SCADA Solution

NORIKER POWER

Noriker Power
Harnessing Complexity

Noriker SCADA Solution

The **Noriker SCADA Solution** is a robust, comprehensive, and fully integrated control and data acquisition package designed specifically for BESS projects of any size or scale. It has been refined through more than 10 years of continuous deployment and real-world updates, with collaboration between our in-house BESS & controls engineers, asset managers, and asset optimisers.

Noriker's SCADA Solution consists of the **Noriker SCADA System**, powered by Noricore software at its heart, and **Noriker SCADA Services**, offering Software as a Service (SaaS) packages for efficient BESS operations, along with expert support services for asset management and optimisation.

The integrated design of the Noriker solution, an all-in-one site network, control, data infrastructure and monitoring solution, creates an efficient and robust product. It is designed, commissioned, and supported by our experienced engineers, who also provide ongoing operational support. Noriker provide a unique package of commissioning support that reduces time to commission, and advances COD.

Noriker SCADA Solution includes:

Noriker SCADA System

- Noricore BESS control system (EMS & PPC)
- Onsite control & network hardware
- Bespoke design
- Local commissioning included as standard
- Redundant system design
- Internet connection configuration & management
- Remotely accessible HMI
- Integrated optimiser API
- Equipment warranty protections

Noriker SCADA Services

Software as a Service:

- Norimon data monitoring web platform
- Reporting and alerting capability built in
- Secure & redundant site data storage
- Advanced data analytics

Support and software maintenance services:

- Noricore maintenance
- Technical support
- Network management
- Cyber security management

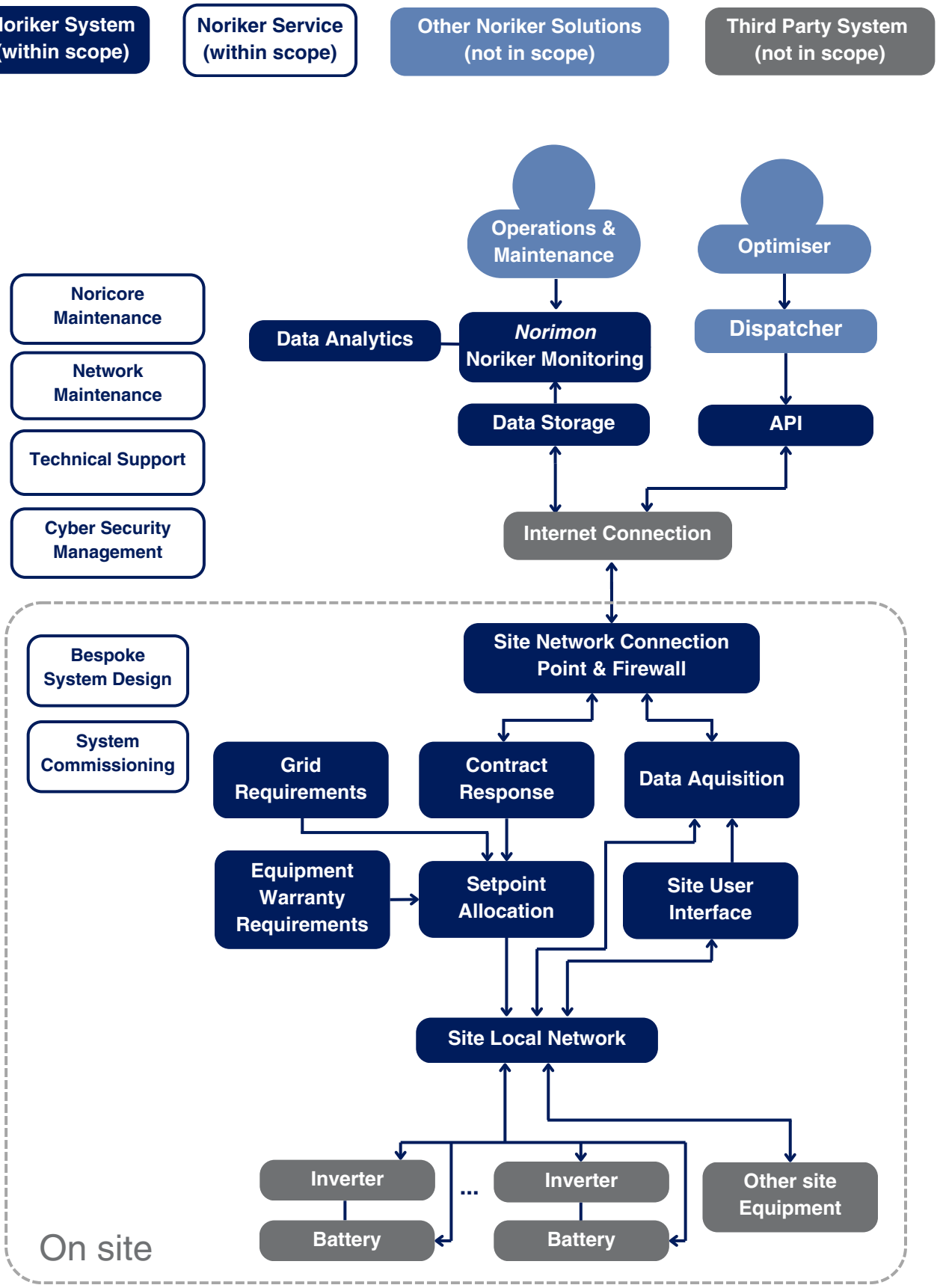
Optional extras:

