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1 **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

2 **PU** = Public
PP = Restricted to other programme participants (including the Commission Services)
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CONTENTS

1 INTRODUCTION

The NEXT-Buildings project deals with the demonstration of very low-energy and affordable buildings. It is the follow-up project of some of the most successful Cities and Actors of the CONCERTO Initiative, a former EU program to promote low-energy cities. These stakeholders now want to demonstrate the next generation of low energy buildings also called active houses, which are not only buildings, but active components in the overall integrated energy systems.

The three pilot projects in Amsterdam, Helsingborg and Lyon are running more than five years ahead of the goal of the EU, to have energy-neutral new build dwellings by the start of 2019. In Amsterdam, an old harbour area close to the city centre, Houthaven, will be developed as a climate neutral, water-rich neighbourhood. In Helsingborg, an area will be registered and evaluated on multiple parameters within 10 eco topics before, during design and in the evaluation. The houses will be built as passive houses and supplemented with renewable energy supply making the houses active. In Lyon, the public urban developer SPL Lyon-Confluence set very ambitious energy targets for the P-Plot building: this building should have a balanced energy consumption calculated in primary energy. Designed and built by Bouygues Immobilier, its commercial name is HIKARI. The three pilots have a total gross floor area of about 50,000 m2. They all set the standard for future developments.

The aim of this document is to describe the construction process of the pilot building that has been built in Lyon within this EC funded project. It contains information on the overall construction process, from the urban planning stage, with information on the decision process to build such a positive energy building, to the design and construction phase with very precise information on the building features.

This report would not have been possible without the support of many people. The author wishes to express his gratitude to the following people:

- Maxime Valentin from SPL Lyon-Confluence,
- Laurent Wittig from Bouygues Immobilier,
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- Christophe Debouit from NEDO Europe,
- Jessica Boillot from Toshiba Systèmes France.

2 OVERVIEW OF THE LYON-CONFLUENCE URBAN PROJECT

2.1 Background and objective

Located in the centre of Lyon in France, the area of La Confluence was reclaimed from water by earthworks between 1770 and 1850. Continuing the city centre, it is the southern half of Lyon's central peninsula. Cut off from the rest of the city by two rivers, a motorway and a railway, it developed as an industrial suburb. Half of its 150 hectares was occupied by manufacturing and logistics businesses, whose decline in the latter half of the 20th century freed up substantial plots of land. The other half is a residential neighbourhood around Sainte-Blandine Church, currently home to 7,000 people. The district has many assets: a central location in Lyon, a landscape of great quality (the gentle banks of the Saône, hilly scenery to the west, five kilometres of riverside, with no point more than 400 metres from the water), the unique appeal of a powerful confluence, a neighbourhood inhabited since the 19th century and efficient transport links (a train station, a metro line, and two tramway lines).

Figure 1 - Overview of La Confluence in the city centre of Lyon

The new story of the district began in 1998. The Greater Lyon authority showed citizens a first project by Bohigas/Melot/Mosbach, and decided to undertake its regeneration. In 1999, the Greater Lyon authority and the City of Lyon set up a public-private redevelopment company for this territory. In 2000, architect François Grether and landscapist Michel Desvigne have been charged to help to execute the project. Design and consultation stages led to the approval, in April 2003, of Phase One of this project in the form of a redevelopment area covering 41 hectares by the Saône. In 2009, the job of master planning of Phase Two, by the Rhône, began and the Greater Lyon authority voted to approve the architect's plan in September 2010.

Once completed, this district will host 16,000 residents and 25,000 jobs with 1 million m2 newly built and get a renewable-energy installed capacity of 10,5 MW.

This urban project is part of the Climate plan of Greater Lyon, which aims to cut Greenhouse Gases emissions by 20% by 2020, and by 80% by 2050. La Confluence neighbourhood has been declared eco-quarter by the French government, has been declared first sustainable neighbourhood by WWF and has been part of the EU CONCERTO Initiative for the construction of low-energy buildings.

In terms of sustainable development, this project ambitions to keep the same carbon emissions and environmental impact while erecting 1 million m2 new buildings in the area and thus doubling the city centre with a smart-developed neighbourhood. It uses two principles to achieve its goal: build up new low-energy or positive-energy buildings and techniques and reduce and monitor energy consumption in existing buildings and infrastructures of the area.

2.2 SPL Lyon-Confluence, a public redevelopment company

In 1999, Greater Lyon, the second largest urban community in France with 58 municipalities and 1.2 million inhabitants and the City of Lyon created and assigned a local public-private redevelopment company to design and build the Lyon Confluence project. It has first been the Société d'Economie Mixte (SEM) Lyon Confluence, which in 2008 switched to wholly public ownership and was renamed Société Publique Locale d'Aménagement (SPLA) Lyon Confluence, and then changed to Société publique locale (SPL, local public redevelopment company) in 2013. SPL Lyon Confluence capital is currently 1,8 M€, in which Greater Lyon has an 89% stake.

More precisely, the role of SPL Lyon Confluence is to:

- Perform or commission all studies prior to redevelopment and construction operations.
- Conduct or ensure all acquisitions of buildings or unbuilt plots with a view to their enhancement, and all necessary demolitions.
- Draw up all contracts and agreements in order to control land prior to execution of redevelopment operations, and oversee land sales to third parties for construction purposes.
- Conduct all necessary studies and financial, commercial, industrial and property operations.
- Conduct or commission the operation, management, maintenance and enhancement of structures during the build phase.
- Promote the Lyon Confluence project and undertake communications and consultations to support its execution. The House of la Confluence describe later is the flagship of this communication activity.

SPL Lyon-Confluence designed a 2-phase project:

- Phase 1: 41 ha - western part near the Saone river (red area below)
- Phase 2: 35 ha - eastern part near the Rhône river (blue area below)

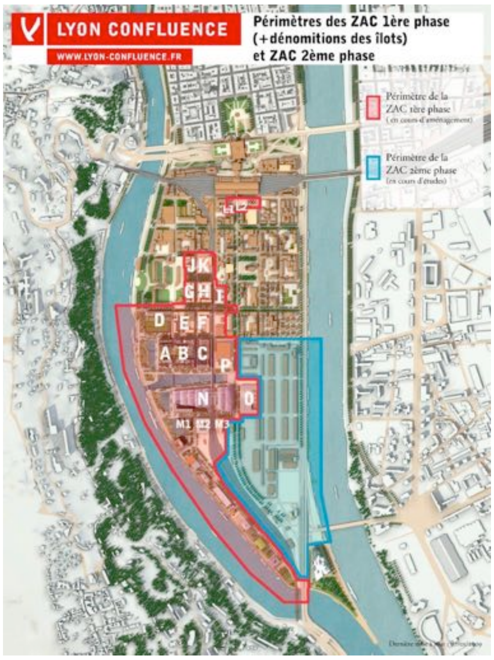


Figure 2 – Site plan of the Lyon-Confluence project with the 2 project phases

2.3 Phase 1: 41 hectares on the Saone

Launched in 2003 and expected to end in 2016, Phase One immediately applied the core principles of the overall project: generous public spaces that play a structural role, a neighbourhood for all fostering a good social mix, a balanced range of uses (housing, offices, retail, leisure, etc.) and of course sustainable development and smart energy development. Phase One makes up nearly 40% of the overall project by value, with an estimated total investment of €1.2 billion. Its construction programme comprises 400,000 m2 of floor area with a balanced range of all city-centre uses across 41 hectares on or near the Saône.

