

Application Description:

Energy Monitoring in a concrete plant



Sum up of the application

A large precast concrete plant requires an energy monitoring system to monitor and optimize energy consumption. This typically involves monitoring several forms of energy, including electrical energy, heat energy, energy generation using liquid gas, heating oil and compressed air consumption. The aim of monitoring is to achieve ISO 50001 certification and to continuously improve production and save costs in view of rising energy costs. Energy monitoring with the EMS - On-Premises software is installed locally on an EPC.

Description of the customer's circumstances

The company consists of a local production area and an adjacent office building. Precast concrete parts are produced on the 500,000 m² site using several mixing plants. Workshops and the administration building are also located on the site.

Existing Challenges

- 1) Communication via wireless modules is virtually impossible due to large prefabricated concrete parts on the site, which is why all communication must be cable-based via an Ethernet network.
- 2) Old energy data from already installed energy measuring devices should be read in regularly so that they can also be used in energy monitoring.
- 3) The large variance of different measuring devices and forms of energy requires different communication interfaces such as Modbus RTU, MBus and a pulse interface.
- 4) 80 different energy measuring devices are to be integrated.
- 5) Energy monitoring should be implemented locally and not in a cloud.

Solution from Phoenix Contact

The "EMS - On-Premises" software is used in conjunction with an edge PC from Phoenix Contact to implement the energy monitoring solution. A license for the use of 100 measuring points is pre-installed on the Edge PC.

Network

Where network technology has not yet been installed, Ethernet switches from Phoenix Contact are used to establish communication with the existing network.

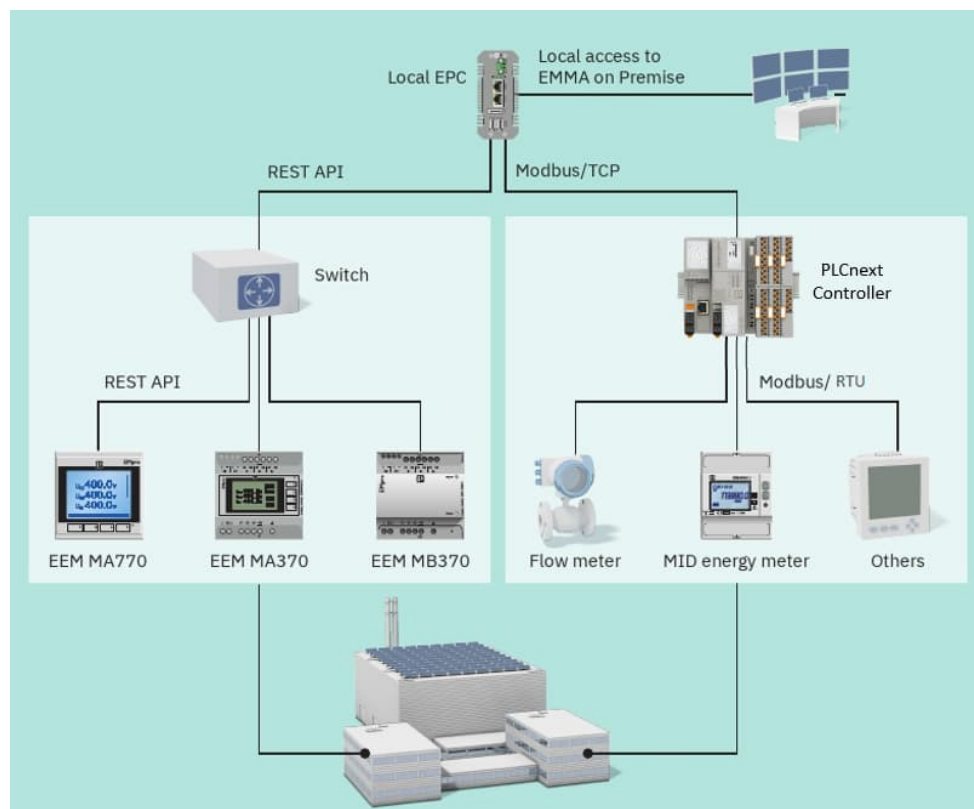
Connection of Energy meters

The EMpro energy measuring devices for DIN rail mounting are used to measure electrical energy.

The other existing energy measuring devices with Ethernet communication are integrated directly via the network and the setting of individual Modbus TCP registers in the EMS - On-Premises software.

Further measuring devices with Modbus RTU interface are integrated via the connection to a PLCnext Control. The measuring devices for the flow of liquid gas and heating oil are also connected via the PLCnext Control or a data logger, depending on their position.

The combination of Edge PC and software collects the available data in the field and displays it graphically. The customer can view all the data via the existing Ethernet network by calling up the IP address of the Edge PC. A technical diagram of the application is shown in the following figure.



