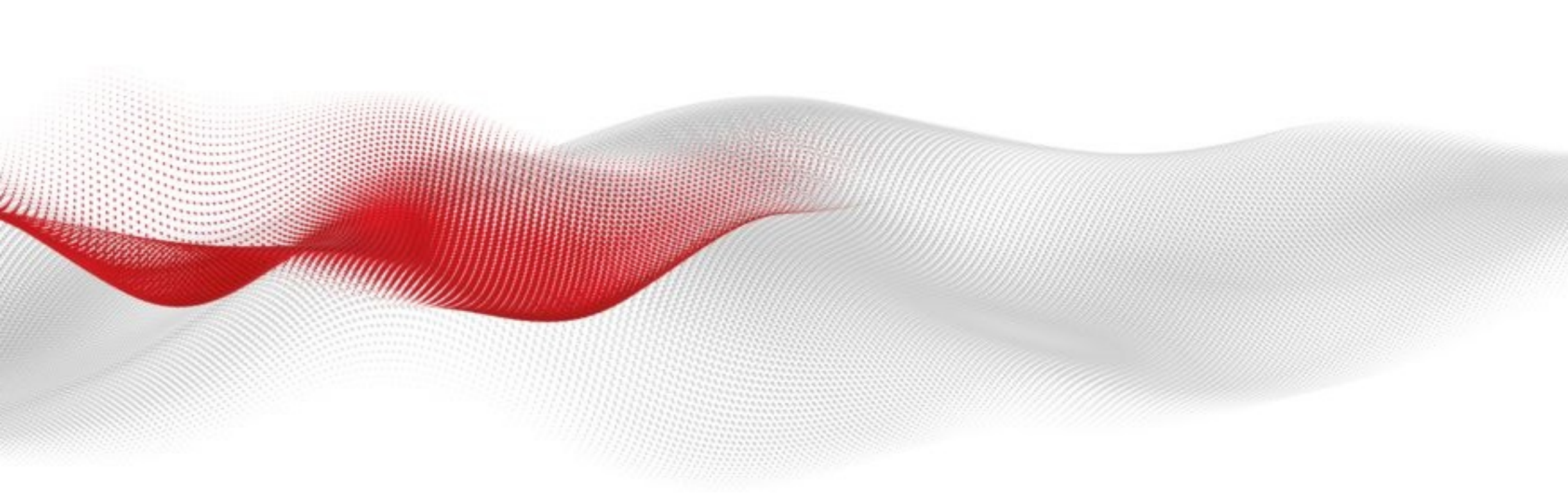


ABB ELECTRIFICATION WEBINAR – SEP 18, 2020

EL15 - Energy Efficiency in Low Voltage Electrical System

ABB Electrification Training Session

About Myself

Product Marketing Director

Ta

Norrarat Navaratgulchai

16 Years

ABB Electrification (Thailand) Co., Ltd

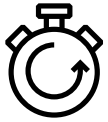
Electrification business – Low Voltage Products

Responsible for

- Electrical Solution & Technical Advisor
- Products , Innovation and Marketing Strategy

Agenda and The key takeaways

15 Webinar : Energy Efficiency in Low Voltage Electrical System



60 Minutes training duration

The key takeaways

- Introduction of Energy Efficiency in electrical system
- Standard IEC60364-8-1 – Low voltage electrical installation – energy efficiency
- Example of energy efficiency assessment according to IEC60364-8-1
- Example of technology & application for energy efficiency

Sustainability

Eco-efficiency

Reduce environmental impact minimizing switchgear energy loss using sensors technology.
Low environmental impact with SF6 gas-free switchgear and components.

Renewables

Easy integration of renewables with automatic-synchronization protection function.
Energy Storage Module to optimize the distributed energy resources within the grid.

E-mobility

Easy to deploy e-mobility solution packaged with compact secondary substations.
Energy Storage Module for scalable deployment of EV chargers.

Energy Efficiency in Electrical System

Why that is important?

Population and energy demand

Growing economy and population is continuously demanding more energy consumption, reaching more than 175,000 TWh of energy demand by 2020.

Pollution and emissions

Global warming as result of the emission of greenhouse gases and pollution is effecting the world in which we live.

Buildings are responsible for over 40% of the world's total energy consumption and about 25% of world's CO2 emissions.

Laws and directives

International and national laws and directives are pushing for reduction of the energy consumption of buildings.

The EU Energy Performance of Buildings Directive is setting the target that all new buildings must be nearly zero energy buildings by 31 December 2020 (public buildings by 31 December 2018).

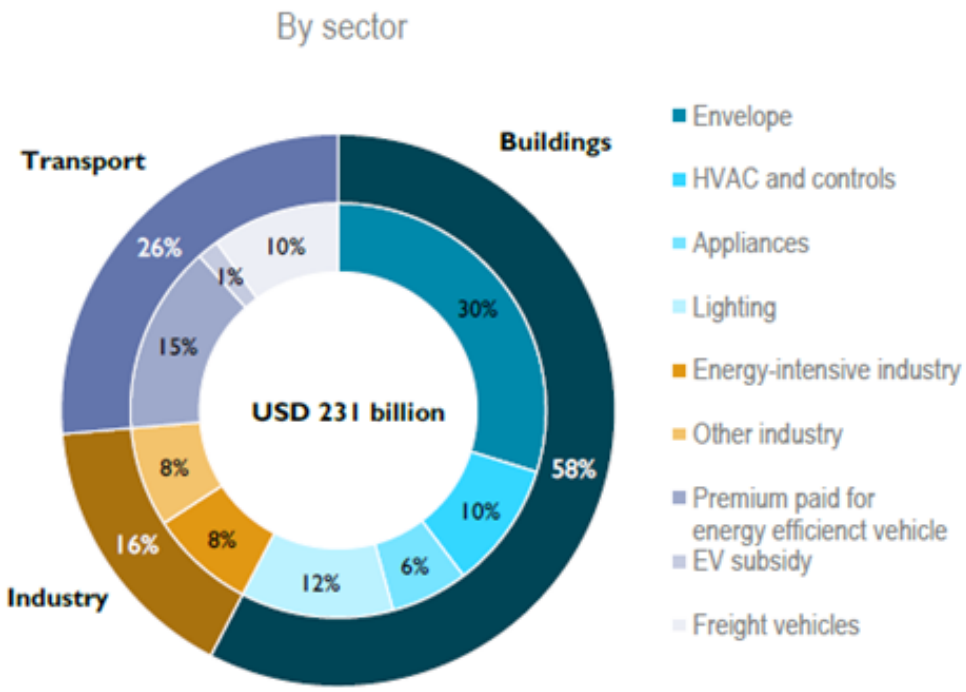
Need for energy efficiency

An efficient energy use, or more commonly **Energy Efficiency**, is the goal of all the actions implemented to reduce the energy consumption through products and services.

ABB products and solutions for green buildings provide a great contribution to energy saving and climate protection.

Market trends

Energy Efficiency investment by sector



- Global investment in energy efficiency:
- 58% of energy efficiency investments belong to the Building sector.
- Main building areas of investment:
  - Envelope (Building Envelope Thermal Insulation).
  - Lighting.
  - HVAC and controls.
  - Appliances.

Sources: IEA Energy Efficiency Investment Database; Navigant Research (2016), *Energy Efficiency Buildings Global Outlook* (database),

Importance of energy efficiency in electric installation

Market trends

Global building & infrastructure sector is responsible for almost

40%

of energy consumption

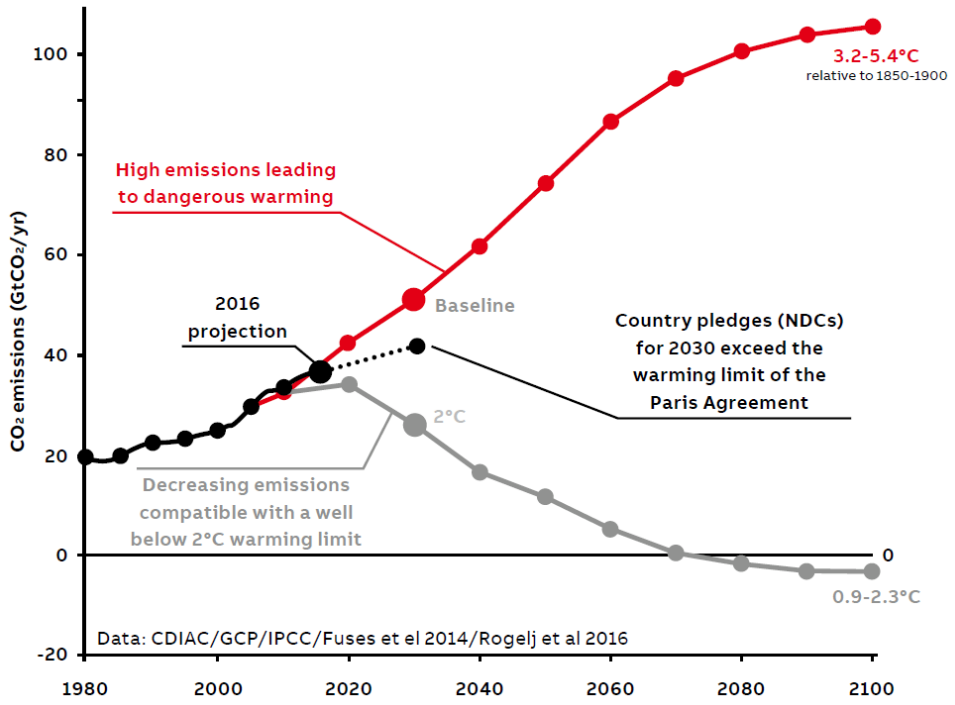
36%

of CO2 emission

Global building & infrastructure sector has a huge growth

3%

Annual growth



To allow future growth of the segment without having an impact on the environment, **energy efficiency must increase**

Energy Efficiency in Electrical System

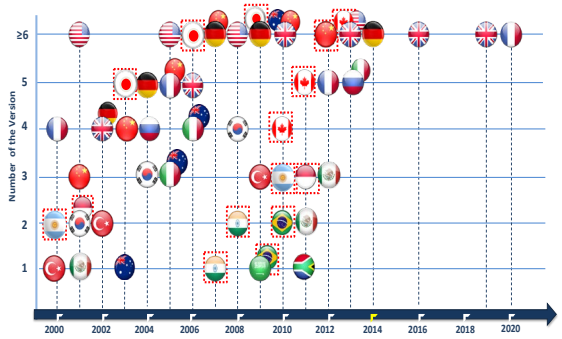
Certification & Standard

International Standard

- ISO 50001 Energy management systems – Requirements with guidance for use (ISO 50001:2018)
- IEC 60364-8-1:2019 Low-voltage electrical installations
- ANSI/ASHRAE/IES/USGBC Standard 189.1-2014, Standard for the Design of High-Performance Green Buildings
- UNI EN 15232 Energy performance of buildings – Impact of Building Automation, Controls and Building Management

National Regulation

- Many Countries developed local regualtion for measuring new constructions and renovations



European Directive

- The Energy performance of buildings directive requires that all new buildings must be nearly zero-energy buildings (NZEB) as of 31 December 2020.
- Energy that NZEB require should comes mostly from renewable energy sources.