- Additional availability guarantee
- Cloud based site dispatcher and interface
- 24/7 monitoring
- Additional third party API integration

No need to procure additional:

- Analytics software
- Specialist commissioning and integration services
- Third-party optimiser API
- Monitoring platform, reporting and alerting systems
- Internet connection, site network and cyber security management services

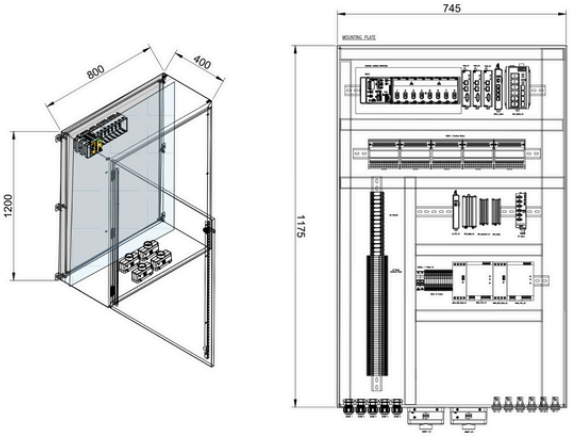
Noriker SCADA Solution Diagram



What's included - Primary supply items

"Plug and play" hardware supply

Noriker's hardware solution comprises both cabinet-based and distributed hardware components. All hardware is pre-configured and factory-tested before delivery, making it effectively "plug and play." The Noriker SCADA solution incorporates built-in redundancy, reducing single points of failure and minimising the impact of potential faults. Depending on the scope of supply and hardware requirements, one or multiple cabinets may be provided.



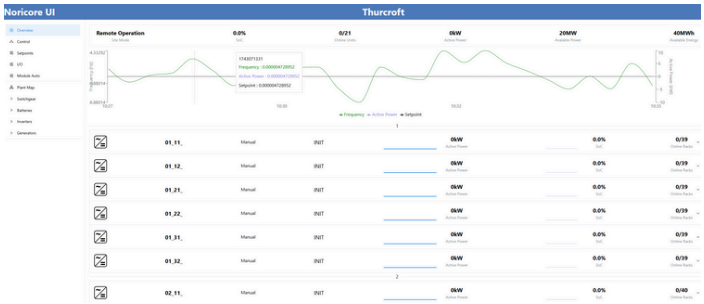
Note: Image may not accurately represent the final solution.

Human Machine Interface (HMI) workstation

The HMI comes pre-loaded with the necessary software for site control and system utilisation. Appropriate cybersecurity measures are implemented during equipment configuration. The HMI provides on-site access to both the Noriker SCADA UI and Noriker Monitoring platform.

