SMART GRID

Load Shedding innovation
Service continuity, space saving and ease of use
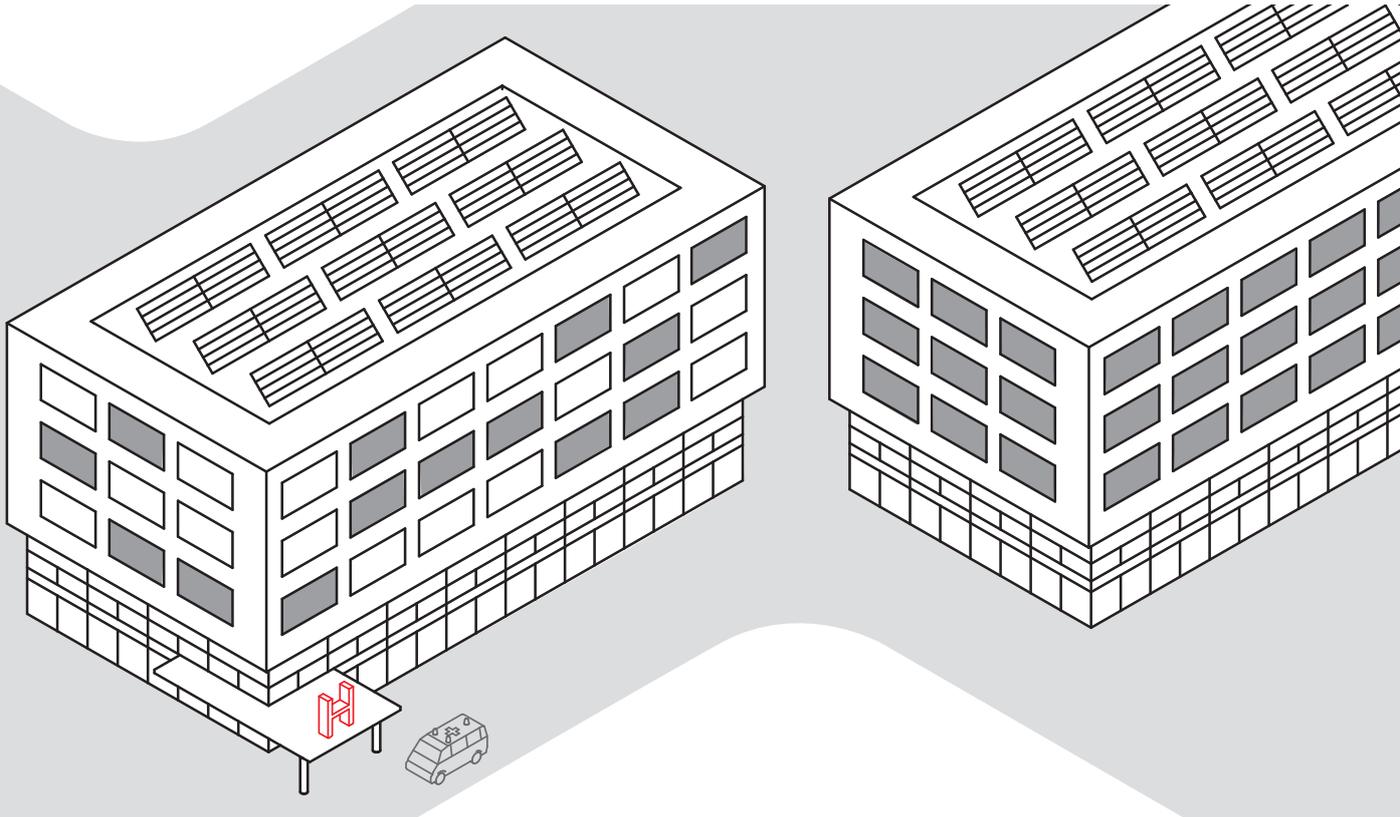
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01
Tmax XT

02
Emax 2

03
Ekip UP⁺

ABB Ekip electronics platform embeds patented functions based on load shedding that reduces Microgrid (or Nanogrid) stress in all situations.

