Småkraft Forum, Loen 6-8. august 2026

Prosjekt beskrivelse 2 * 10 MW/37 MWh BESS

Teknisk løsning og estimert lønnsomhet

Malthe Winje

Stor bredde – Høy kompetanse

BESS – 9.99 MW / 37 MWh

Project Overview and Capacity

Honkakero BESS delivers 9.99 MW power and 37 MWh energy storage to provide grid stability services and energy arbitrage, therefore supporting the energy transition and renewables.

Fully Integrated BESS System and Grid Connectivity

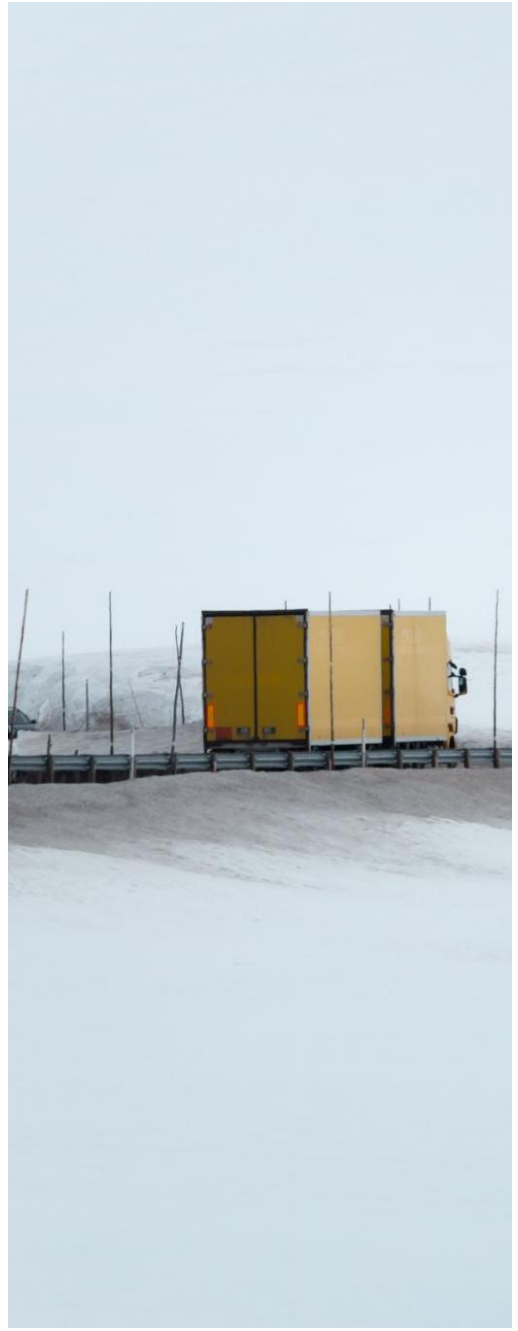
The system integrates energy storage containers, power converters, transformers, and an E-House for unified operation and integration to the 20kV distribution grid.

Modular Design and Scalability

Modular standardized containers enable faster installation, reduction in materials and ground works, and ease of future system expansion.

Safety and Environmental Standards

Equipped with temperature insulation, climatization, and fire protection, to ensure safe operation under stringent Arctic conditions.



PROFITABILITY OVERVIEW

Investment Case: Two 9.99 MW / 37 MWh BESS Assets in Finland

2 × 9.99 MW / 37 MWh • Lapland, Finland • Under construction — targeting COD November 2026

20 MW / 74 MWh

Combined portfolio capacity

2 × 9.99 MW / 37 MWh — under construction

19.6%

Unlevered project IRR

Base case (2026 est.); range 18.2%–21.8%

90%

EBITDA margin

Base case; scenario range 89%–90%

6.4x / 25.5%

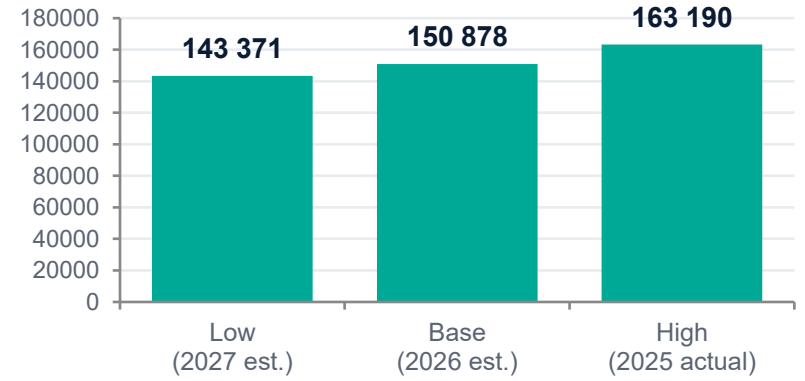
Equity MoIC / EIRR

Base case; range 5.6x/22.7%–8.2x/31.0%

Why the case is investable

- **On schedule and de-risking fast** — equipment has passed Factory Acceptance Testing (FAT); site civil works begin mid-August 2026, keeping COD on track for Nov/Dec 2026.
- **Revenue is grounded in our own price history** — backtested on 2023–2025 Finnish prices for this exact 10 MW / 3.75h configuration, then trended forward on each stream's own growth rate.
- **Reserve and merchant revenue are rotating** — reserve revenue has compressed c. 26%/year as more batteries enter the market; day-ahead revenue has grown c. 5%/year over the same period.
- **Long, de-risked operating life** — +15-year operational horizon underpins a stable, predictable distribution profile for equity investors.

Revenue scenario range (€/MW/year)



Backtested on this asset's own 2023–2025 prices, trended to 2026–2027 — detail on the Market Outlook slide

