Grand Lyon, Part-Dieu district

Implementation Plan

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Executive Summary

The district of the Part-Dieu was designed in the years 1960-70 to be the decision-making center of Lyon and its region. It is at the same time the main business district of the metropolis of Lyon today, and its main front door, by the interchange hub through which the flows of traffic are redistributed on the whole urban area.

Today, to be and remain a business district competitive and recognized in the European landscape, the Part-Dieu district has to increase and diversify its accommodation facilities for a bigger diversity of companies, but also adapt and develop its range of services.

But, to be durably attractive Part-Dieu district also has to propose an urban offer turned to the future needs for the users: a more lively and dynamic district, gathering a bigger diversity of functions and practices. The culture an the leisure activities have to find a more important and visible place, while being mixed in the other activities.

The first objective of the Implementation Plan was to produce an energy diagnosis in GIS format (geographical information system) for the Part-Dieu district on the 3 energy carriers (electricity, gas, district heating and cooling networks to know and measure precisely the district's current energy demand and consumption levels.

The energy diagnosis thus produced is presented in map form and provides the following data: *building typology, heat recovery potential in the Part-Dieu district, consumption by energy carriers, buildings connected to the urban heating and cooling networks, heating and cooling consumption, location of networks: electricity, gas, heating and cooling network, total primary energy consumption, total final energy consumption, energy efficiency of buildings with regard to primary energy, energy efficiency of buildings with regard to final energy.*

At the scale of the Part-Dieu district, the aimed energy objective is to maintain overall energy consumption (for primary energy), despite the planned increase in area in the order of a doubling of the floor space.

To test whether this objective is achievable at the 2030 horizon (date of completion of the urban project), a specific method has been set up.

The method selected consisted of integrating the scheduling in sqm of future buildings to be constructed or refurbished and allocating a forecast consumption figure calculated on the basis of the future use of the building and the performance level it is deemed to achieve by acting on the following orientations: energy performance of buildings' envelop, behaviour of buildings' users and energy carriers used to cover heating and cooling demand.

In conclusion, the objective of maintaining the energy balance of the district is achievable only by combining highly energy efficient buildings (scenario 3) together with a very strong reduction of the specific electricity consumption.

In addition, a 3 day Intensive Lab Session has been held in June to present the first results to local stakeholders and TRANSFORM experts. During this workshop, participants worked very hard to propose comprehensive measures by confronting the local situation with other experiences and innovation developed in other European countries. The intensive lab sessions has been devided on 3 workshops:

(1) Innovative district heating and cooling networks,
(2) Operation/maintenance and awareness-raising of users",
(3) Integrated energy planning.

For the Grand Lyon, this approach allows to:

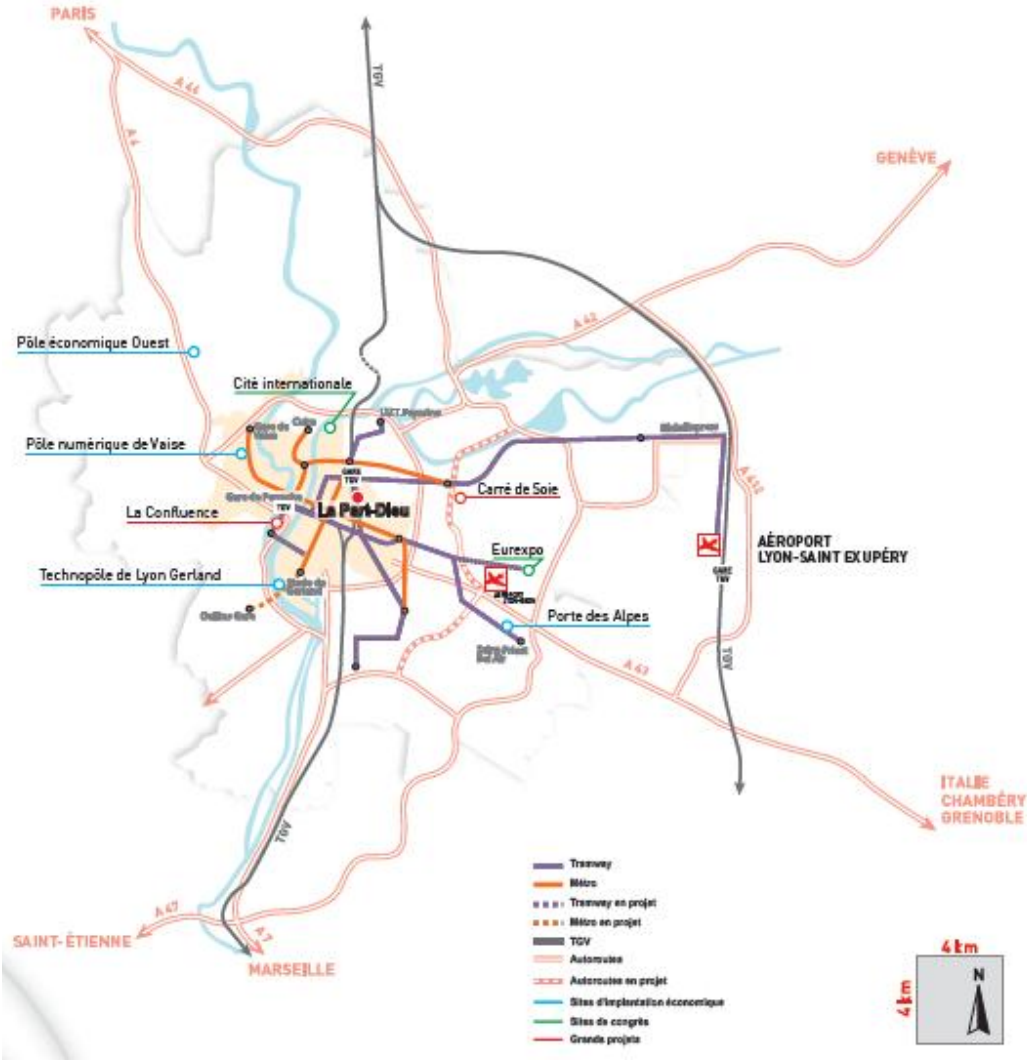
- ★ know the level of energy performance to reach for new buildings and to rehabilitate and support promoters in the implementation of this objective,
- ★ guide choices regarding the evolution of the respective contribution of the different energy carriers in 2030 (network deployment).
- ★ propose concrete measures to ensure that the urban project can meet its energy performance objectives

At the moment, the following action plan has been set up:

Implementation Plan	Achieved	Ongoing	Foreseen
Energy systems and networks			
Programme approach (changes in the shares of the various energy carriers)		Study in progress	
Pre-sizing subscribed power of all buildings to be constructed and refurbished in P-D by 2030	Achieved		
Technical and economical impact on the electricity grid of the evolution of Part-Dieu district		Study in progress	
Buildings, industry and services – energy demand and energy efficiency The production of a reference framework for environmental issues and for the energy performance of buildings	Achieved		
The constitution of an authority to monitor the environmental aspect of new building projects	Achieved for the 1st buildings	Ongoing for the designing buildings	Foreseen for the next buildings projects
Local renewable energy sources Reflection on the changes to the energy mix of the urban heating and cooling networks		Study in progress	
Mobility Implementation of grips of refills for battery-driven vehicles		Study in progress	
Use of TIC and smart grids			
Study of the cold demand on the district cooling network		Study in progress	
Modelling study of the electrical load curve of the Part-Dieu district		Study in progress	
Study of the flexibility potential on Part-Dieu district		Study in progress	
Reflection on reducing the peak demand on the heating and cooling networks		Study in progress	

1. Background and context information on Part-Dieu district and Lyon

1.1 Description of the area and its overall development



1.1.1 History of the Part-Dieu district

Fields liable to flooding, a prosperous farm and then military barracks – it was not until 1960 that Lyon Part-Dieu became the property of the City of Lyon. Mayor Louis Pradel then wanted to implement a housing and infrastructure policy on these 28 hectares.

