

Energy Performance (NEMA)

Analyze KPI Performance to Drive Behavioral Changes and Operational Efficiency

EcoStruxure Power Digital Application

0100DB2323
12/2023

EcoStruxure™ Power



Legal Information

The information provided in this document contains general descriptions, technical characteristics and/or recommendations related to products/solutions.

This document is not intended as a substitute for a detailed study or operational and site-specific development or schematic plan. It is not to be used for determining suitability or reliability of the products/solutions for specific user applications. It is the duty of any such user to perform or have any professional expert of its choice (integrator, specifier or the like) perform the appropriate and comprehensive risk analysis, evaluation and testing of the products/solutions with respect to the relevant specific application or use thereof.

The Schneider Electric brand and any trademarks of Schneider Electric SE and its subsidiaries referred to in this document are the property of Schneider Electric SE or its subsidiaries. All other brands may be trademarks of their respective owner.

This document and its content are protected under applicable copyright laws and provided for informative use only. No part of this document may be reproduced or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), for any purpose, without the prior written permission of Schneider Electric.

Schneider Electric does not grant any right or license for commercial use of the document or its content, except for a non-exclusive and personal license to consult it on an "as is" basis.

Schneider Electric reserves the right to make changes or updates with respect to or in the content of this document or the format thereof, at any time without notice.

To the extent permitted by applicable law, no responsibility or liability is assumed by Schneider Electric and its subsidiaries for any errors or omissions in the informational content of this document, as well as any non-intended use or misuse of the content thereof.

AccuSine™, Acti 9™, Altivar™, ASCO™, BlokSeT™, ComPacT™, EcoStruxure™, EnerLin'X™, ETAP™, EVlink™, EvoPacT™, Galaxy™, Harmony™, Iso-Gard™, Masterclad™, MasterPacT™, MicroLogic™, Modicon™, Okken™, PowerLink™, PowerLogic™, PowerPacT™, Power-Zone™, PremSeT™, PrismaSeT™, Schneider Electric™, SM AirSeT™, Square D™, SureSeT™, TeSys™, TransferPacT™, Trihal™, and Vigilohm™ are trademarks and the property of Schneider Electric SE, its subsidiaries, and affiliated companies. All other trademarks (Cyber Sciences™, Hirschmann™) are the property of their respective owners.

Table of Contents

Overview5

 Context of Application5

 Application Outcomes5

Electrical Architecture8

Digital Architecture.....9

System Description..... 10

 Data Flow 10

 Inputs 10

 Data Recording and Timestamping 12

 Time Synchronization 13

 Data Processing 13

 Outputs..... 13

Overview

Context of Application

Once the basic energy conservation measures have been identified, the next step in the energy management journey is to continuously optimize energy usage efficiency. Understanding the true energy efficiency is best achieved by normalizing energy usage within the context of production processes, building areas, shifts, working hours, or other contextual data to help identify areas to optimize through operational or behavioral changes.

Problem to Solve

The facility/energy manager needs to:

- Understand the energy intensity of the facility's operations.
- Implement changes to process or building controls, energy production/consumption, or operator behavior to continuously improve energy efficiency.

Purpose of the Application

Normalize energy data to give it context

- Relate energy efficiency data with relevant operational context.
- Establish baselines of energy intensity for buildings, processes, areas, shifts, or products.

Establish normalized baselines for comparison against best performing processes, operations, buildings, or shifts

- Compare performance of a production line, building, area, or shift to find areas to optimize.
- Implement changes to operations, procedures, or staff behaviors to continuously improve energy usage.

Application Outcomes

Events and Alarms

System events and alarms are displayed in chronological order with sorting and filtering capabilities.

Trends

Real-time and historical data can be viewed on a trend viewer.