Source: Frigg.eco revenue model (own 2023–2025 backtest, trended); Aug 2026

CASH FLOW & RETURNS

15-Year Cash Flow & Return Profile

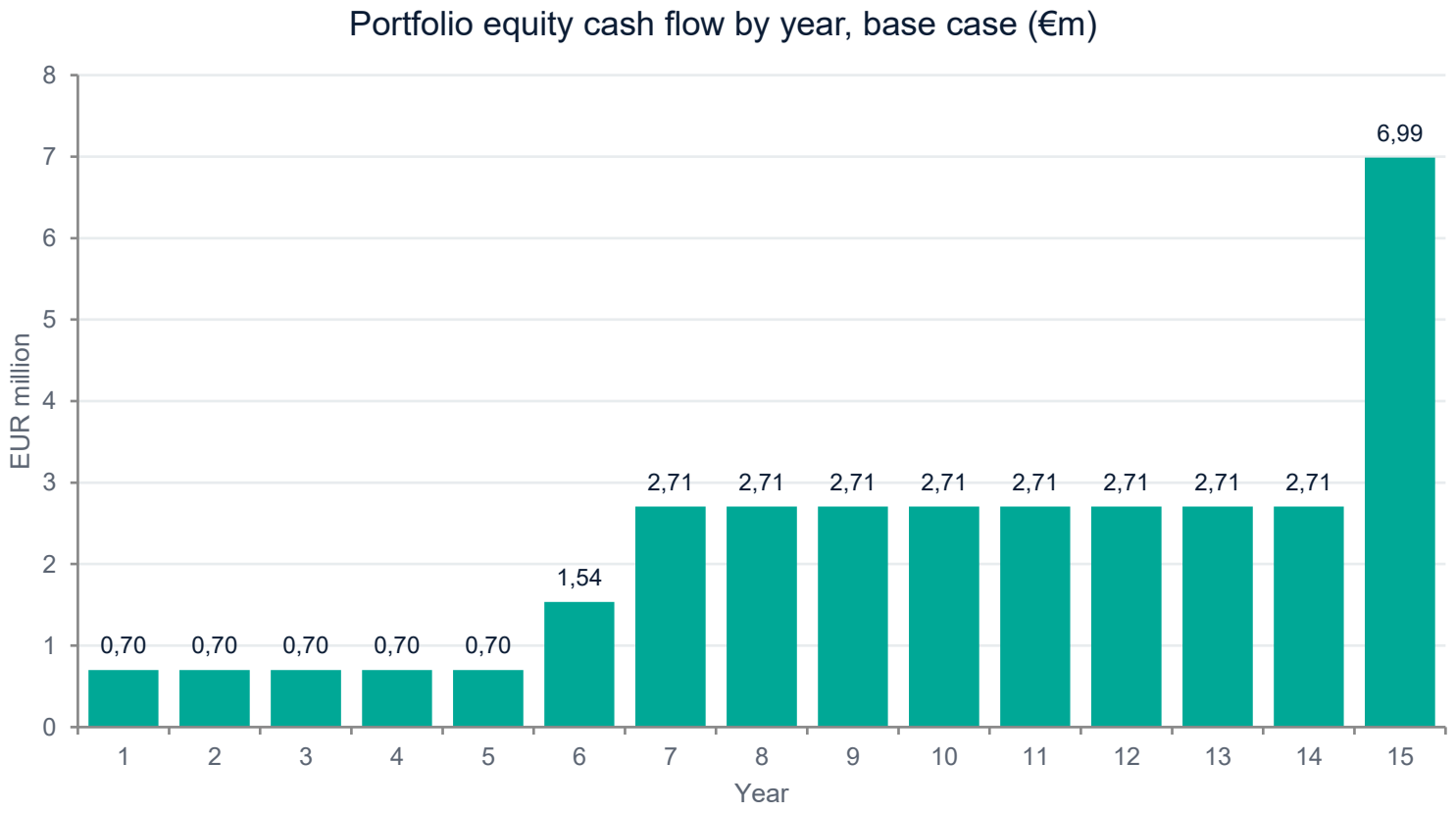
Combined portfolio (2 × 9.99 MW / 37 MWh) — base case, this asset's own backtested revenue trended to 2026

6.2 years
Equity payback period (base case)

€33.7M
Distributions on €5.3M equity invested

1.35x / 63%
DSCR target / loan-to-value, base case

Net gain of €28.4M on €5.3M equity in the base case (6.4x MoIC, 25.5% IRR), on top of a **19.6% unlevered project IRR**. Range across scenarios: 5.6x–8.2x MoIC, 5.7–6.4 yr payback, as reserve-price compression continues or levels off.



Years 1–5: equity cash flow net of debt service (€0.70M/yr). Debt (€9.0M, 8%, 5y7m tenor, 63% LTV) is repaid mid-year 6. Years 7–14: full EBITDA (€2.71M/yr) flows to equity. Year 15 includes €4.3M residual value.

Source: Frigg.eco revenue model (own 2023–2025 backtest, trended); Aug 2026

MARKET OUTLOOK

Finland BESS Market: Backtested on This Asset's Own Price History

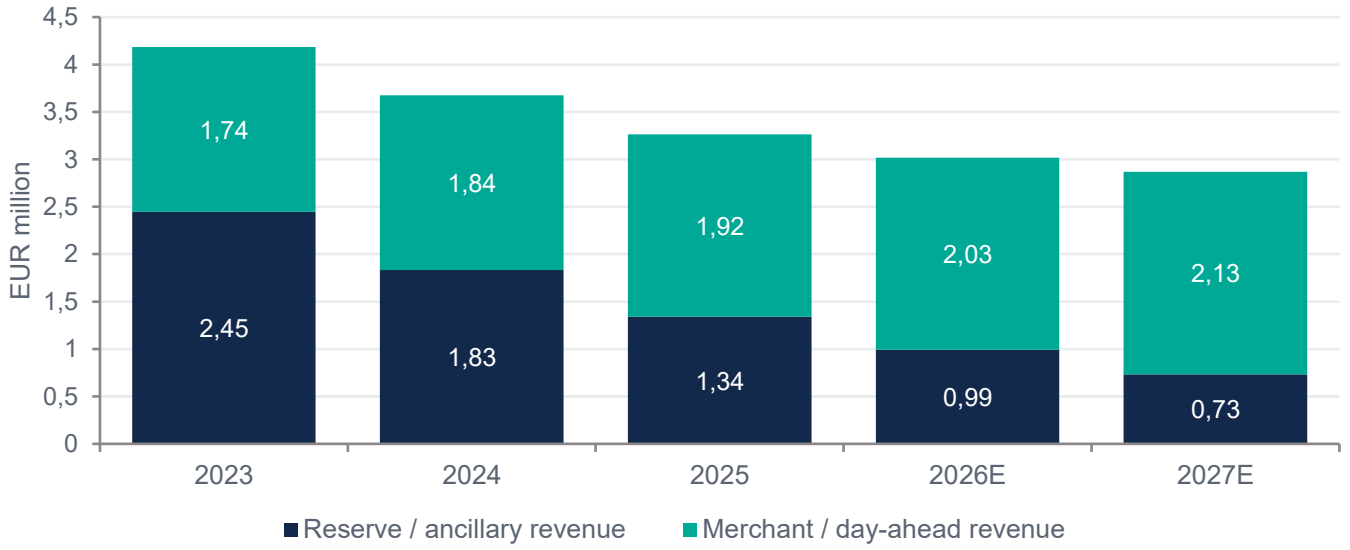
2023–2025 actuals for this exact 10 MW / 3.75h configuration, trended forward — reserve revenue is rotating into merchant, not disappearing

- **Reserve revenue is compressing fast.** As more batteries enter Finland's ancillary markets, reserve/capacity revenue for this asset has fallen c. 26% per year over 2023–2025 (actual, backtested).
- **Merchant revenue is growing in its place.** Day-ahead/arbitrage revenue has grown c. 5% per year over the same period, consistent with Clean Horizon's independent read that Finnish BESS revenue is now mainly day-ahead-driven.
- **Longer-duration assets remain well placed.** Assets with 2–4 hour duration are best able to flex between ancillary and energy-market participation. This portfolio's c. 3.7-hour duration sits in that range.

€150,878 per MW / year (2026E)

Cross-checked against Clean Horizon's Finland Storage Index (2h basis, duration-adjusted): c. €134,000–160,000/MW/yr — consistent range

Portfolio revenue mix: actual (2023–25) and trended (2026E–27E), €m



2023–2025 are Frigg.eco's own backtest for this asset's exact configuration (10 MW / 3.75h), using actual Finnish market prices. 2026E–27E trend each stream at its own 2023–25 growth rate. Reserve −26%/yr; merchant +5%/yr.

