**A field of solar panels

Description automatically generated**

**UAB Kaunas BESS Standalone 50 MW 2 hour duration**

**BESS EQUIPMENT SUPPLY, TESTING AND COMMISSIONING**

**Proof of change**

|  |  |  |  |
| --- | --- | --- | --- |
| **Version No.** | **Date** | **Reason and scope of the change** | **Author(s)** |
| 00 | 23/04/2025 | Draft | NKO |
|  |  |  |  |
|  |  |  |  |

1. **Introduction & Company Overview**

Aquila Group is a leading investment manager in real asset solutions. Its sustainable investment strategy focuses on investments in renewable energy, energy efficiency, infrastructure, residential real estate and green logistics. Founded in 2001 by Dieter Rentsch and Roman Rosslenbroich as one of the first German alternative investment companies, Aquila Group currently manages EUR 12.5 billion for institutional investors worldwide.

Over the last decade, Aquila Group has built a portfolio of assets in Europe with investments in the renewable energy sector amounting to a total capacity of 10.7 GW and more than 2 million square metres of sustainable real estate and green logistics projects completed or under development.

As a responsible investor, Aquila Group is committed to contributing to the European energy transition by financing sustainable investments and providing investment solutions that reduce carbon emissions.

To create value for its investors, Aquila Group employs a fully integrated investment and asset management approach and integrates Environmental, Governance and Sustainability criteria throughout the investment process. Aquila Group's teams of investment experts draw on their sector networks and expertise to select, develop, finance, manage and operate investments along the entire value chain. As this concept requires local management teams, Aquila Group is currently represented with 14 investment offices in 12 countries.

Aquila Clean Energy (ACE) is the Aquila Capital group company responsible for the (co-)development and construction of Aquila Capital's portfolio of wind and solar PV projects in Spain, Portugal, Greece and Italy. ACE's team of professionals consists of experts from the development and construction areas, integrating strong technical expertise with Aquila Capital's investment experience.

1. **Project Description**

UAB Kaunas BESS is a planned 50 MW 2 hour duration standalone BESS at the land plot Panevėžys district municipality, Panevėžys sen., Bliūdžiai village (plot unique no. 4400-0019-0907), Lithuania and connecting to 110kV over-head line Krekenava-Panevėžys I.

1. **Project Location**

|  |  |
| --- | --- |
| **BESS Site** | Panevėžys District Municipality, Lithuania |
| GPS Coordinates | 55°45'39.1"N 24°18'43.7"E |
| Nearest main city | Panevėžys |

1. **Environmental conditions**

|  |  |
| --- | --- |
| **BESS** |  |
| Plant design lifetime | Not less than 19 years |
| Ambient temperature | Not less range than from -10º C to 45º C |
| Altitude a.s.l | 200 m |
| Location | Inland: 130 km from the Baltic Sea |
| Corrosion protection class | Minimum C5M or according to local Environment conditions |

1. **Scope of services**
2. Supply of Materials – DDP to site required:
   1. Battery Energy Storage Systems: Battery enclosure, racks, modules and cooling systems
   2. Converters/inverters
   3. Communication Modules
   4. Fire detection and suppression systems inside containers
   5. AC and DC – LV circuit breakers and switch gear
   6. Black start ability (optional)
   7. MV skids including PCS, MV/LV step-up transformer
   8. Ancillary material
   9. Provide O&M manuals and training – for respective equipment
   10. Plant Power Controller (PPC) for grid-compliant real time control of plant output
   11. Energy Management System (EMS) for optimization of energy flows and plant dispatch strategy
3. Support Development works and BOP works including concept site layout, permits, civil design, electrical design, Control and network system schematic design,
4. Provide site technical assistance during installation of Equipment, anchoring of units, fire detection systems
5. Testing and commissioning:
   1. Support EPCM with overall plan system commissioning plan
   2. Develop testing and commissioning procedures for BESS including battery units, PCSs, fire suppression systems, MV/LV transformer, RMUs, EMS and all associated control, communication of the power ancillaries
   3. Start-up procedures for BESS
   4. Factory Acceptance Test, pre shipment test, Site Acceptance Test (For respective equipment)
   5. Commissioning tests and prequalification tests required by TSO
   6. Handover
6. O&M (to be included) – Minimum of 19 years
   1. Periodic onsite/offsite preventative maintenance
   2. Performance Guarantee tests
   3. Spare parts management
   4. Reporting
   5. 24/7 Monitoring
   6. Recycling obligation
7. Performance Requirements – can be shared (Active power, reactive power, usable energy capacity at POI, etc.,)
8. Energy density requirements: 5 MWh installed capacity or more inside a 20-feet container
9. PCS system should be inside the container (DC-AC conversion) or supplied as a separate installation from container.
10. Compliant with the grid code and reactive power requirements
11. Performance guarantees and Warranties:
    1. Capacity Guarantee based on usage profile – minimum 19 years
    2. Availability Guarantee – 98% for a minimum of 19 years
    3. System RTE throughout lifetime
    4. Auxiliary consumption throughout lifetime, including calculation formula. Conditions offered for this formula shall be defined by the supplier.
12. LDs – delay, energy capacity, availability and RTE LDs
13. End of life recycling obligation
14. **Functional requirements**