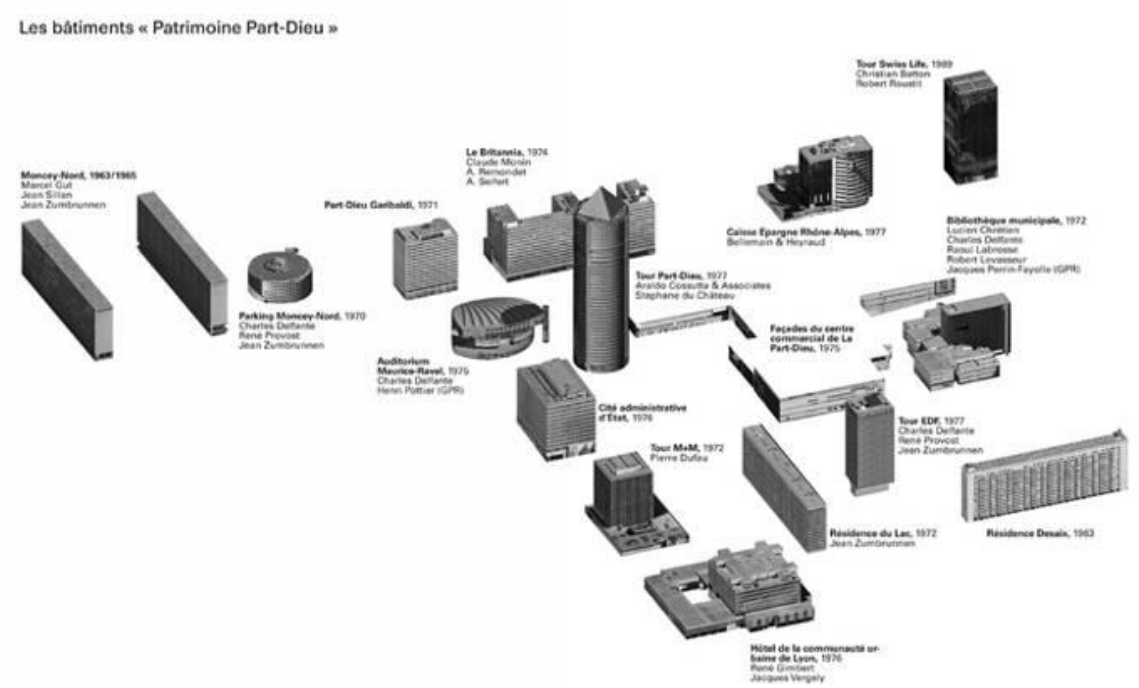
In 1962, the first houses, designed by architect Zumbrunnen, rose from the ground.

In parallel, the State decided that France's major cities should have their own "decision-making centres" to counterbalance the importance of Paris.

Lyon Part-Dieu was to be one of these centres. The aim was to design an entire urban development scheme including a business, administrative, cultural, commercial and residential centre.

The centre's designers opted for a podium-style development which separated pedestrian and vehicular traffic.

In the 1960s and 1970s, a series of remarkable structures were built in Lyon Part-Dieu, which gave it a very modern architectural identity.


Les bâtiments « Patrimoine Part-Dieu »
Moncey-Nord, 1963/1965
Marcel Gut
Jean Sillan
Jean Zumbrunnen
Parking Moncey-Nord, 1970
Charles Delfante
René Provost
Jean Zumbrunnen
Le Britannia, 1974
Clayde Morein
A. Remondet
A. Seifert
Part-Dieu Garibaldi, 1971
Auditorium Maurice-Ravel, 1975
Charles Delfante
Henri Pottier (GPR)
Tour Part-Dieu, 1977
Araldo Cossutta & Associates
Stephane du Château
Tour Swiss Life, 1989
Christian Button
Robert Rousti
Caisse Epargne Rhône-Alpes, 1977
Bellemain & Heynaud
Façades du centre commercial de La Part-Dieu, 1975
Bibliothèque municipale, 1972
Lucien Chrétien
Charles Delfante
Raoul Labrosse
Robert Levasseur
Jacques Perrin-Fayolle (GPR)
Cité administrative d'Etat, 1976
Tour MxM, 1972
Pierre Dufau
Tour EDF, 1977
Charles Delfante
René Provost
Jean Zumbrunnen
Résidence du Lac, 1972
Jean Zumbrunnen
Résidence Desaix, 1963
Hôtel de la communauté urbaine de Lyon, 1976
René Gimbert
Jacques Vergely

But Lyon Part-Dieu strayed off the path of its initial plan and switched to a logic of individual sites, thereby losing its overall coherence. The arrival of the station, inaugurated in 1983, caused a real shake-up of the uses and development of the district.

In the 1990s, Lyon Part-Dieu continued to grow vigorously but seemed to be in parentheses, in favour of a multipolar development of the conurbation.

Part-Dieu: 135 hectares right in the heart of Lyon, close to 900,000 m^2 of office space, mainly for the upper tertiary sector. The 1st business district after La Défense, located in the heart of the city, houses a major multi-modal hub, with high-speed rail links and an airport connection.

In this dense district in the 60s and 70s, close to 120 000 people passed through the station from east to west every day.

Part-Dieu was facing saturation and also stagnation, or even regression, as part of the structure had become obsolete due to new environmental standards.

1.1.2 Situation at the project launch in 2007

Coherence and clarity needed to be restored in this district, and consideration given to its future. The primary imperative was economic. Part-Dieu, as a very well-connected business district, was the epicentre of the tertiary offer in the city of Lyon. It was also its economic entrance and its showcase. To reinforce this central role, the office building offer had to be redeveloped, and thus Part-Dieu had to be consolidated and renovated, and its density increased.

But action also needed to be taken with regard to the parameters making the area economically attractive, in particular with regard to its service offer.

To establish a basis for the project, Greater Lyon firstly considered the issue of the strategic positioning of this district. Was it a business district, a shopping district – home to one of the country's largest shopping centres – a place of work, a residential location or all of these things? Rather than an "office centre" or 2nd city centre, was it not an urban centre, i.e. a real "hub": a geographical interface, a multimodal platform and a crossroads of uses? On what distinct values could the project be based?

