

The main categories of requested energy equipment are presented below:

## I. Power Supply

### 1. Power Equipment

#### 1.1. Power Transformers and Autotransformers

- Autotransformers:
- Autotransformer 200 MVA, 330/110 kV — 1 pc.
- Autotransformer 250 MVA, 220/110 kV — 1 pc.
- Autotransformer 400 MVA, 150/330 kV — 1 pc.
- Autotransformer 250 MVA, 150/330 kV — 1 pc.

#### Power transformers:

- Power transformer 40000 kVA, 110/10/10 kV — 1 pc.
- Power transformer TDTN-40000/115-U1 — 2 pcs.
- Power transformer TDTN-40 MVA 150/35/10 kV — 1 pc.
- Power transformer TMN-10 MVA 35/10 kV — 2 pcs.
- Power transformer TDC-250000/330, 250000 kVA, 347/15.75 kV or equivalent — 2 pcs.
- Power transformer TRDNS-32000/35-U1 or equivalent — 4 pcs.
- Power transformer TDC-400000/330 or equivalent — 6 pcs.
- Power transformer 25 MVA, 110/35/10 kV — 7 pcs.
- Power transformer 25 MVA, 150/35/6 kV — 10 pcs.
- Power transformer 16 MVA — 6 pcs.
- Power transformer 10 MVA — 6 pcs.
- Power transformer 6.3 MVA — 14 pcs.
- Power transformer 4 MVA — 12 pcs.
- Power transformer 2.5 MVA — 5 pcs.
- Distribution transformers 0.16–1 MVA — 14 pcs.

#### Additionally:

- Block transformers 200–400 MVA — 9 pcs.
- Start-up and reserve transformers 20–40 MVA — 5 pcs.
- Auxiliary transformers 32 MVA — 4 pcs.
- Transformers for gas-piston and cogeneration facilities — 8 pcs.

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 12–24 months).

#### 1.2. Circuit Breakers

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

- 750 kV — 10 sets (3 phases)
- 330 kV — 32 sets
- 220 kV — 2 sets (3 phases)
- 150 kV — 8 pcs
- 110 kV — 67 pcs

##### Vacuum circuit breakers:

- 35 kV — 23 pcs
- 10 kV — 20 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)

- 750 kV — 12 sets.
- 330 kV — 40 pcs./sets.
- 220 kV — 6 pcs.
- 150 kV — 7 pcs.
- 110 kV — 35 pcs.
- 35 kV — 52 pcs.

**Quickly available:** standard 35–110 kV.

**Long production cycle:** 220–750 kV configurations.

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

##### **Current transformers:**

- 750 kV — 20 pcs.
- 330 kV — 24 pcs.
- 150 kV — 21 pcs.
- 110 kV — 107 pcs.
- 35 kV / 10 kV — 61 pcs.

##### **Voltage transformers:**

- 750 kV — 12 pcs.
- 330 kV — 35 pcs.
- 150 kV — 27 pcs.
- 110 kV — 31 pcs.
- 35 kV / 10 kV / 6 kV — 31 pcs.

**Quickly available:** 35–110 kV.

**Long production cycle:** 330–750 kV high-accuracy units.

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

- 750 kV — 2 sets.
- 330 kV — 2 sets.
- 220 kV — included in mixed packages.
- 150 kV — 51 pcs. + 2 sets.
- 110 kV — 82 pcs. + 10 sets.
- 35 kV — 262 pcs. + 1 set.
- 10 kV — 300 pcs.

**Quickly available:** standard MV/HV designs.

**Long production cycle:** EHV class equipment.

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

- High-voltage bushings 10–330 kV — 278 pcs.
- Insulators — 3,102 pcs.

**Quickly available:** standard 10–110 kV.

**Long production cycle:** 330 kV+ equipment.

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

- 6 kV switchgear cubicles — 6 pcs.
- 10 kV switchgear — 4 pcs.
- 35 kV switchgear / GIS — 3 pcs.
- Gas-insulated switchgear 35 kV — 2 pcs.
- Compact switchgear (KRPZ/KRU) — 7 pcs.
- SMA medium-voltage inverter substations — 5 pcs.
- Outdoor switchgear cabinets for cogeneration units — 2 sets.
- Bus ducts 15.75–20 kV / 6.3 kV — 13 pcs.

**Quickly available:** standard MV solutions.

**Long production cycle:** GIS and customized solutions.

### **3. Cable Products**

- Power cables — approximately 405 km.
- Control cables — approximately 14.6 km.
- Overhead conductors / SIP / ABC — approximately 59 km + 10 t ACSR.
- 110 kV cable — 556 m.
- Cable joints and terminations — over 400 pcs.
- Control cable type KVVHng 19x2.5 — 3,640 m.

