



The French network of
public and private stakeholders
for sustainable cities

Innovative solutions for sustainable cities

Energy



URBAN INNOVATION IN ENERGY

/// BACKGROUND: WHY TAKE ACTION IN THE FIELD OF ENERGY?

In France, 43.6% of energy is consumed by buildings and the tertiary sector, and 31.5% by transport. In a country where 80% of the population is urban, French cities are thus major energy consumers. In addition to the economic aspect, for the citizen who pays the bill in various forms, the said consumption also has a major environmental dimension, in particular due to the percentage of energy that comes from fossil energies and the greenhouse gas emissions that result from this. Across the world, cities today are responsible for 71% of CO₂ emissions. The global impact on the climate is often the result of local pollution and deterioration in the quality of the air.

Lowering energy consumption in cities, in particular from fossil energies, has multiple benefits, for the inhabitants' health and quality of living, the fight against climate change, the operating costs for the municipality and the expenses that bear upon its inhabitants - in a nutshell, for the attractiveness of cities.

/// WHAT ARE THE MAIN AREAS FOR INNOVATION WHEN IT COMES TO ENERGY?

The energy-related innovative ideas can be classified into 3 +1 main categories:

► **Innovation aimed at lowering energy consumption**, regardless of origin (fossil or other), applicable to any number of areas: energy efficiency in buildings, both new and or renovated; decreased energy consumption

by modes of transport, whether individual or collective; less traffic congestion thanks to the development of mass transit, low-impact modes of transport, and better-regulated traffic resulting from better information for all players; lower energy consumption in all urban services, from public lighting to water or waste management; shifting toward a reduction in mobility needs thanks to the opportunities opened up by digital technologies;

► **Innovation aimed at developing local power generation in the form of renewable energies**: newly-deployed systems incorporated into the city's infrastructures, enabling photovoltaic power generation, or more marginally, wind-powered electricity; the use of wasted heat and/or renewable sources of heat, from better management of waste, waste water and locally-specific resources (geothermal, marine, data centre, etc.);

► **Innovation in legal (e.g.: SEM energies), organisational and technological aspects aimed at expanding local consumption of locally-generated power**: a system enabling self-consumption of power generated either directly (in the building, lighting, thanks to heating grids, etc.), or with a storage system that "adjusts" intermittent power generation sources (electrical vehicle battery, hydrogen-based and methane production from green electricity, etc.);

► **"Cross-cutting" innovation** which facilitate the implementation of the first three types of energy, by combining energy efficiency, RWE production and local energy consumption thanks to the deployment of smart grids, making it possible to opti-

mally manage at all times offshore and diffuse energy resources, by pooling and allocating them based on needs, between users and uses in a neighbourhood combining residential and office activities, a tertiary zone, a campus, etc.

Most of the innovative ideas shown in the pamphlet fact sheets reflect multiple categories of innovation that often buttress each other, resulting in greater overall effectiveness for each action carried out.

/// WHAT KINDS OF INNOVATION ARE INVOLVED?

The innovative ideas presented generally combine several different types of innovation:

- ▶ **technological**: there are many forms of technological innovation when it comes to energy, which are neither the norm nor the most frequent choice;
- ▶ **digital**, in other words, based on the use of sensors, data exchange and optimisation systems integrated into the usual structures and services;
- ▶ **economic and legal**, to enable the development of new business models and facilitate the integration of urban functions that require the development of smart grids and self-consumption, to name only two; the economic aim (reducing the cost of energy) of innovation is another important aspect that should not be overlooked;
- ▶ **in the field of governance**, so that very different types of players (State, regulator, enterprises, local authorities, universities, citizens, etc.) become involved in joint energy management projects that can even aim for energy autonomy at the local level.

Most of these innovative ideas require **behavioural change** on the part of the relevant players, especially the citizens, and thus will need compelling initiatives to educate, explain and train.

/// WHAT ACTION IS BEING TAKEN IN FRANCE TO SUPPORT THIS INNOVATION?

For many years now, France has designed its public policy to support developing and experimenting with innovative ideas in energy as applied to cities. In 2016, the following programmes were of note:

- ▶ **the Investments for the Future Programme (PIA)** from the Commissioner General on Investments, implemented by ADEME, which supports such initiatives as institutes for the energy transition and renewable energy demonstrators, digital innovation and smart grids, energy renovation at the neighbourhood level, etc.;
- ▶ **the “Positive Energy Territories” programme** run by the Ministry of the Environment, Energy and Maritime Affairs, which supports and provides assistance to municipalities that have committed to generating more power than they consume;
- ▶ **the “sustainable city” solution for the New Industrial France**, from the Ministry of the Economy, which supports for instance the development of smart grids and energy efficiency in the building (construction and operation);
- ▶ **the “Industry Demonstrators of the Sustainable City” (DIVD)**, by the Ministry of Housing and Sustainable Housing and the Ministry of the Environment, Energy and Maritime Affairs, which are all championing one or more innovative products in the field of energy and circular economy (the latter promotes the exchange of flows between city stakeholders in order to cut back on the use of primary resource).



THE WATER LOOP:

REDUCING A BUILDING'S ENERGY CONSUMPTION BY 40%, BY RELYING ON A CIRCULAR ECONOMY SYSTEM

BANQUE DE FRANCE BUILDING - PARIS 9^e

As part of the rehabilitation work on the Parisian "InTown" office building, France Energie has provided an innovative global system that provides heating, cooling and air conditioning: a water loop connects over 700 4-in-1 water/air heat pumps, which heat the building by relying almost exclusively on the heat recovered from the building itself, which is carried through the water loop, as a model of circular economy. This technology is also an answer to the space constraint issues faced by buildings located in the heart of Paris.

INNOVATIONS

- ▶ The water loop installed in the Banque de France building is a heating micro-system adjusted to the scale of the building and almost exclusively self-powered. More precisely, **close to 700 reversible water/air heat pumps installed in each room of the building collect all the excess heat in the hottest rooms (computer rooms, south-facing rooms, etc.).** The water loop carries this heat through the building and it is used to heat the cooler rooms.
- ▶ This system is sufficient to heat or cool the building without requiring practically any external energy, as long as the outside temperature is between about -7°C and 37°C. Under extreme weather conditions, additional heating or cooling is provided by the Parisian heating and cooling urban networks (the solution chosen for the InTown building. It is also possible to connect the loop to a small sustainable energy power source: solar, geothermal, etc.).

KEY FIGURES

→ The building

- 21,300 m² over R+6, including 17,600 m² for offices and 600 m² for shops
- Delivery of the renovated building in February 2017

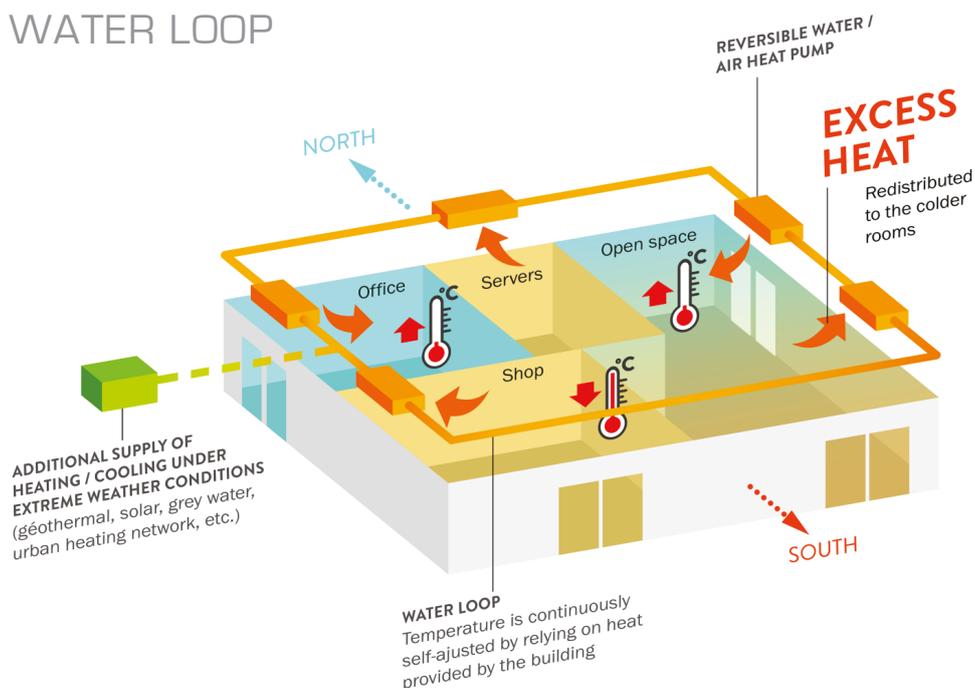
→ The water loop

- 710 4-in-1 water/air heat pumps (heating or cooling air supply, heat collection and air renewal)
- Performance COP up to 7.00
- Water loop installed in less than 36 weeks

STAKEHOLDERS

- ▶ **Project owner:** SCOR
- **Delegated contractor:** Bouygues Immobilier
- **Assigned architect:** Agence A. Béchu & Associés
- **Engineering and design office:** Ingérop
- **Architect:** Agence François Leclerc
- **Main contractor:** Bouygues Rénovation Privée
- **Supplier of the water loop solution:** France Energie

THE WATER LOOP



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IMPLEMENTATION

► In the heart of Paris, where there is very little free space, and in the case of this building which has low ceilings, it was impossible to install large heating ducts. Therefore Bouygues Immobilier sought a solution combining energy

savings, thermal and acoustic comfort and minimum space requirements. **The PAC 4-in-1 water/air solution** with water loop was the only one that solved this equation.

RESULTS

- /// A reduction of close to 40% in the building's energy consumption compared to results obtained in office buildings operating under standard technology, such as fan coil units (estimate based on current consumption in the LillEurope building, also equipped with a water loop).
- /// Water loop technology is space saving: 700 m² of terraces, 12 parking places and 50 m² in basement premises (space usually used as technical premises for the heating system).

Jean-Philippe Hugron,
editor-in-chief of the *Courier de l'Architecte* and
author of the book *InTown*

“ The merit of the water loop, in addition to providing comfortable ceiling heights, is that it has finally freed roofs and basements of technical premises. Quite an accomplishment! ”

FINANCIAL ASPECT OF THE OPERATION

- /// About 3 years: the return on investment of the PAC solution using a water loop compared to technology that is cheaper to purchase but consumes a lot of energy.



Contact :
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SÈTE 2.0

A RENOVATED AND CONNECTED CITY FOR ENHANCED ATTRACTIVENESS, QUALITY OF LIFE AND MOBILITY

The “Sète 2.0” project is part of the “Energy Cities” program and reflects the city’s desire to reduce its CO₂ emissions by 20% by 2020.

Sète is working to improve the well-being of its inhabitants, protect the environment and enhance its tourist appeal through the renovation of its lighting and traffic light systems, smoother traffic flows thanks to connected services and the promotion of soft modes of transport.

INNOVATIONS

- ▶ **Digital urban space management platform, MUSE® by Citelum.** The MUSE® platform references the city’s urban equipment. Thanks to MUSE®, Sète also has access to reliable indicators on the operation of its installations, can rapidly schedule maintenance interventions and track the progress of works in real time.
- ▶ **Smart parking deployed by Citelum and Mentis:** installation of sensors along the road network, a radio network connected to street lighting and kiosks to inform users of available parking spaces, facilitate service payments and alert the city to potential fraud attempts.
- ▶ **Access control bollards installed by Citelum to restrict vehicle access to commercial zones:** these bollards are connected to a videoprotection camera equipped with a license plate reader and a kiosk linked to the Urban Surveillance Center. If the vehicle is authorized to circulate, the bollard is automatically retracted.
- ▶ **Remote management of illuminations and lighting points on Sète’s main roads.**

OBJECTIVES

- **Safety:** inhabitants, visitors and installations.
- **Savings:** on equipment consumption and maintenance costs.
- **Attractiveness:** showcasing of the city’s heritage and improved mobility.
- **Innovation :** facilitated management of equipment and traffic.

