, basic care, etc.) must also be able to be sheltered and function for several hours in the event of a *blackout*.

- **The large number of generators, but also the inconsistencies in this area** (of all makes and models, representing a very heterogeneous power range). This massive influx of generators was also made possible by reduced import regulations (no VAT). Some were installed, others were not, due to non-delivery of the cabling required for connections or the existence of equipment already in place. In many places, generators arrived at the end of winter due to availability problems (energy crisis in donor countries, unavailability of generators on the market, slow manufacture of quality equipment while low-quality generators were sent en masse) and therefore have not yet been installed. Ukrainian interlocutors indicated that they would no longer need them from March-April 2023 onwards, as they had received enough. However, some structures were asking for them as a double *back-up*, as they already had a generator as first aid. However, one of the key issues for the use of these generators over the coming months will be the ability to purchase fuel: this is one of the major constraints encountered by many structures.

- **Inadequate coordination of international aid on the energy issue:** the Ukrainian crisis led international humanitarian aid into a very specific sector in which it had no real expertise, apart from a few specialist organizations such as Electriciens sans frontières: that of energy and electricity. This problem was compounded by the fact that this was a modern country, with a skilled workforce, complex procedures and regulations, but also a country with very cold winters. The humanitarian coordination system therefore found itself in difficulty, not least because the silo system of the clusters made it difficult to coordinate across the board on these energy issues in general, and prevented the emergence of any real strategic thinking on the distribution of generators. The dashboard set up by OCHA to track the supply of generators¹¹ covers only a fraction of the generators received (those from UN agencies and a few large NGOs), and the thousands of generators of all sizes and power sent by bilateral cooperation agencies, local authorities, diaspora NGOs and the many other equipment donors (private companies) are very poorly accounted for (two to three times as many generators probably arrived in Ukraine as those counted by the dashboard).
 Faced with this reality, a number of measures have been adopted by the Ukrainian government to better manage this risk next winter. This new centralized system, which includes digitization of import documentation and upstream validation for the import of humanitarian donations, has been in force since December 2022.

- **The still insuitable coordination of aid with national and local systems, both globally and more specifically on energy issues:** Ukraine is structured by a strong decentralization which gives significant responsibilities to the *oblast*, city, *rayon* (district in urban areas) and *hromadas* (district in rural areas) levels in all fields, including energy¹². At the start of the war, as in all humanitarian crises, coordination between certain international aid agencies and decentralized institutions was largely lacking. Only those who worked closely with local Ukrainian civil society structures were able to

¹¹

<https://app.powerbi.com/view?r=eyJrIjoibWFiMTE2MTYtYmYwOC00MTFiLTk4YTItMDdlOTYyMjUzNjU3liwidCI6IjBmOWUzNWRiLU0NGYtNGY2MC1iZGNjLTViYTOxNmU2ZGM3MCIslmMiOjh9>

¹² The mission was able to take part in interdepartmental energy meetings at *oblast* and town hall level, which were very productive.

overcome this difficulty. The situation has improved with the setting up of a number of exchange systems between humanitarian actors and local authorities (*oblasts* and cities) with the help of OCHA, notably with a view to territorial coordination, but this coordination still needs to be strengthened, particularly in the energy sector. Ukrainian energy legislation is complex: who manages energy (gas, electricity, hot water)? What can be done in terms of production, generation, storage and re-injection into the grid, depending on the legislation that sets the rules in relation to institutions and the nature of the area (urban, rural). Who has the power to decide? What are the procedures for building a photovoltaic system, generator or water heater in a collective structure? All these questions are generally underestimated by the players involved, which can lead to difficulties in operating the systems installed.

- **Capacity challenges:** Ukraine is a country with high-quality human resources and skills, but the war effort has sent young engineers and technicians to the front, and all that's left behind in the rear and in the institutions is often older personnel, who are certainly competent and capable of solving many problems, but less up to date with modern techniques and more innovative approaches.
- **Worrying about the coming winter:** last winter was relatively mild, but during the winter of 2022-23, Russia's ability to strike at critical infrastructure in the energy sector has made it difficult for the country to function, turning people's daily lives into a nightmare. While energy sector players were highly responsive and effective in limiting the geographical amplitude and duration of total *blackouts*, this was achieved at a very high human cost and thanks to the massive use of spare parts from Soviet-era stocks, which are now very depleted.

