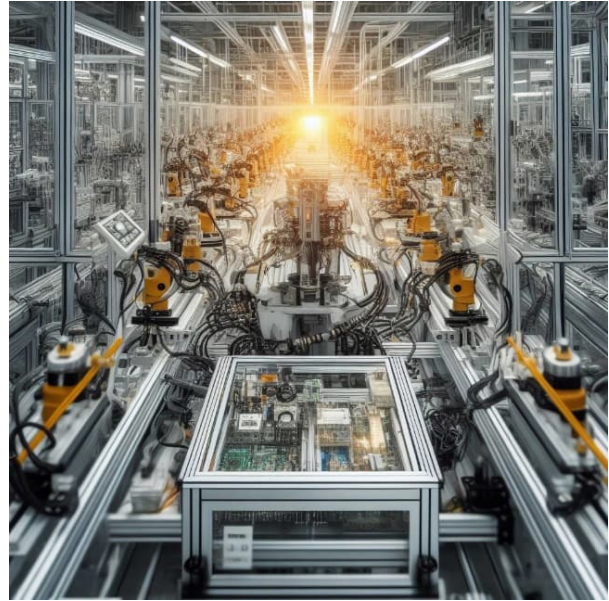


Application Description: Energy Monitoring in an Automated Electronics Manufacturing Plant



Abstract of the application

In a highly automated production environment for electronic components, precise energy monitoring is essential. The customer's facility comprises several production lines with advanced technologies, including automated assembly lines, electric and pneumatic actuators and specialized parts feeding equipment. The integration of photovoltaic systems, a charging park for electric cars and its own combined heat and power plant adds to the complexity of energy monitoring at this site. It is not only necessary to monitor electrical energy, but also other forms such as heat energy and compressed air consumption. The aim of this project is to comply with the ISO 50001 standard and to optimize energy consumption and costs. The EMS - On-Premises energy monitoring software is stored locally on an EPC.

Description of customer conditions

The plant extends over a large production hall with highly automated production lines and a separate administration building. In addition, there are photovoltaic systems installed on the roof of all buildings and a charging park for employee and company vehicles directly in front of the entrance. In view of the growing demand for the components produced, the company is planning to expand its production space. With this in mind, the plant has been equipped with its own combined heat and power plant right from the start in order to meet the increasing energy requirements.

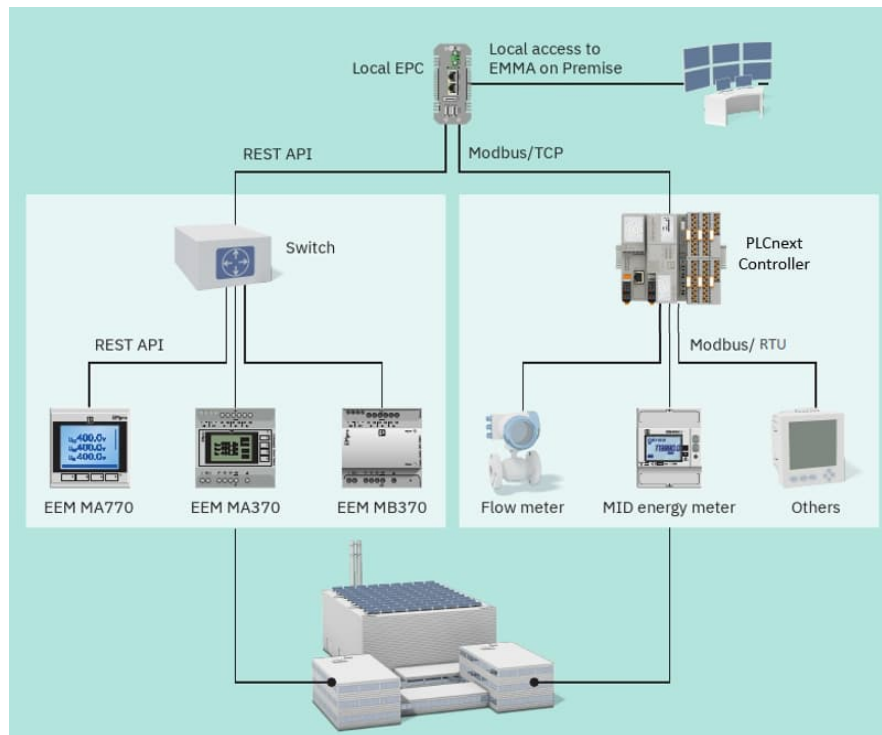
What are the challenges?

- 1) The need for differentiated energy monitoring for different parts of the plant, such as production areas, PV panels and a charging park.
- 2) The processing and analysis of large amounts of data from various energy sources to optimize overall energy consumption.
- 3) Ensuring network security and stability to support the energy monitoring software.

