Energy Monitoring (NEMA)

Identify Quick-Win Opportunities for Energy Savings

EcoStruxure Power Digital Application

EcoStruxure™ Power

Schneider Electric

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Table of Contents

Overview

Context of Application

There are numerous opportunities for saving energy in a building or critical facility. However, not all lead to profitable return on investment. In order to choose quick-win conservation measures, energy in the facility must be monitored to understand where and how it is consumed, and to understand which factors contribute the most to energy consumption and cost.

Problem to Solve

The facility/energy manager needs to:

- Raise awareness of where, when, and how energy is used.
- Find and prioritize opportunities for energy conservation.

Purpose of the Application

Become aware of energy usage

- By turning data into information and representing energy usage and consumption within easy-to-interpret graphical dashboards and reports to raise awareness of key stakeholders.

Identify quick-win opportunities for energy savings

- By comparing and visualizing hourly, daily, weekly, monthly, and yearly energy usage, and associated costs for different utilities.
- By identifying and prioritizing which load types, equipment, processes, areas, or buildings lend themselves to a better return on investment for energy conservation initiatives.

Application Outcomes

Live Data Display

Real-time energy data displayed in configurable diagrams or real-time data tables

Events and Alarms

Configure and visualize energy overconsumption events to display in a historical event log.

Trends

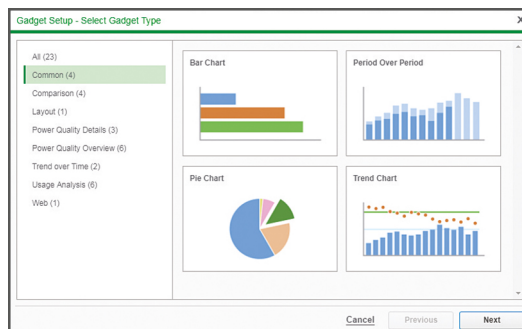Monitor consumption (WAGES)[1] for the whole facility, specific areas, or loads in real-time charts.
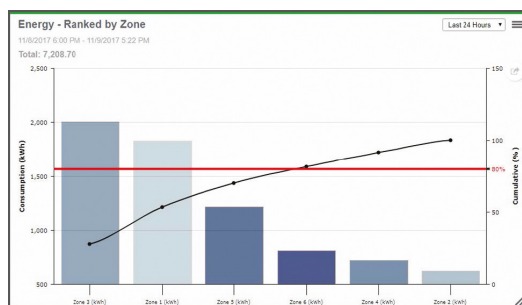
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1. Water, Air, Gas, Electricity, Steam

Dashboards

- Historical trends
- Energy consumption ranking
- Energy heat map
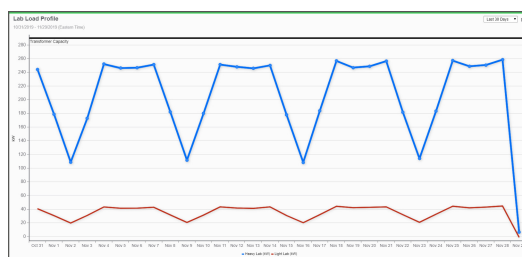- Pareto charts
- Sankey diagram

   NOTE: Any of the dashboards shown can be included as part of a slideshow ("Energy Kiosk").

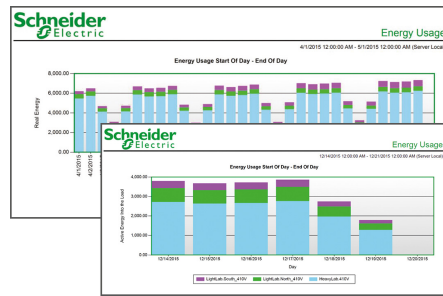Configurable Dashboard Gadget Library for Analyzing Energy Usage

Pareto Chart

Simple Load Profile Chart

Reports

- Calendar Trend Report
- Energy Cost Report
- Energy Comparison Report
- Consumption Ranking Report
- Hourly Usage Report
- Load Profile Report
- Energy Usage Report
- Energy Period Overperiod Report

Energy Usage Report

Notifications

SMS or email notifications are sent on pre-alarm and alarm conditions described above to enable fast action.