In new plants, Emax 2 or Tmax XT are the main circuit breakers of the low-voltage system located at the interface point with the medium-voltage grid, able to control the plant in every circumstances. In existing switchgears or anytime new ABB breakers are not available, Ekip UP⁺ can be used to upgrade the installed devices and achieve the same performances.

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02

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01

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03

Microgrid in islanding operation

After the switching device opening, because of Interface Protection Systems intervention or external command, the microgrid should transit from on-grid to off-grid state with bumpless transition. When it is standalone, the power absorption from the main grid stops, so that the microgrid loads is supplied only by the local generation, like diesel GenSet or energy storage systems.

This microgrid generation can be always active or started up by an automatic transfer switching (ATS) logic after the disconnection from the main grid, depending on the plant configuration. During the islanding transition, it is very important to avoid the frequency drop, otherwise the generation protections could trip, thus jeopardizing the microgrid stability with a consequent long downtime.

Ekip units, based on current and voltage measurements, integrate two different fast load shedding logics to reduce any blackout risk by protecting the microgrid during the intentional or unintentional islanding operation:

- **Basic Load Shedding**: simple logic able to detect the microgrid disconnection event and shed a group of non-priority loads thus ensuring a fast time response and power balance.

- **Adaptive Load Shedding**: the advanced algorithm available with Ekip units is an enhancement of the basic version. The intelligent software embedded in the products sheds very quickly the non-priority loads according to the microgrid power consumption and frequency measurements. Moreover, such software has a dedicated configuration for backup generation related to ATS and the software itself is even able to estimate the energy produced by a solar plant based on plant-geography settings.

Ekip UP⁺
Tmax XT
Emax 2

Main grid

Energy Storage System

PV Plant

Wind Plant

Gen Set

Priority load

Basic Load Shedding

Adaptive Load Shedding
1   2   3   4
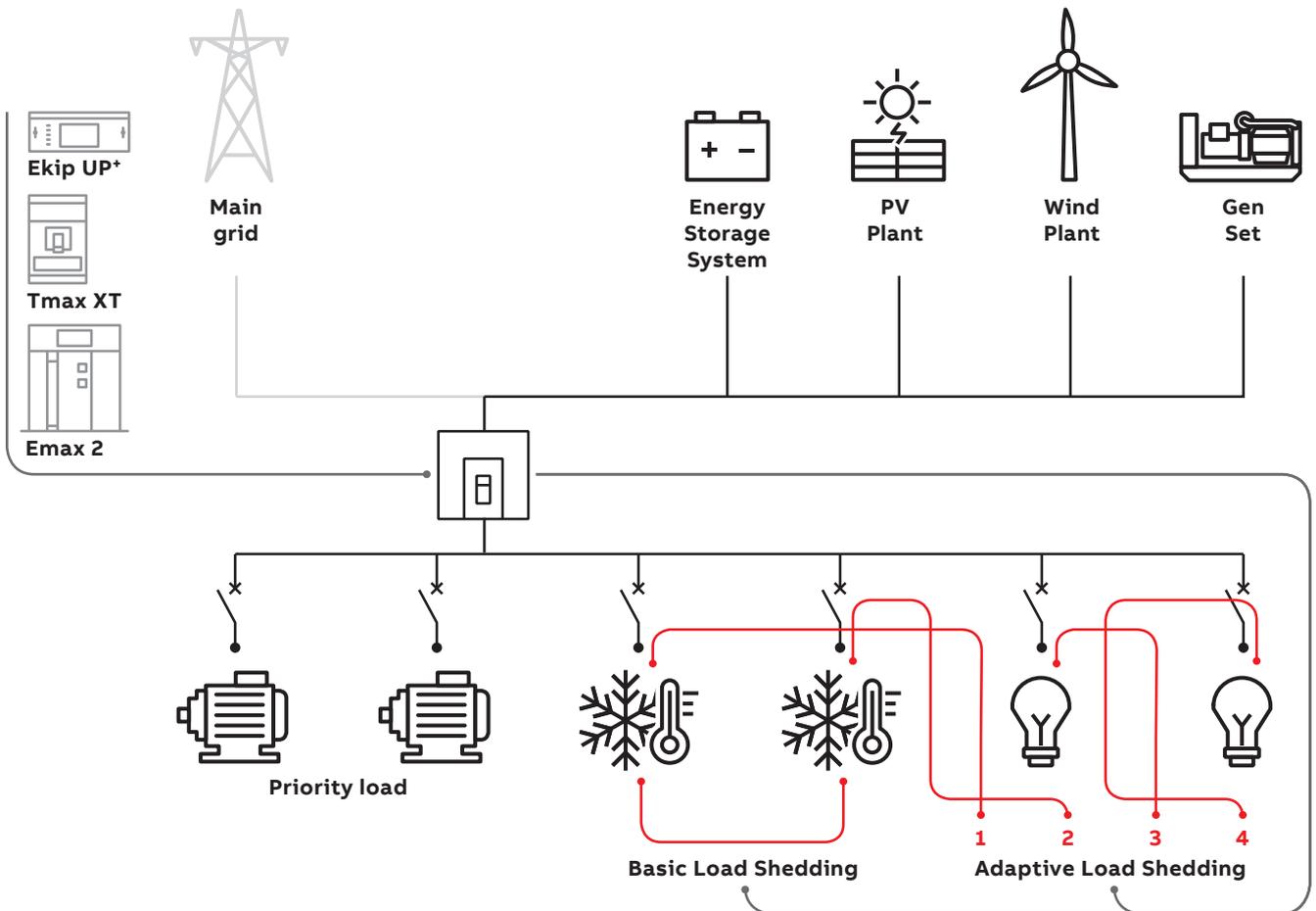
Application scenarios with one smart product

