

## Ukraine: Immediate Energy and Utilities Restoration and Repair Needs

### 1.1. Power system

During the fourth winter of the war, Ukraine's energy infrastructure has once again become a primary target of daily Russian attacks, which have been even more intense than before.

Moreover, besides attacks on electricity and gas, Russia also targeted heating and water supply infrastructure. This was a deliberate attempt to create a humanitarian crisis in the capital and other regions.

During **January 2026**, Russia carried out four large-scale missile and drone attacks on Ukraine's energy infrastructure. The most severely affected areas were Kyiv and the Kyiv region. As a result of the attacks, on each occasion approximately half of the city was left without heating, water supply, and electricity. More than one million residents were deprived of essential utility services at freezing temperatures of  $-15^{\circ}\text{C}$  and below.

Autotransformers at key substations responsible for electricity transmission to the city of Kyiv were severely damaged during the attacks. As a result, electricity transmission to consumers in Kyiv was extremely limited.

Autotransformers at the city's CHPPs were also damaged, rendering electricity generation within the city currently impossible. Heat supply to Kyiv has been only partially restored.

Despite the so-called "energy ceasefire," on **1 February** Russia deliberately attacked energy workers in Dnipropetrovsk. Russian drones struck a company service bus, killing at least 12 mine workers and injuring 16 others. This again shows Russia targets civilians, including energy staff, in clear violation of international law.

On **3 February**, Russia launched a large-scale missile and drone attack across eight Ukrainian regions, targeting civilian energy infrastructure, including heat and power plants in Kyiv, Kharkiv, and Dnipro that were providing **only winter heating**.

We had set up more than 10,000 heating points across the country, helping millions of Ukrainians get through that difficult time.

On **7 February**, Russia carried out a large-scale drone and missile strike on substations and 750 kV and 330 kV power lines. As a result, nuclear power plants were forced to reduce their generation capacity. Combined heat and power plants and thermal power plants were also attacked again. Large-scale attacks also took place on **17 February** and **21 February**, primarily targeting electricity generation facilities, while smaller, targeted strikes continue to affect the sector on a **daily** basis.

During the winter, domestic generation peaked at 10.1 GW, domestic consumption at 18.2 GW, and with electricity imports of 2.1 GW, the resulting deficit was 6 GW. Under these conditions, maintaining the stability and functionality of the power system is not only a technical task, but a matter of national resilience and security.

At the beginning of March, the situation in the energy sector slightly improved due to rising temperatures and ongoing restoration work. However, during **March**, several attacks on energy infrastructure occurred, with the enemy primarily targeting Kyiv and Kyiv region, Dnipropetrovsk, Zaporizhzhia, Chernihiv, and Kharkiv regions.

As of 10 April, Domestic generation (at peaks) – 10,3 GW (2 nuclear units (2 GW) under maintenance), Domestic consumption 3 (also at peaks) – 12,2 GW. Electricity import - 1,9 GW.

Restoration works are ongoing without interruption, but this also requires the mobilization of international support. The top priority is restoring generation, substations, and networks, as well as forming reserves of equipment and capacity.

## **1.2. Natural gas**

Throughout 2025, Russia systematically targeted Ukraine's natural gas infrastructure. Following the termination of Russian gas transit on 1 January 2025, Moscow began deliberately striking gas production and processing facilities. In total, Naftogaz Group infrastructure was subjected to 229 attacks in 2025 - more than in the previous three years of full-scale war combined - with nearly 1,400 missiles and drones deployed against gas facilities.

In the early months of 2025, strikes on production sites in the Kharkiv and Poltava regions. Following partial restoration over the spring and summer, Russia carried out its largest assault on gas infrastructure since the start of the full-scale invasion on 3-4 October 2025, with further strikes in mid-October, destroying national gas production capacity. Surface infrastructure at underground gas storage (UGS) facilities also suffered significant damage, with critical equipment destroyed or requiring full replacement.

To ensure stable gas supply and reliable operation of the gas transmission system, the Government of Ukraine tasked Naftogaz Group with filling UGS to 13.2 bcm by 1 November 2025. This target was met, and seasonal withdrawals began on 4 November.

Due to reduced domestic production, Ukraine's gas imports in 2025 surged to 6.5 bcm - a ninefold increase over 2024. Naftogaz alone imported more than 5.7 bcm, using its own funds alongside loans and grants from international partners. For the 2025/26 heating season, Ukraine identified the need to procure approximately 4.4 bcm of imported gas to ensure uninterrupted supply. To date, the lion's share of this volume has already been purchased and delivered to consumers. Gas procurement has been financed through a combination of sources, including an EBRD loan of up to EUR 500 million (backed by European Commission guarantees), an EIB loan of EUR 300 million supplemented by an additional EUR 50 million, an EU grant of EUR 127 million (with Norwegian support), as well as additional grants from Norway and loans from Ukrainian banks.

