Li-Ion Capacitor UPS

A powerful and reliable solutionfor applications requiring short back-up times

SITE 847 A

The customer: JSR Micro N.V.

JSR Micro N.V., based in Leuven, Belgium, is a subsidiary of JSR Corporation. It is a multinational company employing approximately 6000 people worldwide, and a leading materials supplier in a variety of technology-driven markets. JSR's global network is headquartered in Tokyo (Japan), with factories and offices in Europe, US, China, Taiwan, Korea, Singapore and Thailand.

JSR is a research-oriented organisation pursuing close collaboration with leading innovators in various industries key to the present and future welfare of human society: life-sciences, energy storage, synthetic rubbers, electronic materials, display and optical materials. Its value proposition to its customers can be summarised as: 'Innovation one-on-one'. Through close and timely collaboration with its partners, JSR offers its customers a competitive advantage based on leading edge technologies, consistent high quality and a balanced cost of ownership. JM Energy Corporation is a fully owned subsidiary of JSR Corporation.

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The requirements

Protection against short and frequent power outages

- Protection against any possible power supply outages for a chemical process installation and a compressor providing compressed air to a chemical production installation.
- Avoiding damage, loss of production and an increase in costs for applications and processes sensitive to short duration downtime.
- Ensuring the optimal availability and working life time of the batteries.
- A powerful UPS back-up storage solution with a very short recharging time, requiring low maintenance and providing constant monitoring.


APPLI 785 A

JSR Micro N.V. has chosen to protect its sensitive critical applications with SOCOMEC's LI-ION CAPACITOR UPS back-up storage solution, specifically designed to protect applications requiring a back-up time lasting from a few seconds to minutes.
It also safeguards processes sensitive to frequent micro-interruptions and ensures the maximum availability and reliability of the power supply to these applications.

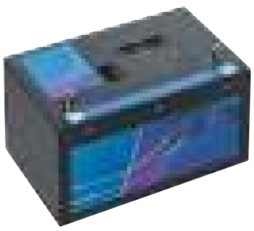
M. Johan DESIMPELEARE
Vice President Operations
Semiconductor at JSR MICRO N.V.

The solution

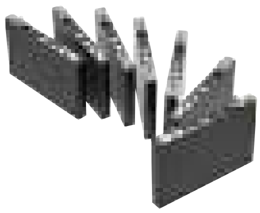
A Socomec LI-ION CAPACITOR UPS sized for an 80-kW load system.
A back-up energy storage system made from Lithium-Ion Capacitor (LIC) cells manufactured by the JM Energy Corporation and assembled in EAS Elettronica Endurance modules.
The system provides a back-up time of two minutes which allows for the addition of supplementary loads without altering the UPS protection.

The benefits

- Less heat generation than a standard, long-term back-up UPS system using VRLA (Valve Regulated Lead Acid) batteries.
- Optimal performance in all critical operating conditions, whilst only requiring extremely low maintenance.
- Ultra-high power density in a reduced footprint.
- Ultra-fast recharge: only a few minutes required until the Lithium-Ion capacitor blocks are fully charged.
- Maximum availability and total protection from short power drops.
- Safe installation in a standard room with no temperature, humidity or dust control required (no hydrogen generation).
- Embedded cell-to-cell monitoring system providing continuous monitoring to prevent unexpected failures and reduce the number of maintenance operations.
- No threat to the system due to partial and/or frequent discharges as it is not sensitive to regular or unexpected supply failures.


ASI 043 B

Lithium-Ion capacitor module.


ASI 044 A

Lithium-Ion capacitor cells.

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Energy storage system for hybrid microgrids

Multi-source power supply for an isolated site

The customer:
Mini Green Power

Mini Green Power
L'énergie de demain

Mini Green Power is a French company specialising in the development of biomass power plants and boilers.

To meet its aim of local low-carbon energy self-sufficiency, Mini Green Power develops, finances, manufactures and operates renewable energy generation solutions worldwide, using locally recovered plant residues to produce electricity, heat and refrigeration.

Mini Green Power offers support throughout the duration of its projects to enable customers to achieve complete energy self-sufficiency.

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The project

The aim of the Mini Green Power project is to show that it is possible to run and operate its green mini power plants by connecting them to a solar installation to produce electricity and refrigeration on an isolated grid or in non-electrified areas.
In this project, Mini Green Power combines several technological solutions, which are controlled by an Energy Management System (EMS) developed by the company.

The microgrid created within this project includes:
- A biomass co-generation plant connected to an Organic Ranking Cycle (ORC) that transforms heat into electrical energy
- An energy storage system using Lithium-ion batteries
- A field of photovoltaic solar panels
- A refrigerated container
- A backup genset

The project was financed with European Regional Development Funds (ERDF).

The requirements

For isolated locations, Mini Green Power wants to use its solutions without relying on gensets under normal operating conditions. The idea is to run the mini power plant on 100% green energy. The diesel genset is on standby, used only for emergencies or after extended downtime.

The storage system required must therefore fulfil several major functions: voltage generation, frequency regulation on the microgrid, energy supply/storage in the event of sudden load variations and self-consumption.


STUD 014 A

Photovoltaic plant

Voltage generation

The storage system must be able to function as a voltage generator to start up the microgrid. The entire biomass ORC and solar panels all need voltage to run in the first place.

The mini green power plant takes two to three hours to start up before it can generate electricity itself. Without a mains connection, the storage system holds the energy needed for a "black start". While the mini power plant is starting up, the storage system must ensure that the voltage and frequency of the microgrid are maintained within acceptable limits to power the auxiliaries. As soon as the ORC of the mini green power plant starts, it connects to the bus controlled by the storage system, and recharges the storage batteries that provided the energy needed to start it. The battery recharges with energy so it can continue generating voltage indefinitely.

Microgrid frequency regulation

The electrical consumption of the mini power plant varies continuously to regulate the multi-stage combustion process. However, the frequency must remain stable.

It is the storage system that accurately and instantly delivers the right power to the mini plant, to ensure a perfectly stable frequency.

Managing load changes

When the ORC is synchronised and generating on the microgrid, it cannot instantly regulate the required load. This is because the biomass ORC has a certain inertia. If there is a change in load, it will not respond immediately:

- As microgrid consumption increases, the storage system is used to provide the missing energy, while waiting for the ORC to take over.
- When microgrid consumption decreases, the storage system is used to absorb excess energy until the ORC reduces the load.

Self-consumption

The final aim of the storage system is to maximise the rate of self-consumption across the entire installation. The idea is to store the surplus production, rather than disconnecting the solar panels. One of the means of storing excess energy for this project is the refrigerated container, which increases the stability of the grid by self-consuming surplus energy.

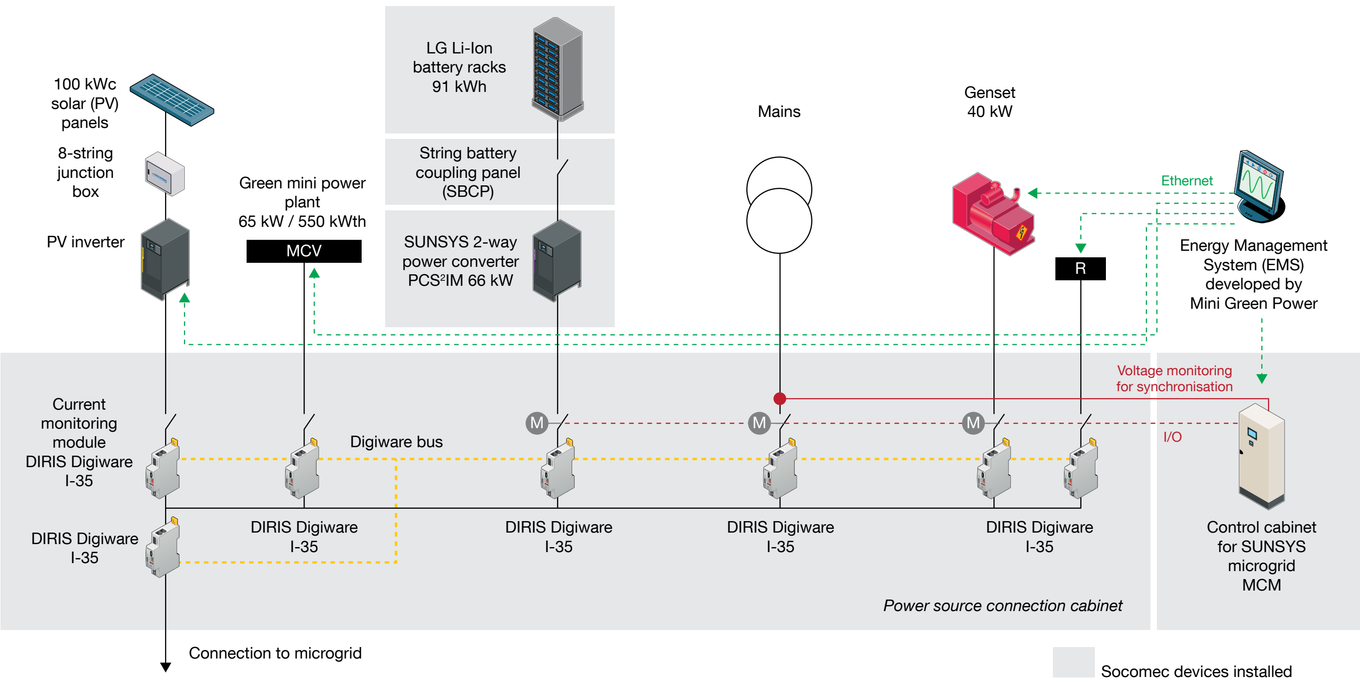

STUD 015 A

Cogeneration plant connected to an ORC (green mini power plant)

The solution

Socomec's solution consists of a system that includes:
- A 66 kVA two-way converter capable of operating as a voltage generator (island mode)
- A 91 kWh Lithium-ion battery rack
- A DC distribution box
- The cabinet for paralleling the different power sources
- A control cabinet (MCM) that manages the storage system and synchronisation to the grid for non-isolated sites.

Mini Green Power managed the electrical and mechanical interfaces between the equipment and developed the Energy Management System (EMS).



The advantages

- Complete system tested by Socomec.
- System compliant with EN 62477-1 and IEC 62619.
- Operating tests carried out by Socomec experts on the Mini Green Power site.
- System commissioning carried out by Socomec experts at the Mini Green Power site.
- Simple interfacing between the storage system and other production sources with the Energy Management System (EMS) manufactured by Mini Green Power.
- Easy replacement of conversion modules (in Socomec converters) without total loss of power.

Focus

Gonzague DE BORDE
Development Manager

STUD 017 A

The Isolated Grid project is fully in line with Mini Green Power's mission, which aims to bring local low-carbon energy self-sufficiency to our customers. Producing renewable and economical energy from biomass and solar panels on isolated sites is a real challenge for governments and manufacturers, particularly in southern countries.

Key figures

Project duration: 24 months
PV production installed: 100 kWc
Converted power installed: 66 kVA
Battery energy installed: 91 kWh
Total biomass/ORC: 65 kW / 550 kWth

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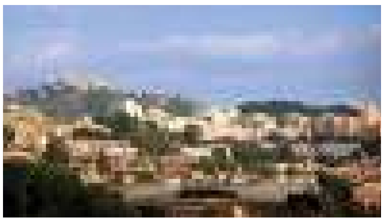
Energy storage solutions

for the massive integration of renewable energies and management of peak load times

APPLI 777 A

The project: Nice Grid



SITE 799 A © NICE GRID

NICE GRID
UN QUARTIER SOLAIRE INTELLIGENT

Principal manager of the French distribution grid, ENEDIS (formerly ERDF) has tested a smart electricity grid demonstration in Carros, near Nice. This site was used because of its significant photovoltaic energy production, and also because it is an industrial zone that borders on a residential area.

The Nice Grid project exploits the potential of grid storage in order to give distribution grid managers additional flexibility in managing their loads (management of peak consumption and massive integration of renewable energies).

Socomec has furnished and implemented smart solutions for energy storage on the low-voltage grid.

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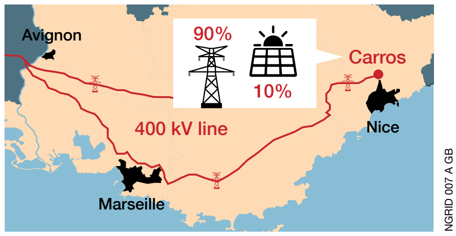
The needs

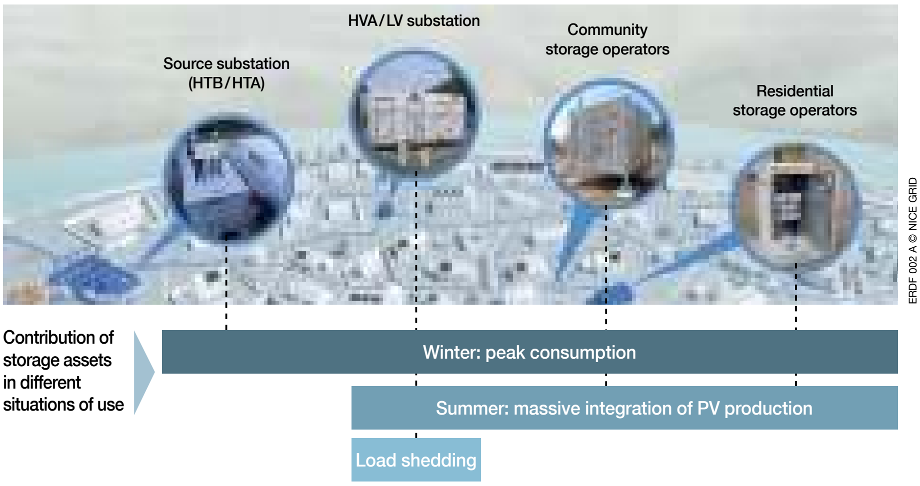
The challenges

In the Carros zone, 90 % of energy consumed is carried by a single high-voltage line. One of the challenges of the demonstration is to foster an increase in the amount of renewable energies in the energy mix. Combined with suitable storage means, this local production will improve the energy autonomy of the area.

Moreover, the storage of this production would be an opportunity for the grid manager to manage peak consumption in wintertime and to limit the loads on the electricity grid when PV production is highest, i.e. on days of full sunshine.



Carros is located at the end of the single high-voltage line that supplies the Provence Alpes Côte d'Azur region.



Energy storage objectives

- Provide useful experience about the installation, startup and operation of storage assets on the distribution grid.
- Provide remote, automated management of storage assets by innovative communication means, supervisory interface and an aggregator (NBA).
- Test the contribution of storage assets in three different cases: reduction of peak consumption, massive integration of photovoltaic production and load shedding.

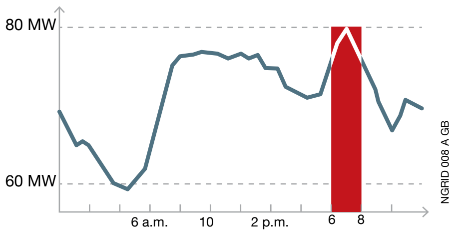
This case study covers the first two cases. Load shedding is the subject of another case study*.
The Carros district concerned has the following characteristics:
- 2.350 residential customers,
- 1.3 MW grid storage,
- 80 kW residential storage,
- 2.5 MWc PV production.

Several storage assets have been installed at different levels of the grid: at the source substation (HVB/HVA), at the public distribution substation (HVA/LV), on the LV feeders, and finally at the residential level.

Although all of these storage systems participate in reducing peak consumption, only the last three mentioned, connected to the low-voltage grid near photovoltaic electricity producers, participate in the massive integration of that production by locally resolving the loads explained below.

How to manage peak consumption?

French regions experience peak electricity consumption between 6 PM and 8 PM. During cold winter days, in this timeslot the French electricity grid (or ENEDIS) sends islanding requests to the storage assets connected to HVA and LV in order to discharge the energy previously stored in the batteries. In the tested district, all available types of flexibilities are contributing: the four storage systems, the industrial flexibilities as well as the residential flexibilities.



Consumption curve (MW) - Source ERDF.

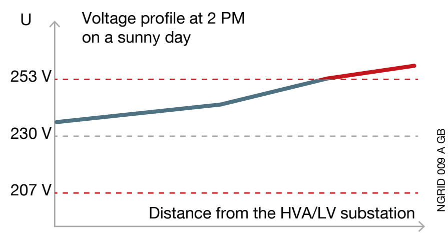
How can the massive production of renewable energies be integrated?

Photovoltaic production is particularly high between 12 noon and 4 PM in summer (2.5 MWp in the district concerned). By charging the storage assets during this timeslot, the grid manager limits the loads on the LV grid. In Carros, the three storage systems that are on the LV grid are contributing, along with the residential flexibilities.

When it is substantial, PV production generates three types of loads on the LV grid:
- voltage loads,
- current loads,
- backflow problems.

- **Voltage loads**

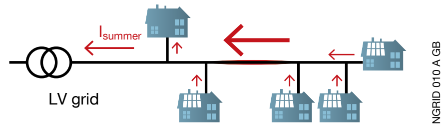
The injection of PV production on the LV grid causes a local increase in the voltage: the current I generated by the PV inverters, multiplied by the resistance of the line R causes an increase in the voltage (U = R x I). This is all the greater when the injection is at the end of the power line, when there is low consumption on the line, and the current is fed back onto the upstream HVA grid. By locally "consuming" the current generated by the PV inverters, storage avoids injecting the current towards the upstream grid, thus canceling out the voltage increases.