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 Monitoring application:
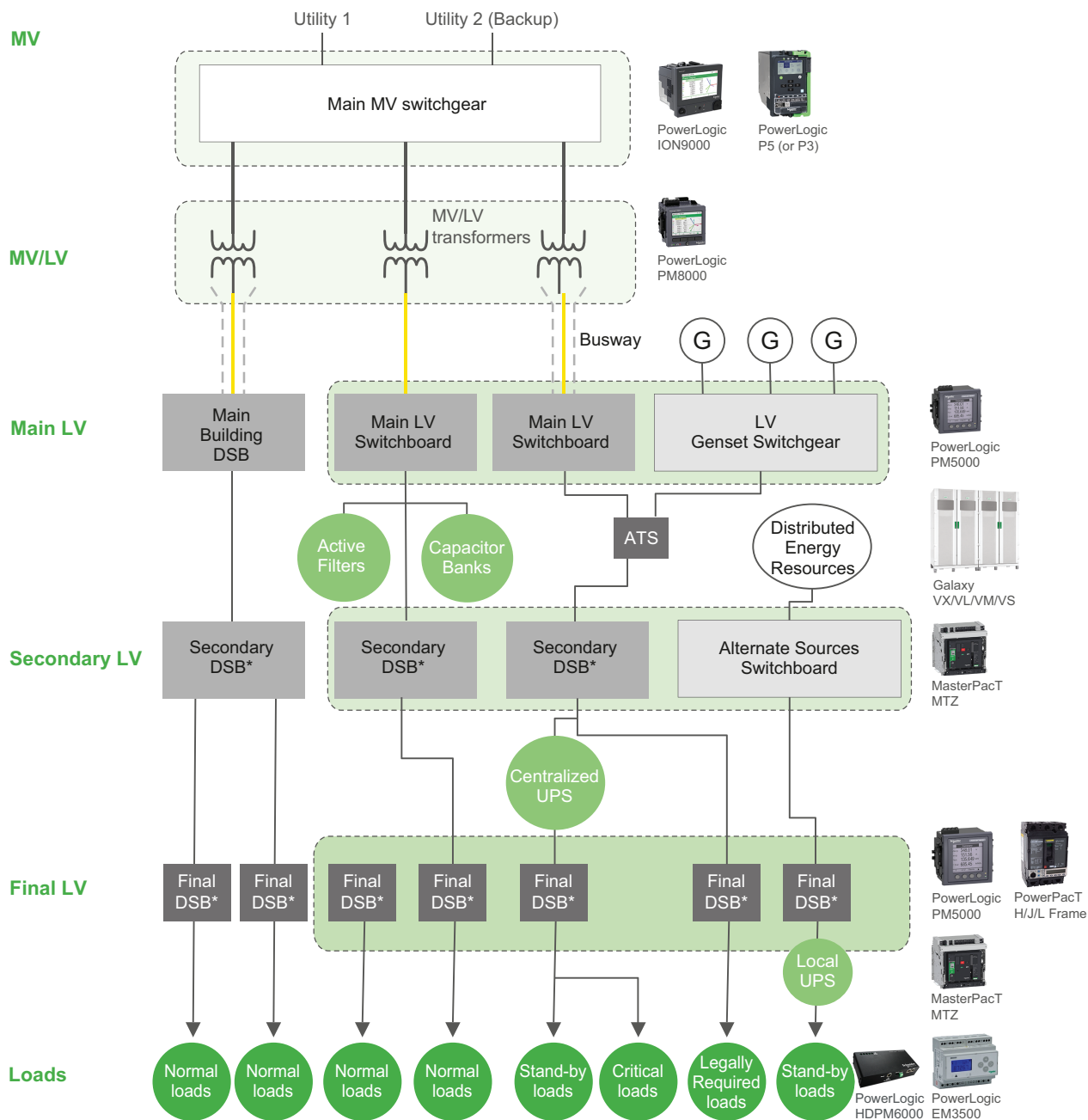
*   DSB = Distribution Switchboard
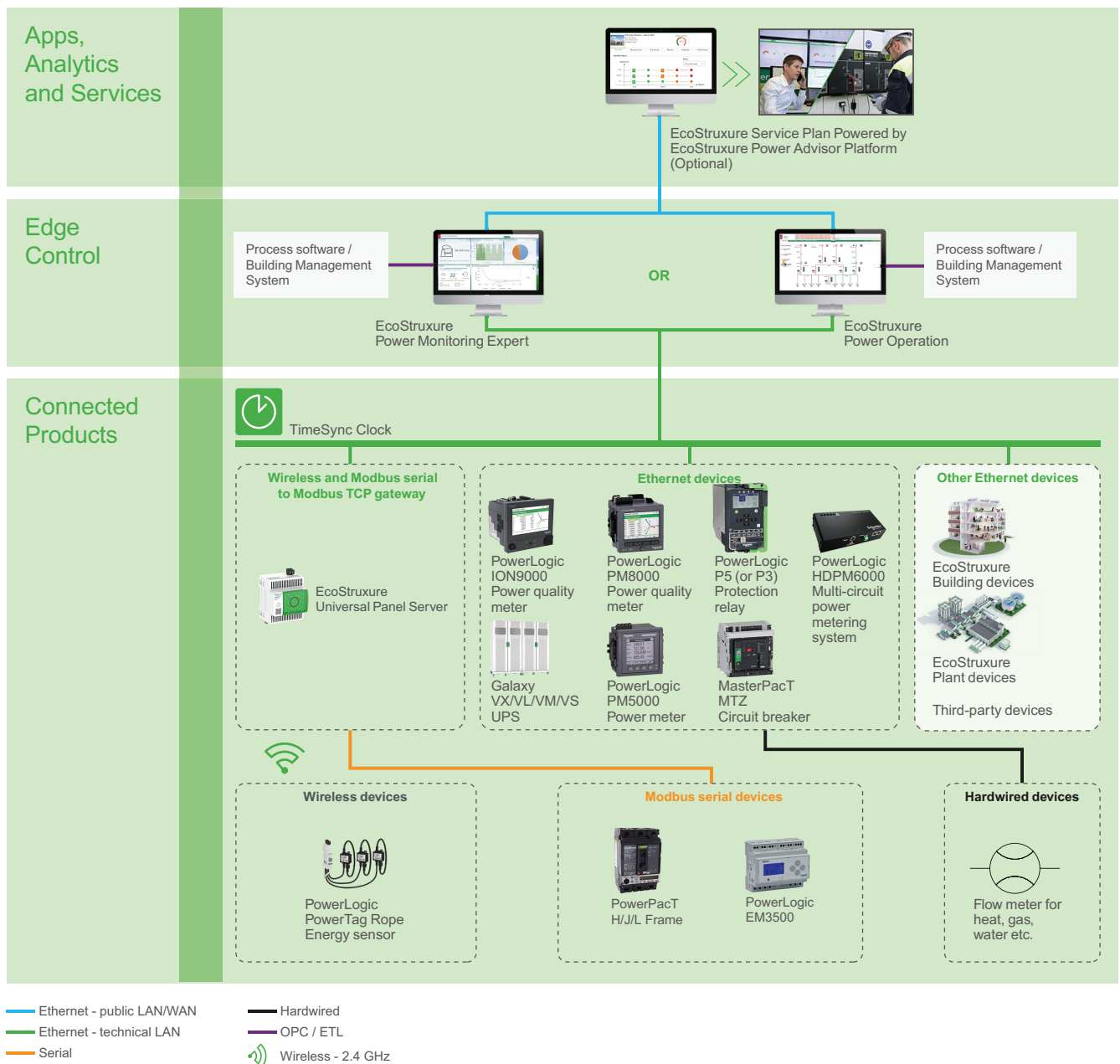
Digital Architecture