Dashboards


- Key Performance Indicators (KPI): energy per unit of production, energy per shift, energy per process order, energy per production state
- Energy Intensity



KPI Dashboard

Reports

- Duration Curve Report
- Energy Usage per State Report
- Power Usage per State Report
- Power Usages Summary Report
- KPI Engine Report
- Energy Usage by Shift Report¹
- Single Equipment Operation Report
- Multi-equipment Operation Report



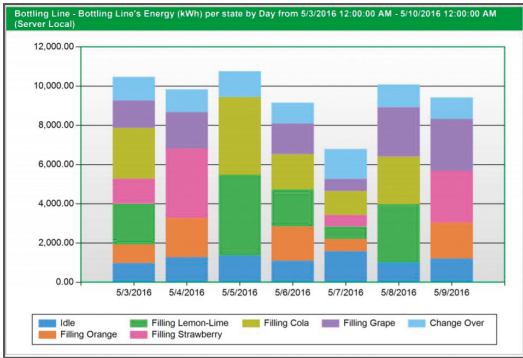
KPI Engine Report

1/08/2016 12:00:00 AM - 1/09/2016 12:00:00 AM (Server Local)

Daily Calculation Table

Timestamp	East Wing Real Energy (M)	Site A Real Energy into the Load (C)	University Theatre Real Energy (A)	University Energy/KPI Hour method/Usage Daily (IA +B+C+D+E+F+G)
1/08/2016	5.27	0.50	5.77	90.33
2/08/2016	4.26	0.49	4.80	74.68
3/08/2016	17.27	0.50	5.75	187.60
4/08/2016	13.67	0.50	6.05	160.57
5/08/2016	14.38	0.51	4.90	155.03
6/08/2016	9.82	0.52	3.00	100.09
7/08/2016	4.42	0.53	3.01	57.22
8/08/2016	6.10	0.51	5.59	93.21
9/08/2016	5.13	0.51	5.08	81.85
10/08/2016	7.92	0.50	5.85	111.42
11/08/2016	7.11	0.51	4.85	95.66
12/08/2016	8.94	0.51	4.83	109.95
13/08/2016	2.69	0.52	3.02	44.32
14/08/2016	2.74	0.53	3.03	44.22
15/08/2016	7.94	0.51	4.97	102.71
16/08/2016	6.37	0.51	4.68	87.89
17/08/2016	8.95	0.51	4.56	108.18

KPI Engine Report



Energy Usage Report

1. Uses static, pre-configured shift information.

Cloud-Based Analytics and Services

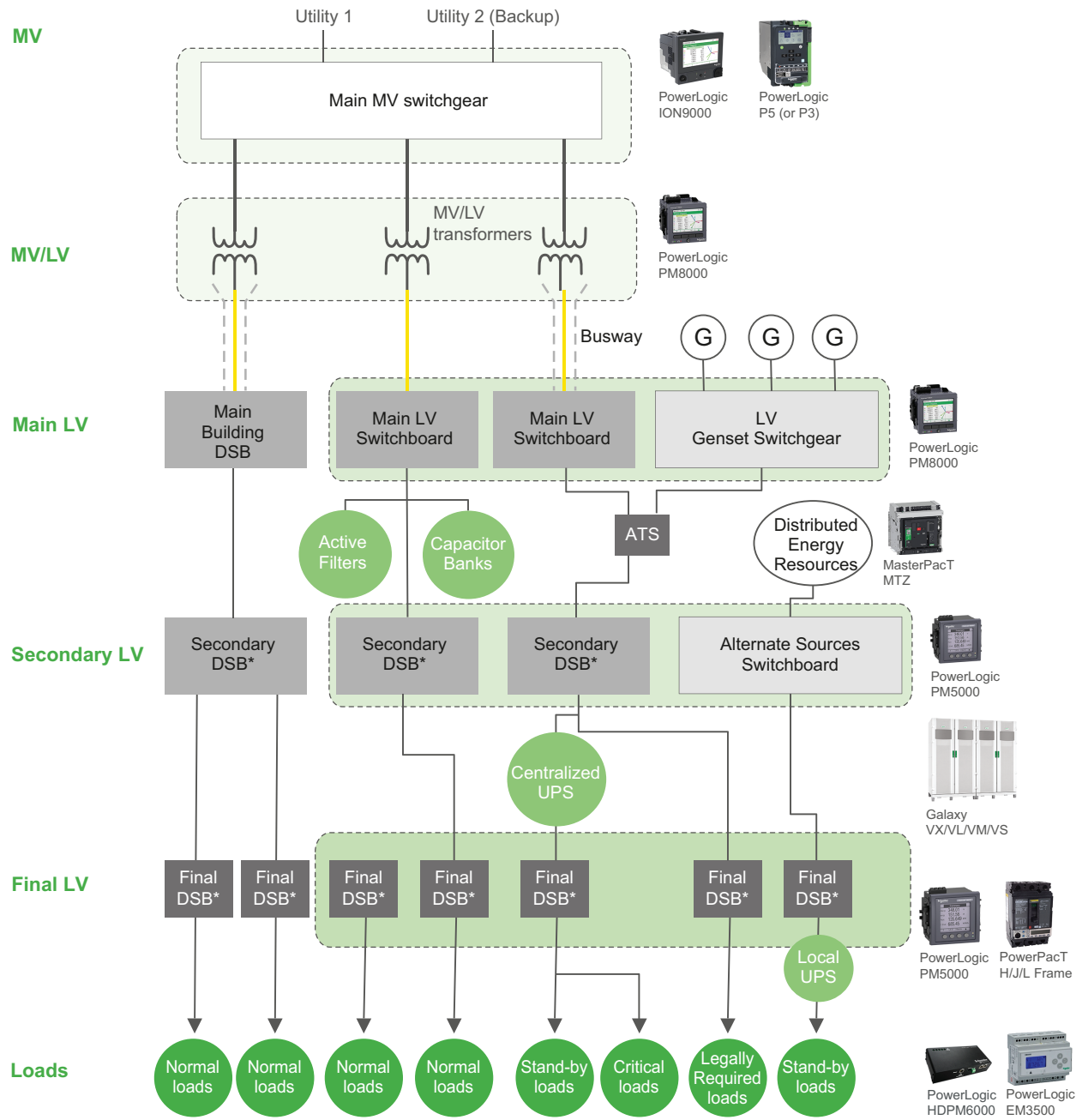
As an option, EcoStruxure Service Plan powered by EcoStruxure Power Advisor provides data quality analytics with recommendations from our Schneider Electric service experts.