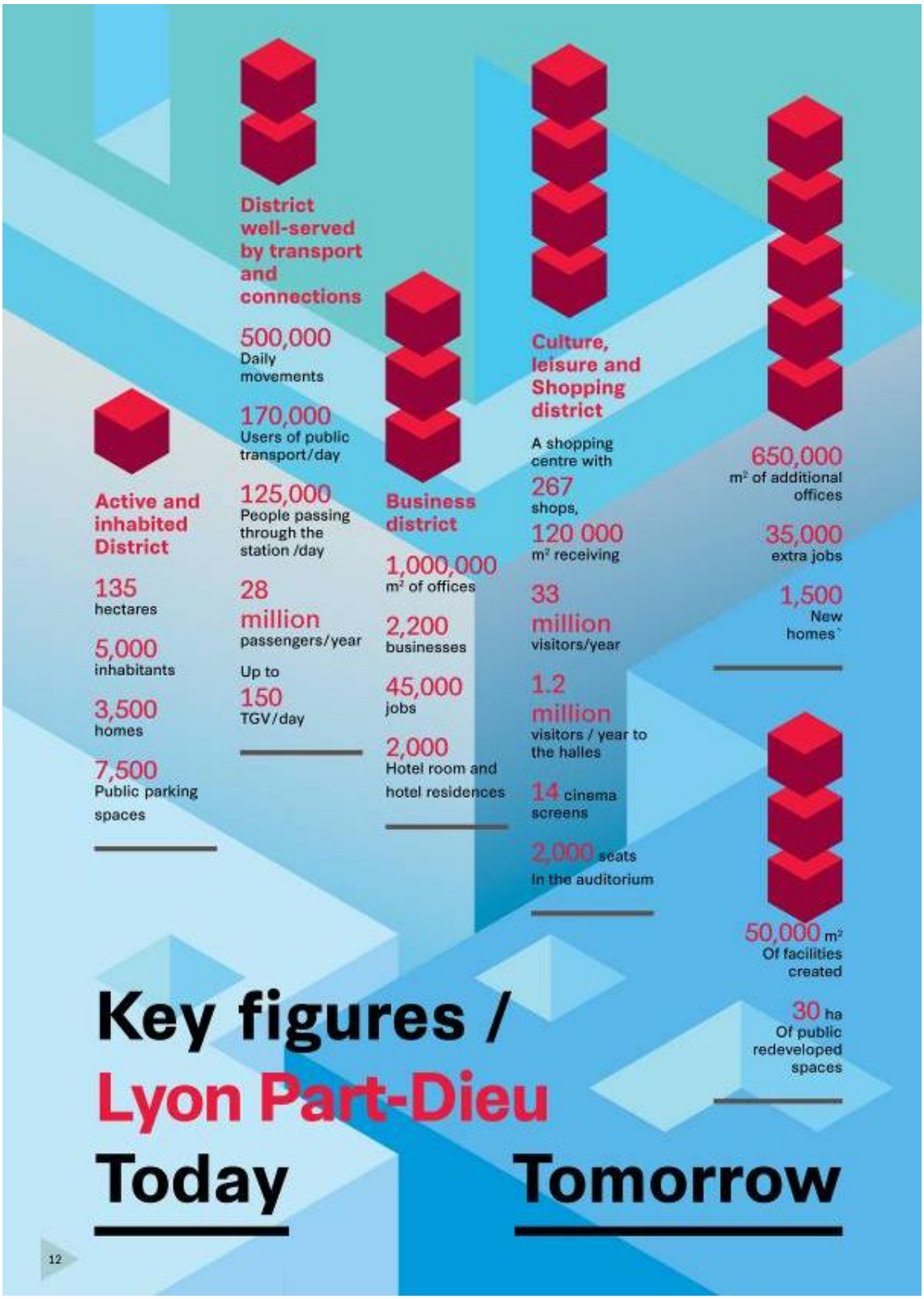
A series of studies confirmed that Part-Dieu was suffering from an image of being a purely functional district, with no particular charm; it was where people went to work, caught a train or did their shopping. It was a sort of "gap in the imagination of the people of Lyon" according to these studies. In this context, how should this existing district be regenerated, be given character or quite simply a "backstory" to position it in the city's history and ambition?

The multidisciplinary team of designers, led by the AUC, produced the Prospective Strategy and the Plan Concept positioning Part-Dieu as a "contemporary metropolitan hub". The architects sought an "integrated scheme" taking into account "the new playing field of sustainable mobility, the responsible business, working "à la carte", commerce/culture/leisure, and the public space of a contemporary metropolitan urban landscape". They based their scheme on a number of transversal principles such as the innovative concept of "easy ground".

Another principle was based on the revelation of a "cultural and event-based" crossing.

Pooling, hybridisation and decompartmentalisation were the key words of their project.

1.2 Structure of population and businesses



2. Development process

2.1 Insight in the ongoing development process

2.1.1 The key concepts of the Part-Dieu 2030 project

To reinforce the economic positioning of Part-Dieu

The stimulus for the Part-Dieu project stems first and foremost from an economic imperative.

Part-Dieu is Lyon's economic "hot spot" – the priority location and the entry point for investment in the city.

With a very marked upper tertiary image, Part-Dieu is home to corporate and regional headquarters of banks and insurance companies, consultancies, the administrative headquarters of major corporations and State and local authorities.

In it are concentrated the businesses and services which support the entire economic fabric of the city of Lyon.

To continue to attract investors, Lyon must therefore present a managed vision of its economic development and business real estate.

However, for some years now, Part-Dieu, in which up to 50% of the city's office space market was concentrated, has been at saturation point while the emergence of new economic clusters has given the impression of a dispersion of the public sector; there was hence a need to devise a true strategic vision of the economic attraction of the city, one in which Part-Dieu once again has a pivotal role.

To reinforce the central role of Part-Dieu, the office building offer has to be redeveloped, and thus Part-Dieu has to be consolidated and renovated, and its density increased.

The objective: to double the net floor area. But action also needs to be taken with regard to the parameters which make a site economically attractive, such as the quality of the hotel accommodation available, and the offer in terms of leisure, sport and relaxation, and indeed lifestyle.

Priority of intermodality: an ultra-connected district

Originally designed for 35,000 travellers daily, today 120,000 passengers per day pass through Lyon Part-Dieu station. Studies predict 220,000 users by 2030.

The Lyon Part-Dieu station project, the clients of which are Greater Lyon, Réseau Ferré de France and Gare et Connexion/SNCF, has two objectives: to absorb the increase in the flow of passengers and to be better integrated in the city.

The Lyon Part-Dieu station will be opened up to the city and double in area to become a station that is used like a public space. The main hall will be free of shops and services, which will be repositioned in lateral galleries which can be seen from the district.

Lyon Part-Dieu will thus offer a service gateway providing the keys for entering the metropolis of Lyon, and shops and hotels geared to new ways of living and new consumption modes.

The station will be opened up: after demolishing the building located in its centre, Place Béraudier will be redeveloped allowing the station to be more visible from Boulevard Vivier Merle. To the east, Place de Francfort (the current road terminal) will be renovated.

There will be greater access to the platforms via a new station entrance on Avenue Pompidou, and the intermodal connections (vehicle hire, taxi ranks, bike parks etc.) will be better distributed around the road terminal.

The creation of a new track “L” will be a first stage in overcoming the saturation of Lyon’s railway junction.