4. RECOMMENDATIONS

The recommendations below focus on preparations for the coming winter, and are formulated in the light of the lessons learned from winter 2022-23. They are organized around six axes :

4.1. PROTECT

First and foremost, of course, we must continue our efforts :

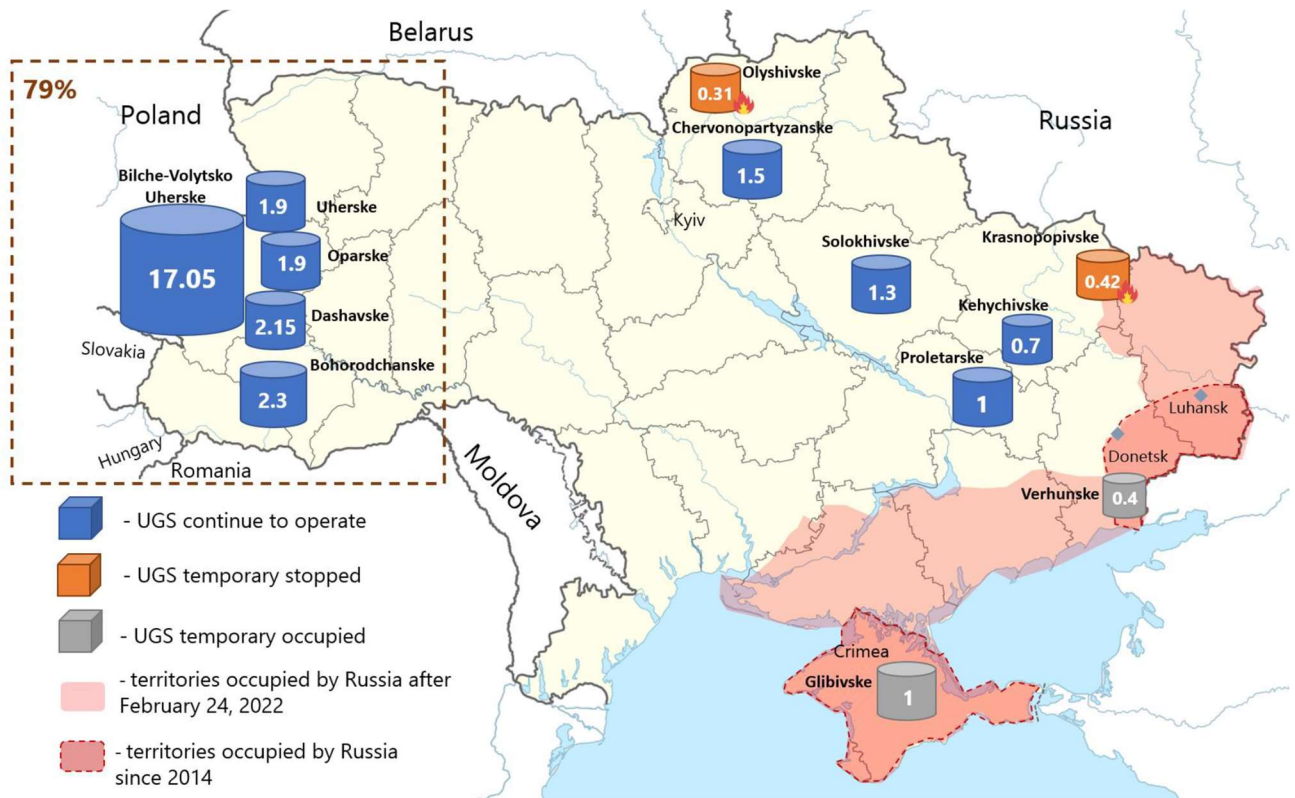
- **to protect populations, through the development of "anti-aircraft shelters" and "invincibility centers".** Efforts to create and install air-raid shelters have been significant in some areas since the 2014 conflict (particularly those close to the front lines), and each time the energy challenge of operating these population protection capabilities has been highlighted. Nevertheless, for most areas, these efforts began after the outbreak of aggression in February 2022, continued through the winter of 2022-23 and are often still ongoing. They have consumed significant parts of municipal budgets (in dire straits due to reduced economic activity and lower tax receipts) and energy sector institutions (impacted by difficulties in paying citizens' energy bills).
- **to reinforce the protection of energy production and distribution systems, particularly electricity.** While air defense elements are important (this military analysis is not within the remit of this mission), promoting the physical protection of facilities, notably with sandbags/earthbags and gabions, anti-drone grids and burying LV, HV lines, seems essential. The government has instructed all energy players to protect energy production and distribution sites by implementing appropriate measures. Only a minority of hospitals have taken the initiative to protect this essential equipment for the coming winter.