Gen Set · Ekip UP⁺ · Tmax XT · Emax 2 · PV Plant

LINE 1 · OFFICES · LINE 2 · WAREHOUSE · POWER FACTOR CORRECTION

ASYNCHRONOUS MOTORS · LIGHTING · SOCKET · LIGHTING · HVAC
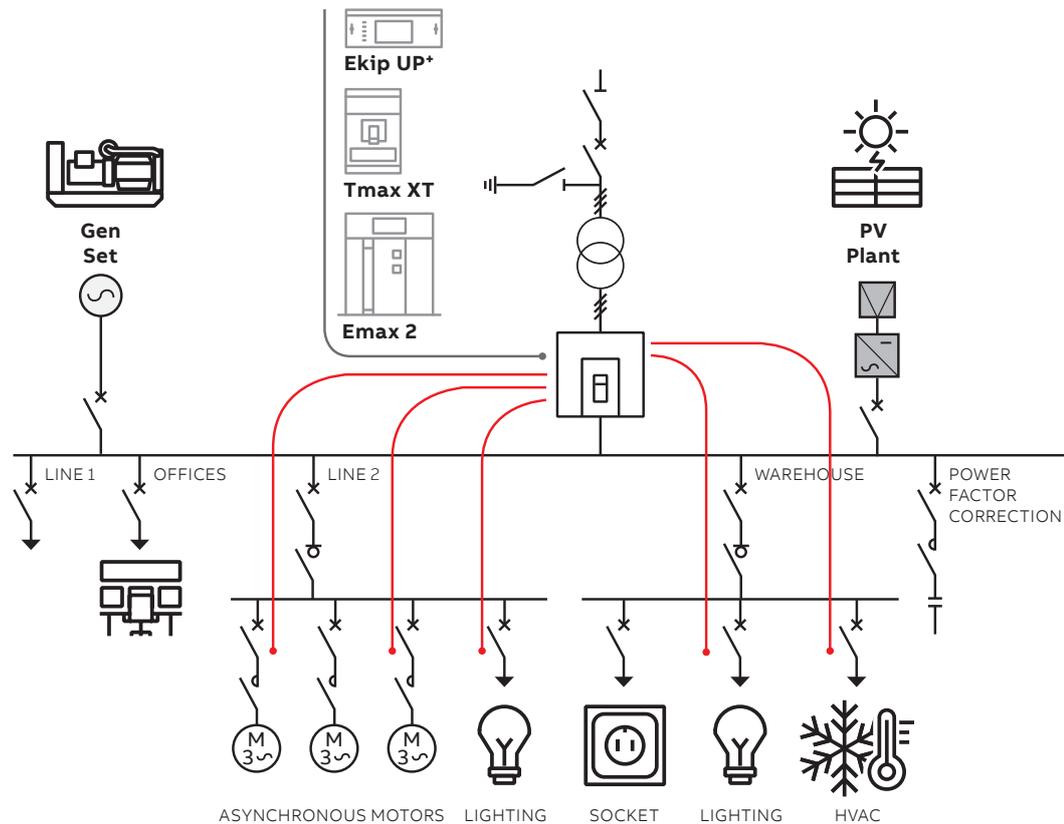
- **Grid-connected plants with running GenSets**, which contribute to self-consumption, together with potential renewable sources, and support the load power supply in emergency conditions. It is the case of hybrid PV-diesel remote communities connected to weak distribution grids where there are a lot of daily faults, or facilities located in geographical areas where frequent harsh environmental events happen, e.g. hurricanes or earthquakes.