Source: Frigg.eco revenue model (2023–25 backtest, own asset spec); Clean Horizon Storage Index (cross-check only)

Location, Capacity, and Main Characteristics

Geographical Location and Climate

Located in Lapland, Finland, the facility is designed to withstand cold temperatures, snow loads, and seasonal daylight changes.

Power and Storage Capacity Type B

The plant has a power capacity of 9.99 MW and an energy storage capacity of 37 MWh, classifying it as a medium-to-large scale facility.

Modular Plant Configuration

Six energy storage containers and forty-eight oversized PCS units enable modular operation with enough power and redundancy for component maintenance and service reliability.

System Architecture and Grid Connection

One stop fully integrated E-House centralizing all power plant control and communications systems, including primary MV switchgear and SCADA to connect the power transformer containers to the medium-voltage grid.

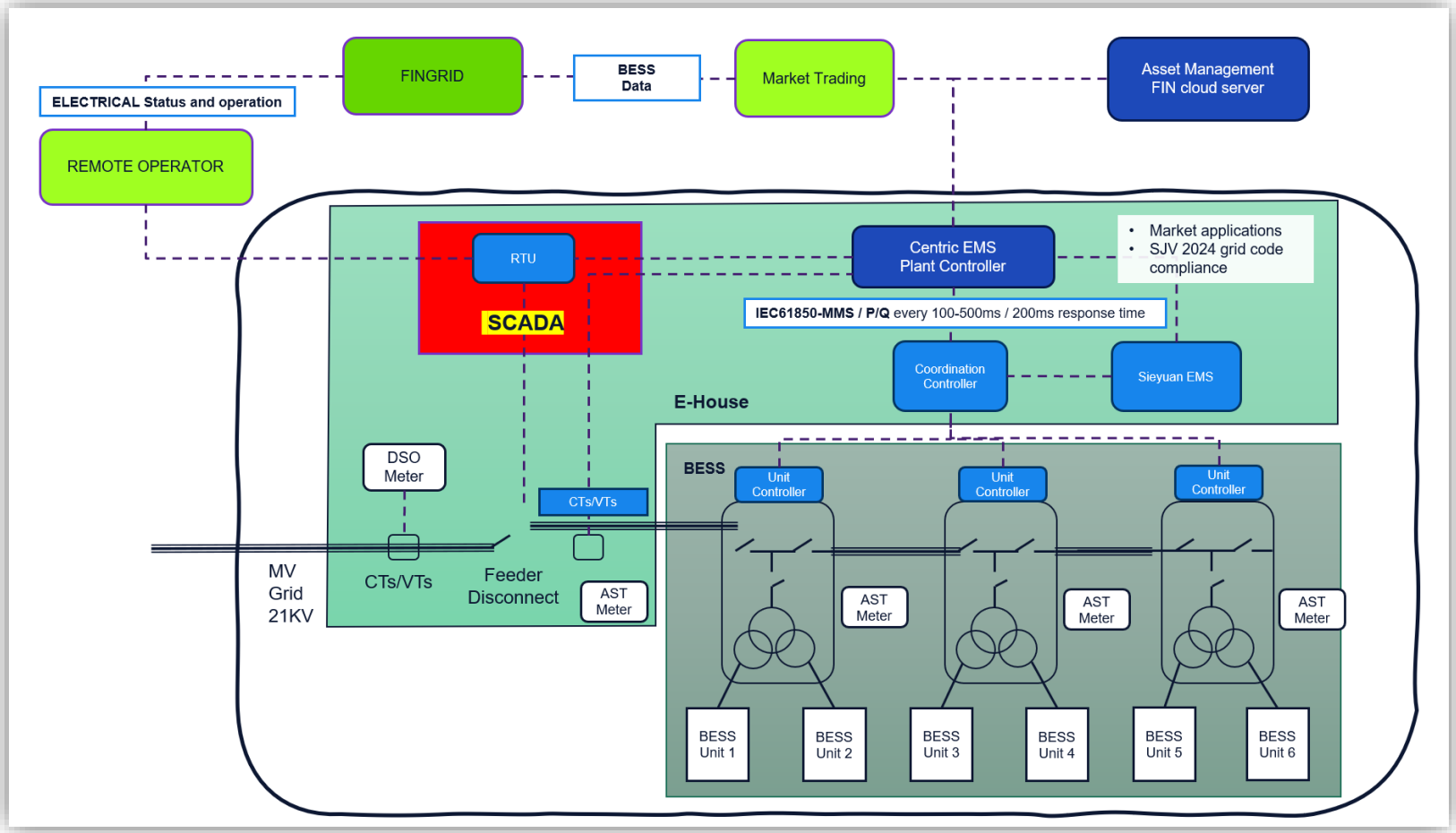
System overview

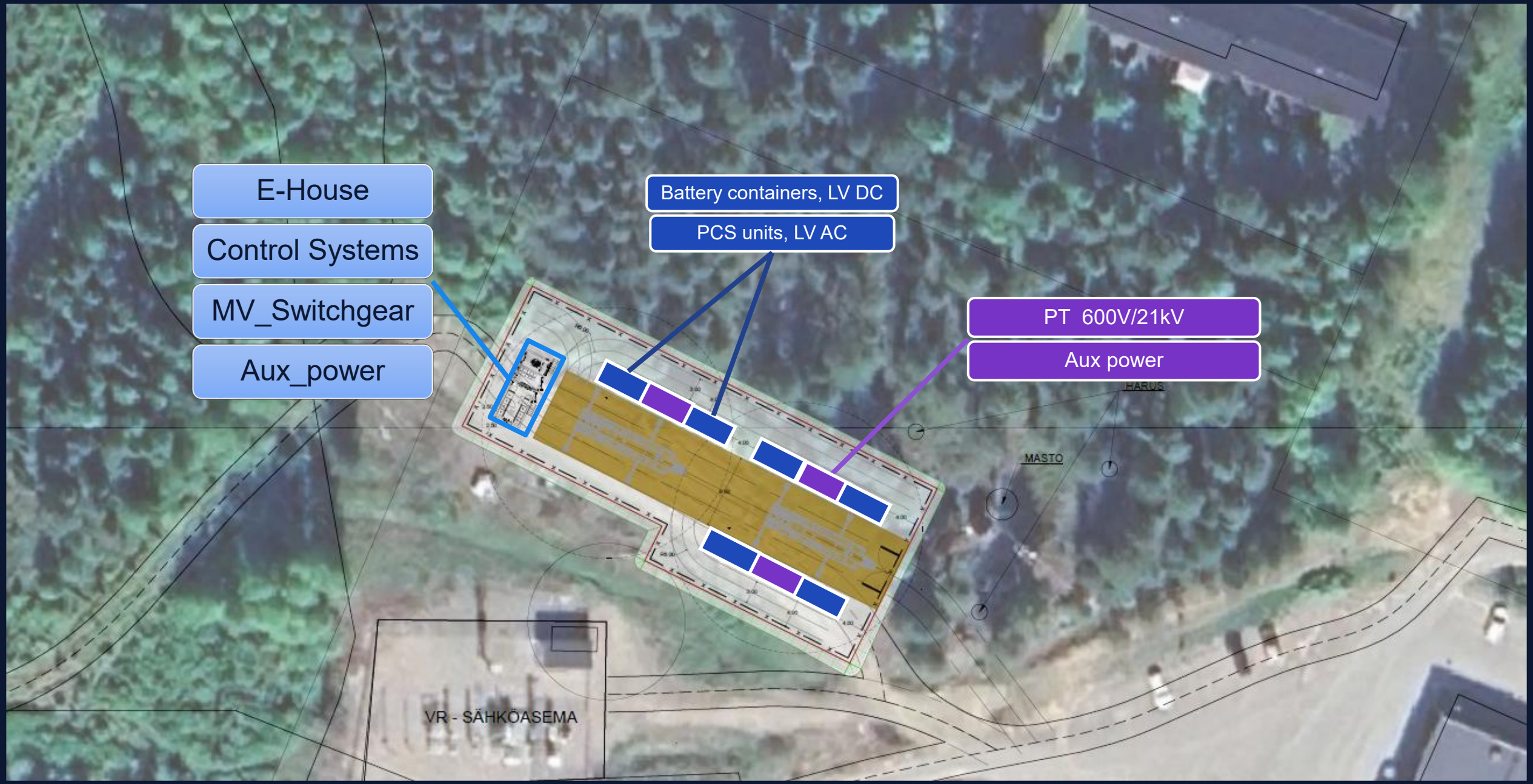
Full electrical, protections and control scope from one single entity