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.
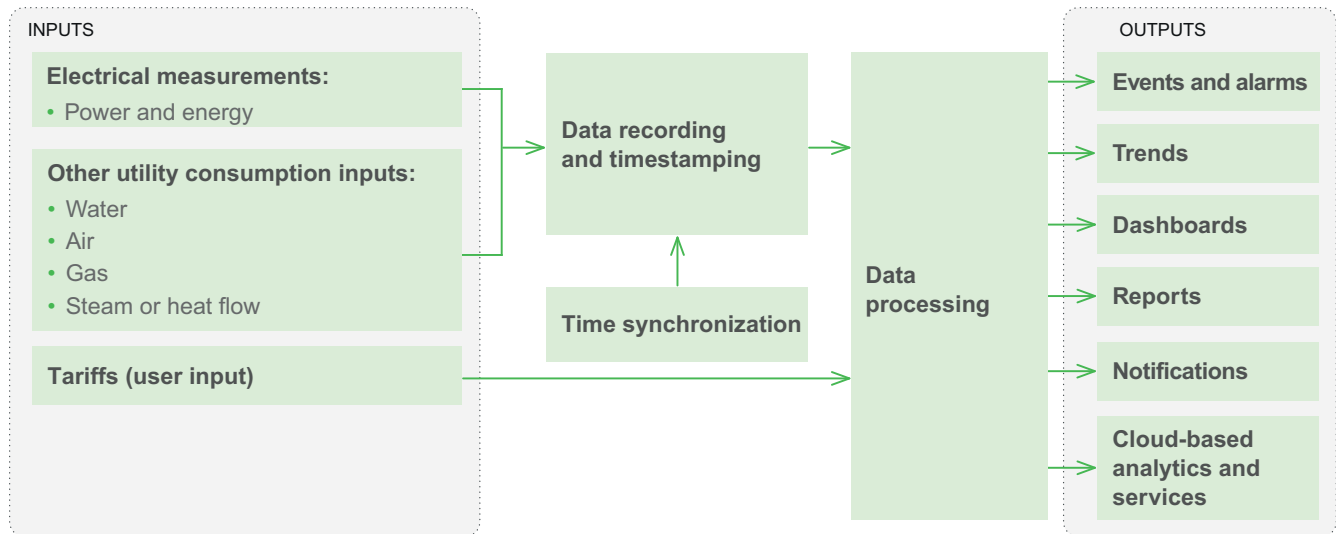
The recommended digital architecture for the application is shown below:

Apps, Analytics and Services

EcoStruxure Service Plan Powered by EcoStruxure Power Advisor Platform (Optional)

Edge Control

Process software / Building Management System

EcoStruxure Power Monitoring Expert

OR

EcoStruxure Power Operation

Process software / Building Management System

Connected Products

TimeSync Clock

Wireless and Modbus serial to Modbus TCP gateway

EcoStruxure Universal Panel Server

Ethernet devices

PowerLogic ION9000 Power quality meter

PowerLogic PM8000 Power quality meter

PowerLogic P5 (or P3) Protection relay

PowerLogic HDPM6000 Multi-circuit power metering system

Galaxy VX/VL/VM/VS UPS

PowerLogic PM5000 Power meter

MasterPacT MTZ Circuit breaker

Other Ethernet devices

EcoStruxure Building devices

EcoStruxure Plant devices

Third-party devices

Wireless devices

PowerLogic PowerTag Rope Energy sensor

Modbus serial devices

PowerPacT H/J/L Frame

PowerLogic EM3500

Hardwired devices

Flow meter for heat, gas, water etc.

Ethernet - public LAN/WAN
Ethernet - technical LAN
Serial
Hardwired
OPC / ETL
Wireless - 2.4 GHz

System Description

Data Flow

The Energy Monitoring application can be broken down as follows:

INPUTS

Electrical measurements:
• Power and energy

Other utility consumption inputs:
• Water
• Air
• Gas
• Steam or heat flow

Tariffs (user input)

Data recording and timestamping

Time synchronization

Data processing

OUTPUTS

Events and alarms

Trends

Dashboards

Reports

Notifications

Cloud-based analytics and services

Inputs

The following data are required to implement the Energy Monitoring 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, EM3500, Tag Rope

PowerLogic
ION9000

PowerLogic
PM8000

PowerLogic
PM5000

PowerLogic
HDPM6000

PowerLogic
EM3500

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 P5 | PowerLogic P3 | MasterPacT MTZ | PowerPacT H/J/L | Galaxy 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.