STAKEHOLDERS

- ▶ **Client**
 - **Sète**, the third largest city in the Hérault department in the Occitanie region of southern France. The “Sète 2.0” project is designed to modernize the city and offer its inhabitants a better living environment.
- ▶ **Partenaires**
 - **Citelum**, a subsidiary of the EDF Group and a leading player in smart lighting and associated connected services, has over 1,000 references in France and internationally. Citelum is transforming Sète into a Smart City with the renovation of its traffic light systems and illuminations.
 - **Sogetralec, Société Générale des Travaux d’Electricité**, a public lighting expert based in Béziers. It is heading up the renovation and maintenance works for Sète’s street lighting.
 - **Mentis Services** is a software publisher for Smart Mobility.

IMPLEMENTATION

- ▶ Before carrying out these renovation works, Citelum drew up a lighting master plan to identify the priorities and lighting solutions to be installed per road type.
- ▶ 3,200 lighting points have been replaced in the first 4 years, with 650 others planned over the course of the remainder of the contract.
2,000 power reducers have been installed on high pressure sodium lamps.
- ▶ To date, all traffic light junctions have been renovated and smart parking and access control solutions have been installed.

Sète's heritage:

- 7,800 lighting points
- 200 control boxes
- 530 sports lighting points
- 30 traffic light junctions

Smart Sète program:

- 50 parking spaces
- 2 multi-service kiosks
- 3 variable message signs
- 100 traffic sensors
- Radio infrastructure
- Access control bollards

RESULTS

/// Substantial savings made:

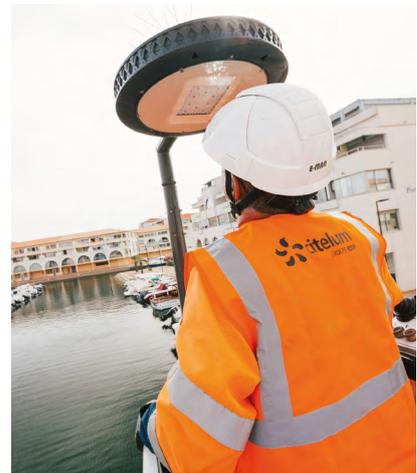
- Reconstruction of 78% of the street lighting system.
- Protection of electricity networks.
- +60% energy savings over the duration of the contract.
- <0.4% breakdown rate with an initial commitment of <1%.

/// Greater mobility and safety for users:

- Replacement of traffic light junctions with LEDs.
- Remote junction surveillance in real time.
- Installation of sound kits for the visually impaired.

/// Showcasing of heritage that can be adapted to suit the event:

- Illumination of 24 remarkable sites and monuments.
- Simultaneous management of illuminations via a radio system.



FINANCIAL ASPECT OF THE OPERATION

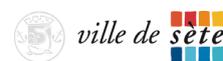
/// A Public-Private Partnership for a project worth over €10M.

This financing model provides for:

- pre-financing of the project to begin works as early as possible,
- ex post facto reimbursement by the client in the form of installments.

KEY DATA

- Public-Private Partnership for the management, operation and maintenance of installations
- 20-year contract including:
 - 4 years of investment works;
 - 20 years of maintenance works.



KEY DATA

- Number of dwellings: 231
- Built date: 1964
- Renovation year: 2012
- Length of renovation: 18 months
- Label BBC Effinergie Rénovation, Category (A)
- Commitment EPG: - 40% on consumption
- Perimeter commitment: Heating and Domestic Hot Water
- Length of the commitment: 4 years



1st ENERGY PERFORMANCE CONTRACT IN SOCIAL HOUSING

RESIDENCE SAUSSEY LOGIREP - VITRY SUR SEINE

MODEL OF GLOBAL ENERGETIC RENOVATION ON EXISTING BUILDINGS, GUARANTYING PROJECT ECONOMIC AND ENVIRONMENTAL EFFECTIVENESS

Social housing energetic renovation is a fundamental matter for our societies. Either concerning environmental aspects in the fight against global warming or economic issues like fuel poverty, It must be ambitious. The model of "Energy Performance Contract" deployed on Saussey residence in Vitry sur Seine encourages this ambition by Guarantying 40% energy saving after renovation.

A success: Since the energetic renovation period ended, every year energy savings are higher than expected!

INNOVATIONS

Energy performance contract is an economic, legal, technical and social innovation.

- ▶ **Economic:** the contracting owner is now guaranteed of the substantial energy saving on his patrimony. It can consider the renovation cost as an investment and launch more environmentally ambitious projects.
- ▶ **Legal:** Root of the economic innovation, it's an evolution from obligation of means into obligation of results for the operator (here Bouygues Construction) in terms of energy performance.
- ▶ **Technical:** Make the legal innovation possible. Thanks to a thermal energy model, commissioning quality check process and performance follow up, the operator is able to commit on the energy performance.

- ▶ **Social:** Support the technical innovation. Raise residents awareness, before and after the renovation, the operator involve them in the project and at the same time increase the global performance.

STAKEHOLDERS

▶ Bouygues Construction

One of the main actors in sustainable construction and services, the group and its 53500 collaborators design, build and operate structures that improve daily living and work-spaces: public and private buildings, transports infrastructures, energy and communication network.

▶ LogiRep Groupe Polylogis

Private Social Housing Association with more than 36000 dwellings in Ile-de-France and Normandy. It's a global actor in agglomeration program.

▶ Lair et Roynette architectes

Architects specialist of renovation in occupied environment, with high focus on energy efficiency.

▶ CET ingénierie

Technical consultant specialist in environmental engineering.

IMPLEMENTATION

- ▶ The contracting owner launched an Energy performance contract tender under design, built and maintenance scheme, for the global renovation of Vitry Saussay residence. Cost and level of energy performance were the 2 mains factors for selection. Laureate, Bouygues Construction relied on the expertise of its subsidiaries specialized in renovation and energy efficiency, as well as its partners for this first implementation.
- ▶ Since this renovation concerned accommodations, specific support for the residents has been implemented, like information meetings, distribution of an educational guide and the launch of a website giving resident instantaneous consumption.
- ▶ This operation success rely on the combination of technical expertise, and residents support and involvement.

Bruno Marotte, Director Energetic
Renovation of Bouygues Bâtiments Ile-de-France

“ This 1st Social Housing Energy Performance Contract is exemplary in many ways. It will allow to effectively reduce by 40% the energy bill of the residence (otherwise penalty for Bouygues Construction), it will use renewable energy via solar thermal creating 30% gain on Domestic Hot Water. Reduce the climate change impact, dividing by 4 the greenhouse gases released by the scheme. And create new dwelling with disable access. ”

RESULTS

/// With 40% energy savings contractually guaranteed for 4years, this project was a real challenge, by going from theory to practice on a global renovation project. In 2016 after 3 heating years elapsed, results exceed expectations (See the adjacent table).

/// This operation is a total success for all the actors involved. If the technical achievement in designing, building and maintaining is demonstrated. The main beneficiary is the tenant, whom on top of financial gain on its energy bills, can enjoy the improved level of comfort in the flats, as well as a social cohesion reinforced by its participation to this collective project.

Economies d'énergie	Engagement contractuel	Résultats		
		1ere année	2ème année	3ème année
	40%	-53,26%	-56,51%	-54,52%

“ This affects directly the building energy bill. At the end of the 1st year the EPG create over 40 € monthly economy, including 28 € of direct benefit for the tenants. ”

FINANCIAL DIMENSION OF THE OPERATION

/// Ambitious renovation financially secured

In case of non-achievement of the objectives, the operator (Bouygues Construction) supports 100% of overconsumptions.

/// A Win-Win project economically

- Energy savings are shared between landlord and tenants.
- If project outperform, gains are shared between project owner and operator. All stakeholders therefore have the same desire to perform.

KEY FIGURES

- Operation of €9m:
 - €4m Energetic renovation,
 - €5m dwellings refurbishment.
- Subventions :
 - €400,000 from Ademe,
 - €320,000 from city of Paris,
 - €20,000 from the region, Ile-de-France.



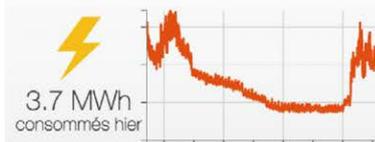
Production

1 Photovoltaïque



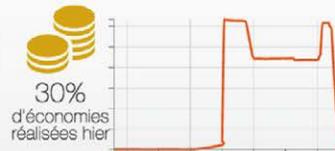
Consommation

2 Immeubles de bureaux

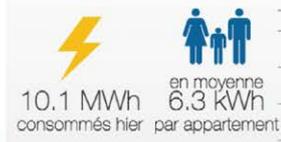


3 Eclairage public

Mode économie d'énergie (●N/A)



4 Logements For



ISSYGRID

THE FIRST DISTRICT SMART GRID

IssyGrid is an R&D project developed by a consortium of ten industrial partners specialising in energy, urban planning and digital technology and is aimed at gaining expertise in developing smart grids at district level and identifying the value proposition afforded by this type of service.

Located in Issy-les-Moulineaux (west of Paris) the project was launched at end-2011 and is scheduled to run until end-2017, and involves more than 10,000 employees and 5,000 residents. Each year, more than 20 international delegations visit the district which boasts the first dashboard monitoring energy consumption in real time at district level.

INNOVATIONS

- ▶ Based on the real experience of this scale 1 district smart grid, IssyGrid has led to significant technological, regulatory and economic advances.
- ▶ The use of batteries connected to solar panels shows the feasibility of the virtuous integration and optimisation of renewable energies in urban areas since any surplus energy unused by buildings can be stored in distribution substations operated by the local utility.
- ▶ On a regulatory level, after a year of collaboration with Cnil, IssyGrid is the first smart grid to have reached an agreement on data use guaranteeing privacy and data confidentiality.
- ▶ IssyGrid now offers a viable business model for the roll-out of district smart grids in eco-neighbourhoods across France.
- ▶ Eco-neighbourhoods that can better produce and consume energy, at the right time.

STAKEHOLDERS

- ▶ The project is developed by a consortium of partners with complementary expertise: Alstom Grid, Bouygues Energies & Services, Bouygues Immobilier, Bouygues Telecom, EDF, Enedis, Microsoft France, Schneider Electric, Sopra-Steria and Total. These partners demonstrate the ability of the French smart grid industry to provide turnkey solutions to local authorities.
- ▶ While the consortium is not subsidised, it has regular discussions with the Municipality of Issy-les-Moulineaux and the Grand Paris Seine Ouest urban authority, as well as organisations such as the Energy Regulatory Commission (CRE) and the French data protection authority (Cnil).
- ▶ Start-ups with strong technological expertise are also involved in developing IssyGrid: Embix (energy management solutions) and Objenious (LoRa network).