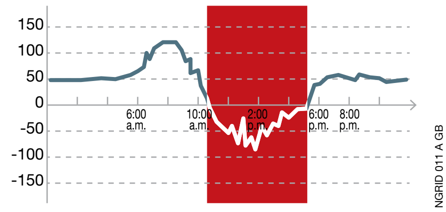
Increase of voltage due to PV production

* *"Energy storage solutions for load shedding and microgrids".*

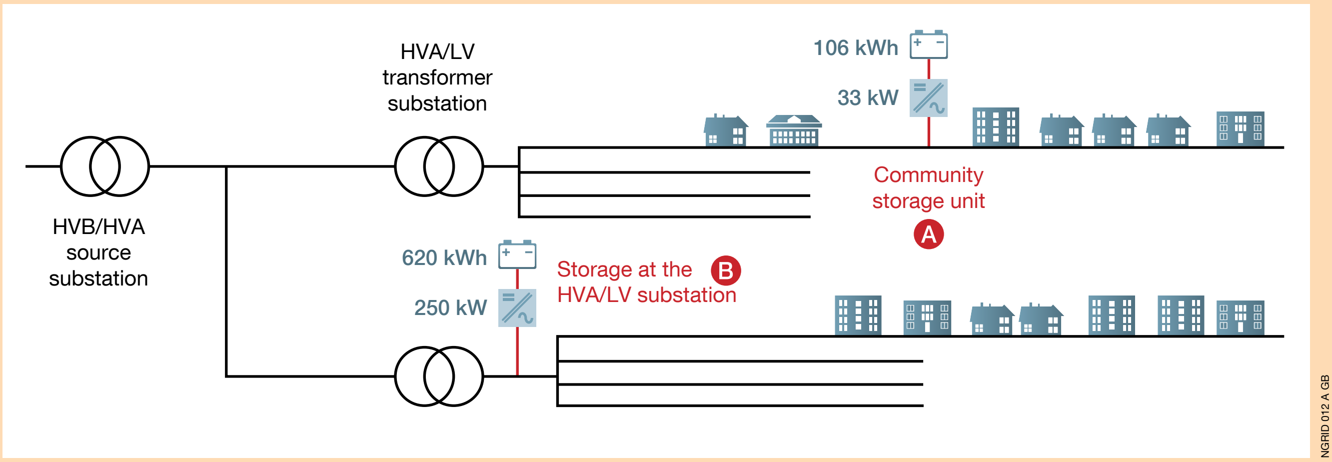
- **Current loads**
The electricity grid is dimensioned so as to carry centralized production to consumers. Decentralized production reverses the usual flows and can generate current loads on portions of the grid that have not been dimensioned to carry them. Storing energy close to production makes it possible to avoid these loads.



- **Backflow problems**
On the LV grid, when PV production is greater than consumption, the excess energy is injected onto the upstream grid. This backflow can exceed the capacities of the transformer and have an impact on the HVA voltage.



Architecture Community storage and that the HTA/LV substation



Socomec has furnished the storage system at one of the HVA/LV transformer substations as well as the community storage units located on different LV feeders 400 m from another HVA/LV substation.

Ⓐ Each community storage unit offers 33 kW of power and storage capacity of 106 kWh.

Ⓑ At the HVA/LV substation, the power is 250 kW and the storage capacity is 620 kWh.

The solution

SUNSYS PCS² : energy conversion and storage system

The SUNSYS PCS² bidirectional converters and their innovative control systems follow a charge and discharge profile that corresponds to the desired functions.

- From 33 kW to several MW.
- High-performance: high performance even at low power thanks to modular architecture.
- Availability thanks to a modular rack solution.
- Compatibility with numerous brands and numerous battery technologies: lithium-ion, lead, vanadium redox.
- Fast, safe maintenance: hot replacement of modules.

Storage at the HVA / LV substation

The storage system is primarily composed of the following equipment:

- 4 SUNSYS PCS² converters from 66 kVA limited to 250 kVA,
- the load shedding control system,
- a bus bar circuit breaker housing (DJC),
- a storage unit circuit breaker housing (DJS),
- a container located outside the substation, with lithium ion batteries for a total storage capacity of 620 kWh.

This storage system is also used for load shedding - see the “Energy storage solutions for load shedding and microgrids” case study.

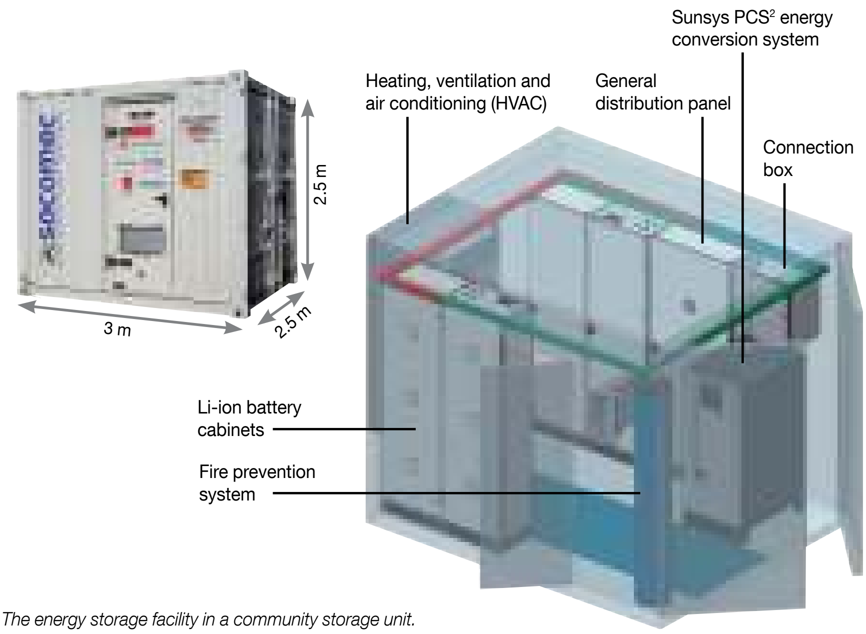
Energy storage facility at the Carros HVA / LV substation.

Community storage unit

Each community storage unit set up in Carros integrates all of the functions in a single 10-foot container:

- two cabinets for lithium-ion batteries make it possible to store 106 kWh,
- 33 kWh Sunsys PCS² conversion system,
- auxiliary services (ventilation, electronics, fire prevention, HVAC, telecom, etc.),
- connection and metering equipment.

Each container is connected to the LV grid like a customer between 36 and 250 kWh. The power and auxiliary circuits are off of the same LV connection.



The energy storage facility in a community storage unit.

Storage control

Storage is controlled centrally by the “Network Energy Manager” located at the ENEDIS control center. Taking into account forecasts for consumption and PV production, as well as the loads of the French electricity grid manager and energy producers, each day the information system defines a battery charge / discharge profile and communicates it to the storage systems.

Left to right: battery storage cabinet, distribution panel and the Sunsys PCS² converter.

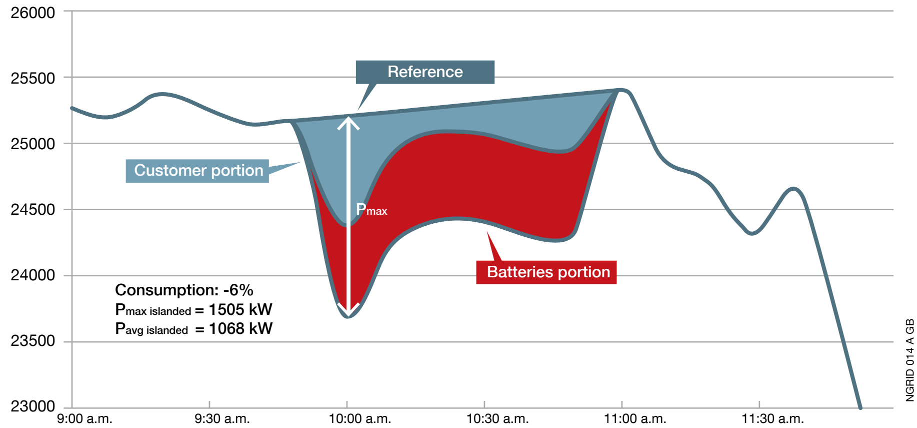
The results

Contributions to the usage scenarios

• ***Reduction of peak consumption***
During the winter of 2014/2015, the 1 MW asset located at the source substation was used together with the 33 kW assets of the community storage units. These assets contributed an average of 43 % of the total islanding power.

The graph here represents the consumption curve at the Carros source substation during one winter day in 2016. The various flexibilities (islanding of customer loads, storage systems) enable consumption to be reduced significantly. During the peak evening consumption, these flexibilities will make it possible to decrease the loads on the grid and not have to resort to peak production means.

Power at the source substation (kW)

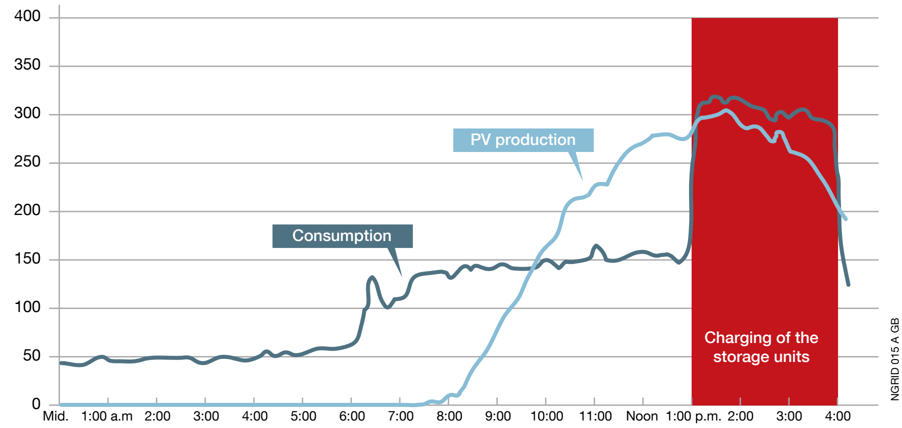


Impact of the various flexibilities on consumption at the source substation - Test of February 3, 2016.

• ***PV integration***
During the summer of 2015, the grid storage assets connected to LV (community storage units and HVA/LV substation) were charged between 1 PM and 4 PM in order to absorb the surplus PV production.

The graphic here shows that the increase in consumption through the storage makes it possible to preserve a production/consumption balance and thus avoid the increase of the voltage upstream and the current loads mentioned previously.

Power on the LV grid (kW)



Energy storage for reducing the load in the summer.

Key lessons

• The observed availability rate is close to 90 %. Industrial deployment would make it possible to achieve even better rates.

• The batteries and power converters must be carefully dimensioned based on their local environment. It is essential that analyses first be done on the maximum powers and energies involved in order to make optimized use of the storage for the surrounding grid.

• It would seem essential to improve control in order to maximize the services provided by the storage and the proper use of the storage system (for example by not charging the battery when there are passing clouds). This improvement can be achieved by developing local management in real time, fine-tuning the centralized strategy by taking into account, for example, local voltage, the amount of sunshine or the local PV production.

Key points

One of the strengths of the Nice Grid Project is establishing storage at various levels of the electricity grid: source substation, HVA/LV substation, LV grid, particular customers.

Reduction of peak consumption

With regard to flexibility, storage constitutes a more robust and more reactive solution than what can be contributed by the customers on the grid, the effect of which varies depending on commitment and possible waivers. During the experiment in the winter of 2014/2015, the impact of the grid storage proved to be significant, with 43 % of the power islanded between 6 PM and 8 PM.

PV integration

The case in which “massive photovoltaic integration” was implemented utilized the grid storage assets connected to LV during the summer of 2015. The storage assets were charged between 1 PM and 4 PM, thus absorbing the PV production that exceeded the needs.

The impact of the storage assets proved to be pertinent when they are situated close to the producers, and even interfaced with them.

Prospects

Energy storage offers multiple services to electricity grids:

- locally, it reduces the loads on the grid related to the integration of renewable energies at consumption peaks,
- at the system level, it avoids using heavy CO_2 producers at peak load,
- it can participate in system services such as frequency regulation,
- by eliminating some loads, the manager can avoid having to make heavy investments to reinforce a network when it has to take on new consumers or new production capacities,
- finally, when placed at particular locations a storage system makes it possible to create **resilient microgrids** in the event of loss of the upstream grid. This key concept of smart grids is detailed in the case study “Energy storage solutions for load shedding and microgrids”.

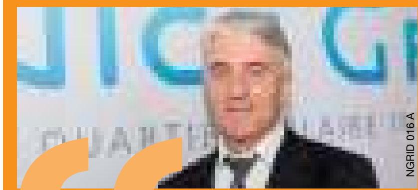
Other case studies on the same subject:
> Energy storage solutions for grid performance
> Energy storage solutions for load shedding and microgrids

Focus on

NICE GRID
UN QUARTIER SOLAIRE INTELLIGENT

Key figures

- Project: €30 million
  - EU subsidies: €7 million
  - ADEME [Environment and Energy Management Agency]: €4 million
- Duration of the project: 4 + 1 Years
- Location: Carros-Nice
- Number of customers equipped with LINKY meters: 2350
- Consortium of nine partners, headed up by ENEDIS
- Storage capacity: 1350 kW, 80 kW of which is at 18 residential customers
- PV production: 2 MWc
- Total islanding capacity: 1,5 MW



Socomec has undeniably made an essential technological contribution that we were lacking in the field of medium power converters; the know-how, reliability and commitment of the teams were crucial for the project.

Energy storage systems are very efficient when they are properly dimensioned for the anticipated service. Durable and very well documented, the Socomec solutions have proved to be easy to operate and run.

Christophe Lebosse
Nice Grid Project Manager
ENEDIS

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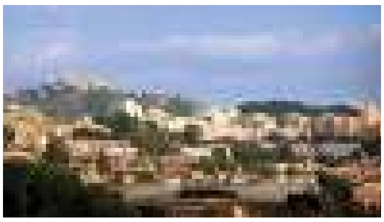
Energy storage solutions
for islanding and microgrids

APPLI 763 A

The project: Nice Grid



SITE 799 A © NICE GRID

NICE GRID
A SMART SOLAR DISTRICT

As the main operator of the French distribution network, ERDF has tested a smart grid demo version in Carros, near Nice. This site was selected firstly for its large-scale production of photovoltaic energy and secondly because it is an area both industrial and residential in nature.

One of the main objectives of the Nice Grid project is to demonstrate the feasibility to disconnect a district from the main grid.

Socomec provided and commmissioned its smart energy storage solutions for this islanding.

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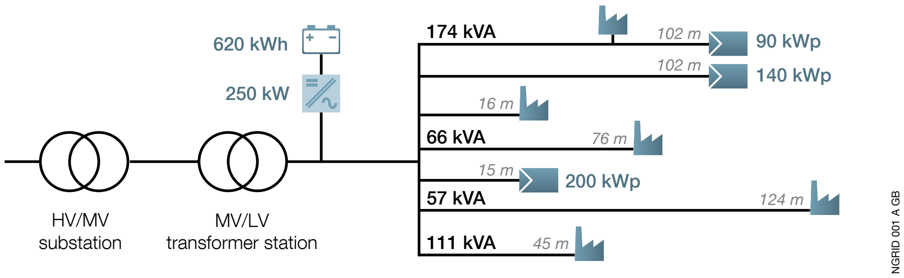
The requirements



The objectives of the Nice Grid project

- To provide feedback on installing, commissioning and operating storage facilities on the distribution network.
- To manage storage facilities remotely and automatically using innovative communication methods, a monitoring interface and an aggregator (NBA).
- To test the contribution of storage facilities to three use cases: the reduction of peaks, the widespread integration of photovoltaic production and islanding.

The vast majority of existing storage systems easily meets the first two use cases, which are the subject of another case study*. By contrast, islanding poses a real challenge to the Nice Grid demo.

The district chosen for testing the islanding solutions is powered by the MV/LV transformer station (400 kVA) to which the following are connected:

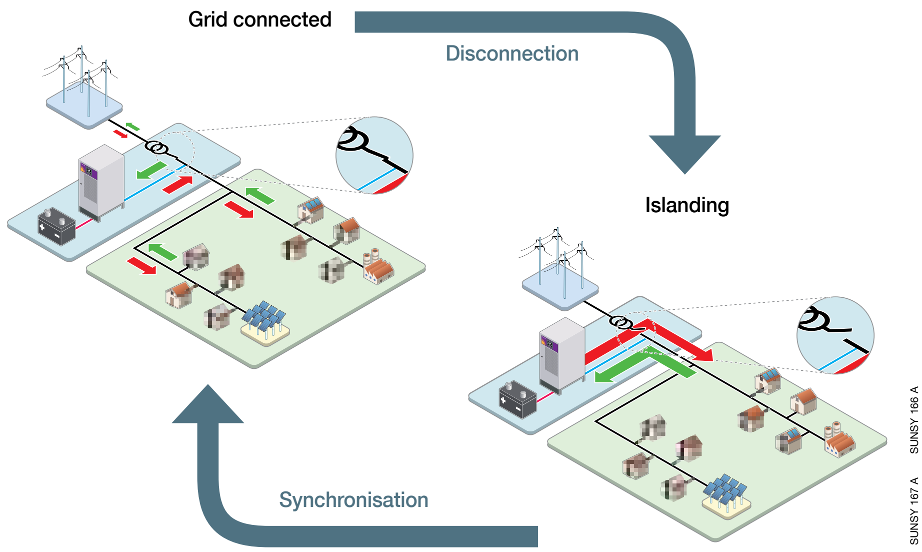
- 8 clients consuming up to 100 kW a day in peak photovoltaic production times,
- 3 large PV producers representing a total of 430 kWp.

* *"Energy storage solutions for the large-scale integration of renewable energy and peak management".*

What is islanding?

Islanding is defined as a sequence consecutive to the disconnection of the LV mircogrid (comment from GID) normally supplied by an MV/LV transformer. Whether decided locally or performed remotely by the network operator, this disconnection is voluntary; and that is when we call it **scheduled islanding**. It can also happen automatically following the detection of the absence of upstream mains voltage; in this case we call it **unexpected islanding**. When the LV grid is disconnected from the MV grid network, an **energy storage system** supplies the microgrid to ensure the continuity of supply.