The development of the district – more housing, more offices, more appeal – will generate even more travel. However, public transport will be better distributed and interlinked over the entire district. Guided by new real-time information systems – contemporary signage, interactive terminals, mobile apps etc. – travellers will be able to combine their modes of transport “à la carte” with more confidence and for greater

convenience. By 2030, over one third of journeys will use public transport and 10% will be by bicycle.

An intuitive and lively public space

Having inherited a podium-style development which fragmented the public space into a number of levels, the Part-Dieu district has a difficult and confusing layout, interspersed with obstacles, low walls and steps. In order to remedy this discontinuity, which is a source of confusion and inconvenience, and to give the district back a single coherent and clear base, the design team (around the AUC) recommends that an ”easy ground” approach should be put implemented.

The objective is to restore coherence and clarity to the Lyon Part-Dieu district by designing an intuitive public space based on circulation habits, flows and uses which will create proper links between the ground and the buildings, the higher levels and the terraces.

Street furniture, lights and signage will trace clear routes which will facilitate accessibility and exchange. Better informed by digital guide systems, transport will be more fluid.

In addition, the project plans a better fit of buildings and public spaces by creating a ground-floor shop and service offer with bustling pedestals: cafés, terraces, and a variety of places of encounter and exchange geared to new ways of living and working, and new consumption patterns.

The culture trail

Lyon Part-Dieu has first-rate cultural amenities. The public library is ranked 2nd in France for the size of its heritage collections. The Auditorium houses the prestigious National Orchestra of Lyon. The Halles Paul Bocuse are the showcase for the gastronomic delights of the Lyon region.

The “culture trail” plans to open and better link these amenities, while offering new events for residents and people working in the district.

The “culture trail” will stimulate the existing cultural offer and also make it more visible, in particular by new digital technologies, with experimentation, innovation and interactivity at the forefront.

The culture offer will also be backed up by the hosting of the city’s major events: the Biennales of Lyon (contemporary art and dance), Festival of Lights, *Nuits sonores*, etc. Place Charles de Gaulle, which opens onto Rue Garibaldi and is stepped, and the roof terrace of the redeveloped shopping centre, will be eminently suitable **for open-air shows**.

2.2 Nature in the city and the quality of the urban ambiance

Nature is more or less absent from Part-Dieu, a district created during a period of massive destruction of nature in the city. There are a few green spaces, often invisible or inaccessible, which should be brought out of hiding. But a few micro nature zones must definitely also be created, as trees are able to reduce the noise nuisance associated with circulation. Since space is very tight, nature can be introduced on roofs or blank walls, or in the many derelict sites or unused spaces at the foot of high-rise buildings. However, green is not the only solution when planning a natural presence.

On a highly mineral site like that of Part-Dieu, nature can also be artificial, with for example, water sprays and light-reflective elements.

In order to contribute to an improvement in well-being, the project takes into account the quality of the urban ambiance: access to natural light and sunlight, controlling noise and the effects of wind, limiting pollution and the effects of heat islands.

Existing public spaces will be upgraded. New spaces will be developed, such as the roof terrace on the shopping centre, equal in area to the Place Bellecour: it could be used for new leisure activities, a new-generation food court and urban chill-out zones.

2.3 A new housing offer

The Part-Dieu project thus plans for a more dense habitat by increasing the number of homes in the district from 3500 to 5000.

The housing offer, both new and refurbished, will be diversified to meet all the needs of a hyper-central address: social and private housing, bought and rented, specific housing (for students or the elderly, residential homes with services) and innovative products combining residence and workspace. Local amenities – schools, crèches and shops on the ground floor of the buildings – will support the creation of these new homes.

2.3.1 Process, institutional context, stakeholders, political validation

The implementation plan is intended to go ahead in the Part-Dieu district in the context of the urban project Part-Dieu 2030. The Part-Dieu urban project is steered by Greater Lyon in the context of a novel arrangement: the creation of a dedicated ad hoc

commission followed by the conversion of this commission into a local public corporation in June 2014.

This project management approach is quite novel as, in this district, the public authority only owns public installations and very few sites, and so has to work with numerous other private, para-public and public landowners.

A formulation of words sums up this singular characteristic: Greater Lyon takes on “the project management for the ambition of the project”.

The stakeholders of the Lyon Part-Dieu project

<table>
<tr><th colspan="2">The departments of Greater Lyon</th></tr>
<tr><td>The Part-Dieu Commission

The Part-Dieu Commission is the leader of the Part-Dieu project. Like any territorial commission, the Part-Dieu Commission is a special organisation and has a limited lifespan and reports to the General Directorate of Greater Lyon; territorial commissions are created to facilitate the implementation of projects in territories with major strategic challenges. This commission’s role is to provide impetus and coordination between Greater Lyon and the institutions affected by the project, the economic partners, real-estate operators, private clients, and indeed residents. It mobilises the resources of the many departments of Greater Lyon and coordinates their actions without representing them. The Part-Dieu Commission is the kingpin of the entire production, communication and thinking with regard to the Part-Dieu project: topic-specific meetings with the departments and satellite organisations of Greater Lyon (Agence d’urbanisme, SYTRAL, Tourist Office, ADERLY etc.), brainstorming sessions, workshops etc.; it works closely with the AUC, the team chosen for the project design.</td><td>The Energy Commission: created only recently (2012), the Energy Commission which was involved in the Transform project is also a stakeholder in the Part-Dieu urban project since:
– it has expertise in the management of the heating and cooling network for Lyon/Villeurbanne/Bron, and, as such, is looking at the development of the energy mix in this network,
– it is associated with programming the roll-out of the future energy networks for the Part-Dieu district,
– it is examining the development of the share of the various energy vectors present in the district.</td></tr>
<tr><td>The Highways Department and the Transport Department

The issues of transport and mobility are significant in this project:
– public transport development strategy with a horizon of 2030,
– development of green modes of transport, development of “easy ground”,
– taking into account urban logistical issues, innovation and sharing of parking while</td><td>The General Delegation for Economic and International Development

Because Part-Dieu is the economic epicentre of Lyon, the Economic and International Development Department was the first to establish the basis for strategic thinking about the future of this district. The DGDEI thus produced notes which were crucial to the production of a project for the re-invention of Part-Dieu, which cannot be reduced simply to</td></tr>
</table>

