



SEPTEMBER 2020

Smart low voltage electrical distribution

Intelligent Distribution webinar series

Speakers



Lionel Ng

Global Training Specialist
ABB Electrification Business Area
Smart Power Division



Aleksandar Grbic

Global Application Specialist
ABB Electrification Business Area
Smart Power Division



Davide Brundu

Global Product Manager - Air circuit-breakers
ABB Electrification Business Area
Smart Power Division



Alberto Sannino

Market developer – ABB Ability™
ABB Electrification Business Area
Smart Power Division

Agenda

- New trends and importance of installation monitoring
- New standards and certifications
- Benefits of metering and monitoring solution implementation
- Smart electrical components
- Intelligent metering and monitoring systems
- Flexible solutions for new and existing installations: Application examples

New Trends

Technologies which are changing the world we know



2019 *This Is What Happens In An Internet Minute*



Cloud computing, big data, internet of things (IoT), artificial intelligence (IA), industry 4.0 are phenomenon which are changing the approach to the electrical distribution as we know it today

Importance of energy efficiency in electric installation

Market trends

Global building & infrastructure sector is responsible for almost



40%
of energy consumption



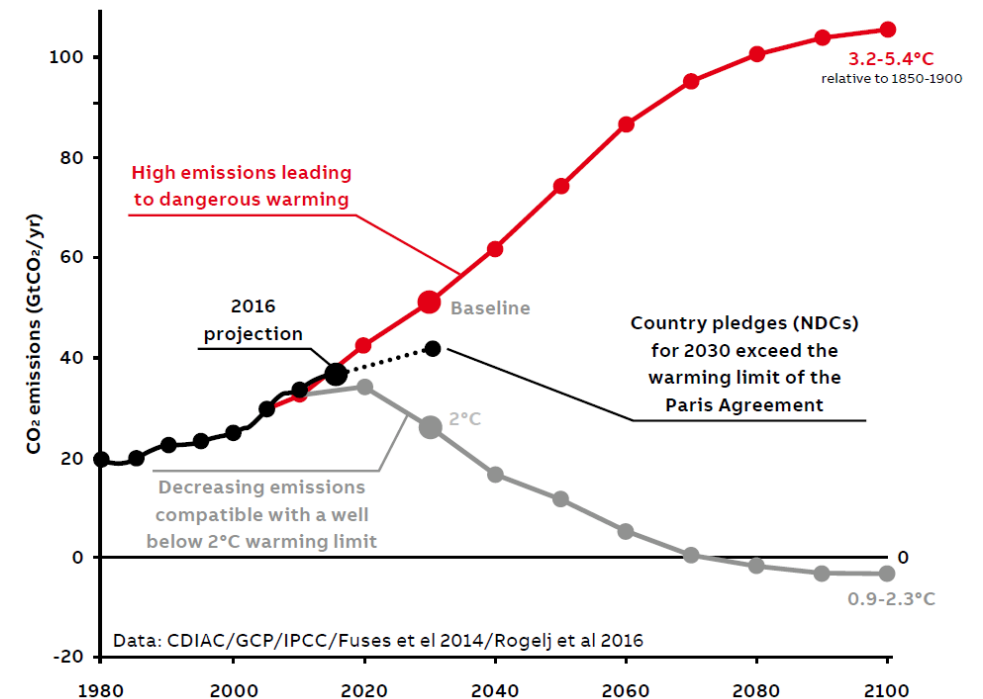
36%
of CO2 emission

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**



Evolution of the electrical distribution

Distributed electrical energy generation

Microgrid concept

Electric grid is adopting a microgrid concept, to allow local electric energy production, very often from renewable sources. Companies are starting to manage electricity on their own



Aperace of the green factories

Sustainability and energy efficiency are main drivers

Future of factories

Circular economy, sustainability and energy efficiency are the key to be considered by the factories of the future. The new factories are using more energy from renewable sources, reducing waste and implementing processes to maximize the resource utilization



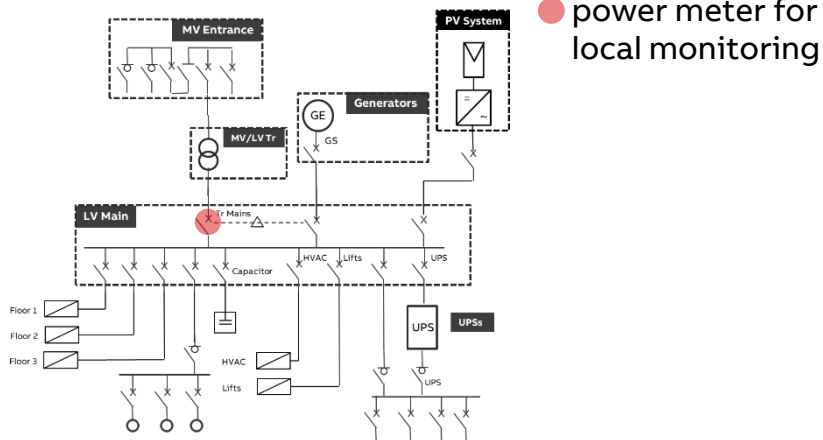
Metering and monitoring systems

Trends and requirements

In the past

1 external power meter for local monitoring of the electrical installation with high accuracy

If necessary, additional meters with the local monitoring



● power meter for local monitoring

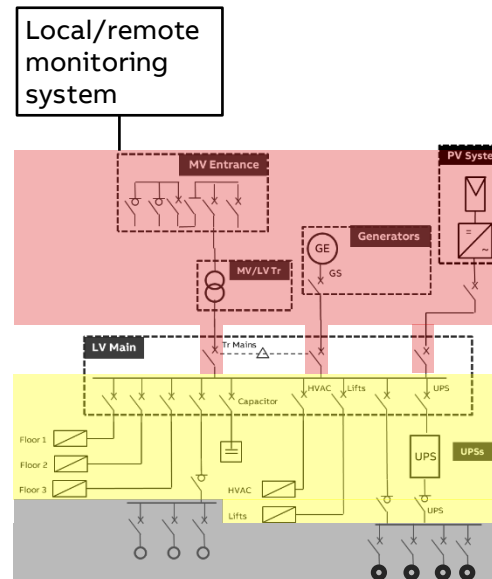
Today

Additional metering devices along the distribution with high and mid/high accuracy and local monitoring system

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

Basic Power Monitoring:
P, Q, S, Ea, Er, Eap, f, I, IN, U and/or V, PF

Energy monitoring:
Ea

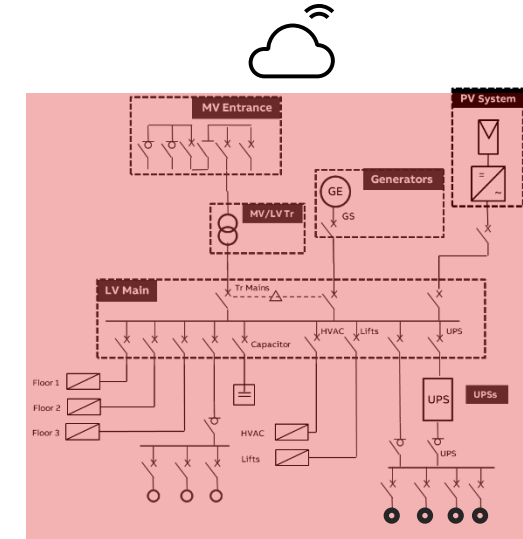


In the near future

All the electrical parameters to be measured with high accuracy

Devices exchanging the information among them and with cloud

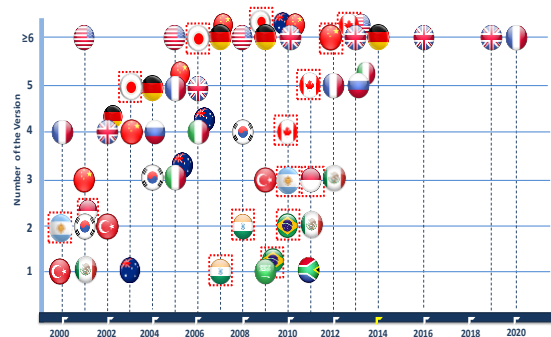
Advanced power monitoring and network performance