Primary software platforms

Noriker's web-based SCADA UI is designed with redundancy in mind. As a web-based platform, the failure of a single host machine does not result in UI unavailability, instead, the interface is automatically served from another available machine. The SCADA UI enables users to manually control equipment, configure site settings, and perform test runs.



Noriker Monitoring, Noriker's proprietary monitoring platform, provides real-time access to current and historical site data from the Noriker provided data storage solution. Advanced visualisation and intuitive data navigation capabilities enable efficient site monitoring and streamlined troubleshooting. Noriker Monitoring is securely cloud-hosted, with remote web based access available to authorised counter-parties as required.

What's included: Noriker SCADA **System**

Noriker SCADA System - BESS Control System Hardware	• Noricore control cabinets, consisting of:
	  ◦ Central & back-up controller with associated I/O modules;
	  ◦ SLIM controllers;
	  ◦ Central site router, firewall & VPN Service;
	  ◦ A segmented ancillary network for CCTV etc;
	  ◦ Network switches
		• Distributed site equipment, including:
		  ◦ HMI workstation & local user interface;
		  ◦ Internet firewall and router;
		  ◦ Network switches;
		  ◦ Network attached storage.
		• Equipment supplied to site or location of choice (Mainland Europe)

Noriker SCADA System - Software (Noricore software licence)	• Noricore software licence package • Central Monitoring System (CMS) and setup • Software testing & integration • SCADA commissioning: remote commissioning services; local commissioning services	• Data analytics configuration • Fault monitoring automation configuration • Alerting system • Report generation system • Integration design and configuration
Noriker SCADA System - Services	• Site BESS control system design • BESS equipment integration and warranty limit inputs • Pre-site equipment configuration and testing (for 'plug and play' installation) • On-site commissioning support, with rapid commissioning protocols	• Remote site testing & commissioning • Site acceptance testing • Meter testing • Tuned site output for customer specified services • Grid conformance tests & report generation • Auxiliary equipment integration
Noriker SCADA System - Cyber Security	• System design aligned with IEC62443 (full compliance in progress) • Strong multi factor authentication enforced on all remote access vectors	• Network micro-segmentation with default-deny traffic filtering at zone boundaries

Noriker SCADA System - Noricore Metering	• Adherent to the following standards:
	  ◦ IEC 61000-4-7:2009
	  ◦ IEC 61000-4-15:2010
	  ◦ IEC 61000-4-30:2008
	• Integration to third party metering
		• 20Hz metering for full UK frequency service's compliance
		• Multiple metering and control point capability for bespoke metering setup

Noriker SCADA System - Local Network and Internet	• Whole site redundant network design • Internet redundancy configuration based on site available internet connections	• Network security management configuration • Permission based access configuration • VLAN configuration as required

What's included: Noriker SCADA **Services**

Noriker SCADA Services - SaaS Norimon - Noriker Monitoring Platform	• Multiple data visualisations • Suitable for real time or historic monitoring and troubleshooting • Flexible time range selection for trend viewing or event investigation • Portfolio view for multiple site management • Overview displays and detailed equipment views for rapid investigation into data	• Cloud-based highly available platform • Historic data access • Secondly granular data visualisation • Secure remote web access for O&M, Asset Manager, Optimiser and other stakeholders • Custom visualisations and dashboards* **Custom visualisations limited per site*

Noriker SCADA Services - SaaS Alterting and Reporting	• Alerting:
	  ◦ Push alerts available to third parties:
	  ▪ Email, messenger, text and phone alert capability;
	  ◦ Custom alert setup;
	  ◦ Multiple alert severity levels;
	  ◦ Historical alert record access for troubleshooting.
		• Reporting:
		  ◦ Routine reports for flexible time range selection;
		  ◦ Performance report printing feature.

Noriker SCADA Services - SaaS Site Data Storage	• Secure long term data storage • Accessible for monitoring, reporting and analysis	• Third party API access available • Data as collected and derived variables
Noriker SCADA Services - SaaS Data Analytics	• Basic and advanced data analytics • Real time data analytics • Enables advanced reporting and troubleshooting	• Advanced equipment performance analysis: ◦ View what is costing the site money.