- 4) The company wishes to store the energy data locally, without connecting to a cloud.
- 5) The specialists for maintenance and servicing work require a quick overview of energy consumption directly at the affected system sections.
- 6) Highly fluctuating use of office space due to increasing home office leads to irregular and difficult to plan energy consumption.

Solution of Phoenix Contact

To overcome these challenges, the "EMS – On-Premises" energy monitoring software is installed on an edge PC from Phoenix Contact. This is equipped with a license for up to 100 measuring points in order to record and analyse the various energy consumptions in detail.



Network communication

Ethernet switches from Phoenix Contact are installed in areas where there was previously no networking to ensure secure and reliable data communication.

Connection of measuring devices

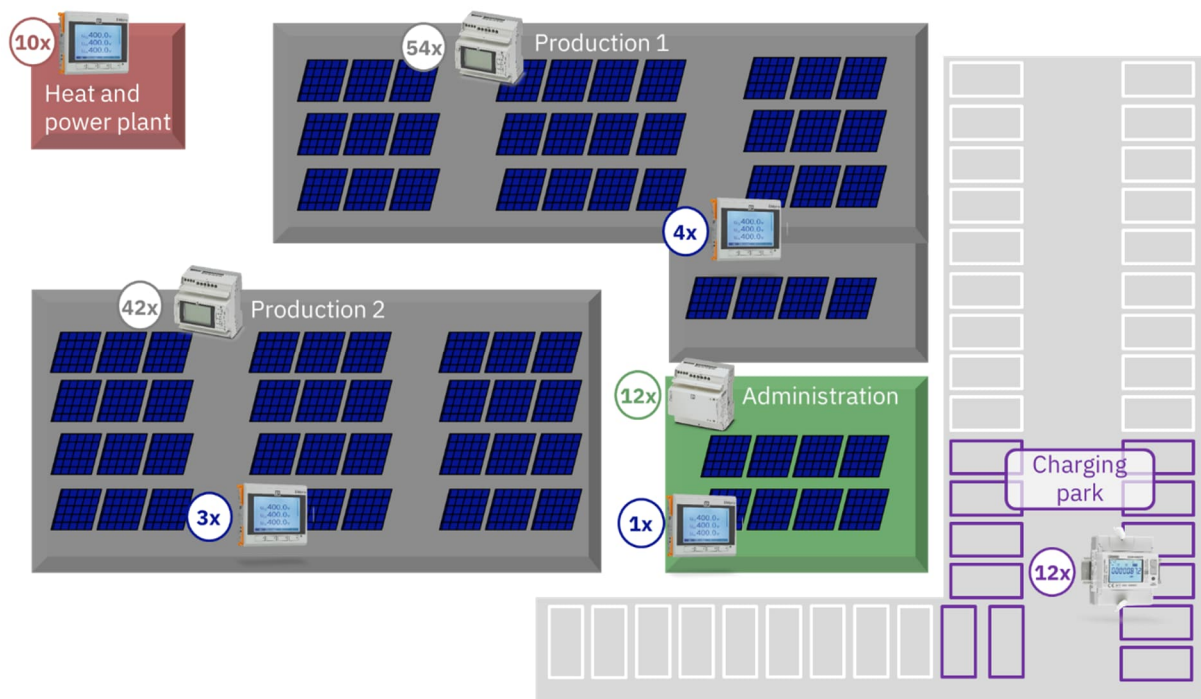
Energy measuring devices from Phoenix Contact for DIN rail mounting are installed along the production lines and at critical consumers in order to measure electrical energy consumption. The company-specific requirements have shown that the measuring devices with integrated display are ideal for this application and provide a direct overview of the systems during maintenance and servicing measures.

Measuring devices on the PV panels and in the combined heat and power plant are also integrated into the system to monitor energy generation. Energy measuring devices designed for front panel mounting are commonly used to present the volume of energy generated outside the control cabinet in the company areas.

The charging infrastructure for electric cars is also monitored separately in order to identify potential for optimizing energy consumption and the individual charging behaviour of employees. In addition, MID-compliant measurement is used for legally regulated billing purposes.

Where were devices installed

- Energy measuring devices were installed at strategic points throughout the production plant:
- Each production line is equipped with several measuring devices that monitor the energy consumption of the electronics and pneumatic actuators as well as the parts feeding equipment.
- The energy extraction of the photovoltaic systems mounted on the roof is equipped with further measuring devices that continuously measure the energy production of the PV module strings.
- Additional measuring devices are installed in the charging park for electric cars and at the combined heat and power plant to precisely record the energy flow and consumption.
- Sensors are also installed in the office areas and outbuildings to monitor energy consumption for lighting and air conditioning.



Successes through the operation of the energy monitoring software

The "EMS – On-Premises" software provides a detailed view of energy consumption filtered by business unit. In the production lines, this overview leads to improved decision-making, energy savings and more sustainable production. The system can be implemented without major interruptions to operations and, thanks to the latest retrofit technology from Phoenix Contact, does not require any rewiring of existing system parts.