EcoStruxure Power Advisor Data Quality Report

Electrical Architecture

The following diagram details the areas of the architecture where the connected products should be installed in order to implement the Energy Performance application:



Digital Architecture

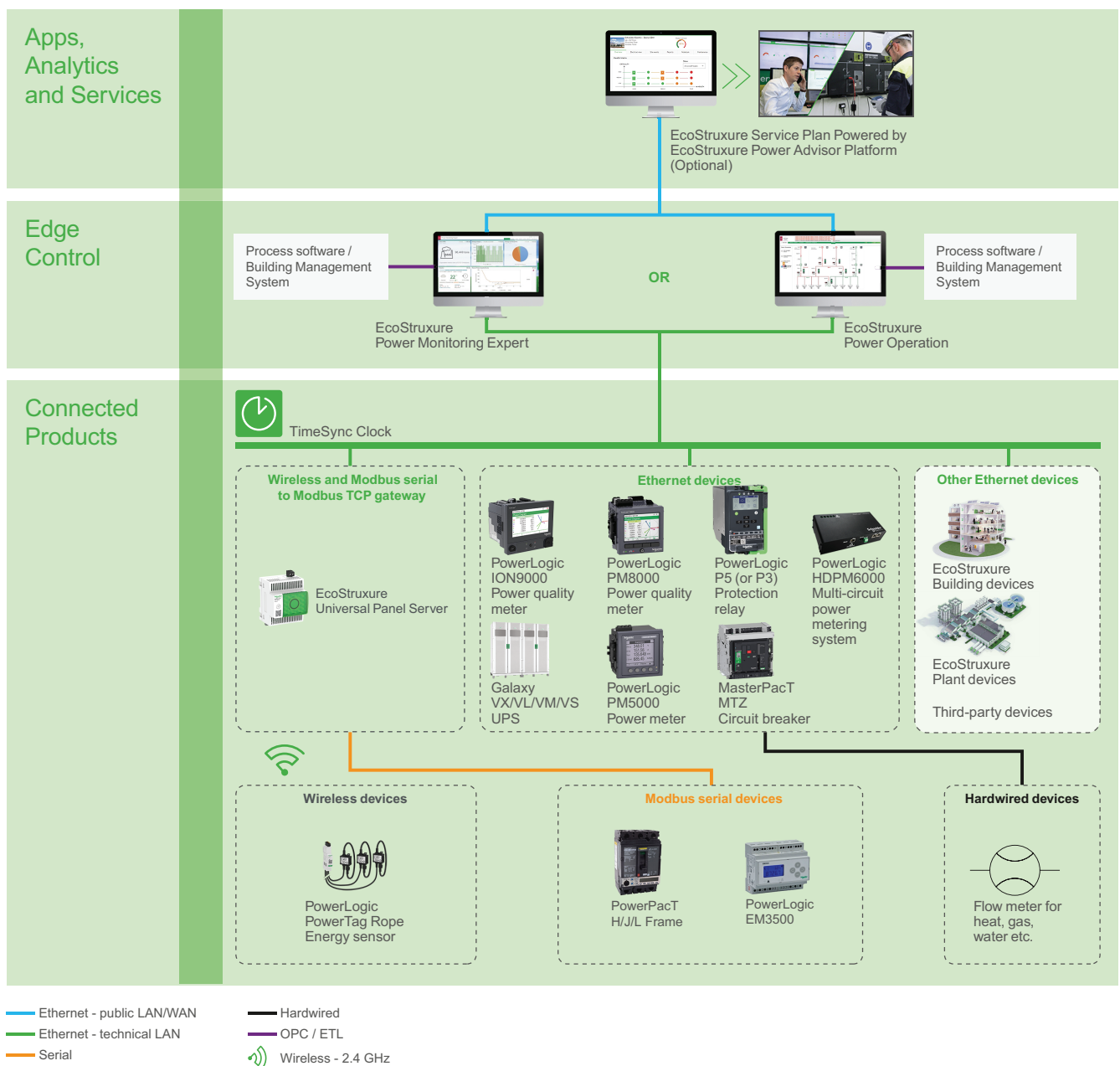
In this architecture, the data is collected from connected products either directly over Ethernet or via gateways (such as the EcoStruxure Panel Server). This data is then recorded and processed by the Edge Control software (EcoStruxure Power Monitoring Expert or Power Operation) for on-premise visualization, analysis, and reporting.