- High density energy storage
- PCS
- Step-up transformers
- MV grid integration
- Power Plant Control
- EMS/BMS
- Asset Management
- Protections, Control & Comms

VALUE ADD SERVICES

- Engineering
- Construction
- Installation
- Commissioning

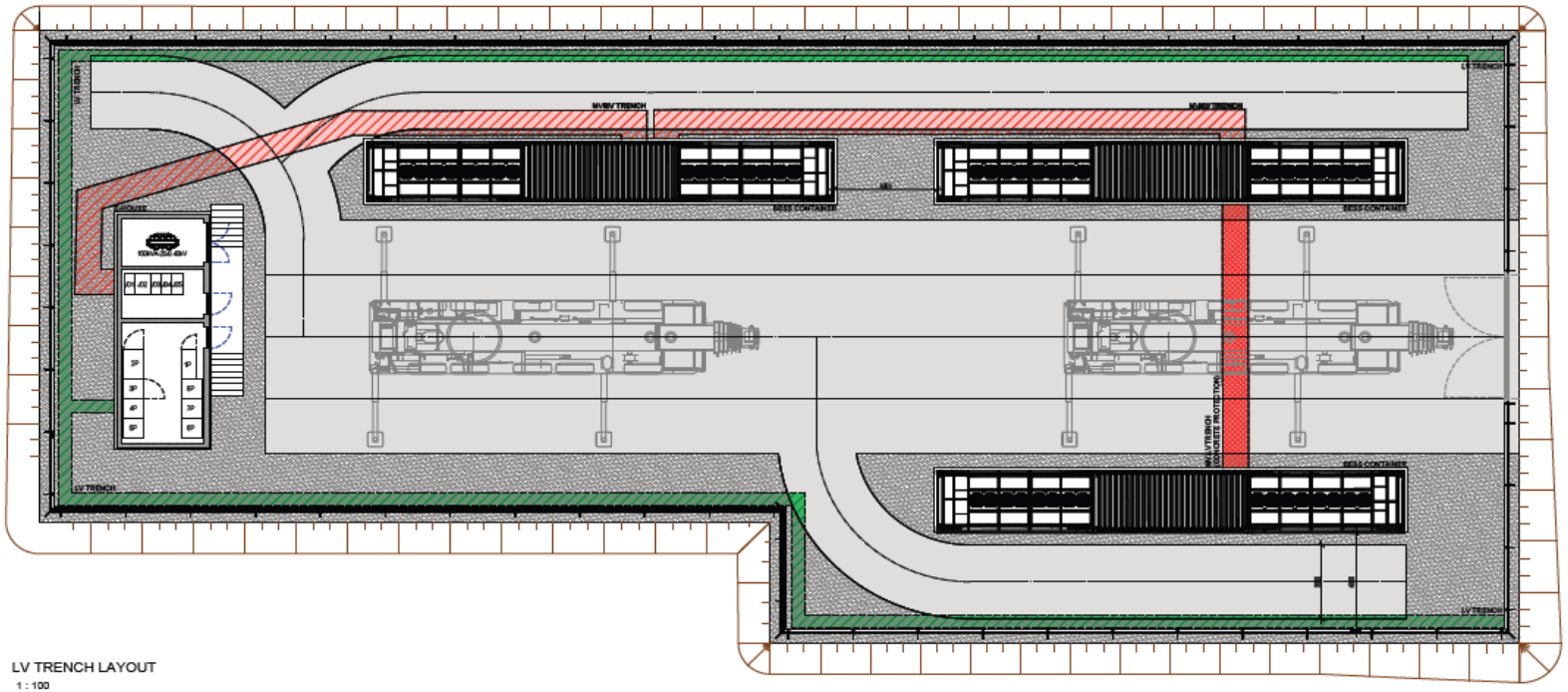



E-House
Control Systems
MV_Switchgear
Aux_power
Battery containers, LV DC
PCS units, LV AC
PT 600V/21kV
Aux power
HARJUS
MASTO
VR - SÄHKÖASEMA