Certification & Standard

- **ISO 50001 Energy management systems – Requirements with guidance for use (ISO 50001:2018)**
- **IEC 60364-8-3 ed. 1 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**

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



- 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 come mostly from renewable energy sources

Energy Star

U.S. GREEN BUILDING COUNCIL
LEED
USGBC

GREEN
GLOBES

ASHRAE

iea International Energy Agency

BREEAM

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

What is ISO 50001

Introduction

ISO 50001 is an international voluntary standard for energy management

A continuous improvement model is divided into four steps: Plan, do, act and check

ISO 50001 is based on the same management system model used for ISO 9001 and 14001. This compatibility makes it easier for organizations to integrate energy management into their quality and environmental management efforts

However, ISO 50001 adds new data-driven sections related to **energy planning, operational control and measuring and monitoring**



ISO 50001

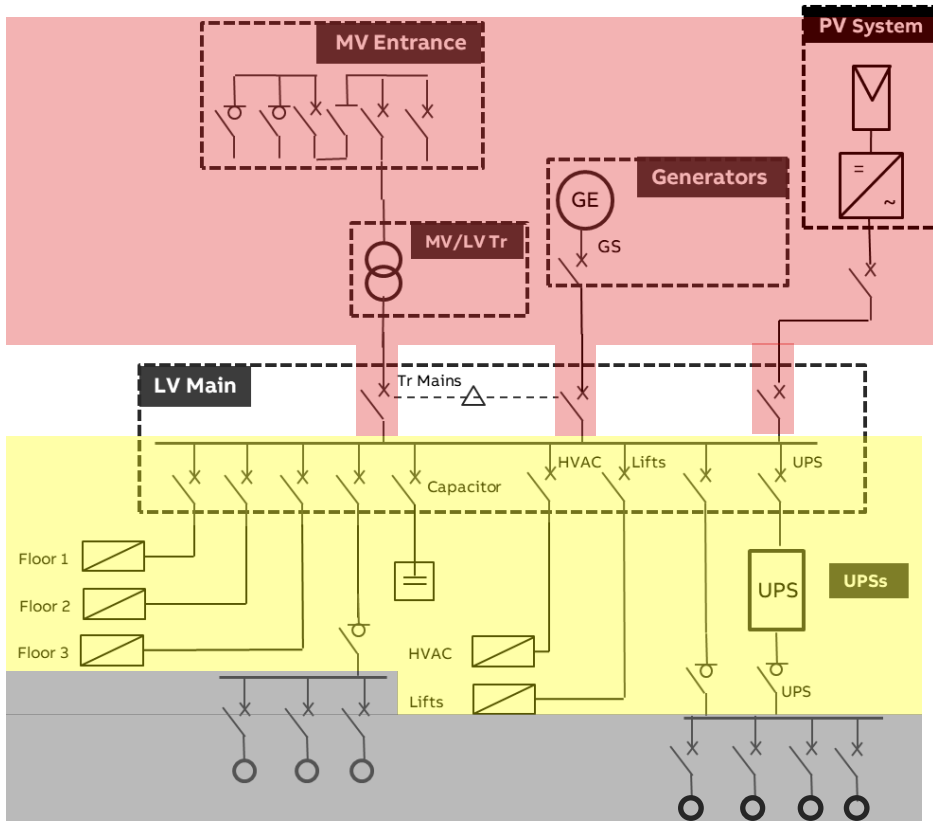
Benefits¹

By achieving certification to this international, best-practice Energy Management standard, customers' organization will accrue some of the numerous benefits of ISO 50001, including:

- Energy reduction, even up to 10% within first 12 months
- Reduced greenhouse gas (GHG) emissions and carbon footprint
- Globally recognized International Standard
- Assist in compliance with current and future voluntary and/or mandatory energy efficiency targets
- Improved corporate image and credibility among customers, clients and stakeholders
- Informed decision-making processes from system design to operation and maintenance
- Increased energy awareness among staff members at all levels
- Improved operational efficiencies and maintenance practices

Recommendation from IEC 60364-8-1

Metering requirements



- For the incoming part of the facility it is necessary to have the most detailed monitoring of all electrical parameters

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

-
- Less details is necessary for the sub distribution part

Basic Power Monitoring:

- P, Q, S, Ea, Er, Eap, f, I, IN, U and/or V, PF

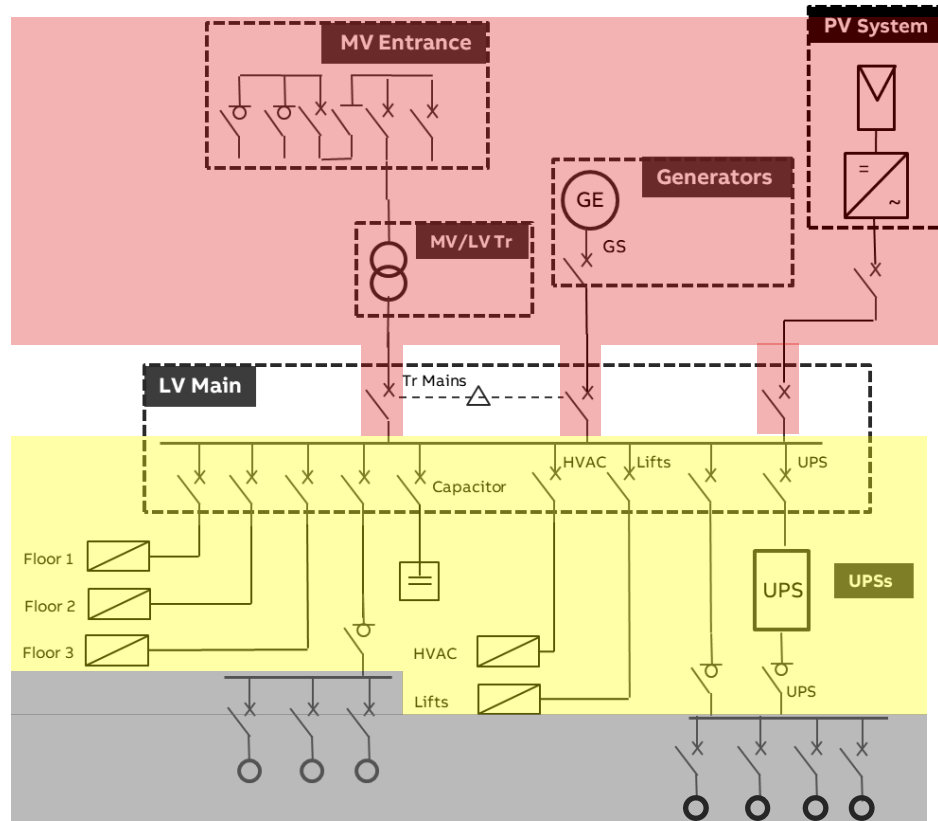
-
- Only the monitoring of the energy is required for the final distribution

Energy Efficiency:

- Ea

Smart metering devices

ABB solution for metering requirements



Metering devices

- Circuit breakers: Emax 2 and Tmax XT
 - Digital Relay: Ekip UP
 - ATS: TruONE
 - Fusegear: InLineII ITS2
-
- Circuit breakers: Emax 2 and Tmax XT
 - ATS: TruONE
 - Fusegear: Slimline XRG and InLineII ITS2
 - ITS2 with OS and OT switches
 - UPS
 - Network Analyzers: M4M 20 and M4M 30
-
- Circuit Monitoring System: System pro M compact® InSite
 - Network Analyzer: M4M 20
 - EQ meters



Smart Metering and Monitoring

The winning choices to make your distribution system more efficient

Our Value Proposition

ABB smart solutions for metering and monitoring are flexible and grant a **7% improvement in energy efficiency**, ensuring access to **LEED Certifications** and allowing a **payback time of less than 3 years**. Furthermore, you can connect your facility to the cloud in 10 minutes, start monitoring the entire electrical system and satisfy demanding new international standards and regulations



Measurement Accuracy

Importance of accurate measurements

Why does accuracy matter?