Certification System

ENERGY STAR

U.S. GREEN BUILDING COUNCIL LEED USGBC

GREEN GLOBES

ASHRAE

iea International Energy Agency

BREEAM

TGBI

International standards

Standards

LEED for New Construction and Major Renovations (v2009)

The Leadership in Energy and Environmental Design (LEED) green certification program is a globally recognized benchmark of green building design, construction, operations and maintenance.

Levels of certification are: Certified, Silver, Gold or Platinum.

SECTION			ADVANTAGES
	SS	SUSTAINABLE SITES	Building low impact environmental
	WE	WATER EFFICIENCY	Savings water consumption
	EA	ENERGY & ATMOSPHERE	Renewables and better energy performance
	MR	MATERIALS & RESOURCES	Optimization disposal and separation of waste, use of sustainable materials
	IEQ	INDOOR ENVIRONMENTAL QUALITY	More home comfort and indoor air quality
	ID	INNOVATION & DESIGN PROCESS	Cutting-edge technology, reduce heat island effect
	RP	REGIONAL PRIORITY	Strong attention to the specific local

International standards

Standards

IEC 60364-8-1 | Electrical energy efficiency within low-voltage installations

The standard benchmarks state-of-the-art energy efficient electrical design and operation in new buildings and existing structures. (Industrial Building , Commercial Building , Infrastructure)

Focus on:

- Minimizing losses
- Correct power usage
- Ensure long-term performance

Energy Efficiency management shall not reduce electrical availability and/or services or operation below the level desired by the user.

ISO 50001 | Energy management systems - Requirements with guidance for use

The standard provides tools, guidance and resources that demonstrate how to integrate energy management into an overall organizational management structure.

It is structured as a “Plan-Do-Check-Act” process of continual improvement to help organizations:

- Develop a policy of efficient energy performance and management.
- Establish targets and goals to achieve the policy.
- Collect data to understand and make better decisions about energy usage.
- Measure the results, review the process, and make continuous improvements.

ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization

International standards IEC 60364-8-1

Introduction

The optimization of the use of electricity is based on energy efficiency management which is based on the price of electricity, electrical consumption and real-time adaptation. Efficiency is checked by measurement during the whole life of the electrical installation. This helps identify opportunities for any improvements and corrections. Improvements and corrections may be implemented by redesign or equipment replacement. The aim is to provide a design for an efficient electrical installation which allows an energy management process to suit the user's needs, and in accordance with an acceptable investment. This document first introduces the different measures to ensure an energy efficient installation based on kWh saving. It then provides guidance on giving priority to the measures depending on the return of investment; i.e. the saving of electrical energy and reducing of electrical power costs divided by the amount of investment.

This document is intended to provide requirements and recommendations for the electrical part of the energy management system addressed by ISO 50001.

It introduces requirements, recommendations and methods for the design and the energy efficiency assessment of an electrical installation within the framework of an energy efficiency management approach in order to get the best permanent functionally equivalent service for the lowest electrical energy consumption and the most acceptable energy availability and economic balance.

International standards IEC 60364-8-1

Clause 4.1.3

4.1.3 Design principles

The design principles of this document take into account the following aspects:

- load energy profile (active and reactive energy);
- availability of local generation (PV, wind turbine, generator, etc.) and storage;
- reduction of energy losses in the electrical installation;
- the arrangement of the circuits with regard to energy efficiency (meshes, see 7.4);
- the customer's power use distribution over time;
- the tariff structure offered by the supplier of the electrical energy;

maintaining the quality of service and the performance of the electrical installation.

Energy Efficiency in Electrical System

IEC 60364-8-1 , Efficiency Measure

Efficiency Measure

“This part 8-1 of IEC 60364 provides additional requirements, measures and recommendations for the design, erection, operation and verification of all types of low voltage electrical installation including local production and storage of energy for optimizing the overall efficient use of electricity. “

EM (= Energy Efficiency Measure)

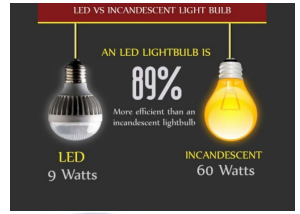
None is mandatory but all contribute to achieve a level of energy efficiency.

Passive Measure

Intrinsic Energy Efficiency (passive)

- Choice of parameters of equipment.

Ex. High efficiency motor, drive , LED …



Active Measure

Systematic Energy Efficiency (active)

- Optimization of energy produced, supplied and consumed.

Ex. Load Shedding, peak shaving , lighting control …

International standards IEC 60364-8-1

Clause 7.3 – Demand Response

Demand response is the management of the electricity demand in response to supply conditions.

Demand response is intended to adapt the consumption of energy to the generated power, especially when generation with renewable energy (e.g. windpower, photovoltaic) is present, and to guarantee system stability. Demand response programs may include dynamic pricing/tariffs, price-responsive demand bidding, contractually obligated and voluntary curtailment, and direct load control/cycling.

Methods of demand response are:

- time-based rates such as time-of-use pricing (e.g. critical peak pricing, variable peak pricing, real time pricing, critical peak rebates);
- limitation of the supply of energy;
- real-time load energy curves.

International standards IEC 60364-8-1

Clause 8 – Energy Efficiency and Load Management System

An energy efficiency and load management system controls the usage of the energy consumed, taking into account the loads, local production and storage and user requirements (see Figure1).

The user specification will be the key input to design the energy efficiency management system.

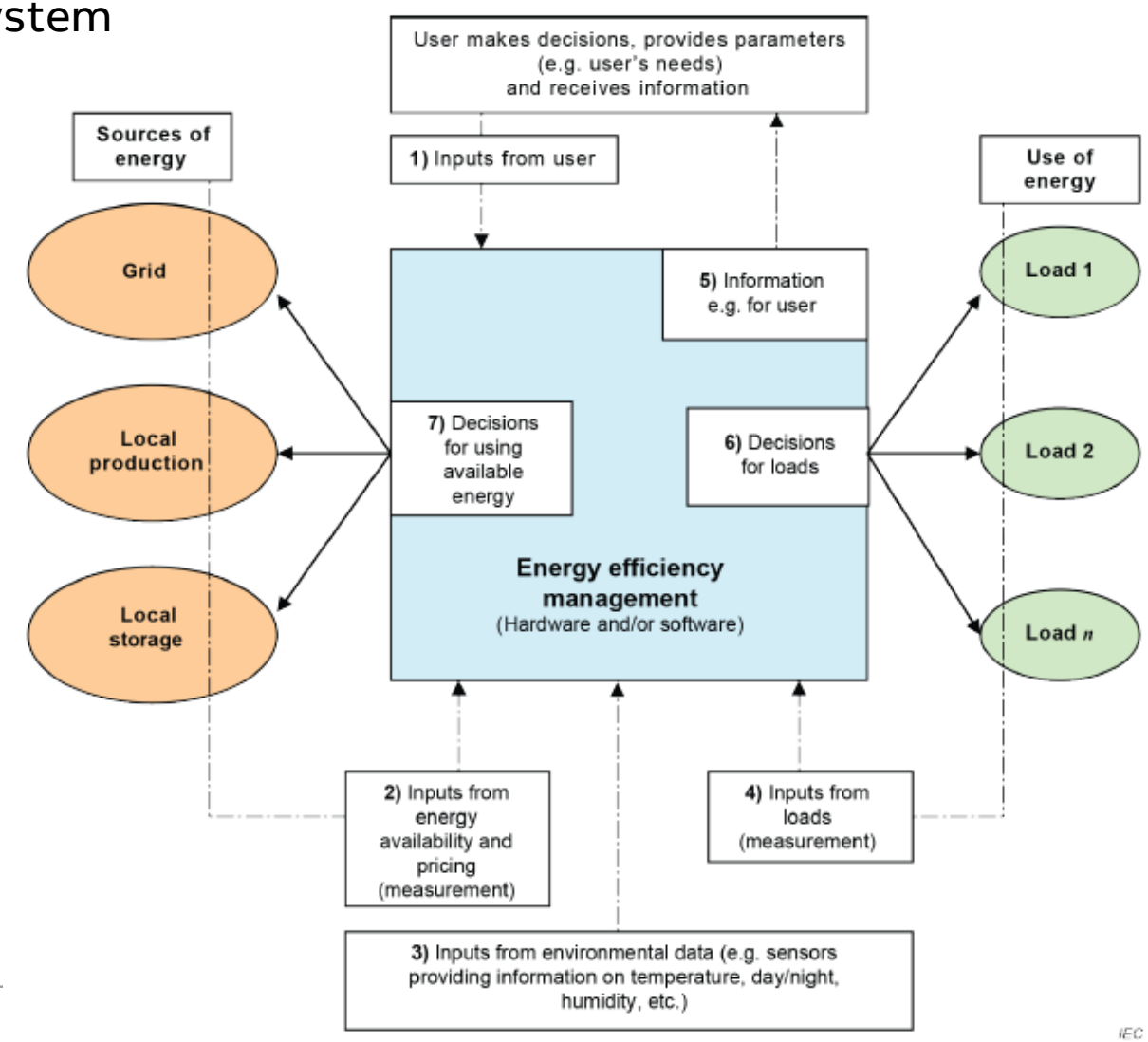


Figure 1 – Energy efficiency and load management system overview

International standards IEC 60364-8-1

Clause 10.2.3.3 – Energy Consumption monitoring

10.2.3.3 Energy consumption monitoring

Monitoring of the electrical power and energy used over periods of time is necessary to understand the behaviours of the current using equipment. Load energy consumption profiles and/or power demand profiles are required to enable energy efficiency analysis. The integration period of the profiles (interval between two measures) should be defined according to the operating patterns of the loads or to the utility meters power demand integration periods to allow comparisons.