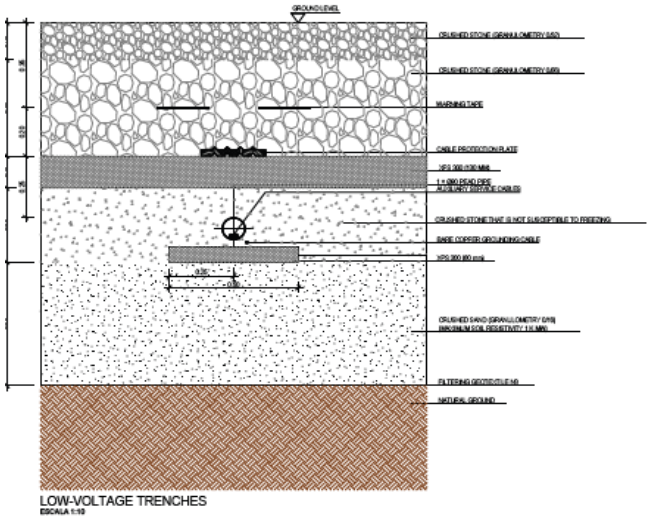
Electrical infrastructure

LV & MV ROUTES
&
CABLE TRENCHES

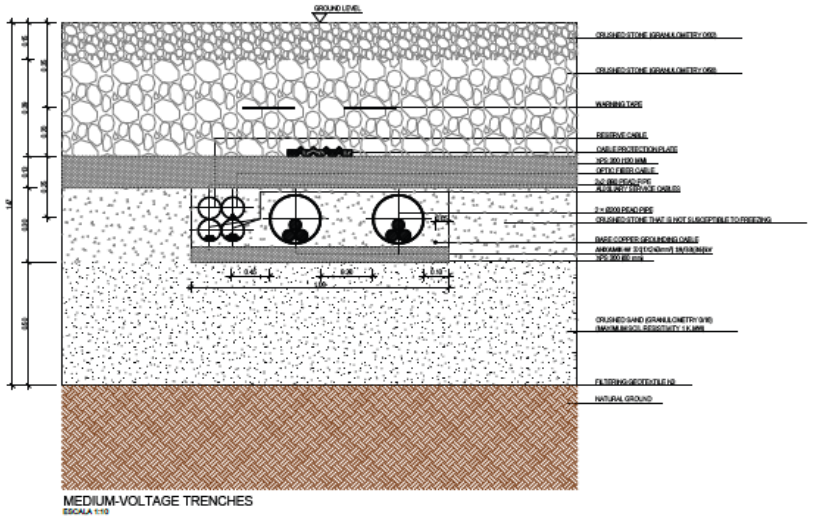
DETAIL VIEW



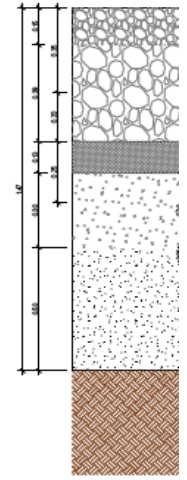
LV TRENCH LAYOUT
1 : 100



LOW-VOLTAGE TRENCHES
ESCALA 1:10



MEDIUM-VOLTAGE TRENCHES
ESCALA 1:10



MEDIUM-VOLTAG
ESCALA 1:10

Single line diagram

The diagram shows a 9.9 MW / 37.9 MWh BESS connected to a 21 kV grid via dedicated switchgear.

The switchgear incorporates circuit breakers, CTs, VTs, disconnectors, metering, and protection relays for safe operation.

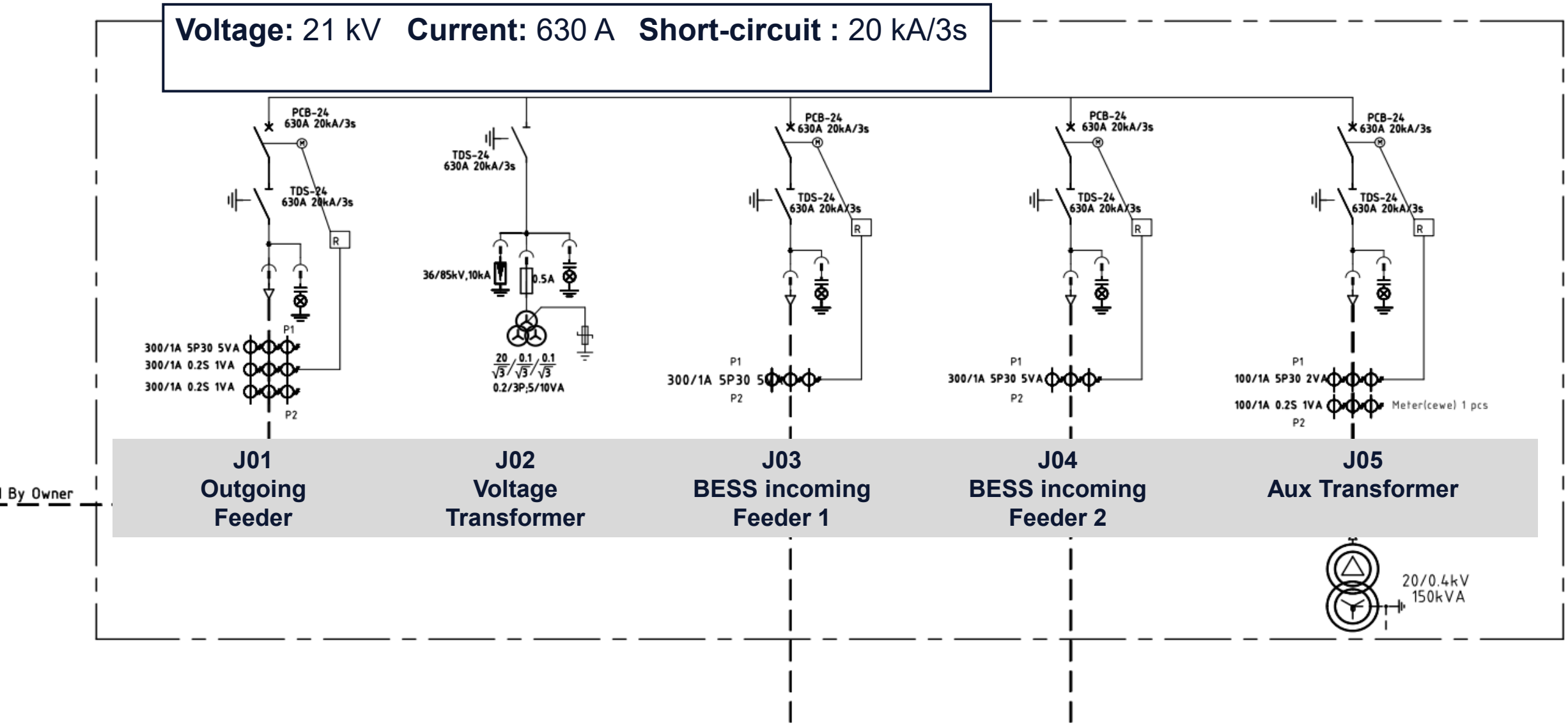
The system is divided into three independent 3.33 MW / 12.62 MWh battery blocks.

Each block includes battery containers, PCS inverters, protection equipment, and a step-up transformer.