4.2. STOCKER

Several key elements of energy systems need to be stockpiled to prepare for the coming winter:

- **Storing energy at the "user" level with batteries** is an essential but largely under-invested area for aid providers. However, it is absolutely essential to strengthen energy storage capacities in hospitals (to ensure continuity of operations in hospitals: surgery, recovery room, resuscitation), as well as in schools and shelters, thanks to economical lighting systems based on LED lamps (in this context, the shipment by Electriciens sans frontières of a large number of LEDs should be renewed for next winter). We also need to ensure that sensitive IT equipment in hospitals and administrations in charge of social and energy management are equipped with *back-up* systems to ensure continuity of supply. The installation of energy storage systems (lithium batteries, etc.) to ensure continuous operation of facilities during power cuts in social service centers or hospitals, is essential for the services concerned and also for the population.

- **Stock up on emergency spare equipment as** part of contingency plans and spare parts. A strong "squirrel syndrome" has been observed: the tendency is to keep additional generators rather than redistribute them. The lack of cross-sectoral coordination of international aid and the low level of expertise of aid actors in these energy-related issues largely contribute to this situation, and reduce the capacity for strategic management of equipment (generators, etc.). This is all the more crucial given that in the coming months we can expect both a new energy war and new flows of generators. The challenges of coordinating the flow of additional generators and strengthening the capacity for agility in managing these flows (contingency plans, equipment mobility, etc.) will require specific efforts from both the Ukrainian decentralized authorities and their partners. The misallocation of GE is not the sole responsibility of aid agencies. In fact, within a single *oblast*, or even a single commune, there does not seem to be any inventory of equipment installed or available, or of the needs of the various structures (hospitals, schools, shelters, etc.).
- **Strengthen fuel storage capacities** to run these generators, including financial reserves for the institutions that manage this equipment and electrical installations. Significant efforts have been made by the authorities to increase gas stocks, and recommendations have been made to social and health structures, as well as other basic services, to stock up on fuel, efforts unfortunately limited by the limited financial resources available.



Gas storage

(Source: ECS based on a UGS operator and publicly available data, 2023)

4.3. MAINTENANCE

The question of the maintenance required to keep electrical equipment in working order is frequently a blind spot in aid, not least because this sector is outside the traditional remit of most conventional humanitarian aid actors (Electriciens sans frontières being an exception, since electricity is its area of expertise par excellence). Many items of equipment were delivered without maintenance manuals (or, at any rate, not in a language that could be used locally), and without air or oil filters. Many small generators not intended for long-term use were over-used, and several cases of generators breaking down were reported. Fortunately, Ukrainian technicians are very skilful and ingenious, and this has enabled many maintenance problems to be resolved. It should be pointed out, however, that all state institutions are required by law to have a person competent to carry out plant maintenance.

4.4. REPAIR

As for maintenance, the technical skills of Ukrainian engineers and technicians have enabled many generators sent by international aid agencies to be repaired. Despite this, we need to ensure that every organization that has sent generators is able to take stock of the equipment's working order and send spare parts for repairs, as quickly as possible before winter sets in.

Things are more complicated for production and distribution systems linked to institutions dedicated to energy production. Equipment running on coal, gas or diesel (power plants, district heating, etc.) was the prime target of the Russian attacks and repairs are often underway, but spare parts stocks are now depleted for this second winter (or, for areas like Kharkiv, almost a third winter). For certain equipment, the search for spare parts supply systems or replacement heavy equipment must be anticipated in advance of shipments, and accelerated if necessary.

4.5. REDUCING RISKS AND LIMITING VULNERABILITY

The Russians have maps of Ukraine's critical infrastructure and know where the energy structures to be destroyed during the coming winter are located. It is therefore important to reduce risks and limit system vulnerabilities. To this end, experience shows that significant gains in resilience can be achieved through a four-pronged strategy:

- **decentralizing production tools** (generators, fuel storage, etc.) to limit the risks associated with a "*total blackout*" resulting from the destruction of a major production or distribution system. Several hospitals visited during the assessment mission have opted to distribute generators at different locations on the hospital site to reduce risks, while at the same time better distributing energy *back-up* capacities according to service requirements. Ukrainian officials mentioned on several occasions that the advantage of decentralized solar and wind power systems was that the production units were spread over larger areas, making them less easy to target.