The construction programme meets three main objectives:

- Functional diversity: Some 2,000 homes for a floor area of 130,000 m2, 150,000 m2 of office places, and 120,000 m2 for shops, leisure and hotels.
- Social mix: in line with the Greater Lyon policy, the proportion of social housing (for tenants and first-time buyers) in Phase One is 23%. On each plot, developers were asked to respect proportions of social, intermediate, innovative and high-end homes, as per the mix targets specified by the public redevelopment company.
- High environmental quality: All offices and homes in La Confluence meet very strict specifications on high environmental quality (particularly on energy efficiency and renewable-energy use). "*The cheapest energy is the unconsumed energy*".

The first new buildings (A, B and C blocks inaugurated in 2010) use 30-90 kWh/m2 (much less than old buildings (200-400 kWh/m2/year) and requirements of thermal regulations (120 kWh/m2/year)) and have then been funded by the EU CONCERTO Initiative (€4 million of funding provided), which rewards mass use of renewable energies and bioclimatic building design. Finally, these plots consume 80% renewable energies (wood-fired boilers, solar hot and PV systems) and 50% less energy than required by the thermal regulation.

Figure 3 – A, B and C blocks built within the EC funded CONCERTO project

One of the last buildings to be built within phase one is HIKARI, the positive energy building located on the P plot, one of the 3 demonstration buildings of the NEXT-Buildings project.

3 FEASABILITY STUDY

In 2009, SPL Lyon-Confluence selected the team Herzog & de Meuron (architects/urban planners) from Switzerland and MDP - Michel Desvigne (landscaper) from France to design the second phase of the Lyon-Confluence project. This team released in December 2009 the masterplan for the redevelopment of the former wholesale market and, in September 2010, the feasibility study of the P Block/Plot.

The P Block is a central piece of the Lyon-Confluence project even if the area of this piece of land is smaller than other blocks of the area with around 3 380 m² (91m x 37m). It is located next to the Ice-Rink, at the corner formed by the water place (quai Antoine Riboud) and Cours Charlemagne, the main street of Lyon-Confluence with the tram line, just in front of the Leisure Centre et the Rhône-Alps region Headquarters (see Figure 4).

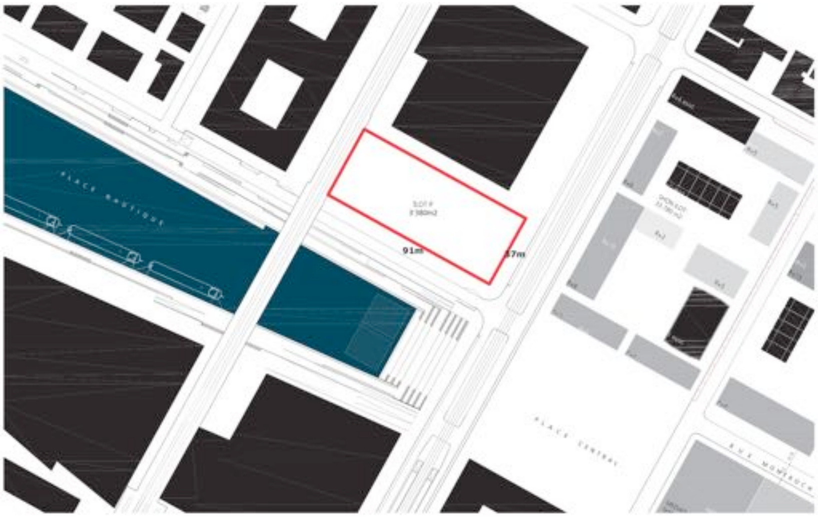


Figure 4 – P Plot/Block location at the corner water place / Cours Charlemagne

Herzog & de Meuron proposed that this block, as most blocks of the area, should have multiple functions (offices, dwellings and shops) and gave an estimation of the floor area potential of the building to be built on this piece of land:

- 7 000 to 8 000 m² of offices,
- 3 000 to 4 000 m² of dwellings,
- 1 000 to 1 500 m² of shops.

Herzog & de Meuron then proposed several possible building shapes with the same expected floor area per usage that can be foreseen on this plot. Two possible shapes are given in Figure 5 with offices in purple, dwellings in yellow and shops in orange.

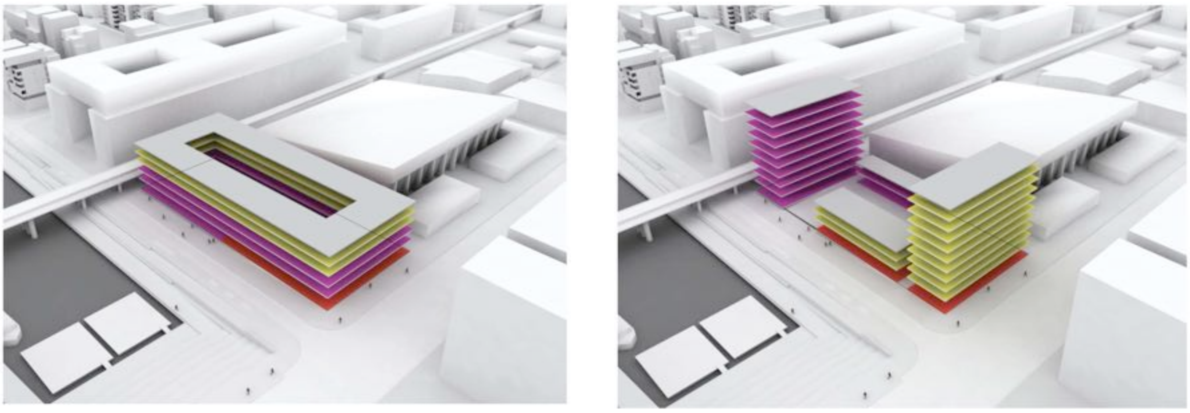


Figure 5 – Possible building shapes imagined by Herzog & de Meuron

4 INTERNATIONAL DESIGN COMPETITION

The selection of the developer in charge of the design and construction of the P Plot building of the Lyon-Confluence area was done in a similar way than what has been done in 2004 for the first housing blocks of this urban project, namely the A, B and C blocks built within the EC funded CONCERTO Renaissance project.