This operation is possible for a limited time which varies depending on the state of charge (SOC) of the batteries, the level of the charges to be supplied and the level of local photovoltaic production. At the end of a set period or with the return of the upstream network voltage, the microgrid is re-synchronized and reconnected to the upstram network without interruption.



To be fully effective, the islanding solution must take into account four technical challenges:

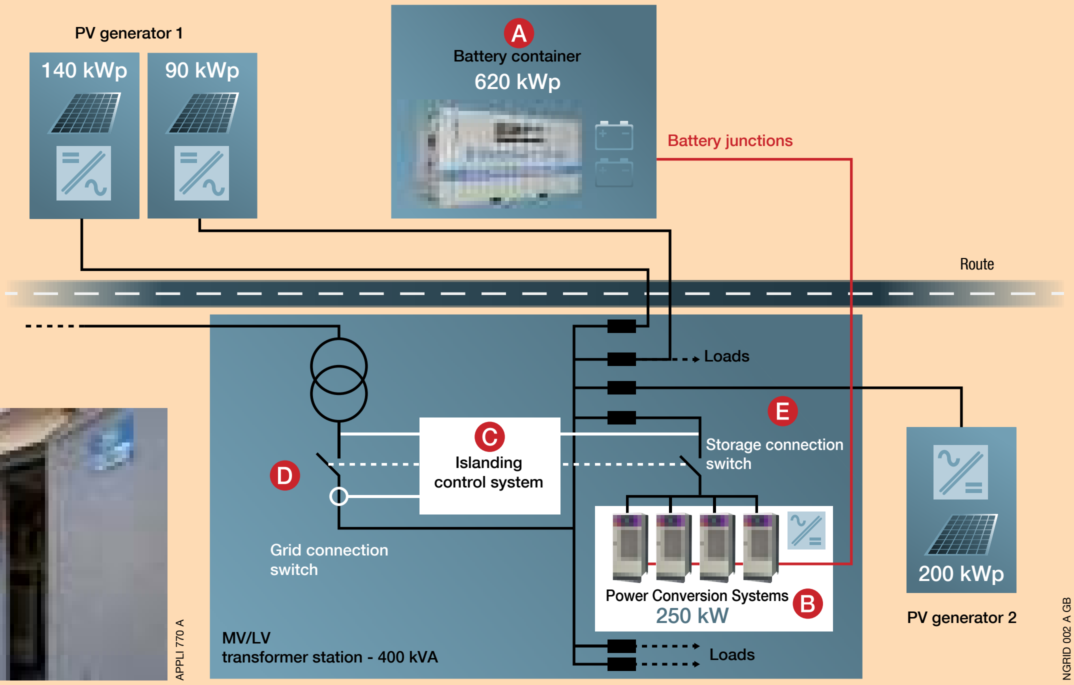
Ensure the quality and stability of the electricity supply
Maintain the voltage and frequency within the limits set by standard EN 50160.

Maintain the supply/demand balance
The strong imbalance between the PV production (430 kW) and consumption (100 kW) may cause the storage system to reach its limit. In this situation, PV production has to be regulated PV production.

Ensure the continued protection of property and persons
The system must ensure the proper functioning of the safety mechanisms against overcurrents with a limited short-circuit power.

Do not interrupt the customer power supply
Disconnection during scheduled islanding and reconnection shall be performed without interruption.

Architecture



NGRID 002 A GB


APPLI 770 A


APPLI 769 A

The islanding system consists mainly of the following:

Provided by SAFT

A 1 INTENSIUM MAX 20 container of 620 kWh Lithium-ion batteries.

Provided by SOCOMEC

B 4 x 66 kVA SUNSYS PCS² converters clamped to 250 kVA.

C 1 islanding control system.

D 1 grid connection switch.

E 1 storage connection switch.

The solution

Islanding control system

At the heart of the islanding control system is composed by:

- 1 industrial programmable PLC,
- 1 HMI,
- 1 electronic board to manage the synchronisation, connection, control and protection.

It features all of the following:

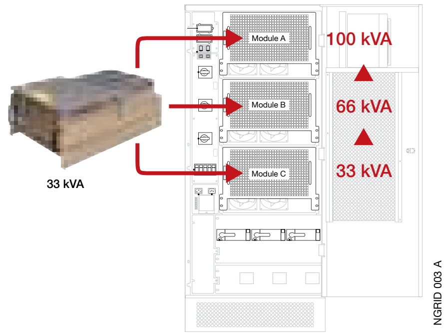
- communication gateway between the system operator and the storage system,
- monitors the battery and manages its operating limits,
- measurement and analysis of electrical parameters on the main grid and microgrid,
- follows charge and discharge schedules received from the energy manager in “grid connected mode” mode,
- distributes power between the conversion units based on their capacity,
- load transfer during scheduled islanding sequences (to achieve P=0 at the connection point between the main grid and the microgrid),
- coordination of the Black Start function during unforeseen islanding,
- regulates pv production (p(f) function) when the system reaches it operational limits,
- synchronization and automatic connection of the microgrid to the main grid when islanding ends,
- circuit breaker control of the coupling circuit breaker (CCB) and storage circuit breaker (SCB),
- additional isolation protection.


APPLI 771 A

SUNSYS PCS² IM: Power conversion and storage system

Like PV inverters, most of the power converters for energy storage systems operate in **current source mode**. An ideal current source delivers a constant current irrespective of the load on the circuit (infinite internal resistance). The output current is controlled and the voltage depends on the load. Such inverters and converters cannot function without a reference voltage and frequency supplied by the main distribution grid. As a result, their use is limited to **on-grid mode**.

Because **islanding** by definition involves disconnecting from the main distribution grid, it requires bidirectional power converters operating in **voltage source mode**. An ideal voltage source maintains a fixed voltage drop across its two terminals irrespective of load (zero internal resistance). The output voltage is controlled and the current depends on the load.
In **on-grid mode**, the main distribution grid provides the reference voltage and frequency. The **energy storage system controls active and reactive power** by charging or discharging the battery according to the commands received from the grid manager in response to energy flow management and voltage/frequency control needs.



During **islanding** sequences, the **energy storage system provides the reference values and controls the voltage and frequency of the microgrid**. It switches seamlessly between charge and discharge modes depending on the balance of energy generation/consumption.

Features

Managing a scheduled
As part of scheduled islanding, disconnecting from the main distribution network is done by **transferring power between** the network and the storage system. This avoids any interruption for users of the *microgrid*.

Managing an unexcpected disconnection
The storage system detects the failure of the network and then opens the coupling circuit breaker in order to island the microgrid. This disconnection is followed by the ***'blackstart'*** function: commonly used in the world of gensets, this involves the gradual restoration of the supply voltage on the microgrid to avoid an excessive inrush of current (e.g. magnetising spikes in transformers).

Distribution of power between storage systems
An installation consisting of several voltage generator type conversion systems must be based on the principles of allocating active (P) and reactive (Q) power to the various machines to avoid the exchange of current.

Balancing production and consumption
During the islanding phases, the main challenge is to maintain the balance between the PV production and consumption dictated by the load, while maintaining the voltage and frequency in regulated operational ranges.
In this mode of operation, the storage system prioritises the regulation of voltage and frequency on the microgrid. In order to ensure the production/consumption balance, it can go from charge mode to discharge mode and vice versa without any noticeable disruption by consumers.

Two factors limit the possibility of maintaining this balance:
- the battery's state of charge (SOC),
- the max power (P) that can pass through the power converters during the charging phases.

The storage system uses the function P(F), built-in to PV inverters, to regulate PV production or reduce the SOC.
And by managing the frequency, it proportionately reduces the power produced.

Protection plan to protect people and goods
Overloads and short circuits create an overcurrent. To enable protective devices to eliminate this type of fault, the power source must provide a strong enough current, which is always the case when the microgrid is connected to the main grid because the main grid has a very high short-circuit capacity. But with islanding, the PCS limits overload and short-circuit currents; SUNSYS PCS² IM devices have an increased overload and short-circuit power.

Synchronisation and coupling
At the end of the islanding process, to reconnect the microgrid to the normal distribution network without any interruption to the main grid, the system synchronises then couples the two grids.
To overlap the sinusoidal voltages of both sources, the storage system regulates its voltage (U), frequency (F) and phase shift (ϕ) depending on the measured differences. When the values are stable enough, the system gives the command to close the grid connection switch.

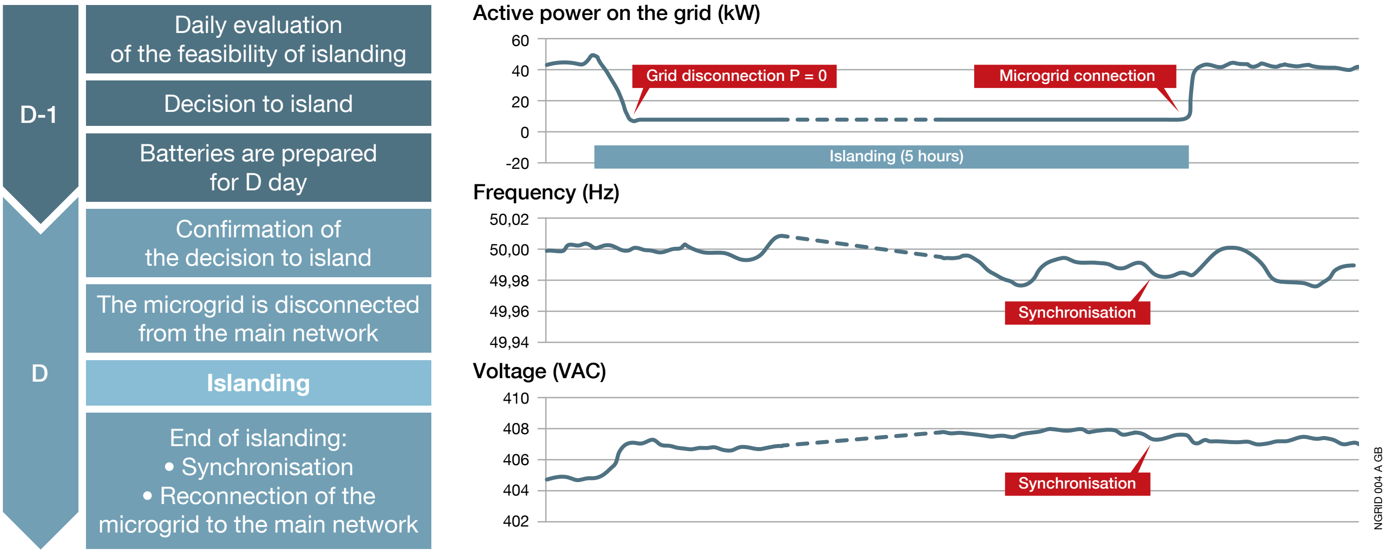
The tests

In September 2015, the islanding version of the energy storage system was implemented at the MV/LV transformer station in order to carry out the initial validation field tests. The primary objective was to test the operational sequences and the lack of influence that photovoltaic power plants have (in their original configuration) over the behaviour of the storage system. Note that these tests were conducted over a weekend — therefore under a moderate load — in order to avoid any risk of disruptive tertiary and industrial activity in the area. Several programmed and unexpected islanding tests were successfully carried out.

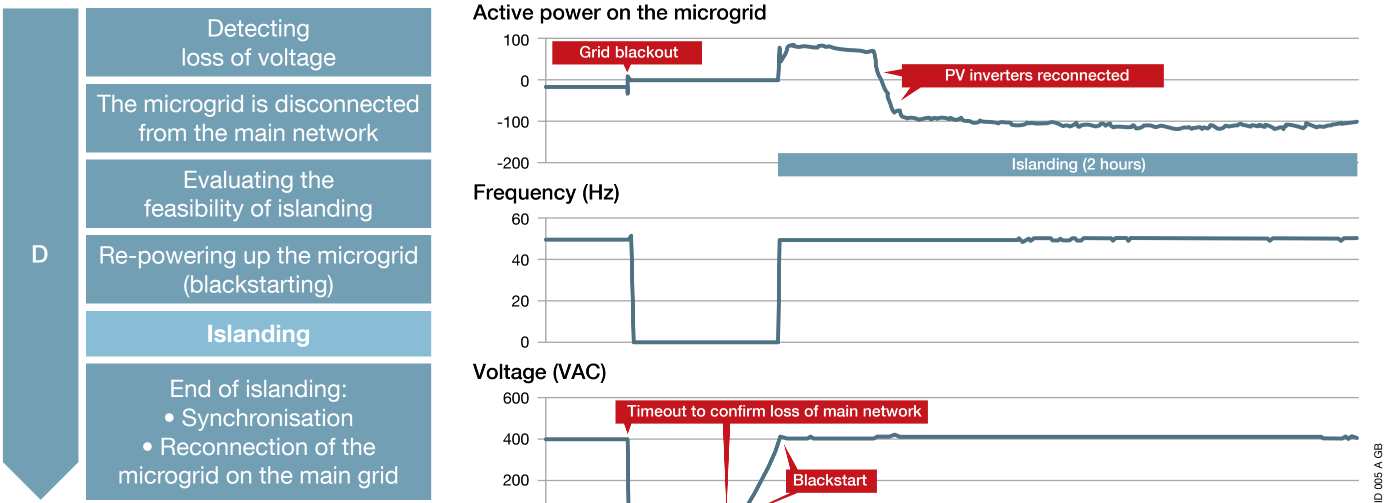
In October 2015, a new campaign of validation tests took place under real PV production and consumption conditions, to definitively validate the solution before the start of the experimental period.

On 6th and 7th October 2015, 5 hours of programmed islanding and 2 hours of unexpected islanding took place and were successful in terms of ERDF's expectations. These tests also confirmed the quality and stability of the distributed energy in compliance with EN 50160.

Programmed islanding



Unexpected islanding



What you need to remember

The islanding tested on Nice Grid is a **world's first**, with five hours of islanding without using rotating machines. Energy storage was able to supply **the microgrid in islanding within 5 hours.**
This solution works without the need to use extra controllable loads (discharge resistors) to manage the production/consumption balance on very sunny days with low load during islanding. This allows **better use of the photovoltaic resource**.
In the event of Unexpected islanding, **the process is fully automatic:** the loss of in upstream voltage triggers the system to start the islanding. Once the voltage of the main grid is back, the micgrogrid is resynchronised and reconnected to the main grid.

Reconnection is carried out **without interruption** after synchronising with the main network.
The solution of islanding can be seen as an **additional service** provided by the storage system, as well as the many services available in "grid connected" mode.
The storage system **does not emit any greenhouse gases** and causes **less noise pollution** than a genset.
The islanding solution also ensures protection against electrical faults, all **without changing the customer's existing protection.** Power converters can deliver twice their maximum intensity in case of a short-circuit on the downstream network.

Focus on

NICE GRID
UN QUARTIER SOLAIRE INTELLIGENT

Key figures

- Project: €30 M
  - EU subsidies: €7 M
  - ADEME (french environment agency): €4 M
- Project duration: 4 years
- Location: Carros-Nice
- Number of clients on the network: 2500
- Consortium of 9 partners, managed by ERDF
- Storage: 1.5 MW
- Network: 1.3 MW
- Residential: 0.46 MW
- PV production: 2 MWp
- Total capacity saved: 3.5 MW


NGRID_006

At the start of the project, we did not imagine we would manage to control every solution to deal with a blackout. Socomec's expertise has been instrumental in the islanding testing phase. This both technological and human adventure has been pure alchemy, thanks to the commitment of the people and a real willingness from businesses to work together for the technological success of an innovative project!

Mr F. Buzin
Director of ERDF Mediterranean

The outlook

Apart from grid support, energy storage is ideal for:

- **areas not served by the electricity networks** but supplied by diesel generators and renewable energies where the aim is to reduce fuel consumption while maximising the performance and service life of the generator
- **smart buildings** which try to optimise the costs of the electricity supply, local energy management and exchanges with the electricity network, while providing a reliable supply in the event of a blackout in the main grid
- **electric microgrids** designed to ensure the continuity of service closer to consumers. SUNSYS PCS² IM energy storage converters are at the heart of the system, safeguarding the supply to clients across a district (low voltage cluster or block), campus or industrial site, whenever there are problems on the main grid.
  The resilient microgrid will be the core design of future Smart Grids.

Other case studies on the same subject:
> energy storage solutions for the massive integration of renewable energy and grid optimization,
> energy storage solution for massive integration of renewable energy and peak management.

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Energy Storage in building applications
Electrical vehicle charging station

STUD 008 A

The customer: ENERGON Advanced Energetics

Energon Advanced Energetics, member of the Energon Holding company, is focused on the implementation of EPC (Engineering, Procurement, Construction) and EPCM (Engineering, Procurement, Construction Management) projects. Thanks to a wide portfolio of services, the company provides comprehensive project implementation, from design to commissioning, including project management and follow-up, as well as provision of related services. With Energon Holding's other company, S-Power Energies, they focus on photovoltaic and energy storage installations in central Europe.

To expand their energy storage projects, Energon opted for Socomec products to equip an electrical vehicle charging station with an energy storage system.

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The project

STUD 009 A

This energy storage project was financed by PRE, the Czech Republic's 3rd biggest energy utility.

The aim was to stabilise the grid whose quality is affected by fast Electrical Vehicle (EV) chargers that generate voltage and currents stresses on the grid.