- To identify the inefficiencies within electrical distribution
 - Measuring losses on highly efficient electrical equipment (e.g. 98%) with non accurate devices (e.g. class 2) will not provide any valuable information
- To identify inefficiencies on a component level
 - Component inefficiency can be recognized immediately by having precise and accurate information
- To make right decisions to improve energy efficiency
- To avoid unnecessary actions
 - Having inaccurate information can lead to actions which are not based on accurate and correct information, risking to make inefficient investment



Data & Measurements

Measurements certified according to IEC61557-12

Guaranteed accuracy

This specifies the limits of the power metering and monitoring devices (PMD) uncertainty, over the specified measuring range, under reference conditions

Defined measuring range

This specifies the minimum and maximum values of quantities between which the limits of measurement uncertainty are defined

Influence quantities

These are environmental quantities (temperature, climatic conditions, electromagnetic perturbations / EMC, etc.) that may happen in harsh conditions encountered in switchboards or electrical cabinets. The standard specifies maximum permitted variations of accuracy due to those influence quantities

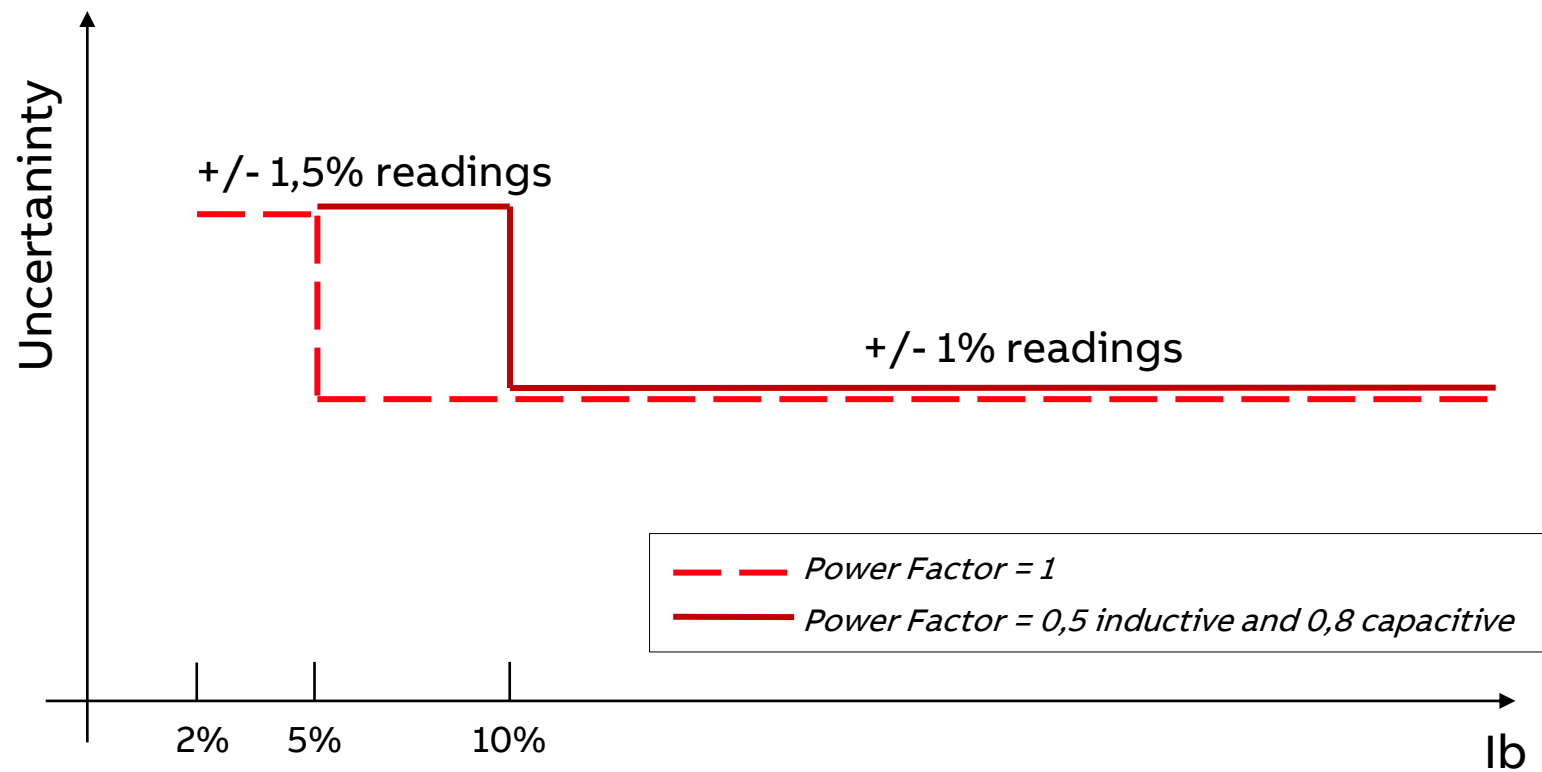
Zero-blind measurements

To ensure reliable and accurate measurements, IEC 61557-12 requires zero blind measurements (i.e. gapless measurements) for several quantities, particularly for energy measurements. This means that sampling shall be performed continuously, not from time to time (i.e. with gaps)

Performance classes defined in IEC 61557-12

Data & Measurements

Class 1 measurements certified according to IEC61557-12



With Ekip Touch trip unit platform with 1% accuracy is possible to measure down to 0,4% of the I_n :

- *i.e. with an XT2 Hi-Touch 100A the lowest measurable values is 0,4A*

Smart metering devices

Same user experience over the whole range of protection devices



Emax 2 and Tmax XT new generation of trip units offer same user experience over the whole range of circuit breakers from 160A up to 6300A

New trip units provides:

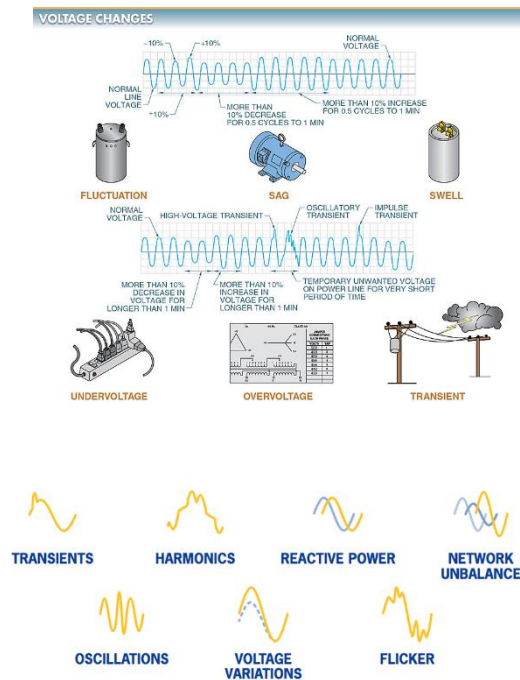
- **Class 1** measurements certified according to IEC61557-12
- **0.5%** accuracy for Current and Voltage measurement
- **1%** accuracy for Power and Energy measurement

Power Quality Analysis

Fundamentals

Power Quality Causes

Equipment	Power quality disturbances	
	Source	Victim
Motor	X	X
Motor Starting		X
Variable Speed Drives	X	X
Transformers	X	X
Capacitor bank	X	X
Generator set		X
UPS	X	
Lighting	X	X
Cables		X
PLC		X
Office equipment	X	X
Circuit breaker		X



Power Quality Consequences

- Unexpected power supply failures (breakers tripping, fuses blowing)
- Equipment failure or malfunctioning
- Equipment overheating (transformers, motors, ...) leading to their lifetime reduction
- Damage to sensitive equipment (PC's, production line control systems, etc.)
- Electronic communication interferences
- Increase of system losses
- Need to oversize installations to cope with additional electrical stress with consequential increase of installation and running costs and associated higher carbon footprint
- Penalties imposed by utilities because the site pollutes the supply network too much
- Connection refusal of new sites because the site would pollute the supply network too much