Based on the feasibility study done by Herzog & de Meuron for this piece of land, SPL Lyon-Confluence and its assistants, the Environmental engineering office TRIBU and Hespul, set up the environmental and energy targets of this building. Thanks to the financial support expected within the NEXT-Building project, the energy performance requirements of this building has been improved compared to what has been achieved for recent buildings of this area and was set at a very ambitious level: make the P-plot building a positive energy building.

More precisely, this objective was defined as the following: the positive energy balance of the plot over the year shall consider the whole energy consumption and not the heating consumption only and shall be calculated with the yearly primary energy consumption and the yearly primary energy produced by the P-Plot (see Figure 6)

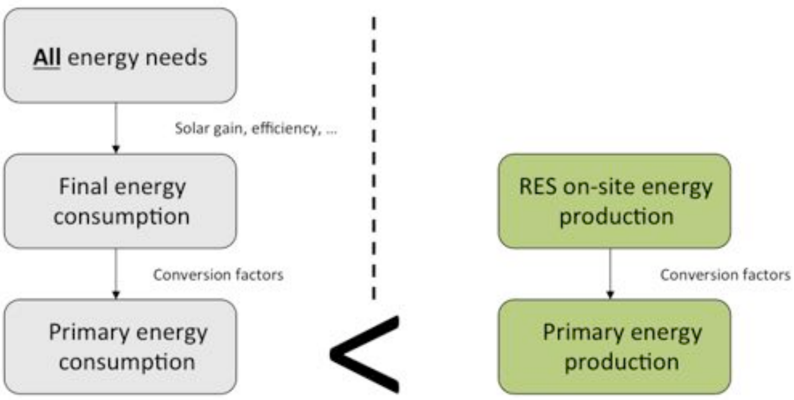


Figure 6 – Definition of the positive energy target

This energy performance target and the primary energy factors to be used (3.2 for electricity and 0.2 for biomass) have been included in the environmental guidelines used for the international competition to select a developer for the design and the construction of this building (see annex 2).

The first round of this international competition was lunched on January 2011 by SPL Lyon-Confluence and was quite successful since 17 teams composed of developers, architects, engineering offices and environmental consultants applied to this bid.

It took then 3 months to SPL Lyon-Confluence to analyse the applications and to short-list 4 teams of developers for the second round of the competition. This time, each team had to pre-design a building and to send a comprehensive report on the architecture features and the energy performance assessment of the building.

SPL Lyon-Confluence received from each selected team building proposals with high quality architecture and very low energy needs so that it was not easy for the jury to select one of them (see **Figure 7**).

Developer: *ALTAREA-COGEDIM*
Architects*: Bernard Reichen, Barbosa & Guimaraes*

Developer: *BOUYGUES-Immobilier SLC*
Architects: *Kengo Kuma, CBR Architectes*

Developer: *ICADE*
Architects: *Shigeru Ban, Rue Royale Architectes*

Developer: *VINCI*
Architects: *Dominique Perrault, Mateo Arquitectura*

Figure 7 – the 4 finalist projects for the design and construction of P Plot

After a full audit of the application report and an oral presentation of each project, the jury decided, in September 2011, to award the proposal lead by **Bouygues Immobilier/SLC in association with Kengo Kuma**.

5 PARTNERSHIP WITH NEDO

Also, at the same period, in early 2010, Grand-Lyon and SPL Lyon-Confluence have been contacted by the New Energy and Industrial Technology Development Organisation of Japan (NEDO) in order to study the feasibility of implementing, in the Lyon-Confluence area, smart-city solutions from Japan.

Among many possible smart-city solutions proposed by NEDO, Grand-Lyon and SPL Lyon-Confluence chose to addresses 4 specific topics:

- The construction of a positive energy building,
- The implementation of a car-sharing system with smart charging stands controlled by PV systems,
- The installation of residential energy monitoring systems,
- And the design of a Community Management System.

In order to select a Japanese company for the implementation of the above-mentioned smart-city solutions, NEDO launched a public request for projects. In December 2010, NEDO selected the consortium lead by Toshiba and allocated a budget of €50 Million to cover the costs of this consortium for the design, supply and installation of the smart-city solutions.

Then, after a feasibility study of one year, Grand-Lyon and NEDO signed in December 2011 a Memorandum of Understanding (MOU) for the implementation of the 4 smart-city solutions on the Lyon-Confluence area and named this partnership the Lyon Smart Community project (see Figure 8).

Figure 8 - Grand-Lyon's President and NEDO's President came to an agreement for the Lyon Smart Community project (December 2011)

Concretely, this project aims, among others, at equipping the P Plot building with innovative technology provided by Toshiba and to connect this building to the Community Management System (CMS).

Therefore, during the international competition launched by SPL Lyon-Confluence for the P plot, the 4 short-listed teams have been offered the possibility to contact Toshiba within the Lyon Smart Community project to study if Toshiba could provide innovative technologies for the construction of this positive energy building.

In this context, Bouygues Immobilier, the real estate developer of the awarded project, has included in its proposal a set of technologies provided by Toshiba such as a comprehensive building management system, phase change material, smart batteries, PV modules, …

6 DESIGN PHASE

6.1 Foreword

The awarded project proposed by Bouygues Immobilier/SLC is called HIKARI, which means natural light in Japanese. It is composed of 3 buildings for a total floor area of approx. 12.000 m2:

- HIGASHI (East), an office building with shops on the ground floor,
- MINAMI (South), in the middle of the plot, an apartment building with 36 dwellings and shops on the ground floor,
- NISHI (West), 3060 m2 with 5 storeys of offices and 4 top-end penthouse apartments on the 2 upper storeys and shops on the ground floor (see Figure 9 and Table 1)

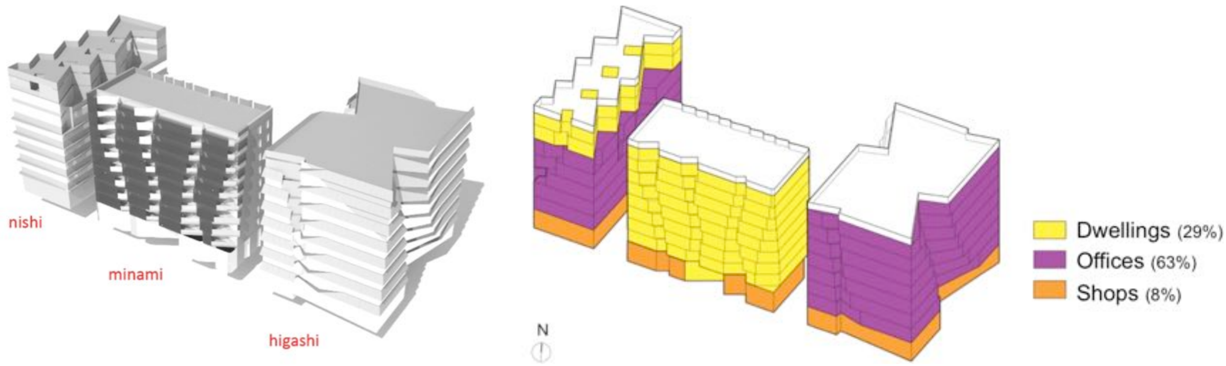


Figure 9 – The 3 buildings of the HIKARI project

Table 1 – Floor area of the HIKARI project

Building name	Offices	Dwellings	Shops	Total
HIGASHI	5.434 m2		567 m2	6.001 m2
MINAMI		2.959 m2	289 m2	3.248 m2
NISHI	2.338 m2	570 m2	153 m2	3.061 m2
Total	7.772 m2	3.529 m2	1.009m2	**12.310 m2**

The design team is composed of the following companies:

- Project developers: Bouygues Immobilier and SLC Pitance,
- Architect: Kuma Associates Europe
- Contractor: SETEC Bâtiment
- PV engineering: Tecsol
- Energy consultant: Manaslu Ing.

