

Gogni Wind Company LLC - About the connection of the Gogni Wind Power Plant to the 220 kV voltage distribution device of the substation "Zestafoni-500"

JSC "Georgian State Electrosystem" (hereinafter referred to as "GSE" or "Electrosystem") considers it possible to connect the 187.2 MW "Gogni Wind Power Plant" to be constructed by LLC "Gogni Wind Company" (hereinafter referred to as "Applicant") (registered office number - 404643418) (coordinates: X=337785 Y=4688293; X=338991 Y=4688178; X=334639 Y=4681194; X=340054 Y=4681202;) to the 220 kV voltage distribution device of the substation "Zestafoni-500" in compliance with the following technical conditions:

1. The applicant shall select a territory and construct a 187.2 MW wind power plant with all necessary equipment and facilities. Also, a substation of the required capacity of 220 kV, the scheme of which shall be specified during the design and agreed in advance with the "GSE";
2. In order to receive the power generated by the project "Gogni Wind Power Plant", one line cell corresponding to the equipment existing in the substation should be allocated/arranged in the 220 kV voltage distribution device of the substation "Zestafoni-500" by "GSE" with all necessary devices and equipment;
3. The applicant shall construct a 220 kV overhead power line between the 220 kV designed substation to be constructed by the applicant and the line cell to be constructed by the GSE in the 220 kV distribution equipment of the Zestafoni-500 substation;
4. The route, length, wire brand and type of the 220 kV overhead power line to be constructed by the applicant shall be specified during the design process and agreed with the GSE;
5. The 220 kV overhead line connecting to the 220 kV substation to be installed by the applicant must be equipped with digital relays for protection, control and automation, which must be integrated with the existing digital relays for control and protection in the substation "Zestafoni-500". The digital protection terminals (at both ends of the line) must have the following functional capabilities:

First set of protection

- Differential protection (with optical connection);
- Distance protection (at least 5 zones, with teleprotection, with optical connection);
- Zero sequence current protection in the direction (at least 4 stages, with teleprotection);
- Maximum current protection;
- Emergency current protection (two stages phase-to-phase, two stages zero);
- Circuit breaker failure reservation;
- Three-phase repeated automatic switching;
- Single-phase repeated automatic switching;
- Remote and local control of the cell;
- Fault location determination;
- Registration and storage of emergency records and oscillograms;
- Synchronism control;
- Communication means;
- Time synchronization.

Second set of protection

- Differential protection (with optical connection);
- Remote protection (at least 5 zones, with teleprotection, with optical connection);
- Zero sequence current protection in the direction (at least 4 stages, with teleprotection);
- Maximum current protection;

- Emergency current protection (two stages phase-to-phase, two stages zero);
 - Circuit breaker failure reservation;
 - Three-phase repeated automatic switching;
 - Single-phase repeated automatic switching;
 - Remote and local control of the cell;
 - Determination of the location of the damage;
 - Registration and storage of emergency records and oscillograms;
 - Synchronism control;
 - Communication means;
 - Time synchronization.
6. Teleprotection should be arranged for the 220 kV overhead power line;
 7. Remote access to the digital protection terminal(s) via the SCADA network should be possible for the purpose of downloading emergency records and configuration files (in the Zestafoni-500 substation);
 8. During the design, the issue of integrating the newly constructed line into the relay protection of the 220 kV switchgear of the substation "Zestafoni-500" should be taken into account.
 9. The report on the installation of relay protection (relay protection setting and calculations) for the 220 kV overhead power line must be submitted by the applicant;
 10. 11. The substation must be equipped with modern digital protection and control devices, and the relay protection settings for each element must be calculated and agreed with the GSE;
 11. The applicant should determine the issue of participation in the frequency and voltage regulation of the power plant at the initial stage of design;
 12. The 220 kV line cell to be installed on the wind power station side shall be equipped by the applicant with a synchronized vector measurement and power quality recording analyzer system(s), the technical details of which shall be agreed with the "GSE" at the design stage and the following shall be taken into account:
 - The synchronized vector measurement system shall send two data streams in accordance with the requirements of the IEEE C37.118 standard;
 - The power quality recording analyzer system shall provide measurement and recording of current, voltage and power in accordance with the IEC 61000-4-30 Class A standard;
 - The power quality recorder analyzer system must ensure operation with appropriate settings of current and voltage harmonic limits in accordance with the requirements of the IEEE 519 standard and data transmission in accordance with the requirements of the IEC 61850 (with the MMS file transmission function) and DNP3 standard;
 - For synchronized vector measurements and power quality recorder analyzer systems, the SDN network switch SEL-2741 manufactured by Schweitzer Engineering Laboratories, which will be administered/configured by GSE, shall be used to connect to the ICON multiplexer in the Zestafoni-500 substation. In addition, the ports of the synchronized vector measurement device (PMU), power quality recorder analyzer device and communication device connected to the ICON multiplexer network shall not be used for other purposes and shall be physically isolated from other networks;
 - Synchronized vector measurement and power quality recording analyzer systems shall be time synchronized via the satellite system «GPS», IRIG-B standard, ensuring an accuracy of at least ± 2 microseconds;
 - The current and voltage circuits of the PMU device used in the synchronized vector measurement system shall be connected to the windings of the current and voltage transformers of the protection accuracy class.