Power Quality Analysis

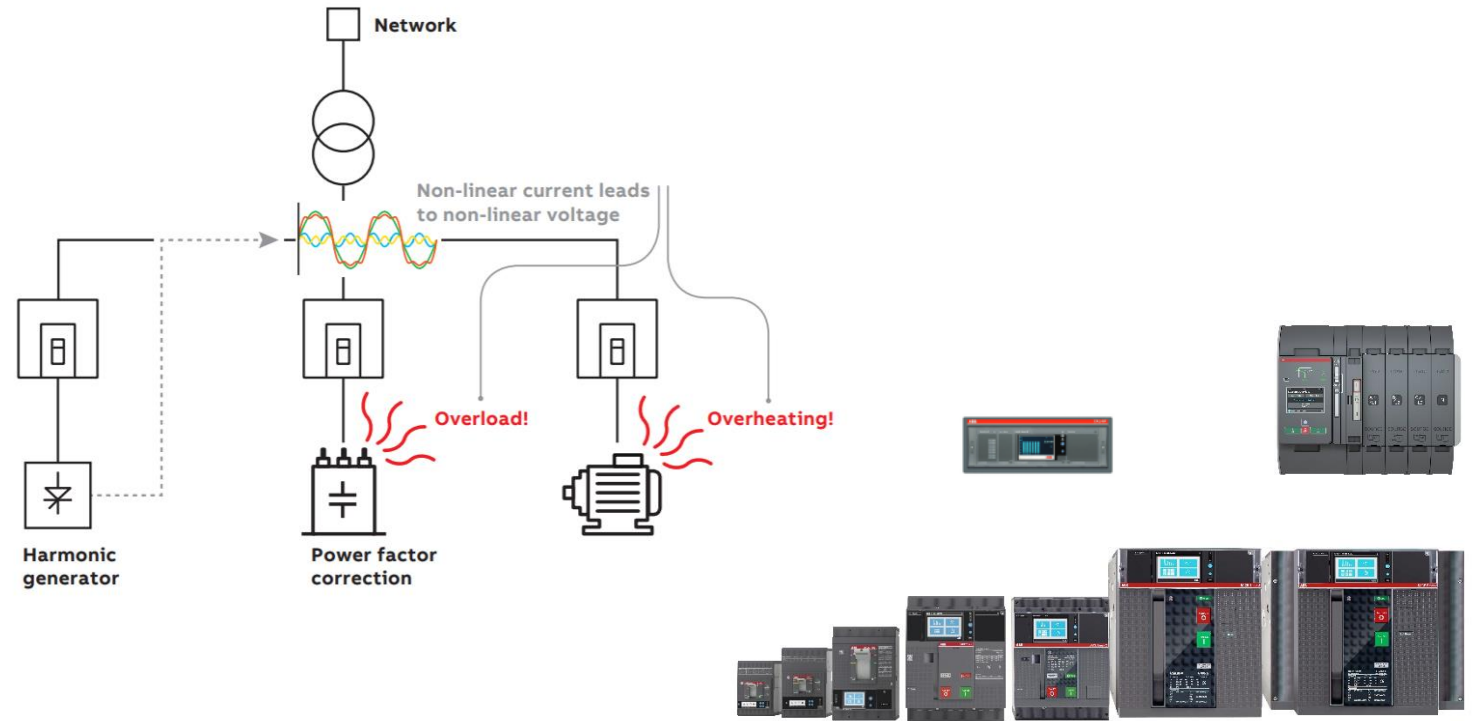
Embedded Network Analyzer

Ease to analyze power quality

By using only switching devices in the installation it is easy to detect power quality issues and take actions to improve the quality of the energy, thus minimizing the energy losses and potential failures

All the following parameters are continuously monitored:

- Harmonic analysis (up to 50th harmonic)
- Hourly average voltage values
- Short voltage interruption
- Short voltage spikes
- Slow-voltage sags and swells
- Voltage unbalances

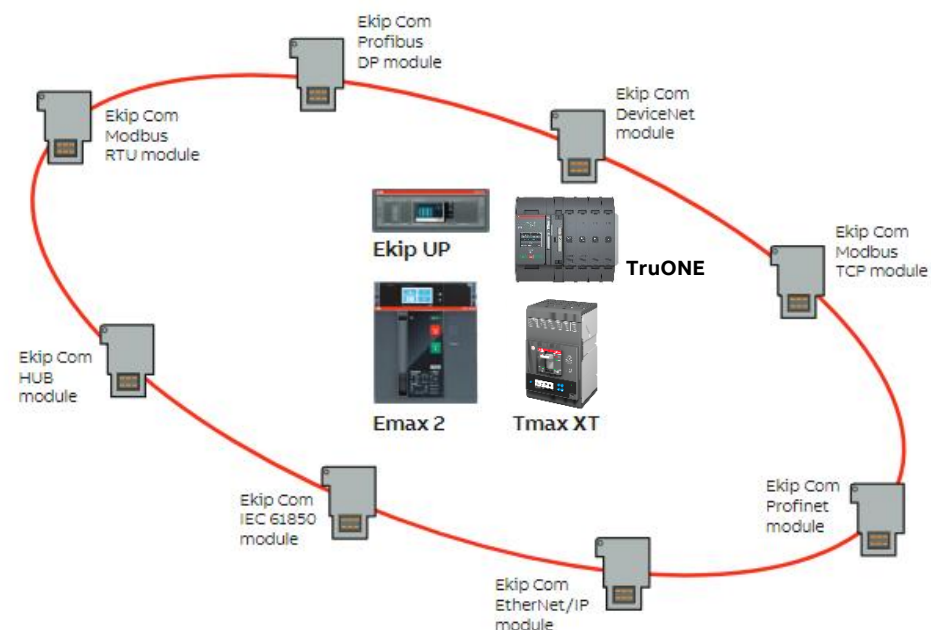


Device Connectivity & Communication

Flexible solution for any application

Emax 2, Tmax XT (new generation), Ekip UP and TruONE ATS devices are embedded with several native communication protocols to allow interconnection among all ABB devices as well as 3rd party devices

- Ekip Com Modbus RTU
- Ekip Com Profibus DP
- Ekip Com DeviceNet
- Ekip Com Modbus TCP
- Ekip Com ProfiNet
- Ekip Com Ethernet/IP
- Ekip Com IEC 61850*
- Ekip link*
- Ekip Com Hub
- Ekip Signalling (2K, 4K* and 10K**)
- E-Hub 2.0**

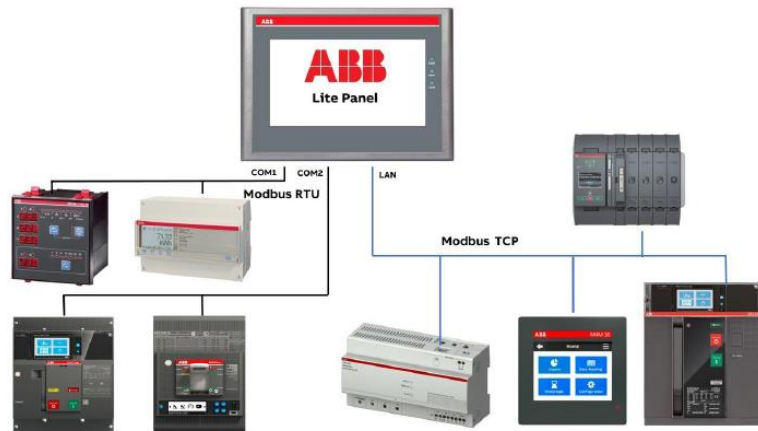


Local monitoring and control of the installation

Flexible solution to fit all installation requirements

Lite Panel

It is a local control panel of 7 inches that can monitor and control max 20 devices connected via Modbus TCP/IP or Modbus RTU



Ekip Connect 3

Ekip Connect is the ABB programming and commissioning software tool that allows the user to unlock the full potential of ABB devices



EPiC commissioning tool

ABB devices with **Bluetooth module** for complete compatibility with unique EPiC commissioning tool



Remote monitoring of the installation

Start monitor in 10 minutes

ABB Ability Energy and Asset Manager cloud based monitoring

- Easy integration
- Remote supervision of facility
- Interactive images through tags & markers
- Alerts management: reduce downtime & improve efficiency
- Scheduled reports
- Power quality (THD)
- Data storage