Other utility consumption inputs (WAGES) and equipment states can also be directly acquired via Ethernet, via serial communication, or through hardwired signals from basic meters and sensors.

To include other process or equipment related data in the analyses, OPC or ETL can be used to acquire data from external process or building management software.

As an option, data from EcoStruxure Power Monitoring Expert or Power Operation can be passed on to the EcoStruxure Power Advisor platform and analyzed by experts as part of the EcoStruxure Service Plan.

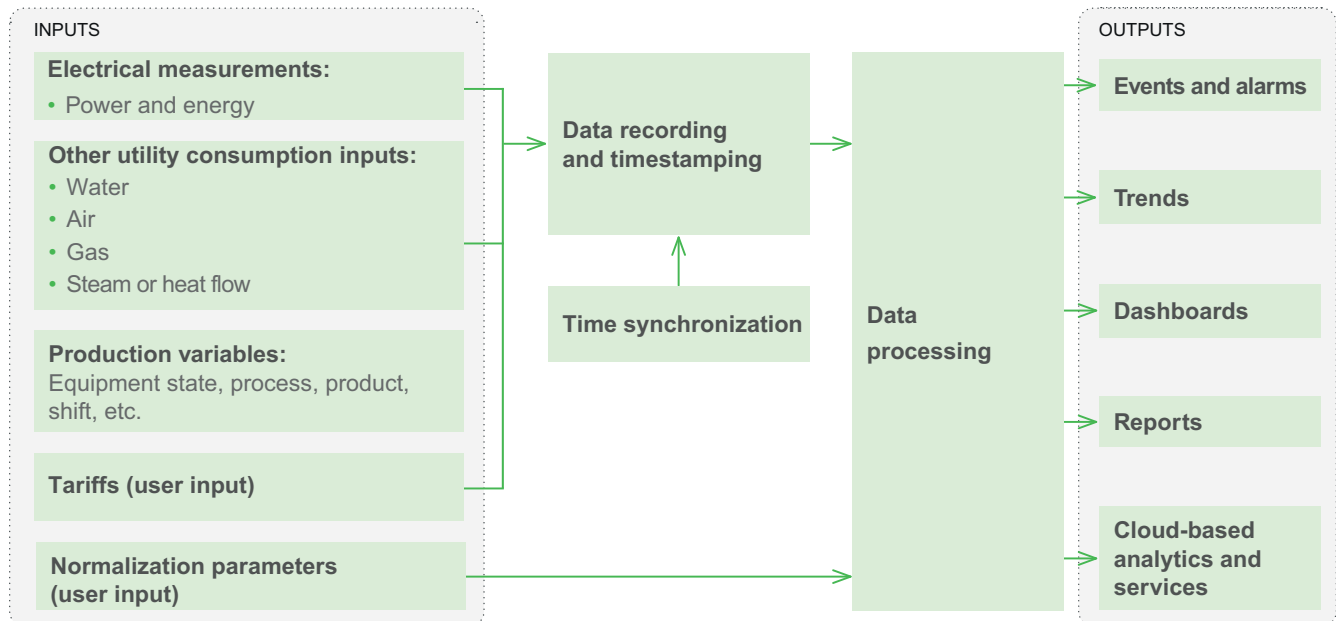
The recommended digital architecture for the application is shown below:



System Description

Data Flow

The Energy Performance application can be broken down as follows:



Inputs

The following data are required to implement the Energy Performance application.

Electrical Measurements

The following electrical measurements are collected at each point of interest in the electrical distribution, from Medium Voltage, to Low Voltage, down to Final Distribution.

- Power values (kW, kVAR, kVA)
- Energy values (kWh, kVARh, kVAh)

These data may be acquired from:

- **Power/energy meters** such as PowerLogic ION9000, PM8000, PM5000, HDPM6000, PowerLogic Tag Rope



PowerLogic
ION9000



PowerLogic
PM8000



PowerLogic
PM5000



PowerLogic
HDPM6000



PowerLogic
Tag Rope

- **Devices with embedded metering** such as PowerLogic P5/P3, MasterPacT MTZ, and PowerPacT H/J/L protection devices, or Galaxy VX/VL/VM/VS UPS

PowerLogic
P5PowerLogic
P3MasterPacT
MTZPowerPacT
H/J/LGalaxy
VX/VL/VM/VS

- **Third-party devices (via Modbus)**

Other Utility Consumption Inputs

The following utilities can be monitored:

- Water
- Air
- Gas
- Steam or heat flow

They can be acquired via digital/analog inputs on meters or directly via Modbus from third-party devices.

Production Variables

To correlate energy consumption with the different production variables such as equipment states, processes, production lines, products produced, shifts, etc., these production variables must be monitored, recorded, and used to normalize the respective energy consumption.

Examples:

- Process batch A/B/C/
- Product X/Y/Z produced on which machine during which shift
- Equipment in normal/maintenance mode
- Motor low/medium/high speed

These can be imported in EcoStruxure Power Monitoring Expert or Power Operation from customer production systems through OPC² or ETL³

EcoStruxure
Power Monitoring ExpertEcoStruxure
Power Operation

Alternatively, these can be acquired via digital/analog inputs on meters or directly via Modbus from third-party devices.

2. OPC: Open Platform Communications

3. The EcoStruxure Extract Transform Load (ETL) engine is a companion application for EcoStruxure Power Monitoring Expert or Power Operation. It is used to extract historical data from one application (Schneider Electric or third-party), then transform that data so it can be loaded into another application.

Tariffs (User Input)

To convert energy consumption into cost, it is necessary to apply relevant tariffs to power/energy consumption values.

Normalization Parameters (User Input)

For certain KPIs to be relevant, it is necessary to normalize their respective data.

Data Recording and Timestamping

For the Energy Performance application, a timestamp accuracy of ± 1 second is sufficient.

Advanced power meters such as the PowerLogic ION9000, PM8000, HDPM6000, and some PowerLogic PM5000 models (PM53xx and PM55xx) can timestamp and record onboard energy measurements as well as connected equipment states. EcoStruxure Power Monitoring Expert or Power Operation can then retrieve the records with their original timestamp.



PowerLogic
ION9000



PowerLogic
PM8000



PowerLogic
HDPM6000



PowerLogic
PM5000

For other devices (PowerLogic P5/P3, MasterPacT MTZ, Galaxy VX/VL/VM/VS, entry-level PowerLogic PM5000 models, PowerLogic Tag Rope, etc.) energy measurements and equipment states are acquired by the connected products and then recorded and timestamped by EcoStruxure Power Monitoring Expert or Power Operation.



PowerLogic
P5



PowerLogic
P3



MasterPacT
MTZ



Galaxy
VX/VL/VM/VS



PowerLogic
PM5000



PowerLogic
Tag Rope



EcoStruxure
Power Monitoring Expert



EcoStruxure
Power Operation

When acquiring data from other customer systems, timestamps can also be imported through OPC⁴ or ETL⁵.

