

ENERGY MONITORING SYSTEM (EMS)

1 GENERAL

1.1 Responsibilities

Provide a complete Energy Monitoring System (EMS) to continuously measure, record and report electrical parameters at nominated switchboards and circuits, including hardware, software, communications, configuration, integration and commissioning. The EMS must support multi-circuit monitoring, local data resilience, and remote analytics and alerting.

1.2 Associated worksections

Coordinate with:

- Main switchboards and distribution boards.
- Metering and protection.
- Communications.
- Building Management/Automation System

1.3 Submittals

- **Data and reporting plan:** naming, sampling/reporting intervals, retention, standard dashboards and alerts.
- **Integration plan:** Third-party data sources (e.g, REST API, BMS).
- **Commissioning results:** end-to-end data flow, CT sizes, configuration
- **O&M manuals:** As-installed schedules, credentials, training sources.

1.4 Warranty

Minimum 3-year parts and labour on EMS hardware, plus workmanship warranty.

2 PRODUCTS

2.1 System type

- Basis of design: **PhiSaver or approved equal.**
- Function: Multi-circuit electrical monitoring of voltage, current, energy (kWh) and power factor with analytics.

2.2 Sensors (CTs)

- Type: Split-core/double-insulated current transformers sized to suit conductor/busbar; typical 20 A to 1000 A range; custom CTs for busbars where required.
- Accuracy: Manufacturer's standard for the selected range; match CT ratio in configuration.
- Installation: Clip-on around each monitored phase/feeder; maintain directionality; label to circuit schedule.
- Approved makes: Accu or Echun, or equal.

2.3 Controllers / data acquisition

- Hardware: Multi-channel monitor with voltage reference input and CT inputs; automatic restart on power loss.
- Sampling and reporting: High-rate internal sampling with **reporting interval 10 s** (configurable).
- Local storage: Minimum 5 years time-series buffer with circular overwrite.

2.4 Enclosures

- Construction: Polycarbonate or 1.6 mm sheet-metal, earthed, tamper-resistant, IP66 weatherproof where exposed; external lockable where accessible to the public. Provide separate EMS enclosure adjacent to boards to allow validation under power.
- Space and access: Allow service clearances for CT validation and maintenance.

2.5 Power supply

- Dedicated GPO/UPS-ready supply to EMS enclosure; include 9 V voltage reference transformer as required.

2.6 Communications

- Dedicated **4G gateway** to the EMS to ensure connectivity. Provide external antennae as required.
- Resilience: Cache data locally during outages; auto-sync on reconnection.

2.7 Software and cloud services

- Dashboards: Web/mobile responsive UI with charts, heat maps and custom images; multi-site roll-ups where applicable.

- Alerts and reporting: Configurable scheduled email/PDF and event-based SMS/alerts (e.g. “solar offline”).
- Hosting and data protection: Commercial cloud hosting with redundant storage and daily backups; preference for open-source software stack.
- Accounts and permissions: Site-level and fleet-level roles.

2.8 Interfaces and integration

- Ingest: Modbus (local) and web APIs (remote) for third-party data; map into dashboards and reports.
- Expose: RESTful API and embeddable live panels for BMS/portal integration and kiosk mode.

3 EXECUTION

3.1 Installation

- Mount EMS enclosure adjacent to each nominated switchboard; route CT leads neatly and segregate ELV from LV.
- Clip CTs to each nominated circuit/feeder per schedule; verify phase association and polarity; label CTs and inputs to match drawings.
- Provide communications per design (Wi-Fi/WAP/4G/5G) and test signal strength and throughput.
- Minimise outages; where practicable, confine power-off to ≤ 2 hours per board.

3.2 Configuration

- Create point database (tags) with consistent naming; configure aggregations (e.g. Pool Plant, HVAC, Lighting) and “total unmonitored load” per board.
- Set **reporting interval = 10 s** (unless noted otherwise).
- Implement user accounts: facility manager (site) and administrator (fleet) roles.

3.3 Commissioning and acceptance tests

- **Point-to-point check:** Verify every CT against clamp meter sample; correct polarity and ratios.
- **Functional:** Live dashboards showing all points; historical backfill visible after 24 h; loss-of-comms test demonstrates local buffering and later cloud sync.

- **Reporting/alerts:** Demonstrate scheduled weekly email/PDF and at least one event-based alert.
- **Integration (if applicable):** Demonstrate ingest of one Modbus or API data source and exposure of one REST endpoint or embedded panel.

3.4 Training

Provide session(s) for operators covering dashboards, ad-hoc analysis, downloading data, acknowledging alerts. Provide user guide.

4 MEASUREMENT & VERIFICATION (M&V)

4.1 Sampling and retention

- Sub second waveform sampling; **minimum reporting 10 s**; retain raw/interval data locally for ≥ 5 years with cloud copy.

4.2 Standard deliverables

- **Dashboards:** Real-time overview, weekly load profile, solar vs load (where applicable), and cost/day summaries.
- **Reports/alerts:** Weekly summary email/PDF and critical event alerts (e.g. abnormal baseload, solar offline).
- **Multi-site views (where applicable):** Fleet map with consumption/solar overlays and category roll-ups.

5 SELECTIONS

5.1 Approved manufacturer

- **PhiSaver or approved equal.** Any alternate must demonstrate, at a minimum:
 - o Circuit-level monitoring with CT range $\geq 20\text{--}1000$ A;
 - o 10 s reporting; five-year local storage; auto-sync on comms restore;
 - o Web/mobile dashboards, scheduled reports, SMS/alerts, kiosk mode;
 - o API ingest/expose capabilities and role-based permissions;
 - o Commercial-grade cloud hosting with daily backups; 3-year warranty.