- The current circuits of the power quality recording analyzer device shall be connected to the windings of the current transformer of the measurement accuracy class, and the voltage circuits shall be connected to the windings of the voltage transformers of the measurement or protection accuracy class;
- In the synchronized vector measurement system, the PMU device shall be able to send data in both M class and P class (Performance class: P and M);
- In the synchronized vector measurement system, the PMU device must be able to send 50 data per second (Reporting rates: 50 messages per second) in both TCP and UDP protocol formats;
- The PMU device(s) must be able to make at least 600 period records (oscillograms) and it must be possible to export data in the form of a "COMTRADE" (Common format for Transient Data Exchange for power systems) format file;
- The synchronized vector measurement system must provide measurement of the following parameters for a 220 kV wind power station line cell:
 - Phase voltage of all three phases and phase shift angle;
 - Phase current of all three phases and phase shift angle;
 - Voltage frequency;
 - Voltage frequency rate of change;
 - Circuit breaker status (discrete signals - circuit breaker on / off);

- The power quality recording and analysis device:

- The ability to perform at least 128 measurements in one period;

Must have a memory of at least 1 gigabyte

- Must have an oscilloscope function;
- It must be possible to export data in the form of a "COMTRADE" (Common format for Transient Data Exchange for power systems) format file;
- It must be possible to make 600 period recordings, with a total number of at least 190 records;
- It must be possible to record sequential events (Sequential Events Recorder);
- The ability to produce load profile recordings (Load Profile Recorder) with adjustable intervals from 3 seconds to 120 minutes, with the ability to record at least 16 channels, each with at least 32 electrical parameters;
- The device must have free programmable logic, capable of processing analog and binary signals;
- A chronological report shall record the most recent >50000 events with 4-ms time stamp accuracy;

- The power quality recording and analysis system for 220 kV overhead/cable power transmission lines must provide measurement and recording, taking into account the following:

- Including 63rd order harmonics;
- Including current and voltage interharmonics;
- Including the angle of current and voltage harmonics;

13. In the substation of the wind power station to be built (designed), "GSE" shall provide Anti-crash automation, for which the user shall provide the following:

- In the row of control and protection cabinets for the connections, a place shall be allocated for the Anti-crash automation cabinet, where the following shall be brought:

o For each connection (except for the aux. transformer), appropriate cables for connecting the current and voltage transformers to the protection accuracy class windings (technical details shall be agreed upon at the design stage);

o For each unit (except for the aux. transformer) a suitable cable to connect to the circuit breaker block contacts (technical details to be agreed at the design stage);

o For each unit (except for the aux. transformer) a suitable cable to connect to the circuit breaker trip circuit (technical details to be agreed at the design stage);

o For each unit (except for the aux. transformer) a suitable cable to connect to the DC and AC power supplies (technical details to be agreed at the design stage);

o For the wind power station synchronized vector measurements and power quality recording analyzer systems, a suitable optical or network cable with terminations to connect to the SDN network switch SEL-2741 manufactured by Schweitzer Engineering Laboratories (technical details to be agreed at the design stage);

14. All electrical equipment and installations of the wind power plant – transformers, various voltage switchgears, auxiliary (own-use) transformers, etc. (all elements) – must be equipped with protections in accordance with modern standards and must be coordinated with the “GSE” at the design stage.

