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LE GRAND PLAN D'INVESTISSEMENT
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SUSTAINABLE

Schneider Electric helps make an ambitious Microgrid campus project

IMT - Grenoble, France

Europe's first technology and educational microgrid testbed

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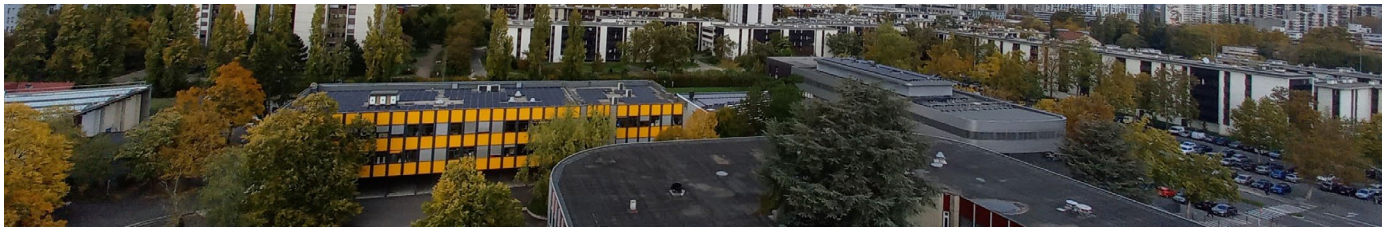
Life Is On Schneider Electric



An ambitious microgrid project, launched in partnership with the Chamber of Commerce of Grenoble in France

Schneider Electric, the leader in digital transformation of energy management and automation, and the Grenoble Chamber of commerce and Industry (CCI) launched the LearningGrid project at large vocational training institute (Institut des Métiers et des Techniques, IMT) to create a local microgrid across campus buildings to optimize energy performance, reduce consumption, train energy specialists, and empower apprentices to understand energy issues as part of their professional training. The IMT serves more than 2,500 trainees and consists of 7 buildings, some of which date back to the 1960s, others that are more recent or new. The institute had an overall picture of its energy consumption, but it wanted to control costs and measure when, where and how it consumes energy, in order to reduce its total costs by 30% to rely on 15% renewable sources and 30% from local production.

Schneider Electric has implemented the microgrid — a pooled management system of solar and cogeneration production, storage and the buildings' loads, interconnected with the electricity grid and the district heating network. At its heart is a newly constructed 400 m² building — an "energy cockpit" to centralize all local facility management.

This unique project of building intelligent electrical network between all the buildings of the IMT of Grenoble is supported by the state through the Investments for Future Program (PIA), the Auvergne Rhône-Alpes Alpes region, Grenoble Alpes Métropole, the County Council of Isère, but also by the Intercommunal Heating Company of Grenoble (CCIAG).

With 7 buildings totaling 20,000 m² necessary for highly energy-intensive training for its 2,500 apprentices (bodywork, bakery, hairdressing, etc.), a staff of some 150 people, accommodation structures, catering, sports and leisure activities. The IMT campus reproduces the economic and social life of a small town of nearly 3000 inhabitants. It perfectly illustrates a small-scale smart city operation, while serving as an educational, awareness and experimentation tool for students on campus.

This project has two major objectives. The first, of technical nature, aims to reduce campus energy consumption by 30% through tools and solutions to improve building performance. It then involves integrating new sources of clean energy management to achieve an optimum balance between energy production and consumption. The second is based on a large educational mission. The LearningGrid will allow apprentice electricians and mechanics, but also apprentice hairdressers, cooks or bakers, to integrate energy issues into their training curriculum, thus measuring the impact of their activities and behaviors on their own consumption of energy.

Goal

Original and innovative project aiming to deliver an educational, technical tool on the IMT campus, to support its journey from an energy-hungry site into a much more sustainable one.

Story

A technological challenge made possible thanks to the close collaboration of IMT with the Grenoble Chamber of Commerce and Industry, and Schneider Electric, supported by the State, the Regional Council, the Department, and the Grenoble metropolitan area.

Solution

Implementation of energy efficiency measures combined with photovoltaic, co-generation and storage systems. The operation of local power sources and intelligent, flexible loads is optimized by EcoStruxure™ Microgrid Advisor.