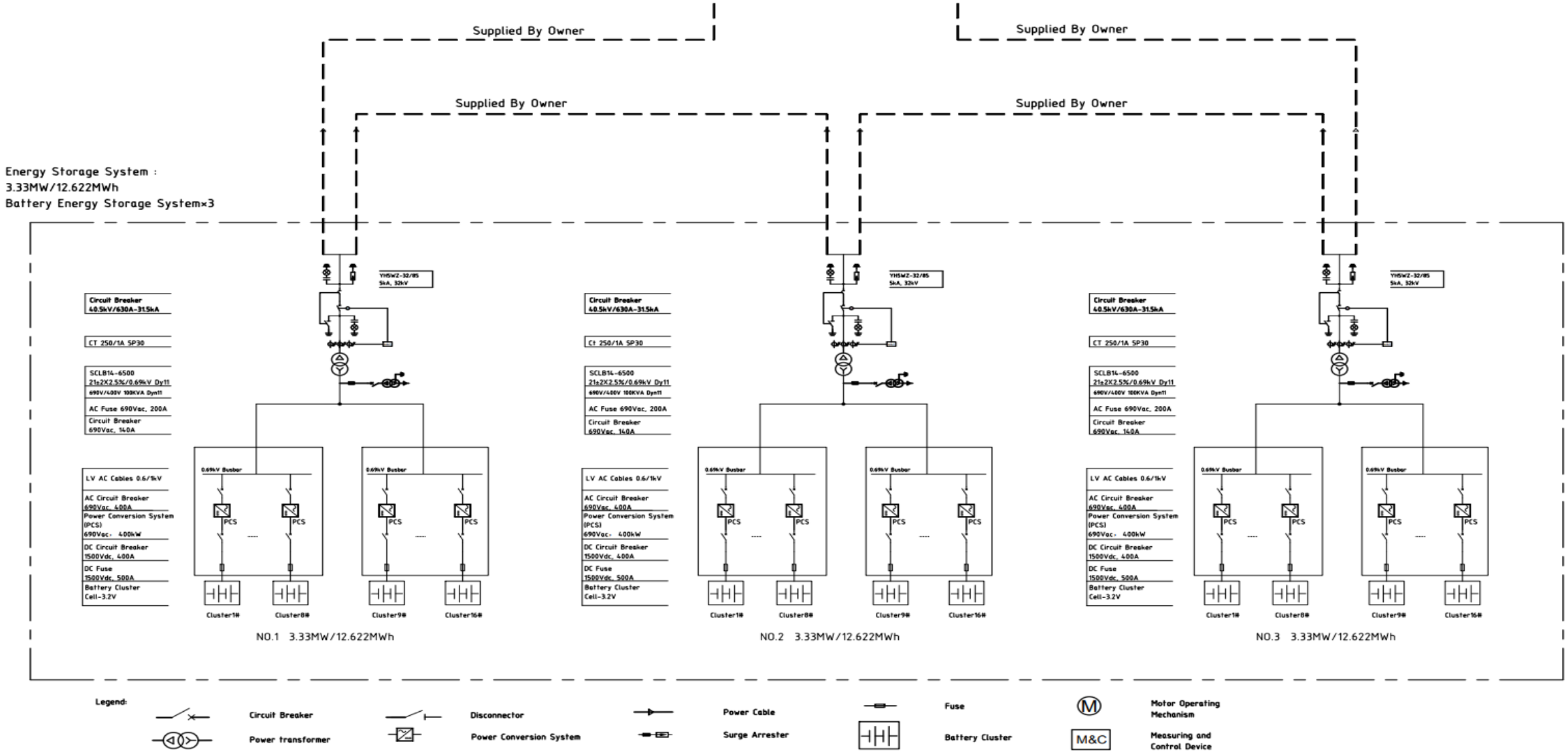
The architecture is modular, reliable, and well-suited for utility-scale energy storage applications such as grid balancing and renewable integration.

e-house 21kV Primary & Aux Transformer

Voltage: 21 kV **Current:** 630 A **Short-circuit :** 20 kA/3s



Energy storage and MV step-up trafos



BESS components overview

#	Equipment	Specifications	Voltage Level	Function	Main Advantages
1	**Battery Cells**	Cell = 3.2 V	LV DC	Energy storage	High energy density, fast response
2	**Battery Clusters**	Multiple clusters	DC	Aggregates battery cells into usable storage blocks	Modular replacement and maintenance
3	**DC Fuse**	1500 Vdc, 500 A	DC	Short-circuit and fault protection for battery strings	Fast fault isolation
4	**DC Circuit Breaker**	1500 Vdc, 400 A	DC	Switching and protection of battery circuits	Safe maintenance and emergency isolation
5	**Power Conversion System (PCS)**	690 Vac, 400 kW modules	DC ↔ AC	Converts battery DC power to grid-quality AC and vice versa	Bidirectional power flow, reactive power control
6	**LV AC Circuit Breaker**	690 Vac, 400 A	LV AC	Protects PCS output circuits	Selective fault clearing
7	**LV AC Busbar**	0.69 kV Busbar	LV AC	Collects power from multiple PCS units	Simplifies power aggregation
8	**LV Main Circuit Breaker**	690 Vac, 1600 A	LV AC	Main protection and isolation before transformer	Provides feeder protection
9	**AC Fuse**	690 Vac, 200 A	LV AC	Additional transformer/feeder protection	Limits fault energy
10	**Step-Up Transformer**	SCLB14-6500, 21 ± 2 × 2.5% / 0.69 kV, Dyn11, 6900 kVA	LV to MV	Steps voltage from 690 V to 22 kV collection system	Reduces current and cable losses
11	**Current Transformer (CT)**	250/1 A, 5P30	MV	Current measurement and protection input	Accurate relay operation
12	**Surge Arrester**	MV Surge Arrester	MV (22 kV)	Protection against lightning and switching surges	Protects transformer and switchgear
13	**MV Disconnector / Isolator**	Motor-operated	22 kV	Visible isolation for maintenance	Improved safety
14	**Motor Operating Mechanism**	M	22 kV	Remote operation of switchgear	Enables SCADA/remote control
15	**Measuring & Control Device**	For power quality and metering	22 kV	Metering, protection and monitoring	Supports EMS/SCADA integration
16	**MV Circuit Breaker**	40.5 kV, 630 A, 31.5 kA	HV/MV Interface	Main protection to grid connection point	High interruption capacity
17	**22kV Power Cable & Grid Interface**	Aluminium, 240 mm2	22 kV	Connects BESS to plant and utility substation	Dual feeder for flexible plant integration and resilience

Electrical parameters for 1 BESS

Parameter	Value
BESS Power Rating	3.33 MW
BESS Energy Capacity	12.622 MWh
Battery Cell Voltage	3.2 V
DC Fuse Rating	1500 Vdc, 500 A
DC Breaker Rating	1500 Vdc, 400 A
PCS Rating	400 kW each
LV Bus Voltage	690 Vac
LV Main Breaker	690 Vac, 1600 A
Transformer Voltage Ratio	0.69/22 kV
CT Ratio	250/1 A
MV Breaker Rating	40.5 kV, 630 A, 31.5 kA
Grid Connection Voltage	21 kV

BESS MV container

Voltage Transformer: Each Transformer Container houses a 6.5 MVA dry-type transformer that steps up the PCS output voltage from 0.69 kV to 21 kV and delivers power to the RMU in the E-House.

Protection & Monitoring: The containers include LV and MV switchgear, protection relays, CTs, and VTs that provide measurement, protection, and fault isolation functions to ensure safe and reliable operation.

BESS Auxiliary Systems: Integrated auxiliary transformer, UPS systems, cooling fans, and control power supplies support continuous operation of protection, control, and monitoring equipment, even during grid disturbances.

BESS Integration: The Transformer Containers provide a standardized interface between the PCS units and the step-up transformer, enabling efficient installation, simplified maintenance, and reliable integration of the BESS into the plant's medium-voltage network.

EMS, SCADA, and Measurement Systems

Power Plant COntrol and Energy Management System (EMS)

PPC and EMS coordinate the battery systems and grid interface, optimizing charge schedules and ensuring grid code compliance.