Metering and monitoring is a key requirement for the energy efficiency improvements

Energy Metering

Metering, Measuring, Monitoring - Differentiation

Measuring

Measuring is ascertain an actual physical value e.g.:

- Temperature
- Voltage and Amperage (P = U * I)
- Length / size of a device
- Speed (P = F * v)

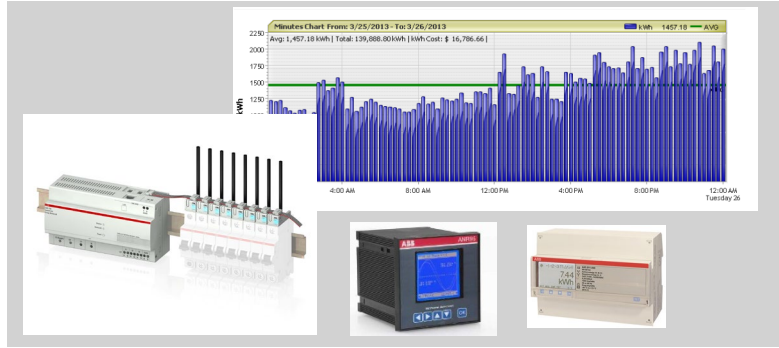
Metering

Metering is the integral of a measured value over time:

- Electrical Energy
- Kinetic energy
- Volume of a liquid flow (e.g. gas, water)

$$Active\ Energy = \int U\ x\ I\ cos\varphi\ dt$$

Monitoring



Monitoring means to supervise a system over time. In our context it means to store data from a measurement or metering device and put a time tag on it. So for example:

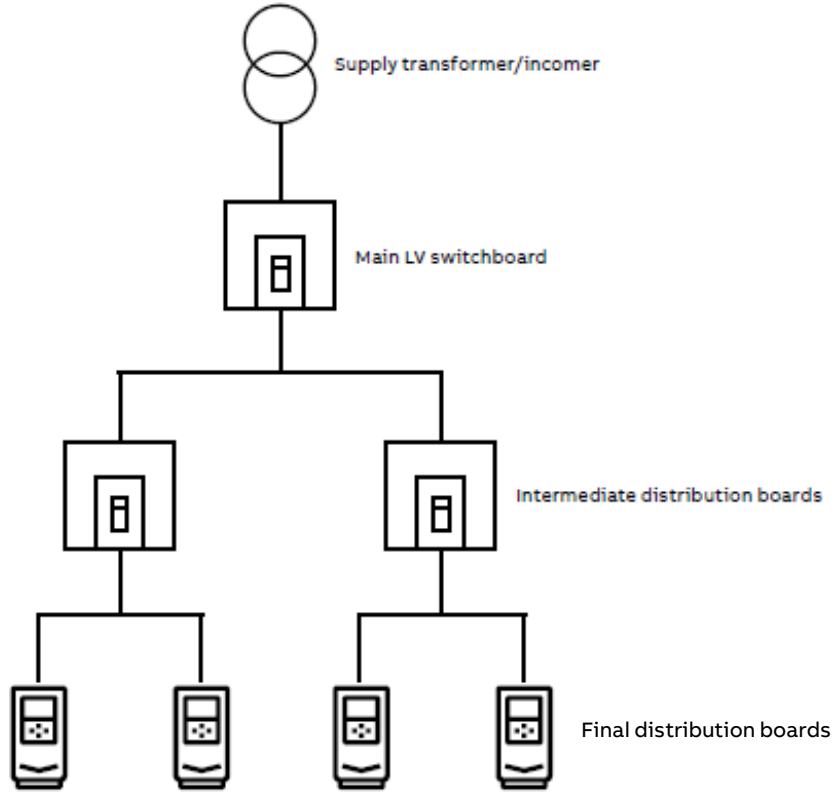
- you can verify a change of a value over time (temperature)
- You can verify the consumption of energy in a certain time period

Energy Efficiency in Electrical System

Determination of energy consumption

Measuring system is fundamental to define installation load profile, necessary accuracy is now provided in the standard.

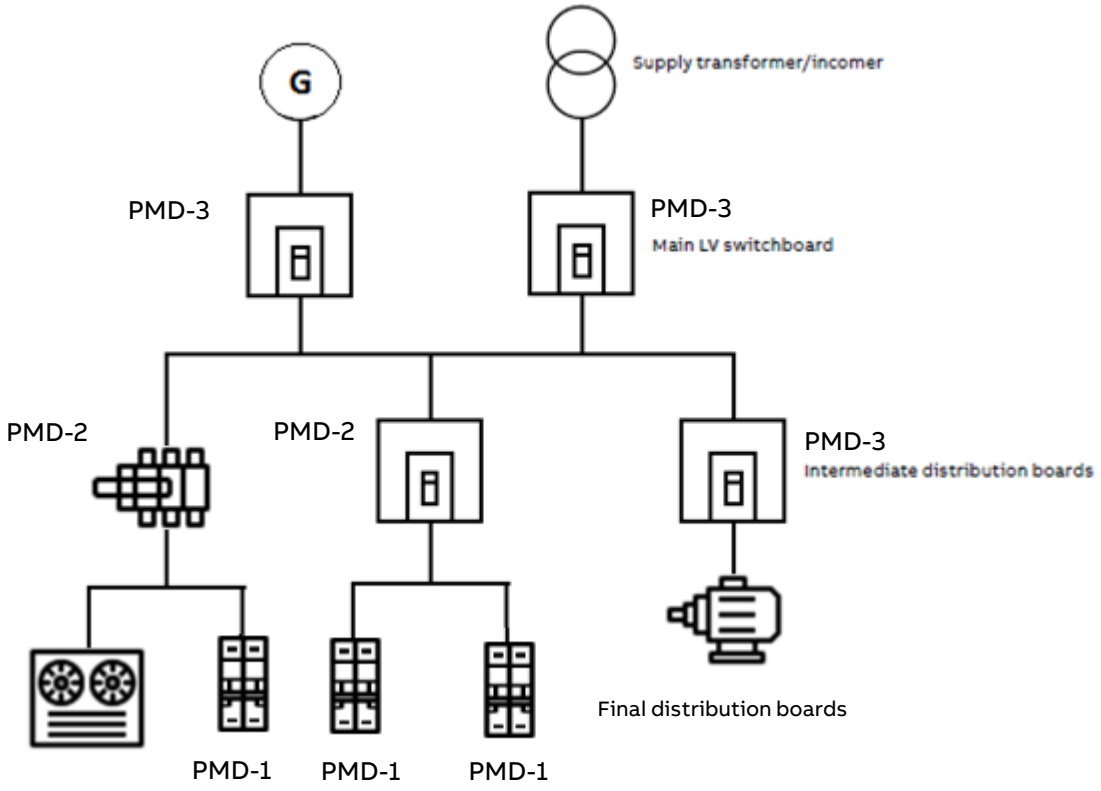
Level in the network	Measurement objective	Accuracy
Incomer	Revenue metering, Bill checking, Energy usage analysis and optimization.	Class ≤ 1
Main LV switchboard	Cost allocation, energy usage analysis and optimization, efficiency assessment.	Class ≤ 2
Intermediate distribution board	Cost allocation, energy usage analysis and optimization, efficiency assessment.	Class ≤ 2
Final distribution board	Energy usage analysis and optimization. Energy usage trends assessment	Class ≤ 2



Energy Efficiency in Electrical System

Determination of energy consumption

Power Meter Device	Description	Minimum measure
PMD-1	Energy efficiency energy usage analysis for energy efficiency assessment	Ea
PMD-2	Basic power monitoring: power monitoring for electrical energy distribution monitoring and control within the installation	P, Q, S, Ea, Er, Eap, f, I, IN, U and/or V, PF,
PMD-3	Advanced power monitoring and network performance: advanced power monitoring and network performance	P, Q, S, Ea, Er, Eap, f, I, IN, U and/or V, PF, THDU and/or THDV and/or THD-RU and/or THD-RV, THDI and/or THD-RI



International standards IEC 60364-8-1

Clause 11 – Energy efficiency actions

11 Energy efficiency actions

Measurements shall be analysed and then direct or programmed actions shall be undertaken:

- direct action consists in making energy efficiency improvements immediately, such as closing or opening the windows, or controlling temperatures of the building;
- programmed actions consist in analysing previous measurements over a period of time (for example, a year) and comparing the results with defined objectives. Then actions shall consist in:
  - maintaining existing solutions;
  - implementing new solutions.

Energy management achieves sustainability and optimizes the electricity consumption by:

– setting energy targets;

– designing energy management measures to optimize electricity consumption.

Energy Efficiency in Electrical System

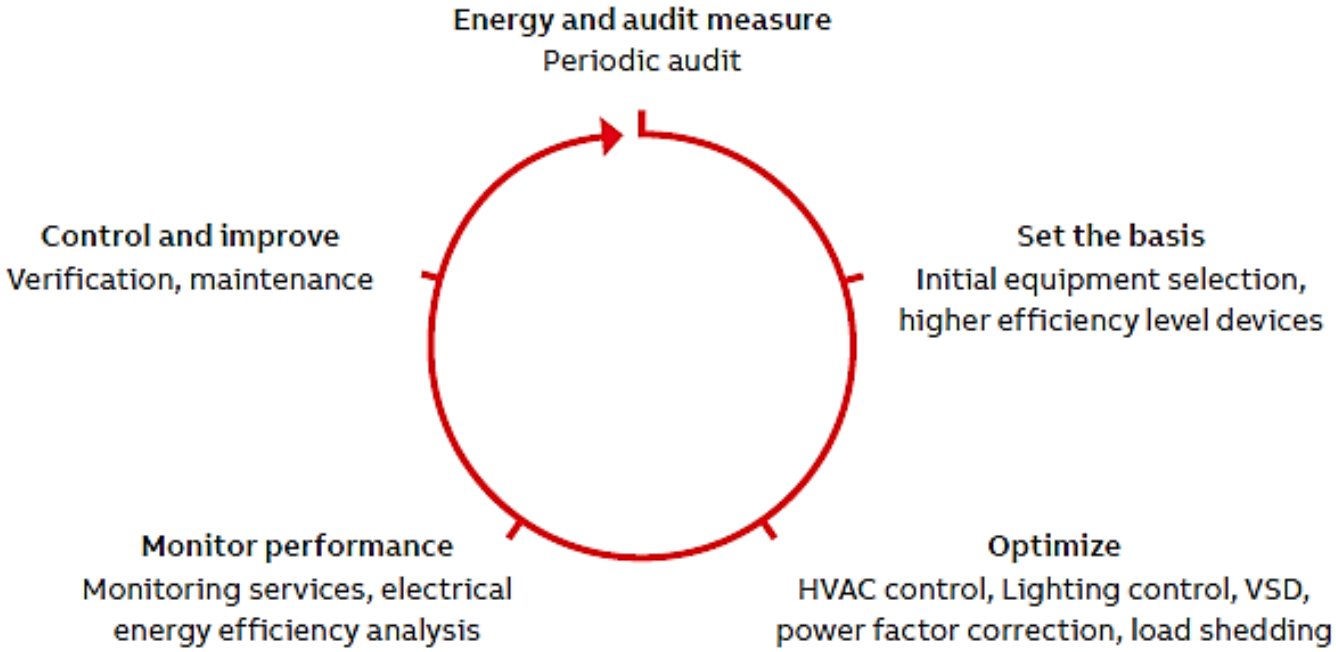
Installation life-cycle methodology

This cycle is permanent and intended to be followed during the whole life of the electrical installation for an energy efficiency approach compliant to the standard.

The maximum interval for periodic assessment is recommended to not exceed:

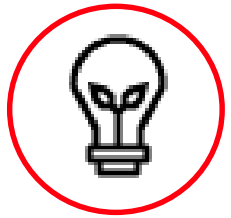
– 5 years for commercial;

– 3 years for industrial and infrastructure.



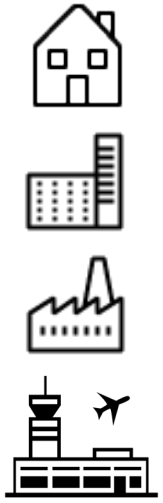
Energy Efficiency in Electrical System

IEC 60364-8-1 Annex B – Method to assess the energy efficiency of an electrical installation



Electrical Energy Efficiency shall be measurable as

- Reduction in energy consumption (kW)
- Reduction in electricity cost ($)
- Lower environmental impact CO2)



Residential building

Commercial building

Industrial building

Infrastructure

LOW

HIGH

Energy efficiency classes:

- Class EE0: low efficiency installation;
- Class EE1: basic efficiency installation;
- Class EE2: basic plus efficiency installation;
- Class EE3: medium efficiency installation;
- Class EE4: high efficiency installation;
- Class EE5: very high efficiency installation.