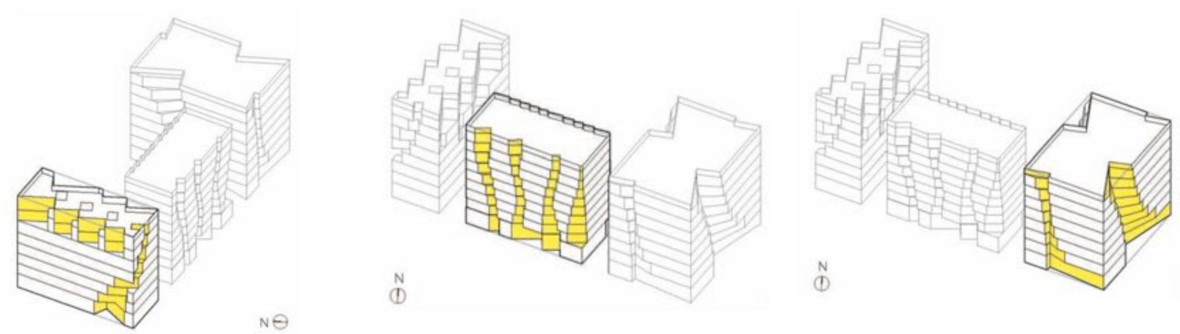
6.2 Architecture

"Lighting is one of the most energy-hungry aspects of office environments, in particular. As such, light has been both the starting point and the common thread in this project. We started out with the various technical, thermal and energy constraints and sought to find the ideal form. The architectural line we adopted led us to make deep openings in the facades in order to provide as much natural light as possible, cutting down the need for artificial lighting and improving visual comfort."

Kengo Kuma, Architect of the HIKARI building

Figure 10 - Kengo Kuma – Architect of the HIKARI building

The building designed by Kengo Kuma fully complies with Herzog & de Meuron's feasibility study in terms of height and shape. But, in order to improve natural lighting, Kengo Kuma created specific cuttings in each façade based on the sun path (see Figure 11 and Figure 12). The function of these cuttings is also to link the inner space of the building with the outer space, which is a long-lasting concept of Kengo Kuma's architecture.



NISHI (West) MINAMI (South) HIGASHI (East)

Figure 11 – Cuttings in each façade in order to improve natural light

Figure 12 – Eastern façade of the HIGASHI building

These specific cuttings also create transparency in order to connect the public spaces with the private spaces. The large glazing areas of office places and a see-though PV façade for dwellings also increase this transparency and create a pleasant and convenient ambiance for the users of buildings (see Figure 13).

Figure 13 – Southern façade of the HIKARI building

6.3 Building envelop

6.3.1 Envelop of dwellings (MINAMI and NISHI)

In order to reach the goal set by SPL Lyon-Confluence to design a positive energy building, the design team decided to significantly lower the energy consumption with a high performance building envelop with reduced thermal bridges. Table 2 and Figure 14 give the detailed specifications of this envelop for dwellings.

Table 2 – Detailed specifications of the envelop of dwellings

Type	Description	U value [W/m2.K]
Façade/wall	Concrete + 20 cm of mineral wool	0,16
Roof	Concrete + 16 cm of polyurethane	0,15
Ground floor	Concrete + 20 cm of fibrastyroc	0,18
Glazing	Triple glazing wood/alu (Fs=0,55; g=0,65)	0,75

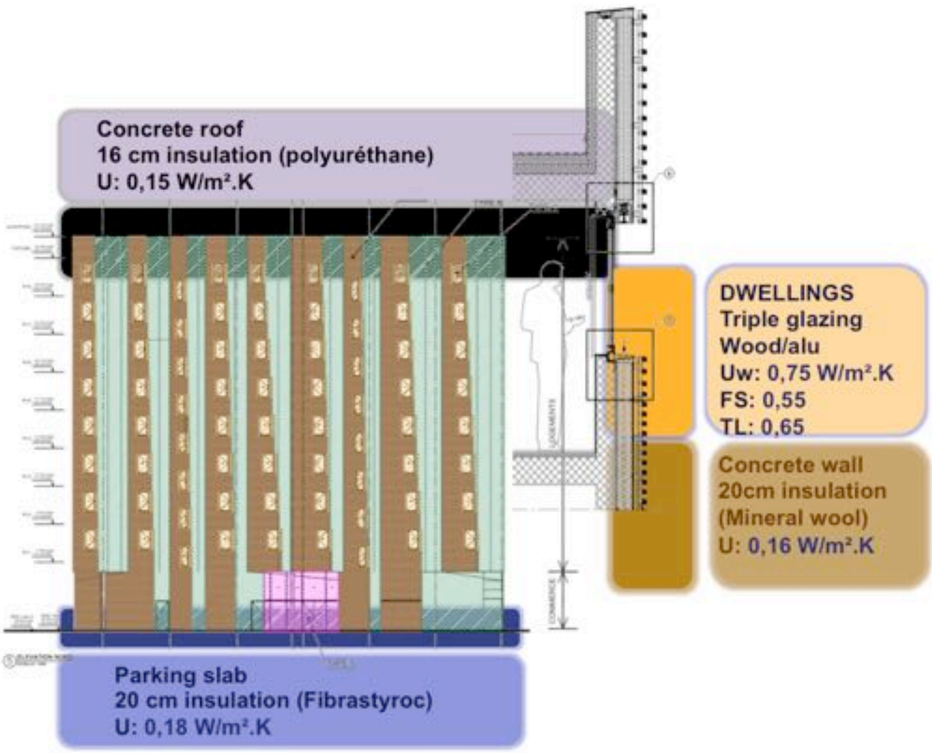


Figure 14 - Detailed specifications of the envelop of dwellings

6.3.2 Envelop of offices (HIGASHI and NISHI)

For offices, the main difference in the building envelop compared to dwellings lies in the performance of glazing which has a better transmission factor and a slightly lower energy efficiently.