- **by diversifying systems.** The introduction of "generator-photovoltaic panel" hybrid systems, as well as "production-storage" hybrid systems, needs to be more systematic. Energy storage systems are essential for the operation of certain functions. Various programs are currently under development, notably with Electriciens sans frontières, GIZ, Danish bilateral aid, etc. It will be important for the Ministry of Energy to follow these programs and thus strengthen its own capacities.
- **thinking about "degraded modes"** to reduce the overall vulnerability of systems, by strategically identifying the elements that are essential to their operation, and on which efforts can be concentrated. This requires efforts to prioritize and identify essential functions, **making systems autonomous where possible.** Ukraine has already been installing battery-powered solar systems for highway lighting for several years, and autonomous systems have been set up to operate red lights in urban environments.

4.6. REPLACE

In a number of cases, particularly where irreparable damage or obsolescence is too great, the only solution will be to replace all or part of the equipment:

- In some cases, as with coal-fired power plants, sourcing work needs to be carried out quickly to identify what exists in other countries that would be compatible/adaptable to Ukrainian plants. Efforts similar to those made by the USA to support aging nuclear power plants could be explored in Ukraine.
- For the rest, and in particular for all other broken electrical equipment (transformers) and non-functioning Soviet-era equipment, we need to look at ways of replacing them with equipment that is both suited to the Ukrainian context and would move the country towards European legislation and standards for clean, renewable energies. Efforts have already been made in Ukraine with the adoption and even construction of new systems, such as in the wind power sector¹³ (observed around Mykolaev) or for large solar farms (around Lviv). This is one of the avenues for the future for which the seeds are now being sown, even if it should be remembered that renewable energy capacities have also been targeted, with wind and solar energy production down by a third (Source: UNDP, 2023).

¹³ For example, DTEK has a Renewable Energies division with a portfolio of 1 GW of solar and wind power.

CONCLUSION

The unknowns hanging over the coming winter are considerable and can be summed up in a few major questions, which are anchored in the analysis of the response to the past winter and attempt to explore the uncertainties for the coming winter:

- After a series of mild or temperate winters, what will the weather be like in winter 2023-24?
- Having seen the effects of its targeted strikes on Ukrainian energy infrastructure last winter, and the depletion of resources to repair them, is Russia preparing a new winter campaign to destroy critical infrastructure¹⁴ ?
- The efforts made by Ukrainians and international players in 2022-23 to "win the winter battle" and reduce the dramatic impact of these energy cuts on the population have been considerable. Can they be repeated if the situation of the previous winter is repeated in the coming one?

The main conclusions of this assessment mission are as follows: the efforts made by the Ukrainians and the international community to prepare for the winter of 2023-24 are already well underway, but include a number of blind spots and areas where resources are still inadequate.

On a subject as technical as energy in crisis response, a number of theoretical confusions about the "humanitarian-development/stabilization-rehabilitation" link were noted during the mission. In the long term, these confusions can have a pernicious impact on winter response and preparedness, as they can reduce the margins and areas of action available to humanitarians. For **example, in the context of active warfare in what can be harsh winter conditions, repairing heating plants is not development, but just an appropriate humanitarian response.** The dividing line is therefore not between emergency and development, but between working on individual needs and supporting structural mechanisms with collective impacts. At the same time, all those involved - and Ukrainian officials in particular - are aware that we need to work in two phases:

- that of the wartime period, which is that of urgency and maintaining the population's quality of life by maintaining existing facilities and distributing products and equipment to get through the winter;
- and the post-war era, with the modernization of facilities, the implementation of "green" energy strategies to reduce carbon footprints and bring Ukrainian systems into line with European standards.

Nevertheless, it seems possible to innovate in the crisis, with new approaches, repairing bombed-out power plants, investing in energy mixes and hybrid systems proposed by Electriciens sans frontières and a few other players to increase the resilience of people and services in the context of high-intensity conflict.

¹⁴ Russian military forces have a thorough knowledge of the area and its capabilities, as little has changed in terms of critical infrastructure since independence in 1991.