KEY DATA

- More than 900 homes connected (including 861 with Enedis smart meters)
- 120 000 m² of office buildings (10,000 occupants)
- Street lighting (3 streets)
- 3 photovoltaic installations
- A solar energy forecasting system
- 14 inter-connected information systems
- 2 energy storage systems

IMPLEMENTATION

► The IssyGrid project has been developed according to a “learn through experience” approach, in order to gain know-how as a result of extensive and documented feedback. This approach is necessary to ensure that smart grids can be replicated in different types of neighbourhood. Drawing on this know-how, consortium members can today provide a service to develop smart grids in four steps:

- Co-construct the project with urban players to strengthen buy-in to the project
- Connect sites, the technical equipment phase of the project
- Collect data, taking account of the regulatory context
- Analyse data, the value creation phase which can only be done after having successfully completed the three previous phases.



IssyGrid is a success due to the fusion of intelligence



André Santini,
Mayor of
Issy-les-Moulineaux

RESULTS

/// Understanding what smart grids bring to local authorities

Local authorities can now benefit from turnkey commercial offers that optimise the management of their eco-neighbourhoods' environmental performance, while enhancing transparency for residents and cost competitiveness in a context of volatile energy prices.

/// A district energy monitoring dashboard

For the first time, public authorities can access real-time information summarising different data.

/// Possibility for developers to optimise energy resources when designing neighbourhoods

IssyGrid is now better with a tool enabling developers to give feedback on past operations to adjust the size of energy networks for future eco-neighbourhoods.



FINANCIAL DIMENSION OF THE OPERATION

/// Replicable industrial expertise and budgetary decisions

10 industrial partners each equally finance an R&D project with no state subsidy, proving the economic viability of the offer to local authorities.

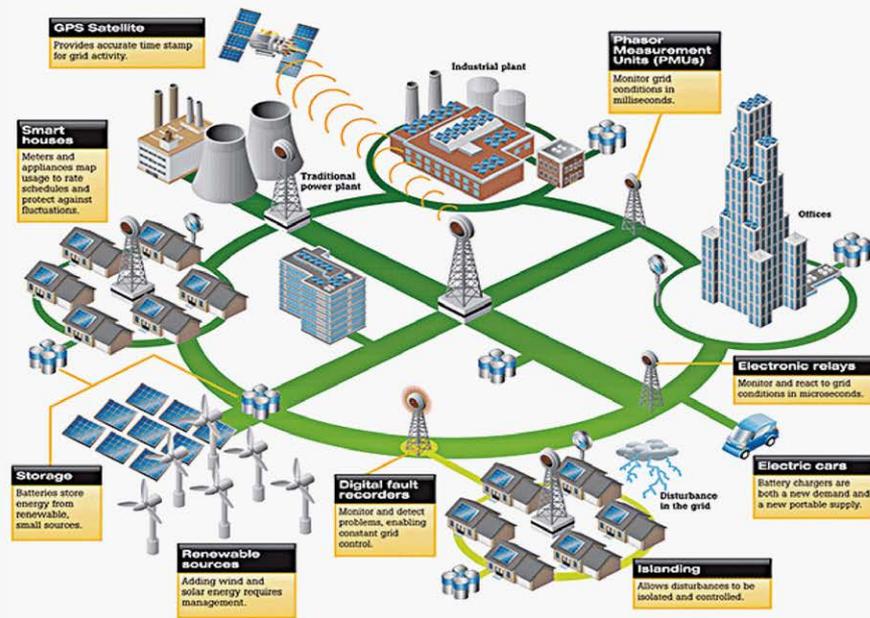
/// A proven economic model

District smart grids to be rolled out shortly: Nanterre, Marseille and others to be announced soon.

KEY FIGURES

- €2.5m budget, available to a number of local authorities
- €0 state subsidy
- 24 international delegations visited this showcase of French industrial know-how in 2015
- 295 articles on the web covering the project as at 01/09/2016





LARGE SCALE SMART GRID DEPLOYMENT

IN THE EUROPEAN METROPOLIS OF LILLE (MEL) TERRITORY

THE “SO MEL SO CONNECTED” PROJECT INVESTMENTS FOR THE FUTURE PROGRAMME (PIA) FOR SMART GRIDS

This project aims to prepare for the industrialisation of Smart Grids and better understand potential business models. These general objectives will lead to the development of innovative services for industry and individuals in four types of situations:

- A. Self-consumption in non-residential areas with photovoltaic panels on buildings.**
- B. Recovery of energy potential in an urban territorial unit.**
- C. Optimisation of the electric vehicle charging cycle through the deployment of electric vehicle supply equipment (EVSE).**
- D. Approaches that combine energy planning with measures to build social cohesion, in order to identify situations in which residents face energy insecurity.**

The work is scheduled to begin in 2017 for entry into service in 2020.

KEY FIGURES

- A test in a 4,000 ha urban and peri-urban zone with 17 towns and 200,000 inhabitants
- 2 years of development and 2 years of operating results
- 10 experimental projects

INNOVATIONS

- ▶ The broad experimental area and the search for economic profitability (process of industrialisation).
- ▶ The development of new services for users relating to energy insecurity and electric car recharging stations.

STAKEHOLDERS

- ▶ This project is above all a concrete example of a public-private partnership between industry and the municipal government.
- ▶ The project partners are: the MEL (European Metropolis of Lille), project coordinator and stakeholder; ENEDIS (formerly ERDF); GENERAL ELECTRIC (formerly Alstom Grids); EDF; DALKIA; LEM (Lille Économie Management); HEI/ISA/ISEN (Engineering schools at the Université Catholique de Lille); INTENT TECHNOLOGIES; and ADEME with project financing via the Investments for the Future Programme (PIA) call for projects.
- ▶ Each partner will manage its own projects, with the involvement of most of the partners. MEL is responsible for governance, general oversight, the implementation of projects related to renewable energy production, and reporting to ADEME.

IMPLEMENTATION

► After the initial six-month study phase, the cost/benefit analysis, and adjustment of experiment's scope, the projects will be launched in 2017 in order to set-up the measurement campaigns in 2018 and 2019 and obtain feedback in 2020.

► One of the difficulties will be in achieving profitability, particularly given the trend towards lower electricity prices in the markets.

Cost/benefit analyses will be necessary to determine ways for the new services to generate revenue in order to ensure economic equilibrium.

Mathieu NEAU, Project Manager for the MEL's "So MEL So Connected" initiative



This is a major project for the MEL, which is positioning itself as a 'territory of excellence' in the field of energy distribution. Smart grids are well suited to an integrated municipal approach covering multiple competences, which allows us to address energy issues in territorial planning far in advance. This project should also boost the regional industrial sector in the field of Smart Grids.



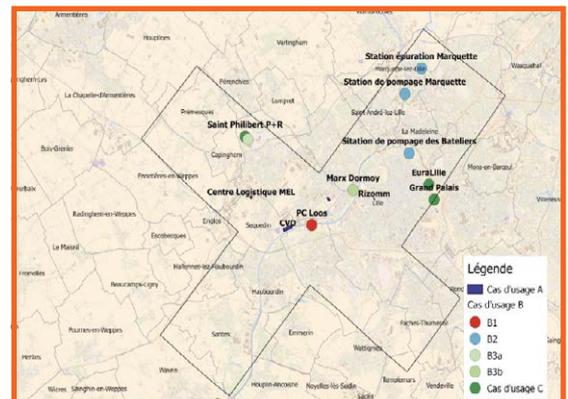
RESULTS

/// The Hauts-de-France region has some of the highest energy consumption in the country due to its industrial activity, and is also a European hub for the production and transport of electricity (the Gravelines nuclear power plant, the largest plant in Western Europe; cross-border exchanges between Belgium, the United Kingdom, Germany, etc.). The MEL's Territorial Climate Energy Plan set an ambitious objective to reduce greenhouse gas emissions by 30% and reduce energy consumption by 10%.

Thanks to Smart Grids, individual and industrial users will be able to improve their consumption by adapting their needs to the offer, particularly with renewable electricity, which will reduce the number of consumption peaks and the use of back-up fossil fuels.

It will also improve distribution quality thanks to greater flexibility and faster activation of back-up units (via remote control or even automation). Lastly, this intelligence will make it possible to:

- contribute to local management of intermittent production;
- better inject renewable energy without disturbing the power grid;
- handle demand variation and any resulting network limitations;
- have better control over energy consumption.



FINANCIAL ASPECTS OF THE PROJECT

/// A 4-year investment of 20 million euros, with 5.5 million for the MEL and 11.5 million for ENEDIS to modernise the electricity distribution network.

This project is funded by ADEME as part of the "Investments for the Future Programme for Smart Grids".

KEY DATA

- €20m investment over 4 years, with 5.5m for the MEL and 11.5m for the power grid
- Promotion of a network of local companies, particularly in the digital field





ENEKIO SMART CITY SAINT JEAN EN ROYANS (26)

SMART, LOW CONSUMPTION AND CONNECTED LIGHTING SYSTEM

In a context of communities, endowments decrease and energy price increase, reducing the electricity bill is a real issue.

Enekiio proposed to 10 municipalities in the Drôme and Isère areas to install a smart lighting system. It decreases light intensity on traffic lane until car or pedestrian passage.

This project fits in Enekiio's smart cities deployment in France to curb global warming and enhance the digital city in rural municipalities and urban areas.

Saint-Jean-en-Royans approved Enekiio's solution deployment on his commune.

Based on the results and as part of the project in Enekiio City, 30 000 luminaires on the 10 requested municipalities are in the financing and the deployment phases.

INNOVATIONS

- ▶ The project consisted in **building a smart lighting network** which serve, as a first basis, for the digital city and the smart city deployment with higher energy efficiency, for the benefit of the inhabitants.
- ▶ Each smart luminaire can be managed independently. A minimum and a maximum light intensity can be defined for each space depending on visibility and security needs. Commissioning schedules also can be customized according to the seasons or events.
- ▶ The luminaire is equipped with a radio technology allowing it to collect, transmit and use city's information to reduce energy consumption. It provides and reports useful information for preventive maintenance. Thus, main-

KEY DATA

- Municipalities : 2,500 to 15,000 people
- Public spaces surface: 1,500 km of roads mainly in rural and peri-urban areas.
- Space between luminaires : 50 m
- Areas concerned : industrial, residential, commercial et tertiary.

tenance services can permanently anticipate failures and ensure lighting's functionality.

- ▶ On users side, the increase of the light intensity is progressive and simultaneous on the road to optimize both drivers and pedestrians experience and comfort.

STAKEHOLDERS

- ▶ SAINT-JEAN-EN-ROYANS CITY
ENEKIO - Urban Contracting Owner.
- ▶ Consultation with municipality, the municipal council, the mayor, the technical managers of the city and inhabitants.
- ▶ During consultations, the constraints associated with mobility-impaired persons were taken into account.

- ▶ In terms of municipality strategy to come up with the digital city features, smart lighting solution deployment showed up as a relevant and challenging project.
- ▶ Integrated complete solution deployed and delivered by Enekiio.
- ▶ Enekiio invested through a partnership with Saint-Jean City and The Canton of Royans, subsequently supported by the General Council of Drôme.

IMPLEMENTATION

- ▶ To reduce the consumption of some municipalities, they have started to completely switch off certain streets or neighborhoods. However, this method meets residents' reluctance who then feels insecure.
- ▶ Reducing the intensity of luminaires without switch them off completely until a car or a pedestrian comes by is an alternative that make pedestrians feel safe and comfort.
- ▶ The minimum or maximum light intensity can be adapted independently on each luminaire. Maximum intensity can be reached at pedestrian crossing. The most dangerous places

are reported and the municipality is sure not be incur liability in case of accident.