For a comprehensive overview of device recording and timestamping capabilities, refer to [Data Recording and Time Synchronization Capabilities of EcoStruxure Power Connected Products](#).

Time Synchronization

For consistent timestamping of all the data, the date and time should be accurately distributed to connected products and data loggers.

Time synchronization can be performed through various technologies (PTP, NTP, SNTP, etc.). An external master clock may be required and can be connected to a GPS antenna to reach the expected time precision.



TimeSync Clock

Data Processing

Specialized dashboards and dedicated reporting engine analyze data to:

- Provide highlights on energy consumption according to the most relevant criteria.(per load type, per process line, per area, etc.)
- Assess energy usage by process area or by product output
- Highlight what factors (process state, external conditions, etc.) contribute most to energy usage

Energy data processing is embedded in EcoStruxure Power Monitoring Expert or Power Operation.



EcoStruxure
Power Monitoring Expert



EcoStruxure
Power Operation

Outputs

Display of outputs is performed by EcoStruxure Power Monitoring Expert or Power Operation except in specified cases.

The following outputs, when used as part of an energy management program, can help normalize energy data with respect to business operations (number of items produced, etc.) that drive energy usage.

4. OPC = Open Platform Communications

5. ETL = The EcoStruxure Extract Transform Load (ETL) engine is a companion application for EcoStruxure Power Monitoring Expert and Power Operation. It is used to extract historical data from one application (Schneider Electric or third-party), then transform that data so it can be loaded into another application.



EcoStruxure
Power Monitoring Expert



EcoStruxure
Power Operation

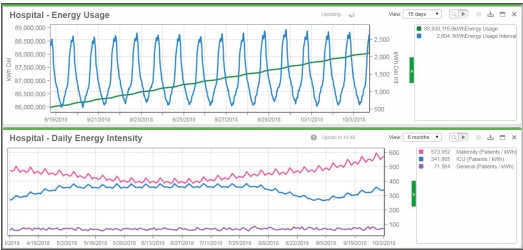
Events and Alarms

In EcoStruxure Power Monitoring Expert smart setpoints offer threshold-based alarming on energy usage.

Trends

Energy Usage Trending

All input data detailed above can be displayed as trends.



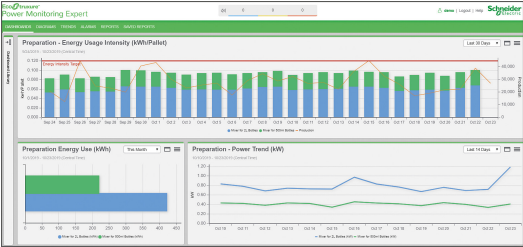
Energy Usage Trending

Dashboards

All dashboards can be configured to run automatically in slide show mode to perform the function of an Energy Kiosk.

Key Performance Indicator Dashboards⁶

Dashboards to visualize, analyze, and communicate information about an organization's energy performance KPIs for continuous energy improvement



KPI Dashboard

6. KPI dashboards require contextual data and configuration of the KPI Report available with the Energy Analysis module in EcoStruxure Power Monitoring Expert or Power Operation.

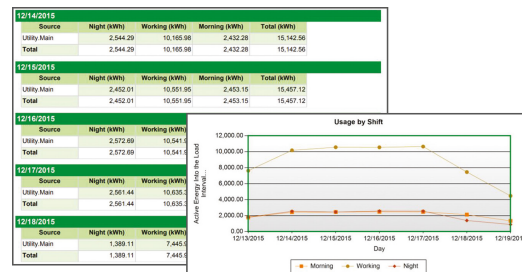
Reports

The following reports can be displayed or automatically sent by email:

Energy Management Reports:

- **Energy Usage by Shift**

Compares a measurement from multiple devices for specified time periods (or shifts). This means energy usage can be compared between shifts (for example, 6:00 to 1:00 vs. 1:00 to 8:00).