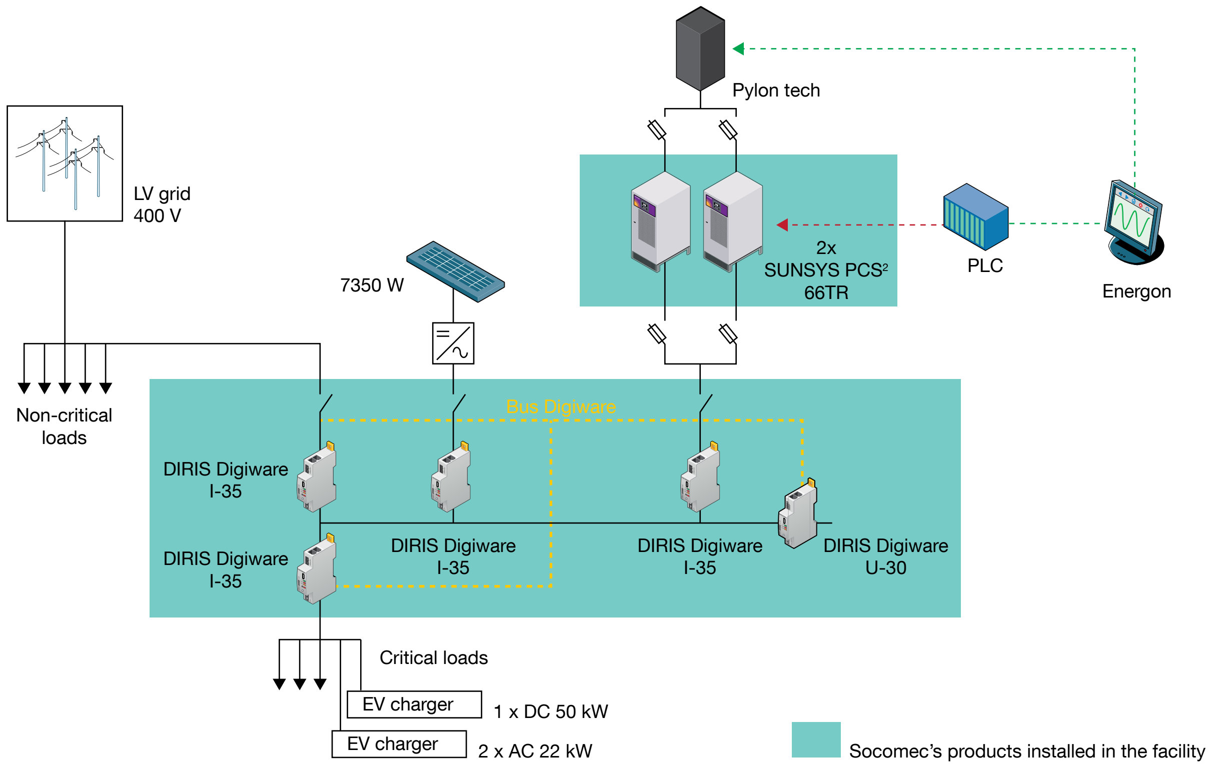
To better integrate the EV charging station without reinforcing the grid, the PRE utility wanted to use energy storage for active and reactive power management. In addition, energy storage is used to better integrate the production of 7.5 kWp of PV power, so that it can be self-consumed when charging the EV.

The requirements

The charging station is powered by 3 different sources: the grid, a photovoltaic installation and a battery energy storage system.
The system is composed of:

- two SUNSYS PCS² 66 kVA Bidirectional Power Converters each with their control system (Socomec),
- lithium-ion batteries (Pylon Tech),
- Energon EMS, the "brain" of the system that controls the entire storage system to stabilise the grid and maximise the use of renewable energy locally.

In addition to this material, Socomec's DIRIS Digiware measurement system is installed, a Socomec solution, which enables the monitoring of the entire facility.



STUD 010 A GB

The solution

STUD 012 A

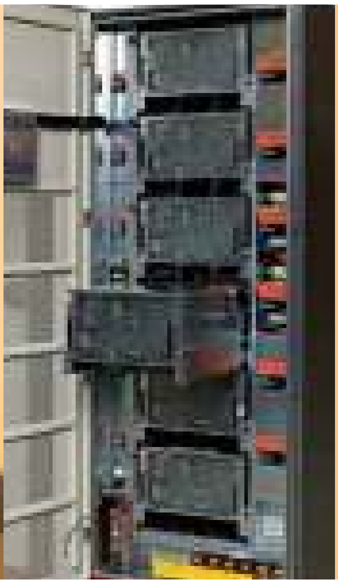
Based on a 50 years' experience in UPS technology, Socomec has developed a modular, flexible and scalable bidirectional power converter, ideal for energy storage. Thanks to its modular technology, with Dynamic Power Control mode, this converter ensures maximum product efficiency even at low power and the longest possible equipment lifespan.

For this project, Socomec provided two SUNSYS PCS² converters for a total of 132 kVA.
- 1 SUNSYS PCS² 66 kVA to stabilise the grid with active power.
- 1 SUNSYS PCS² 66 kVA to stabilise the voltage grid using reactive power.

Its fast reaction time (less than 80 ms) allows the EMS to quickly act to stabilise the grid.

The advantages

COUV 436 A



SUNSY 051 A

Flexibility

- Modular frame from 33 to 200 kW
- Scalable architecture up to several MW.
- Compatible with most battery technologies.

Performance

- Up to 96 % efficiency.
- Dynamic Power Control Mode.
- Full circular 4-quadrant P / Q capability.

Availability

- Hot swappable modules.
- No downtime during maintenance.

Key success factors

With its modular power of 33, 66 and 100 kW, Socomec's solution was well suited to this EV charging station application.
The active and reactive power management with the very fast reaction time of the SUNSYS PCS² means the Energy Storage System (ESS) can react quickly to periods of peak demand and production, and therefore contribute effectively to stabilising the grid.

Socomec was also able to provide the Diris Digiware monitoring and measurement system with fast and accurate measurement that allowed ENERGON's EMS to stabilise the grid quickly and efficiently.

Perspectives

The development of electrical vehicles will impact and stress the electrical grid. The normal solution to manage peaks in consumption due to EV charging is to reinforce the grid. An alternative is to install energy storage systems that provide functionalities to stabilise the grid, increase local renewable energy self-consumption, and even provide power in case of grid outage.

Focus on

Tomas Pastrnak
CEO ENERGON
Advanced Energetics


STUD 011 A

We were very happy with Socomec's products and approach. We are looking forward to working together on future projects.

Key figures

Investment: 313 k€
Installed PV production: 7.5 kWp
Installed power conversion: 132 kVA
Installed energy: 108 kWh

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DOC 311013i - 06/18 - Réalisation: Socomec

DIRIS Digiware system for food retailers

STUD 002 A

The customer:
W Foods Market*

W Foods Market is one of the largest supermarket chains in the world, currently operating over 1000 stores. W Foods Market specialises in retailing groceries but is also active across other key categories such as health and beauty, household products, pet and baby supplies as well as stationery items, DVDs and magazines.

The management team at W Foods Market was keen to identify opportunities to reduce the business' impact on the environment and to maintain competitiveness, while also increasing customer comfort and building brand sustainability.

Energy is vitally important for the business – not least as their second highest operating expense – but also as an opportunity to drive growth. According to specialist retail studies, a 15 % reduction in energy consumption can directly increase profit margins by approximately 1 point.

** Names have been changed to maintain confidentiality.*

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The solution

DIRIS Digiware system

In common with the majority of their peers in food retail, more than 80 % of the energy consumed by W Foods Market is split across three key usage groups: refrigeration, HVAC and lighting.
Despite monthly energy billing by store, it was not previously possible to break this consumption down by usage – preventing meaningful action from being taken.
In order to drive a more energy efficient policy, the management team took the decision to install a power monitoring system across 530 stores – more than half the estate – in order to more precisely measure the energy consumption across each of these three key usage areas.
A significant challenge in many aspects – initially in terms of minimising downtime, as it was only possible to retrofit the power monitoring solution in store between midnight and 5am.
It was also vital to identify a flexible power monitoring system that could adapt to different technical installations within each store.
Furthermore, the test-bed of stores includes building stock across different generations – with heterogeneous electrical installations, in some cases being rather complex.
Finally, given the number of sites and the economic stakes, it was necessary to identify a suitably qualified team to perform a deployment of this scale.

DIRIS DW 143 B

Socomec – along with the System Integrator – were identified as the ideal partners to provide the right solution to W Foods Market: DIRIS Digiware system.

DIRIS Digiware system is the most simple and effective system to enable building managers to monitor power parameters in real time and understand consumption levels in forensic detail.
In every W Foods Market, the DIRIS Digiware system deployed comprised at least 1 DIRIS Digiware D-70 (local display with Modbus IP communication), 1 DIRIS Digiware U-10 for voltage measurement and 4/5 DIRIS Digiware I-30 with flexible sensors for load measurements.

SOFT 078 A

Combined with Socomec's software solution, WEBVIEW, building managers are provided with the ability to access data gathered from meters via any web browser. WEBVIEW also allows the building owners and managers to more effectively manage power usage and respond to changing power usage requirements.

DIRIS Digiware is a full open system that's seamlessly integrated with an existing BMS (Building Management System).

The advantages

DIRIS Digiware: one system that meets all requirements

DIRIS Digiware is the power monitoring system best suited to meet the unique challenges of retailers.

Flexible

- First measurement system that is 100 % customisable and scalable.
- Complete Socomec solution: from the power monitoring devices to the current sensors (from 5 to 6000 A), including the visualisation software.

Plug & Play

- Implementation in a quarter of the time for multi-point metering.
- RJ45 interconnection of modules.
- Fast RJ12 connection to current sensors, on-load disconnection without shorting blocks, automatic rating detection.

Compact

- The best compactness / performance ratio of the market.
- Compact current sensors: line or staggered mounting, matching the pitch of protective devices.

PreciSense

Another key advantage of DIRIS Digiware system is its unrivalled accuracy.
Guaranteed accuracy in accordance with the IEC 61557-12 standard: class 0.5 for the global measurement chain (meters associated with current sensors), from 2 to 120 % of rated current.

The benefits

Energy management is an integral and significant element of the maintenance of a facility and the ongoing control of costs. One of the biggest issues when it comes to **reducing energy costs** is knowing precisely where energy is being consumed and, therefore, **avoiding energy wastage**.

A power monitoring system as DIRIS Digiware system provides W Foods Market with an indispensable tool to really get to know the business' energy profile and to effectively drive energy policy. This system provides an in-depth picture of energy usage to establish an **energy reduction strategy** in a more informed manner.
The first step for W Foods Market was to measure each supermarket's energy consumption in order **to establish a baseline and comparative data set**. Even if differences between individual supermarkets are apparent, with accurate measurements it is possible to determine energy profiles and to quickly identify supermarkets moving away from more regular profiles.

For example, energy consumption data at three supermarkets in the same area showed a distinct difference in energy cost per square meter for its HVAC chillers. Each supermarket had two chillers of an equivalent design specification and operated at the same ambient temperature. After analysing energy consumption at the individual asset level, W Foods Market discovered that the supermarkets were employing different operating and control strategies for the two chillers. W Foods Market identified the best practice chiller control strategy by benchmarking energy consumption across assets and applied it at the supermarket with the highest consumption with a result of a **20 % reduction and several thousand euros in annual savings.**

As part of the implementation of actions to improve energy performance, W Foods Market is now able to check the results of these actions, including the ROI. If an action generates the expected savings, it is deployed across all sites. This approach has resulted in the roll out of a high-efficiency lighting installation achieving **savings** in terms of energy usage of more than **15 %** - which represents financial savings of **several thousand euros**.

Socomec's DIRIS Digiware system is helping W Foods Market to implement a continuous improvement strategy based on their goals and the available energy consumption data gathered. The more detailed information gathered in real time from energy metering devices, the more specifically it is possible to target a strategy to meet and exceed a **building's energy conservation goals**.

Finally, DIRIS Digiware system has also enabled W Foods Market **to obtain an energy certification - ISO 50001** - which supports a structured approach to energy improvement but also communicates to employees and customers that the business is truly committed to **reducing energy consumption and its carbon footprint.**

Socomec: our innovations supporting your energy performance

1 independent manufacturer

3,600 employees worldwide

10 % of sales revenue dedicated to R&D

400 experts dedicated to service provision

Your power management expert

POWER SWITCHING

POWER MONITORING

POWER CONVERSION

ENERGY STORAGE

EXPERT SERVICES

The specialist for critical applications

- Control, command of LV facilities
- Safety of persons and assets

- Measurement of electrical parameters
- Energy management

- Energy quality
- Energy availability
- Energy storage

- Prevention and repairs
- Measurement and analysis
- Optimisation
- Consultancy, commissioning and training

A worldwide presence

12 production sites
- France (x3)
- Italy (x2)
- Tunisia
- India
- China (x2)
- USA (x3)

28 subsidiaries and commercial locations
- Algeria • Australia • Belgium • China • Canada
- Dubai (United Arab Emirates) • France • Germany
- India • Indonesia • Italy • Ivory Coast • Netherlands
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80 countries
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DOC 323013i - 06/19 - Réalisation: Socomec

Power availability in public access venues

Twickenham Rugby Stadium

The customer: SES Engineering

The UK's pre-eminent design-led Mechanical and Electrical (M&E) provider, Shepherd Engineering Services (SES), has partnered with integrated power solutions specialist, Socomec, to deliver a high profile project with Twickenham Rugby Stadium.

Acquired by Wates group (one of the largest privately-owned construction, development and property services companies in the UK) in 2015, SES specialises in the design and installation of building services and infrastructure solutions covering all aspects of M&E, to ensure that environments and spaces work hard for their customers.

An organisation driven by innovation, SES delivers bespoke, expertly designed and cost efficient solutions optimised for the entire construction team – making SES the partner of choice in the built environment.

Socomec works hand in hand with SES to deliver efficient and fully certified backup power systems for key infrastructure projects.

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The project

The home of English rugby, Twickenham Stadium, underwent a huge renovation project of £75 Millions in 2012. Main contractors, SES, undertook the M&E infrastructure works, installing new technologies to improve the fan experience whilst also improving operational efficiencies.

As the largest dedicated rugby union venue in the world, the project formed part of a wider investment programme to future proof the stadium for the next 25 years. The Twickenham stadium also hosts other events such as concerts or public gatherings.

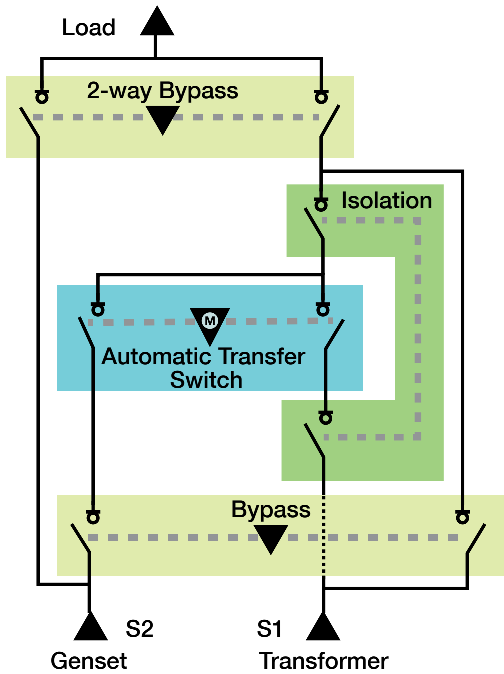
Proven within high profile and demanding applications, Socomec has scored with its ATyS Bypass technology at Twickenham, delivering the ultimate protection for the stadium's critical assets, infrastructure and people – and ensuring that the supporters enjoy the best possible experience, time after time.

The requirements

The key objective of the wider development programme was to enhance the event day experience for fans, and to ensure that Twickenham continues to exceed supporters' expectations both on and off the field.

Guaranteed power availability for stadium safety systems and essential broadcast equipment was vital – delivered via a global and / or simplified electrical scheme. Furthermore, **on time, below budget delivery** of each project phase was critical.

Complete redudancy was also an essential requirement for stadium management. Any electrical malfunction would result in significant consequential losses, not least due to the need to reschedule an event.



ATYS 952 A GB

The solution

Socomec ATyS Bypass switching technology – with automatic transfer switches available from 40A to 3200A – was selected to guarantee power availability for the stadium.
The Socomec ATyS Bypass incorporates Socomec's proven ATyS automatic transfer switching technology, combined with a maintenance bypass system to allow any testing or inspection procedures to be carried out safely – without interruption to the load – whilst guaranteeing power availability to critical loads at all times.
The complete system has been designed, manufactured and tested by the manufacturer, Socomec. Fully certified to IEC 61439(1), the bypass allows the system to also meet the ATS requirements of BS8519(2).

In the event of a mains failure, the ATyS Bypass will transfer to the backup supply. The status of the supplies and the system are monitored remotely by the building management system, delivering optimum efficiency.
ATS switches have 3 stable positions which are not affected by voltage drops or vibrations and the system provides simultaneous upstream and downstream isolation and fully visualised breaking.
Working in partnership with Shepherd Engineering Services (SES), Socomec products have been deployed around the stadium supplying various loads including lifts, pumps, control centres and a restaurant.

(1) IEC 61439-2 guarantees that the complete ATS assembly has been verified and certified to meet a recognised international standard for power switchgear assemblies.

(2) BS 8519 is a UK code of practice for power supplies to life safety and fire fighting applications. It calls in particular for a maintenance bypass to be provided on ATS supplying loads whose availability is critical while a building is occupied.

ATyS Bypass double line 250 A integrated in the stadium installation

The advantages

Reliable

- Complete ATS redundancy
- Optimised MTTR
- Simplified inspection, testing and maintenance

Integrated

- A complete and fully tested solution
- Ideal for new installations and retrofits
- Remote control capabilities

Safe

- Intuitive and secure operation
- Optimum electrical performance

Key success factors

With over 90 years' experience in the development and manufacture of innovative power systems, **Socomec's rich heritage in low voltage electrical power combined with market leading technology** were key factors in the selection process for this major development.