Noriker SCADA Services - Cyber Security and Network Management	• Cyber security:
	  ◦ Cyber security monitoring;
	  ◦ Remote virtual access management;
	  ◦ Key equipment software maintenance and patch management.
		• Network management:
		  ◦ VLAN mantenance and adjustment as required;
		  ◦ Additional equipment adjustment in line with security requirement;
		  ◦ Internet access management.

Noriker SCADA Services - Noricore Maintenance and Technical Management	• Noricore Maintenance:
	  ◦ Ongoing update capability with zero downtime;
	  ◦ Security patch and performance updates;
	  ◦ Feature updates, including new service capability functionality.
		• Technical Support:
		  ◦ Technical troubleshooting assistance;
		  ◦ Highly experienced expertise support.

Advanced Architecture Details

Hardware Architecture

The Noriker SCADA System includes the following hardware features in our systems:

Dual Primary Controllers	• Hot shadowing for bump-less changeover • Dual metering & data acquisition for full hardware redundancy • Interfaces with replicated highly available processes within the hardware cluster
Lateral Scaling	• Distributed and scalable hardware modules • RAFT algorithm based hardware clusters • No proprietary hardware requirement for un-risked project life cycle
Cluster Control Hardware	• Physically separated with separate auxiliary supplies possible • Distributed software control on independent hardware • Can support the loss of control devices with minimal impact to site output • Supports rolling zero downtime upgrades • In-built health monitoring
Redundant by default	• No single point of failure • Intelligent failover protocols • Seamless transition

Software Architecture

The Noriker SCADA System includes the following software features in our systems:

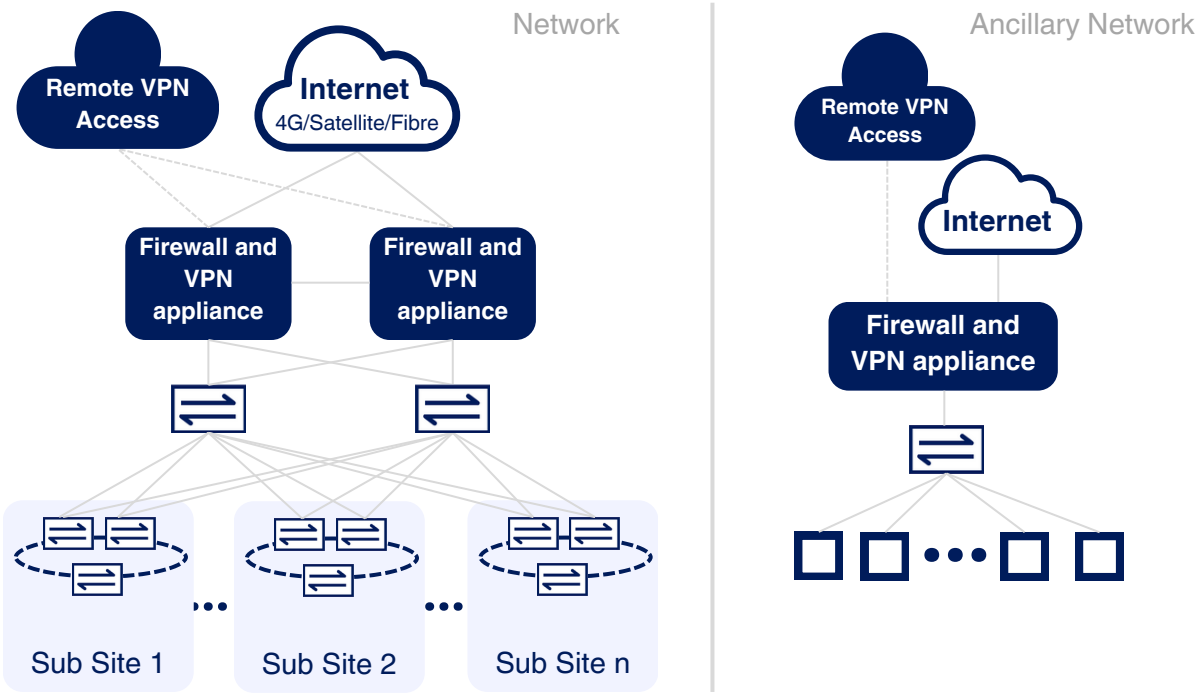
Dedicated Plant Processes	• Dedicated software module to each individual piece of plant • Data accumulation and capture • Set point control • Automatic node (hardware component) changeover in event of maintenance or outage
Fast Metering and Control	• 20Hz metering and control loop • Reacts to site output and availability • Bespoke site calibration and capable of virtual points of metering • Overlayed error correction
Hot Shadowing	• Dual primary controllers send set points to power unit interfaces • Interfaces filter the commands from the main controller • Seamless changeover
Configurable Site	• Site software topology determined by configuration file • Easy to scale up and down site • Performs rolling updates
Extensible	• Technology agnostic • Already integrated with 60+ plant versions from major BESS suppliers • Streamlined onboarding process for additional integration of new plant