- **Grid-connected plants with back-up GenSets** started up after Main - Gen transfer switching logics that require high reliability. For example, hospitals, banks or data centers.

The application example above refers to an installation connected to the medium-voltage Utility through a MV/LV transformer. In such system, there are a GenSet and a PV plant which are in parallel with the Utility power feed during grid-connected operation.

There are two production lines: Line 1 and 2. Line 1 feeds the priority loads belonging to a continuous production process, so they cannot be controlled by the Load Shedding during islanding operation.

On the other side, Line 2 feeds non-priority loads which can be managed by the load shedding through contactors, installed on the power circuit of the corresponding asynchronous motors.

Moreover, in the warehouse, there are several loads (e.g lighting and HVAC) that can be controlled by the load shedding through circuit breakers.

Benefits

Thanks to Ekip unit with embedded load shedding innovation, the following benefits are guaranteed.

Service Continuity

- When a plant remain disconnected from the main grid, even if local production is ongoing, there is a significant stress that turns off all the generators with a consequent blackout. Load shedding logics embedded in Ekip units reduce the frequency drop that usually makes the local generation protection trip, thus maintaining the plant live.

Space Saving
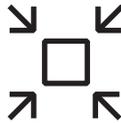
- Neither PLCs nor any other external trip unit are needed as Ekip units embed the intelligence to carry out the load shedding logics, taking advantage of current and voltage sensors for electrical parameter measurements.
- In addition, static converters for low-voltage photovoltaic production have typically anti-islanding protections: this implies another power deficit to be added to the main grid contribution during the Microgrid islanding. Ekip units are the first relays that estimate solar production without additional sensors.

- Load shedding is suitable with ATS architectures like Main-BusTie-Gen used to distinguish priority/non-priority loads. Where feasible, BusTie switch disconnector is no longer required and this means:
  - Significant space and material saving up to 50% in the power distribution switchgear for panel builders.
  - Load shedding is self-tuned with the specific power unbalance identification and dynamically chooses the controllable loads to be shed, reducing constraints for consultants during plant design.
  - ATS unit manages only two sources, without interlock, logic programming and wiring connections for the third circuit breaker with less time required for installation.

Ease of use

- Load shedding logics are generally set with high engineering skills and customization effort with devices as PLC.
- Ekip units guarantee easy installation thanks to the predefined templates and the user-friendly graphic interface in the software commissioning tool.