Energy Efficiency in Electrical System

IEC 60364-8-1 , Efficiency Measure by categories

Initial installation

- Determination of **energy consumption**
- Location of the main substation
- Voltage drop
- Efficiency of the transformer(s)
- Efficiency of current using equipment

Energy Management

- Zones
- Usages
- Demand response
- Meshes
- Measurement by usages
- Detection of the occupancy by zone/room
- Implementation of an **energy management system**
- Lighting control

Performance Maintenance

- Implementation of **life cycle methodology**
- Frequency of the performance verification procedure
- Data management
- Performance of the transformer(s) if any
- Presence of continuous monitoring for large energy using systems

Power monitoring

- Power Factor
- Total Harmonic distortion

Bonus

- **Renewable energy source**
- **Electrical energy storage**

Energy Efficiency in Electrical System

Efficiency measure 1/2

Table B.2 – Energy efficiency measures

Parameter	Title	See
Initial installation		
II01	Determination of energy consumption	B.3.2.2.1
II02	Consumption and location of the main substation	B.3.2.2.2
II03	Voltage drop	B.3.2.2.3
II04	Efficiency of the transformer(s)	B.3.2.2.4
II05	Efficiency of current using equipment	B.3.2.2.5
Energy Management		
EM01	Zones	B.3.2.3.1
EM02	Usages	B.3.2.3.2
EM03	Demand response	B.3.2.3.3
EM04	Meshes	B.3.2.3.4
EM05	Measurement by usages	B.3.2.3.5
EM06	Detection of the occupancy by zone/room	B.3.2.3.6
EM07	Implementation of an energy management system	B.3.2.3.7
EM08	HVAC control	B.3.2.3.8
EM09	Lighting control	B.3.2.3.9

Energy Efficiency in Electrical System

Efficiency measure 2/2

Table B.2 – Energy efficiency measures

Parameter	Title	See
Performance Maintenance		
MA01	Implementation of life cycle methodology	B.3.2.4.1
MA02	Frequency of the performance verification procedure	B.3.2.4.2
MA03	Data management	B.3.2.4.3
MA04	Performance of the transformer(s) if any	B.3.2.4.4
MA05	Presence of continuous monitoring for large energy using systems	B.3.2.4.5
Power monitoring		
PM01	Power Factor	B.3.2.5.1
PM02	Total Harmonic distortion	B.3.2.5.2
Bonus		
BS01	Renewable energy source	B.3.2.6.2
BS02	Electrical energy storage	B.3.2.6.3

Energy Efficiency in Electrical System

IEC 60364-8-1 – Case Study

Energy Efficiency in Electrical System

IEC 60364-8-1 – Case Study

ABB SACE Bergamo building

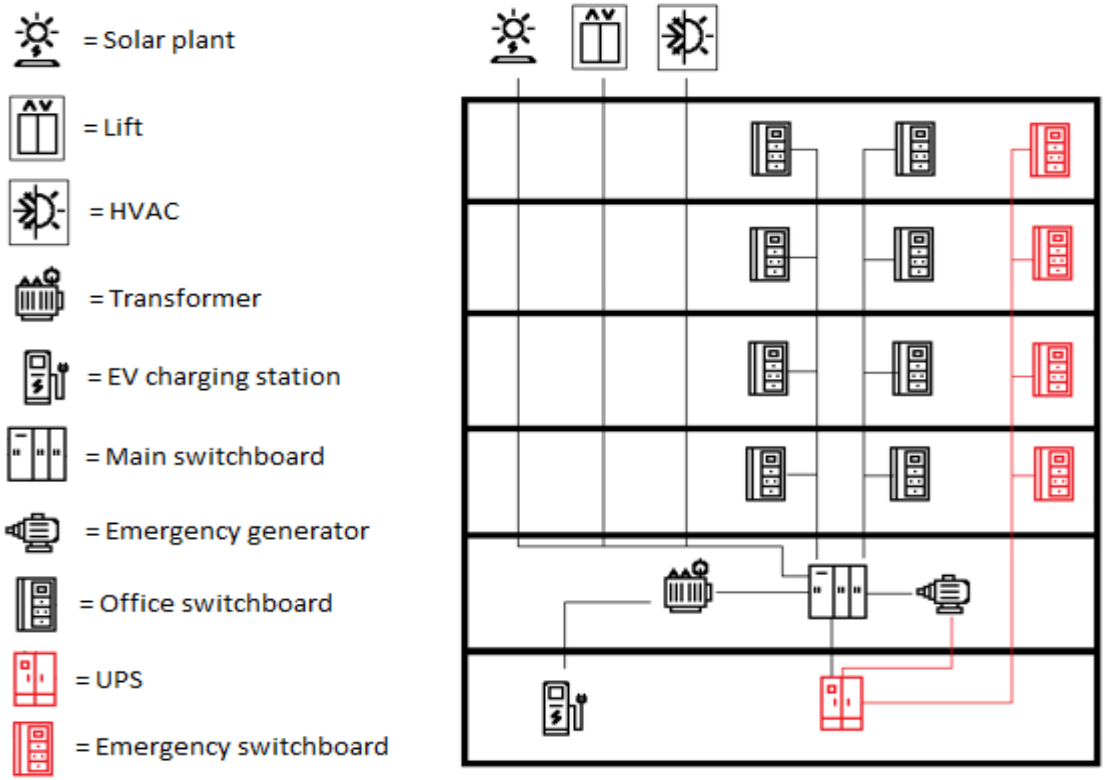
1.2 MW 6 floors office building:

- 2 underground (car parking, goods delivery area, storage area and technical rooms);
- 1 ground floor (reception, post office, conference rooms and canteen);
- 3 floors (offices and meeting rooms).

Supply:

- one MV/LV substation with two transformers;
- PV system in the rooftop;
- one emergency generator for critical loads.

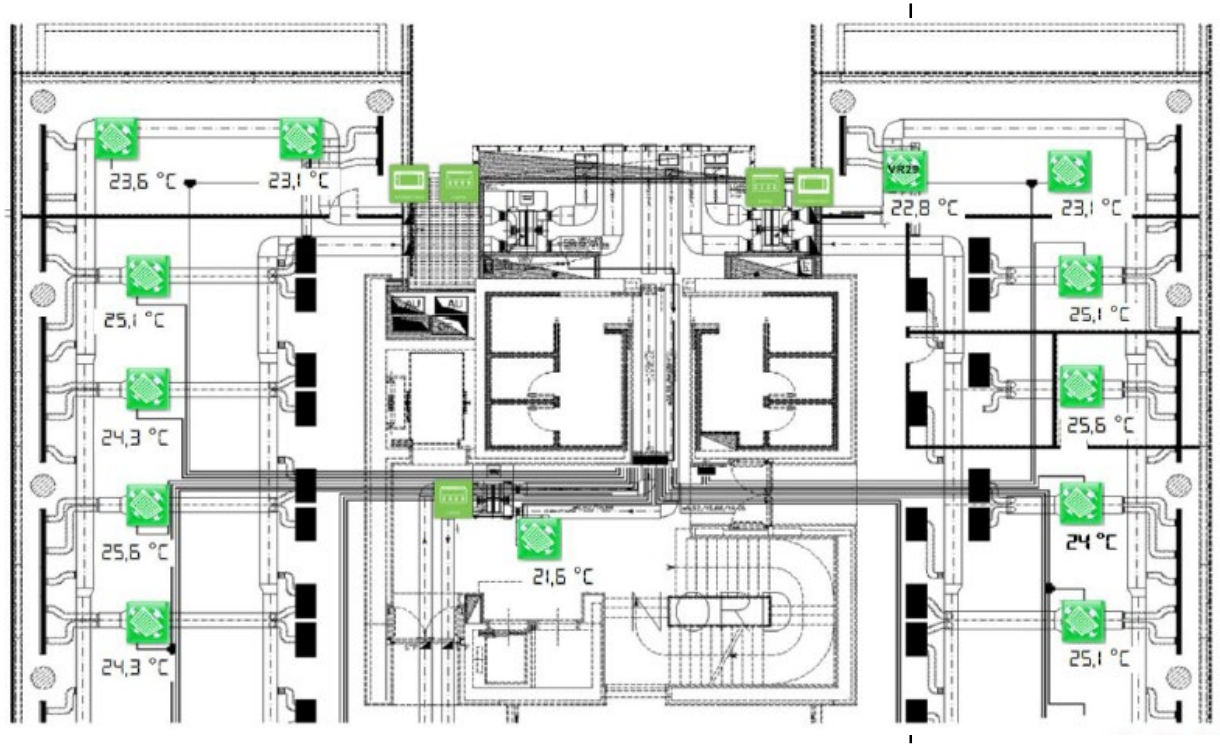
BMS to control temperature and lighting, access control, fire alarm and anti-intrusion system.



Energy Efficiency in Electrical System

HVAC Automation

Parameter EM08



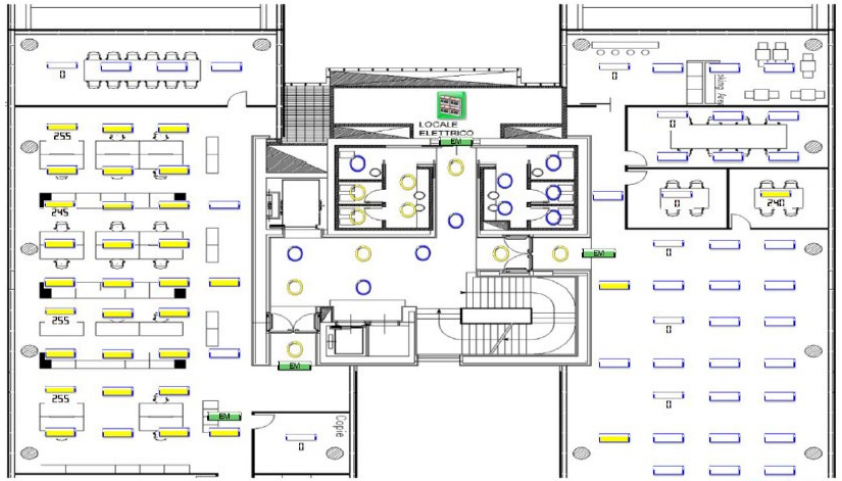
Type of HVAC control	Points for industrial building	Points for commercial building	Points for infrastructure
No consideration	0	0	0
Temperature control	1	1	1
Temperature control at room level	4	4	4
Time and temperature control at room level	6	6	6

SACE Building achieved points: 6

Energy Efficiency in Electrical System

IEC 60364-8-1 – Case Study - Lighting Control

Parameter EM09



% of the consumption of lighting automatically controlled	Points for industrial building	Points for commercial building	Points for infrastructure
< 10 %	0	0	0
≥ 10 % and < 50 %	1	3	2
≥ 50 %	2	6	4