Table 3 - Detailed specifications of the envelop of offices

Type	Description	U value [W/m2.K]
Façade/wall	Concrete + 20 cm of mineral wool	0,16
Roof	Concrete + 16 cm of polyurethane	0,15
Ground floor	Concrete + 20 cm of fibrastyroc	0,18
Glazing	Double glazing (Fs=0,45; g=0,75)	1,4

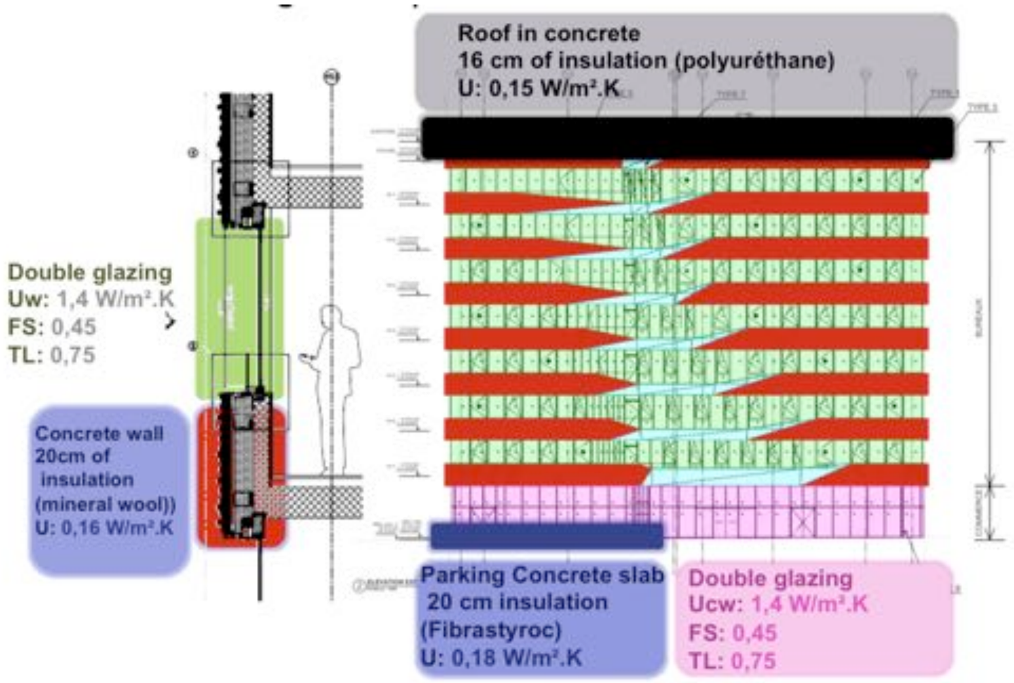


Figure 15 - Detailed specifications of the envelop of offices

Also, for both dwellings and offices, a special attention has been paid to the air tightness of buildings that has been designed to be at the Passiv Haus / Minergie level (air tightness performance of N50 < 0.6 ACH).

6.4 Energy systems

6.4.1 Overall energy strategy

The design a positive energy building requires to strongly focus on energy systems in order to produce on site and with renewable energy sources the energy necessary to operate the building. Thus, in order to provide electricity, heat and cold to the building, the design team decided to use 3 kind of renewable energy sources available on site, which are solar, biomass and ground water, with 3 main energy systems which are solar PV modules, a cogeneration system (CHP) and an absorption chiller (see Figure 16). The technical details of these energy systems, which have been designed in partnership with Toshiba as a supplier of most of them, are given below.

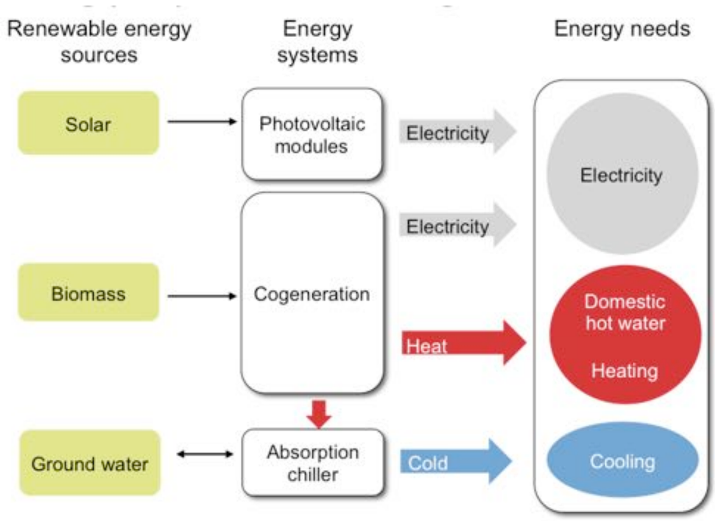


Figure 16 – Overview of the energy system design

6.4.2 PV systems

The HIKARI building is equipped with 2 kinds of PV systems:

- A see-through PV façade on the MINAMI building,
- A rooftop PV system on the roof of each of the 3 buildings.

The see-through PV façade as a power of 21 kWp and is used as balcony for the dwellings of the MINAMI building and is highly visible from the street and from the inside of the flat (Figure 17). Therefore, the design team paid a special attention to its design and to safety issues.

Cells: 1120 x Neo Solar Power NP6 multi crystalline cells (5" – 3,8 W)
PV modules: AGC SunEwat / thickness of 21,6 mm / 9 different layouts
Mounting technic: Bolted glazing façade with custom-made metal supports
Inverters: 3 x SMA Tripower – 18,5 kVA in total
Expected yield: 15 MWh/year

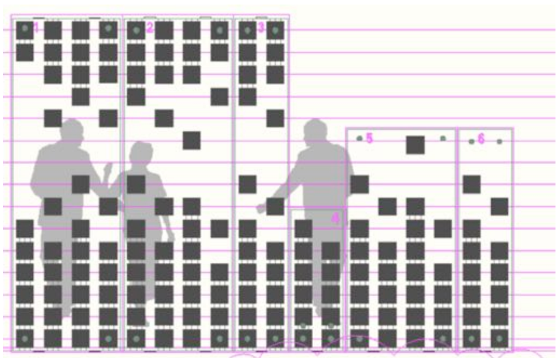


Figure 17 – Custom-made PV modules used as balcony of dwellings

The rooftop PV system has a power of 168 kWp and covers almost all the roof area of the 3 buildings (HIGASHI, MINAMI and NISHI) and has also an esthetical role as it has been design to give an homogenous appearance of the roof surface which is visible from surrounding hills.