- ▶ The light intensity can also be kept at a maximum around bars and restaurants to make them visible.
- ▶ Finally, light emitting diodes (LED) offer better lightning quality. Users comfort is improved and this minimizes biodiversity impact by reducing light pollution.

Method used to calculate the CO₂ impact:

- Calculation realized by considering an emission of 0,09 kg equivalent carbon per kWh saved.
- 550.8 kg CO₂/year saved on lighting of Saint-Jean-en-Royans
- 972 t CO₂/year saved on lighting concerned by Enekiio City Project

RESULTS

- /// The initiative contributes to raise awareness of people about the changes that can occur to limit unnecessary consumption and adopt a more sustainable lifestyle.
- /// The reduction in electricity of municipality can fund new economic development projects or new residents services as a part of the digital city.
- /// The network created by the different radio base stations witch equipped luminaires is open and can be used for the functioning of other application. If Enekiio offers some of them as a part of Enekiio City Project, municipalities can also develop them applications based on the initiatives they want to launch: water, electricity and gas meter reading for the energy efficiency of buildings, air quality; complementary currency system witch rewarding residents for waste sorting.
- /// Offering technological breakthroughs, Enekiio offers a real reduction of environmental footprint associated with municipalities and industries.



75% d'économie sur l'éclairage



Réseau Smart City



Préservation des ressources

FINANCIAL ASPECT OF THE OPERATION

KEY FIGURES

- Annual electricity bills of municipalities reduced by 75%.
- Reduce to zero maintenance costs
- Return on investment : 4 years

- /// The total investment cost (excluding tax): € 15,030,000
- /// Investment amount at the expense of municipality : € 30,000
- /// Subsidies detail (€ excluding tax) :
 - Saint-Jean-en-Royans : K€ 30
 - Enekiio City : M€ 15

Ville de
Saint-Jean en Royans



enekiio



“CITÉ DE L'ENVIRONNEMENT” – METROPOLITAN AREA OF LYON

1ST MULTI-PURPOSE ‘ENERGY-PLUS’ BUILDING



The “Cité de l'Environnement” (in the Lyon metropolitan area) came about from a project launched in 2005 by PÔLE SOLERE, a group of French professionals specialising in high environmental quality in the building sector. At the turn of the century, they were eager to rethink man’s lasting relationship with the environment through the art of building and the art of inhabiting the resulting construction.

The concept of “building together”, an innovative building development showcasing the expertise of responsible builders, resulted in the construction of the Cité de l'Environnement, where “living together” will make long-term sense (both inside the outside Cité) of the environmentally-friendly construction choices.

- **Location:** Parc Technologique - Saint-Priest (69)
- **Operation:** Office building
- **NFA:** 4,499 m², atrium and relaxation area: 600 m²

INNOVATIONS

- ▶ **An energy strategy based on four key areas:**
 - A building that meets the criteria of the Passivhaus label thanks to its heating requirements, which are lower than: 15kwh/m²/year (CG67:144kwh/m²/year)
 - Highly efficient energy systems
 - Controlling specific types of energy consumption
 - Producing more energy than is consumed.
- ▶ **A healthcare approach based on three key areas:**
 - Good air quality thanks to the ventilation system
 - Low VOC emissions from materials
 - High quality light, sound and colour design
- ▶ **Une gestion raisonnée et créative :**
Lower service charges:

- Water management: collecting rain water for use in the garden and toilets (waterless urinals)
- Shared spaces and materials
- Setting up a governance and decision-support system SOCIOCRACY

STAKEHOLDERS

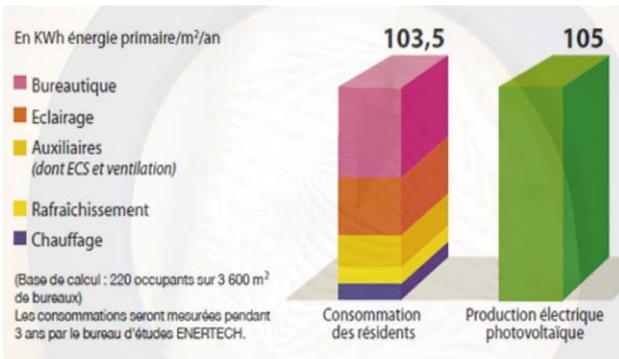
▶ A centre of excellence committed to technology and the environment

The design and construction of the Cité de l'Environnement, a multi-purpose energy-plus bioclimatic office building, involved urban planners, architects, design firms and developers recognised for their expertise in environmental quality in terms of regional planning.

28 companies, 225 employees.

- ▶ **Contractor:** For Home (private)
- ▶ **Project management:**
 - Architect: Atelier Thierry Roche & Associés
 - Fluids design firm: Cabinet Sidler
 - HEQ design firm: Tribu
 - Economist: Betrec
 - Healthcare: Medieco (Suzanne Déoux)
- ▶ **Governance method:** a sociocritical management method for making design and management choices for the jointly-owned property.





IMPLEMENTATION

- ▶ The “Cité de l’Environnement” is a joint project: While great design is crucial, it is not enough on its own. Perfect execution and sustainable performance, thanks to the operations and actions of users, are the strategic links that will ensure that the ambitious energy-performance target is achieved.
- ▶ The design team will also be occupying the building.
- ▶ The contractual aspects were fairly typical of a private development and included the consultation of companies referenced by the engineering team.
- ▶ MCP Promotion’s (the main investor at the end of the development) bankruptcy negatively affected the management of this facility as well as team spirit.
- ▶ It took two years to reach the energy objectives, which were achieved through in-house training and the use of indicators.

Design phase: 2007-2008

Start of work: 2008

Completion: September 2009

RESULTS

- /// Outstanding results: primary energy consumption in the region of 100 kWh/m²/year for all purposes (including offices) for the 3,400m² of office space, 600 m² of atrium and 1,600 m² of car parking! Production of 105 kWh/m²/year from photovoltaic sources.
- /// Photovoltaic solar panels: 1,400 m² of photovoltaic solar panels (140,000 kWh/year) installed on the roof supply 100% of the building’s requirements.
- /// Low-energy consumption buildings: energy-efficient lighting with dimming technology (6 watts/m²) – switches with no batteries – Energy-efficient computers equipped with standby control technology.
- /// Geothermal heating: a reversible heat pump – 87 kW sur 1,700m² – fitted with geothermal collectors providing low-temperature underfloor heating throughout the entire building. In the training room, the air conditioning is powered by a 20-KW Air/Water heat pump (100-person capacity),

FINANCIAL ASPECT OF THE OPERATION

- /// Cost of the build: €9,015,000 (excl. tax)
- /// This building was entirely financed by the building’s private stakeholders. ADEME contributed in the region of €200,000 for the PREBAT certification.

KEY DATA

- 7,000 m² of land
- 3,400 m² of office space
- 600 m² for the atrium and public areas
- 400 m² of terraces
- 28 companies
- 225 employees
- The Cité has been awarded the “Lyon Ville Equitable et Durable” label (NB: in English, Lyon – a fair and sustainable city).





BNP PARIBAS EL DJAZAÏR

THE FIRST “HQE” BUILDING ON THE AFRICAN CONTINENT



Artelia handed over the new Algerian head office of BNP Paribas, located in the Bab Ezzouar business district of east Algiers, in September 2015. BNP Paribas El Djazair (a subsidiary 100% owned by the BNP Paribas banking group) embarked on three years of works to build its new head office near the airport in the framework of its expansion in Algeria. This is the first building in Africa to be awarded certification under the green building standard used in France, “HQE”.

INNOVATIONS

▶ **Exemplary energy performance:** In a country where energy is practically free (thanks to gas exports), the challenges relating to energy performance are new and as yet not all governed by regulations. Right from the start of the design phase, Artelia’s project team opted to use French performance levels as a basis, i.e. the “RT 2005” thermal regulations applicable at that time. On hand-over, the energy performance of the building is 20% better than that of a reference building.

▶ **Reduced energy consumption:** In high-rise buildings, energy savings are generated through technological solutions during building construction, climate control solutions during the operational phase (blinds, internal temperature, demand management, etc.) and the adoption of individual energy-efficient habits.

▶ **Sustainable construction site:** Some aspects that are now closely managed on green building sites in Europe were relatively novel in Algeria. The most notable example concerns the management of construction site waste: there was no structured facility for sorting this type of waste anywhere in the Algiers area. The quantity of waste sent for landfill disposal from the BNP Paribas El Djazair construction site was successfully reduced by approx. 25%.

KEY DATA

- The “HQE” procedure is promoted by Artelia in its capacity as Engineer to set targets to be met along with their priority level for the building
- Targets requiring a “very high performance” are: the building’s relationship with its environment, water management, business waste management, and sustainability of environmental performance
- Targets requiring a “high performance” are: low-impact construction site, energy management, hygro-thermal comfort, acoustic comfort, visual comfort

STAKEHOLDERS

▶ To complete this project, BNP Paribas appointed Artelia to supervise construction, provide organisation, planning and coordination services and oversee the “HQE” procedure, in partnership with architectural firm ATSP. Cerway was responsible for final certification of the buildings.

▶ Artelia is accustomed to assisting private-sector project owners with project design. The various methods used in eco-design enable each project stage to be optimised and involve numerous players.

IMPLEMENTATION

► BNP Paribas El Djazaïr had decided to build its new headquarters back at the end of 2007. However, the works were halted for two years due to the financial crisis of 2008. The works eventually restarted in February 2012 and were completed in March 2015.

► In the framework of the defect rectification procedures, Artelia deployed a method considered innovative in Algeria in the form of the IDCAPTURE software for digital tablets, providing a means of noting the defects while adding photos and recording the position of each one on the Architect's drawing, and then tracking the associated rectification process.



RESULTS



/// **Environmental impact is managed:** This innovative building consumes less energy, emits less pollution and optimises use of resources.

/// **The new head office is a showcase for BNP Paribas El Djazaïr, enhancing its economic appeal:** The Algerian subsidiary of the BNP Paribas group has been operating in the country for 14 years. This state-of-the-art building reflects BNP Paribas's commitment to build sustainable business in Algeria.

/// **The BNP Paribas El Djazaïr tower is the first building to be handed over with "HQE" certification** – (tertiary buildings) anywhere on the African continent. The "Sustainable Building" passport issued by Cerway (Certivéa's international subsidiary) achieves Very Good level. In total, with 5 targets achieving Very High Performance (excellent practices), 7 targets achieving High Performance (good practices) and just 2 at Base level (practices at statutory level), this project far exceeds the minimum levels stipulated for "HQE" certification.

FINANCIAL ASPECT OF THE OPERATION

- 2 towers
- 30,000 m²
- 18,000 m² of offices
- 9 storeys and 4 basement levels
- 3 years of works
- BNP Paribas in Algeria: 1,400 employees, 75 branches, 200,000 customers including 4,000 businesses

/// BNP Paribas funded the works, costing 42 million euros.





LUMIROUTE®

OPTIMISING THE BALANCE BETWEEN ROAD SURFACES AND LIGHTING FOR THE RIGHT LIGHT

Road projects are rarely designed by combining the reflective characteristics of the road surface with those of the lighting that will illuminate it. Yet it is the luminance, that's to say, the light perceived by the driver, that should determine the successful dimensioning of the lighting installation.

Lumiroute® relies on this fact to offer a project involving these two themes in order to optimise the performance of the installations, with the aim of achieving significant energy savings. The evaluation of Lumiroute®, scheduled over a period of 3 years, started in 2014 on an experimental site in Limoges.