15. The applicant is obliged to ensure testing of the automatic frequency regulation and automatic voltage regulation functions during the trial run in the presence of a representative of the “GSE”. The testing plan must be agreed in advance with the “GSE” and must be carried out using the simulation verification method. After testing, test protocols must be submitted to the “GSE” before the station is put into operation;

16. GSE shall implement the complete integration of the new digital relays added to the Station Control and Monitoring System (SCMS) at the substation “Zestafoni-500”, i.e. the Level II SCADA system (this includes the installation of new digital relays, integration into the substation communication network, integration/upgrading of the existing substation control and monitoring system (GW&HMI), testing (including blocking and teleprotection)). Technical details shall be agreed upon during the design phase.

17. The applicant shall arrange fiber-optic communication from the control building of the planned 220 kV substation and the telecommunications equipment cabinets in the control building of the substation “Zestafoni-500”, namely:

- On the 220 kV overhead line under construction, from portal to portal, an OPGW type fiber-optic cable with single-mode (SM) optical fibers shall be installed. On both sides of the line, in the territory of the substations, from the portal connection boxes (Joint Box) to the telecommunications equipment cabinets, communication shall be arranged with a single-mode (SM) ground dielectric fiber-optic cable placed in a corrugated plastic pipe, protected from rodents (Rodent Protection), with a double protective layer;
- Optical fiber termination devices (ODF, connectors) of the optical fiber of the fiber optic cable/cord must be compatible with the existing communication devices in the “GSE”;
- Optical fiber of the optical fiber of the fiber optic cable/cord must be “ITU-T G.652D”;
- Optical fiber distribution box (Joint Box), termination box (ODF), pigtails (Pigtail), connectors (Optical fiber connector), ground dielectric optical fiber cable and OPGW optical fiber cable must be from the same manufacturer; details should be agreed upon during design.
- Differential and remote teleprotection must be implemented with optical cable.

18. In order to implement remote control and monitoring (National Dispatch Center) of the power equipment of the project station/substation, the applicant shall organize a substation/station control and monitoring system (SCMS – Station Control and Monitoring System) and an automatic generation regulation system (AGC - Automatic Generation Control), i.e. a level III SCADA system. This system, along with other functions specified in the “Network Rules”, shall ensure the exchange of teleinformation of the station/substation (all units) with the National Dispatch Center using SCADA level I communication elements;

The technical details of the communication (information exchange) arrangement between level III and level I elements shall be agreed in advance with the GSE.

The SCADA Level I communication element may include:

- GW (GateWay), a data collection and transmission device between the station and the National Dispatch Center to collect information, send it to Level I SCADA and ensure power plant management;
- MPLS/DWDM/L3/L2 network devices. To integrate the project station into the existing Level I SCADA telecommunications network;

19. The applicant's proposed substation/station must be equipped with IT/SCADA MPLS/DWDM/L3/L2 network devices. In particular, for the integration of information into the IT/SCADA system of the "GSE", at least the following network devices must be installed:

o DWDM 8ch Mux/Dmux - 2 pieces;

o Juniper MPLS ACX710 - 1 piece;

o Juniper CE (Customer Edge) Router / Firewall – SRX300 (for IT system) - 1 piece;

o Juniper Switch EX2300 with POE-support L2/L3 level network device (for IT system) - 1 piece;

o L3 level network device (for SCADA system) C9300L-24T-4X-A (must include at least 715W AC redundant power supply module; corresponding high-stability (stack) module and cable) - 2 pcs;

o To connect the above devices to the communication devices of the substation of the substation "Zestafoni-500", it is necessary to determine the optical modules according to the length of the optical cable:

- Full C-band Tunable DWDM SFP+ 80Km - 2 pcs;
- CFP2 Digital Coherent Optic - 4 pcs;
- Service SFP+ 10G Multirates SM 10Km - 4 pcs;
- Service SFP GbE 1310nm 10Km SM - 2 pcs;

o SDN network SEL-2741 (for providing communication of the Synchronized Vector Measurement Unit (PMU)) - 1 pc;

o IP telephones UNIFY OpenScape Desk Phone CP 110 – 2 pieces;

The communication elements of the design substation must be provided with appropriate guaranteed uninterrupted power supply (at least 12 hours) and must be located in a protected area with a microclimate;

Technical details must be agreed with the “GSE” during the design;

20. The applicant must provide the design station/substation with a workstation integrated into the “Automated System for the Management of Power Equipment” software complex to ensure automatic circulation of dispatch “requests”, on which the relevant software will be installed with the assistance of “GSE”.
21. The applicant shall provide the design station/substation with at least two telephones to establish direct communication between the on-duty personnel and the National Dispatch Center;
22. The applicant must provide assistance from the project station/substation during the installation work (configuration/testing) of the remote control and monitoring system;
23. The applicant shall place the SCADA Level I communication elements in the design station/substation in a protected space with a microclimate;
24. The nominal active power factor ($\cos\phi$) of the applicant’s station must be ensured to be **0.9** in the reactive power generation mode and **0.95** in the reactive power consumption mode;
25. The power plant must meet the requirements of Articles **124, 130 and 24¹**, paragraph 2 of the “Network Rules”;
26. The inverters of the wind power station must be able to operate within the frequency limits specified in Article 121, paragraph 1 of the Network Rules;
27. The applicant’s station shall be equipped with technologies that ensure the fulfillment of the requirements listed below. The detailed parameters of these requirements shall be agreed with the “GSE” at the design stage.

1. Frequency stability requirements:

- i. Limited frequency regulation mode - frequency up (LFSM-O);
- ii. Rate of change of frequency immunity (RoCoF);
- iii. Ability to maintain stable power output in accordance with a predetermined amount of active power;
- iv. Active power control capability and regulation range;
- v. Frequency recovery control;
- vi. Frequency regulation mode (FSM);
- vii. Limited frequency regulation mode - frequency down (LFSM-U);
- viii. Frequency response monitoring (FSM);
- ix. Static stability;

2. Voltage stability requirements:

- i. P-Q/Pmax profile;
- ii. U-Q/Pmax profile;
- iii. Voltage control modes;
- iv. Control of power oscillation suppression in the power system;

3. Requirements for the operation of the station in emergency mode:

- i. Fault resilience (FRT) of power plants;

- ii. Ability to provide fast short-circuit current;
- iii. Recovery of active power after an accident;
- iv. Priority of participation in the regulation of active or reactive power flows;

4. Requirements for the operation of the station in emergency recovery mode:

- i. Ability to perform fast repeated synchronization;