|  |  |
| --- | --- |
| **BESS** |  |
| Installed Nameplate Power (MVA) | 56 MVA |
| At POI | 110 kV (Site S/E) |
| Design Conditions | Beginning of life |
| Battery cycling | 548 cycles/year |
| Connected Voltage | 110 kV |
| Site voltage (MV) | 33 kV |

Battery will be intended for: Wholesale, Ancillary Services, Capacity Market, and Curtailment avoidance (Renewable integration or energy shifting).  The Call specifically states the need to provide System Services (equivalent to the before mentioned operations). Battery must be designed with 100 MWh as minimum beginning of life (BoL) usable capacity and must be operated for 19 years with 548 cycles per year.

The BESS must be prepared to operate in standard European markets, such as FCR, IGCC, aFRR (PICASSO), mFRR (MARI) and RR (TERRE), and complying with the Lithuanian conditions for such markets. A specific test to satisfy the local market conditions would be provided by the asset optimization partner, commonly referred as Route to Market (RtM).

1. **General specifications**

6.1. Overview

1. The Works consist of the supply, delivery to site (DDP Incoterms 2020), commissioning, and testing of the provided BESS equipment. The Works exclude the installation of the BESS and electrical and civil BoP works, which will be separately contracted by the Employer.
2. All equipment provided will be compliant with all local rules and regulations as set out in this document (chapter 6.12).
3. The installation of all supplied equipment that will be carried out by the BoP will be carried out according to the installation manuals provided by the Battery Supplier.
4. The Employer shall be responsible for the supply of all MV cables, (excluding the MV cables and cable glands from the step-up transformer to the RMU), the AC cables and cable glands between the Battery container and the MVS and any communication and auxiliary cables that are to be terminated from the MV substation and location of the BESS PPC/SCADA .
5. The BESS equipment provided by the Battery Supplier will be designed to operate for 19 years, which is the lifetime of the project. The life of the project is assumed to start with the achievement of the Provisional Acceptance milestone by the Battery Supplier.
6. The BESS will be under normal conditions an unmanned facility and the Works will be operated and monitored remotely by the Employer.
7. The BESS Supplier shall support with relevant documentation the BoP Contractor to ensure the correct integration of the BESS system. This includes, but it is not limited, communication protocols.
8. The Battery Supplier is responsible for delivering a certificate for operation in that will enable the BESS to operate in the following modes:
   1. by the TSO
   2. by an external party, for example a **Route to Market (RtM)** partner.
   3. automatically (based on a manually/ through interface set schedule)
   4. manually
9. The Battery Supplier shall comply with Aquila Capital HSE Minimum Requirements and the BoP Contractor’s HSE requirements on site.
10. The Battery Supplier shall comply with the available working days/hours
    1. Permits

* The Employer will obtain and/or coordinate:
* The electrical connection agreement for the site.
* The Lease agreement.
* The building permit.
* Any permits, licenses and authorizations which only the Employer can obtain as a matter of law or procedural requirement, and which are necessary for the fulfilment of the obligations of the Battery Supplier.
* Any permits, licenses, consents, notifications and authorizations arising as a requirement of or in connection with the lease agreement and associated property and planning documentation.
* Any works required by the Transmission System Operator (TSO) to interconnect the compounds.
  1. Performance metering

The Battery Supplier will provide the Employer a list of recommended PQM meters that shall be used for the asset’s performance assessments and operations by latest 2 months from execution of the Supply agreement. The Employer shall ensure that the suggested meters are compliant with local rules and regulations and shall consider any measurement requirements from the Lithuanian DSO/TSOs. If none of the PQM meters were compliant, the Battery Supplier shall identify a new list within 30 days of notification by the Employer

The Employer is to procure and install the meter on behalf of the Battery Supplier.

The Battery Supplier is to setup the meter and integrate it within its controller.

* 1. Internet

The Employer shall be responsible for the installation and availability of a permanent internet connection

The Battery Supplier shall confirm during the commissioning of the project that the internet connection meets its communication requirements.

* 1. Auxiliary power

The Employer shall be responsible of providing power to the BESS auxiliary services, there is a 50 kVA 33 kV/400-230 V auxiliary transformer, the Battery Supplier will confirm the aux load required for the batteries, the LV switchboard and the necessary cabling and termination for the auxiliary needs of the Battery Supplier’s BIC equipment. The Battery Supplier shall provide relevant information to the Employer. For the purposes of internal calculations, the supplier shall deliver an auxiliary’s consumption per year calculation, explaining their assumptions with a formula. KPI shall be table of kWh/year of auxiliary consumption for the lifetime of the project.