Ukraine is wrapping up the 2025/2026 heating season and starting to get ready for the 2026/2027 heating season.

## **1.3. Heat supply**

As a result of the targeted attacks of Russia against Ukraine, a significant number of critical infrastructure facilities have been destroyed or critically damaged. This has jeopardized the commencement and stability of the 2025/26 heating season which is vital for public health and safety, the stable functioning of settlements, and the maintenance of the national defense capabilities under martial law.

As of today, given the ongoing state of martial law in the country and regular, targeted attacks on critical infrastructure, ensuring the resilience of housing and communal service facilities within local communities for the upcoming autumn-winter period remains a matter of urgent priority.

Ensuring the stability of critical infrastructure is fundamental to both public resource security and the continued operation of national and municipal utilities amidst external threats.

To prevent the interruption of housing and communal services, the Ministry for Development is actively implementing distributed heat and power generation within the municipal sector. The expected result of these measures is to ensure the continuous life-support of local communities despite the challenges of martial law and severe weather conditions.

## 1.4 Water supply

As a result of the armed aggression of the Russian Federation and the subsequent systemic damage to energy infrastructure, Ukraine's centralized drinking water supply, sewerage, and heating facilities are currently operating under increased risks associated with prolonged and unpredictable power outages.

The high energy intensity of pumping stations, water intakes, treatment facilities, and heat-generating plants does not allow for prolonged shutdowns without humanitarian and man-made consequences, making them critically dependent on a stable power supply. Despite the extensive humanitarian aid of generators and mobile power stations provided in 2022–2025, water and heating utilities remain among the most vulnerable objects of critical infrastructure.

The Ministry for Development, in collaboration with regional and Kyiv city military administrations, local self-government authorities, and heat, drinking water, and wastewater utilities enterprises, has consolidated and verified the current state of backup power supplies for critical infrastructure facilities. Furthermore, priority facilities requiring autonomous power supply to ensure continuous operation under extreme conditions have been identified.

Given the urgent and unpredictable nature of these needs and the inability to fully cover them with available resources, their fulfillment requires the involvement of targeted international technical and financial assistance, as well as coordinating donor efforts for priority aid provision of the most critical facilities.

### *Context and problem*

Since the beginning of the full-scale war, Ukraine's energy infrastructure has suffered systemic damage due to missile and drone attacks. Water and sewage utilities have been among the most vulnerable critical infrastructure facilities, as their operation is completely dependent on uninterrupted power supply.

In 2022–2025, international partners provided thousands of units of backup equipment — diesel generators, mobile power plants, and uninterruptible power supply systems. This support has allowed us to maintain a minimum level of services during times of crisis.

At the same time, humanitarian generation has significant limitations:

- it is mainly designed for small and medium-power facilities;
- does not cover pumping stations, water intakes and treatment plants with a load in the megawatt range;
- does not ensure long-term autonomous operation of water supply systems in large cities.

As a result, the most critical and system-forming facilities are left without an alternative to centralized electricity supply.

### *Key facts and observations*

The analysis of the aggregate needs of water utilities shows common trends:

- the largest cities of Ukraine have facilities with a unit electrical load from hundreds of kW to several MW;
- there are no basic alternative energy sources to support the minimum operating mode;

It is especially critical that the operation of several key facilities depends on the water supply, sewage, heat supply and fire extinguishing of entire agglomerations, and not individual districts.

## 2. Emergency Repair Needs

### 2.1. Power sector equipment needs

Despite ongoing large-scale attacks, emergency repair works in the energy sector continue daily. Energy companies are prioritising the rapid restoration of critical equipment needed to maintain

power system stability during the 2025/26 heating season. Because damage is continuous and repair capacity is constrained, emergency equipment needs are evolving.

There remains a significant need for core equipment for the electricity transmission system required to restore damaged facilities, ensure the reliable operation of backbone networks, and establish an emergency reserve. This primarily includes power transformers and autotransformers of high voltage classes, high-voltage switching equipment, switchgear, as well as auxiliary components of primary and secondary equipment and cable products. The existing resources do not fully cover the actual needs for the rapid restoration of damaged capacities and for enhancing the resilience of the power system against repeated attacks.

Despite these efforts, current equipment deliveries do not fully cover the need for emergency reserves, replacement of critically damaged EHV substations (330/750 kV), or the restoration of damaged transmission and distribution capacities.

**High-risk and frontline regions** where the energy infrastructure has suffered the most damage and is at high risk of repeated strikes include: Donetsk, Dnipropetrovsk, Zaporizhzhia, Kharkiv, Sumy, Chernihiv, Odesa, Mykolaiv, and Kherson regions.

To enable a rapid response to repeated attacks and minimize electricity restoration time, the Ministry of Energy of Ukraine has initiated the creation of a **National Strategic Reserve** of power transformers. The reserve is intended to ensure the prompt replacement of critical equipment in the event of massive attacks or large-scale network damage.