PV modules: 700 x Panasonic HIT-N240 (240 Wp)
Mounting technic: custom-made metal frames - tilt angle: 10° - east-west (see Figure 18)
Inverters: 13 x SMA Tripower – 143 kVA in total
Expected yield: 182 MWh/year

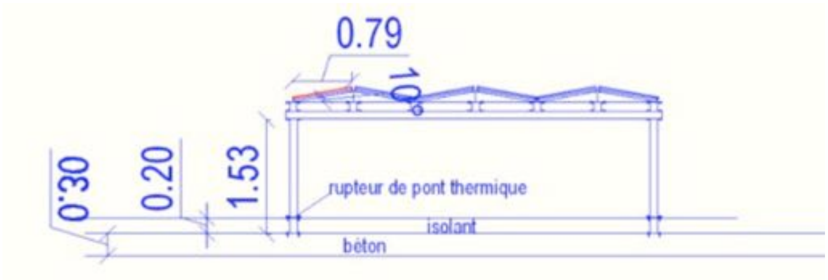


Figure 18 – Rooftop PV system on east-west oriented metal frames

6.4.3 Cogeneration system

The heat and the domestic hot water of the HIKARI building is generated by a 75 kW CHP unit from COGENGreen, which will be fired by rapeseed oil that is stored in a 90 m3 tank (see Figure 19). The power generated by the CHP is simply consumed within the building (self-consumption).

Type: COGENGreen ecoGEN-75SH
Fuel: vegetable oil (rapeseed)
Electric outpour/Heat rating: 75 kW/98 kW
Fuel consumption: 21 l/h
Total efficiency: 85,2%
Expected yield: 275 MWh/year

Figure 19 – CHP unit of COGENGreen

6.4.4 Absorption chiller

The cold necessary to cool office places is generated by an absorption chiller, which uses heat from ground water and from the CHP (see Figure 20).

Type: YAZAKI WFC-SC30
Heat medium input: 70 kW
Heat flow rate: 7,8 m3/h (72-64.2°C)
Cooling capacity: 46 kW (8.4-6°C)
Chilled water flow rate: 16,5 m3/h

Figure 20 - Absorption chiller from Yazaki

6.4.5 Ventilation

The 3 buildings all use mechanical air extract systems. In addition, HIGASHI has a specific design to increase natural ventilation at night in order to cool down this building. On each floor the façade has fresh air inlets located on the corners of the building. Also, 2 chimneys located in the middle of the floor generate airflow to extract the heated air (see Figure 21). The 2x7 chimneys are grouped on the roof of the HIGASHI building and are equipped with a system to open/close them automatically.

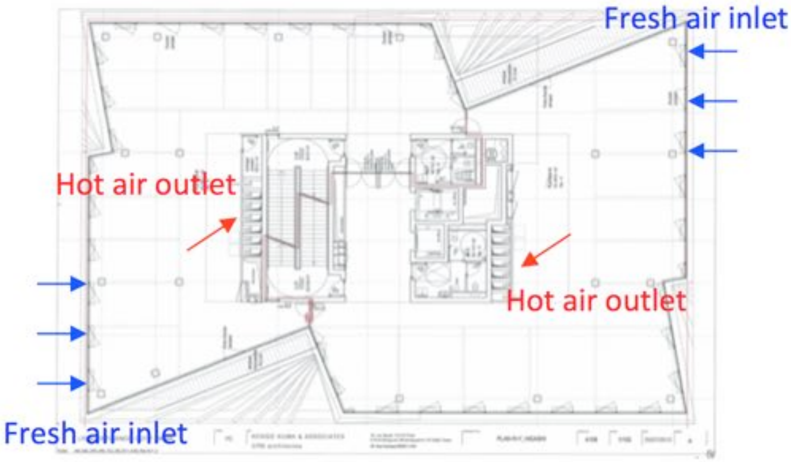


Figure 21 – Natural ventilation flow in the HIGASHI building

6.4.6 Storage

The design team undertook many simulations in order to demonstrate that the use of thermal storage could drastically reduce the size of energy production systems. Thus, without thermal storage, energy production systems have to be sized on peak loads but with a storage capacity they can be sized close to the average load (see Figure 22). These simulations lead to decide to equip HIKARI with an 8 hour heat storage made of 65 m3 of water.

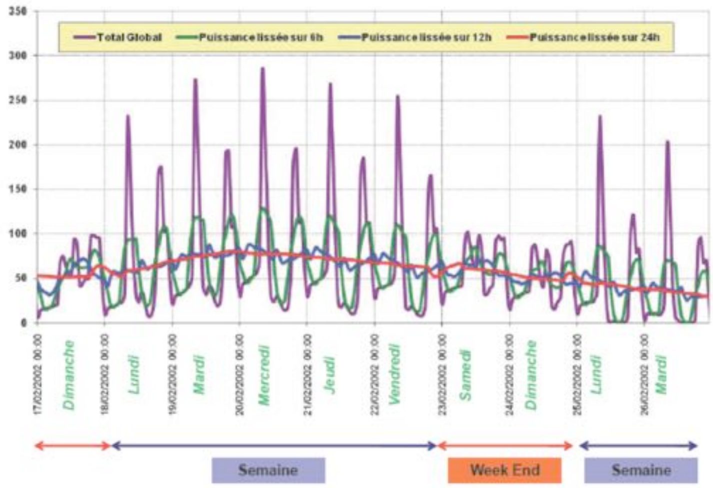


Figure 22 – Evidence of the effect of thermal storage on the sizing of energy production systems

Also, in addition to the heat storage, HIKARI is equipped with a cold storage and a power storage.
The cold storage is made of 20 m3 of phase change material (PCM) from paraffin stored on tanks in the basement.
The power storage uses a hybrid battery (lead/acid and L-ion) with a capacity of 100 kWh used to demonstrate the possibility to reduce consumption/production power peaks as part of a smart-grid strategy.

6.4.7 Building Energy Management System (BEMS)

A comprehensive Building Energy Management System (BEMS) is used to control the operation of all energy systems and devices and to monitor many parameters in order to check the energy performance of the HIKARI building. This BEMS is designed to optimise the indoor comfort of users and is connected to more than 10.000 sensors such as image based motion sensors, temperature, CO2 and humidity sensors.
This BEMS is also connected to one Home Energy Management System (HEMS) per dwelling used to control the indoor comfort and to provide energy feedback to inhabitants in order to help them to make energy savings.

6.5 Energy balance

According to the international competition launched by SPL Lyon-Confluence, the positive energy balance of this building over the year shall consider the whole energy consumption and not the heating consumption only and shall be calculated with the yearly primary energy consumption and the yearly primary energy produced on-site:

Energy consumption (Offices + Dwellings + Shops) / year < Energy produced (CHP + PV) / year

For this, conversion factors to be used to turn final energy into primary energy where also given in the guidelines of the international competition and are the following:

- Gas: 1.1
- Electricity: 3.2
- Biomass: 0.2

With these assumptions, the design team confirmed the possibility to build a positive energy building as the primary energy consumption of the HIKARI building is assessed at 1 483 MWh/year and the primary energy production at 1 486 MWh/per (see Table 4).