5. Requirements for general system management:

- i. Equipment for recording and monitoring of malfunctions and dynamic behavior of the system;
 - ii. Installation of devices necessary for system operation and safety;
28. The parameters of the wind power plant inverters shall be agreed upon in advance by the applicant with the “GSE”;
29. During the design phase, the frequency increase-decrease settings of the wind power plant inverter, which act on the blocking of the inverter, shall be agreed upon with the GSE;
30. The applicant shall ensure that the electricity quality parameters are maintained within the permissible limits in accordance with Articles **16, 17 and 18** of the “Network Rules”;
31. The applicant shall submit to the “GSE” static and dynamic simulation models of the power plant in PSS/E and/or DigSilent PF format;
32. “GSE” shall arrange electricity settlement and control metering nodes for the 220 kV line cell of the “Gogni Wind Company” LLC wind power plant at the “Zestafoni-500” substation.
33. The applicant shall arrange an electricity metering node for the 220 kV line cell at the “Gogni Wind Company” LLC wind power plant substation.
34. Technical metering point(s) shall be arranged in the wind power plant:
- a) in accordance with paragraph 4 of Article 62 (taking into account the requirements of paragraph 41 of the same article).
 - b) in the metering point(s) provided for in paragraph 6 of Article 66;
35. The project for the arrangement of the settlement and control metering point(s) in the design substation by “GSE” and its connection to the upper-level AMR system shall be drawn up by “GSE”. In addition, the works to be carried out on site shall be carried out in accordance with this agreed project;
36. The applicant shall prepare a project for the installation of a 220 kV line cell and technical metering nodes at the “Gogni Wind Power Plant” and its connection to the upper-level AMR system and shall agree with the “GSE” in accordance with the established procedure prior to the commencement of the works, and the works to be carried out on site shall be carried out in accordance with this agreed project;
37. The metering points specified in the clause of these Technical Conditions shall be arranged in accordance with the relevant requirements of all relevant normative acts in force in Georgia, namely:
- a) in accordance with the relevant requirements of Chapter 8 of the “Network Rules” approved by the National Energy and Water Supply Regulatory Commission of Georgia by Resolution No. 10 of April 17, 2014;
 - b) in accordance with the relevant requirements of the Technical Regulations on Approval of the Rules for Technical Operation of Power Plants and Networks established by Resolution No. 434 of the Government of Georgia of December 31, 2013

38. During the design and installation of the network by the "GSE" and the applicant, as well as during the subsequent operation of the facility, the requirements of the "Rules for the Installation of Electrical Installations", "Rules of Safety Techniques during the Operation of Electrical Installations", "Network Rules" and other normative acts in force in Georgia shall be fully observed;
39. In emergency/force majeure situations of the network, as well as in cases of planned preventive shutdowns, the applicant is responsible for providing the responsible power consumers of the facility with an alternative/autonomous power source;
40. In case of using a generation source for backup power supply of the facility, technical and organizational measures shall be taken into account that exclude the supply of voltage from the generation source to the 220 kV voltage network supplying the facility;
41. The applicant shall submit to the "GSE" a technical project for connection to the transmission network (hereinafter referred to as the "Project") within 6 (six) months from the signing of the Agreement. The project shall be accompanied by all relevant documents, plans and/or schemes/drawings requested by the "GSE". The project for connection to the transmission network, which has undergone an expert examination, and the attached documentation shall be submitted to the "GSE" in Georgian, both in material (printed) and electronic form.
42. The project provided for in paragraph 43 of the Technical Specification shall include the design documentation of the facilities to be constructed within the scope of the connection to the transmission network in accordance with Appendix N1. The connection project shall fully reflect that part of the connection works, the implementation of which is the applicant's obligation. In the event that the connection project and/or the attached documentation submitted by the applicant has a defect(s) or is incomplete (except for the issues provided for in paragraph 45 of these Technical Specification), the Electrosystem shall be entitled to set a reasonable deadline for the applicant to correct the existing defect(s).
43. Within 6 (six) months from the complete submission of the project and attached documentation provided for in paragraph 43 of the Technical Requirements, GSE is obliged to check the compliance of the submitted project with the established requirements and standards, as well as to supplement it in terms of connectivity and send the completed project to the applicant for approval.
44. The applicant is obliged to submit, before connecting the facility to the electrical network:
 - List of protocols of relay protection and automation devices;
 - Measurement/testing protocols of all primary and secondary electrical devices conducted by an accredited company (the protocols must indicate the conclusion on the suitability of the device);
 - Testing protocols of relay protection and automation devices in the agreed project conducted by an accredited company;
 - Calibration certificates of measuring and testing equipment;
 - A document certified by the applicant (in the form of a substation connection installation map), indicating that the relay protection and automation devices at the facility have been installed in accordance with the "GSE";

- The applicant must submit the requested protocols no less than 10 (ten) working days prior to the commission inspection;