SCADA Monitoring and Control

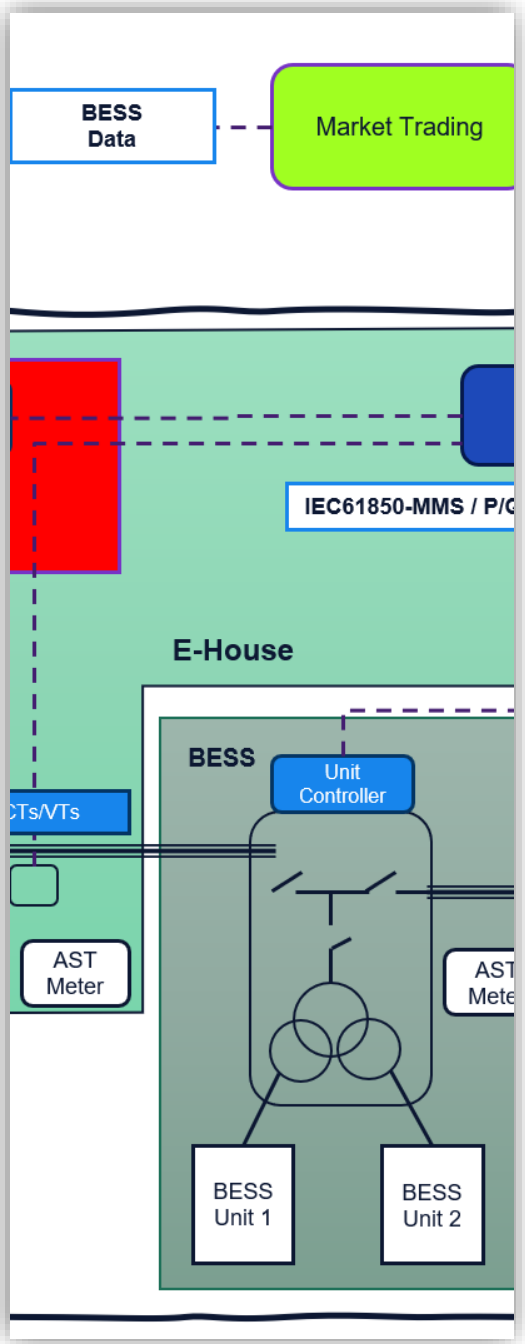
SCADA offers real-time monitoring and control with alarms, event logs, and remote operation capabilities.

Measurement and Protection Devices

Devices collect data for protection, performance monitoring, and fault clearance to ensure system stability.

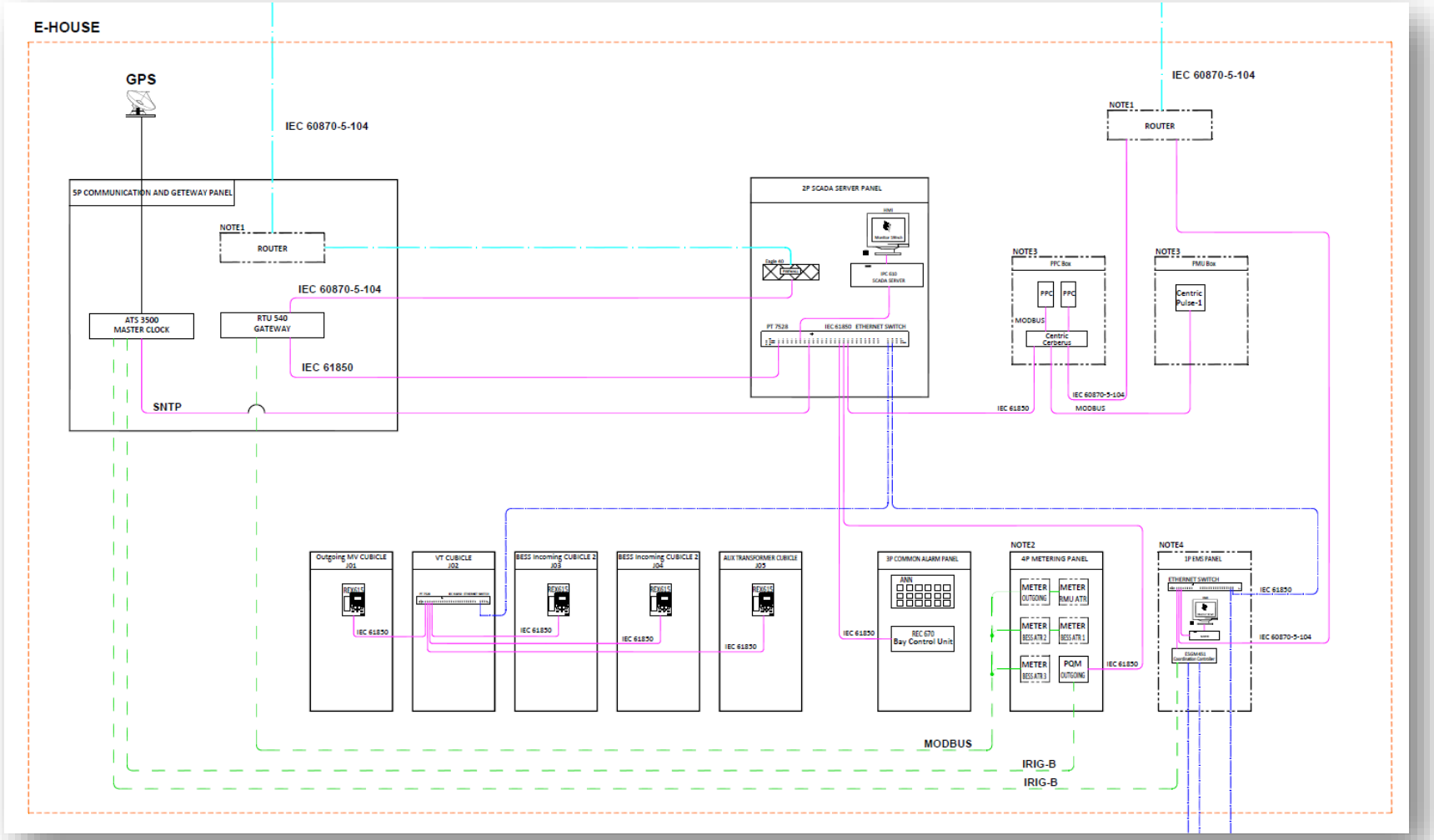
Integrated Control Architecture

EMS, SCADA, and protection systems together enable reliable, efficient, and compliant BESS operation.



Protections, Control & Communications

- GPS Time Synchronization
- Communication & Gateway
- Station Ethernet Network
- SCADA Server & HMI
- MV Protection & Control Relays
- Common Alarm System
- Metering System
- PPC (Power Plant Controller)
- PMU Monitoring System
- External Utility Communications