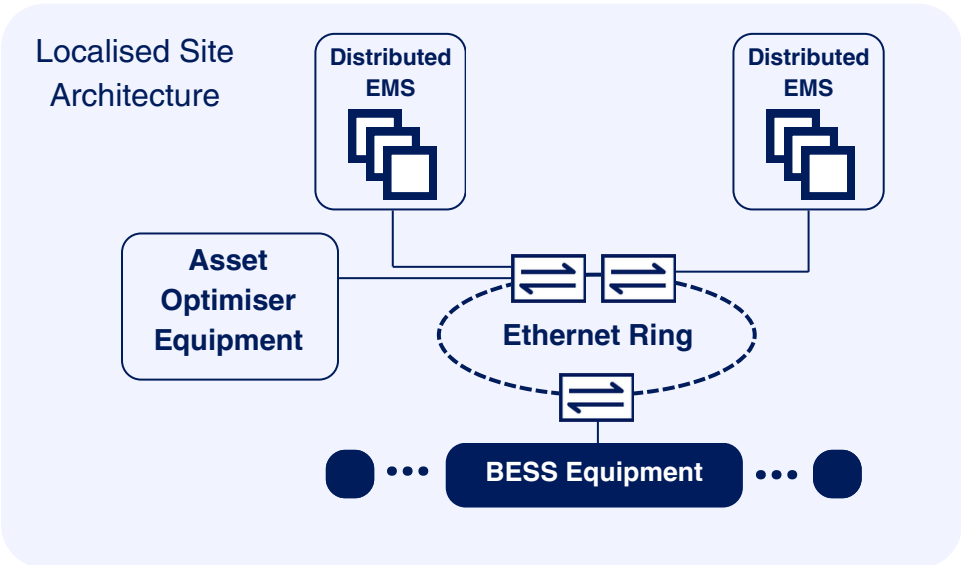
Advanced Architecture Details

Network Architecture

Extensible design capable of operating up to Gigawatt sized sites. The network is secure by design, with the following key features:

- Segmented sub-sites have limited visibility of the outside world
- Access to the site is via secure VPN, only authorised personnel may access
- All access is logged and associated with VPN users
- Redundant design at every stage
- Redundant ring topology on each sub-site and redundant interconnections
- Minimal exposed surface of each sub-site
- Physical segregation of ancillary equipment with potential vulnerabilities, such as CCTV