Table 4 – Yearly energy balance in primary energy

	Primary energy consumption		**Primary energy production**
Gas	15 MWh	-	-
Biomass (rapeseed)	153 MWh	CHP (rapeseed)	879 MWh
Electricity	1 315 MWh	Photovoltaic	607 MWh
TOTAL	**1 483 MWh**		**1 486 MWh**

7 CONSTRUCTION PHASE

7.1 Preparation works

Once the design of the HIKARI building was completed, Bouygues Immobilier and SLC Pitance, the project developers, signed on July 2012 a land sell promise contract with SPL Lyon-Confluence, the landowner, and then applied for a building permit on August 2012. Local authorities have accepted the building permit on November 2012 and, after a legal recourse period of 3 months, Bouygues Immobilier, SLC Pitance and SPL Lyon-Confluence signed, on April 2013, the final land sale agreement.

To undertake the construction work, Bouygues Immobilier, SLC Pitance and the design team selected many companies and among them:

- 1 – Structure: FONTANEL
- 3 - Glazing skin: DECOTECH
- 4 - Mineral and wood cladding: SOMIROC RAPHAT/SMAC EUROFAÇADE
- 5 - Wood and aluminium millwork: BERTIN/PIC
- 6 - Photovoltaic: TCE SOLAR/FONTBONNE
- 11 Wood windows (Offices): GUILLON MENUISERIE
- 17 Wood windows (Dwellings): SIMONETTI
- 22 Lifts: OTIS
- 23 Power, communication and lighting: SNEF
- 24 Building Management System: IRIS REGULATION

In order to celebrate the start of construction of this ambitious building, an official event called "First stone ceremony" has been organised on June 2013 for decision makers and journalists with the President of the Metropolis of Lyon, Mr Gérard Collomb, the Deputy General Director of Bouygues Immobilier, Mr Eric Mazoyer, and the President of NEDO, Mr Hideo Hato.

Figure 23 – First stone ceremony (June 2013)

7.2 Foundation work and concrete pouring

Figure 24 – Digging and levelling work (May 2013)

Figure 25 – Construction of the ground floor (November 2013)

Figure 26 - Construction of level 4 (March 2014)

Figure 27 - Construction of level 6 (May 2014)

Figure 28 - Construction of last level (July 2014)

Figure 29 - Completion of concrete pouring (September 2014)

7.3 Insulation, cladding, windows and façade

Figure 30 – Installation of windows on HIGASHI (September 2014)

Figure 31 – Outdoor insulation of MINAMI (September 2014)

Figure 32 – Cladding of the northern façade of MINAMI (September 2014)

Figure 33 – Work in progress on the southern façade (December 2014)

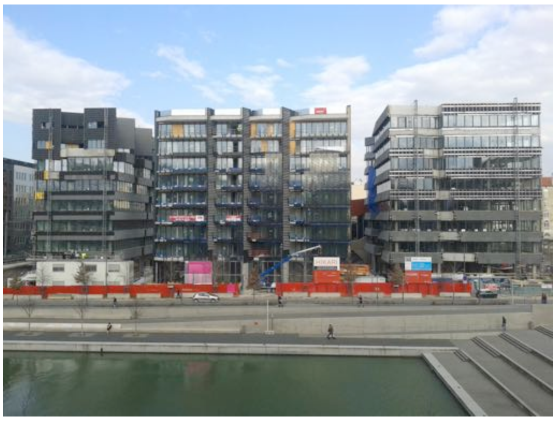


Figure 34 – Work in progress on the southern façade (February 2015)

Figure 35 – Southern façade completed (May 2015)

7.4 PV systems

Figure 36 – Support structure of the rooftop PV system (November 2014)

Figure 37 – Rooftop PV system completed (July 2015)

Figure 38 – Prototype of PV façade (July 2014)

Figure 39 – Support structure and bolts of the PV façade (September 2014)

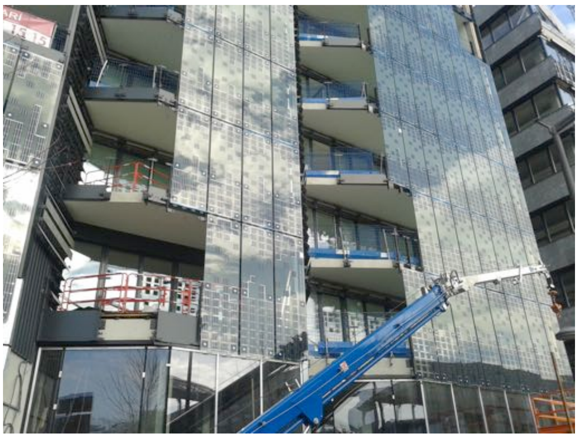


Figure 40 – Installation of the PV façade (March 2015)

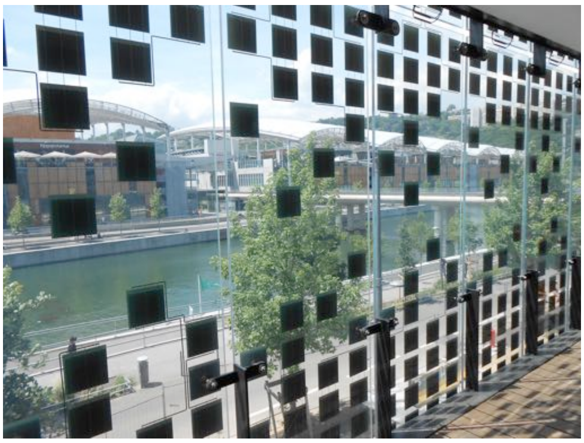


Figure 41 – View from inside on the PV façade (July 2015)

7.5 CHP

Figure 42 – CHP delivered but still packed (September 2014)

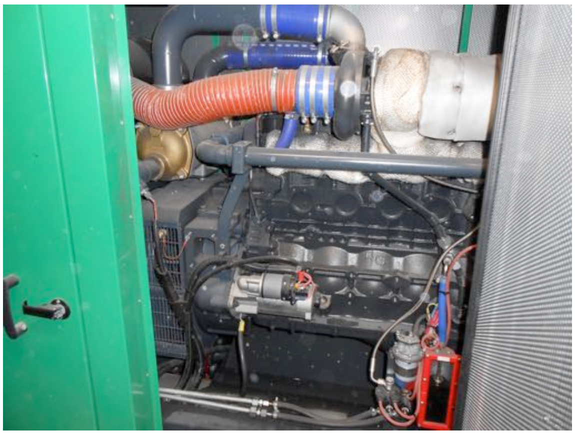


Figure 43 – Engine of the CHP after installation (July 2015)

Figure 44 – Rapeseed oil tank – 90 m3 (July 2015)

Figure 45 – Rapeseed oil filling pipe (July 2015)

7.6 HVAC and LED light for office places (HIGASHI)

Figure 46 – Chimney used for natural ventilation (July 2015)