Based on proven, third generation ATyS technology in the second generation ATyS Bypass, **Socomec's switching solutions were identified as being the most advanced and reliable available today.** Providing robust, cohesive support to critical buildings and infrastructure, they are deployed in the most demanding operating environments around the world.

Fully certified by the original manufacturer, Socomec's products are engineered to deliver optimum performance throughout the equipment's lifecycle. **Designed to be simple to commission and maintain**, the compact units are efficient in terms of both space and energy – key considerations within this programme.

Socomec worked closely with partner, SES, to understand the brief for this high profile project in terms of both performance requirements and budgetary parameters and specified the best-fit solution for the project's specific needs. Furthermore, Socomec's expert project management and technical support teams were on hand every step of the way.

Focus on

Glenn Smith,
Senior Project Engineer
at SES Engineering

Socomec's ATS system was selected in this application for its unparalleled reliability and cost effectiveness – as well as being as efficient in terms of space as it is on energy. It is vital for Twickenham to meet important safety standards; furthermore, it is critical to maintain power during matches and events both commercially for the stadium itself and in terms of delivering an excellent customer experience every time. Commissioning was fast and efficient, supported by a highly professional and skilled Socomec team of expert engineers.

Key figures:
Investment: £ 75 Millions
Lifetime: 25 years
Numbers of Bypass installed: 17

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Power availability in Data Center applications

Dongguan Telecom

The customer: Dongguan Telecom

中国电信 CHINA TELECOM

A subsidiary of China Telecom – the largest telecommunications operator in China – Dongguan Telecom's 324 million RMB operation is a leading national internet and mobile network service provider.

The development of their Data Center facility includes a hard-working electrical infrastructure to ensure that the operation maintains peak performance at all times.

Proven within Data Center applications, Socomec's automatic transfer switches offer the ultimate protection for an organisation's critical assets, infrastructure and people - and operate in some of the most demanding environments around the world.

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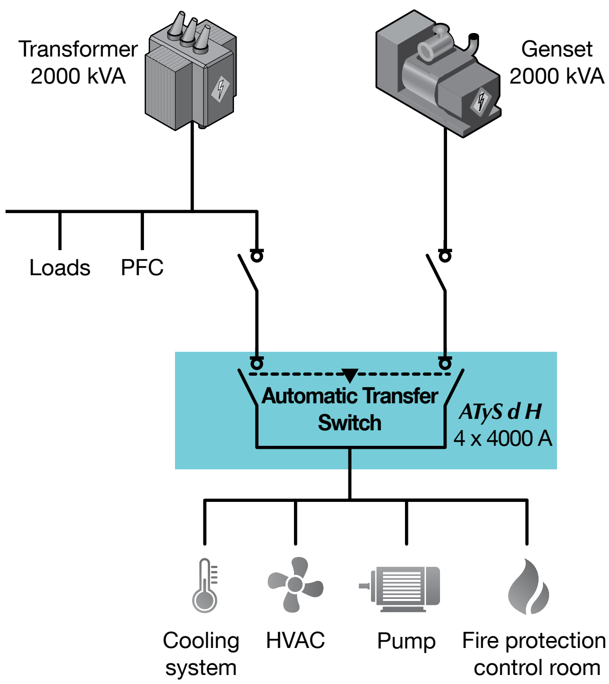
The project

In partnership with Socomec and distributor, Kingroad, Dongguan's Data Center project represents a significant investment of over 1 million RMB and is a high profile development that started life in 2015.

With construction work ongoing through 2016, this super-scale Data Center will tower six floors high, with a further two floors below ground level, serving the entire Dongguan Telecom estate.

The requirements

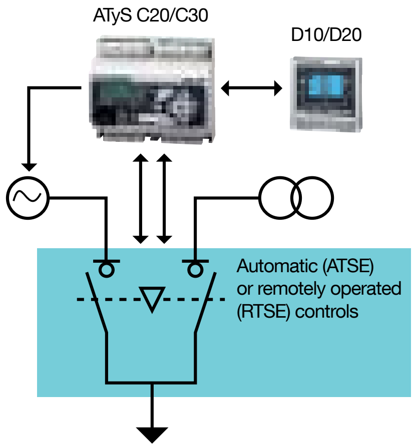
The key requirement for this Data Center facility was to **ensure transfer between a 2000 kVA transformer and a 2000 kVA genset.**
Guaranteeing mains incoming power across the whole infrastructure, 4000 4P 380 VAC, **the power supply interruption to the load is minimal during transfer.**
Ongoing safety and performance - and **guaranteed business continuity** - are vital, as is the associated protection of critical assets, infrastructure and people.
Furthermore, **easy and efficient ongoing maintenance** is critical. Comprehensive technical training will ensure that the system's performance is optimised throughout the product's lifecycle.



The solution

ATyS d H Transfer Switching Equipment from 4000 to 6300 A.
Eight units of 4000 A 4P have been supplied for this project. Power availability is safeguarded when using integrated and safe transfer switching equipment.
Socomec's ATyS d H transfer switching equipment has been designed for use in power systems for the safe transfer of a load supply between a normal and alternative source.

The changeover takes place in open transition and with minimum supply interruption during transfer, ensuring full compliance with IEC 60947-6-1 and GB 14048-11.
The ATyS d H is a remotely operated Transfer Switching Equipment (RTSE) that can be easily used in conjunction with an ATS controller – C20/30 or C40, depending on the application – to provide automatic functionality.



The advantages

High performance switching

Socomec's ATyS d H is a remote three-phase transfer switch with 3 and 4 poles and integrated dual power supply.
Engineered for low voltage high power applications it has been designed for applications that demand high performance and rapid, reliable switching.
Offering high withstand short circuit current ratings of 143 kA I_{cm} (making) and 65 kA for 0.1 second Icw (withstand), the performance in terms of load switching capacity is AC33iB (6xIn cos Ø 0.5) without derating.

Easy & fast integration

The multiple mounting options mean that integration is easy, whether into standard enclosures or custom-designed structures. Two switches are mounted one above the other, with accessible power connections located at the rear.
The installation time can be reduced even further as the load side is connected within the product – eliminating the need for external bridging bars.

Safe on load transfer I-0-II

The ATyS d H includes two mechanically interlocked switches to ensure fast switching whilst providing a neutral (Off - 0) position. This ensures that the main and alternative power supplies do not overlap.
The 0 position can also be used for safe maintenance of the installation, providing isolation between both sources and the load – a vitally important factor in this specific application.

Key success factors

As a recognised leader in high performance switching systems, the ability to deliver **optimised safety and guaranteed performance** were key factors in the selection of Socomec as a partner in this prestigious project.

What were the deciding factors in the selection of Socomec's solutions ?

- Socomec's ability to provide **specialist support** throughout the project – as well as providing a vision for the future.
- Socomec's delivery of **expert training** prior to installation and commissioning, resulting in the simplification of ongoing maintenance.
- Guaranteed **business continuity and safe product maintenance** associated with the 0 position.
- Socomec's investment in the creation of strong relationships and anticipation of challenges and needs.
- Best in class performance combined with a compelling commercial product and service package.

Focus on

Kerry Gu,
Region Marketing Leader

"As a global integrated power specialist, Socomec delivers the most robust, reliable and efficient energy performance solutions for mission critical applications.

We invest heavily in Research and Development to ensure that we design and manufacture products that exceed the appropriate standards – as well as exceeding our customers' expectations.

Furthermore, we understand that our customers need to maintain control of their operating costs.

Our expert engineering teams provide exemplary technical support throughout the entire process. From design to installation, commissioning and on-site maintenance, we ensure that the system operates at peak performance – today and tomorrow."

Key figures:
Investment: over 1 million RMB
Size: 8 floors high tower
Project duration: 1 year
Number of products:
8 ATyS d H installed

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DOC 2830118 - 01/17 - Produced by: SOCOMEC

Power availability in building application

Fuzhou Lijia International Commercial Center

The customer: Linca Industrial Group

利嘉集团 LINCA GROUP

Established in 1992, Hong Kong based multi-million RMB real estate development group - Linca Industrial Group Co. Ltd - invests in the construction of infrastructure throughout Asia, the US and Australia. With interests in sustainable urban development across a number of diverse sectors, the group's 3000 employees and 100 member organisations are active in transportation, mining, energy, forestry, medicine, logistics and hospitality.

A progressive and hard-working organisation, Linca Industrial Group's landmark projects deliver measurable change, transforming the landscape of urban areas.

The group's work positively impacts communities and cities, whilst raising the profile of important renewal and renovation work.

Developments are diverse, from a residential complex including cottages and high-rise buildings on the Zhongtian Gold Coast, to the creation of a shopping mall complex with its own hotel at Fuging Linca Center. Investments also include the Nantong Tianze International Trade City – China's largest trading area for wine and medicine.

The deployment of Socomec's products and services within such a prestigious and important development is testament to their efficacy and performance.

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The project

The 87 acre site is located south of Third Ring of Fuzhouin Fujian province, and is home to the largest distribution centre in the West-Straits Economic Area. Purchased in 2015/16, the global investment in this innovative project is over 15 billion RMB.

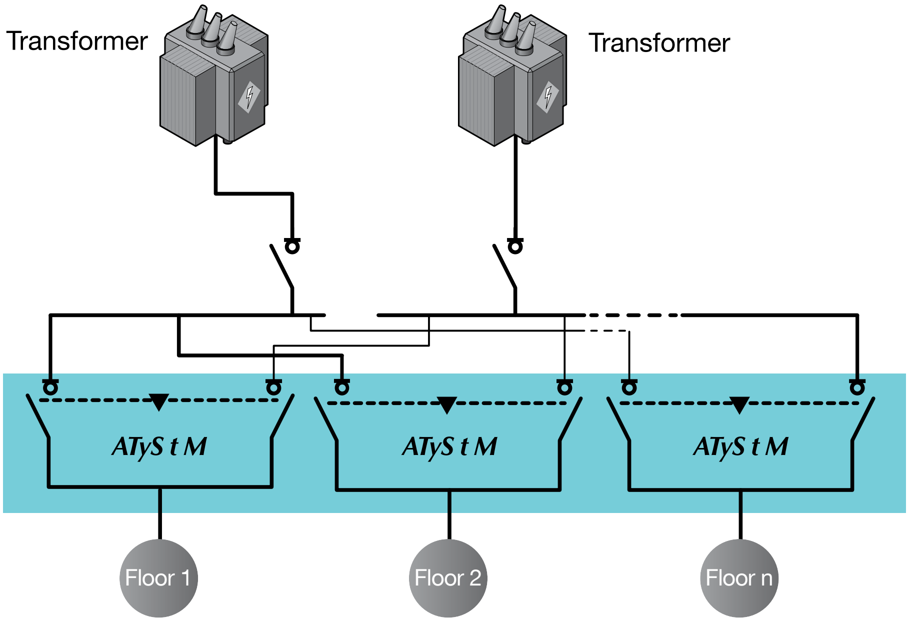
A key project within Fujian province, China, the Fuzhou Lijia International Commercial Center is a 100 billion RMB contemporary development by Linca Industrial Group.
The promotion of trade and international business relationships extends across a range of products including gold, jewellery, clothing and footwear, leather goods, bedding, sports equipment and cosmetics.

This 3 million square metre commercial and shopping complex boasts a 4D theatre and food court as well as a logistics centre, office buildings and other supporting infrastructure and facilities including 10,000 parking spaces. For the ultimate shopping experience, visitors can even stay in the 5* hotel – and for those who want their own slice of real estate, exclusive apartments are available to buy on the prestigious site.

The requirements

The main objective of this high profile project was to **enable automatic transfer switching between two sources (normal – emergency) and to ensure power availability throughout the building.**

Ensuring the continuity of power supply within a public venue such as Fuzhou Lijia International Commercial Center presents a range of challenges – which Socomec addressed with the following solutions:
• Protection of critical assets thanks to highly controlled switching
• Minimal downtime (contact transfer time of 150 ms)
• Fast and easy integration to meet the project delivery deadline
• Compatibility with building management and fire monitoring systems



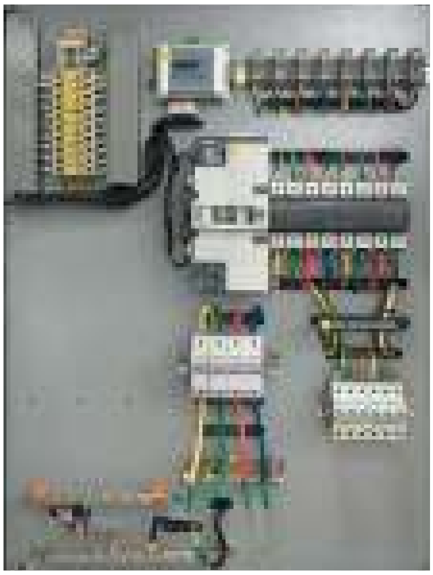
The solution

In partnership with key distributor Tengsheng, the integrated power solutions manufacturer, Socomec, has provided **more than 3000 ATyS t M** automatic transfer switches for the Fuzhou Lijia International Commercial Center project.

Socomec's ATyS t M are 4 pole, three-phase, modular automatic transfer switches with positive break indication. This automatic switching solution guarantees the critical power supply, optimising both safety and performance.

The equipment monitors the supply to a critical system and – in the event of failure or instability – safely manages the transfer to an alternate source. ATyS M are ideal for use in low voltage power supply systems, where a brief interruption of the load supply is acceptable during transfer.

Based on Socomec's proven load-break switching technology, ATyS M provide a robust and modular solution to safety and supply availability requirements.



ATyS t M 4 x 125 A

The advantages

Maximum safety

Safety is optimised via both electrical and mechanical interlocking. A manual operating handle is included as standard as an additional safety feature, for rapid response emergency access at all times. Immunity to voltage fluctuations is as a result of stable positions - and that the power supply is only required during switching. The ATyS demonstrates excellent dynamic withstand for improved safety when closing on a short-circuit. Electromagnetic actuator technology with rotary self-cleaning contacts guarantees extremely low electrical blackout time.

Fully integrated solution

Supplied as a complete, plug and play manufacturer-certified, compact unit that is robust, reliable and simple to install.
The ATyS enables new and refurbished critical buildings and facilities to conform to IEC 60947-6-1: the international standard governing transfer switching equipment, as well as to GB 14048-11: the equivalent Chinese standard.
Easy to order; one single part number covers the complete solution.

Easy to install

Quick and simple to commission: nominal voltage and frequency are configured automatically.
With an integrated controller for use with Mains/Mains applications, the labour intensity of commissioning is reduced. Programming is via one potentiometer and dip switches – using just a screwdriver. Furthermore, secure programming is provided by sealable cover, preventing access to the configuration panel and mitigating against tampering. Coil-based technology speeds up the operation with a contact transfer time of 150ms.

Key success factors

The combination of **optimised safety and guaranteed performance** was critical in the selection of the Socomec ATyS.

Specific product features were vitally important to ensure the total security and operational requirements of this project:

- Manual transfer on load, available as emergency function
- Contact transfer time of less than 500 ms
- Product padlocking possible in the 0 position for safe maintenance
- Padlocking configurable in any position (I, 0 or II)

In addition to the safety and performance of the core product, service played a deciding role in the choice of project partner.

The ability of the Socomec team to provide expert local support from the initial specification right through to the commissioning of the electrical installation was a key factor in the success of this project.

Focus on

Kevin Wang,
Product Support & Training Officer, Socomec

The combined impact of a high performance product from a European manufacturer – plus local, 24 hour on-site servicing and a 3 year warranty from our distribution partner – meant that we were able to provide a compelling package for this exciting project. With significant investment in our global development and production facilities, we are a recognized leader in high performance switching systems.

We offer a complete range of load-break switches and can individually engineer solutions for very specific requirements. Furthermore, the fact that we have identified and built a worldwide network of expert engineering and technical resource means that we are able to support the equipment throughout the product lifecycle.

Fuzhou Lijia International Commercial Center key figures:
Investment: 100 billion RMB
Size: 3 million square metre commercial and shopping complex
Project duration: 2 years
Number of products:
3000 ATyS t M installed

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Energy storage system for hybrid microgrids

Multi-source power supply for an isolated site

STUD 018 A

The customer:
EDF

The EDF Group specialises in the design, development and operation of microgrids and smart grids. Projects are located in areas with poor power quality or even in areas that have no access to the power grid.

In recent years, EDF has implemented several innovative microgrid solutions, in particular the 100 % renewable energy system on Reunion Island, the demo system Nice Grid in Carros near Nice and the Toucan and Kaw hybrid microgrids in French Guiana.

As part of this strategic development, EDF is supported by Concept Grid, EDF's R&D smart grid laboratory based in the Paris region.

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STUD 019 A

The project

The MASERA project (Microgrid for Affordable and Sustainable Electricity in Remote Areas) is part of the REIDS demo project (Renewable Energy Integration Demonstrator – Singapore). Launched in 2016, this initiative by Nanyang Technological University in Singapore primarily consists in implementing several microgrids on the island of Semakau off Singapore and then interconnecting them to share the generated energy.

The MASERA plant is a fantastic opportunity for EDF to implement its innovative solutions on the microgrids, drawing on its experience and expertise in this field. The project also has significant support from EDF Lab Singapore, one of the international centres of EDF R&D, and from the EDF International Division, also based in Singapore.

The MASERA facility was actually designed, developed and implemented within a year with French and local partners – including ENEDIS and Socomec – under the direction of EDF. This project represents the enormous complexity of managing all the sources of a microgrid ; it gives credence to our solutions in real-life situations and teaches us about the use and operation of a microgrid in remote areas.

The requirements

EDF aims to become a world leader in microgrids. The MASERA project is an excellent opportunity for national operators to design a product tailored to isolated areas, which can provide reliable and 'carbon-free' electricity at affordable prices. There is a dual objective – to both improve the quality of life of people living in remote areas and to protect the environment.