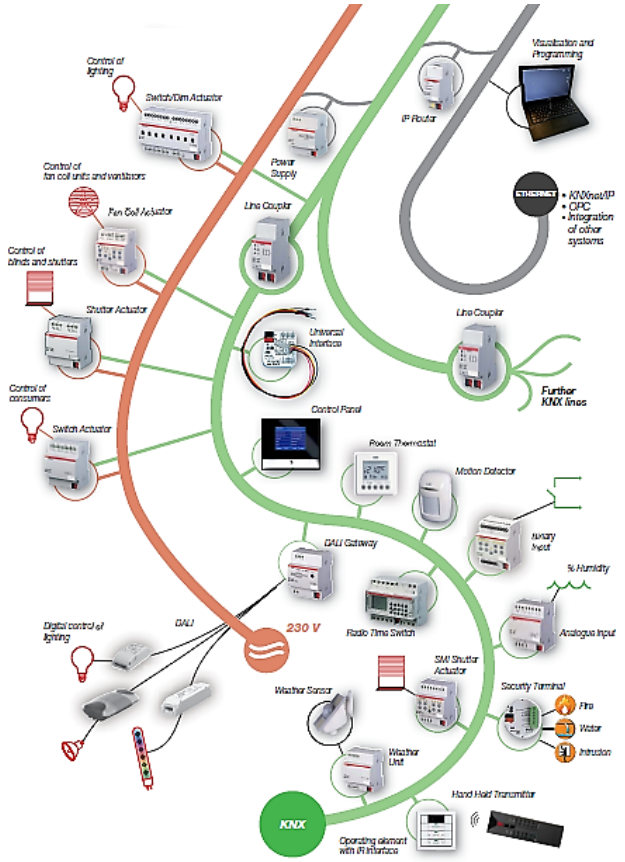
SACE Building achieved points: 6

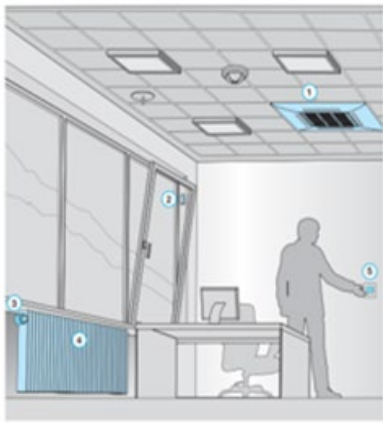
Energy Efficiency in Electrical System

ABB i-bus® KNX

ABB i-bus® KNX interconnects all the components in the electrical installation to form a networked system and thus guarantees the transparency and utilization of information across the installation. In this way, building subsystems such as lighting, shutters, heating, ventilation, security and more are all interconnected; maximize comfort and efficiency with minimal user interaction is guaranteed.

Temperature regulators, light sensors, presence and brightness detectors are installed throughout the building adjusting the lighting levels, heating, air conditioning and blinds, according brightness, the presence of employees, opening hours and site closure.





Energy Efficiency in Electrical System

Detection of the occupancy

Parameter EM06

R_O	Points for industrial building	Points for commercial building	Points for infrastructure
< 50 %	0	0	0
≥ 50 % and < 70 %	1	3	2
≥ 70 % and < 83 %	2	6	4
≥ 83 % and < 90 %	3	8	6
≥ 90 %	4	10	8

SACE Building points achieved: 10

R_0 is the ratio between:

- the annual energy consumption of the current using equipment within the zones or the rooms where the occupancy is permanently detected; and

- the annual energy consumption of the installation

Energy Efficiency in Electrical System

Measures & Monitoring 2/3

Parameter MA03

Data stored	Points for industrial building	Points for commercial building	Points for infrastructure
< 1 year of history	0	0	0
≥ 1 year and < 5 years	4	4	4
≥ 5 years	10	8	8

SACE Building points achieved: 8

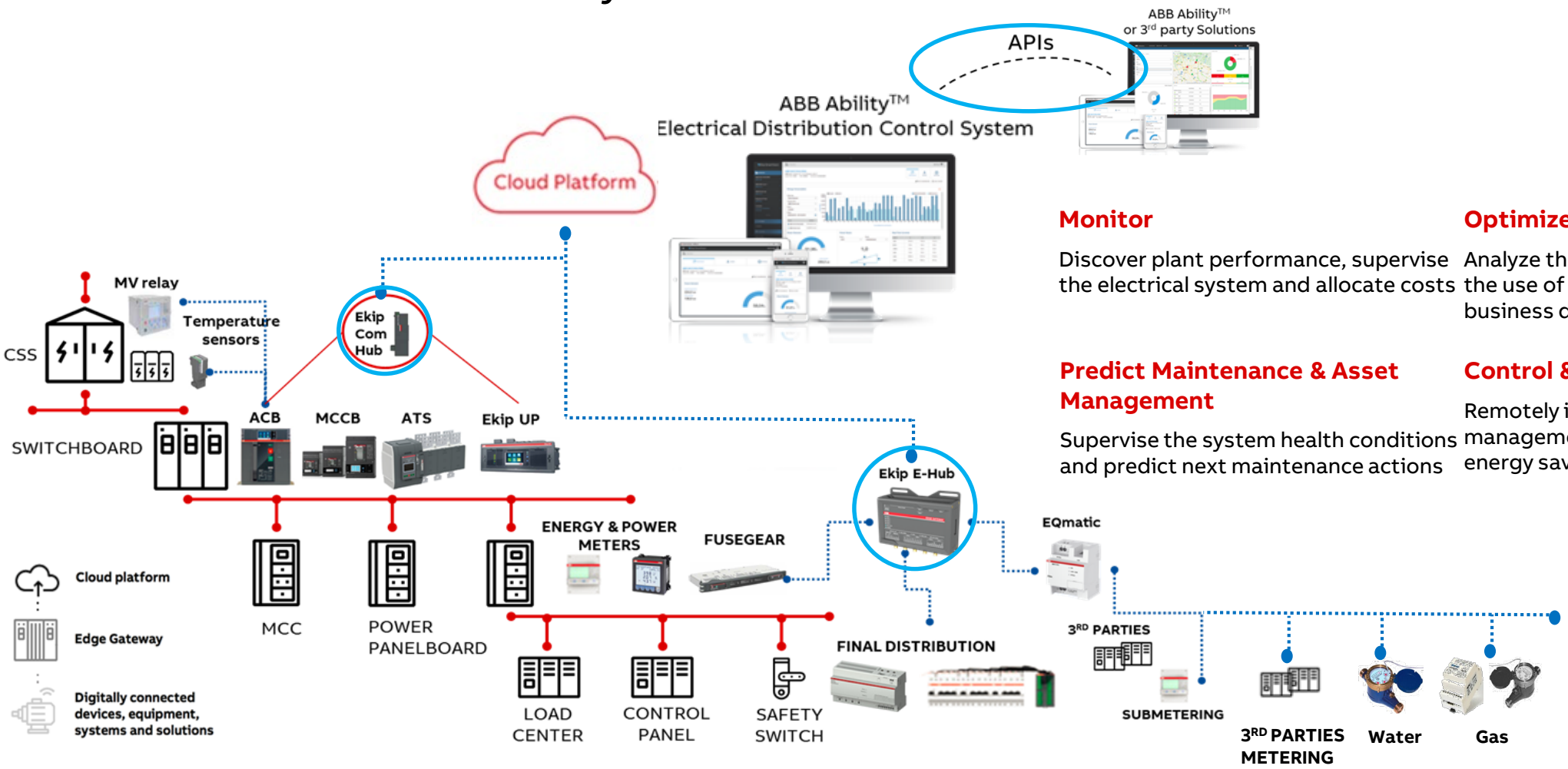
Parameter MA05

Presence of continuous monitoring	Points for industrial building	Points for commercial building	Points for infrastructure
No	0	0	0
Yes	5	5	5

SACE Building points achieved: 5

ABB Ability™ applications available – Digital Solution At Edge & Cloud

Electrical Distribution Control System



Monitor

Discover plant performance, supervise the electrical system and allocate costs

Optimize & Energy Management

Analyze the relevant information, improve the use of your assets and take the right business decision

Predict Maintenance & Asset Management

Supervise the system health conditions and predict next maintenance actions

Control & Alert Center

Remotely implement an effective power management strategy to simply achieve energy savings

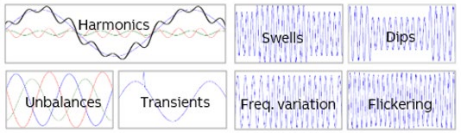
ABB Ability™ Electrical Distribution Control System

Energy Management

ABB Ability™ EDCS – Energy Management

- Configurable dashboard thanks to widgets that can be added/moved/deleted
- All data available at a glance: Power Demand, Energy Consumption, Power Quality
- Comparison of power/energy/current among different plants/devices in different periods

- **Scheduled reports**
- **Power quality (THD)**
- **Data storage**



Example : ABB Italy office building report

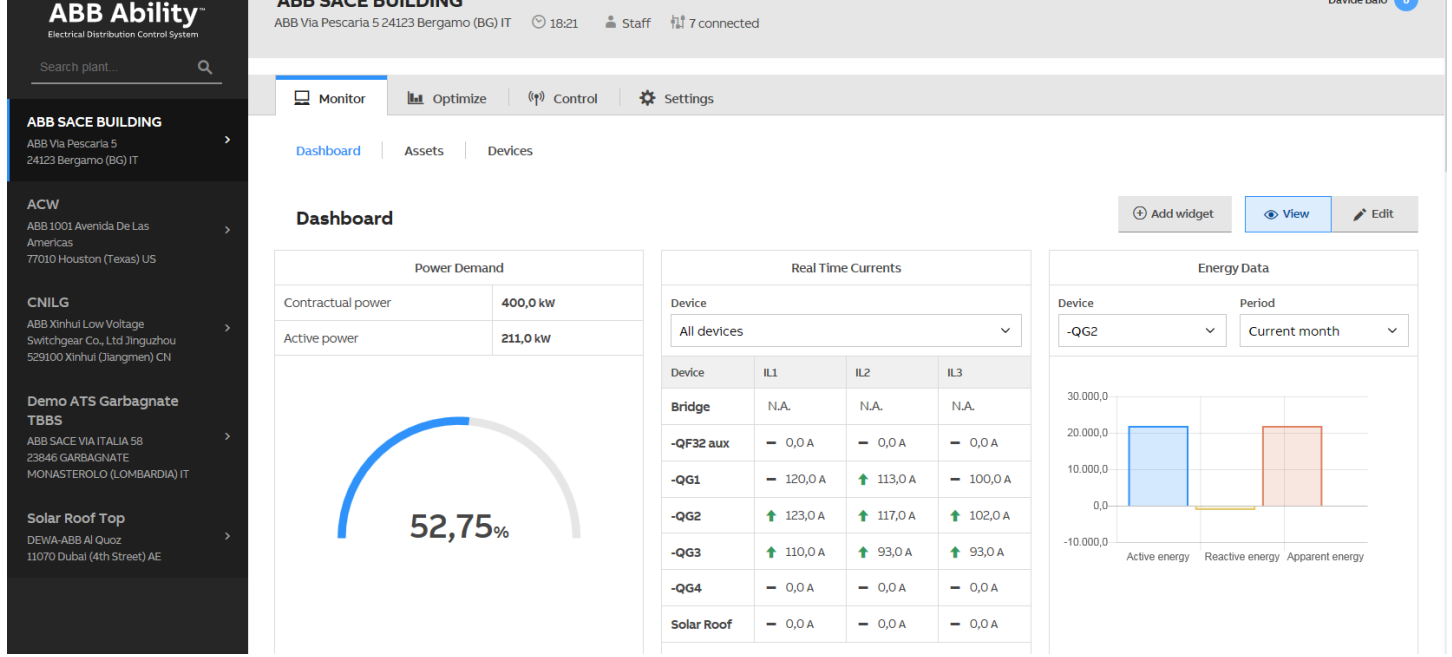


ABB Ability™ Electrical Distribution Control System

Energy Monitoring – Historical , Comparison , Report , Analyze ..