APPENDICES

ANNEX N°1 : TERMS OF REFERENCE OF THE MISSION

1. INTRODUCTION

Since the start of the conflict in Ukraine in February 2022, the NGO Electriciens sans frontières has been heavily involved in supporting the affected populations by providing humanitarian assistance in the energy sector. Aware of the urgent needs of health and reception facilities, the organization mobilized its teams and resources to provide emergency responses in terms of energy supply, with the support of the CDCS as well as numerous industrial players and other partners of Electriciens sans frontières. On the basis of an in-depth assessment of the energy needs of health and reception facilities, in collaboration with local players and Ukrainian partners, Electriciens sans frontières identified critical points and specific problems linked to energy supply in areas affected by the conflict, as well as partners in Ukrainian administrations, national NGOs and international partners. On this basis, Electriciens sans frontières has implemented a number of actions for the response to winter 2022/2023. From October 2022 onwards, the systematic targeting of energy production/distribution systems, particularly electricity, has greatly affected the living conditions of the Ukrainian population. In addition to classic "winterization programs", managing the consequences of the war on energy from October 2022 onwards posed a new challenge for the aid system: providing electricity to assist populations in freezing conditions and ensuring that basic services (hospitals, etc.) were able to function. The international response consisted of supplying generators of various sizes, models and production capacities. The production of basic stoves already planned in the winter appeal, particularly for rural/peri-urban areas, and the distribution of winterizing items were accelerated, in addition to what the Ukrainians were already doing. Substantial resources have been transferred to Ukraine through bilateral budget support agreements to deal with the energy crisis. This poses complex problems due to the meeting of two "technological worlds": the world of "Soviet-era" technologies and that of advanced Western technologies in fields such as construction, insulation, heating, electricity, water production and distribution, etc. The diversity of responses enabled Ukraine to win the winter battle. The response nevertheless came up against numerous difficulties: limited interoperability of equipment, maintenance, etc. At the same time, Electriciens sans frontières set up training programs for staff in health and reception facilities, to raise awareness of the effective use of these new energy installations and promote good energy efficiency practices to ensure optimum use of energy resources. Thanks to the ongoing involvement of Electriciens sans frontières, the health and care facilities assisted in Ukraine were able to overcome the difficulties associated with energy supplies during the conflict. The organization has played a key role in the reconstruction and resilience of health and reception facilities, promoting access to health and assistance services for vulnerable populations as well as for health and rescue personnel.

In the course of its projects and travels, the NGO has also built up trusting relationships with energy distributors Dtek and Ukrenergo, as well as with the Ukrainian Ministry of Energy and several members of Ukrainian civil society. More than a year after the start of the conflict, Ukraine still faces challenges in terms of energy supply and environmental sustainability. To meet these challenges, it is essential to develop sustainable, hybrid, low-carbon energy solutions that support public services while reducing greenhouse gas emissions. Since the early months of 2023, Electriciens Without Borders has been working with the Ukrainian Ministry of Energy and local communities to raise awareness of the importance and benefits of deploying renewable solutions. This has led to the following project, which aims to solve energy supply problems in health and care facilities in Ukraine, while enhancing their sustainability and efficiency. For its part, Groupe URD closely followed the evolution of the conflict and the humanitarian response. We were then involved in a number of activities, including the publication of a document on key lessons learned from similar situations, a real-time assessment of the aid response in summer 2022, a video, several articles and participation in conferences with aid actors and Ukrainian municipalities. Based on the combined experience of the two structures, an evaluation of the response to winter 2022-2023 with a forward-looking

objective for winter 2023-24 is being conducted by a combined Electriciens sans frontières-Groupe URD team.

2. EVALUATION OBJECTIVES

To support operational planning for the 2023-24 winter season, the objective of the review will be to explore the following questions and draw lessons from the 2022-2023 winter response:

- What strategic lessons can we draw from the ability of the aid system to adjust its response to a rapidly evolving humanitarian context requiring unplanned and unconventional activities (transition from conventional winterization programs to the new "energy paradigm")?
- What lessons can be learned from the massive but uncoordinated supply of different types of electrical equipment, sometimes without spare parts or maintenance manuals?
- What lessons can we learn from the massive efforts made by local authorities to establish safe hot zones (bunkers, subways, invincibility centers, etc.) often supported by local volunteers and aid organizations?
- What lessons can be learned from cooperation between aid agencies, local authorities and technical services (such as Ukrenergo, health and social services, etc.)?
- How can we start thinking about the link between the 2022-2023 and 2023-24 winter emergency phases and the rehabilitation phases, so as to ensure the continuity of the Ukrainian energy system, strengthen resilience in the face of difficult winter conditions, and find an alternative to support the transition to low-carbon technologies?