The MASERA system should:
- optimise real-time electricity generation and consumption,
- allow the microgrid to be fully autonomous in terms of electric power,
- be compatible with a wide variety of sources (PV, energy storage systems, etc.) to eliminate the use of oil-fired gensets and operate on potentially 100 % renewable energy,
- provide flexibility by using electric vehicles on a Vehicle-to-Grid platform.

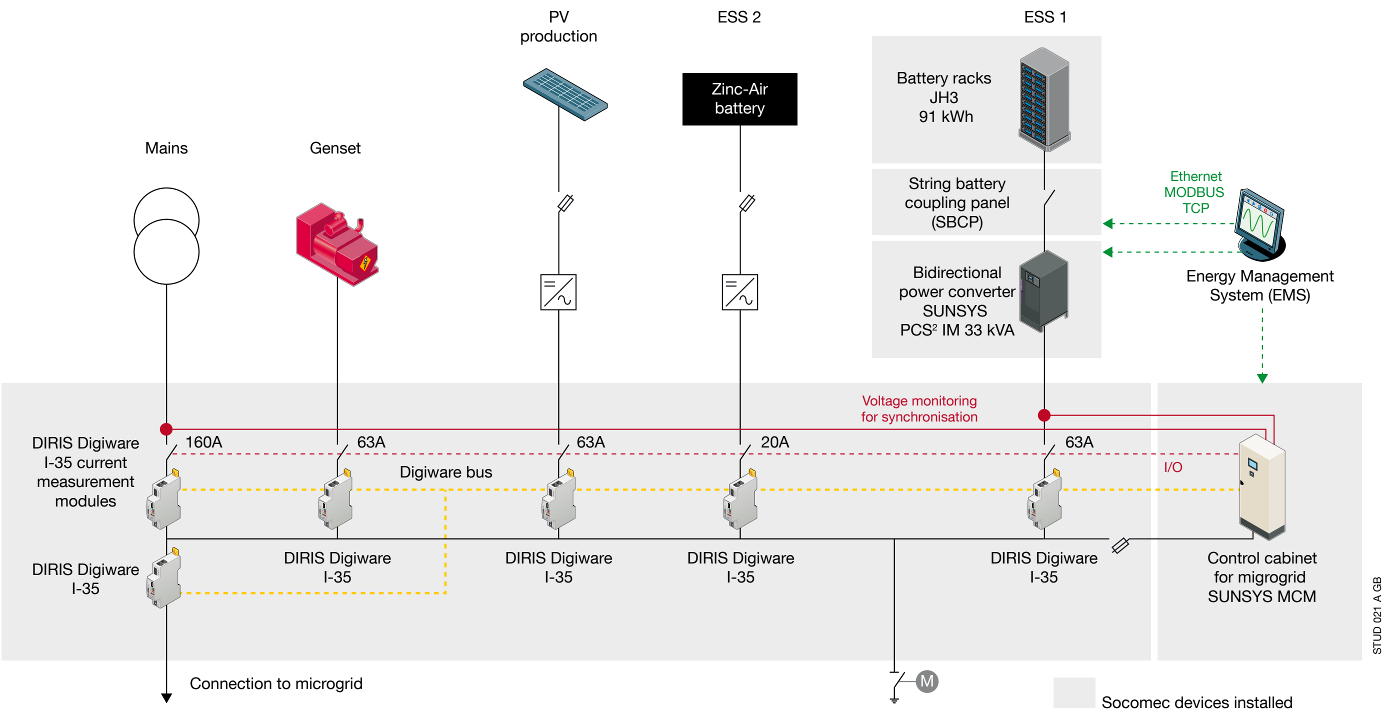
STUD 020 A

View of the Masera installation site.

The solution

The microgrid created as part of this project consists of:
- a genset,
- bi-facial solar panels,
- a 33 kW/91.3 kWh storage system with Lithium-Ion batteries supplied by Socomec,
- a Zinc-Air battery supplied by Zinium (EDF spin-off),
- a Nissan Leaf electric vehicle and a V2G (Vehicle-to-Grid) charger from NUVVE,
- a load bank to reproduce typical customers' consumption.

All these components are connected to a reliable and secure communicating metering system. MASERA is controlled locally and remotely by a 100 % EDF system that optimises the energy produced for different uses (customer consumption, battery storage, electric vehicle charging).



Socomec provided the following storage system:
- a bidirectional SUNSYS PCS² IM converter that can operate in island mode,
- a battery rack, consisting of 14 LG Chem modules,
- an MCM control cabinet, which not only manages the storage system but also controls the generator using Socomec's Power Monitoring System (PMS) software.

Where a microgrid is connected to the network, this storage system can decouple and resynchronise the microgrid to the network.
In island mode, it also regulates the voltage and frequency of the microgrid.

Why choose Socomec?

EDF has been able to build on a strong and established partnership through previous joint projects. It therefore benefits from an excellent understanding of the issues and open communication. What's more, these projects had already validated the performance of Socomec solutions and the interoperability between Socomec and EDF systems – both crucial to the success of the new project.

Focus

Kévin CHOLETAIS

Research Engineer EDF R&D
Project Manager MASERA - REIDS

STUD 022 A

Thanks to the expertise and quality of the Socomec solution, we have met the challenge of designing, integrating and deploying a microgrid on a remote island in Singapore.

Socomec supported the project through all these phases, working closely with local teams and in France, making them a key partner in the success of the project.

Key figures

Project duration: 4 years
Funding: internal and through local partnerships with Nanyang Technological University (NTU) and the Economic Development Board (EDB)

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DOC 326013I - 10/19

Power availability in critical hospital applications

The client: University Hospitals Trust of Strasbourg

The University Hospitals Trust of Strasbourg includes six hospital sites around the city of Strasbourg. More than 12,000 people work there, taking in a maximum capacity of 2,711 patients. Healthcare provision is very wide-ranging, catering for the most diverse pathologies.

The University Hospital of Strasbourg Centre sets itself apart with its investment in innovation and research. It also includes 7 colleges and institutes, divided into 10 teaching sectors which manage the training of future healthcare professionals.

In 2006, Socomec won an initial contract with the University Hospitals Trust of Strasbourg for a hospital bay at the New Civil Hospital, one of the Trust's 6 hospital sites. As part of the project to build the new Medical Technology and Musculoskeletal Unit and the new Regional Cancer Institute at the Hautepierre site, Socomec supplied 39 equipped hospital bays to ensure continuity of power to operating theatres.

Les Hôpitaux Universitaires de STRASBOURG

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The project

Two new buildings are under construction at the hospital site of Hautepierre.

• A new Medical Technology and Musculoskeletal Unit.
  This building will house departments specialising in orthopaedics, trauma and maxillofacial surgery. It will include 39 operating rooms at a total implementation cost of €150 million.
• This unit will be closely linked to the new Regional Cancer Institute which will replace the current Paul Strauss Centre.

The construction of the Medical Technology and Musculoskeletal Unit will free up valuable space in the current building at Hautepierre and is the precursor to a major restructuring of these buildings.

SITE_863 A

In addition to this major restructuring, Hautepierre hospital wanted to equip its Angiography Department with two new operating rooms. Thierry Oswald, Operations Electrical Engineer at the Trust, took the decision to combine the electrical equipment needs for all these projects to find a single solution that fits all requirements: “My idea was to take advantage of the new operating theatres built for the Angiology Department project to develop a hospital bay solution designed to fit with the overall construction project of the Medical Technology and Musculoskeletal Unit and Regional Cancer Institute”.

The work will be completed mid-2017 to allow for new infrastructure to be started up in 2018.

Project Requirements

Energy availability

In a hospital setting, it is critical that power to the operating rooms is continually available. The installed solutions must address several challenges.

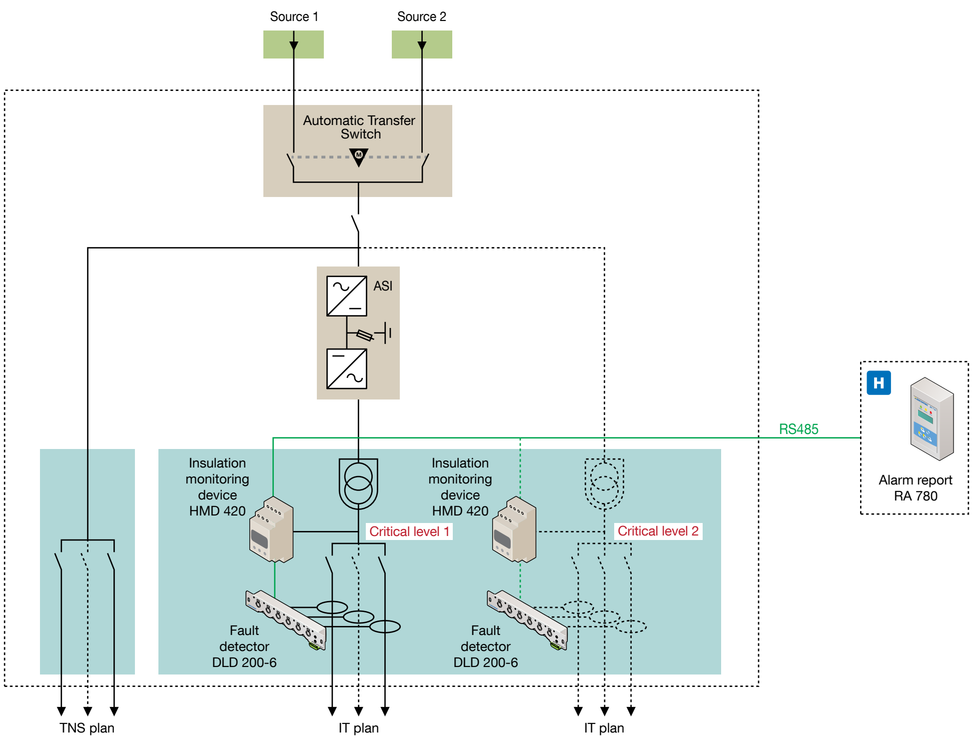
- At Hautepierre, operating theatres will be powered by two outputs from the low voltage mains panel powered by two MV/LV transformers; this redundancy can mitigate any processor failure. If there is a power grid outage upstream of the transformers, the backup gensets will take over. "The philosophy of the Trust is not based on an architecture with inverters upstream of the cabinets powering the operating theatres", explains Thierry Oswald. "We want the inverted power to be integrated into the hospital bay, which is what MEDSYS does".
- In addition, the IT layout requires the bay to feature an insulation monitoring device to protect people against indirect contact.
- Finally, the electrical installation of the new Medical Technology and Musculoskeletal Unit must conform to standard NFC 15-211, which sets out design, implementation and operation methods for the LV power supply in a healthcare facility. This norm and the standard HD 60364-7-710 requires a medical IT layout for group 2 premises and at least one transformer for each operating room or each medical site. For the Trust, the electrical cabinet powering an operating theatre must meet criticality levels 1 and 2 of the standard NFC 15-211.

Usage requirements

The solution must also:

- meet a small footprint of 2000 x 800 x 800 (H x W x D),
- allow for easy and intuitive use for electrical work,
- ensure the safety of maintenance staff: all installations should meet protection class IP2x,
- ensure the availability of the installation,
- allow the power source to be manually operated in an emergency,
- integrate current and energy measuring functions in accordance with RT 2012.

Electrical architecture



MEDSY 019 A GB

Reminder
These criticality levels determine the permissible time from loss of power depending on the type of load (electrical medical devices) that can be found in the operating room:
- criticality 1: no cut-off allowed,
- criticality 2: cut-off of less than 15 s allowed.

The solution


APPLI 803 A

39 MEDSYS 60 hospital bays made wholly by Socomec will equip the operating theatres of the new Medical Technology and Musculoskeletal Unit and the 2 angiography operating rooms.

The MEDSYS modular cabinet creates both a physical separation between the input and output wiring as well as a separation between low and high currents. It is equipped with a pivoting and reversible front panel, and fully extractable transformer and inverter compartments. The heart of the system is a culmination of “expert” functions:
- ISOM Insulation Monitoring Device, specific to hospital applications,
- NETYS UPS to ensure criticality level 1 without cut-off,
- ATyS transfer switch to ensure the redundancy between the double power supply upstream and the energy monitoring required by RT2012.

The connection is made by two IT neutral arrangements comprising a 10 kVA isolation transformer connected to an HMD 420 insulation monitoring device.
To ensure criticality level 2 (cut-off < 15), an isolation transformer is installed downstream of the ATyS switch.
If there is an isolation or overheating fault on the transformer, the monitoring interface (RA 780L) warns the surgery staff with a visual and audible alarm.


APPLI 804 A

With criticality level 1, no cut-off is allowed; a second isolation transformer is installed upstream of the inverter (see the architecture diagram opposite).
If one of the sources fails, the UPS takes over when switching to the ATyS p transfer switch.

The advantages

MEDSY 005 A

Guaranteed safety for people and the installation

- The solution protects people against indirect contact (IT neutral arrangement, insulation) and direct contact (IP21, segregation).
- The ATyS p transfer switch incorporates a watchdog timer to continuously monitor the product and its switching capability, in order to safeguard the system.
- In an emergency, an emergency lever allows staff to control the device quickly, easily and safely.

Continuity of service

- The solution ensures the continuity of use, even in the case of a single fault condition.
- It identifies an insulation fault in less than 10 seconds, even with highly disrupted sensors.
- The equipment conforms to norm NFC 15-211 and the standard HD 60364-7-710, guaranteeing an uninterruptible power supply.

Certified & tested equipment

IEC/EN 61439 READY

- The MEDSYS 60 hospital bay is a 100 % Socomec manufacturer solution, from sheet metal to automatic transfer switch, right through to the electronic protection devices and UPS.
- This solution has been certified and tested according to the standard IEC 61439, which will soon be integrated into standard NFC 15-211.

Easy implementation

- Thanks to the cable output / input compartment, the system is easy to install without having to touch any working units ; all connections are grouped into this one compartment.
- Reduced size, with a footprint of 80 x 80 cm.

Easy maintenance

- The motorised section of the ATyS p is easy to replace.
- The modules containing the isolation transformers and UPS are removable.

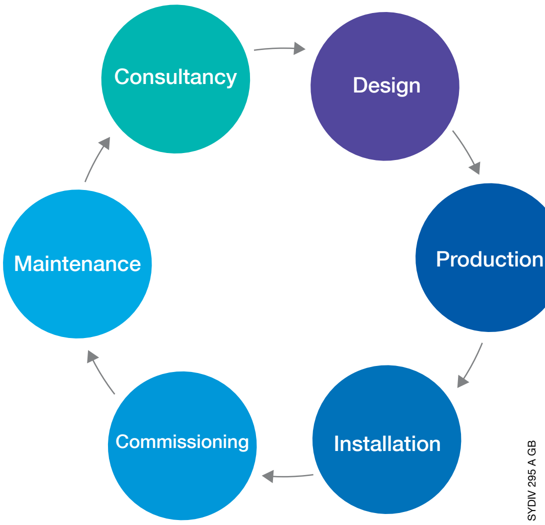
The results

After an initial testing phase, Socomec reviewed a part of the hospital bay design to ensure MEDSYS 60 met all the needs of the Trust.

Frédéric Kapps, Regional Sales Manager at Socomec, says that the MEDSYS 60 unit in its current form is the result of a close collaboration between Thierry Oswald and the Socomec design office: *"The equipment project of the new Medical Technology and Musculoskeletal Unit and the operating rooms for the Angiography Department spurred Socomec on to define and create our hospital bays. The MEDSYS 60 solution we now offer has reached new performance heights, since we took into account the requirements of the customer and the facility".*

Key success factors

- A “made-to-measure” solution that is flexible and adaptable to the specific requirements of the healthcare facility.
- An IEC 61439-certified and qualified manufacturer solution.
- An effective partnership, involving the onsite support of the Socomec teams, from design to maintenance.



The Outlook

This project is testimony to Socomec’s expertise in securing the availability of energy in healthcare facilities. Colmar Hospital in the Haut-Rhin area is also equipped with MEDSYS bays. The specifications for this project state that the type of bay installed must be fitted with 2 inverter inputs. Equipped with the STATYS static transfer system (a 100 % Socomec product) offering 2 inverter inputs, the modular cabinet solution MEDSYS 40 is a perfect match for the requirements of the Colmar Hospital’s electrical system.
The MEDSYS range includes 4 model versions and 8 configurations to meet a wide range of needs.

Focus on

Thierry Oswald,
Operations Electrical Engineer

Thierry Oswald is an Operations Electrical Engineer within the Trust. Having put his faith in Socomec, he established close links with our Sales teams.

“I am in regular contact with Socomec, attending customer events such as the technical event days, which are a great chance to exchange knowledge. On this particular project, the Socomec teams listened to me and understood my operating requirements. With their excellent interpersonal skills and ability to listen, Socomec came up with hospital bays that respond to our technical and financial project requirements.”

Key figures
Total investment in the Medical Technology and Musculoskeletal Unit project: €150 million
Operating rooms equipped: 39
Cut-off tolerance: 0

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CASE STUDY: **HOT-SCALABLE UPS SYSTEM**

DELPHYS Xtend GP

Providing the protection of a supercomputer

The customer: Met Office

The leading provider of weather and climate services.

The Met Office (UK), delivers over 3,000 precise daily forecasts and briefings to the broadest possible range of customers, from the Armed Forces, Civil Aviation Authority and Government to the media, businesses and the public.
Founded in 1854 as an experimental government department to research the possibilities of forecasting the weather - mainly to protect the safety of ships and their crews at sea - today, the Met Office is recognised as a world leader in the provision of weather and climate services, employing more than 1700 people at 60 locations around the world.
Processing more than 10 million weather observations every day, using an advanced atmospheric model and high performance supercomputer, The Met Office ensures that accurate weather and climate advice is available around the clock. Helping agencies and governments take emergency measures, as well as making tactical plans and strategic choices, the information that the Met Office provides undoubtedly reduces environmental risks and improves the resilience of the UK to extreme weather.