Effective monitor and control of facility performances makes possible to **easily obtain certifications of compliance** to the highest energy efficiency standards.

Solution : Can generate report , Analyze energy and then manage it.

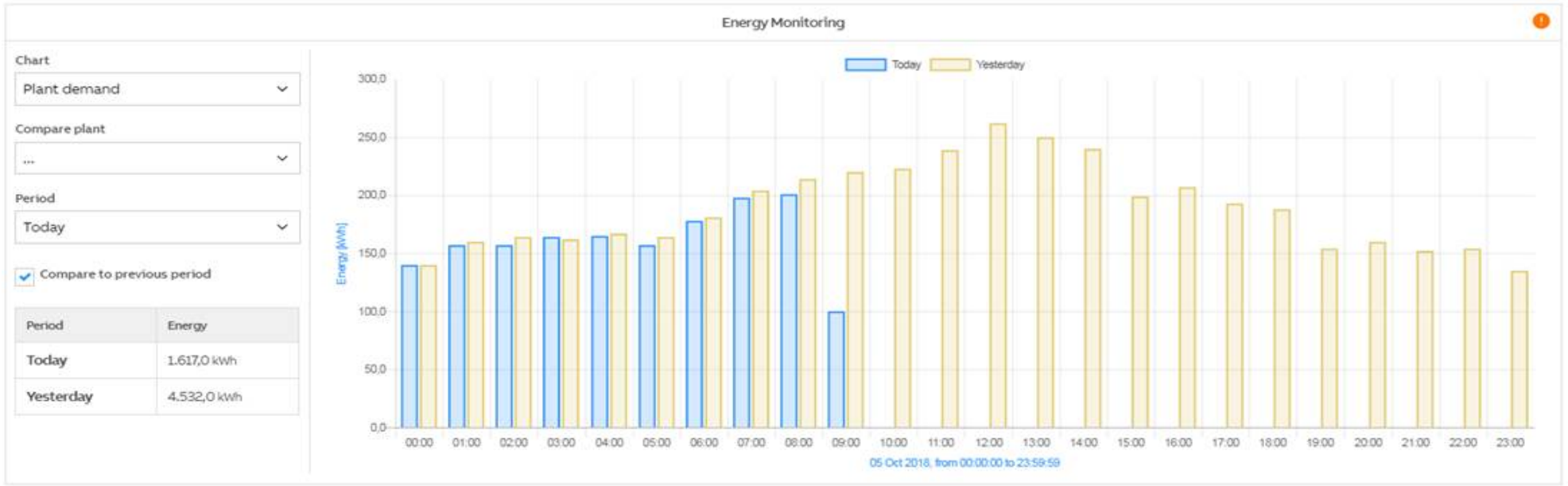
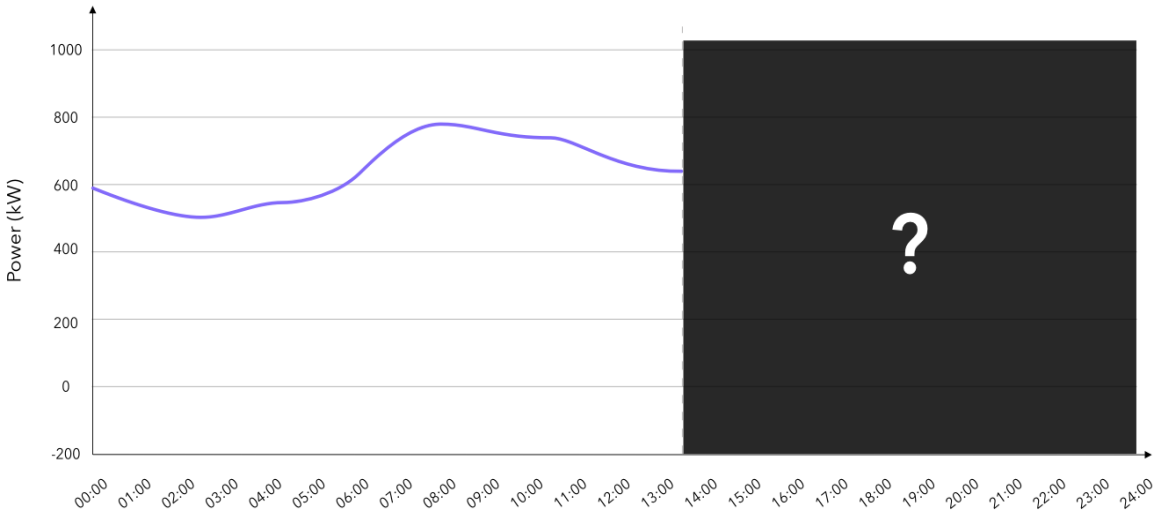


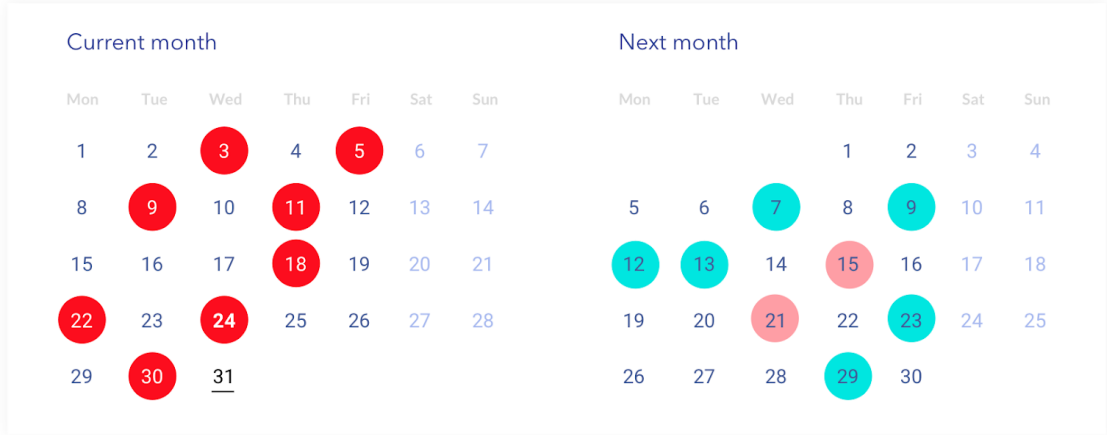
ABB Ability™ Electrical Distribution Control System

Energy Forecasting & Artificial Intelligence

Forecast as a Service predicts power consumption for the next 24 hours (down to the billing interval), and informs you whether you will exceed the contractual power.



With forecasting, you can plan corrective actions to stay below contractual limits.



Current Month Bill

Consumption: 186MWh
Peak Demand: 590kW
Energy Charges: €26,569.2
Demand Charges: €8,024

Next Month Forecast

Consumption: 192 MWh
Peak Demand: 390kW
Energy Charges: €24,000
Demand Charges: €5,215
Savings: €3,000

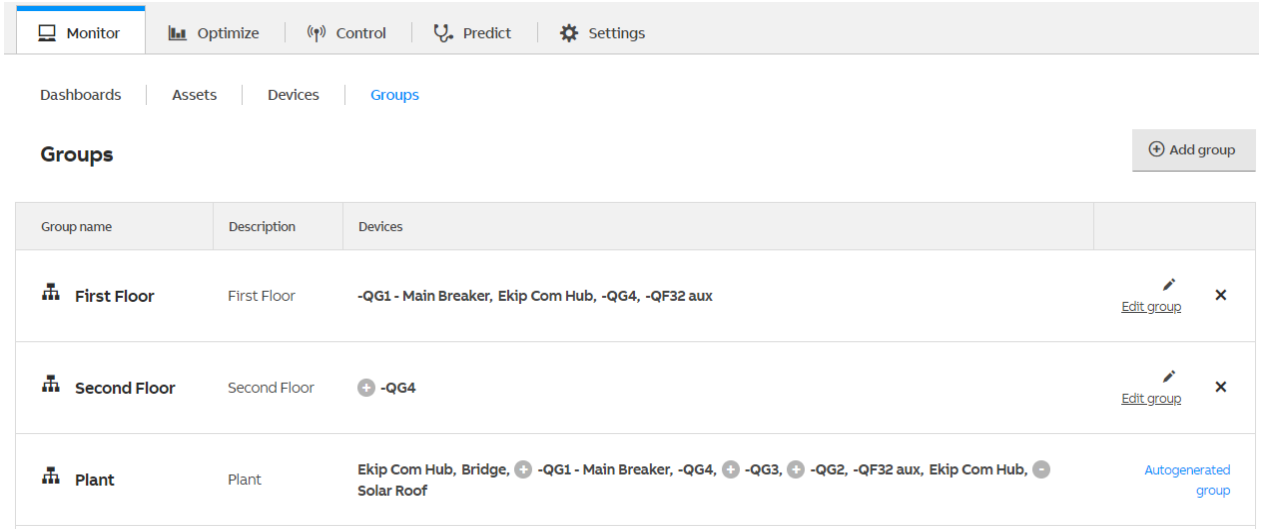
ABB Ability™ EDCS: New widget and functionalities

Grouping

Under the spotlight

Monitor a specific area of your plant thanks a virtual group where it's possible to visualize aggregated data for different devices

- Maximum 100 groups
- Automatic group generated on energy contribution
- Possibility to create specific group to monitor a defined area (i.e. Production Line, First Floor, HVAC)
- Compare the grouped data to the one related to other devices or groups



Energy Efficiency in Electrical System

Demand Management

Parameter EM07: implementation of an EEMS (Energy Management System)

R_I	Points for industrial building	Points for commercial building	Points for infrastructure
< 50 %	0	0	0
≥ 50 % and < 70 %	3	3	2
≥ 70 % and < 83 %	6	6	4
≥ 83 % and < 90 %	10	10	6
≥ 90 %	12	12	8

R_I is the ratio between:
– the annual consumption of the loads managed by or interfaced to an EEMS;
– the annual energy consumption of the installation.