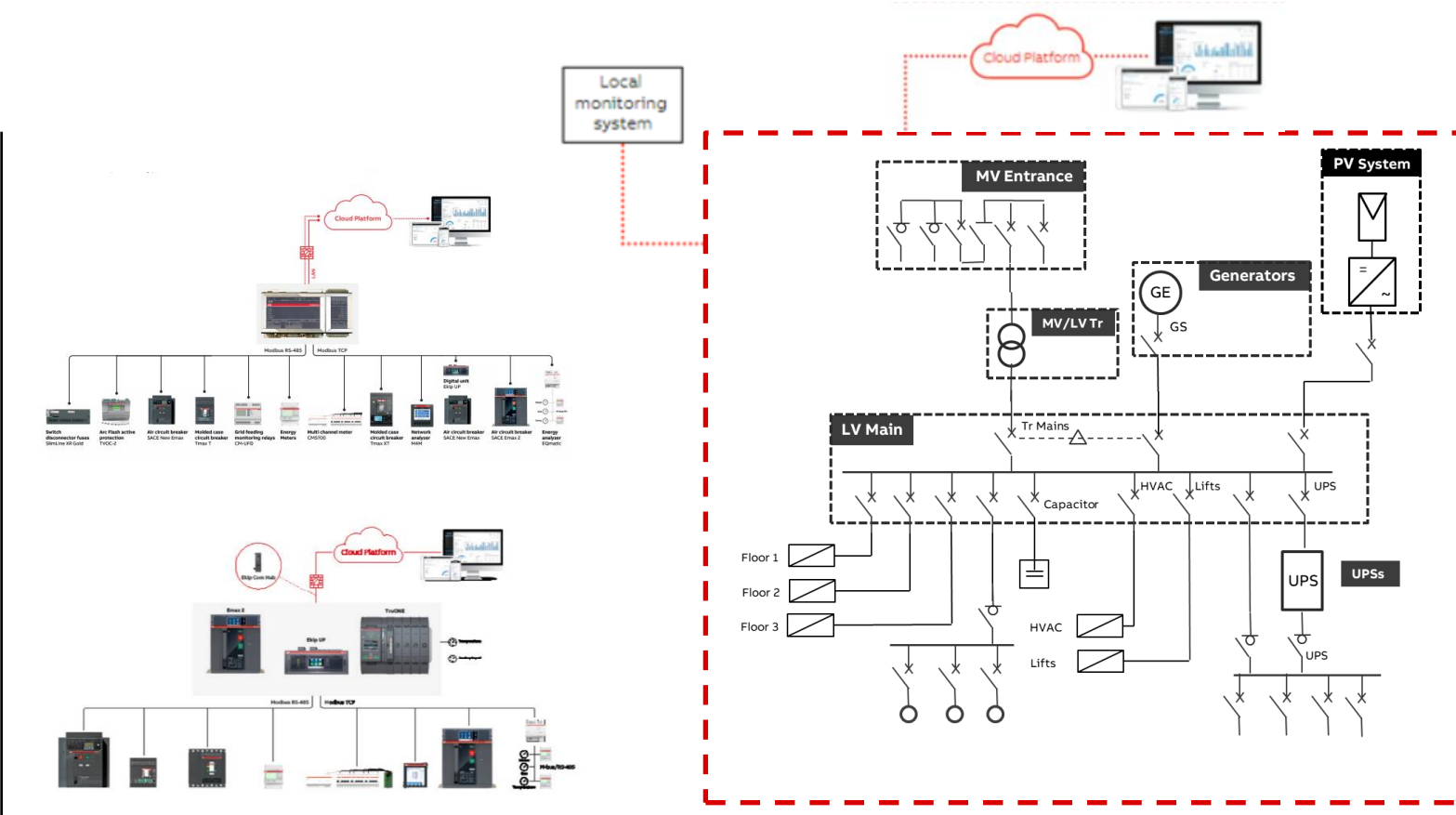
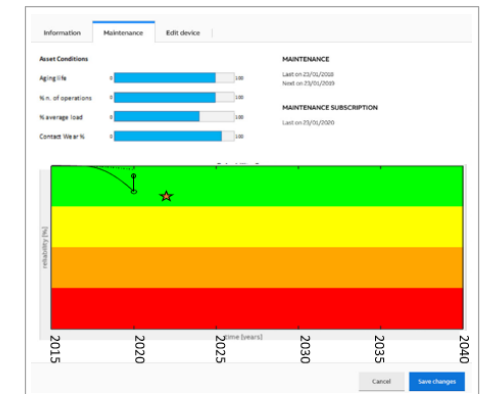
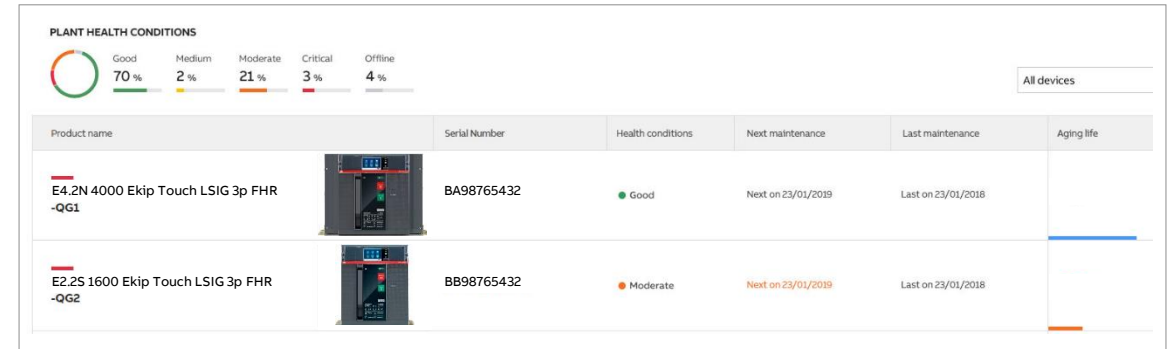


ABB Ability™ Energy and Asset Manager

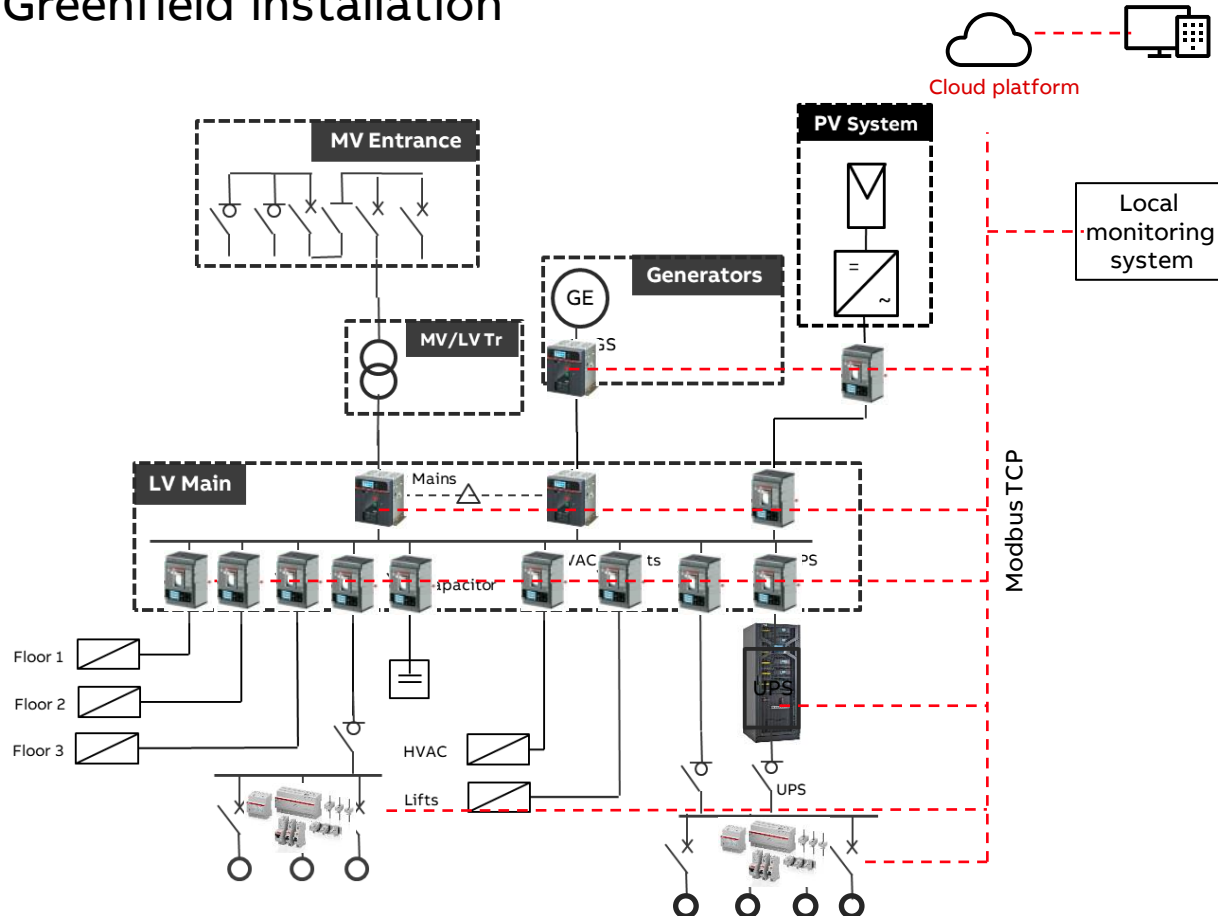
Predictive maintenance

- Overall plant health conditions
- Smart visualization (traffic light) to monitor the system at a glance, with proactive alerts
- Operation and Maintenance cost saving thanks to optimized maintenance schedule
- Spare parts management: you know exactly what you need, no waste of time
- Reduced downtime
- Based on an algorithm that considers:
 - Environmental conditions
 - Utilization conditions
 - Circuit breaker Aging
 - Measures (humidity/vibration/temperatures)