3. METHODOLOGICAL APPROACH

3.1 Methodology and process

The review process will be divided into three different phases, each with its own methodology and specific results:

The start-up phase: This consists of taking stock of existing information (documentation, initial interviews), preparing a list of people to contact upstream (local authorities, UN, donors, etc.) and developing the methodology. This will include the preparation of an initial mapping, a timetable and interview guides for the various stakeholders:

➔ **Deliverable No. 1: Inception report**

The field phase: The team will be deployed in Ukraine and will visit authorities, donors, agencies and projects in the field. It will gather and analyze information relating to the various topics of interest for the Review. Key points to be reviewed will include: the ability to define a new strategy in a rapidly changing situation, the reorganization of stocks and supplies, the speed of mobilization of new resources, the efficiency of supply processes, security management in the new environment, and coordination between national and international players. Semi-structured individual interviews with authorities (from central to municipal level), aid agencies, volunteer groups, affected people, as well as thematic focus group meetings and site visits (repaired houses, hospitals, invincibility centers, energy production sites, winter dedicated Cash programs, etc.) will be organized. To ensure that different situations and responses are covered, visits will be organized (security permitting) to the affected areas in the west (Lviv), center (Kyiv, Irpin) and east (Kharkiv), returning to Kiev via Dnipro. The team already has contacts in these areas who will facilitate visits. The aim here will be to map the diversity of issues and responses as well as site-specific timelines, lessons learned and recommendations.

➔ **Deliverable No. 2: PowerPoint to be presented at the first "end-of-field feedback session".**

The reporting phase: This phase involves preparing the analysis and recommendations, as well as dedicated briefings for key stakeholders. The report will include an executive summary and a full report including the methodology, a description of the different situations and actions, achievements, lessons and links to possible future phases. It will also include recommendations on how to improve the winter response based on lessons learned from 2022-2023. This phase will also include a series of debriefing sessions with key stakeholders.

➔ **Deliverable No. 3: Review report: A draft version will first be submitted and finalized, taking comments into account.**

➔ **Deliverable No. 4: Final debriefing in Ukraine and Paris, with CDCS, Electriciens sans frontières partners and interested local authorities (to be confirmed).**

3.2 Targeting areas and facilities to be visited

Priority will be given to information gathering:

- In areas where Electriciens sans frontières has been active, either directly or through its partners
- In areas of interest to the CDCS ;
- In areas of interest to French local authorities who have contributed to the response to the winter 2022-23 crisis and would like information on their programs.

3.3. Key evaluation questions

The main questions of this assessment will be organized around the OECD/DAC criteria

<p>Relevance</p>	<p>EQ No. 1: To what extent have the actions implemented met the needs of Ukrainians, particularly in terms of healthcare facilities, essential winter facilities and the populations affected by the programs?</p>	<p>The extent to which the objectives and design of the intervention correspond to the needs, policies and priorities of the beneficiaries, the country, the international community and the partners/institutions, and remain relevant even as the context evolves. "Correspond to" means that the objectives and design of the intervention take into account the conditions - economic, environmental, equity, social, political economy and capacity - in which the intervention is carried out. The term "partners/institutions" encompasses administrations (national, regional, local), civil society organizations, private entities and international bodies involved in financing, implementing and/or supervising the intervention. Assessing relevance involves examining differences and trade-offs between different priorities or needs. It also involves analyzing any changes in the context to determine to what extent the intervention can be (or has been) adapted to maintain its relevance.</p>
<p>Coherence</p>	<p>QE N°2 : How have these interventions been consistent with both national policies and the strategies of Ukrainian players?</p>	<p>Extent to which the intervention is compatible with other interventions within a country, sector or institution. Note: The criterion seeks to examine how other interventions (particularly policies) support or undermine the intervention being assessed, and vice versa. Both internal and external coherence are covered:</p> <ul style="list-style-type: none"> • Internal coherence concerns the synergies and interdependencies between interventions carried out by the same institution/administration, as well as the coherence between the intervention and the relevant international standards and criteria to which the institution/administration adheres. External coherence concerns the consistency between the intervention under consideration and those carried out by other actors in the same context. It encompasses complementarity, harmonization and coordination with other players, and verifies that the intervention brings added value while avoiding duplication of activities.
<p>Efficiency</p>	<p>EQ N°3: What were the specific effectiveness of the various winter crisis response actions? EQ N°4: What constraints have been encountered, particularly in delivering capacity to respond to the energy crisis?</p>	<p>Extent to which intervention objectives and results have been or are being achieved, including results differentiated between populations. Note: effectiveness analysis involves taking into account the relative importance of objectives or results.</p>
<p>Efficiency</p>	<p>QE N°5 : What were the specific efficiencies of the various winter crisis response actions? EQ N°6: What alternative approaches could have improved efficiency in delivering capacity to respond to the energy crisis?</p>	<p>Extent to which the intervention produces, or is likely to produce, results in a cost-effective and timely manner. Note: the term "economic" refers to the conversion of inputs (funds, expertise, natural resources, time, etc.) into outputs, achievements and impacts in the most cost-effective way possible, relative to the options available in the context. The expression "on time" refers to meeting set deadlines, or deadlines reasonably adapted to the requirements of the</p>