Installation locations of the various devices

It is generally advisable to install measuring devices at all energy-intensive machines and consumption points. This makes it easy to compare them, especially in the case of machinery with several identical machines. It is also advisable to allocate them according to subject areas, for example ventilation,

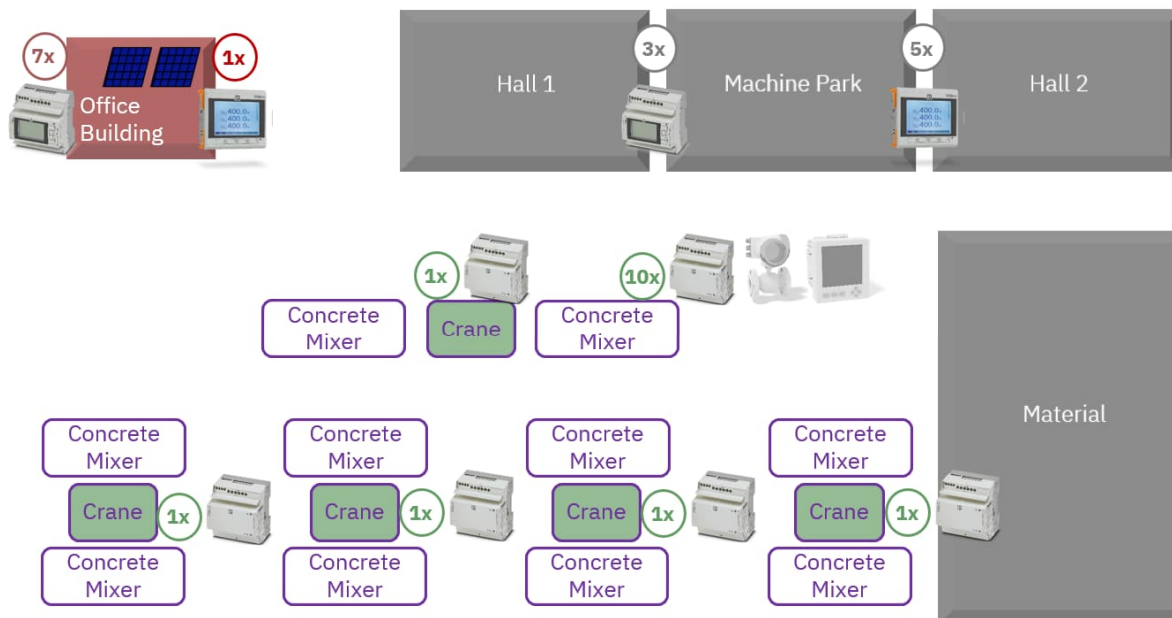
cooling, heating, machines and lighting. The following describes where measuring devices are installed in a concrete plant:

Each mixer for the precast concrete elements requires measuring devices for electrical energy, gas flow, heating oil, water and compressed air. The measured values are assigned to an individual concrete mixer in EMS - On-Premises and can therefore be easily compared with the other mixers.

The electrical energy for load cranes to lift the concrete parts on the site is also measured and assigned to the respective load crane in EMS - On-Premises.

In addition, each workshop hall has a meter for the lighting and, in some cases, several meters for the other machinery.

The office building, including server rooms, reception area and similar, is measured and displayed separately using several energy measuring devices.



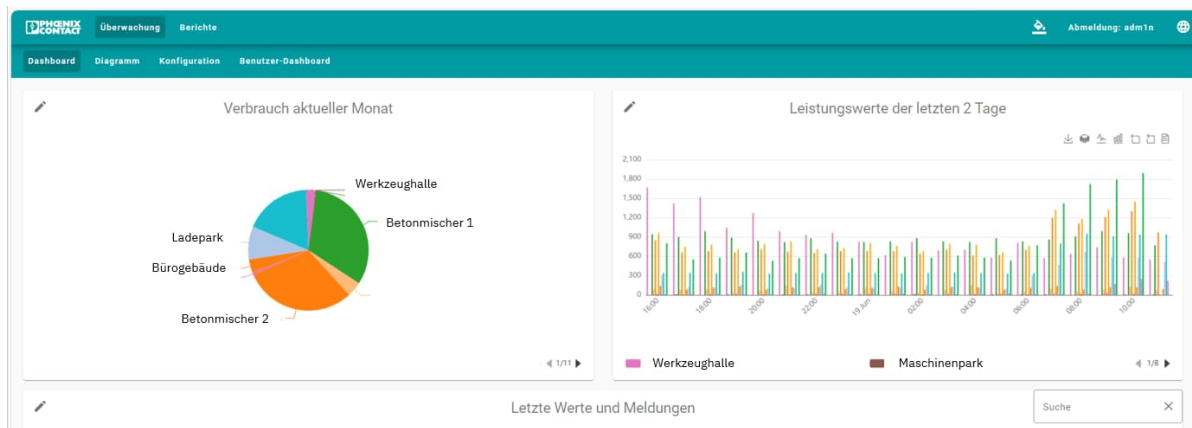
Successes through the operation of the energy monitoring software

The EMS - On-Premises monitoring software could be installed in conjunction with the EMpro energy measuring devices during operation. Thanks to the measurement technology using Rogowski coils and foldable current transformers, no system had to be shut down for the installation.