Tarrifs (User Input)

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

Data Recording and Timestamping

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

Advanced power meters such as the PowerLogic ION9000, PM8000, 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 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 OPC[2] or ETL[3].

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 a dedicated reporting engine analyze data to:

*   Provide highlights on energy consumption according to the most relevant criteria (time of day, day of week, month, etc.).
*   Visualize consumption data in an easy to interpret format (heat map, calendar trend report, consumption ranking report, etc.).

Energy data processing is embedded in the reporting engine and in the dashboards.EcoStruxure Power Monitoring Expert or Power Operation.

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2.   OPC = Open Platform Communications
3.   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

Outputs

Outputs are displayed remotely via EcoStruxure Power Monitoring Expert or Power Operation except in specific cases.

The following outputs, when used as part of an energy management plan, can help meet relevant requirements for energy efficiency compliance standards such as ISO 50001, ISO 50002 and ISO 50006.

EcoStruxure
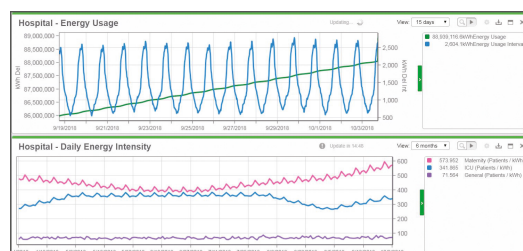Power Monitoring Expert

EcoStruxure
Power Operation

See the Energy Efficiency Compliance application for detailed information.

Events and Alarms

In EcoStruxure Power Monitoring Expert, smart setpoints provide threshold-based alarming of historical 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.

Generic data display dashboards can be used:

- To analyze energy consumption parameters by day of the week, hour of the day, season, etc

- To compare different energy consumption parameters between buildings, areas or departments, and load types

- To detect increasing energy consumption caused by deteriorating equipment

Dashboard

Energy usage gadgets [4]

The following gadgets make it easier to display and interpret energy consumption data:

- Heat map gadget

  Creates a graphical representation of data where the individual values are represented as colors in a matrix format. This gadget can be used with consumption data to identify usage patterns and anomalies.
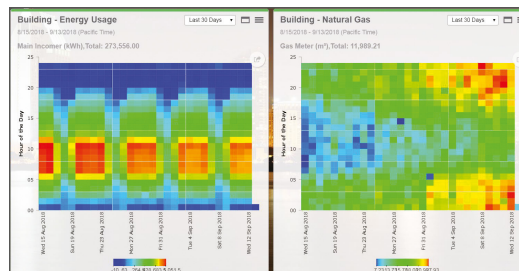
Heat Map Gadget

- Consumption / aggregated consumption ranking gadget

  Compares the consumption of loads during specific time intervals, for example by hour, by day of week, or by day.
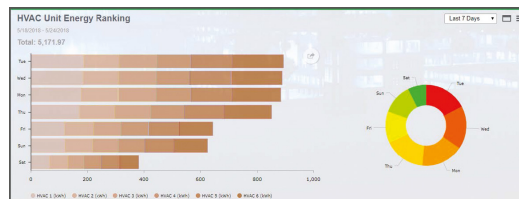
Consumption/Aggregated Consumption Ranking Gadget

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4.   The Energy Analysis Dashboards Module of EcoStruxure Power Monitoring Expert must be deployed to benefit from these features.

- Sankey gadget
  - Shows a flow diagram in which the width of the arrows is proportional to the data values. The diagram starts as a combined flow for all the selected loads and then breaks out into individual flows for each consumer.
  - Used to show WAGES consumption broken down by load type or to visualize consumption costs by load. It can also be used to show power losses.
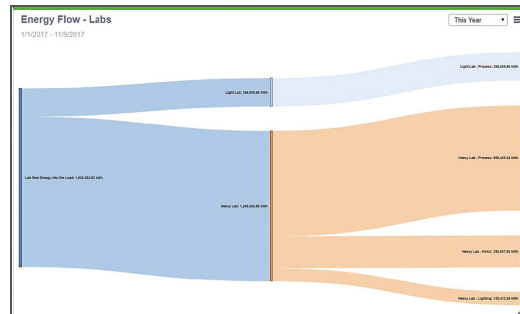
Sankey Gadget

- Pareto / aggregated pareto chart gadget
  - Used to perform an 80/20 analysis, identifying the loads that together make up the largest portion, or 80% of the overall consumption
  - Shows consumption data by load for multiple loads, over a selected time period. The information is shown in a combined column and line chart, grouped by aggregation period. The columns are arranged from highest consumption to lowest consumption with a target threshold.
  - Includes a cumulative curve based on the aggregation period consumption values.