Energy Efficiency in Electrical System

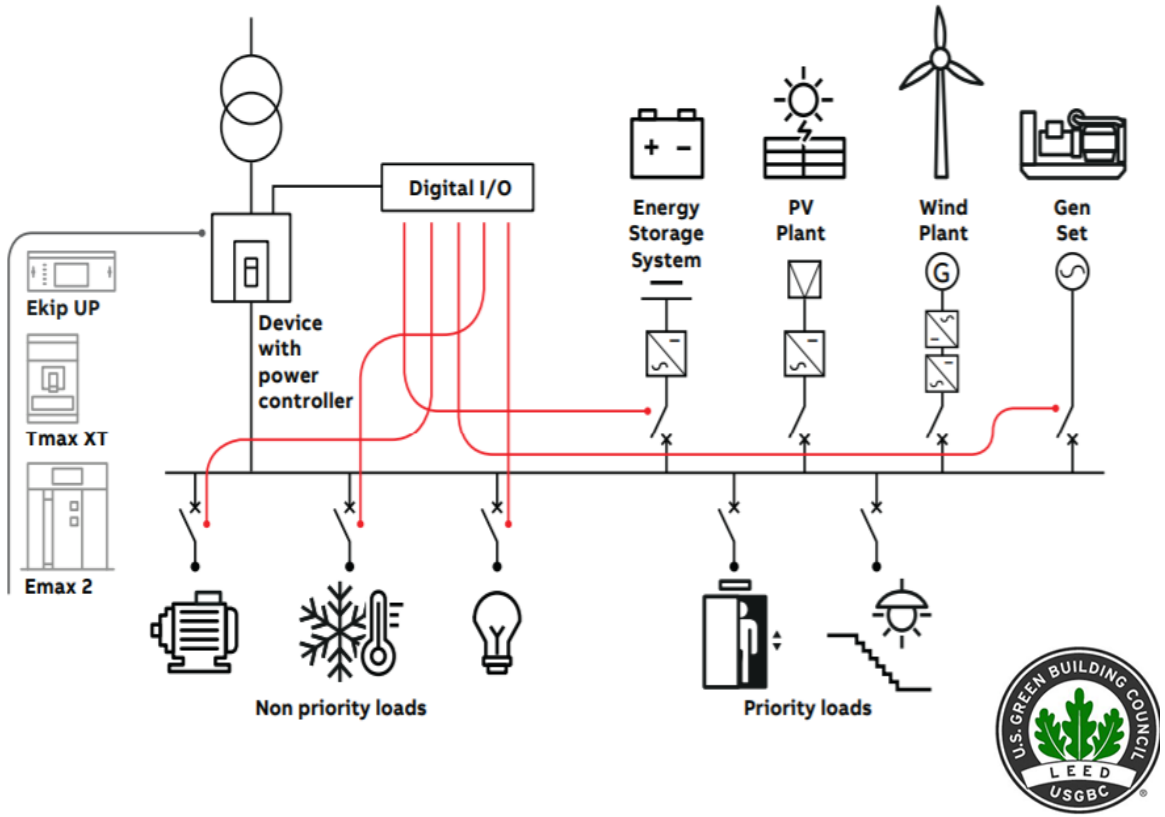
Power Controller

Nowadays **Ekip Power Controller** enables engineers to quickly design peak shaving function by managing different loads and generators.

Based on consumption forecast it allows listed loads to be controlled through the remote command of the relevant switching device.

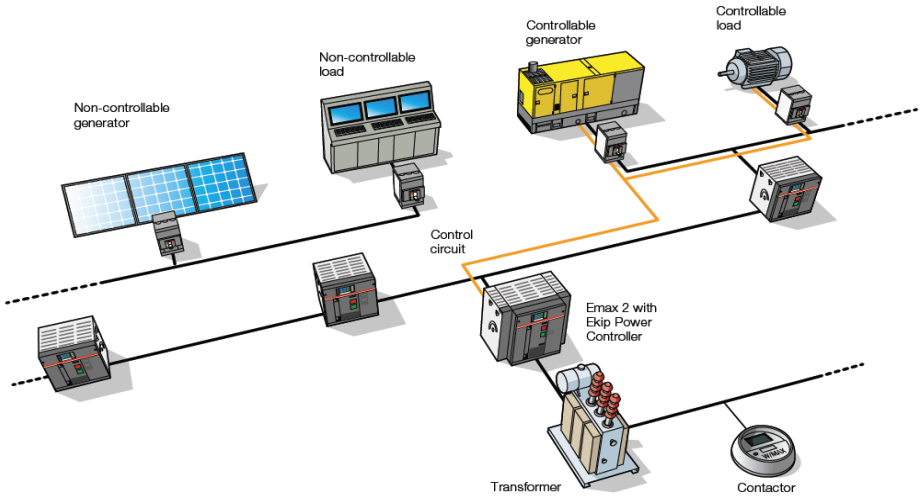
In SACE building the power controller has been easily applied for partializing the HVAC system and for the EV charging stations, when the loads demand is reaching the maximum power set, adding 3 points to the count.

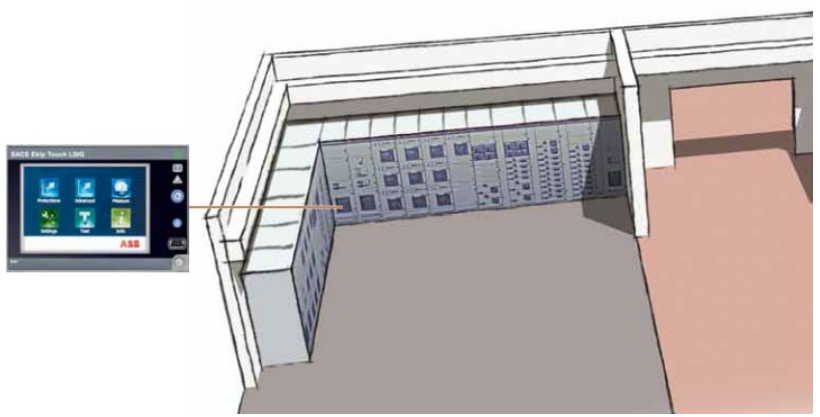
Ekip Power Controller strongly contributes to obtain points also for LEED certification.



Energy Efficiency & Save up energy bills

Taking advantage of the smart management solution





Solution :
Controller is the ideal solution for load management and provides the optimum balance between **reliability, simplicity** and **cost-effectiveness**.

For applications in industrial plants, buildings and smart cities:

- Allows savings on electricity bills from Peak hour or Peak Demand Charge
- Reduces power management costs, no additional monitoring system
- Simple to install and Ready to use
- High flexibility: up to 15 loads and/or generators

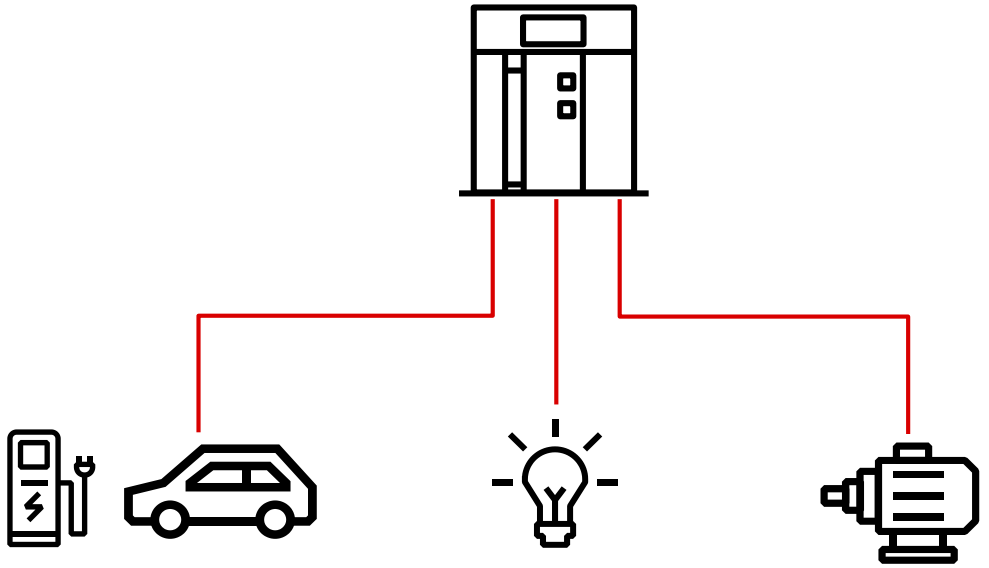
ABB Ability - Power Controller

Type of loads managed

Ekip Power Controller works by managing the loads to limit average power use.

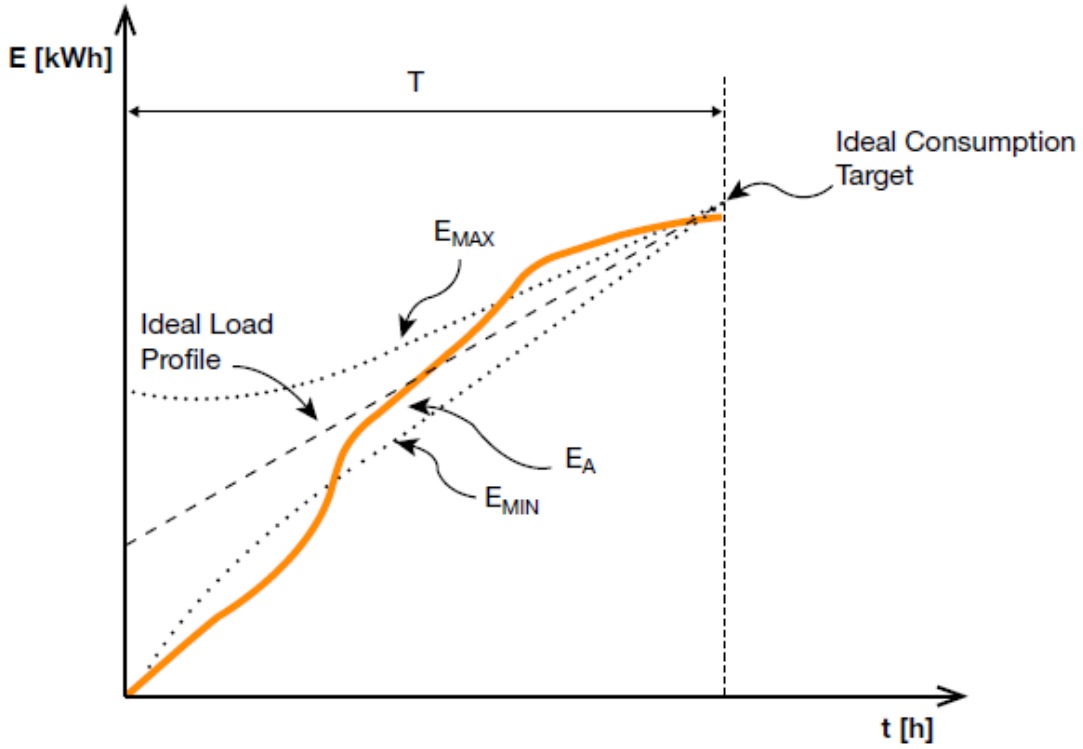
The types of loads that can be managed include:

- Thermal and refrigerating loads
- Lighting apparatus
- Delayed start loads
- Charging systems for electric vehicles
- Generators



Power Controller

The algorithm



The software examines the trend of the curve up to the current moment and evaluates the energy consumption at the end of the period

The evaluation phase divides the plane t,E in 3 zones, indicative of *acceptable consumption, high consumption* and *reduced consumption*