The energy monitoring of the company's energy-generating technologies creates new possibilities for analyzing the direct correlation between the energy generated and consumed. And to optimize the usage periods of the self-generated energy.

Reporting and presentation of graphs

The recorded data is displayed in a clear dashboard view, which makes it easier to compare consumption values and enables immediate adjustments to be made. The tree structure creates an orderly display of different levels and differentiates between generation and consumption in the first position. Production, administration and the charging park form the sub-chapters of the consumer level. The solar system and the combined heat and power plant are separated in the generators section. A detailed overview at meter level can be called up within these structural elements and provides promising analysis options, particularly in production.

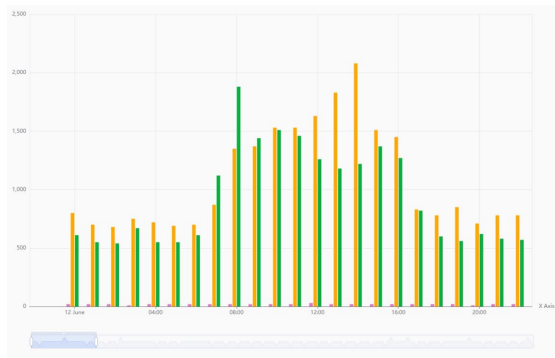


Exemplary reduction of energy consumption and optimization of generation:

Significant energy savings were achieved by installing the EMS – On-Premises energy monitoring software:

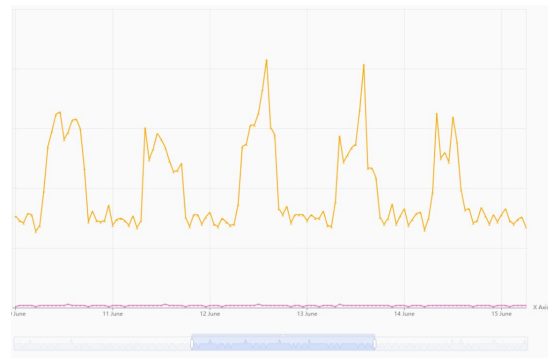
- In the production lines, the comparison of energy consumption made it possible to optimize the machine settings, which led to a 13% reduction in electricity consumption.
- The analysis of the energy generation of the photovoltaic systems showed that an increase in energy efficiency of 10% was possible through optimized alignment and maintenance.
- Monitoring the charging park revealed inefficiencies in the charging technology, which enabled a 20% reduction in energy consumption following technical adjustments. The charging currents were limited in time when the photovoltaic system was not expected to be active.
- The implementation of energy-efficient lighting and air conditioning systems in the office areas and the more energy-conscious behavior of employees reduced energy consumption by 26%.

Overall, these measures helped to significantly reduce the site's energy costs while making production processes more sustainable. The regular review and adjustment of settings using the EMS – On-Premises software ensures that energy efficiency is continuously improved.



Reducing the energy use

Orange → Green



The power produced by the solar power plant

→ Charging park reduced when no solar power

List of devices installed by Phoenix Contact

Software and Edge PC

Article Description	Articlenumber	Description	Quantity
EMS – On-Premises LIC-100	1667806	License for up to 100 devices	2
EPC 1522 - Edge Device	1185423	Edge PC	1
STEP-PS/ 1AC/24DC/1.75	2868648	Power Supply for EPC	1

Networking

Article Description	Articlenumber	Description	Quantity
FL SWITCH 1016N - Industrial Ethernet Switch	1085255	Connection for up to 16 Ethernet ports	8
FL SWITCH 1008NT - Industrial Ethernet Switch	1085165	Connection for up to 8 Ethernet ports	4

Energy measurement devices

Article Description	Articlenumber	Description	Quantity
EEM-MA771	2908286	Energy measuring device with large display for front panel mounting on PV panel	18
EEM-MA371	2908307	Energy measuring device with display for top-hat rail mounting in production	96
EEM-MB371	2907955	Energy measuring device without display	12
EEM-EM377	2908590	Directly measuring energy meter for billing-compliant measurement in every charging station	12

PACT RCP-D90	2904890	Rogowski coils for the current measurement of the energy measuring devices	378
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Others

Article Description	Articlenumber	Description	Quantity
Controller - AXC F 2152	2404267	Axioline control front module for connecting the other modules	4
AXL F BP SE4	1088135	Module clamping block for inserting additional modules	4
AXL SE RS485	1088128	Plug-in add-on module for RS 485 communication (for connection to Modbus RTU-based measuring devices such as compressed air meters)	12

Workload / Time for installation

Workload	Quantity	Working hours per piece (/h)
Installation of additional network switches	12	0,5
Installation of EMpro measurement devices	138	0,25
Installation of Edge PC and connection to the existing network	1	0,5
Configuration of the EMS – On-Premises Software including implementation of all Energy meters	1	3
Familiarization and initial evaluations with EMS – On-Premises	1	2
Total		46