Figure 47 – Drilled wall panel to exhaust hot air (July 2015)

Figure 48 – Rooftop air outlets to control natural ventilation (July 2015)

Figure 49 – Heat/cold celling emitters with LED light (July 2015)

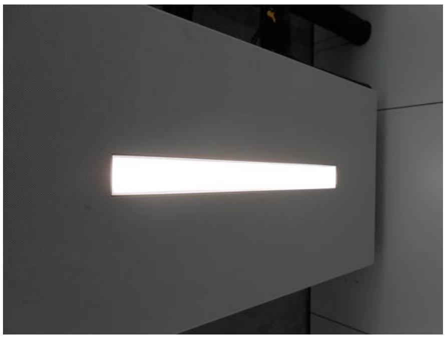


Figure 50 – Front side of heat/cold celling emitters with LED light (July 2015)

Figure 51 – Back side of heat/cold celling emitters with LED light (July 2015)

7.7 Storage

Figure 52 – Water tanks used as heat storage (December 2014)

Figure 53 – Water tanks after full insulation (July 2015)

Figure 54 – PCM tank used as cold storage (December 2014)

Figure 55 – Inside of the PCM tank before PCM installation (December 2014)

Figure 56 – Element of the 100 kW hybrid battery use for power storage (July 2015)

Figure 57 – Overview of the 100 kW hybrid battery (July 2015)

7.8 Home Energy Management System – HEMS (MINAMI)

Figure 58 – Smart water meter that sends data to the HEMS (July 2015)

Figure 59 – Control panel in each dwellings (July 2015)

Figure 60 – Display in PC tablet to provide information to the users (July 2015)

8 OPENING CEREMONY AND OPERATION

In order to celebrate the delivery of the HIKARI building, designed and built with a special attention on architecture, energy performance and quality, an opening ceremony was organised on Thursday 17 September 2015 for decision makers and journalists (see Figure 61 and Figure 62). A press conference was also organised with the attendance of:

- François BERTIERE, Chairman and CEO of Bouygues Immobilier,
- Gérard COLLOMB, President of the Lyon Metropolis,
- Hiroshi KUNIYOSHI, Executive Director of NEDO,
- Shinichiro AKIBA, President and CEO of Community Solutions Company Toshiba Corporation,
- And also Mario DIONISIO, Technical Officer of the NEXT-Buildings project from the European Commission – DG Energy.

Figure 61 – Opening ceremony of HIKARI (September 2015)

Figure 62 – HIKARI building after completion (September 2015)

From September 2015, a comprehensive monitoring campaign will start, based on the large amount of data that will be recorded by the BEMS, in order to fine tune all energy systems, to make sure that this building is operated properly, to verify if all assumptions and models used for design were accurate and of course to check the actual energy performance of the HIKARI building.

A summary of this monitoring campaign will be provided within deliverable D6.5 "Report on energy results the P plot building" expected to be released by the end of 2016.

9 CONSTRUCTION SQUEDULE

September 2010:	Feasibility study of the P Block/Plot by Herzog & de Meuron
February 2011:	Deadline to apply to the international design competition
March 2011:	Deadline for the 4 short-listed teams to submit their proposal
September 2011:	Selection of Bouygues Immobilier/SLC
July 2012:	Land sell promise contract
August 2012:	Submission of building permit
November 2012:	Building permit approved
February 2013:	End of legal recourse period
April 2013:	Land sale agreement signed
Mai 2013:	Start of construction work
August 2015:	End of construction
September 2015:	Opening ceremony

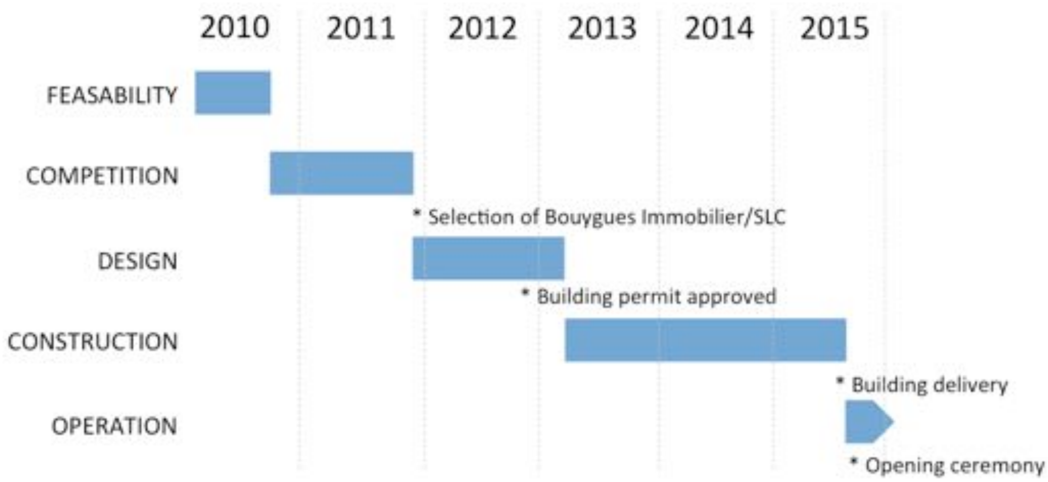


Figure 63 – Simplified schedule of P Block/HIKARI construction

10 CONCLUSION

The Lyon-Confluence urban project is a real flagship for the Metropolis of Lyon and for France. Its innovative nature in terms of urban spaces and services, social sustainability and energy makes possible a lot of ambitious projects.

The construction of the A, B and C Blocks built with the financial support of the European Commission (CONCERTO Initiative) and commissioned in 2010 is one of them. The objective of this project was to demonstrate the possibility to set high energy requirements to real estate developers to build the first buildings of the Lyon-Confluence area. This has been successful and widely replicated since these energy related requirements have been used for other buildings of the area and also elsewhere in France.

The construction of the HIKARI building is another good example of the possible level of innovation in the Lyon-Confluence area. In partnership with NEDO, a public organisation from Japan, and within the EU funded NEXT-Buildings project, SPL Lyon-Confluence decided to go a step further and to set, in the guidelines of the international design competition, a requirement to make the P-plot building a positive energy building.

The selected consortium led by Bouygues Immobilier and SLC designed an ambitious building that fully complies SPL Lyon-Confluence guidelines in terms of architecture, functions and energy performance and was built with a lot of attention to make sure to deliver a high quality building.

And, even if the actual energy performance of this building will just be known in a year or two, this project is already seen as a real success so that the energy performance targets set by SPL Lyon-Confluence for this building are now been used for other buildings of the Lyon-Confluence area such as the emblematic A3 bloc, composed of 8 buildings for a total floor area of 28.000 m2 to be commissioned around 2017, that will also be a positive energy block, just as HIKARI.

11 ANNEXES

Annex 1 – International competition brochure
Annex 2 – Environmental guidelines
Annex 3 – Opening ceremony flyer

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