Application example 1

Greenfield installation



Easy monitoring of a new installation

Fast and easy solution to implement **metering** on all electrical distribution levels

Just by using switching devices it is possible to have a **complete installation overview**

Using the embedded **Modbus TCP** communication protocol the device data can be immediately collected and transferred to any monitoring and/or control system

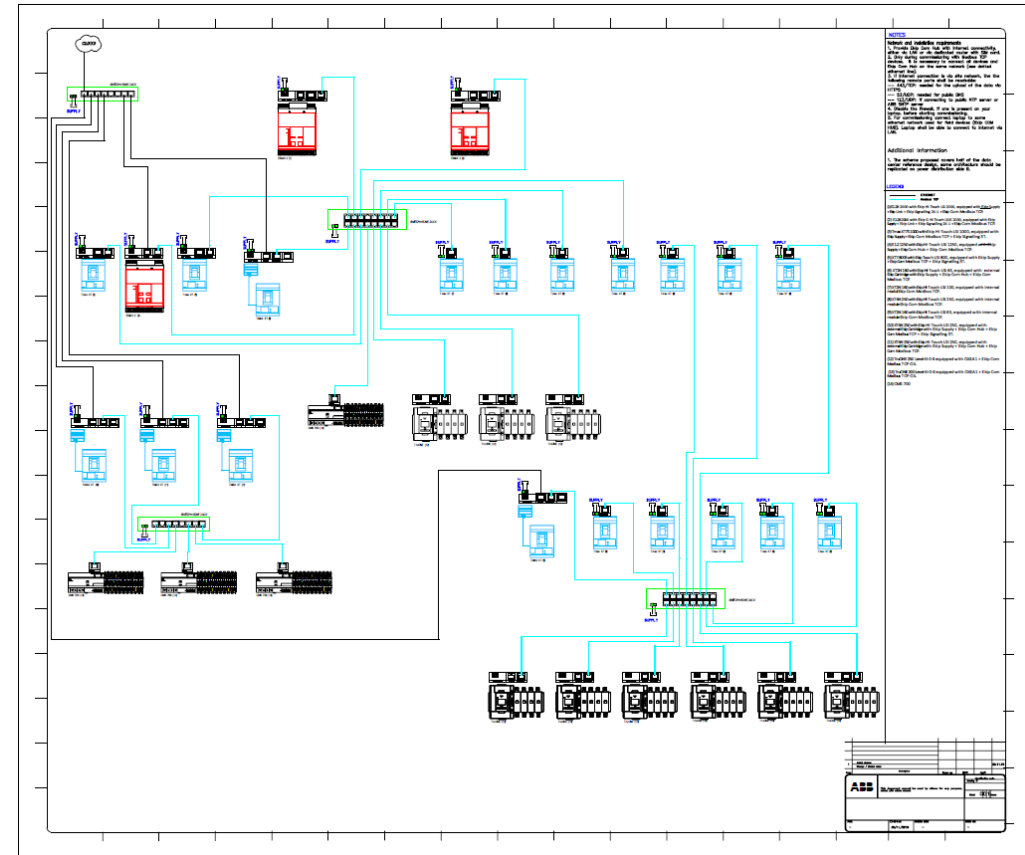
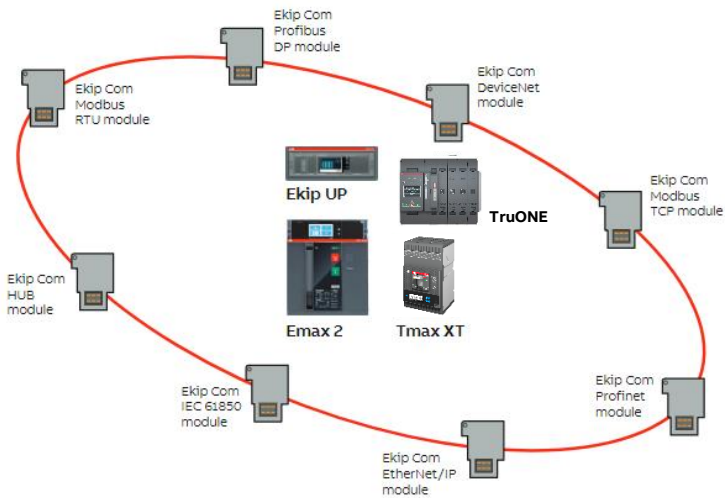
By adding the gateway **E-Hub 2.0** (din rail mounted) or **Ekip Com Hub** (embedded on devices) in 10 minutes it is possible to connect to **ABB Ability EDCS cloud platform** and start plant monitoring

Design and build new smart switchboard

We make connectivity simple

Simplest hardware for monitoring

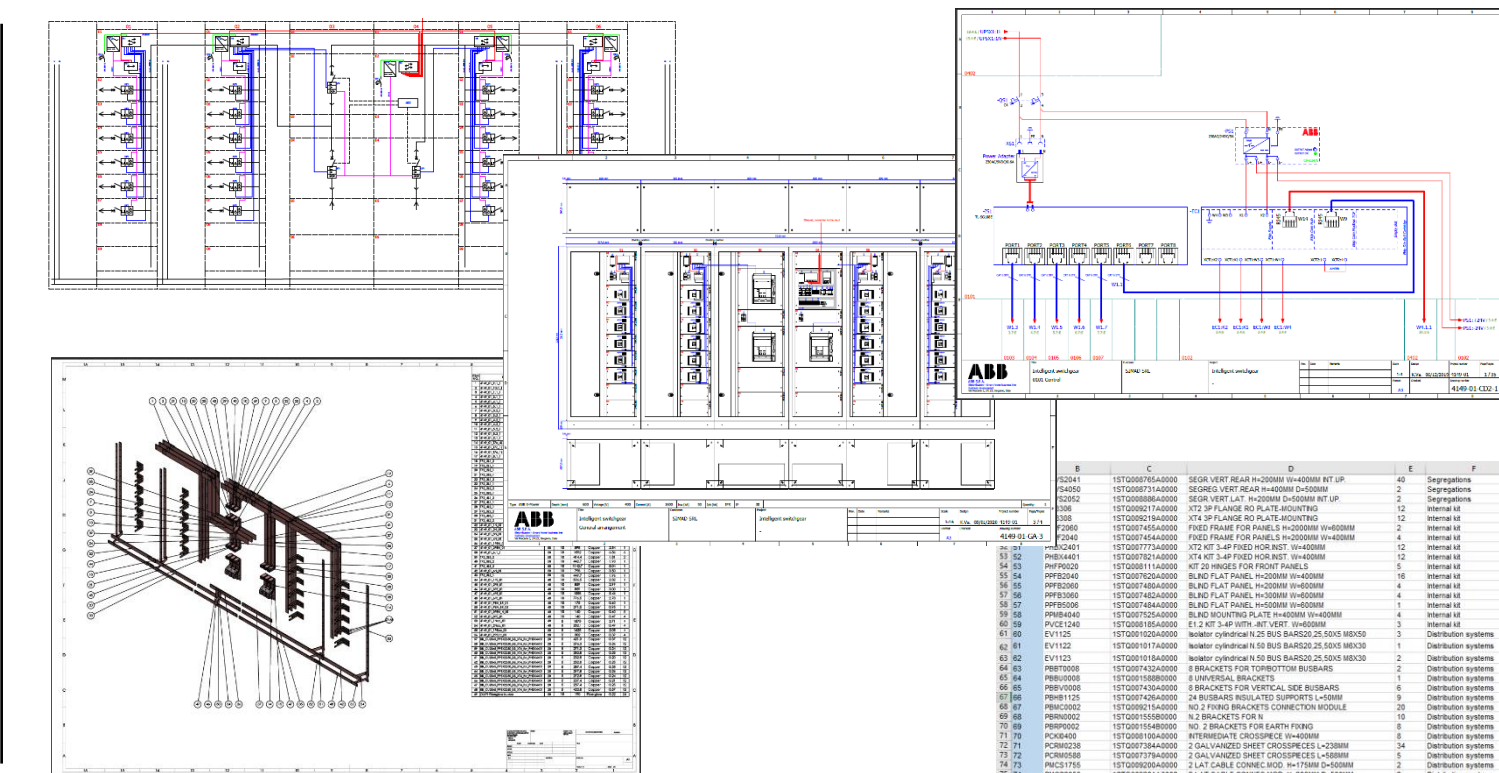
Thanks to ABB unique solutions connection between devices is very simple and immediate