INNOVATIONS

- ▶ The principle of the Lumiroute® process is based on optimising the management of urban assets by combining two trades:
 - the road, by mastering its ability to reflect light,
 - the lighting, by taking into consideration the optical properties of road surfaces to dimension the installations.
- ▶ The Innovation allows an optimised concept to be proposed whereby the road surface and the lighting equipment are inseparable in order to provide a controlled luminance. The electrical power installed is also directly dependent on the optics of the street lamps associated with the properties of the road surface's reflection.
- ▶ The surface covering was formulated in the laboratory in order to optimise photometric properties. It can either be a light covering by combining synthetic binder and specific pigments, or a traditional covering made of light aggregates whose colour is left apparent by hydroblasting (high pressure water projection).
- ▶ Thanks to an innovative technology in the light intensity management system provided by LED street lamps, "Lumiroute®", addresses the power and light distribution depending on developments in the time of photometric properties of the road surface. The goal is to the "right Light".

STAKEHOLDERS

- ▶ Winner in 2011 of the call for projects for "Road Innovation" launched annually by the Ministère de l'Environnement, de l'Énergie et de la Mer (MEEM), the Lumiroute® system is subject to a procedure defining the framework for an experiment that includes broad support of CEREMA (Centre d'Études et d'expertise sur les Risques, l'Environnement, la Mobilité et l'Aménagement) and ADEME (Agence d'Environnement et de la Maîtrise de l'Énergie), together with the designers for the Lumiroute® process experiment on a real site.
- ▶ The Communauté d'agglomération Limoges Métropole is a project partner strongly committed to sustainable development.
- ▶ A steering committee is made up of the different stakeholders, both public and private, working in partnership on this project: Limoges Métropole, the project client; Cerema, commissioned by the Comité d'Innovation Routes et Rues (CIRR); Malet, specialised in road construction, the lighting specialists Thorn; Spie Batignolles Energie, experts in lighting and electrification, and ADEME.

KEY DATA

- Reduction in the amount of lighting equipment (street lamps and cables)
- Individual and intelligent management of lighting power
- Less glare
- Reduction in light pollution
- A profitable investment for a town whose public lighting expenses represent 10% of its operating budget

IMPLEMENTATION

- ▶ For the first experiment of the Lumiroute® process at a national level, Limoges Métropole was able to invoke Article 75 of the Procurement Code and establish a works contract following a tendering procedure limited to the winners of the call for projects.
- ▶ The requirements for the site selection were the existence of a new lighting project for a sufficiently long and straight section of road, designed for heavy traffic.
- ▶ The experimental site is made-up of two control sections with traditional solutions (discharge lighting) and two Lumiroute® sections with the combination of surface coverings + adapted lighting (LED).
- ▶ The site, commissioned in the last quarter of 2013, is regularly monitored with photometric property readings every six months, together with the main characteristics of the asphalt and lighting. The evaluation covers the entire installation and then for each component (street lamps and the ground), considered individually, (energy,

photometric and acoustic evaluations). The environmental lighting assessment that focuses on the spread of light emanating from the lamps, allows the light pollution to be measured.

- ▶ After three years of experimentation, a report presenting all the results will be produced by the Monitoring Committee led by CEREMA to validate the innovative solutions used.

“ The objectives have been met and even exceeded. ”

Gérard VANDENBROUCKE,
president of the Communauté
d'agglomération Limoges Métropole

RESULTS

/// The four sections show an adherence conforming to the standard noise levels and which have not evolved significantly.

/// Based on the photometric surveys carried out over different periods, an over-dimensioning of the light level was observed on all sections. The flexibility of Lumiroute® facilities allowed the steering committee to take the decision to gradually lower the power of the LEDs.

/// So, after two years, this reduction of 38% of the installed capacity on the Lumiroute® sections has allowed an energy saving of around 60 to 70%. The Lumiroute® sections are 3 times less energy-consuming than control study sections.

/// There is also better control of lost light flow (non-useful light reflected back into the sky) for Lumiroute® sections which therefore causes less light pollution.



THE FINANCIAL SCALE OF THE OPERATION

/// **A real additional cost of the solution Lumiroute®**

The extra cost of a solution such as Lumiroute® compared to a traditional solution, is estimated to be around 40 to 60%.

/// **Offset by energy savings**

Energy savings are estimated to be in the order of 60 to 70% → **Profitability after 5 years.**

KEY DATA

- Total cost of the experimental project: €450k
- ADEME Grant: €30k
- Monitoring services are undertaken by CEREMA



Contact:

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PAGLIA ORBA SMART NETWORK

RENEWABLE ENERGY AND HYDROGEN STORAGE ENSURING AUTONOMY AND ENERGY EFFICIENCY IN AN ISLAND ENVIRONMENT

Installed on the site of the Université de Corse Pasquale Paoli and CNRS in Ajaccio on the MYRTE, PAGLIA ORBA platform – literally “Advanced platform for managing electricity in an island environment combining storage and renewable energy solutions - Autonomy objective” – an electric micro-network (not connected to the island’s network) i.e. a smart grid in an island environment.

This platform couples electricity production from renewable sources (100 kWc photovoltaic plant) to a hydrogen chain (production technologies, storage and fuel cells) in order to test its relevancy in terms of energy supply issues.

The aim is to stabilise and strengthen the electrification of isolated sites in a reliable, continuous and green manner.

In brief: to ensure continuous service to users while conserving their natural environment.

KEY DATA

- 100 kWc of solar panels
- Multiple storage systems: batteries (lead, ion, redox, NaNiCl₂), mechanical (flywheel, STEP) and hydrogen
- i.e. 100 kW/1000 kWh of storage
- Hybridisation between possible storage solutions

INNOVATIONS

- ▶ The PAGLIA ORBA platform, which uses 100 kWc of photovoltaic panels connected to the EDF network, will supply 20 households. This micro-network will power homes, offices and electric vehicles. The priorities are: ensuring self-supply with an injection of surplus energy to the grid and isolation from the main grid for a few hours a day.
- ▶ In order to overcome the intermittent nature of renewable energy sources, electricity not consumed by the network (at time T) is sent to the McPhy electrolyser installed on the PAGLIA ORBA platform. Thanks to a chemical reaction between water and the electricity, the electrolyser produces hydrogen.
- ▶ In this way, McPhy Energy has been able to deploy a solution supplying 10 kilos of hydrogen a day (at a pressure of 10 bar). This hydrogen energy can then be stored in solid form (5 to 10 kg of storage capacity in phase 2 of the project) before being converted back into electricity when required by the network (e.g. in the evening or during peaks in consumption) via a fuel cell.

STAKEHOLDERS



RESULTS

- ▶ The expected results of the PAGLIA ORBA platform can be calculated both qualitatively and quantitatively.
- ▶ Qualitatively, it preserves Corsica's natural environment by using green energy while, at the same time, increasing the skills of the island's technical teams.
- ▶ Furthermore, it validates the concept of combining photovoltaic electricity production and storage solutions

in the form of hydrogen as well as the overall output of installations.

- ▶ The installation was completed early in 2016. The next step will be to evaluate the overall price of the hydrogen chain in order to compare it with traditional solutions.

PROJECT EXTENSION: FOCUS ON HYDROGEN MOBILITY

/// HYWAY & H2 ENGIE GNVERT STATION: GREEN MOBILITY IN THE HEART OF THE REGIONS

If the tests conducted on the PAGLIA ORBA platform are conclusive, hydrogen energy could provide a range of new applications for the entire island of Corsica e.g. hydrogen mobility, which is used by regions wishing to tackle air pollution and climate change.

Hydrogen vehicles have a range of first rate benefits. The high energy density of hydrogen doubles vehicles' autonomy compared to electric vehicles and allows them to be refuelled in under five minutes ensuring increased productivity and time savings for users. These 'zero-emissions' vehicles (i.e. no CO2 or particles) only release water thereby contributing to better air quality and better living conditions for city dwellers.

In order to support the growth in zero-emissions mobility, McPhy Energy plans to deploy a series of hydrogen refuelling stations in France and abroad. This is the case of the ENGIE GNVert station on the CNR site in Lyon in the context of the Hyway project.

Managed by the Tenerrdis cluster, the Hyway project uses a unique and innovative model for deploying fleets of electric utility vehicles fitted out with hydrogen kits permitting them to double their autonomy by accessing two refuelling stations in Grenoble and Lyon.

The first users will be pioneers of sustainable hydrogen mobility.

Designed and installed by McPhy Energy, the Lyon station can refuel HyWay vehicles in under seven minutes at a pressure of 350 bars.

Located at the Port de Lyon CNR, a busy logistics hub in the centre of the city, the station can refuel (with hydrogen) around fifteen vehicles a day i.e. four times more than in the pilot station.

This modular project will be further developed in 2017. The hydrogen will be produced on site by installing an electrolyser running on 100% renewable electricity produced by CNR. This station will also have an NGV refuelling station and electrical charging stations to become a truly "green" multi-fuelling station.



HYWAY IN FIGURES

- 50 electric hydrogen vehicles (Kangoo ZE-H2)
- 2 hydrogen refuelling stations in Grenoble and Lyon
- During the first four months of operation, the vehicles have:
 - Driven over 60,000 kilometres
 - Refuelled over 280 times in the stations
 - Clocked up over 10,000 km on the most used vehicle

AVEC LE SOUTIEN DE



AUVERGNE - Rhône-Alpes

EN PARTENARIAT AVEC



McPhy
energy



HQE™-CERTIFIED SOCIAL HOUSING IN BOGOTÁ, COLOMBIA

RESERVA DE MADRID

Located in the town of Madrid Cundinamarca near Bogotá, "Reserva de Madrid" is a project consisting of 2,600 units of affordable housing. It was constructed as part of the Colombian capital's growth strategy. Private property developer Prodesa has built a mixed-housing real-estate project containing a large proportion of social housing units that are environmentally friendly and HQE™-certified.

The environmental profile, improved during the certification process to "excellent" level, far exceeds the basic requirements recommended in HQE™ certification, in particular regarding the relationship between the quality of life of future occupants and environmental responsibility in areas such as water consumption and respect for biodiversity.

KEY DATA

- 1st HQE™-certified project in Colombia
- 2nd HQE-certified social housing project in South America
- 520 certified housing units with an average floor space of 50 m²
- 26 5-storey certified blocks with a surface area of 35,157 m²

INNOVATIONS

► The choice of HQE™ is innovative, making this the very first certified social housing project in Colombia, and only the second in South America. HQE™ certification of the Piemonte project in the Reserva de Madrid programme also raises the new issue of finding a compromise between sustainability and the economic constraints specific to social housing. Prodesa successfully implemented a strategy that would include sustainability in all aspects of the project so as to obtain the lowest economic impact and the highest environmental performance possible. The flexibility of the HQE™ process makes it possible to establish guidelines for studies, while adapting to the specific features of the project in its context. For example, acoustic comfort is usually not taken into account in Colombia, meaning that the performance of certified housing will exceed the general level for residential buildings. Reserva de Madrid required Cerway to deal with the issue of delivery of "buyer-completed" housing units (in other words, some of the finishes and fittings are payable by the purchaser), and helped to further develop HQE™ through the creation of an addendum to its Housing Reference Guide

STAKEHOLDERS

► The town of Madrid Cundinamarca was confronted with fast, unplanned growth which was adversely affecting the local natural environment. With Reserva de Madrid, private property developer Prodesa wanted to stop to this state of affairs. French sustainable development engineering firm Terao suggested that Prodesa seek HQE™ environmental certification, delivered internationally by Cerway. An independent auditor visited the site to assess effective implementation of HQE™ technical requirements.