		evolving context. This may involve assessing operational efficiency (the extent to which the intervention has been well managed).
Impact	<p>EQ N°7 : What were the specific impacts of the various actions taken in response to the winter crisis?</p> <p>EQ N°8: What alternative approaches could have improved the impact of providing capacity to respond to the energy crisis?</p>	Extent to which the net benefits of the intervention will endure or are likely to endure. Note: This includes an examination of the financial, economic, social, environmental and institutional capacities of the systems required to sustain the net benefits over time. This includes analyses of resilience, risks and potential trade-offs between priorities. Depending on when the assessment is carried out, this process could analyze the actual flow of net benefits, or estimate the likelihood of net benefits being sustained over the medium to long term.
Viability	<p>QE N°9 : What is the viability of the actions implemented during winter 2022-2023, in particular from October 2022?</p> <p>EQ N°10 : What alternative approaches could have improved the viability but also reduced the carbon impact of the activities implemented in response to the energy crisis?</p>	Extent to which the net benefits of the intervention will endure or are likely to endure. Note: This includes an examination of the financial, economic, social, environmental and institutional capacities of the systems required to sustain the net benefits over time. This includes analyses of resilience, risks and potential trade-offs between priorities. Depending on when the assessment is carried out, this process could analyze the actual flow of net benefits, or estimate the likelihood of net benefits being sustained over the medium to long term.

APPENDIX 2: MISSION ITINERARY AND SCHEDULE



APPENDIX 3: LIST OF DOCUMENTS CONSULTED AND WEBSITES OF INTEREST

Ukraine energy profile IEA Sept. 2021

www.iea.org

- Draft Ukraine recovery plan - The national council for recovery of Ukraine from the consequences of the war July 2022

<https://www.kmu.gov.ua/en/national-council-recovery-ukraine-war/about-national-council-recovery-ukraine-war>

- Critical areas situation report Left Bank Analytics, Sept. 2022 - Mar.2023

<https://leftbankanalytics.org/library/?search=ukraine&category=5&date=07-2022>

- Ukrainian energy sector evaluation and damage assessment - I and II Cooperation for restoring Ukrainian energy infrastructure project Sep. 2022

https://www.energycharter.org/fileadmin/DocumentsMedia/Occasional/20220829_UA_sectoral_evaluation_and_damage_assessment_final.pdf

- Russian war against Ukraine DIXI Jan - April 2023 <https://dixigroup.org/en/analytic/russian-war-against-ukraine-energy-dimension-dixi-group-alert-march-16/>

- Risk and impacts from attacks on energy infrastructure in Ukraine PAX Environment & conflict alert Dec. 2022

<https://paxforpeace.nl/what-we-do/publications/risks-and-impacts-from-attacks-on-energy-infrastructure-in-ukraine>

- Ukrainian oil pipeline system in the European energy security context Energy community VIII Oil forum Sep. 2016

<https://docslib.org/doc/10473536/ukrainian-oil-pipeline-system-european-energy-security-context>

- Ukraine Rapide damage and needs assessment Feb. 2022 - Feb 2023 World Bank, the Government of Ukraine, the EU, the UN <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099184503212328877/p1801740d1177f03c0ab180057556615497>

- UKRAINE Energy Damage Assessment the World Bank - UNDP March 2023

<https://www.undp.org/ukraine/publications/ukraine-energy-damage-assessment> and

<https://www.undp.org/ukraine/press-releases/undp-energy-damage-assessment-ukraine-reveals-continued-vulnerabilities>

- On approval of the Energy Strategy of Ukraine for the period up to 2035 "Security, Energy Efficiency, Competitiveness

<http://zakon3.rada.gov.ua/laws/show/605-2017-%D1%80>

- Total installed electricity capacity in Ukraine in 2021, by energy source Statista Dec 2022