Full documentation for an easy design

ABB smart switchgear solutions

- Fully type tested and ABB proven
- Simple to realize offering up to 66% less cables and up to 10% less connectivity components
- Sustainable, offering from 7% up to 20% energy efficiency improvements
- Reliable and simple to maintain offering up to 36% less maintenance cost
- Future proof, offering upgradability without physical intervention on the switchgear



Largest Swiss rice mill monitors energy distribution digitally

la riseria

APPLICATION

Food processing plant

COUNTRY / CUSTOMER / SITE

Switzerland / La Riseria / Ticino

CUSTOMER NEEDS

M-Industrie has set sustainability targets that require significant advances in energy efficiency. More precise monitoring of the power consumed in every part of its operations is key. ABB Ability EDCS enables plant operators to access this data anytime, anywhere

SOLUTION

- ABB's EDCS
- Two low-voltage distribution boards
- Emax 2 circuit breakers, Tmax T4 and T5 molded case circuit breakers
- CMS-700 circuit monitoring sensors

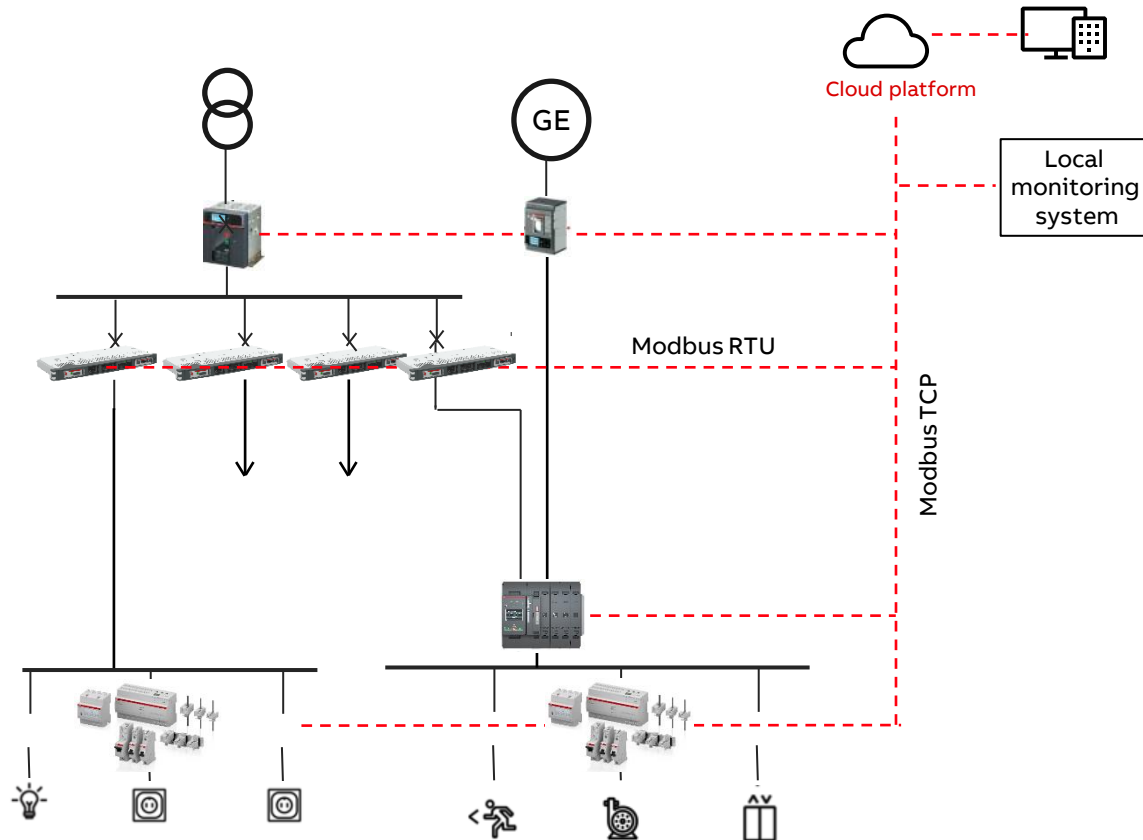


[Link to online story](#)



Application example

Greenfield installation with switches and fusegear



Easy monitoring of a new installation

The same principle, explained in example 1, to have metering monitoring and control is valid also for installation with **fuses** and **transfer switching devices**

Fast and easy solution to implement **metering** on all electrical distribution levels

Just by using switching devices it is possible to have a **complete installation overview**

Using the embedded **Modbus TCP** and **Modbus RTU** communication protocol the device data can be immediately collected and transferred to any monitoring and/or control system

By adding the gateway **E-Hub 2.0** (din rail mounted) or **Ekip Com Hub** (embedded on devices) in 10 minutes it is possible to connect to **ABB Ability EDCS cloud platform** and start plant monitoring

Upgrading solutions: tailored according to needs

Our offer



1. Light upgrade

Once you have a new digital enable product, add further digital functions or solutions

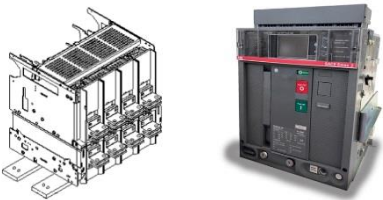
- No downtime
- No impact on the electrical installation