EMS Control Architecture

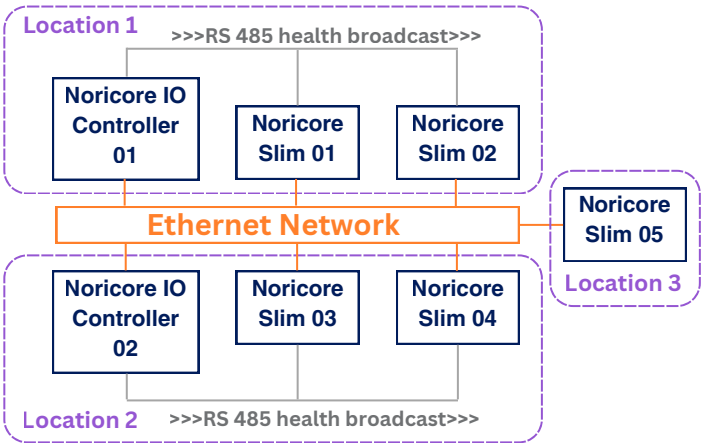
- Distributed control system utilising modern micro service architectures
- Highly available design with great resilience
- Multi level user access reduces risk
- Up to 100ms data recording resolution
- <100ms output response rate
- Sophisticated error correction
- Distribution algorithm that maximises full power availability
- Capability to remove plant from system control for maintenance actions
- Automatic compensation of aux load, output error and manually instructed inverter output

Operation and Safety Features

- Noricore observes all limits in a power chain to never breach the limits of an individual component
- Layered protections on top of manufacturer's limits
- In house developed manufacturer specific protections and algorithms to further improve battery performance and availability
- Inverter quick stop triggers: Loss of battery comms, fire signals, alarms
- Manual mode toggle for all major plant to prevent auto operation when work is occurring
- Safe auto shutdown and grid reconnect on loss of mains events compliant with G99
- Fault reset loop protection: repeatedly faulting hardware may be disabled by the control system to improve overall system performance

Redundancy by Default

- No single point of failure
- Hot backup controller
- Hybrid dual pathway redundancy using Ethernet/RS-485
- Compute swarm of multiple devices spread across spatially separated locations
- (N-1)/2 cluster node redundancy
- Uptime guarantee of 99% available



Redundancy is included by default into our designs, and doesn't come at additional cost

Distributed architecture allows the removal of individual nodes from the control system with minimal downtime. Once removed, nodes may be updated without any effect on the control system. Constant health checks will only allow a node to rejoin the control system once healthy.

Energy Management

- The control system autonomously distributes set points to optimise full-site power availability and asset utilisation
- The algorithm balances the effective C-rate of each battery to maximise full power availability
- Power is concentrated within a small group of units when target output is low and distributed across all available units as demand increases, reducing output fluctuations
- The management framework minimises trapped capacity through real-time adjustments
- Dynamically responds to capacity fluctuations to maintain operational stability and maximise system efficiency
- Power distribution balances loads between batteries to manage temperature differences, state of energy and over the long term SOH

Integration Services

- EPC / BOP Design Support: Network Architecture and Auxiliary Equipment design and specification
- Internet procurement and configuration
- On-site equipment installation: Controllers, cabinets, network switches, routers; Network and Security Appliances Configuration
- Pre-installation control system build, configuration and hardware in the loop testing against simulated site (digital twin)
- On-site Commissioning Support: Cold-Commissioning (prior to site energisation); Hot-Commissioning (after site energisation)
- Rapid automated commissioning processes
- Remote Site Testing & Commissioning including out-of-hours support
- Site Acceptance Testing
- Tuned site output for customer desired services
- Grid conformance tests & report generation
- Metering Conformance
- Auxiliary Equipment Integration
- Training Package - On site / Remote / Classroom for monitoring or full control

Site O&M

- Automated testing:
  - Dynamic Frequency Response
  - Capacity
- Setpoint algorithm automatically diverts away from units under test or maintenance
- Secure web-based access to the HMI subsystem enables O&M teams to provide remote technical support and safety oversight during onsite maintenance activities
- Stringent access controls including MFA and dual approval ensure that only properly authorised users can operate the site remotely
- Advanced user access to the interface giving each user an auditable log trail
- Fine grained permissions for different access requirements
- Automated alerts when manual actions undertaken