The emergency reserve structure includes the procurement of the following transformers:

- 63,000 kVA (150/35/10, 150/35/6, 150/10, 110/10 kV) – 21 units
- 25,000 kVA (150/35/10, 150/35/6, 110/10, 110/6 kV) – 14 units
- 4,000 kVA (35/10, 35/6 kV) – 3 units

A detailed list of equipment for energy companies is provided below in the document attachment.

## **2.2. Natural gas sector equipment needs**

In 2025, attacks increasingly targeted natural gas infrastructure, including large-scale strikes on gas production facilities.

In October and November 2025, combined missile and drone attacks again focused on the gas production sector. As a result, gas producers reported the loss of approximately 40% of national gas production capacity. Surface infrastructure of underground gas storage facilities (UGS) was also significantly damaged, with part of the equipment destroyed or requiring complete replacement.

A detailed list of equipment for energy companies is provided below in the document.

## **2.3. Ukrainian Railways equipment needs**

Ukrainian Railways have increasingly been targeted by attacks intended to disrupt national logistics. Since the start of the full-scale invasion, **more than 100 traction substations** have been damaged, several of them repeatedly. These facilities are part of Ukraine's critical infrastructure.

The frequency of air strikes exceeds manufacturing and delivery timelines for replacement transformers, many of which require custom production due to traction voltage standards.

To restore damaged infrastructure, Ukrainian Railways reports an immediate need for **around 120 transformers** across all voltage classes.

## **2.4. Water and heat supply equipment needs**

Based on the results of the consolidation and verification of information provided by Regional Military Administrations (RMA), the Ministry for Development has determined that the key

requirement to maintain the continuous operation for heating, centralized drinking water, and wastewater enterprises is the provision of mid-to-high capacity backup power sources, that are essential to maintain the continuous operation of critical infrastructure facilities during prolonged power outages.

Structure of needs for drinking water supply, centralized wastewater, and heat supply enterprises indicates a substantial deficit of medium- and high-capacity generator sets. These units are critically necessary for water intakes, wastewater treatment plants, main pumping stations, large boiler houses, central heating points, and heat-generating facilities in major cities. Such installations cannot be replaced by usual small-capacity humanitarian supplies and require targeted international technical and financial assistance, as well as the coordination of donor efforts to prioritize the protection of the most system-critical and vulnerable infrastructure objects.

Currently, according to the information provided in the attachment, the estimated additional need for diesel generator sets for drinking water supply and centralized wastewater disposal enterprises is approximately 869 units with a total capacity of about 335.3 MW, and for heat supply enterprises — approximately 543 units with a total capacity of about 196.66 MW.

A detailed list of equipment for water and heat supply disposal companies is provided below in the document.

### 3. Funding from the Energy Support Fund of Ukraine (UESF)

#### 3.1. UESF: Emergency Restoration

Energy companies continue to submit procurement needs to be financed through the UESF. As of 10 April 2026, requests with a total estimated value of **EUR 135.3 million** remain unfunded.

It should be noted that smaller requests (in the range of up to EUR 5 million) are allocated relatively quickly, while large and complex requests tend to wait for financing for a considerably longer period.

The table below summarises the submitted needs by company and sector.

Ukrainian company	Total Estimated Amount SR, EUR
<b>Natural gas sector</b>	
JSC "Ukrgezvydobuvannya"	24 180 000,0
<b>TOTAL Gas sector</b>	<b>24 180 000,0</b>
<b>Electricity sector</b>	
PJSC "Centrenergo" Trypilska TPP	36 963 851,0
JSC "DTEK Dniproenergo"	31 851 819,7
JSC "DTEK Westenergy"	22 502 000,0
JSC "Mykolaivoblenergo"	4 036 384,0
PrJSC "NPC Ukrenergo"	3 647 264,0
JSC "DTEK Odesa Electric Grids"	3 442 080,0
PJSC "DTEK Pavlohradcoal"	3 405 600,0
LLC "Shostka Enterprise Kharkivenergoremont"	2 624 316,3
JSC "Kharkivoblenergo"	788 700,0
LLC "Sumyteploenergo"	798 000,0
JSC "DTEK Kyiv Regional Electric Grids"	602 750,0
<b>TOTAL Electricity sector</b>	<b>111 147 887,8</b>
<b>TOTAL</b>	<b>135 327 887,8</b>

#### 3.2 UESF: Emergency Reserve

The establishment of an emergency equipment reserve remains one of the key elements of preparing the energy sector for possible damage, in accordance with the **Ukraine Resilience Plan** and preparations for the 2026–2027 **winterization period**. Particular attention is given to the accumulation of critically needed equipment that has long manufacturing lead times or limited market availability.

Such needs are defined by energy companies based on the existing equipment nomenclature, selecting approximately **up to 20% of the most critical items** to create a reserve required for rapid response in the event of damage to energy infrastructure.