<https://www.statista.com/statistics/1219982/ukraine-power-system-capacity-by-plant-type/>

- The Ukrainian conflict and the long story of energy pipelines Aspenia Apr. 2022

<https://aspeniaonline.it/the-ukrainian-conflict-and-the-long-story-of-energy-pipelines/>

- Ukraine: Current status of nuclear power installations NEA Apr. 2023

https://www.oecd-nea.org/jcms/pl_66130/ukraine-current-status-of-nuclear-power-installations

- Gas transit through Ukraine as of December 31, 2008, January 01, 2009, and January 06, 2009 EEG East European Gas Analysis https://eegas.com/ukr_010609r.htm

- Naftogaz group

<https://www.naftogaz.com/en/business/retail-supply-business-unit>

INTERESTING WEBSITES

- National Council for the Recovery of Ukraine

Draft Ukraine Recovery Plan Materials of the "Energy security" working group

<https://www.kmu.gov.ua/storage/app/sites/1/recoveryrada/eng/energy-security-eng.pdf>

- Service for the protection of critical infrastructure and ensuring of the national resilience system of Ukraine established

<https://www.kmu.gov.ua/en/news/stvoreno-sluzhbu-zakhystu-krytychnoi-infrastruktury-ta-zabezpechennia-natsionalnoi-systemy-stiikosti-ukrainy>

<https://www.rada.gov.ua/en/news>

- The Ministry of Energy, with the support of the EBRD Ukraine Stabilisation and Sustainable Growth Multi-Donor Account' (Ukraine MDA)

https://www.facebook.com/minenergoUkraine/posts/577075914450359?__cft__%5b0%5d=AZX5vtLXI5fg8EAllk9a1zzD_YAmGuX_HEd-vDtp3aZjf_AIBr_PaHNr-

[p_9tS6UZayhIZxpH7B2hevSjihOX24riKVIhZRqsNxrWX12k7JCN1kAkeUz0Fs9UcXI5AiySbliEiDC-](https://www.facebook.com/minenergoUkraine/posts/577075914450359?__cft__%5b0%5d=AZX5vtLXI5fg8EAllk9a1zzD_YAmGuX_HEd-vDtp3aZjf_AIBr_PaHNr-p_9tS6UZayhIZxpH7B2hevSjihOX24riKVIhZRqsNxrWX12k7JCN1kAkeUz0Fs9UcXI5AiySbliEiDC-kmfwdzFxlveZMkYdc_QBg9afi-)

[814Fg_slqGAj93vrip4WBBZly04NNEL7jWfy0NIHgkeHcVyuow&__tn__=%2CO%2CP-R](https://www.facebook.com/minenergoUkraine/posts/577075914450359?__cft__%5b0%5d=AZX5vtLXI5fg8EAllk9a1zzD_YAmGuX_HEd-vDtp3aZjf_AIBr_PaHNr-p_9tS6UZayhIZxpH7B2hevSjihOX24riKVIhZRqsNxrWX12k7JCN1kAkeUz0Fs9UcXI5AiySbliEiDC-kmfwdzFxlveZMkYdc_QBg9afi-814Fg_slqGAj93vrip4WBBZly04NNEL7jWfy0NIHgkeHcVyuow&__tn__=%2CO%2CP-R)

- Ukraine: Critical services available during power and water cuts

<https://nezlamnist.gov.ua/>

- DixiGroup Russian War Against Ukraine: Energy Dimension

<https://dixigroup.org/en/analytic/russian-war-against-ukraine-energy-dimension-daily-updating-dixi-group-alert/>

- Ukraine Energy

<https://ua-energy.org/>

- Ukrenergo

<https://ua.energy/en/>

- UAEITI

<https://eiti.org.ua/en/>

- IEA

<https://www.iea.org/data-and-statistics/data-tools/ukraine-real-time-electricity-data-explorer>

- DTEK

<https://grids.dtek.com/en/>

- Naftogaz

<https://www.naftogaz.com/en/>

- The Energy Community

<https://www.energy-community.org/Ukraine/observatory.html>

- OCHA services

<https://data.humdata.org/dataset/ukraine-idp-estimates>

- OCHA Total Number of Conflict Events

<https://data.humdata.org/visualization/ukraine-humanitarian-operations/?tab=chart-view>

- The Energy Map is the largest database of official information about all sections of the Ukrainian energy sector

<https://map.ua-energy.org/en/dashboards/>



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