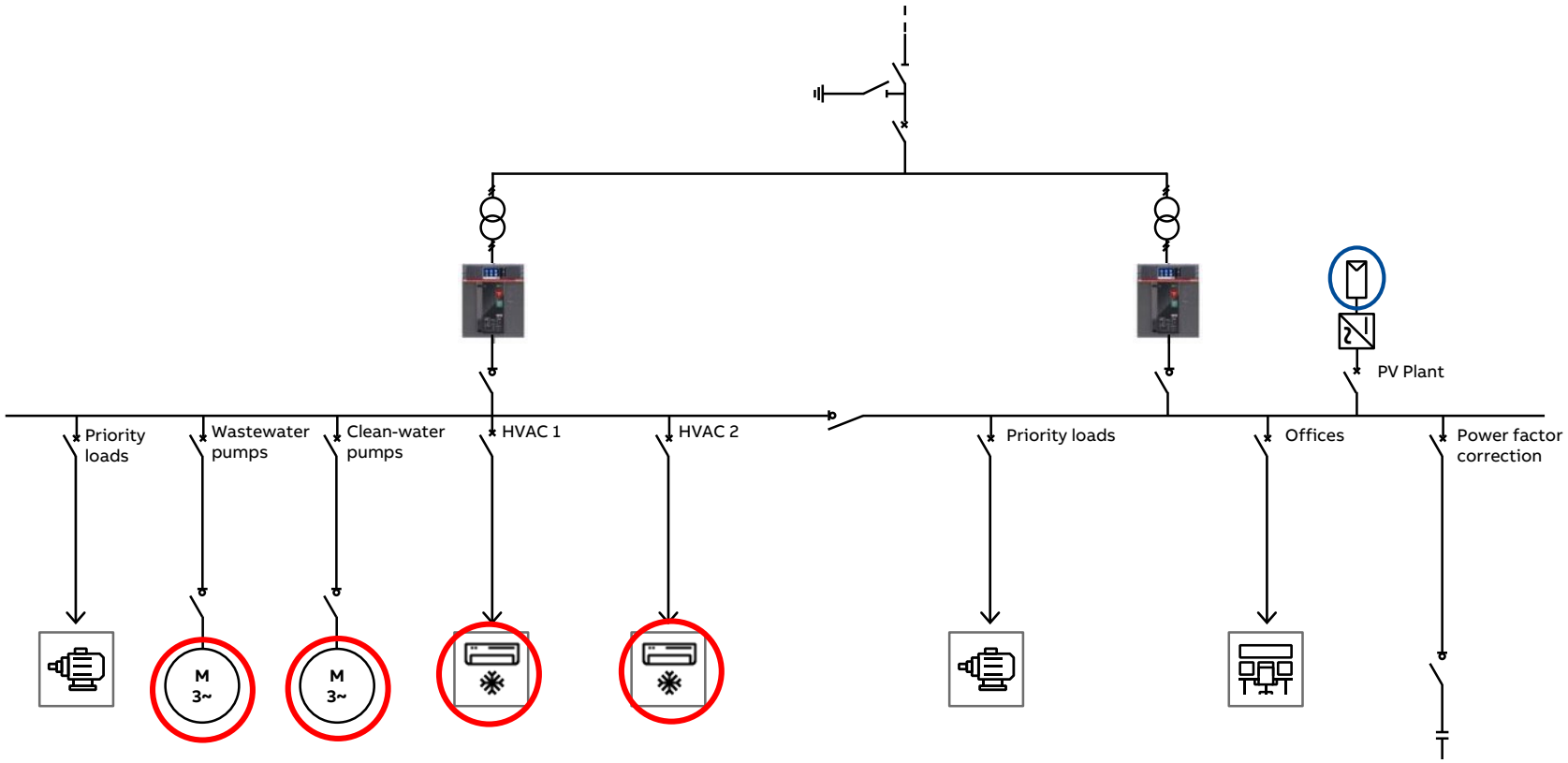
The algorithm tends to “guide” the energy-time line

The dotted lines (E_{MIN}, E_{MAX}) represent the boundaries among the 3 regions: whenever the curve crosses one of such boundaries, the algorithm reacts with load connection or disconnection

The 3 zones are separated by curves optimized by the software according to the number of loads and so as to permit the instantaneous power to exceed the maximum allowed level

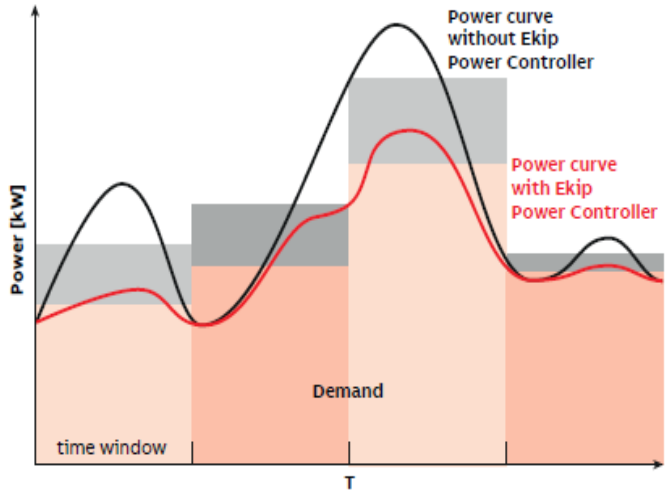
Building

Study Case Example



Cost reduction of

up to 20%



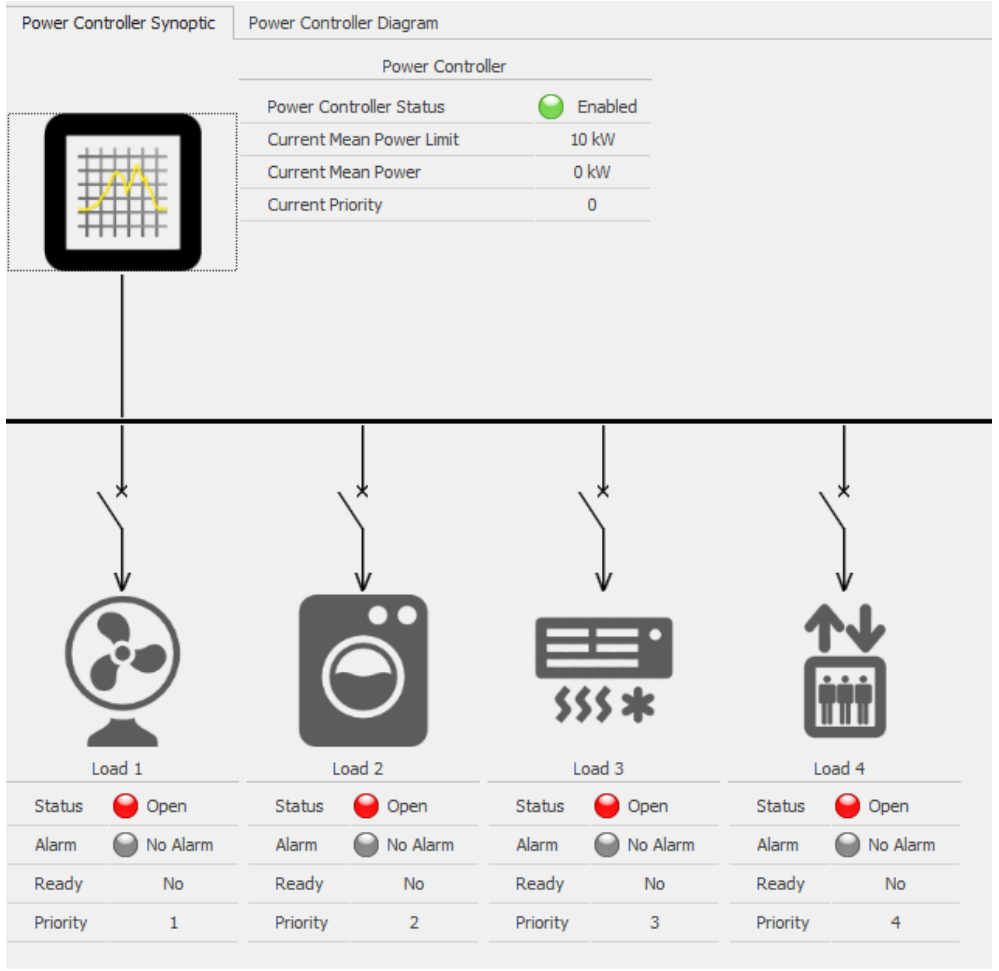
Settings

Ekip connect 2- Power Controller Wizard

To initiate the Power Controller, the user may set a list of parameters:

- Enable/ disable
- Power limits
- Week scheduling
- Saturday scheduling
- Sunday scheduling
- Synch configuration
- Start-up behavior

- Connection type
- Open/closed input
- Optional input
- Enable/disable
- Shed priority
- Ton_min
- Toff_min
- Toff_max
- User type
- Nickname



Energy Efficiency in Electrical System

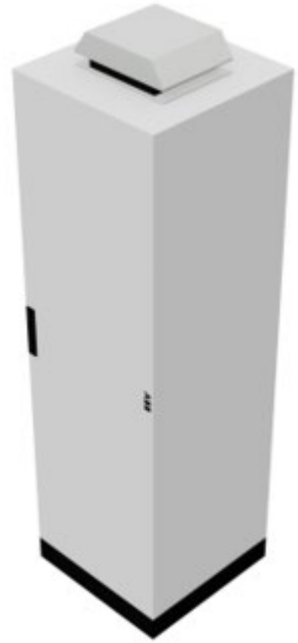
Power factor correction

Parameter PM01: Power factor

Value of the power factor	Points for industrial building	Points for commercial building	Points for infrastructure
< 0,85 or no measurement	0	0	0
≥ 0,85 and < 0,90	1	1	1
≥ 0,90 and < 0,93	2	2	2
≥ 0,93 and < 0,95	4	3	4
≥ 0,95	6	4	6

SACE Building points achieved: 4

The power module **PMOD** has a standard range from 220V until 690V and ratings starting from 6.25 kvar
up to 100 kvar in one module
(option with de-tuning reactor included up to 50 kvar),
reaching up to 400 kvar (without reactors)
or 300 kvar (with detuning reactors) per cubicle.



The **System Pro E Power**, innovative ABB main distribution switchboard solution,
is perfectly coupled with the capacitor bank unit,
for a perfect integrated solution.

Energy Efficiency in Electrical System

Energy Storage

Parameter BS02

R_{PES}	Points for industrial building	Points for commercial building	Points for infrastructure
< 1 %	0	0	0
≥ 1 % and < 5 %	1	1	1
≥ 5 % and < 10 %	2	2	2
≥ 10 %	3	3	3

R_{PES} is the ratio between:

– maximum power storage sources;
– total annual electrical energy consumption of the installation divided by 360 days.

SACE Building points achieved: 1

Energy Efficiency in Electrical System

IEC 60364-8-1 Annex B

Efficiency classes

To each efficiency measure is assigned a score, the sum of all points for an installation determines the efficiency class.

Table B.1 – Electrical installation efficiency classes

Electrical installation efficiency classes	Total number of points			
	for Residential	for Industrial	for Commercial	for Infrastructure
Class EE0	from 0 to 14	from 0 to 19	from 0 to 18	from 0 to 18
Class EE1	from 15 to 30	from 20 to 38	from 19 to 36	from 19 to 36
Class EE2	from 31 to 49	from 39 to 63	from 37 to 60	from 37 to 59
Class EE3	from 50 to 69	from 64 to 88	from 61 to 84	from 60 to 83
Class EE4	from 70 to 89	from 89 to 113	from 85 to 108	from 84 to 106
Class EE5	90 or more	114 or more	109 or more	107 or more

Energy Efficiency Electrical System

Value Proposition

Advantages of the integrated system **in** operation:

- **Compliant with environmental standards**
- **Efficient facility management**
- **Reduced operating costs**
- **Increasing building efficiency and safety**
- **Increase in property value**

The system can be expanded almost indefinitely over its entire service life.