maintaining convenient accessibility for private vehicles – these are the challenges to be addressed.	economic factors but must also take into account a more global service offer.
The Prospective and Public Dialogue Department of Greater Lyon Via its network of intelligence-gatherers, the DPDP conducted a study of the image of the district and produced a meaningful diagnosis of its uses and its function from the point of view of the individual. The DPDP also revealed certain trends with regard to consumption, catering and new economic models, highlighting in particular the need to adopt a "services" approach in the urban project, the challenge of restoring the visibility of the public institutions present on the site and of introducing new functions (cultural functions for example) alongside the dominant tertiary and commercial functions.	**Greater Lyon's other departments** All Greater Lyon's services and also several members of the cabinet of the President of Greater Lyon, have been drawn into the thinking on the emergence of a Part-Dieu project and inter-departmental meetings. So-called operational departments, the Development Department, the Highways Department and the Logistics and Building Department are already involved in the large-scale public development schemes. The Real Estate and Land Department, the Planning and Conurbation Policy Department, the Finance Department, the Communication Department, the Financial and Administrative Department of the DGDU, the Data Observation and Exploitation Department etc. also have a crucial role to play in the progress of the project.
The other institutional stakeholders	
The Agence d'urbanisme de Lyon [Lyon Urban Development Agency] An association created in 1970, the *Agence d'urbanisme de Lyon* has a mission of assistance in the project management for the production of the Part-Dieu urban project. The agency first conducted a study in two parts on the historic context of the district and its constitution. It took part in the workshops and the production of a "deposit" to feed the thinking. And last but not least, it has a mission of knowledge of the territory by producing the urban and landscape atlas of the Part-Dieu district, by means of which the district can be precisely described in all its aspects: functional, landscape, urban, architectural and heritage.	**The City of Lyon** The City of Lyon is involved in the project via a number of its departments, in particular the Urban Planning and Development Department which examines the planning permission applications for Lyon, the Transport Department and the Technical Building Management Department, the latter being responsible for monitoring the electricity and gas concessions for the territory of the city of Lyon.

2.4 Basis for decisions – available data and detailed knowledge

When the Transform project was being launched, Grand Lyon had a large database on urban planning and built heritage.

A document that has played a very important role in the Part-Dieu project, called the urban atlas produced by the Agence d'urbanime de l'agglomération lyonnaise (Urban

Planning Agency of the Lyon area) can specifically be cited. This is actually an inventory of all buildings located in the heart of the Part-Dieu district, and provides information on the age of each building, its height, ground area, surface, technical characteristics, and general condition.

Furthermore, this atlas provides a qualitative assessment on how the building can be adapted to its current use and identifies some areas of intervention for obsolete buildings.

Unfortunately, this atlas is not in a GIS format.

The team in charge of the urban project also had information on movements and traffic, socio economic data, data on public facilities, etc.

However, many studies have been launched to complete this body of data and build a forward-looking vision of the district by 2030.

The Part-Dieu mission has especially enhanced its knowledge of the district on acoustic, biodiversity, mobility, parking issues ...

Conversely, the energy component was particularly lacking. The only data available was on the district heating and cooling system, given that Grand Lyon manages the public service of urban heating and cooling.

Grand Lyon therefore has very detailed information on the consumption of different customers, the state of the network, its supply and energy mix.

Regarding the other energy distribution networks, Grand Lyon only had information on the location and layout of electricity and gas networks that supply the district, as well as the location of source substations.

When the urban project was being launched, the actors in charge of the Transform project had no data on:

- the overall energy consumption of the district,
- detailed consumption per building (except for the urban heating and cooling network),
- consumption per building type and use,
- distribution of energy vectors across the district,
- share of renewable energies,
- potential heat recovery.

The approaches adopted to constitute a reliable energy database are detailed in point 4.

In parallel with the collection of data, the “observation and use of data” service of Grand Lyon included this data in its geographic information system (GIS), which makes it possible to organise and present the data in a georeferenced format, as well as produce plans and maps.

Hence, the Part-Dieu district now has a geo-referenced urban and energy atlas.

2.5 Legal framework, tax incentives, aid schemes

At national level

The national energy regulatory environment has witnessed many changes over the past five years. But the biggest changes are still to come with the future law on energy transition, currently being discussed in parliament.

The most important measures are presented here below.

Interest-free eco loan

An important measure on the financial aspects of subsidies for the rehabilitation of existing housing stock was adopted in the 2009 finance law; the interest-free eco loan. This approach comes to complement the range of already existing incentive-based financial instruments for thermal renovations in buildings, such as the "sustainable development” tax credit or the sustainable development passbook account.

The eco-loan provides financing for energy saving initiatives and potential costs resulting from these initiatives in order to make the house more energy-efficient, more comfortable and emitting less green house gases.

To qualify for the interest-free eco-loan, you must:

- either implement a “work package”
- or attain a minimum housing “overall energy performance”
- or rehabilitate a private sanitation system using an energy-saving device.

A “work package” is a set of consistent works whose simultaneous implementation considerably improves the energy efficiency of the house. The works, carried out by professionals “Certified as Environmentally-Friendly” as from 1 September 2014 (as

from 1 October 2015 in the overseas departments) must be selected from at least two of the following categories:

- Efficient roof insulation,
- Efficient insulation of external walls
- Efficient insulation of external windows and doors,
- Installation or replacement of a heating system or production of domestic hot water,
- Installation of a heating system using renewable energies
- Installation of a domestic hot water production device using renewable energies.

Equipment and materials used must meet minimum technical specifications.

MAPAM law

The law of 27 January 2014 on the modernisation of territorial public action and affirmation of metropolises, called “MAPAM law” or “MAPTAM law” aims to clarify the competences of local authorities, by particularly reorganising the legal system of the most integrated French inter-municipal communities, the metropolises.

The MAPAM law provides for a metropolitan status adapted to the local characteristics of major French urban areas.

The text makes provision, in Lyon, of a special scheme with the creation of a new local community: the Lyon metropolis, to go effective as from 1 January 2015.

The following are amongst the new tasks assigned to the Lyon metropolis:

- construction and maintenance of the heating and cooling networks
- construction and maintenance of high speed broadband networks,
- concession of electricity and gas distribution

The new Lyon Metropolis will therefore have a wider energy mandate, which will enable it to build a forward-looking vision, translated in the form of an energy master plan, and directly manage investment policies and operational action programmes.

Law on energy transition

Articles 64 of “the draft *law on energy transition for green growth”* makes provision for a series of measures aimed at greater sobriety and better energy efficiency, as well as

the promotion of renewable fields “void of any nuclear activity” http://www.lemonde.fr/nucleaire/.

The law mainly concerns the construction sector, which alone accounts for nearly half of the energy consumption in France. The roadmap makes provision for the thermal renovation of 500,000 houses per year, a goal stated since 2012, but still a long way from being achieved. Furthermore, the entire housing stock should be renovated according to “low energy buildings” standards by 2050

New public buildings must be *“Energy exemplary”* and http://conjugaison.lemonde.fr/conjugaison/auxiliaire/%C3%AAtre “*energy positive whenever possible”*. Efficient energy use will henceforth be part of the decency criteria of houses. A *“digital housing health record”* will be set up for all new constructions as from 2017, in order to help households in their renovation approach. The poorest households will also receive an “energy-cheque” to pay suppliers or carry out works.

At the local level

The aid mechanism to eco renovation

Within the framework of the implementation of its Climate Plan, Grand Lyon is experimenting an eco-renovation grant for social landlords to attain the BBC-renovation standards.

This experiment concerns 15 pre-selected renovation activities between the period 2013-2014.

The grant, representing 50% of the extra cost of works to attain the BBC renovation standard and a maximum of EUR 5,000 per house, is a real lever for heat and energy renovation.

Grand Lyon has also voted a subsidy to carry out the eco-renovation of condominiums listed in the programmed actions and experimental approaches..

When the BBC-renovation standard is attained, and provided the condominium is accompanied in its approach, the amount of the subsidy then rises to EUR 2,500 per house.