Pareto / Aggregated Pareto Chart Gadget

Reports

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

Energy Management Reports:

- Energy Usage Report

  Highlights discrepancies and provides a visual interpretation of energy consumption data.
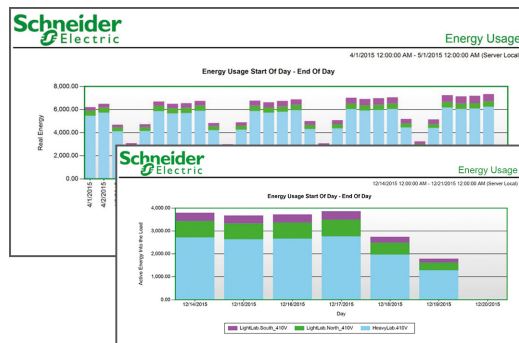
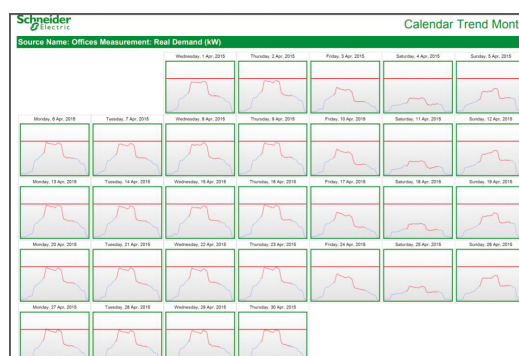Energy Usage Report

- Energy Usage by Time of Use Report

  Compares consumption for different time of use periods (on-peak vs off-peak vs partial-peak).
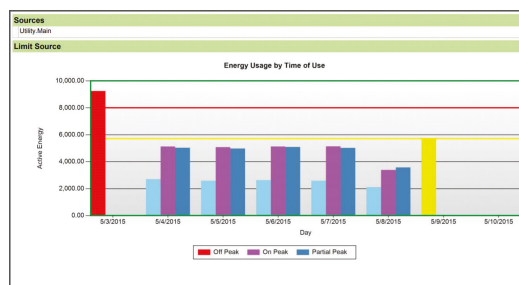
Energy Usage by Time of Use Report

- Calendar Trend Report

  Provides a monthly or weekly interpretation of hourly usage data, benchmarks performance targets, and identifies peak and off-peak usage patterns

Calendar Trend Report

- Load Profile Report

    Creates a graphical representation of demand or load levels over a period of time. The profile shows peak loads as points on the graph where peak electricity demand is high. A load trend report can be used to analyze the electrical loads at the time of maximum demand.
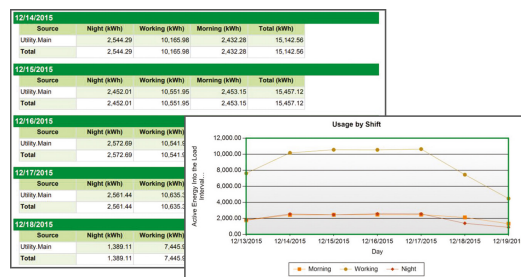
    This information can show opportunities for developing strategies to improve energy management.
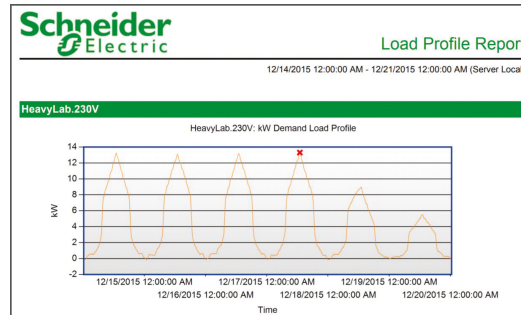

Load Profile Report

- Energy Usage by Shift Report

    Compares a measurement from multiple devices for specified time periods (or shifts). This enables energy consumption comparison between shifts (for example, 6:00-1:00 vs. 1:00 to 8:00).