* 1. Reactive Power/Converter Systems

The converters supplied should be able to provide and consume reactive power in the voltage ranges defined at *attached Annex 4 (or the most updated version of this document)*. Also, the provided converters should demonstrate documentation that proves acceptance by local entities to operate in Lithuanian electrical grid. It is required that the supplier provide all PSSE and Digsilent models in order to perform and cooperate with all required electrical studies.

|  |  |
| --- | --- |
| **Topic** | **Requirement** |
| Electrical requirements | * Adjustable Power Factor: -/+ 1 * Total harmonic distortion ≤ 3% or according to application normative and grid code requirements whichever is more restrictive. * European efficiency > 98.5%. * Receives commands from PPC and SCADA for power control and reactive power compensation. * Separation of output and input power circuits. * Fully automatic operation, suitable for grid-tied applications. * Operates at grid frequencies of 50Hz |
| Environmental requirements | * Protection grade of IP 65 or better. * Excellent resistance to corrosion and chemical substances * High resistance to weather conditions (-20ºC to +50ºC) * High impact resistance * Designed to operate at project specific climate conditions * For coastal installations, the converter cabinet must have a C5-M grade according to ISO 12944 or equivalent classification for corrosion protection. * For extremely dusty/desert applications, the converter enclosure must meet application requirements, including IEC 60068-2-68 certification |
| Temperature behaviour & design | * No derating up to 30ºC ambient temperature |
| Automatic operation | * Automatic Reconnection: Once the conditions causing the interruption of grid injection cease, the converter must reconnect automatically. * Automatic Restart Post-Fault Clearance: If a fault is cleared, the converter must restart automatically. |
| Protections | * On DC side: reverse polarization * On DC side: type II SPD; * On DC side: ground fault protection * On AC side: type II SPD; * Over-temperature: automatic thermal protective control system |
| Communication | * HMI interface on the converter or accessible by APP; * PLC, Modbus TCP and Ethernet communication; |
| Grid code compliance | * The converter must comply with all local grid control requirements, in accordance with the most current grid code |
| Safety Requirements | * DC switch disconnectors, circuit breakers or similar. * Surge-voltage and over-voltage protection (DC and AC). * Ground fault protector interrupter (GFPI) and monitoring. * The converter shall ensure that its electrical, mechanical, environmental and safety construction characteristics are certified by official laboratories, and it must be CE-marked. |

Reactive control, among other topics (e.g., metering) are still being determined by the Lithuanian authorities. Therefore, we find suiting giving you the disclaimer that future equipment might be requested, such as extra PCS (only if the Lithuanian authorities demand so).

* 1. System control and operation

The BESS shall be controlled by a BESS PPC/SCADA and site-level controller. The site-level controller should be prequalified in Lithuania. The BESS PPC/SCADA shall be capable of being controlled by the Transmission System Operator (TSO) and Route to Market Provider (RtM) to provide a combination of the following services:

1. Trading on the day ahead and in the Intraday markets
2. Participation in aFRR, in both up and down directions.
3. Participation in Balancing Markets
4. Participation in System Services.

Moreover, the BESS shall be prepared for European level markets. We request the BESS to be prepared to operate in IGCC (FCR), PICASSO (aFRR), MARI (mFRR) and TERRE (RR). The BESS may also participate in a to be created Capacity Market.

Other possible services are voltage control and/or grid congestion.

The Battery Supplier shall collaborate with the Employer to ensure that the proper communication with the TSO and RtM provided software is achieved.

The BESS PPC/SCADA shall be having 3 main modes:

1. Manual control: the Employer can instruct the assets both on charge or discharge setpoints to the system
2. Automated control; pre-programmed applications (SoC setpoints, Volt/VAR settings in accordance with the grid code requirements)
3. Automated control – RtM and TSO interface

The BESS PPC/SCADA shall integrate the following functions as a minimum:

* Separate management of each individual battery/PCS block to:
  + Maximize efficiency
  + Ensure SoC balance across all units to the maximum extent possible
  + Ensure uniform degradation of all battery modules
  + Minimize the impact of equipment unavailability.
  + Automated start and stop sequences allowing to safely switch on or off the system
  + Integration of fire and other safety alarms such that system operation is automatically stopped in case an alarm is triggered
  + Monitoring temperature management and adjustment of the system operation to keep the temperature within acceptable range.
  + Hard limits to protect the system failure or breakdown caused by a potential parameter error put by the RtM provider.

The BESS PPC/SCADA will be integrated with the DSO and TSO and will prioritize all setpoint commands as mandated within LithuaniaGrid Code.