**Quickly available:** standard cable products.

**Long production cycle:** specialized cable types.

### **4. Auxiliary Equipment**

- Transformer oil — 570 t + 32,000 l.
- Turbine oil TP-22S — 400 t.
- Batteries / DC systems / DC boards — at least 17 sets/items.
- Modular battery blocks Fluence Smart Stack — 56 pcs.
- DC busbar-cable assemblies — 11 pcs.

#### **4.1. Relay Protection & Automation**

- Protection and control cabinets — over 20 pcs.
- Telemechanics and telesignalling cabinet — 1 pc.
- SCADA telecommunications cabinet — 1 pc.
- Microprocessor relay terminals — 10 pcs.
- Generator-transformer protection systems — 4 sets.
- Excitation systems — 4 sets.
- Software and hardware complexes with cable products — 4 sets.
- Schneider Electric PLC module 140 CRP 932 00 RIO Head — 1 pc.
- Schneider Electric PLC module 140 CRA 932 00 RIO Drop Adapter — 2 pcs.
- Splitter AEG Modicon MA-0185-100(C) — 4 pcs.

#### **4.2. Distributed and Backup Generation**

- Diesel generators — 3 pcs.
- Gas turbine units (5.67–16.5 MW) — 3 units.
- Gas piston / gas generator / cogeneration units — approximately 58 units.
- Gas pumping units 16 MW — 5 sets.
- Mobile block-modular gas distribution stations 10,000 m<sup>3</sup>/h — 3 pcs.
- Mobile block-modular gas distribution stations 50,000 m<sup>3</sup>/h — 5 pcs.
- Mobile block-modular gas distribution stations 120,000 m<sup>3</sup>/h — 1 pc.

#### **4.3. Pumping & Mechanical Equipment**

- Pumping units — 20 pcs.
- Compressors — 4 pcs.
- Electric motors — ~10 pcs.
- Feed pumps — 2 pcs.
- Smoke extractors with motors — 2 units.

Electric-operated valves and actuators — included in urgent requests.

#### **4.4. Construction Materials**

- Steel pipes — 1,891 t + 67,810 m.
- Brass pipe — 15 t.
- Steel channel sections — 1,920 running metres.
- Rectangular steel pipe — 310 pcs.
- Roofing and façade materials — 1,727 m<sup>2</sup> + 2,580 pcs. .

- Sandwich panels — 950 pcs.

#### **4.5. Special Equipment**

- Reclosers 6–35 kV — 255 pcs./sets.
- Mobile electrical laboratories — 2 pcs.
- Emergency repair workshops — 5 units.
- Truck with crane manipulator — 1 unit.
- Self-propelled boom crane 100 t — 1 unit.
- Mobile crane, 50-ton capacity — 1 unit.
- Aerial work platforms, AGP/AP — 15 units.
- Excavators / drilling machines / backhoe loaders — 11 units
- Dump trucks — 2 units.
- Telescopic forklift — 1 unit.
- Diesel forklift — 1 unit.
- Emergency and rescue vehicles — 2 units.
- Portable battery-powered X-ray devices — 3 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 requirement: over 1,950 units with a total installed capacity exceeding 530 MW.**

**By capacity range:**

- 0.1 MW — approximately 1,100 units
- 0.1–0.6 MW — approximately 460 units
- 1–5 MW — approximately 230 units
- **≥5 MW — approximately 50 units**

For the connection of consumers to generation units, copper power cables with cross-sections ranging from 25 mm<sup>2</sup> to 400 mm<sup>2</sup> are required, depending on generator capacity and connection scheme, including parallel cable runs for higher-capacity generators.

Additionally, for the connection of approximately 1,500 generator units with capacities ranging from 50 kVA to 1.5 MVA, approximately 84 km of copper power cable are required.

**The consolidated cable requirement includes:**

- 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.

Additionally, cable lugs for copper conductors with cable cross-sections ranging from 25 mm<sup>2</sup> to 240 mm<sup>2</sup> are required in an estimated total quantity of approximately 12,100 pcs, depending on generator capacity and connection configuration.

Detailed requirements for cable products and cable lugs are provided in the **Annex “Information Note on Cables and Cable Lugs for Connecting 1,500 Generators”**.

## **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 VBBSHV 5×2.5 – 2,662 m
- • Cable VBBSHV 5×10 – 400 m
- • Cable VBBSHV 5×4 – 350 m

- Cable VBBSHV 3×6 – 400 m
- Cable VBBSHV 5×16 – 500 m
- Cable VBBSHV 5×35 – 300 m
- Cable KVBSHV 7×1.5 – 500 m
- MG-10 wire – 300 m
- EuroSat RG-58 coaxial cable – 300 m
- MKEKShV 4×2×1.0 control cable – 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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#### **Annex**

#### **“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>