Results

- A microgrid "living lab" of nearly 3000 people
- 15% of the energy consumed is provided by clean local energy sources
- Up to 30% reduction of the grid energy consumption
- Training and educational tools

Technological challenges

The project presents a couple of technology challenges:

- Management of multiple energy flows (electricity, water, and heating) in a complex multi-building project with multiple connection points with energy and water distribution grid
- Management of multiple local sources (photovoltaic systems integrated to the buildings' rooftops, cogeneration and storage systems)
- Energy optimization according to usage demand and electricity tariffs, by using advanced analytics for forecasting and predictive control
- Ambitious goals in terms of electricity bill reduction and optimized usage of local sources (100% of the produced energy is consumed on-site)

An educational mission

In the digital and energy transition era, the training of young people can no longer be done in the same way. Therefore, the Chamber of Commerce and Industry (CCI) has undertaken the mission to educate and train all students on campus about the environment and energy management, and to systematically offer a training module on these topics.

To achieve its sustainability goals on energy efficiency and local energy production, the IMT campus integrated local power generation sources and explored load flexibility to optimize energy usage. Also a significant number of energy meters for electricity, heat, water and gas measurements, as well as a weather station were installed on site.

Local power generation

The site has been equipped with more than 1,000 photovoltaic solar panels on the rooftops of campus buildings and a controllable micro-CHP (combined heat and power) generation system. Both are connected to energy storages systems so in the event of overproduction the systems allow the storage of electricity for later use. In total, the equivalent of 450 kW local power production and 400 kWh storage systems was implemented on the campus:

- PV panel — 350kW peak
- Co-generation — 70 kW electricity/114 kW heat
- Two batteries — 100 kWh and 300 kWh

Flexible loads

To optimize the energy usage in function of the production capabilities or the energy cost, the IMT Campus relies as well on flexible loads, i.e loads that are controllable and with consumption that can be shifted in the time. Examples include electrical vehicle or heating and air conditioning systems. In the IMT Campus, the flexibility of the following loads could be exploited:

- 3 heating sub-stations across 5 different buildings
- 5 air handling units
- EV charging stations