In addition to this experimental approach, Grand Lyon and the National Agency for the Improvement of habitat (ANAH) are also funding works geared at improving the quality and energy performance of houses and condominiums, especially within the framework of the “live better” programme for homeowners or private rental houses.

Sustainable housing and sustainable office references

From 2004, Grand Lyon, with the help of the local energy agency, designed and implemented an environmental quality reference for new houses. The main purpose of these initiatives is to urge all building construction actors working in the urban community (contractors, designers, companies) to implement from the design of each operation up till its delivery and use, the necessary steps to address the following key issues:

- Limiting emissions of greenhouse gases
- Reducing energy and water consumption
- Using renewable energy
- Ensuring efficient management of buildings over time, and giving them an increased use value
- Reducing the impact on the health of builders and users

The habitat reference is based on the search for a greater environmental quality of houses and a cross-cutting and multi-criteria approach allowing for economic management over time, together with users.

It is imposed on all private and social housing operations launched by Grand Lyon within the framework of transfer of land and the ZAC community initiatives.
Its application is required for providers of social housing who build PLUS and PLAI type houses.

The office reference is the equivalent of the housing reference for new construction of office buildings.

The references are systematically linked to consultations initiated by Grand Lyon on its Z.A.Cs and community lands, as well as social housing operations. They define the

environmental performance requirements that new construction projects must meet and contain.

2.6 Achievements and experience

The national regulatory developments mentioned above (MAPAM law and law on energy transition currently under discussion) are not yet applicable in greater Lyon. They will certainly have a major impact but which for now cannot be estimated.

At the local level, feedback on the application of sustainable housing and sustainable office references can be considered as very positive.

Qualitatively, the latest updated figures show that:

- more than 11,000 houses have been constructed or are under construction and applying the housing reference, being 242 residential buildings (accounting for over 921,751 m² of built area)
- 36 office buildings have been constructed or are under construction and applying the office reference, accounting for over 280,000 m^2 of built area.

Qualitatively, it is considered that the references have helped to increase overall awareness on the need to change the way buildings are constructed, especially on issues of energy efficiency, choice of materials and integration of renewable energies.

Other achievements and benefits were observed, resulting directly from this approach:

- a real anticipation of regulatory changes (Grenelle Environment laws): thanks to the approach established by Grand Lyon, developers/builders intervening in greater Lyon were able to get a step ahead with the application of the 2012 thermal regulation, in that the level required for sustainable habitat reference – 2009 version – anticipated the level required for the 2012 thermal regulation.
- an action to fight against fuel poverty across the entire new social construction sector. The sustainable housing reference allows for lower energy consumption and thus helps to reduce household energy bills.
- a consulting/assistance/support approach of the Local Energy Agency (ALE) which helped to enhance the skills of social landlords and builders of greater Lyon on the environmental quality issues of the building.

3. Status of the energy system and related themes and enabling themes

3.1 Energy systems and networks

3.1.1 The energy context of the Part-Dieu district

There are 3 energy vectors in the Part-Dieu district: the district heating and cooling network, the electricity distribution network, the gas distribution network.

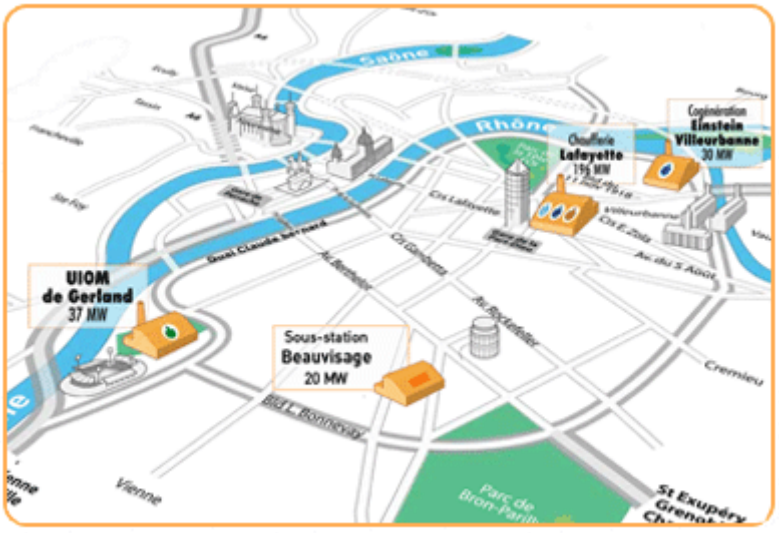
The district heating and cooling network

The Part-Dieu district is served by one heating and cooling network for Lyon/Villeurbanne/Bron.

Created in 1971, this network of Greater Lyon today supplies **45,000 housing equivalents** from **390 substations**.

This is France's 3rd largest heating network, with a useful heat production power of 240 MW and France's 2nd largest cooling network (28 km of pipework and 42 substations).

55% of the output of this network comes from renewable or recovered energy sources, in particular by heat recovery from the household refuse incineration plant located in Lyon 7.



Heating

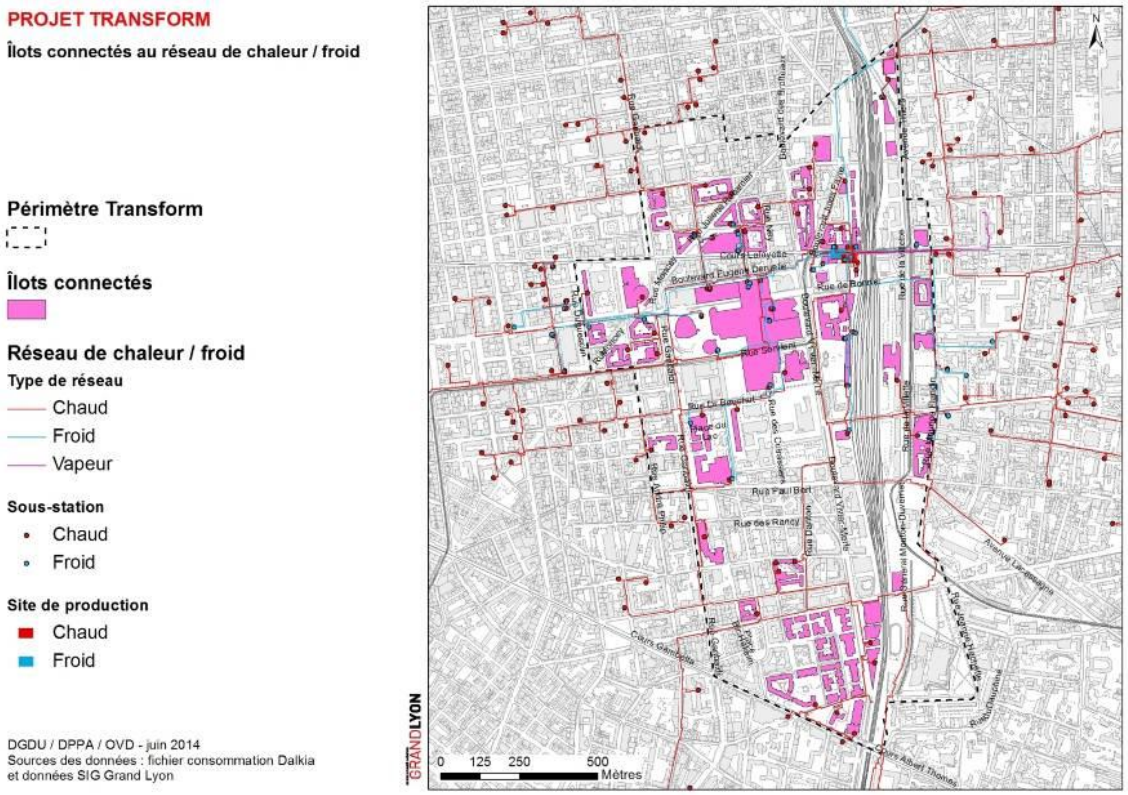
The network itself comprises the underground routing of a double pipe, 118 km long out-and-back.