IMPLEMENTATION

- ▶ The certification process includes three audits in the pre-project, design and construction phases.
- ▶ Requirements related to environmental management of the project, introduced from the planning phase, help the property developer structure the process in consultation with the various parties involved as soon as the initial designs are drawn up.
- ▶ Regular audits of technical requirements in terms of energy, environment, health and comfort allowed the developer to adjust the solutions chosen while complying with the schedule and budget.
- ▶ During the process, the developer was supported by an HQE™ certification advisor recognised by Cerway who provided guidance on the best choice of solutions with a view to attaining certification.
- ▶ Correct implementation of HQE™ is guaranteed by concerted awareness-raising of the various operational stakeholders in the project (builders, service providers and engineers).

Juan Antonio Pardo,

Prodesa CEO



The sustainable development advice and support provided Terao Colombia and Cerway was a decisive factor. HQE™ certification is much more than just a tick list, it goes beyond solely environmental concerns and includes the relationship between the building and the town, and between the people who inhabit it, and its impact on the local area."



RESULTS



- /// Compliance with the budgetary constraints and schedule of the project
- /// CEMEX prize for best design of a housing complex
- /// HQE™ certification with Excellent rating for the design phase submitted at Construverde 2016, an international event organised by the CCCS (Colombian Council for Sustainable Construction).

FINANCIAL ASPECT OF THE OPERATION

- /// The main issue was to find the best possible compromise between sustainability and compliance with the budget allocated as a result of the social nature of the project.
- /// Detailed, comprehensive monitoring of all aspects of the project from the planning phase resulted in fewer corrective interventions on delivery.
- /// HQE™ certification improved marketing of the housing units.

KEY FIGURES

- Average sale price of a certified social housing unit: €30,000
- Budget allocated to certification: €0.52/m²
- Cost overrun for the total construction budget, including support and designs: 3.5%



Contact :
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30 ZERO ENERGY DWELLINGS

NANTES GRAND CARCOUET ENERGY POSITIVE RESIDENTIAL

« *Le Grand Carcouet* » is the first apartment building positive energy (Zero Energy Building) in the west of France. Located in the district Dervalières / Chézine, Nantes, he has 30 social housing rental, from T2 to T6.

The Grand Carcouet has a double ambition:

- **Technical:** make a ZEB building and check its usage and consumption over time.
- **Social:** designing housing, common areas and an accompaniment that develop and promote community life.

KEY DATA

- 30 Housing
- 3,276 m² SHON
- Positive Energy Label BEPOS
- Delivery: 2014
- € 1,800 / m²hab (excluding PV)

INNOVATIONS

- ▶ The project involves the construction of 30 multi-family housing in two buildings low consumption certified buildings (BBC), and Level Building in Energy POSitive (BEPOS). The operation was launched as part of a tender for building design.
- ▶ The uniqueness of this project is that it was designed on a direct electrical heating base while achieving an extraordinary level of energy performance.
- ▶ The construction method of this project uses timber frame walls.
- ▶ The heating of the hot water is produced by a Thermodynamic Solar System (Heliopac).
- ▶ Heating is recovered in waste water through Power pipe system.

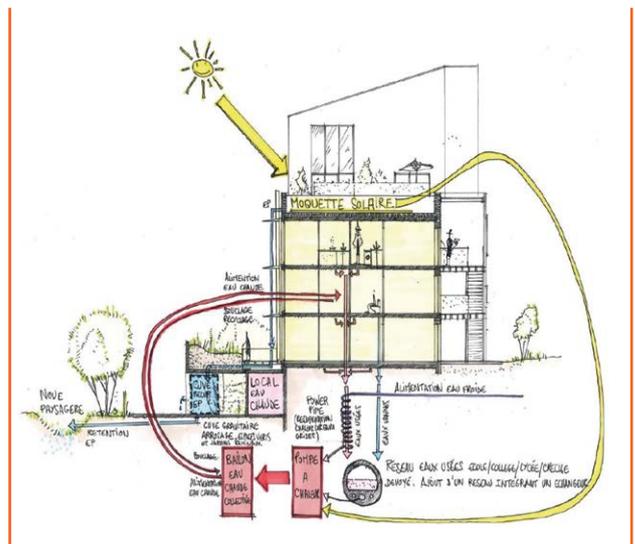
STAKEHOLDERS

- ▶ **Bouygues Construction**
Major stakeholder in sustainable construction and services, the Group and its 53,500 employees design, build and operate the structures that improve everyday part of life and work: public and private buildings, transport infrastructure, energy networks and communication.
- ▶ **Nantes Habitat**
Private social landlord in Nantes region.
- ▶ **Architecte IN SITU Architecture & Environnement**
Architect specializing in environmental and sustainable design.
- ▶ **Pouget Consultants**
Technical Design Office specialized in environmental engineering.
- ▶ **CMB**
Company specialized in wood and wood modular construction.

IMPLEMENTATION

► The project, directed by Nantes Habitat design-build by the Bouygues group Great West Building, CMB, In Situ, Pouget offers a generous response to the issues raised by the issue of sustainable living. This response is illustrated by the quality of the building by the committed advocacy approach.

► Moreover, habitat Nantes wanted for some time realize an innovative project anticipating future thermal regulations in 2020 and develop a return of experiences on techniques and uses (instrumentation housing for performance monitoring and guidance as good practice for tenants and maintenance services of Nantes Habitat).



RESULTS



/// The Grand Carcouet has a double ambition

- **Technique:** make a BEPOS building and check its use and consumption over time.
- **Social:** designing housing, common areas and an accompaniment that develop and promote community life.

/// Quality of use

Definition of additional housing space to accommodate a usually untreated uses in collective housing (workshop, storage, music area, laundry room, office, multimedia center...).

All accommodations are equipped with a loggia (~ 25m²) very glazed south and merges access to housing and laundry area.

FINANCIAL OUTCOMES

/// The total price of the transaction cost is 2,100 €/m² (total cost of operation) or 20% higher than the overall costs recognized in conventional operations.

/// **The land belonged to the city: the land charge is substantially identical to other social housing projects Nantes Habitat**

KEY FIGURES

- Regulated energy ~ 40 kWh_{EP}/(m²GFA.yr)
- Regulated energy ~ - 1 kWh_{EP}/(m² GFA.yr) with Photovoltaïque
- Power pipe System: 2 kWh_{EP}/(m²GFA.yr)
- Global building Uvalue ~ 0,4W/m²
- CO₂ < 2 kgEqCO₂/m².yr

FRANCE 
URBAINE
MÉTROPOLIS, AGGLOS ET GRANDES VILLES


NANTES
HABITAT

P. BELLEVAIRE - F. LANNOU
IN SITU
ARCHITECTURE & ENVIRONNEMENT


CMB
La maîtrise des chantiers bois


POUGET
Consultants



HESOP, INVERTER SOLUTION FOR LONDON UNDERGROUND

IMPROVING THE ENERGY EFFICIENCY OF THE VICTORIA LINE

In 2013, Alstom was chosen by UKPNS to supply Hesop, its advanced reversible power substation, to London Underground (United Kingdom). Configured to operate in inverting mode, Hesop is installed at the Cloudesley Road substation, on the Victoria Line, and has been in commercial service since March 2015.

INNOVATIONS

▶ Hesop is a power-supply solution designed to deliver the best energy efficiency for rail DC systems (tramway, metro and suburban networks). Hesop's novelty lies in its specific single converter which optimizes the power required for traction and captures more than 99% of the recoverable energy during a train's braking phase. The energy can then be redistributed back into the HV network for re-use locally or remotely. Hesop also reduces the amount of heat generated by trains, a notable problem in London's deep small-profile tunnels. Cooling and ventilation equipment along the network can therefore be further optimized and on-board train brake resistors can be removed.

STAKEHOLDERS

- ▶ **Alstom**
(French rail transport equipment manufacturer)
In charge of the design, supply, installation supervision, commissioning and 3-month observation and performance measurement of the inverter solution (Hesop).
- ▶ **UK Power Networks**
(UKPNS – distribution network operator for London and South-East England)
In charge of modifications of existing substation and installation of the inverter solution.
- ▶ **London Underground Limited**
(LUL – London metro network operator)
In charge of operating the inverter solution.

KEY DATA

- Hesop 630V/780kW
(peak power: 3,5 MW)
- IGBT technology
- Natural Air cooling
- Start of service: March 2015
- Line length: 21 km in tunnel
- Number of passenger stations: 16

IMPLEMENTATION

► The contract was signed in April 2013 and the installation of Hesop took place the following year, in June 2014. The main worry of the operator was that a new technology might have caused compatibility issues with existing line equipment and disrupted the operation. This hurdle was cleared by a solid safety case listing all behaviours expected from the unit vis-à-vis its environment.

► **Milestones:**

- Contract signature: April 2013
- Installation: June 2014
- Night tests: End 2014
- Start of commercial service: March 2015

Christine Darragon, Infrastructure Innovation & Competitiveness Director, Alstom



Hesop has been recognized by several networks worldwide including London as a solution offering numerous benefits in terms of energy efficiency and traction optimization.



RESULTS

- /// Energy recovered in line with modelling predictions.
- /// Recovers more than 800kWh/day (on average): equivalent energy amount to power 2 medium-sized passenger stations.
- /// 50% more recovery on weekends vs. weekdays.
- /// London Underground awarded prize from both Railway Industry Awards and Transport Times in the UK for Hesop inverter installation.



FINANCIAL DIMENSION OF THE OPERATION

- /// For London Underground, energy has become a key consideration during power system design. The inverter solution is now part of their future line upgrade plans.

- Over 99% recovery of braking energy
- Energy recovery: 800 kWh daily
- Energy re-used by station equipment or returned to the grid

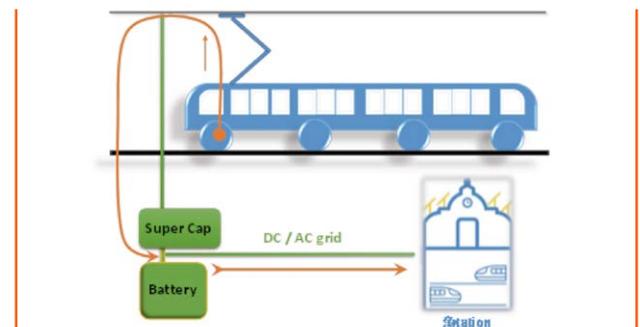
ALSTOM



STATIONS ENERGY OPTIMIZATION: DESIGN AND CONTROL OF A SMART MICROGRID

A NEW POTENTIAL FOR WASTE ENERGY RECOVERY IN THE URBAN TRANSPORT SECTOR, USING REAL-TIME SMART ENERGY MANAGEMENT

Underground subway stations present unexploited energy resources. A microgrid, smart small scale electrical network, integrating harvest and storage of these currently wasted energies, could allow load shedding/shifting, eventually improving air quality through reductions in trains mechanical braking. These important potentials require numerous innovations in multiple fields: electrical engineering, building energy efficiency, mathematical optimization, modelling, energy economy as well as implementation of real test beds.



INNOVATIONS

- ▶ The sporadic and unforeseeable behaviour of renewable and recoverable energies, is a major stake for the energy transition. The electrical current created by a subway regenerative braking is characterized by a large amplitude and a very short time (few seconds). Technological innovations in power electronics have a key role to play to recover this energy with a hybrid storage system.
- ▶ In order to maximize the energy benefits, cutting-edge optimization methods allow an optimal sizing and a real time management taking into account the devices' diversity, the actors' multiplicity and the randomness related to energy and urban transport.