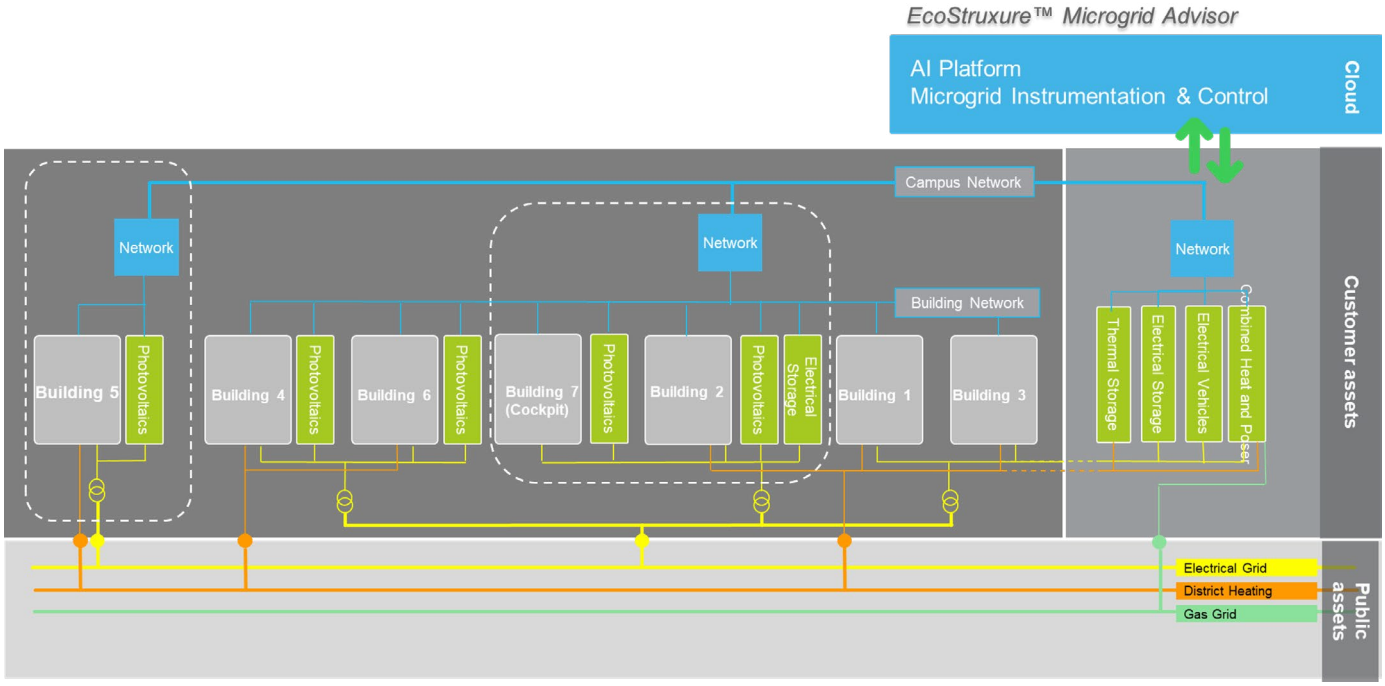
Energy meters

In this smart campus, water, electrical and thermal energy meters are installed in production spaces, laboratories and workshops. In educational workspaces (classrooms, offices, etc.) and in living spaces (self, cafeteria, work-study hotel, sports halls, streets and outdoor spaces, etc.), standard electric meters (radio, wired, pulses), temperature sensors, and fluid meters are used. In total, real-time consumption data is coming from:

- 600 power meters, 80 thermal meters
- 130 water meters
- 1 weather station

EcoStruxure solutions at the heart of this microgrid include:

- EcoStruxure Microgrid Advisor integrates advanced analytics that provides the optimization engine to coordinate the different DERs (PV, Batteries and CHP, thermal storage and EV charging stations) at the campus level, allowing the whole to run as efficiently as possible.
- EcoStruxure™ Power Monitoring Expert is responsible for gathering the data coming from the 800 meters deployed across the site.
- EcoStruxure™ Building Operation is piloting the building HVAC assets. In order to enhance the solution we have created a connection with the room booking system to anticipate occupancy in the classrooms.
- EcoStruxure™ Resource Advisor generates monthly reports and dashboards presenting the energy consumption to different actors allowing them to understand their consumption, adapt their processes, and work to improve their efficiency.



Microgrids rely on local renewable energy sources and flexibility. Controlling the resources using advanced analytics has helped to reach the ambitious performance goals set for this project.

The Schneider Electric offer EcoStruxure Microgrid Advisor (EMA) enables actions to optimally manage local energy sources, storage, and controllable loads. Relying on Model Predictive Control (MPC) techniques, EMA optimizes the energy usage with respect to the occupants needs in terms of comfort. EMA computes the best trade off between the energy source utilization in order to apply the best scenario to minimize the energy bill and CO2 emissions.

Predictive control and energy flexibility optimization

Using Model Predictive Control (MPC) techniques, EMA optimizes the energy usages across the next 24 hours, anticipating demand and local production. EMA controls local production and storage systems to fulfill the demand with the right quantity of energy at the best price.

The Model Predictive Control requires:

- A model with the description of the electrical and thermal networks, the asset behavior and constraints to be respected.
- Knowledge of the upcoming 24 hours including a forecast of the building's energy consumption and energy tariffs.
- Current status of the onsite resources, for example the state of charge of the energy storage systems

By re-evaluating the real measurements every 15 minutes, EMA considers errors in predictions and models in order to keep a reasonably accurate performance.

Forecasting of local production and energy consumption

A forecasting component is used to predict local energy demand and production, thereby enabling short-term energy resource planning and optimized energy use.

The forecasting component uses supervised machine learning techniques to learn the relationship between current variables and desired forecast variables.

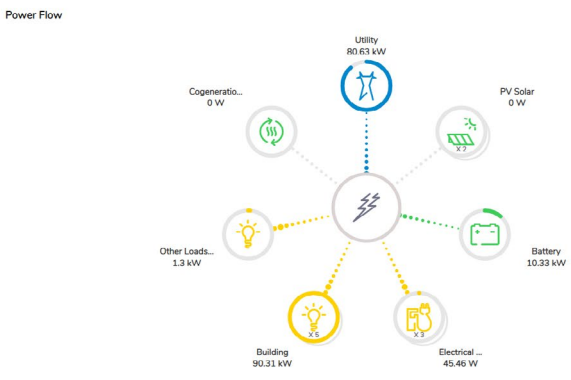
Photovoltaic production forecasting is closely linked to the solar irradiance forecast provided by a weather forecast service.