One pipe transports hot water from the stations to the delivery points, comprising 390 substations supplying consumers, while the other takes the water back; it is a closed circuit.

The outgoing water circulates at temperatures of between 90° et 160°C, and the returning water between 70° et 100°C, all depending on weather conditions.
These pipes are insulated to restrict the temperature drop between the starting point and the furthest delivery point to just a few degrees.

Cooling

This technique is also used to transport chilled water, distributed at 6°C on average, in the urban air-conditioning networks, with 14 km of pipes out-and-back, which supply the delivery points, comprising 54 substations (shopping centres, office buildings, hospitals etc.).



The cooling network is concentrated in the Part-Dieu district.

A consultation process for the award of a new public service delegation contract was launched in 2012.

The specification provided a major technical, commercial and social development plan, in order:

- to ensure the long-term existence and the modernisation of the network, now over 30 years old, and to integrate it in an urban dynamic of sustainable growth and development;
- to allow the commercial development and growth of the network with the emphasis on new connections;
- to achieve lower charges for users;
- to anticipate environmental constraints and to allow the increasing use of renewable energy. The objective here is to achieve a 60% renewable energy level.

The new contract awarded to Elvya (a subsidiary of Dalkia) should allow in particular the construction of a wood and biomass heating plant (3x15 MW) with 12 MW thermal storage in the south of the Gerland district, having the benefit of a gas/fuel top-up. It also covers the modernisation and protection of the installations and the network, in particular with the gradual lowering of the temperature to 120°C (compared with the current 150 to 180°C), a power drop in the Part-Dieu station (from 150 to 86 MW), the construction of a new heating plant of 57 MW relaying the cogeneration on the Einstein site, and the reconstruction of a 57 MW heating plant at Bron.

The average age of the network should drop to 8 years in 2020 as against 20 years in 2014. Finally, the network capacity should rise to 39 km to meet the objective of serving 174 new consumers (in addition to the 432 buildings already served).

Eventually, these technical improvements should allow a perceptible reduction in CO_2 emissions of 100,000 tonnes per year compared with a gas solution, with a renewable energy level of 61.8%. A CO_2 emission level of 98 g/kWh, compared with 127 g/kWh currently, is announced for the future network.

Moreover, consumers and services in Greater Lyon will have access to all the information about them “with the greatest transparency”.

An appeal against the public service delegation contract in October 2013 cast doubt over the award of this contract and forced Greater Lyon to relaunch a competitive tender procedure.

Thus, the calendar for rolling out the initially planned action has been set back by at least 2 years, something which complicates the achievement of the energy objectives sought for the Part-Dieu district and in particular the connection of new real-estate schemes.

The electricity distribution network

The Cities own their electricity networks and in the Grand Lyon area they have delegated their concessionary authority (except the City of Lyon) to two electricity trade unions: SYGERLY and SYDER. On 1 January 2015, within the framework of the law governing the creation of metropolises, this responsibility was transferred to the Lyon Metropolis.

ERDF carries out its task of Network Distribution Operator (GRD) within the framework of a concession contract signed with the Organising Authority for the Distribution of Electricity (AODE), the Lyon metropolis as from 1 January 2015.

The construction of electricity networks had been anticipated following the decision to create the Part-Dieu district in the 1970s. The evolution of electricity networks followed that of urban planning.

Connected to the national transportation network, 2 main Extremely High Voltage transformer substations “Saint-Amour 360 MVA” and “Brotteaux 72 MVA” provide electricity to the local public distribution network (the City of Lyon has 14).

75 km of structured 20 000V underground cables as independent “carriers” connect 206 public distribution stations or of private delivery stations (companies, hotels etc.). Network security is ensured by the design of the connection (between two source substations) and the automation and remote controlling of switches.

These networks are designed for the transit of the “peak” and for the resumption of the supply of an adjacent carrier in standby mode.

Customers are connected to the 70 km low-voltage networks through collective connections for buildings, or individuals (companies, professionals ...).

In winter, due to the strong impact of the commercial and service sectors in this district, the load curve, experiences a high peak level between 10 am and 2 pm. The peak period resulting from household usage is between 7:00 pm and 8:00 pm.

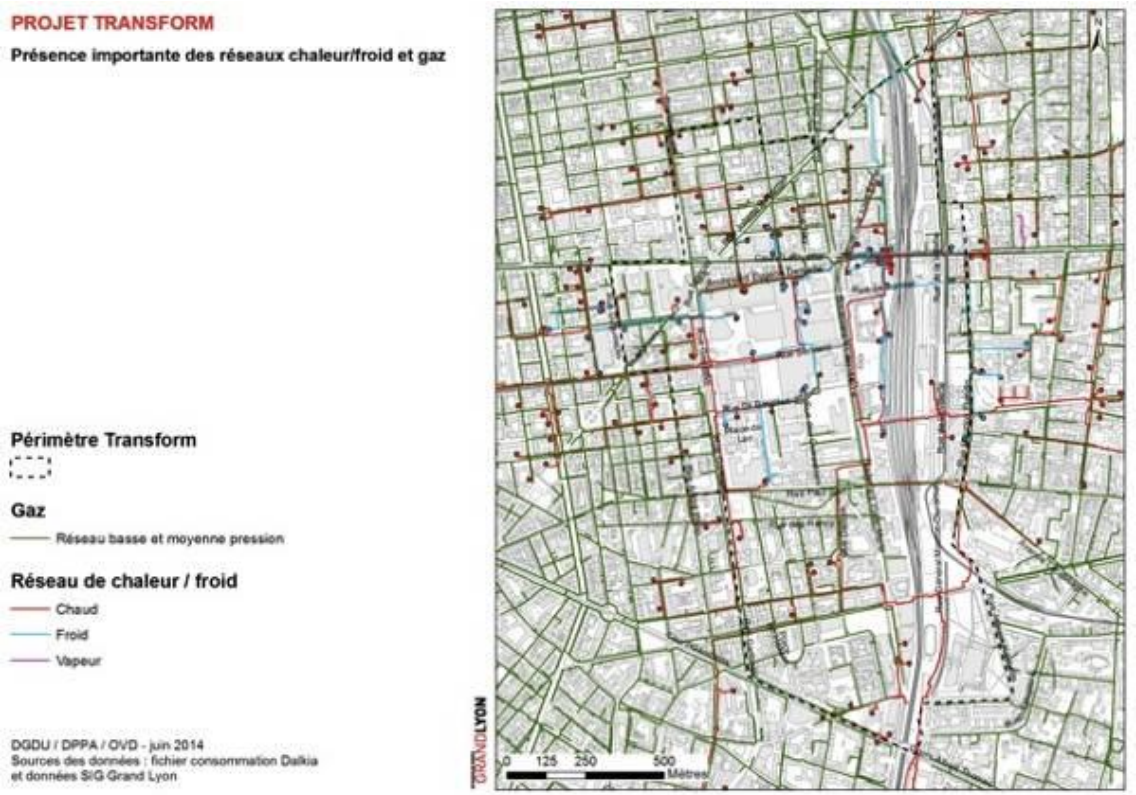
With the phasing out of electric heaters and the appearance of air conditioning systems, the summer load curve is much more linear.