STAKEHOLDERS

- ▶ These innovative concepts specific to stations are related to the railway operators and the public transport institutions.
- ▶ On one hand, a microgrid installation inside a station implies operational changes. Railway operators must be trained to new practices. On the other hand, the real time optimized energy management and storage of renewable and recoverable energies, can benefit to other station services. A complete ecosystem can be developed around a station, such as an electrical buses' service, electric vehicles and bicycles charging stations. Therefore these potential eventual actors may become interested stakeholders in Efficacy's R&D projects.

IMPLEMENTATION

- ▶ One of the solution studied by Efficacity is the hybrid storage, with a high capacity electrochemical capacitor, which stores energy much faster than batteries (supercapacitor) combined with a battery with a low capacity but a slower discharge. This hybrid storage is associated to a voltage converter to adapt the catenary voltage to the station's electrical network.
- ▶ This recoverable and renewable energy storage system is very expensive. Its profitability increases using a charge and discharge smart management of the electrical storage associated to a technical and economical sizing of the most expensive equipment.
- ▶ The aim of this project is also to realize a decision-making and design assisting tool to improve the energy efficiency of a station.

André Pény, Innovations Manager, RATP

“ RATP is an important energy consumer, due to the trains and subways operation, but also due to the stations whose consumption is increasing. Efficacity's scientific progress provided by its innovative solutions are of paramount importance. Trains regenerative braking energy recovery, microgrids connecting trains to stations and districts, adapted energy storage researches, electrical grids modelling and optimal control bring multiple technical enhancements to Efficacity's skills base in the public transportation field. **”**

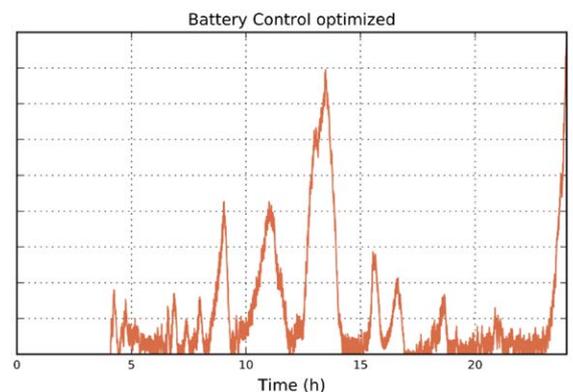
RESULTS

/// Energy benefits

Real-time control of a station electrical network and its eventual electrical storage could bring a significant energy economy, which represents a great deal for a railway operator.

/// Indoor air quality improvements

Following the electrical devices' technological improvements, the most important profits are generated by trains regenerative braking. This project could reduce significantly mechanical braking generating less particulate matters.



Battery optimal management simulation

A MICROGRIDS OPTIMAL SIZING AND MANAGEMENT TOOL

/// Efficacity develops a tool based on generic subway stations' models. These models provide a tool to realize a technical study to size the least energy-friendly devices and propose operation strategies. This tool associated to sensors' measures and to actuators will allow devices' real-time optimal control.

VALIDATION METHOD

- Simulation model development
- Laboratory demonstrator and Real-size demonstrator



HIKARI

EUROPE'S FIRST MIXED BUILDING COMPLEX WITH POSITIVE ENERGY

Inaugurated on September 17, 2015, HIKARI is composed of three buildings along Place Nautique in the heart of Lyon's new Confluence district. HIKARI is part of the sustainable urban planning program for the Confluence area, the first district in France to be awarded a WWF label. The complex includes an office building, a building with 36 apartments, a mixed office/housing building and businesses on the ground floor in the three entities.

Because it allows mixed use and shows strong performance in energy production and sharing, the HIKARI project is on the cutting edge of innovation, making it Europe's first positive energy building complex.

INNOVATIONS

► The project highlights technical innovations based on the local production of renewable energy, representing a real step forward in energy efficiency. The bioclimatic architecture enables capturing a maximum of natural light; the triangular cutouts on the façade and the large glassed-in areas direct light to the inside of the building.

Three renewable energy sources have been implemented (integrated photovoltaic panels, geothermal system and cogeneration plant using canola oil).

The particularly innovative technical character of the complex stems from its ability to store and share energy produced separately by the three buildings. In addition, users can track, optimize and manage the energy consumption in their living area.

► Mixed use inside a single building is a key project fea-

ture that aims to provide another way of thinking about the "home-work-leisure" relationship within the city.

► The partnership between Lyon Métropole and NEDO (a Japanese para-governmental agency dedicated to energy and environmental innovation) emphasizes the international character of the approach by choosing HIKARI as the demonstrative symbol of a new type of habitat.

KEY DATA

- HIKARI means « light » in Japanese
- 12,800 m² complex with mixed uses
 - HIGASHI («east» in Japanese): 5,500 m² of offices
 - MINAMI («south» in Japanese): 3,400 m² of apartments
 - NISHI («west» in Japanese): 2,500 m² of offices and 700 m² of villa-style lodgings
- 1,000 m² of businesses and services on the ground floor of the three buildings
- 160: the number of households that can be covered by renewable energy production through the cogeneration plant and the photovoltaic plant.

STAKEHOLDERS

► Although the buildings were designed by Japanese architect Kengo Kuma, HIKARI is part of a broader urban project (Lyon Smart Community) based on a partnership between Greater Lyon and NEDO (a Japanese public and para-governmental agency dedicated to energy and environmental innovation) Toshiba provides expertise in equipment based on low energy consumption and in the centralized steering of energy.

Bouygues Immobilier is the project manager and a financial backer. NEDO also participates in financing.



Kengo Kuma, Architect

“ Lighting is one of the most energy-consuming factors, particularly in office environments. This is why light was chosen as the starting point and guideline for the project. ”

IMPLEMENTATION

► The project originated with a memorandum of understanding between Greater Lyon and NEDO. One of the particularities of the HIKARI implementation was the joint selection of an outfitter by Greater Lyon and NEDO. Building began in the spring of 2013, and the complex was delivered in July 2015.

Various goals guided the operation:

- Ensure that an industrial building approach (Toshiba) coincided with a traditional development approach using a real estate promoter. Respecting deadlines was thus an important factor.
- Implement technological standards providing a detailed verification of the reception and installation of captors, a key element in the production and management of energy consumption in the complex.
- Implement training and support for users and residents on how to make the most of technologies found in the complex buildings.

RESULTS

/// Total production of renewable energy through the cogeneration plant and the photovoltaic plant is 476 MWh, the equivalent of consumption of approximately 160 households.

/// The production of renewable energy through cogeneration in the complex covers 80% of electricity needs and 90% of heating needs for occupants.

/// Thanks to the storage and sharing of energy produced, the HIKARI complex should consume about 55% less than current thermal norms.



FINANCIAL SCOPE OF THE OPERATION

/// The HIKARI complex is part of an approach based on demonstration and education; the statistical tracking of energy performance will serve as a model for future projects in this area. Not enough time has elapsed to enable an overall appreciation of the project's financial aspects.



KENGO KUMA & ASSOCIATES

Lyon Confluence .fr





SHANGHAI LINGANG, OPTIMIZING LOCAL ENERGY SYSTEMS FOR A LOW CARBON URBAN DISTRICT

EDF, IN PARTNERSHIP WITH URBAN PLANNERS,
PROPOSES AN INNOVATIVE SIMULATION TOOL FOR
SUSTAINABLE ENERGY PLANNING

EDF created a decision making tool, which helps local players to plan and design an energy system of their urban project: it's a 3D web-platform, which offers the possibility to build various energy scenarios at the early stage of a project and to evaluate quickly their impact on costs and benefits.

Thanks to this innovative approach, EDF group, in partnership with the Chinese urban planning institute Tongji UPDI (Shanghai) and the French architecture studio AUC, won in 2014 the first prize of a competition for the development of the new district of Lingang in Shanghai.

By enabling to reduce CO₂ emissions and electricity peak load by 50%, the solutions advocated by EDF's tool perfectly match the specific low carbon challenges of this district.

INNOVATIONS

- ▶ The Lingang project is really innovative as energy planning is integrated since the early phase of an urban project; it is the first time that this approach has been implemented in China.
- ▶ Moreover, EDF's customized 3D tool can be adapted to adapt to each cities' specific local challenges, while using mature and economically viable technologies and energy solutions.

STAKEHOLDERS

- ▶ EDF's proposal was done in partnership with the French architecture studio AUC, specialized in urban projects (Lyon Part-Dieu, Grand Paris, Bruxelles 2040...), and Tongji Urban Planning Design Institute (UPDI), a Chinese institute of the Tongji University College of Architecture and Urban Planning.
- ▶ The clients are the Shanghai Zhangjiang Development Company along with China Investment Development are in charge of Lingang's development.

KEY DATA

- 50% of CO₂ reduction
- 50% of electricity peak load reduction
- 10% reduction on consumer's energy bill
- 100% of the energy produced locally

IMPLEMENTATION

► The Lingang District is one of Shanghai's nine satellite towns, located 70 km away of the city's center. In order to obtain innovative and low carbon urban design proposals for the development of this new green-field site, real-estate developers launched an International Competition of Conceptual Urban Design, in July 2014. The proposed solution needed to address two specific local energy challenges: CO₂ emissions reduction and energy demand optimization.

► The Sino-French team made up of EDF, Tongji UPDI and the AUC won the competition in November 2014. The initial development of Lingang's district has been started on a 1 km² section in 2016, then to be extended to a larger Comprehensive Zone of 42 km².

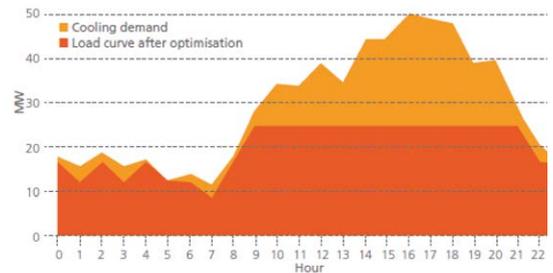
Mrs. Wang Jingxia, President of the jury and former president of CAUPD (China Academy of Urban Planning Design)

“ Integrating an energy planning in the early phase of urban design has never been brought up before in China. For this outstanding proposal, the energy planning is its most original and innovative part.”

Selection of the best available energy mix	District energy	CO ₂	Availability	Evaluation
	●	●	●	●
	●	●	●	●
	●	●	●	●
	●	●	●	●
	●	●	●	●
	●	●	●	●
	●	●	●	●



Estimation and localisation of heat-cold and electricity demand for buildings (snapshot during a winter's day)



Reduction by half of the electricity peak load (example of summer peak)

RESULTS

/// EDF's final proposal proved the added value of integrating energy planning early on in urban development. Thanks to its tool, EDF enabled to draw a district design that allows:

- to cut planned CO₂ emissions and electricity peak loads by half,
- to produce 100% of the district's energy locally,
- to reduce the energy bill for residents by 10%.

FINANCIAL ASPECT OF THE OPERATION

/// The added value of this approach is clearly to pave the way for local low carbon solutions, demonstrating that the mitigation of CO₂ emissions can be cost effective. Integrating energy and CO₂ emissions at the very beginning of urban planning allows to find innovative and efficient energy solutions.



TONGJI
URBAN PLANNING
DESIGN INSTITUTE



“LES AQUEDUCS” BUILDINGS – SOPHIA ANTIPOLIS

MICROGRID (SHARED LOCAL CONSUMPTION, STORAGE, MONITORING)

“Les Aqueducs” is a property showcasing 4 positive energy office : the production is superior than the consumptions.