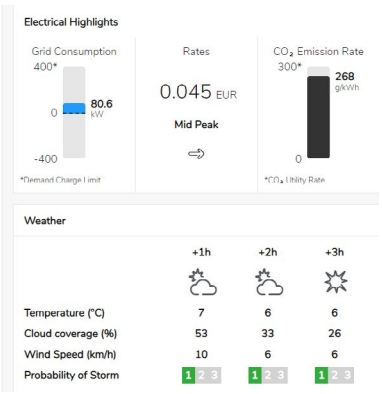
Building energy consumption can be forecast based on the historical energy consumption that identifies recurrent patterns. This forecast is improved by adding additional drivers like weather forecast information and room occupancy forecast provided by the room booking system.

The accuracy of the forecast is critical for an optimal Model Predictive Control.

Simulations for microgrid design

An internally developed Microgrid Design Tool was used in the early design phase to determine the size of the assets for energy production and storage over a year-long simulation. The tool relies on the Forecasting and MPC components to validate different scenarios and foreseen performance before deploying assets on site.





EcoStruxure™
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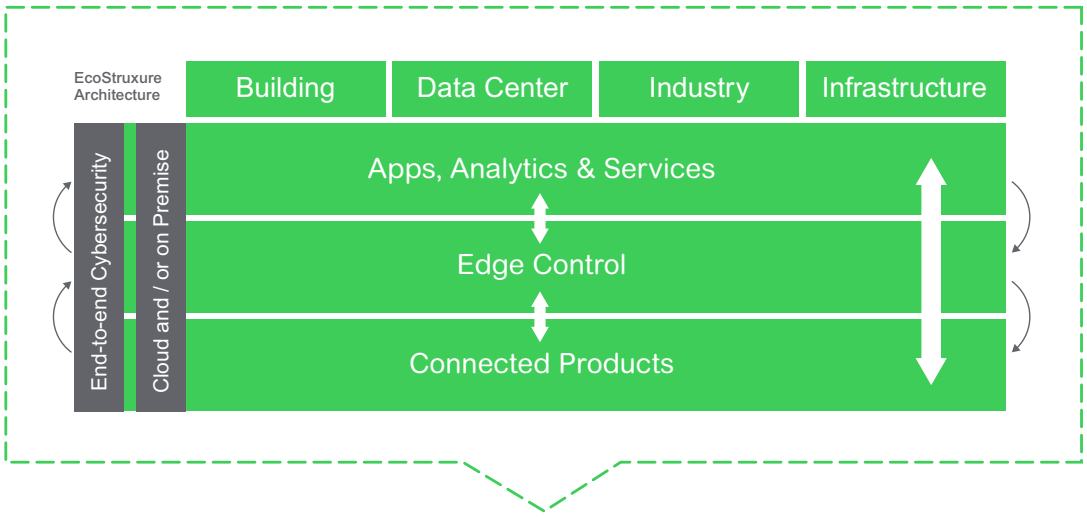
IoT-enabled solutions that drive operational and energy efficiency

EcoStruxure™ is our open, interoperable, IoT-enabled system architecture and platform. EcoStruxure delivers enhanced value around safety, reliability, efficiency, sustainability, and connectivity for our customers. EcoStruxure leverages advancements in IoT, mobility, sensing, cloud, analytics, and cybersecurity to deliver Innovation at Every Level.

This includes Connected Products, Edge Control, and Apps, Analytics & Services which are supported by Customer Lifecycle Software. EcoStruxure has been deployed in almost 500,000 sites with the support of 20,000+ developers, 650,000 service providers and partners, 3,000 utilities and connects over 2 million assets under management.

One EcoStruxure architecture, serving 4 End Markets with 6 Domains of Expertise



Connected Products

The Internet of Things starts with the best things. Our IoT-enabled best-in-class connected products include breakers, drives, UPSs, relays, sensors, and more. Devices with embedded intelligence drive better decision-making throughout operations.

Edge Control

Mission-critical scenarios can be unpredictable, so control of devices at the edge of the IoT network is a must. This essential capability provides real-time solutions that enable local control at the edge, protecting safety and uptime.

Apps, Analytics & Services

Interoperability is imperative to supporting the diverse hardware and systems in building, data center, industry, and grid environments. EcoStruxure enables a breadth of agnostic Applications, Analytics, & Services for seamless enterprise integration.

Find out more about EcoStruxure

se.com/ecostruxure

Notes

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Contact us to start your journey

A sustainable space for 1500 species

EcoStruxure Energy Expert increases electrical and mechanical efficiency for Lake Land College

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