At present, the funding gap for covering the emergency reserve amounts to **EUR 283.8 million**.

Given the high cost of core high-voltage and power equipment, requests aimed at establishing an emergency reserve are financially substantial and, as a rule, require significant grant contributions or dedicated international financing mechanisms.

### 3.3. UESF: Physical Protection

Strengthening the physical protection of energy infrastructure remains a priority for the Government and the Ministry of Energy. Energy companies are implementing a second level of physical protection; however, internal resources are insufficient.

Requests related to physical protection are allocated relatively quickly. As of 10 April 2026, all applications in this area have been funded.

In addition, companies are reporting further needs, including gabions, concrete blocks, sand/granite rubble, barrier mesh, soft containers, materials for protective structures, as well as rapidly deployable modular civil protection shelters for 15–20 people, which we would like to receive as humanitarian assistance.

### 3.4. UESF: Distributed generation

Russian attacks continue to increase the value of local gas-based generation solutions. Distributed gas generation and cogeneration can sustain critical services when centralised plants or key network elements are damaged.

Government efforts are focused on energy-deficit regions and communities, taking into account gas availability and grid connection requirements.

As of 10 April 2026, **36 key projects** are at different stages of implementation, including: **15 projects financed** for a total of EUR 225.1 million (319.7 MW); and **2 projects worth EUR 173.8 million partially financed** for EUR 91.6 million (total capacity 212.4 MW).

In southern Ukraine, damage to high-voltage substations (220–750 kV) and distribution networks (110–150 kV) has created bottlenecks in the 330–750 kV transmission grid, limiting the ability to meet demand in energy hubs around **Odesa**. In this context, additional gas-generation units are prioritised to strengthen energy security and grid stability.

Projects requiring financing (**around 550 MW**) are summarised below.

Ukrainian company	Total Estimated Amount SR, EUR
PJSC Ukrnafta	66 123 533
JSC Odesa CHP	47 600 000
PJSC Kharkiv CHPP-5	47 550 000
JSC Ukrainian Railways	38 760 001
PJSC Trypilska TPP Centrenergo	25 800 000

PJSC Zmiivska TPP Centrenergo	25 800 000
LLC Euro-Rekonstrukcia	16 210 000
JSC Sumyteploenergo	13 875 980
JSC Kherson CHP	11 300 000
ME Kharkiv Heat Networks	11 250 000
Teplokomunenergo (Chernihiv CHP)	7 237 600
LLC Kramatorskteploenergo	1 007 484
PrJSC Cherkasy Khimvolokno, Cherkasy CHP	486 740
<b>TOTAL</b>	<b>313 001 338,5</b>

### 3.5. UESF: Special-purpose vehicles and equipment

The total unmet need for automotive and special equipment is estimated at **EUR 19.9 million**. Commonly requested items include forklifts, excavators, truck cranes, telescopic handlers, aerial work platforms, trucks with crane arms, and other specialised equipment for emergency repairs and rubble removal.

### 3.6. UESF: Special projects

In addition to standard emergency restoration, physical protection, distributed generation and equipment needs, several strategic and large-scale requests have been submitted under a separate category of special projects. These requests address systemic risks to gas supply, electricity generation resilience, and cross-border emergency electricity support.

#### **Natural Gas Procurement (Heating Season 2025/2026)**

JSC "NJSC Naftogaz of Ukraine" – EUR 100.0 million

Following missile and drone attacks in October 2025 on gas production facilities of the Naftogaz Group, domestic production declined significantly, creating a substantial risk of gas deficit during the 2025/2026 heating season.

Under the approved gas balance (base scenario), 4.2 bcm of natural gas must be imported during November 2025 – March 2026, with an estimated total cost of approximately EUR 1.9 billion. Due to limited internal resources and the urgency of securing import contracts, the company has requested EUR 100 million in grant financing from the UESF.

The requested funds will be used, in accordance with Public Service Obligations (PSO), to partially compensate the gap between import prices and regulated supply prices for socially important consumer categories.

#### **Emergency Mobile Generation Solution**

JSC "Ukrainian Railways" – EUR 12.314 million

The company proposes the deployment of mobile power plants based on high-capacity diesel and gas-piston generators (up to 15 MW total installed capacity). The objective is to ensure electricity supply in case of large-scale blackouts, network destruction, or during emergency restoration works, particularly for critical railway and infrastructure facilities.

The project includes:

- 8 diesel-generator units (10 kV, 1.9–2.3 MW each);
- 1 modular switchgear (35/10 kV);
- 3 modular dry-type power transformers (10 MVA, 6.3 MVA, 1.25 MVA);
- 4 auxiliary/control modules (auxiliary, control, personnel);
- 1 own-needs diesel generator (400 kW).

The concept foresees 15 container-based generation platforms with integrated transformer, distribution, protection and utility modules, enabling rapid deployment in affected areas.