Met Office

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The requirements

One of the reasons that the Met Office is so successful in its mission is that every activity - every data exchange - is based on world-leading science and supported by robust and innovative technology.
A key investment - the £97 million HPC project based at the Met Office HQ in Exeter - was first operational in 2015 and is scheduled to reach full capacity this year. Expected to be one of the most powerful High Performance Computers (HPC) on the planet, the supercomputer will deliver improved observations, science and modelling.

With computing capacity to process over 14,000 trillion calculations per second, this supercomputer will firmly establish the UK's position as a world leader in weather forecasting and climate prediction, able to provide unparalleled support to businesses, the government and the public.
The provision of a guaranteed power supply - with inherent flexibility to accommodate evolving requirements - is itself an essential component of the Met Office's HPC systems. With a reputation built on accuracy, robustness and reliability, the Met Office needed a critical power infrastructure to match.

APPLI 787 A

The solution

Delphys Xtend GP - an extension of the highly energy efficient Green Power 2.0 modular UPS range - has been designed specifically for the very largest Data Centres, providing a complete and scalable high performance system that can be built-up in power blocks of 200 kW up to 1200 kW.
The Delphys Xtend GP combines all the efficiency benefits of the GP 2.0 technology with the simplicity of I/O architecture - and the scalability of a modular system.
The simple Cable In/Cable Out (I/O) architecture simplifies upstream and downstream switchboards. This flexibility allows more effective use of capital, as the system power can be matched to current demand, allowing investment in new power blocks to be made only when it is required.
As the system has been designed to allow the power blocks to be hot-swappable, if required, the load can be fully protected by on-line double conversion during system extension or maintenance.
This prewired system has an individual Socomec switching system for each power block enabling easy and safe coupling and disconnection.

The advantages

The Delphys Xtend GP enables large datacentre operators to more effectively manage their initial capital investment whilst also reducing on-going operational costs.
This modular UPS system provides an optimised solution for a set of truly unique requirements - whilst also being mindful of the Met Office's underlying objectives in terms of efficiency, availability, reliability and Total Cost of Ownership.
Offering unique modularity, the system uses 200 kVA units in parallel to protect critical IT systems.

APPLI 788 A

"The investment in the supercomputer is an investment in the future of the prosperity, safety and wellbeing of the UK. Protecting and leveraging that investment is critical.
From daily updates to severe weather warnings, high performance computing is an essential component of everything that we do at the Met Office. This enhanced processing power will help us to protect life and property – and will also enable us to turn more science into services.
Socomec has provided invaluable support to our systems for over 15 years, working closely with us to create bespoke solutions to our precise requirements. Our reputation is built on pinpoint accuracy, robustness and reliability; Socomec's solutions have been engineered to deliver innovative systems that optimise the performance of our organisation."

M. Peter CLAYTON-WHITE
Met Office Building Services

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DOC 289013 - 05/17 - Produced by: Socomec

Measurement and monitoring system for electrical installations

STUD 002 A

The customer: Six Degrees

6° Enabling your brilliance

Leading technology service provider, Six Degrees, provides integrated managed data services linking people, places and clouds. Trusted with high profile mission critical technology around the world, Six Degrees deploys platforms of innovation to host applications and websites.

Leveraging the group's technical expertise, Six Degrees creates successful business outcomes for its partners by bringing technology alive through its people. Defining IT and infrastructure requirements, Six Degrees helps its customers to create better businesses and organisations across the public and private sectors.

Whether keeping patient records safe, retailers trading or providing disaster recovery services, Six Degrees 1000 data centre racks deliver critical support across multiple sectors. With 4 million voice minutes billed per day, Six Degrees enables charities to raise money, helps banks to trade and enables professional services to bill.

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Goals and needs

With a reputation built on robustness and reliability, Six Degrees needed a critical power infrastructure to exceed its customers' expectations. Trading in living technology, around the clock support is vital to the Six Degrees and its partners.

By integrating smart technology within the data centre's infrastructure, Six Degrees can develop an unparalleled understanding of sites, buildings and processes. This new connectivity - combined with a universal view of operating parameters – will enable a reduction in energy consumption, costs and emissions and make the deployment of resources more efficient.

In order to create more efficient data centres, Six Degrees needed to develop a deep understanding about the way that resource is used – and the way that those resources are monitored and managed. By accurately measuring and centrally monitoring energy consumption, it will be possible to improve efficiency – across the entire estate. Of vital importance, is the need to track the status of key operating parameters in real time – accurately – in order to immediately address virtual and physical anomalies, in turn resulting in maximum uptime and reduced operating expenditure.

With energy prices on the rise, and floor space at a premium, power density and the optimisation of infrastructure is under the spotlight - particularly as the cost of powering a data centre can outstrip the cost of the computing horsepower that drives the facility. In particular, a data centre's chiller pumps are power-hungry and, therefore, a significant contributor to non-IT power demand. Optimising their performance will significantly impact the bottom line and improve the facility's PUE score.

The solution

One such system – designed to meet these demands - is Socomec's Diris Digiware, enabling data centre managers to make fully informed decisions.

Diris Digiware is a fully digital, multi-circuit plug and play measurement concept, with a common display for multi-circuit systems. Compact and quick to install, it provides accurate and effective metering, measurement and monitoring of electrical power quality. Infinitely scalable, it is capable of monitoring thousands of connection points from the main incomer to the IT rack.
A modular power distribution system is a key element in implementing a power monitoring solution within a data centre. This advanced – yet simple to use – system enables data centre managers to more effectively manage power usage, and rapidly respond to changing power requirements.

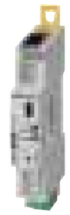
Socomec's Diris Digiware system offers an accuracy of class 0.5 to IEC61557-12 from 2 % to 120 % of the current sensor primary rating.

DIRIS DW 143 A

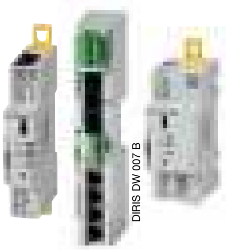
The advantages of the system

Rapid live retrofit – without downtime

Timothy Arnold, Technology Director at Six Degrees, identified Socomec's Digiware range for a number of critical applications.



DIRIS DW 005 A



DIRIS DW 004 A

DIRIS DW 007 B

DIRIS DW 008 B

Modular Digiware solutions - including the I-30 and U-30 - have also been deployed by Six Degrees to monitor a larger number of circuits in one location. Arnold comments: "Previously, with in-rack PDU monitoring, we experienced a number of failures as legacy equipment was operating at higher temperatures whilst not being designed specifically for this purpose. Rather than turn them off, **we were able to retrofit Digiware live** – without downtime – ensuring that the change was invisible from our customers' perspective.
In this instance, the modularity of the Digiware solution was a significant benefit. Rather than having to deploy it for all racks across all customers, and because Digiware is mounted in the 3 phase PDU rather than the rack, we have been able to scale-up over time, therefore reducing capital cost".

"Furthermore, the installation was rapid; it actually took longer to unbox the equipment than it did to install it".

Optimizing chiller performance – and energy consumption

Arnold explains: "We also increasingly need to better understand the specific power utilization within a facility. Although we have historically been able to determine the power utilization for an entire building, we have not previously been able to monitor the power utilization across unique data halls – and different pump sets – within that building. Optimizing chiller performance – and energy consumption – has not previously been possible".

"By retrofitting the Digiware B-30 within one of three data halls – each with two pump sets – we have been able **to monitor and measure the power usage for that specific data hall,** in turn delivering a far more advanced understanding of energy efficiency. Now, when making adjustments, we can confirm – conclusively – that they have been effective, **enabling us to make more informed decisions in the longer term**. Furthermore, as well as determining the energy usage for a specific hall, we can even drill down to individual pump set level, identifying whether one is running harder than the other, for example".
"As a standalone module installed directly into the pumpset panel, Digiware was easy to integrate. Rather than needing to have multiple controls and a larger system, the Digiware B-30 can be deployed in an isolated environment and into the end unit – rather than deploying full modules. The initial trial has been so successful that we are now rolling the solution out across the other two data halls".

This granular level of monitoring is particularly beneficial for colocation facilities whose environments are continually evolving. Conversely, systems that are using lower levels of power can be consolidated resulting in improved energy efficiency resulting by association in lower operating costs for either the provider or end user.

APPLI 637 A

The benefits

“We are also testing Digiware in other scenarios – in determining UPS efficiencies, for example. I am currently using Digiware as a power logger – a really cost effective solution that **has saved me a significant amount of cash**”, said Arnold.

“Across all of these applications, we are now working with accurate and reliable data which means that we can make more informed decisions on how to improve our facilities, particularly in terms of energy efficiency and meeting the terms of the climate change agreement. We can deploy our capital expenditure more effectively as we better understand how energy is being used – and there is zero downtime for monitoring”.

Advantages of DIRIS Digiware

- Retrofit live without downtime.
- Change is invisible from the customers’ perspective.
- Rapid installation.
- Suitable for a constantly changing environment.

Focus on

Timothy Arnold,
Technology Director at
Six Degrees

By retrofitting the Digiware B-30 within one of three data halls – each with two pump sets – we have been able to monitor and measure the power usage for that specific data hall, in turn delivering a far more advanced understanding of energy efficiency. Now, when making adjustments, we can confirm – conclusively – that they have been effective, enabling us to make more informed decisions in the longer term.

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Energy storage
solutions for energy cost reduction

APPLI 784 A

The customer: stem

SYDIV 331 A

Stem is the US leader for intelligent energy storage and predictive energy software. By creating innovative technology services, the company transforms the way energy is distributed and consumed. Thanks to their best-in-class software, combined with energy storage, they help customers reduce energy costs.

Headquartered in Millbrae, California, Stem is funded by a consortium of leading investors including Angeleno Group, Iberdrola (Inversiones Financieras Perseo), GE Ventures, Constellation New Energy, Total Energy Ventures, Mitsui & Co., Ltd. and RWE Supply & Trading.

Socomec has provided the integrated energy storage solution including the bidirectional converter, the Lithium-Ion batteries and all the necessary protection.

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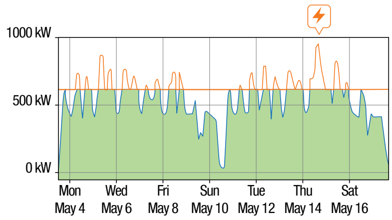
The need

Peak Shaving

- In California and other states in the U.S., utilities are facing high electric demand a few hours each day.
- To avoid oversizing the grid and limiting the generation capacity, utilities charge the customer based on the monthly highest registered consumption during 15 minute intervals.
- Stem installs Energy Storage systems piloted by its predictive software-based solution to reduce the peak demand charge from the utility by charging the energy storage system during the off hours of the day and discharging it during the operational hours.
- Stem's system allows customers to reduce their peak demands and thus their electricity bills. The graph below shows how Stem's Energy Storage system has helped a university campus reduce their peaks by 345 kW and saving more than $6,200 in one month.



SYDIV 329 A GB

Stem is pleased to work with Socomec as one of our technology suppliers. We have integrated their battery and converter with our best-in-class software and found the product to be responsive and able to deliver meaningful results to customers and the grid.

M. Daniel Elizalde
Director of Product Management at Stem

The solution

SUNSYS PCS²: power conversion and storage system

With over 45 years' experience in UPS, integrated power specialist Socomec has provided several integrated energy storage solutions, approved at system level, composed of:

- SUNSYS PCS² 100 kW bidirectional converters complying with UL1741. They follow charge and discharge profile set by Stem edge computing solution to shave peak of consumption,
- 200 kWh Lithium-Ion batteries complying with UL 1973,
- Battery Protection cabinet including all the needed protections, manufactured by Socomec, for safe operation and maintenance.

Each system of 100 kW/200 kWh can be parallelized to reach higher power.
In 2016, Stem installed the biggest energy storage indoor installation in USA: 1.3 MW, choosing Socomec's solution.

APPLI 778 A

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Energy Storage solution

Discover how to operate in Islanding mode at Medium Voltage

The project:
Nice Smart Valley

InterFLEX

NICE SMART VALLEY

SOCOMEC has taken part in Nice Smart Valley, French demonstrator of the European project INTERFLEX, as the energy storage system manufacturer.

The aim of Nice Smart Valley project is to prove the feasibility and performance of a medium voltage microgrid, based on several distributed storage systems.

This paper describes the tested use cases: Islanding with or without black start, synchro-coupling, voltage/frequency generation in the limits required by the standards, grid stability data monitoring and wireless management of several storage equipment for longer backup. All functionalities have been analyzed by theoretical study, experimental tests in a laboratory and in real conditions on the island.

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What is INTERFLEX and its French demonstrator Nice Smart Valley?

INTERFLEX is a European project, piloted by Enedis, which won a European call for projects "Horizon 2020". The objective of the project is to demonstrate and validate new business models, with distributed energy resources and local flexibilities, integrating new technologies and solutions in the context of an increasing share of renewable energy sources. For this project 6 demonstrators will take place in Europe, among which one is taking place in south of France: the Nice Smart Valley Project (NSV).

This French demonstrator is led by the Distribution System Operator (DSO) Enedis and developed with five partners: GRDF, EDF, ENGIE, GE and Socomec. Within this project three main use cases will be performed on Local flexibilities, Storage and Islanding. Medium voltage (MV) islanding with distributed storage systems will be performed by ENEDIS and ENGIE using a solution by Socomec.

This paper describes the stakes, the implementation and the result of this innovative demonstrator.

Figure 1: Presentation of the French demonstrator places

Nice Smart Valley project challenges

The resilient Microgrid: a challenge for the future

In Europe, microgrids are defined by the European Commission inside the "Microgrids" projects. They represent a subgroup of electrical distribution systems equipped with distributed local energy sources such as photovoltaic systems and storage systems that are able to generate voltage and frequency (Grid Forming Units) under the control of the grid operator. Microgrids are connected to the distribution network in normal operating mode and can also operate in islanding mode in the event of a fault of the main grid, thereby ensuring power resilience (back-up mode).

As part of the NSV project, the goal is to ensure the electricity supply of the Lerins Islands in an emergency mode in the event of an incident on the single submarine cable without the use of generators. The Nice Grid project has been completed, tested and operated successfully at LV. The next challenge for this new project is to develop the technology to operate in Islanding mode at MV and develop the hardware and system intelligence that will allow the system to be replicated for other applications without requiring large amounts of engineering each time.

When the islands are islanded from the main grid, the goal of the project is to maintain the voltage and the frequency at acceptable level in accordance with the standards. To achieve this all storage assets available on the MV / LV networks, (2 storage systems) will be used simultaneously.

Finally, the last goal is to demonstrate the economic relevance of the use of storage assets to ensure the resilience of a microgrid. Therefore different business models depending on the operating conditions of the network and owners of the assets will be addressed in order to use Storage assets outside of an islanding period. These topics will be described with a specific contribution shared with Enedis, Engie & Socomec partners.

Grid Forming Units and Grid Supporting Units

As briefly mentioned above, for Socomec, as an energy storage system (ESS) partner, an important target is to use distributed storage assets to build and control the microgrid voltage and frequency when it is disconnected from the main grid. To make it more relevant, the aim is to be able to use those assets whatever their physical location and whoever their owner.

Therefore in the NSV project this is going to be tested by using two storage assets simultaneously, the first owned by Enedis and the second by Engie. To do this the first system will be used as a Grid Forming Unit (GFU), which means that when disconnected from the main grid it acts as a voltage generator that is the master of the microgrid. The second system will be used as a Grid Supporting Unit (GSU), which operates as a current generator following the requests sent by the GFU.

Figure 2: Blackstart process

One of the sequences that will be tested in case of islanding is the blackstart – Fig. 2. Once the main grid is lost, the GFU will start and there will be a soft voltage ramp-up to enable all the power converters (PCS) used in this system to synchronise and avoid the inrush currents, due to the MV/LV transformers. We enable two modes: the synchronization can be done either directly at the nominal voltage or at 80V. In the second mode, by progressively increasing the voltage after the closure of the circuit breaker, we ensure that there are no bad consequences on the loads, mainly on motor type loads. Once the nominal voltage is reached the GSU and the PV inverters can be connected to the microgrid.

Nice Smart Valley microgrid area description

The islands of Lérins, Fig. 3, were chosen for this project because of their particular grid connection. They are currently fed by a 10 kV submarine distribution network cable of 1500 m placed on a shallow bottom (<10 m). Previously second submarine cable provided a back up to the main power supply, but this has now been abandoned as it is expensive and requires a long term approval process. In case of an incident causing the loss of this connection (removal of the cable by an anchor, for example), the installation of one or more generating sets on the islands of Lérins is necessary.

The MV network, entirely in 10 kV, present on the islands is relatively small: 2.2 km of MV network of variable section, five substations MV/LV for a load peak of 600 kVA and 54 clients among which five have powers included between 36 and 250 kVA (monastery, museum, restaurant etc.).

Figure 3: Map of the islands of Lérins

There is no production of relief on the islands: if the link with the continent breaks, customers are no longer supplied during the time of routing and installation of generators, which can be quite long. In fact, the troubleshooting and repair times are very much linked to the climatic conditions of course but also to the provision of a barge to carry the generators and to repair the cable (which must be hoisted onto the surface to repair). So, returning to a normal mains situation may take several days. To overcome these disadvantages linked to the islands isolation, the installation of a microgrid including local production and storage facilities, driven by a system of local optimisation of energy flows and management of peaks of consumption was proposed within NSV. This installation must be able to allow autonomous operation of the local network in the event of loss of the main power supply while ensuring the maximum self-consumption of the locally produced energy. For this demonstrator, we will rely on the results of Nice Grid where islanding has been successfully tested.