2. Medium upgrade

Unlock digital functionalities by digitally enabling the products

- No or minimal downtime
- Very light impact on the electrical installation



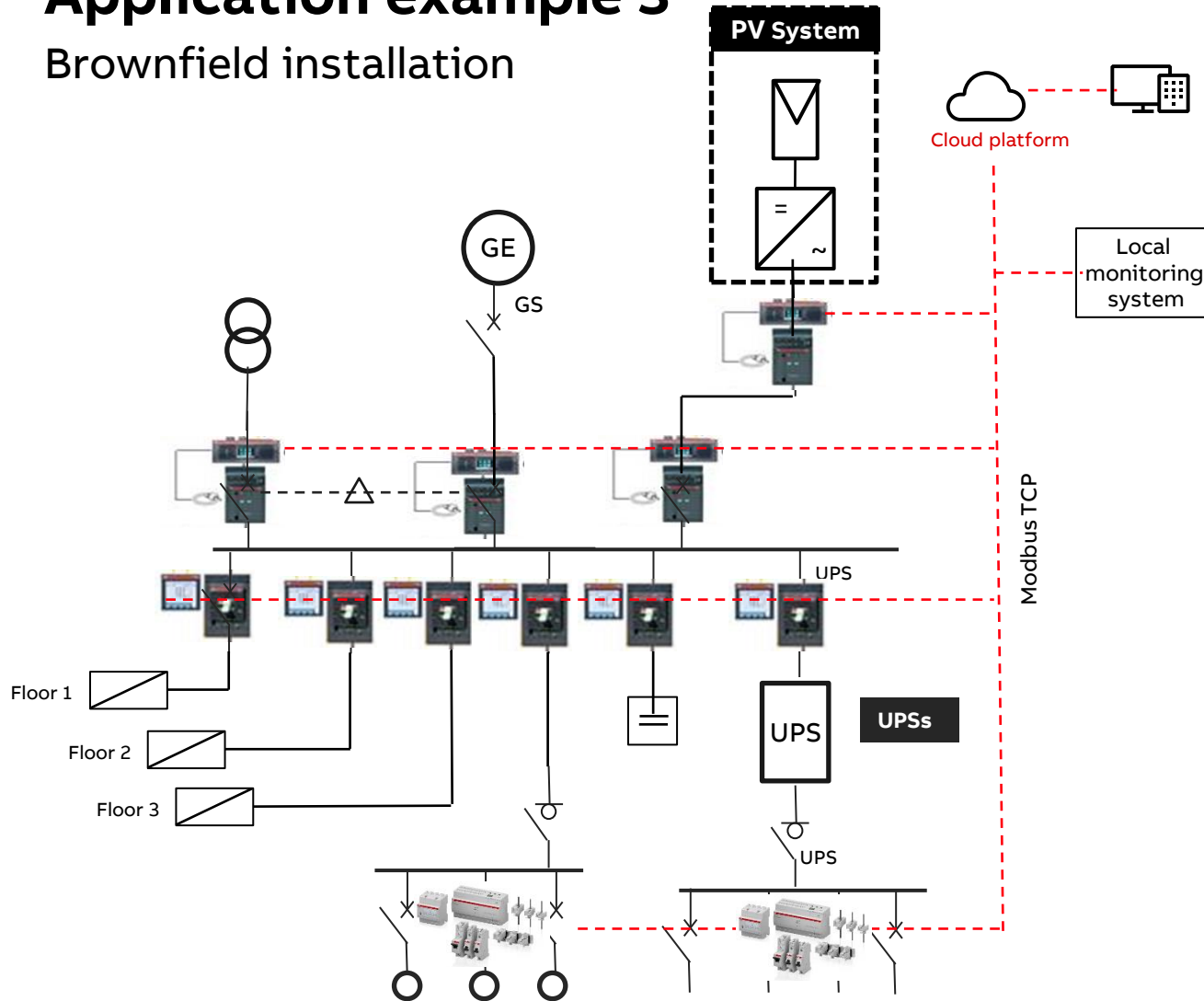
3. High upgrade

Replace aged devices with ABB retrofitting kits

- Minimal possible downtime
- Minimized installation impact

Application example 3

Brownfield installation



Easy monitoring of an existing installation

The same principle, explained in example 1, to have metering monitoring and control is valid also for existing installation

Fast and easy solution to implement **metering** on all existing electrical distribution levels can be done using external meters and relays

With no or minimal impact on the installation it is possible to have a **complete installation overview**

Using the embedded **Modbus TCP** communication protocol the device data can be immediately collected and transferred to any monitoring and/or control system

By adding the gateway **E-Hub 2.0** (din rail mounted) or **Ekip Com Hub** (embedded on devices) in 10 minutes it is possible to connect to **ABB Ability EDCS cloud platform** and start plant monitoring

Smart Upgrade and Update

Flexible and sustainable solutions to renew any low voltage distribution system

Smart upgrade and update solution offers

- Maximum flexibility to choose the most suitable solution for your low-voltage distribution system
- Up to 70% cost saving to upgrade your electrical installation, if compared to traditional replacement
- ABB and 3rd party equipment can be easily upgraded, with solutions certified for the global market
- Extend the lifespan of your electrical system, keeping it live and efficient as long as possible, minimizing CO2 emissions and raw materials usage



ABB helps power the Burj Khalifa

APPLICATION

Buildings

COUNTRY / CUSTOMER / SITE

UAE / Burj Khalifa

CUSTOMER NEEDS

Considering the dimension of Burj Khalifa building, to manage key assets it's a big challenge: 163 floors, 400 electrical loads, including 57 elevators and a 24MW air condition system, just to mention few

SOLUTION

- Real-time sensor data
- Condition monitoring
- Upgrade of existing devices
- Predictive maintenance functions



[Link to online story](#)



Smart Upgrade and Update

Stay tuned

Next webinar

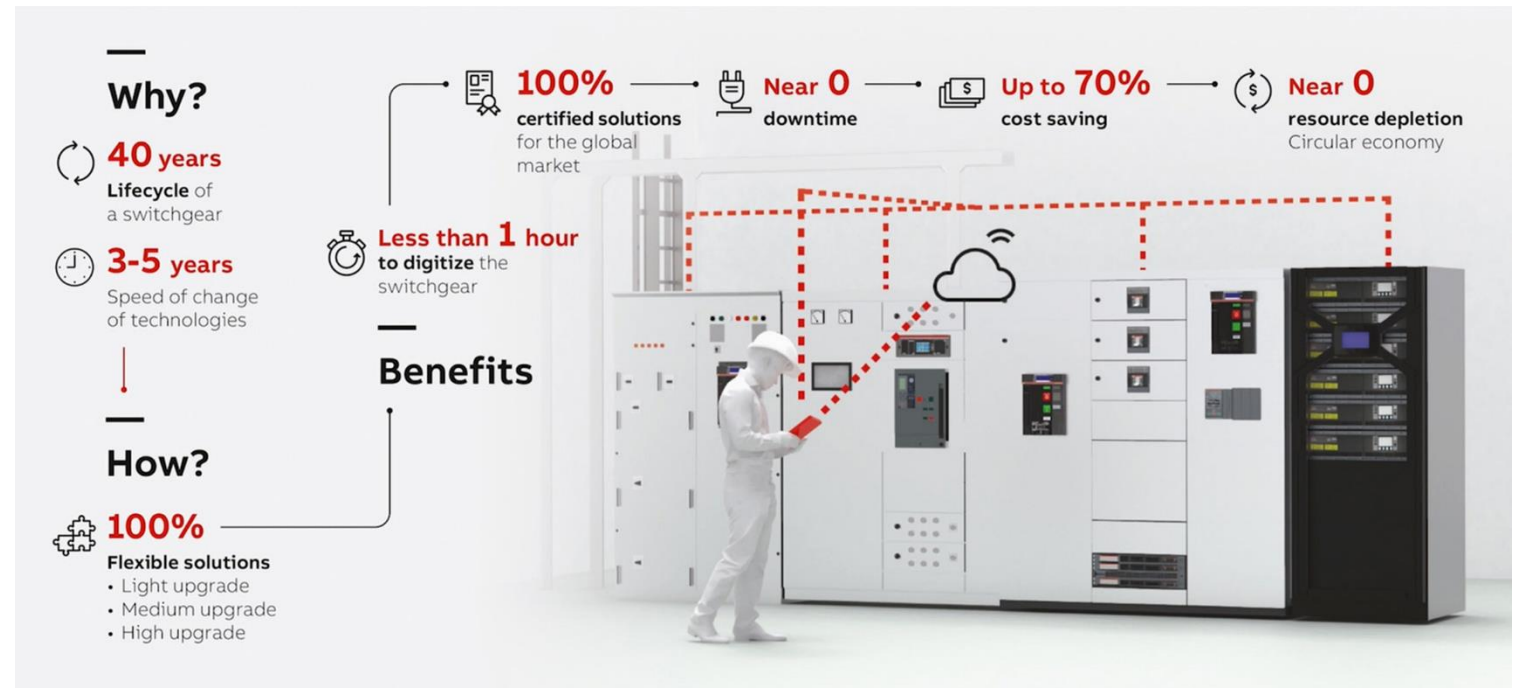
Smart Solutions to upgrade a LV electrical installation

Would you like to learn more about ABB solutions to upgrade a low voltage electrical installation, with a 70% cost saving compared to traditional system replacement?

Wednesday, October 21st

- 9:00 AM CET
- 4:00 PM CET

We will get in touch with you soon



Intelligent Distribution

Useful links

- Smart Metering and Monitoring Web Page: [link](#)
- Smart Switchgear Web Page: [link](#)
- Smart Upgrades and Updates Web Page: [link](#)
- Efficiency of Electrical System. Introduction to IEC 60364-8-1: [link](#)
- Smart Switchgear for Building and Infrastructure package: [link](#)
- Smart Upgrade & Update Article: [link](#)
- Smart upgrade for Emax 2: [link](#)

ABB