### **Emergency Electricity Supply and Cross-Border Support**

PrJSC "NPC Ukrenergo" – EUR 30.0 million

NPC "Ukrenergo" anticipates significant electricity deficits within the Integrated Power System (IPS) of Ukraine during peak and emergency periods. To maintain system stability, emergency electricity imports from neighbouring transmission system operators are expected to be activated.

Since such emergency assistance is provided on a commercial basis, and considering the elevated risks of further attacks on transmission infrastructure during the heating season, the projected financial requirement for emergency electricity procurement and related restoration services amounts to EUR 30 million.

These special projects are strategic in nature, aiming to prevent systemic energy shortages, stabilise the power system under extreme conditions, and safeguard critical services during the 2025/2026 heating season.

## **Comprehensive Needs of the Government of Ukraine in Energy Equipment (updated based on urgent emergency needs)**

### **I. Power supply**

#### **1. Power Equipment**

##### **1.1. Power Transformers and Autotransformers**

###### **Autotransformers:**

- 330/110–330/150–220/110 kV – 6 pcs

###### **Power transformers:**

- 750 kV — 500–750 MVA – 4 pcs
- 330 kV — 250–400 MVA – 9 pcs
- 220 kV — 1 pcs
- 150 kV — 25–63 MVA – 8 pcs
- 110 kV — 10–63 MVA – 17 pcs
- 35 kV — 2.5–32 MVA – 20 pcs
- 0.4–10 kV – 38 pcs (distribution transformers)

**This includes urgent requirements for restoration of critical generation and substation infrastructure, including damaged high-voltage nodes.**

**Quickly available: distribution transformers and standard HV units from stock**

**Long production cycle: 330–750 kV transformers and autotransformers (up to 12–18 months)**

##### **1.2. Circuit Breakers**

###### **SF<sub>6</sub> circuit breakers:**

- 750 kV – 1 set
- 330 kV – 15 pcs
- 220 kV – 6 pcs
- 150 kV – 15 pcs
- 110 kV – 25 pcs

###### **Vacuum circuit breakers:**

- 35 kV – 63 pcs
- 10 kV – 286 pcs

**Quickly available: vacuum breakers 6–35 kV, standard 110 kV SF<sub>6</sub>**

**Long production cycle: 220–750 kV equipment**

##### **1.3. Disconnectors (Isolators)**

- 330 kV – 45 pcs
- 150 kV – 15 pcs
- 110 kV – 34 pcs
- 35 kV – 35 pcs

**Quickly available: standard 35–110 kV**  
**Long production cycle: 220–750 kV configurations**

#### **1.4. Current and Voltage Transformers**

- 750 kV – 143 phases (CT), 56 phases (VT)
- 330 kV – ~250 units
- 150 kV – ~30 units
- 110 kV – ~496 units
- 35 kV – ~118 units

**Quickly available: 35–110 kV**  
**Long production cycle: 330–750 kV high-accuracy units**

#### **1.5. Surge Arresters**

- 150 kV – 51 pcs
- 110 kV – 18 pcs
- 35 kV – 120 pcs

**Quickly available: standard MV/HV designs**  
**Long production cycle: EHV клас**

#### **1.6. Insulators and Bushings**

- Bushings 110–330 kV – ~48 pcs
- Insulators – ~11,800 pcs

**Quickly available: standard 10–110 kV**  
**Long production cycle: 330 kV+**

#### **2. Switchgear and Substation Equipment**

- 6–10 kV switchgear – ~120 pcs
- GIS 150 kV – 6 pcs
- Compact switchgear – 5 pcs
- Mobile substations – 5 pcs

**Quickly available: standard MV solutions**  
**Long production cycle: GIS and customized solutions**

#### **3. Cable Products**

- Power cables – ~412 km
- Control cables – ~over 150 km
- Overhead conductors – ~100 km
- Cable joints & terminations – ~500 pcs

**Quickly available: стандартні кабелі**  
**Long production cycle: спеціальні типи**

#### **4. Auxiliary Equipment**

- Transformer oil – ~585 tons

- Batteries / DC systems – ~112 pcs
- Busbars / bus ducts – ~10 pcs

#### 4.1. Relay Protection & Automation

- Protection systems / cabinets – ~342 pcs
- Telemechanics – 15 pcs

#### 4.2. Distributed and Backup Generation

- Diesel generators – 8 pcs
- Gas turbine units (6–30 MW) – 2 units
- Gas piston units – ~30 units

#### 4.3. Pumping & Mechanical Equipment

- Pumping units – 18 pcs
- Compressors – 2 pcs
- Electric motors – ~22 pcs

#### 4.3. Construction Materials

- Steel structures – ~350 tons
- Pipes – ~1,800 tons + 70,000 m
- Thermal insulation & roofing – ~40,000 m<sup>2</sup>