NSV could test a multi-day islanding based on battery storage (or other means) and a renewable local production (mainly PV) to be developed with the partners of the project.

The GFU, connected at the public distribution system – Medium Voltage -, will make it possible to generate a microgrid in case of incidents on the upstream network (connection with the continent). This system will make it possible to balance generation and consumption, and to manage frequency and voltage during the phases of islanding with an optimisation of the loads.

Key achievements

Given the degree of innovation in this project, the risks associated with the new functions were validated in three stages.

At first, we worked with the University of Padova in Italy, which helped us to simulate the interactions between the equipment and the grid topology on the islands that could be causing instability. These instabilities can result from the high reactive powers exchanged in the electrical distribution under the influence of capacitive loads due to the cables and inductive loads due to the transformers, Fig. 4.

In a second step, we reproduced an installation identical to the one of the islands of Lérins, at a fourth (25 %) of the real power. This has been done in the research laboratory of EDF R & D, Concept Grid in Moret sur Loing, Fig. 5. Thanks to this installation, the qualification of the new features of our converters has been made and all the risks have been removed, enabling the warranty of the quality of energy supply. During these tests all the use cases detailed after have been validated.

After a successful test programme at Concept Grid, and approval by ENEDIS, the last step was to carry out real tests on the islands of Lérins.

Figure 4: Load profile on the LV network

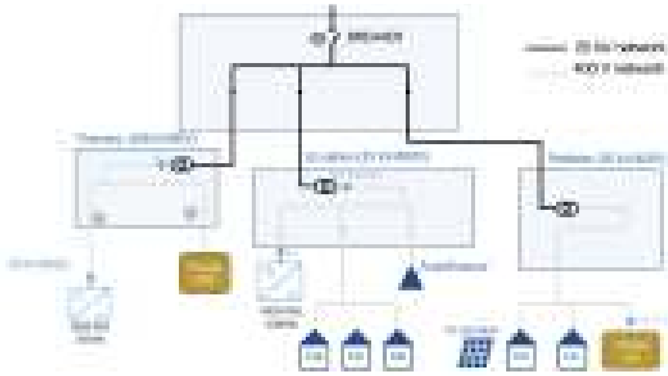

Figure 5: Picture of the islands simulated at Concept Grid

Medium Voltage Islanding

By definition, islanding is the situation when a part of the grid is disconnected from the main grid but remains energised by the local generation. In MV islanding, as it is the case for NSV, some additional equipment needed to be put in place. They have to ensure the connection and disconnection from the main grid without disturbances on the load by the synchronization process. Therefore, it is necessary to measure the voltage upstream and downstream of the islanding breaker (CBG), Fig. 6.

To do so, MV switchgears measurements (voltage and current) have been adapted in order to be compatible with the islanding controller and with the requested accuracy. This aims to determine the power consumed from the grid in order to compensate it via the ESS. This will enable an islanding without energy exchange, as detailed below.

Two types of modes for islanding are tested in the NSV project:

- The first mode is the so-called **scheduled islanding**. This type of islanding is planned by the DSO and it isn't noticeable from the customer's side. When the islanding is requested, the power of the PCS will ramp up, thus doing a ramp down of the grid's power, in order to erase the current flow on the grid circuit breaker. Once the current and power are close to 0, the grid breaker is opened, without any disturbances to the load. After the breaker is opened the ESS switches automatically from a slave voltage generator to a master voltage generator. In this situation, the ESS ensures autonomously the balance between the local production & consumption, while the state of charge and the

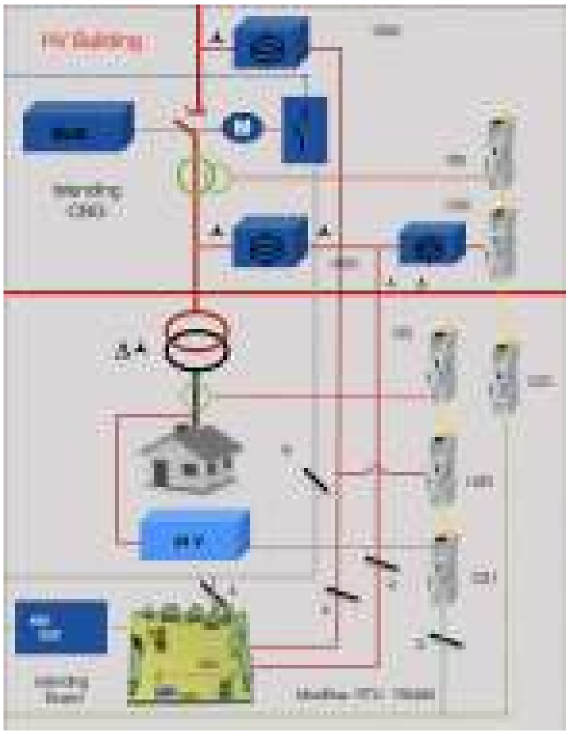

Figure 6: CBG upstream and downstream measures

power of the PCS are within the operating ranges. The ESS is able to perform PV production control acting on the standard PV inverter P(f) function. This capability allows the extension of the islanding duration. The power sharing between the PCS is ensured by droop algorithm, without any communication link for robustness. The reconnection to the grid is performed with a synchro-phasor; the phase of the voltage, voltage amplitude and frequency are measured on the main grid. These parameters are entered as an input in the inverter regulation to get the same parameters on the microgrid. When all the parameters are identical, the breaker closes and the islanding stops.

- The second mode is called the **unforeseen islanding**. It simulates the situation when a fault occurs (loss of the submarine cable) and a breaker opens leaving the distribution grid without energy. The ESS has to create a blackstart, which means that it is able to energise the microgrid starting from no voltage, Fig. 7. The resynchronisation is performed in the same way as for scheduled islanding: without interruption of service.

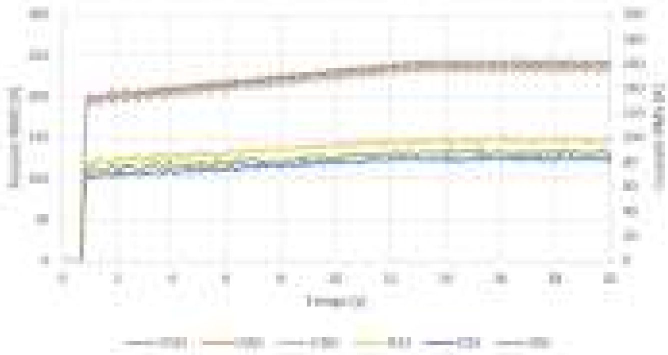

Figure 7: Voltage and current during a blackstart

Finally for NSV project the ambition is also to prepare a third way of islanding: the anticipated islanding. The idea for that is to analyse the network, thanks to several measurement devices that have been put in place, in order to see if some specific grid behavior systematically lead to a loss of the grid. This will stay at an analysis phase for this project.

Energy Quality EN 50160

When performing an MV islanding, there are some new challenges compared to the LV islanding that has been done during the Nice Grid project. As already described, there is a risk of instability when powering the islands of Lérins microgrid with the ESS. These instabilities come from a potential resonance between the intrinsic inductances of transformers and of long and capacitive cables (buried and submarine). The goal for the ESS control system is to not interact with these resonances and furthermore to contribute to maintaining the quality of the energy supply, Fig 8 and 9. This quality shall be compliant with the recommendation of the EN 50160 standard, which defines the limits of voltage, frequency and distortion rate.

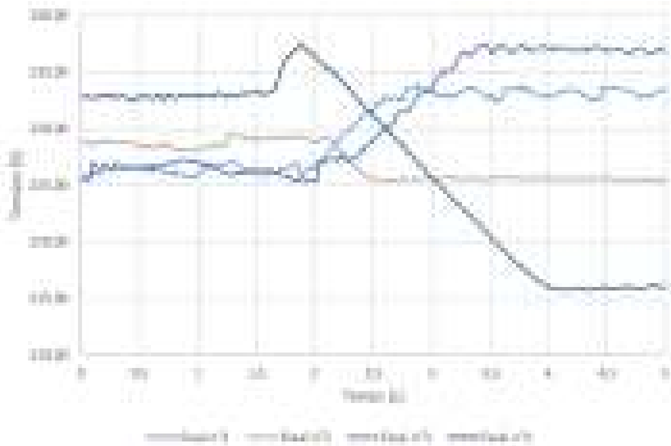

Figure 8: ESS RMS voltage during several islandings

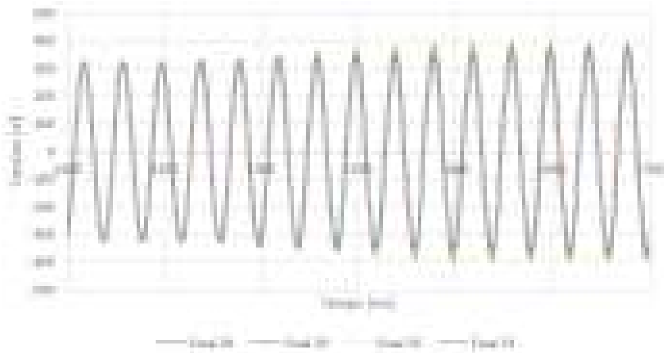

Figure 9: Voltage wave form during several islandings

Protection Plan

NSV project also includes a part concerning the setting of medium-voltage network protection devices. Therefore several single-phase and three-phase short circuits were created and the tripping of the network protections and storage converters was tested, Fig. 10.

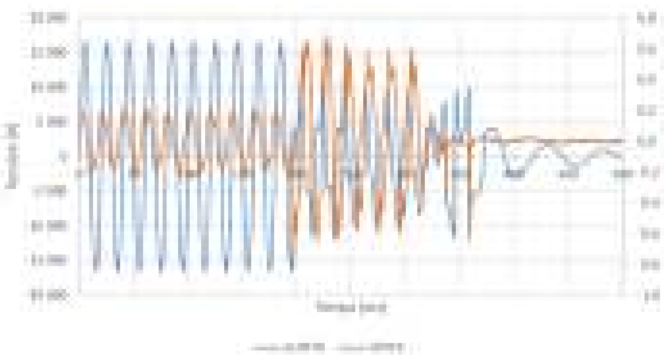

Figure 10: MV Voltage and Current during and after a fault

Control of renewable energy sources

One use case of the NSV project is to manage the photovoltaic production. Two main topics are considered here: balance between production and consumption and self-consumption.

Figure 11: Illustration of one P(f) function

Preservation of the balance between production and consumption during islanding phases while maintaining the voltage and frequency within required operating ranges is really important. In this operating mode, the ESS's priority is to regulate voltage and frequency of the micro-grid. This operation is possible for a limited time which varies depending on the state of charge (SOC) of the batteries, the load consumption and the level of local photovoltaic production. To reduce PV generation and thereby avoid the maximum power level or reduce the SOC, the PV inverters' built-in P(f) function is used. This function reduces proportionally the PV power generated according to the frequency, which is controlled by the ESS, Fig. 11. As soon as the frequency of the microgrid exceeds the value of 50.2 Hz, the reduction of P(f) function is activated.

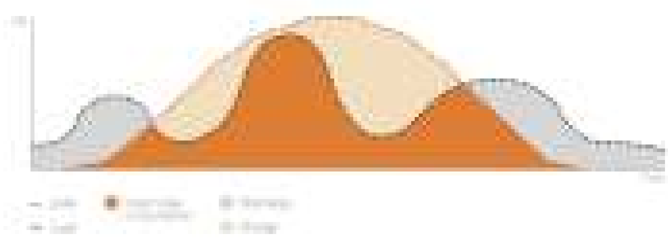

Figure 12: Self-consumption principles

The goal of self-consumption is to charge and discharge batteries according to the ratio between plant consumption and renewables sources production. It means that self-consumption function can be summarized by, Fig. 12:

- Renewables production > Load consumption ⇨ battery charging
- Renewables production < Load consumption ⇨ battery discharging

Self-consumption has to be based on Grid measurements but renewable generation must also be monitored.

Interaction mode between two energy storage systems

Concept Grid facilities also enabled us to adjust the operation of several voltage sources in a single electrical installation. The interaction between two storage systems, Fig. 13, distant from each other and regularly communicating together for optimum control of the batteries, was tested according to a protocol defined in collaboration with ENEDIS and ENGIE. The strategy is to maximise the use of the master GFU and to consider the GSU as a support when the GFU reaches its defined limits in terms of SOC and power, Fig. 14.

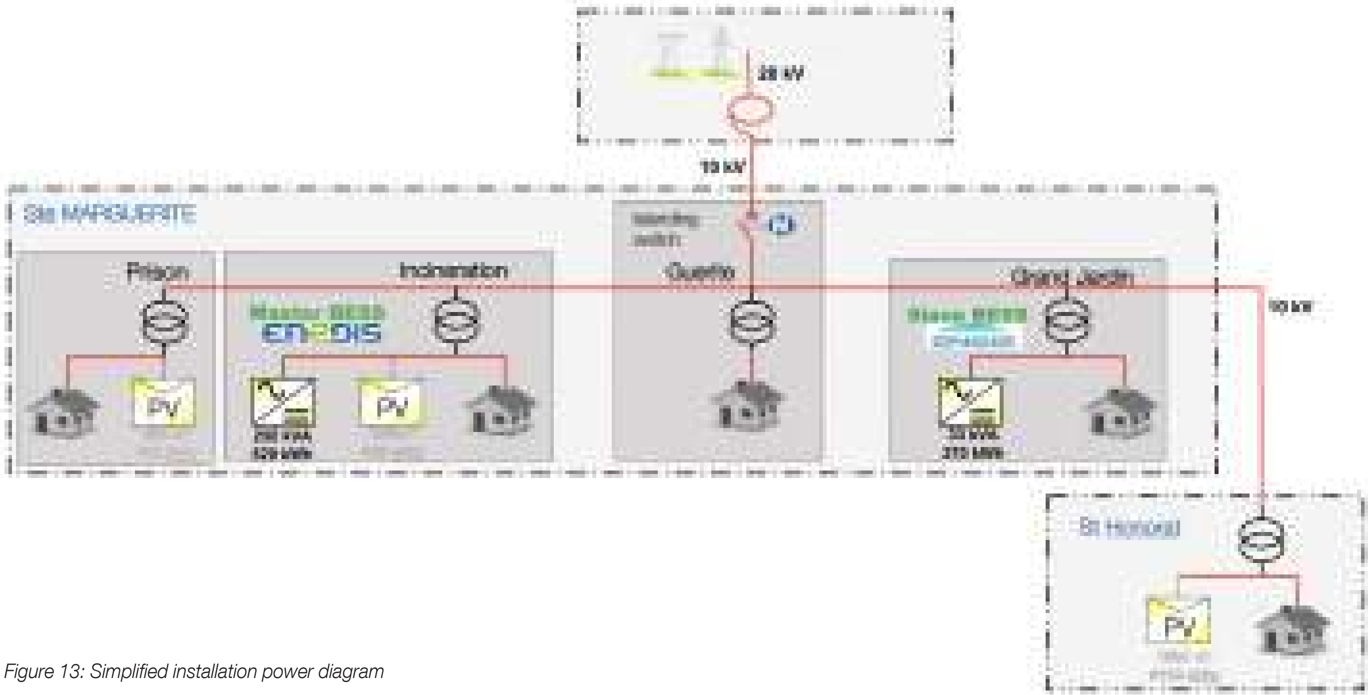

Figure 13: Simplified installation power diagram

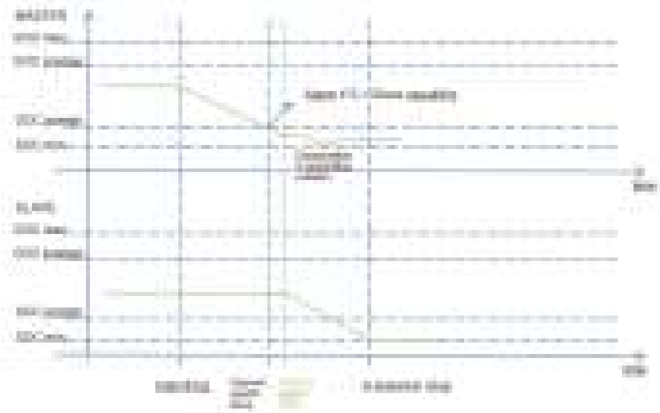

Figure 14: Strategy in discharging mode

Data measurement and monitoring

To analyse the microgrid behavior, the ESS in NSV include an innovative measurement system for multi-circuit electrical installations, Fig. 15. This system measures several data on the AC network such as frequency, voltages (phase to phase and phase to neutral), currents, powers (active, reactive, apparent), power factor and phases unbalance.

All collected data are transmitted to an IoT platform hosted in the cloud, in order to enable ENEDIS to do a continuous monitoring of the grid evolution.The main features proposed by this online application, Fig. 16:

- Map and alarms
- Measurement of the last values
- Historical data
- Data export to an excel file
- Alarms for device non-communication

Figure 15: Digiware measurement and monitoring system

Figure 16: Online application

Conclusion

In the end, our ESS make it possible to secure the power supply of the islands in the event of a main grid fault, but also on demand; to store locally the energy produced by renewable energy sources and to ensure the longest possible supply of energy. This will be made possible thanks to the wireless communication between the two storage systems that we are going to implement.

The different tests will continue during the period between April and December in real situation directly on the islands. The aim is to observe the behavior of the systems and to measure and store a maximum of electrical values of the islands of Lérins. Data recovery is facilitated by the automatic transmission of all measures to our servers, which will allow us and our partners to exploit them optimally.

Focus

NICE SMART VALLEY

Key figures

Project: €5 million financed at 70% by the European commission
Duration of the project: 3 years
Location: 5 sites in the South of France in the Alpes Maritimes
Organisation: Consortium of six partners, headed up by Enedis

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