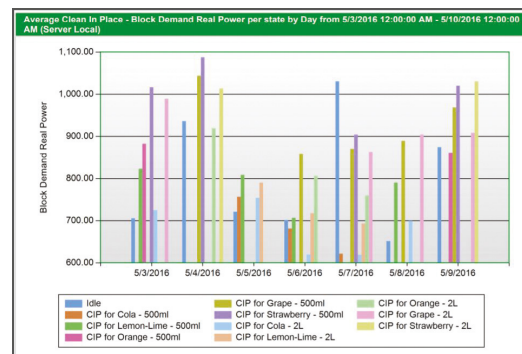


Energy Usage by Shift

Energy Analysis Reports:⁷

- **Power Usage per State Report**

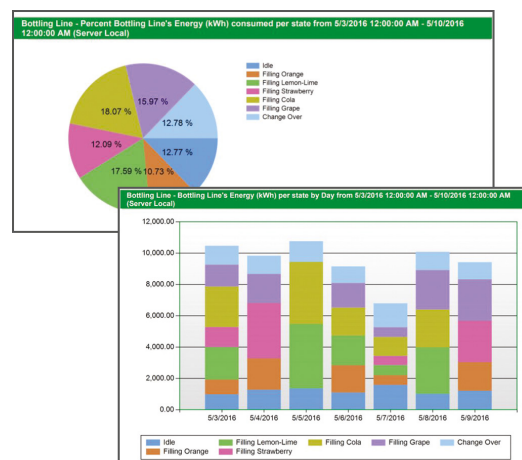
Details power usage per state of operation of a machine or process.



Power Usage per State Report

- **Energy Consumption per State Report**

Details energy consumption per state of operation of a machine or process.

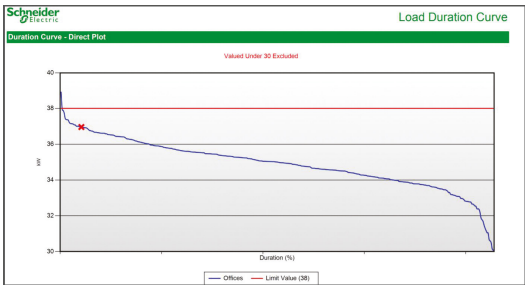


Energy Consumption per State Report

7. The Energy Analysis Reports module of EcoStruxure Power Monitoring Expert must be deployed to benefit from these features.

- Duration Curve Report**

Shows distribution of power consumption versus duration to detect potential capacity or utilization issues.



Duration Curve Report

- KPI Engine Report**

Calculates complex energy KPIs.

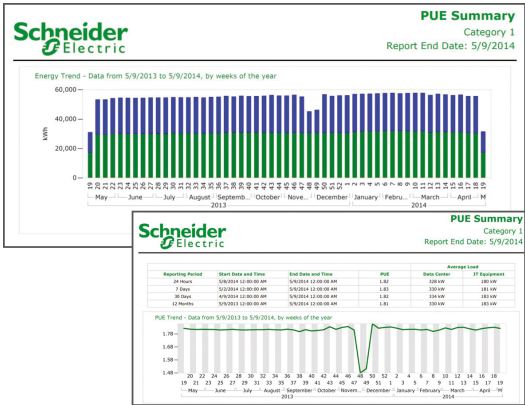
Timestamp	East Wing Real Energy (kWh)	Site A Real Energy into the Load (kWh)	University Theatre Real Energy (kWh)	University Energy/KPI (kWh/1000kVA)
1/08/2016	5.57	0.50	5.57	90.53
2/08/2016	4.26	0.48	4.80	74.68
3/08/2016	17.27	0.50	5.75	187.60
4/08/2016	13.67	0.50	6.05	160.57
5/08/2016	14.38	0.51	4.90	155.03
6/08/2016	9.82	0.52	3.00	100.08
7/08/2016	4.42	0.53	3.01	57.22
8/08/2016	6.10	0.51	5.59	93.21
9/08/2016	5.13	0.51	5.08	81.85
10/08/2016	7.65	0.50	5.85	111.42
11/08/2016	7.11	0.51	4.85	95.66
12/08/2016	8.94	0.51	4.83	109.95
13/08/2016	2.69	0.52	3.02	44.32
14/08/2016	2.74	0.53	3.03	44.22
15/08/2016	7.64	0.51	4.97	102.71
16/08/2016	6.37	0.51	4.68	87.89
17/08/2016	8.95	0.51	4.56	108.18

KPI Engine Report

- Power Usage Effectiveness (PUE) Report (for data centers)**

Displays and analyzes Power Usage Effectiveness by day, week, month and year.