#### 4.4. Special Equipment

- Cranes, excavators, lifts – ~20 units
- Emergency repair workshops – 4 units
- Mobile electrical laboratories – 2 pcs
- Reclosers 6–35 kV – ~205 pcs

### 5. Electricity Generation (Diesel and Backup Power)

**5.1. Diesel and Autonomous Generators (Consolidated** including energy facilities, district heating, water supply companies, and mobile reserve stock)

**Total:** over **1,950 units**, total installed capacity **>530 MW**

**By capacity range:**

- 0.1 MW - approx. 1,100 units
- 0.1–0.6 MW - approx. 460 units
- 1–5 MW - approx. 230 units
- ≥5 MW - approx. 50 units

For connecting consumers to the generation units, the following cables and total lengths per category are required:

- 0.1 MW (≈1,100 units) — copper cable, cross-section 4×95 mm<sup>2</sup>, total length ≈ 55 km
- 0.1–0.6 MW (≈460 units) — copper cable, cross-section 4×240 mm<sup>2</sup> (3 parallel lines), total length ≈ 69 km

- 1–5 MW ( $\approx 230$  units) — copper cable, cross-section  $1 \times 300 \text{ mm}^2$  (3 single-core cables, one per phase), total length  $\approx 34.5 \text{ km}$
- $\geq 5 \text{ MW}$  ( $\approx 50$  units) — copper cable, cross-section  $1 \times 400 \text{ mm}^2$  (3 single-core cables, one per phase), total length  $\approx 7.5 \text{ km}$

**Additionally Urgent request for 1,500 generators with a capacity of 300 kW or higher for supplying power to residential buildings.**

- $\geq 300 \text{ kW}$  ( $\approx 1,500$  units) — copper cable, cross-section  $4 \times 240 \text{ mm}^2$  (*or equivalent, depending on connection scheme*), approx. 50 m per unit, total length  $\approx 75 \text{ km}$

Additionally, cable lugs with cross-sections ranging from  $95 \text{ mm}^2$  to  $400 \text{ mm}^2$  are required for connection, in a total quantity of approximately 33,500 units.

(including:  $95 \text{ mm}^2$  —  $\approx 8,800$  units;  $240 \text{ mm}^2$  —  $\approx 23,040$  units;  $300 \text{ mm}^2$  —  $\approx 1,380$  units;  $400 \text{ mm}^2$  —  $\approx 300$  units).

## **II. GAS supply**

**Urgent emergency equipment needs of the Gas TSO of Ukraine and the Naftogaz Group include:**

- Compressor Ariel KBK/4 CU (3-stage reciprocating compressor) with engine – 2 units
- Compressor Ariel KBE/4 CU (2-stage reciprocating compressor) with engine – 2 units
- Compressor Ariel KBK/4 CU (1-stage reciprocating compressor) with engine – 2 units
- Gas processing unit (packaged equipment for gas treatment) – 2 units
- Gas turbine unit with a capacity 16 MW – 8 units
- Gas turbine unit with a capacity 13 MW – 3 units
- Gas turbine unit with a capacity 6 MW – 16 units
- Gas turbine unit with a capacity 8 MW – 6 units
- Gas turbine unit with a capacity 2-3 MW – 3 units
- Gas motor compressor unit with a capacity 2-3 MW – 12 units
- Gas motor compressor unit with a capacity 1.1 MW – 1 unit
- Gas processing unit Titan 130 – 1 unit
- Gas processing unit Centaur 40 – 3 units
- Compressor Ajax DPC 2804 – 4 units
- Compressor Caterpillar + Ariel – 1 unit
- Turbine Taurus 70 or similar – 4 units.

## **III. Heat Generation**

### **6. Cogeneration and Heat Generation Equipment**

#### **6.1. Cogeneration Equipment**

- 0–1 MW: 196 units (51.23 MW)
- 1–2 MW: 51 units (60.4 MW)
- 2–5 MW: 54 units (162.1 MW)
- 5–10 MW: 24 units (190.3 MW)

## **6.2. Modular Boiler Houses**

Total: 254 units, total installed capacity >1,200 MW

- 0.04–2 MW: 73 units (114.78 MW)
- 2.1–4.8 MW: 92 units (294.07 MW)
- 5–7 MW: 51 units (307.3 MW)
- 7.5–15 MW: 28 units (308.26 MW)
- 15–18 MW: 4 units (64.66 MW)
- 20–25 MW: 6 units (129 MW)

## **IV. Water Supply and Heat supply Companies**

**9. Diesel generators water supply:** represent 869 units (335.3 MW)

- **0.6–5 MW: 107 units (203.82 MW) first priority**
- **5 MW: 7 units (75.3 MW) first priority**
- 0–0.1 MW: 586 units (17.54 MW)
- 0.1–0.6 MW: 169 units (38.64 MW)