Based in French Riviera (Sophia Antipolis – South of France), these buildings uses solar power first and foremost. This electricity is shared between occupants, and the production surplus is stored in batteries.

INNOVATIONS

- ▶ Solar electricity is self consumed in office buildings by different occupants.
- ▶ Equipments are controlled to adapt consumption to production (Hot Water, Electric Vehicles, heating/cooling system).
- ▶ Electric uses are mesured in real time and displayed to users.
- ▶ Complete Autonomie is reached during working hours.

STAKEHOLDERS

- ▶ 100% private office program, cost effective without any subvention
- ▶ Land Developer, Owner, Asset Manager: VALIMMO
- ▶ R&D Department and Energy Installer: VALENERGIES
- ▶ Occupants: Altedia, Silicon Mobility, Trustonic, Pearl Partner, Wildmoka.

IMPLEMENTATION

- ▶ New Building: 2012 Thermal Regulation-Positive Energy
- ▶ Active since November 2015
- ▶ Challenges:
 - **Technical:** Storage techniques from Solar Power were used only in experimental conditions; this is the first realisation in operating conditions.
 - **Financial:** No subvention, an economic balance was absolutely necessary for this program.
 - **Regulatory Framework:** The distribution system operator, faced to this new type of project, was opposed to a single connection principle to the public grid network, which is necessary to allow shared consumption.

KEY DATA

- 4 Buildings - 6,400 square meters (24 open spaces)
- Solar Photovoltaic: 215 kWp installed on the roofs and on carports
- Storage System 50 kW/ 50 kWh

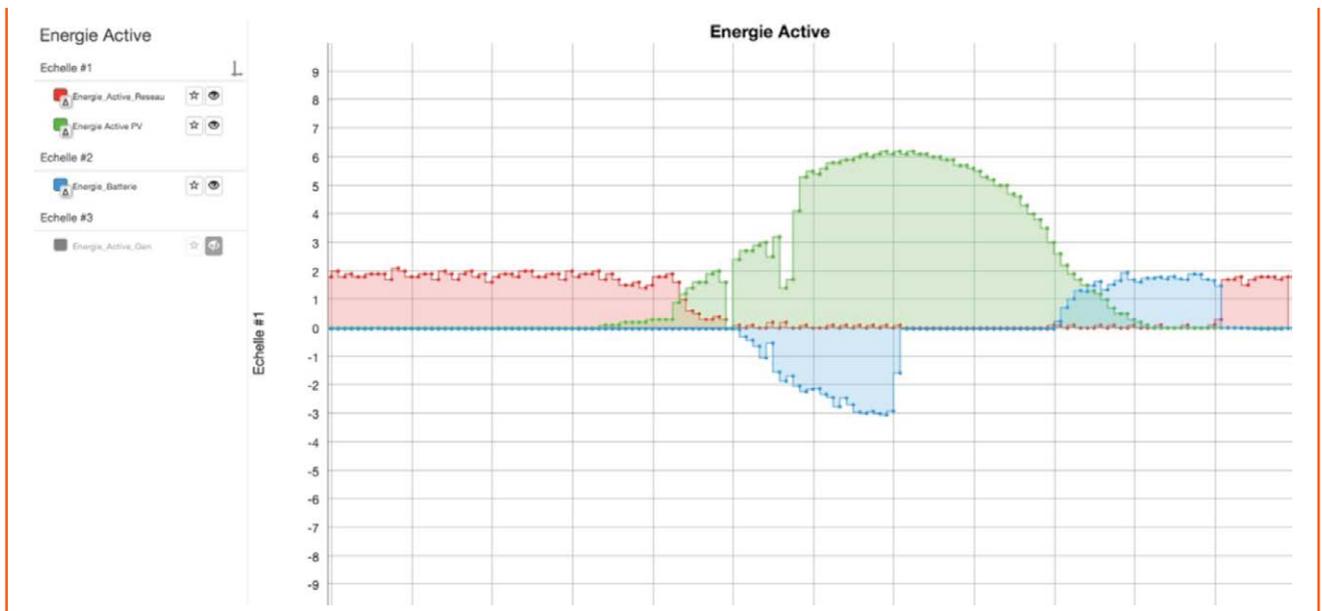
RESULTS

/// Environmental impact: Total Energy autonomy during working hours.

/// For occupants :

- Attractive place: Reduced Electricity Invoice, these offices are used only during working hours, when solar panels produce energy.
- Responsible use of resources: improvement of their corporate responsibility and brand image.
- For the Land Developer: attractiveness for future occupants.

/// Price: **Climate Energy Trophy**



FINANCIAL ASPECT OF THE OPERATION

/// The Business Model has been calculated for the whole program: a building which produces its own green energy reduces occupants' costs. It enhances the attractiveness of the building compared to other old buildings, but the addition of rent amount + lease expenses don't increase. Goal achieved: at the end of 2016, every spaces will be rented.

→ Additional cost : +5%

→ Return of Investment : 10 years





French and International delegations are welcome to the IMT to live the experience of:



LEARNINGGRID BY GRENOBLE

The first european Microgrid that blends education and new energy technology to fast-track the energy transition

► LearningGrid by Grenoble is hosted by the IMT [Trades and Technology Institute], a true Living Lab of 3000 players portraying the economic and social life of a present-day small town.

The project has two objectives:

- create a world-class benchmark microgrid, promoting auto-consumption of locally produced green energy today, and demonstrating the “smart grid ready” scenarios of the future,
- train the younger generations on the challenges of the energy transition, by covering energy issues, based on the local example, in training curricula.

An essence of technology combining energy production, storage and management solutions

► LearningGrid by Grenoble will implement a large number of technological innovations:

- Ecoblade, a modular, smart Li-ion battery-based energy storage system,
- Struxureware Demand Side Operation, a supervision-control-modeling software suite that collects weather forecast data to predict energy consumption needs and continuously adapt production and storage means accordingly.

► It will also benefit from all the latest advances made in the European Ambassador* research project aimed at optimizing electrical power consumption and overall energy management in complex, multi-stakeholder urban environments.

*Ambassador is a European research project dedicated to shared-energy districts. The project took place from 2012 to 2016 and involved 14 partners led by Schneider Electric.

IMT HOSTS LEARNINGGRID BY GRENOBLE

- The IMT is the Grenoble CCI's apprenticeship training center.
- With nearly 2,400 learners, 110 permanent teaching staff and 200 contractors, it is the number one apprenticeship training center in the Isère Department and number two in the Auvergne Rhône-Alpes Region.
- 80 trades are taught in several main sectors: buildings, energy management, cars and motorcycles, hotels and restaurants, floristry, personal services, and service sector trades.
- The IMT site is located in the Grenoble urban area. It includes six buildings, four of which were built between 1968 and 1970.



Cooperation between municipam, training and industry stakeholders

- The stakeholders are founding members: the CCI and Schneider Electric.
- The private partners in the second circle are KIC InnoEnergy and the Compagnie de Chauffage de Grenoble [Grenoble Heating Company] (CCIAG).
- The public partners are the Commissariat-General for Investment (CGI), the Auvergne Rhône-Alpes Region, the Isère Department and Grenoble Alpes Métropole.

CONDITIONS FOR PROJECT IMPLEMENTATION

- ▶ The project was made possible by the commitment of two stakeholders closely involved in local economic development and determined to take fundamental action in favor of the energy transition: the Grenoble CCI and Schneider Electric. The founding members soon managed to motivate other partners to co-build an ambitious and realistic project mixing proven technologies and innovations from research programs.
- ▶ LearningGrid by Grenoble was granted support and funding from a number of sources in view of the innovations developed, the project's educational vocation, the creation of new modules dedicated to energy in all professional sectors, and new "microgrid" learning material for each energy-sector degree or diploma.

Jean Vaylet, Grenoble CCI President

The CCI wanted full involvement in the energy transition. First, it created a center for Sustainable Development and Energy and hosted the Schneider Electric Energy Trade School on the IMT campus. Now it has gone further and made the IMT a testing ground and educational pioneer in new energy technologies, offering new energy technology training/work experience programs to meet business needs, today and tomorrow.

Luc Remont, Président de Schneider Electric France

For a group like ours, as a global energy management specialist, participating in the project was an important opportunity. First, because a successful energy transition calls for totally new products, services and solutions... Schneider Electric knows what smart energy management is about, not just in buildings, but in entire districts... Our group has also always focused on training and the integration of young people, creating its own training/work experience schools, starting in 1929! So we are especially pleased to extend this deep-rooted commitment through this promising project.

RESULTS ACHIEVED

Stakeholders from the municipality, education and industry sharing the project

More than 15 % renewables

Bâtiment B4
Cogénération, Production, Stockage, Réseaux, Énergie, Éclairage

Bâtiment B6
Cogénération, Production, Stockage, Réseaux, Énergie, Éclairage

Bâtiment B2
Cogénération, Production, Stockage, Réseaux, Énergie, Éclairage

Bâtiment B7 (à construire)
Cogénération, Production, Stockage, Réseaux, Énergie, Éclairage

A fast track from research to industrial integration

Bâtiment B5
Cogénération, Production, Stockage, Réseaux, Énergie, Éclairage

This project has 3 big phases: (1) Diagnose and requirements for consultations in 2016, (2) Works in 2017 and (3) deployment teaching aids in 2018. We ended the energy diagnoses. We are in phase of characterization of needs so as to build the CDC of the consultations (Public AO start on 2017).

At this stage are defined: lthe powers Cogeneration planned - The modes and the principles of management of the Energy Grid Campus. - The electric, thermal and computing works to be realized - The sketches of the Building "cockpit énergétique".

THE ECONOMICS BEHIND THIS OPERATION

KEY DATA

- 30% reduction of energy consumption
- 15% renewables
- 30% auto-consumption of local production
- 2,400 apprentices trained on energy issues
- 300 vocational trainees per year

/// A €10.8 million project for an energy transition demonstrator. Funded by the PIA [French State-run "investing for the future" program] and supported by the Grenoble CCI and Schneider Electric, investing €2.8 million and €1.15 million respectively.



The Vivapolis network aims to federate French public and private stakeholders involved in conceiving, building and operating sustainable cities, in France or abroad, in order to improve synergy and help them be, individually and collectively, more efficient in their action.

www.cohesion-territoires.gouv.fr/vivapolis

These sheets have been produced by the Vivapolis network members, who attended 5 different work groups to promote examples of innovative solutions for sustainable cities.

Work groups jointly run by:

Circular economy:

Alice Sarran, OREE / **Jean-Christophe Daragon**, EuroMéditerranée /
Nicolas Prego, Suez

Citizen participation:

Marianne Malez, FNAU / **Alain Renk**, Urbanfab / **Catherine Savart**, Veolia

Energy:

Maud Lelièvre, Eco Maires / **Fabrice Bonnifet**, Bouygues /
Claude Thouvenin and **Franck Lesueur**, Eneki

Integrated urban utilities and digital platforms:

Amandine Crambes, Ademe / **Jacques Perrochat**, Schneider Electric /
Adrien Ponrouch, TERA0

Mobility:

Camille Roccaserra-Vercelli, Fédération des EPL / **Christian Dubost**, SNCF /
Annabelle Ferry, AREP / **Jean Bergounioux**, ATEC ITS

Each file focuses on a unique theme. Some solutions may address several themes, but they will appear in one file only.

Some of the solutions are also included in another file edited by France Urbaine together with Vivapolis: "A French Experience of Smart Cities" which presents a set of innovative solutions implemented in several French cities.