Reporting and presentation of graphs

By arranging the installed measuring points in a tree structure according to their position in the plant, a clear presentation of the available data is achieved.

Diagrams and overviews are created from the measurement data. In addition, evaluations are summarized and saved for storage. The next figure shows the display in dashboard form in EMS - On-Premises. This currently shows a comparison of consumption over the last month.



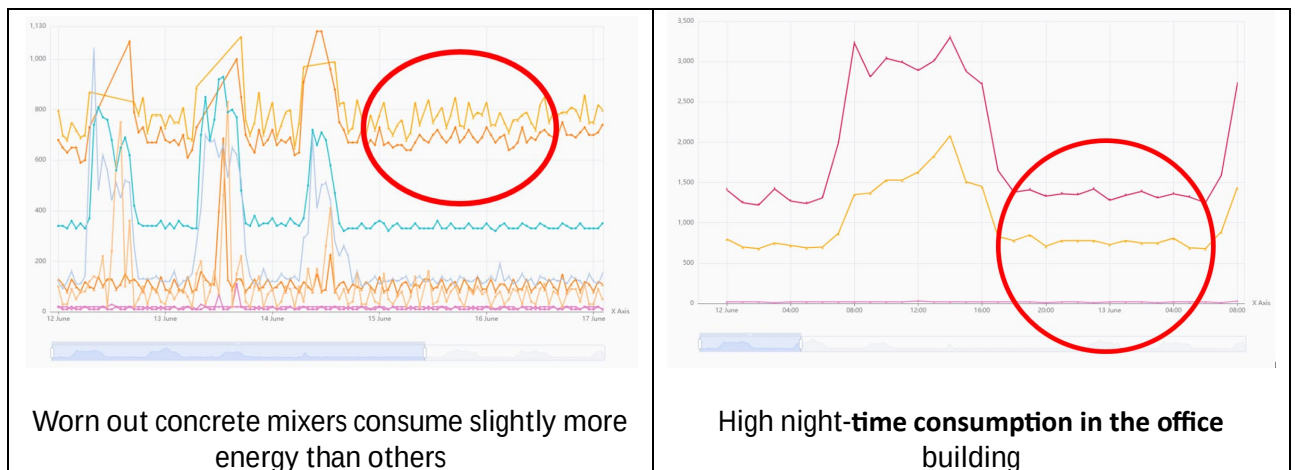
Display of the current monthly consumption in a circle and bar chart

Exemplary reduction of heating output and electrical energy:

The installation on all concrete mixers resulted in good comparability of the consumption of the plants. Immediately after the start of monitoring, the comparison of electrical consumption revealed sluggish machines that could be optimized through maintenance.

By comparing the heating periods for the poured precast concrete parts, it was possible to reveal that certain concrete parts are heated unnecessarily quickly and are therefore already sufficiently hardened several hours before the planned stripping. The heating costs can be continuously optimized by the software.

The simplest optimization of electrical energy consumption was achieved in the halls and the office building. Shortly after installation, it is noticeable that the lighting and air locks in particular are also partially active at night, even though they are not needed outside working hours.



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	1
EPC 1522 - Edge Device	1185423	Edge PC	1

STEP-PS/ 1AC/24DC/1.75	2868648	Power Supply for EPC	1
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Networking

Article Description	Articlenumber	Description	Quantity
FL SWITCH 1016N - Industrial Ethernet Switch	1085255	Connection for up to 16 Ethernet ports	3
FL SWITCH 1008NT - Industrial Ethernet Switch	1085165	Connection for up to 8 Ethernet ports	1

Energy measurement devices

Article Description	Articlenumber	Description	Quantity
EEM-MA771	2908286	Energy measuring device with large display for front panel mounting on PV panel	6
EEM-MA371	2908307	Energy measuring device with display for top-hat rail mounting in production	10
EEM-MB371	2907955	Energy measuring device without display	26
PACT RCP-D95	2904890	Rogowski coils for the current measurement of the energy measuring devices	126

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)	4

Workload / Time for installation

Workload	Quantity	Working hours per piece (/h)
Installation of additional network switches	4	0,5
Installation of EMpro measurement devices	42	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		18