**10. Diesel generators heat supply:** represent 543 units (196,66 MW)

- **1 – 5 MW: 45 units (98,76MW) first priority**
- **5 – 22,5 MW: 4 units (52,5 MW) first priority**
- 0–0.1 MW: 364 units (13,04 MW)
- 0.1–0.6 MW: 121 units (25.2 MW)
- 0.6 - 1 MW: 9 units (7.16 MW)

**The total requirement water and heat supply amounts to – 1412 units ( 531,96 MW)**

## **V. Mobile Equipment Fund/Reserve Stock of equipment:**

**Operator: SARDI: STATE AGENCY FOR RESTORATION AND DEVELOPMENT OF INFRASTRUCTURE**

### **Mobile Equipment Fund - on a chassis, for moving to different locations**

**Block-modular boiler houses:**

- 1–3 MW: 586 units (1,284,185.23 kW heat power)

**Diesel generators:**

- 0.1-3 MW (1-3 MW priority): 136 MW (funded via state budget)

## **VI. Urgent need for cogeneration for the city of Kyiv (Kyivteploenergo Municipal Enterprise)**

- Gas reciprocating unit (GPU) 2.3 MW 11 units
- Gas reciprocating unit (GPU) 2.5 MW 19 units
- Gas reciprocating unit (GPU) 4.5 MW 20 units

- Gas reciprocating unit (GPU) 5.0 MW 2 units
- Gas reciprocating unit (GPU) 10.0 MW 5 units
- Gas turbine unit (GTU) 57 MW 2 units
- Steam turbine unit (STU) 46 MW 1 unit
- Battery energy storage system (BESS) 10 MW 2 units

**Electric Motors (or equivalents)(for district heating enterprises)**

- 4AZM 5000/6000, 6 kV, 5000 kW, 2982 rpm - 1 unit
- DAZO-15-49-8/10, 6 kV, 630/320 kW, 734/595 rpm - 6 units
- AO2-92-4U2, 0.4 kV, 11 kW, 750 rpm - 2 units
- 4AM160M8UZ, 0.4 kV, 11 kW, 730 rpm - 2 units
- AIR160M8UZ, 0.4 kV, 11 kW, 730 rpm - 1 unit
- A02-81-2, 0.4 kV, 40 kW, 2920 rpm - 1 unit
- 4AMN225M2, 0.4 kV, 90 kW, 2930 rpm - 3 units

**VII. Emergency Equipment Requirements of LVDS “Brody” of the Druzhba Oil Pipeline**

The Linear Production and Dispatch Station (LVDS) “Brody” of the Druzhba oil pipeline is a critical infrastructure facility within the main oil pipeline system of Ukraine and is operated by JSC Ukrtransnafta.

In order to ensure uninterrupted operation of the facility and enable rapid restoration a list of emergency requirements for electrical, technological, and automated equipment has been developed, namely:

**Power transformers**

- Power transformer 150/6 kV, 16 MVA – 1 pc
- Power transformer 110/10 kV, 16 MVA – 1 pc
- Power transformer 110/6 kV, 16 MVA – 1 pc

**Process equipment**

- Mixer Plenty 30(28)P-70-S TM-30 (50HP) or equivalent – 3 pcs
- Electric-operated flanged gate valve DN500 PN16 (complete set: valve, gearbox, electric actuator) – 3 pcs
- Electric-operated flanged gate valve DN600 PN16 (complete set: valve, gearbox, electric actuator) – 1 pc
- Electric-operated flanged butterfly valve DN500 PN16 (complete set: valve, gearbox, electric actuator) – 3 pcs
- Electric-operated flanged butterfly valve DN600 PN16 (complete set: valve, gearbox, electric actuator) – 1 pc
- Limitorque MX-40 electric actuator or equivalent – 2 pcs

**Cable products**

- Cable ВБ6ШВ 5×2.5 – 2662 m
- Cable ВБ6ШВ 5×10 – 400 m
- Cable ВБ6ШВ 5×4 – 350 m
- Cable ВБ6ШВ 3×6 – 400 m

- Cable ВВ6ШВ 5×16 – 500 m
- Cable ВВ6ШВ 5×35 – 300 m
- Cable КВВ6ШВ 7×1.5 – 500 m
- Wire МГ-10 – 300 m
- EuroSat RG-58 coaxial cable – 300 m
- Control cable МКЄКШВ 4×2×1.0 – 200 m

### **Electrical installation materials**

- Connecting coupling 0.4 kV (150–240) – 20 pcs
- Connecting coupling 0.4 kV (16–50) – 25 pcs
- Connecting coupling 0.4 kV (50–95) – 20 pcs
- Connecting coupling 0.4 kV (1.5–2.5) – 20 pcs
- End connector 0.4 kV (150–240) – 15 pcs
- End connector 0.4 kV (70–120) – 20 pcs
- Explosion-proof distribution box 300×350 – 15 pcs