Cyber Security

- System Design and Cyber Security Risk Assessment aligned with the IEC 62443 standard (full compliance in progress)
- Encrypted VPN protected with Multi Factor Authentication (MFA) supporting federated identity providers which can facilitate tailored remote access for third parties e.g. vendors, O&M etc
- Cloud Firewall supporting deep packet inspection continually monitors dataflows leaving site (VPN and Internet) and mitigates traffic matching live threat intelligence signatures in addition to applying the configured filtering rules.
- Zero Trust network architecture poses a hostile environment for threat actors
  - Physical segmentation between Control and Ancillary components
  - Deny-by-default for dataflows crossing security zone boundaries
  - Network isolation enforced for safety critical equipment
- SCADA equipment configured to log audit and activity events to offsite data storage
- Ongoing patch management programme including vulnerability triage and response
- Administrative system access secured with uniquely identifying strong credentials over encrypted channels
- All data transmitted to Noriker Cloud services is authenticated and protected by modern TLS encryption parameters

Additional Standout Features

Additional features not usually provided with other BESS control systems standard offering, included as standard with the Noriker SCADA Solution:

Advanced Energy Management

- The control system autonomously distributes set points to optimise full-site power availability and asset utilisation, taking into account disconnected or limited equipment
- The algorithm balances the effective C-rate of each battery to maximise full power availability
- Power is smartly distributed across equipment for stability and reduced fluctuations, balancing temperature, state of charge and state of health
- The management framework minimises stranded capacity through real-time adjustments

Data Analysis

Data is captured at 1s resolution and stored on a monitoring platform, onsite NAS (CSV format), and cloud database, with visualisation via Noriker's remote platform. Features include:

- 35,000+ metrics at 1s resolution for a 50MW site
- Granular battery cell-level data
- Real-time safety and alarm tracking
- Battery health monitoring (charge, temperature, voltage)
- Integrated control with real-time and historical data

Reporting & Monitoring Built In

- Configured monitoring platform as standard
- Custom dashboards tailored to requirements
- Visuals for up-time and performance analysis
- Auto-generated reports for accuracy
- Raw data exports for deep analysis

Third Party Integrationsl

Many operator contracts require an API for dispatcher-site communication. Noriker's SCADA solution includes a built-in REST API removing requirement for third party middleware, avoiding extra costs and delays, and reducing counterparties, whilst simplifying integration.
Our SCADA integrates with third-party service providers, offering full API compatibility, monitoring and virtual site access. Access is actively managed in line with cyber security protocols.

Bespoke configurations

Common bespoke configurations are included to integrate all hardware present on site into the SCADA system, for example:

- Customer switchgear, including remote and automated control
- Virtual metering points from model and measurement derivations
- Fire and alarm systems, site entry controls

Warranty

We offer a comprehensive 5-year warranty as standard, included with all our systems. Additional years of coverage are available for purchase upon request.

Guarantee Liabilities

If the availability of the control system falls below the agreed guarantee, the Employer will receive compensation. This compensation is calculated as 2% of the applicable Control System Maintenance Service Fee, multiplied by the total percentage below the Availability Guarantee, with a maximum of 25% of the Service Fee for each 6-month period.

We have an additional guarantee purchase options for 99.5% availability.

Terms of this quotation are as set out in our Noriker SCADA contract.

Optional services

(Optional) Dispatcher

Our dispatcher tool empowers optimisers to control asset operations, enabling charge and discharge actions and scheduling assets for frequency services. Designed for minimal manual intervention, the dispatcher automates frequency service operations by transmitting real-time operational and performance data (including k-factor calculations), maintaining heartbeats, and responding to ARM/DISARM instructions.

This dispatcher tool is continuously developed in conjunction with our in-house asset optimisers, ensuring it is finely tuned to real-world operational demands and industry best practices. By leveraging deep expertise and live performance insights, we deliver an advanced, responsive, and intelligent communication platform.

(Optional) Technical Assistance Services

These services are included as standard with a live operations and maintenance service through the contractor. They are also available with the stand alone SCADA solution as an optional add-on:

- Expert technical assistance for advanced investigation and troubleshooting, including root cause analysis. The contractor will use data, site engineering information, and OEM support to identify performance issues or equipment failure, determine responsibility, and assist in resolution where appropriate.
- BESS-specific data analytics service, which includes baselining commissioning test data, monitoring for non-conformance from operational data, periodic retesting of battery system health, and regular reporting.

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