Energy Usage by Shift Report

- Consumption Ranking Report

    Highlights the relative ranking of energy consumption for several loads or areas. Consumption data can be normalized to facilitate the comparison. This report is intended to assist in building energy awareness through relative visualization.
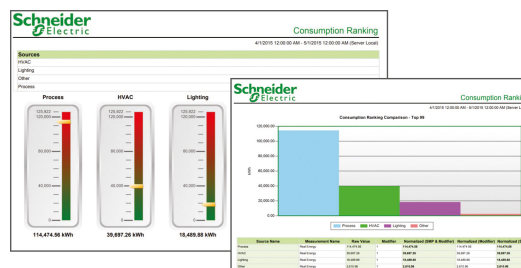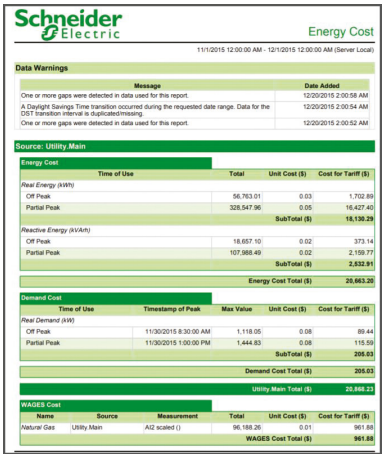

Consumption Ranking Report

- Energy Comparison Report

  Compares energy consumption by process, equipment, or area.
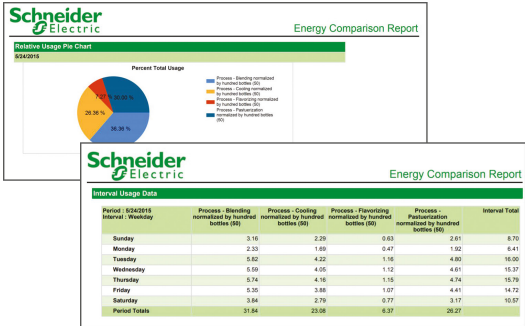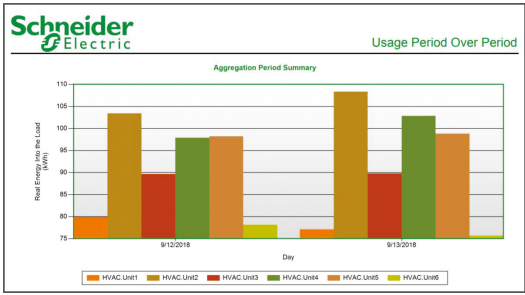

Energy Comparison Report

- Energy Cost Report

  Converts energy consumption into cost by applying the relevant tariffs.

Energy Cost Report

- Energy Period Over Period Report

  Shows consumption data for the same measurement for two different viewing periods side-by-side.

Energy Period Over Period Report

Notifications[5]

SMS or email notifications are sent on pre-alarm and alarm conditions described above to enable fast action.

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5.   For notifications in EcoStruxure Power Monitoring Expert and Power Operation, the Event Notification Module is required.
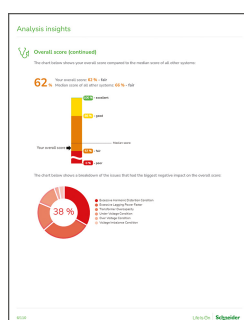
Cloud-Based Analytics and Services

As an option, EcoStruxure Service Plan powered by EcoStruxure Power Advisor provides data quality analytics with recommendations from our Schneider Electric service experts.
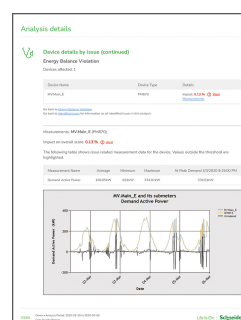
For further information, refer to Data Quality Management.

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

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

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