### **Automation and control systems**

- Schneider Electric PLC module 140 CRP 932 00 RIO Head – 1 pc
- Schneider Electric PLC module 140 CRA 932 00 RIO (Remote I/O) Drop Adapter – 2 pcs
- Splitter AEG Modicon MA-0185-100(C) – 4 pcs

### **Fire-fighting and emergency equipment**

- Fire truck (fire tanker) – 2 pcs
- PH-Poseidon 1 portable floating fire pump or equivalent – 2 pcs
- Genergy Limited 3000 portable petrol generator or equivalent – 2 pcs
- Lukas SC 358E3 battery-powered combination tool (spreader and cutter) – 2 sets
- Lukas R 521E3 battery-powered jack – 2 sets
- Streamlight Survivor personal flashlights with charger – 8 pcs
- Streamlight Fire Vulcan multi-lamp units with charger – 5 pcs
- Protek Style 366 multi-mode combination hand-held fire hose – 6 pcs
- Foam dispensing nozzles for Protek Style 213 hose – 6 pcs

### **Fire hoses**

- Fire hose Ø51 mm (20 m) – 40 pcs
- Fire hose Ø66 mm (20 m) – 30 pcs
- Fire hose Ø77 mm (20 m) – 40 pcs

### **Protective equipment and tools**

- Fireproof fire-fighting gloves – 100 pairs
- Petrol chainsaw (Husqvarna / Stihl / Makita or equivalent, with spare cut-off wheels and oil) – 2 sets
- Chainsaw (Husqvarna / Stihl / Makita or equivalent) – 2 sets

### **Focal points**

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## **Information Note on Cables and Cable Lugs for Connecting 1,500 Generators**

Standard Generator Capacities from 50 kVA to 1.5 MW

**Lower capacities (commonly used for backup power supply to buildings)**

- 50 kVA — 80 units
- 63 kVA — 100 units
- 80 kVA — 120 units
- 100 kVA — 160 units
- 125 kVA — 140 units
- 160 kVA — 130 units
- 200 kVA — 140 units

#### **Medium capacities (distributed generation units)**

- 250 kVA — 120 units
- 300 kVA — 110 units
- 320 kVA — 70 units
- 330 kVA — 40 units
- 400 kVA — 80 units
- 440 kVA — 30 units
- 500 kVA — 60 units
- 550 kVA — 20 units
- 600 kVA — 35 units
- 650 kVA — 10 units
- 700 kVA — 15 units
- 750 kVA — 10 units
- 800 kVA — 10 units
- 900 kVA — 8 units

#### **Upper range up to ~1.5 MW**

- 1,000 kVA — 6 units
- 1,100 kVA — 2 units
- 1,200 kVA — 2 units
- 1,250 kVA — 1 unit
- 1,500 kVA — 1 unit

#### **Cable Requirements**

To connect 1,500 generator units with capacities ranging from 50 kVA to 1.5 MVA, approximately 84 km of copper power cable with cross-sections from 25 mm<sup>2</sup> to 240 mm<sup>2</sup> is required, taking into account parallel cable runs for higher-capacity generators.

#### **Consolidated Summary by Cable Type:**

- Copper cable 4×25 mm<sup>2</sup> — 4.0 km
- Copper cable 4×35 mm<sup>2</sup> — 5.0 km
- Copper cable 4×50 mm<sup>2</sup> — 6.0 km
- Copper cable 4×70 mm<sup>2</sup> — 8.0 km
- Copper cable 4×95 mm<sup>2</sup> — 7.0 km
- Copper cable 4×120 mm<sup>2</sup> — 6.5 km
- Copper cable 4×150 mm<sup>2</sup> — 7.0 km
- Copper cable 4×185 mm<sup>2</sup> — 6.0 km
- Copper cable 4×240 mm<sup>2</sup> (single run) — 16.5 km
- Copper cable 4×240 mm<sup>2</sup> (parallel runs, 2–4 runs) — 18.0 km

#### **Cable Lug Requirements**

(for generators from 50 kVA to 1.5 MVA, 0.4 kV, copper conductors, 4-core connection scheme, including parallel runs)

#### **Summary by Lug Size**

- 25 mm<sup>2</sup> lugs — 640 pcs
- 35 mm<sup>2</sup> lugs — 800 pcs
- 50 mm<sup>2</sup> lugs — 960 pcs

- 70 mm<sup>2</sup> lugs — 1,280 pcs
- 95 mm<sup>2</sup> lugs — 1,120 pcs
- 120 mm<sup>2</sup> lugs — 1,040 pcs
- 150 mm<sup>2</sup> lugs — 1,120 pcs
- 185 mm<sup>2</sup> lugs — 960 pcs
- 240 mm<sup>2</sup> lugs — approx. 6,176 pcs

**Overall Summary**

Total number of cable lugs: approximately 12,100 pcs

Application: connection of generator units with capacities from 50 kVA to 1.5 MVA

Material: copper

Cable cross-section range: 25 mm<sup>2</sup> to 240 mm<sup>2</sup>