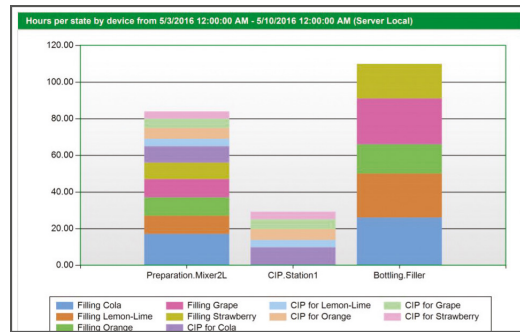
Compares the IT loads and support loads.



PUE Report (Data Center)

- Multi-equipment Operation Report**

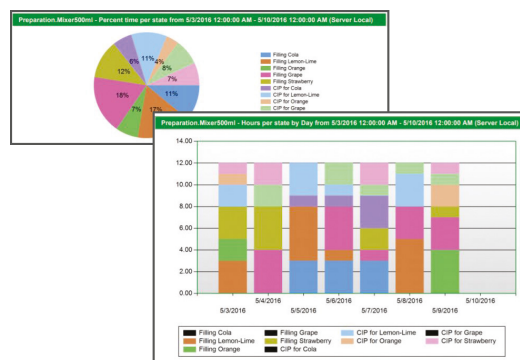
Compares duration per state, per machine or process.



Multi-equipment Operation Report

- Single Equipment Operation Report**

Compares duration per state for a single machine or process.



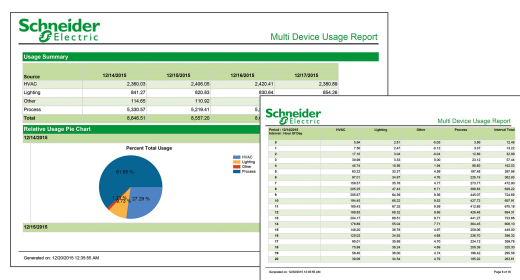
Single Equipment Operation Report

Usage Trending Reports:

- Multi Device Usage Report**

Displays consumption information for multiple devices.

View energy usage for a single period, or compare two periods, for example, this month versus last month.

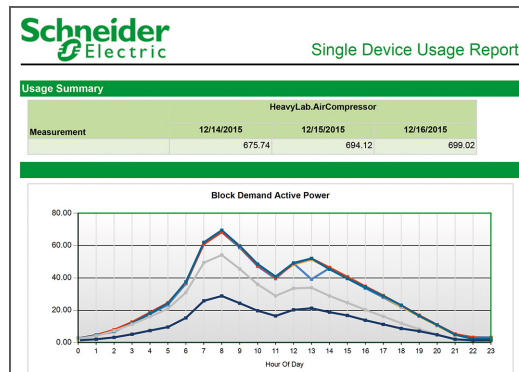


Multi Device Usage Report

- **Single Device Usage Report**

Displays energy information for one device.

View energy usage for a single period, or compare two periods, for example, this month versus last month.



Single Device Usage Report

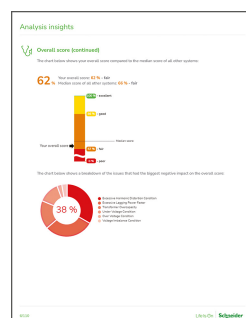
Cloud-Based Analytics and Services

As an option, EcoStruxure Service Plan powered by EcoStruxure Power Advisor provides data quality analytics with recommendations from our Schneider Electric service experts.

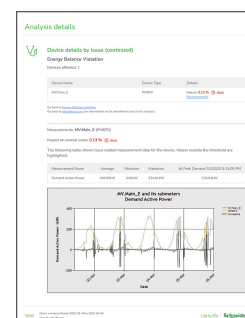
For further information, refer to Data Quality Management.



EcoStruxure Service Plan Powered by EcoStruxure Power Advisor Platform



EcoStruxure Power Advisor Data Quality Report - Overall Score



EcoStruxure Power Advisor Data Quality Report - Device Details by Issue

Schneider Electric
35 rue Joseph Monier
92500 Rueil Malmaison
France

+ 33 (0) 1 41 29 70 00

www.se.com

As standards, specifications, and design change from time to time,
please ask for confirmation of the information given in this publication.

© 2023 Schneider Electric. All rights reserved.

0100DB2323