The Battery Supplier shall demonstrate compliance with LithuaniaGrid Code through:

* Provision of a BESS numerical model under PSCAD, DigSilent Powerfactory or equivalent software, enabling to simulate all required functions
* Development and performance of unitary tests during commissioning demonstrating alignment between the provided model and the physical test results
  1. Technical Documentation

The following documentation should at least be delivered to be considered in the tender:

* Project SLD
* Communication Architecture of PPC and EMS, including schematics to connect to the substation. This document should clearly define the Scope of Work vision of the supplier
* Auxiliary consumption
* Nominal Capacity, Usable Capacity before auxiliary consumption, Usable Capacity after auxiliary consumption and Round-Trip Efficiency (RTE), for all the years considered in the lifetime. Consider the losses only on supplier components. Usable Capacity definition is energy available for trader, considering all operational restriction on supplier BES system.
* Cost and conditions of Long-Term Service Agreement (LTSA) or maintenance contract to secure the performance guarantee and RTE for the lifetime of 19 years. Costs variation per year are acceptable.
* PPC full certificate to operate in the Lithuanian grid
* Thermal behavior through time of inverters of Power Converters Systems and MV components
* Harmonic test of inverters and MV components.
* Fire Risk mitigation documentation.
* Burn Test report done by an independent partner.
* Product installation manual, datasheet, foundations and component distribution schematics.
  1. Certification

The Battery Supplier shall be responsible of providing all the necessary equipment certification documents required to operate a BESS in Lithuania and in line with Lithuania Grid Code.

* 1. Commissioning

The Battery Supplier shall be responsible for on-site cold and hot commissioning its equipment (Battery Containers, PCSs, transformers and RMUs) excluding RMU energization and MV transformer energization / switching or HV/MV switching. As part of the Commissioning process the Battery Supplier shall deliver to the Employer all Project documentation in-line with applicable Lithuanian regulations necessary when commissioning the battery equipment such as statements that equipment has been pre-tested in line with Lithuanian standards.

* 1. Testing and acceptance

The following shall be submitted as a minimum in electronic and paper format:

* Final as-built documentation for all batteries and associated equipment including all protection settings
* All site commissioning test results
* O&M manuals
* Warranty documentation
  1. End of life planning

The Battery Supplier shall provide all technical guidelines on the safe handling, removal and recycling of the battery modules at the end of life.  
The Battery Supplier shall remain responsible for disposal of the used battery modules during the lifetime of the Project and at end life pursuant to the Agreement and in accordance with applicable laws.

* 1. Engineering standards

The equipment supplied by the Battery Supplier shall be compliant with the standards and regulations listed in the tables below and any other applicable standard and regulation for BESS in Lithuania at the time of signature. Local standards shall prevail over international ones. The Battery Supplier shall submit a design basis with the standards relevant to each equipment to the Employer one (1) month before the FAT of the respective equipment.

In case that the Employer requires compliance to additional standards or regulations, which are not enforced or requested by the Lithuanian authorities, regulators or policy makers, the Supplier will consider such request and provide a Variation Order offer for such addition to the Employer.

|  |  |
| --- | --- |
| **BESS Converters** | |
| IEC 62477-1:2022 IEC 62477-2:2018 | Safety requirements for power electronic converter systems and equipment |
| IEC 61000-6-2:2016  IEC 61000-6-4:2018 | Electromagnetic Compatibility Regulations relating to electromagnetic compatibility |
| IEC 62433-4-2:2019 | Models of integrated circuits for RF immunity behavioral simulation - Conducted immunity modelling (ICIM-CI) |
| IEC 61683 | Photovoltaic Systems – Power Conditioners – Procedure for Measuring Efficiency |
|  |  |
| **BATTERY ENERGY STORAGE SYSTEM** | |
|  |  |
| IEC 62933-5-2 | Electrical energy storage (EES) systems - Part 5-2: Safety requirements for grid-integrated EES systems - Electrochemical-based systems |
| IEC 62619 | Safety requirements for large-scale industrial applications (for lithium batteries) |
| UL 9540 Sub assembly | For battery safety testing or field evaluation to ensure compliance with IEC 62485-2, 61508, 60812 (where applicable). |
| UL 1973:20108 | Batteries for use in stationary, vehicle auxiliary power and light electric rail |
|  |  |
| **GENERAL ENGINEERING STANDARDS** | |
| IEC 60076 | Power Transformers - ALL PARTS |
|  |  |
| **Power Quality** | |
|  |  |

1. **Annexes**

* Annex 1: Code of Conduct for Business Partners of Aquila Group
* Annex 2: Aquila Group ESG and H&S Requirements for Supply Equipment
* Annex 3: Lithuanian Cyber Security requirements and applicable law
* Annex 4: Grid code compliance Testing Program