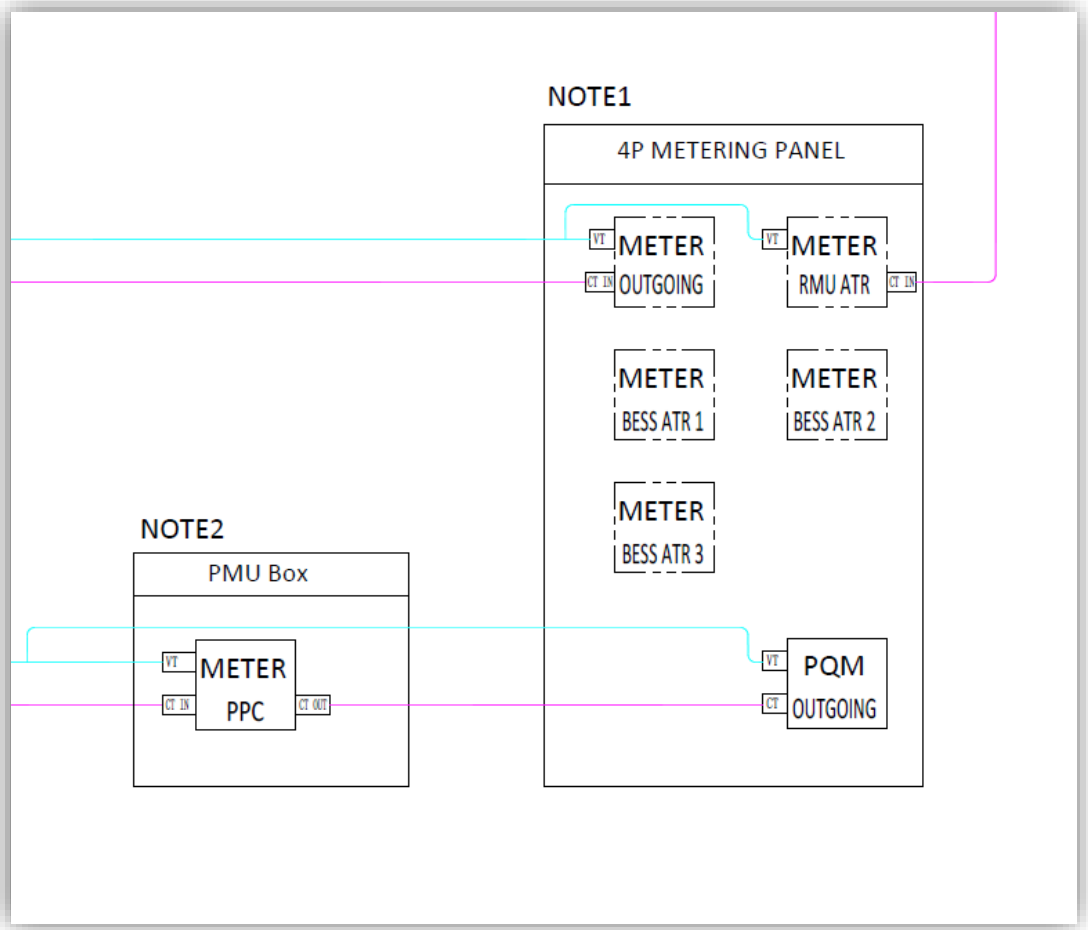


Metering

Dedicated metering for

- Power plant control @ Point of Connection
- Power quality @POC
- Fiscal metering (incoming, outgoing)
- Aux loads
  - E-house
  - BESS 1
  - BESS 2
  - BESS 3

Metering of auxiliary loads may result in substantial savings depending on BESS tax regulations



E-house design

Designed with 3 separate compartments

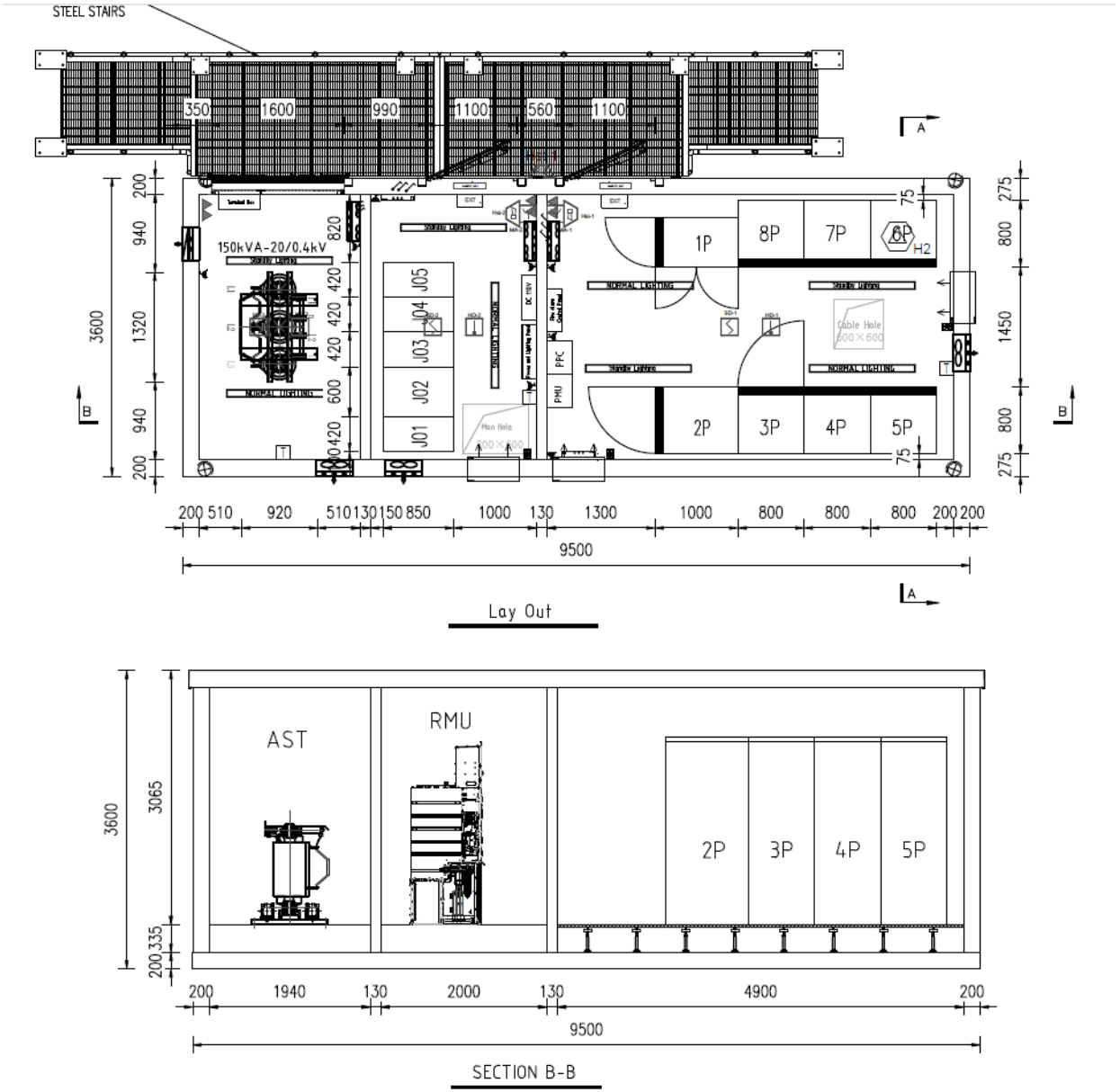
E-house is designed as 3 separate compartments to ensure operational and physical safety.

Each compartment is independently climatized contributing to energy savings.

1) Auxiliary Service Transformer (AST)

2) MV Room (J01…J05 switchgear, RMU)

3) LV Control room



Control room, AC and DC power supply

Auxiliary AC Power

AC power to HVAC, heating, dehumidifier, lighting, control panels, and communication equipment ensuring normal operation.

Battery-Backed DC Systems

110 V DC systems with battery-backed chargers provide reliable power for protection and control equipment during outages.

Uninterruptible Power Supply Systems

UPS systems maintain continuous power to critical devices like BESS control system, SCADA, EMS panels and fire alarms during power disturbances.

Redundancy and Fail-Safe Design

Redundant backup power supply to BESS 1, BESS2 and BESS 3 to ensure BESS auxiliary systems remain operational in case of BESS aux transformer failures.