The annual electricity consumption data provided by ERDF is aggregated according to the need of the Community:

- Within homogeneous geographic areas defined with the local community. We distinguish IRIS residential and business areas as well as other empty spaces such as parks and gardens.
- A building or group of buildings (respect of Commercially Sensitive Information (ICS)

The gas distribution network

The map below display the deployment of the gas network (in green) in Part-Dieu district together with the district heating (in red) and cooling (in blue) network.



The gas network is strongly present in the peripheral part of the district and is mainly supplying residential buildings with gas for heating, DHW and cooking. Heating systems are either collective (at the building level) or individual. The gas network is very scarcely deployed in the central part of the Part-Dieu distric (Coeur Part-Dieu, commercial centre, train station and more recent offices building along the railway). The Lafayette heat power plan of the district heating network is mainly supply with gas, it is therefore being the bigger consumer of the area.

The gas network used to be sized in order to meet the further increase of demand. It implies that an eventual future increase of the demand on this network would not need any new investment to reinforce the existing network.

4. Overall development visions, objectives and targets, future organization and management of the SUL from the policy perspective

4.1 Objectives, targets and KPIs, development vision and end-state of urban development

The Transform project helped the target energy objective for the Part-Dieu district to make considerable progress.

In particular it allowed an energy development scenario to be formalised while initial thinking were oriented more on a sectoral consideration of energy issues centred on the following questions:

- how to estimate the increase in energy demand due to the doubling of the constructible capacity?
- how to ensure the extension and capacity increase of the energy networks, and make them compatible with the calendar for implementing the urban project, in particular with regard to future road and public space projects?
- how to ensure an upgrading of existing buildings and improvement in their energy performance level?

The Transform project raised awareness as to the need for a global rethink about energy in all its aspects (estimates of demand, supply, energy mix, system performance, efficiency of new and old buildings, consumption management and monitoring).

The diagram below illustrates the approach taken in the Part-Dieu district to define and implement an energy transition scenario.

4.2 Development strategies and priorities of future development activities

(1) Energy context of the Part-Dieu district

In the first place, it appeared essential to know and measure precisely the district's current energy demand and consumption levels.

To do so, the decision was made to produce an energy diagnosis in GIS format (geographical information system) for the Part-Dieu district from previously compiled databases on the 3 energy vectors.

It then quickly appeared that this energy diagnosis should be done per building complex or block of buildings in order to find out as precisely as possible how the district's buildings were performing.

This work was carried out by means of a survey conducted by the urban-development office for all the district's buildings, which in particular consisted of identifying each developed area, and characterising it on the basis of the period in which it was built, the building system, its use and its general condition.

The diagnostic approach consisted of cross-checking this real estate database with:

- **estimated consumption** data (averaged approach by type of use)
- **actual consumption** data from network managers.

The decision to implement a dual approach regarding consumption (estimated consumption data and actual consumption data) was dictated by the will to test a "theoretical" approach of consumption by buildings based on their characteristics (period of construction, use, rehabilitated/not rehabilitated) in order to check whether this hypothesis-based estimate was reliable, i.e. close to actual consumption data.

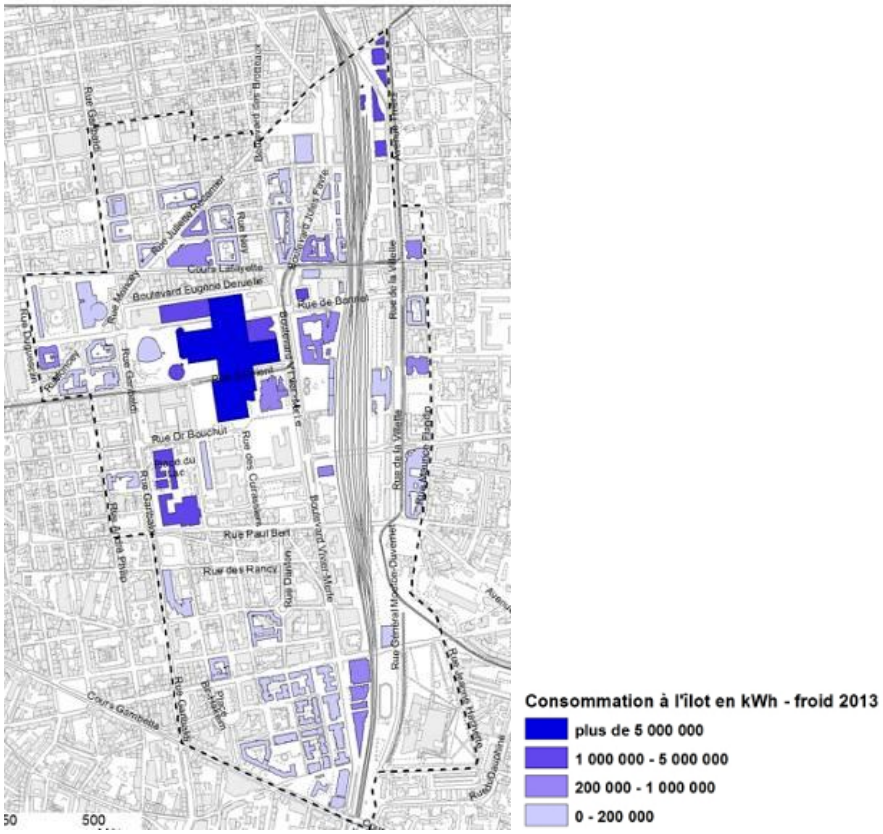
This approach was dictated by the fact that in the current context, actual consumption data are difficult to obtain and that the work which could have been done in the context of the Transform project with ERDF and GRDF would not be possible for the entire conurbation for various reasons:

- no global agreement at national level, with the network managers, for the provision to local authorities of consumption data at building level,
- enormous collection and processing work by the network managers which is difficult to imagine on a larger scale than that of a district.

The energy diagnosis thus produced is presented in map form and provides the following data:

- building typology,
- heat recovery potential in the Part-Dieu district,
- consumption by energy vector,
- islands connected to the urban heating and cooling network,
- islands connected to the urban heating and cooling network, and heating and cooling consumption,
- location of networks: electricity, gas, heating and cooling network,
- total primary energy consumption,
- total final energy consumption,
- energy efficiency of buildings with regard to primary energy,
- energy efficiency of buildings with regard to final energy.

The maps shown illustrate part of the work carried out.

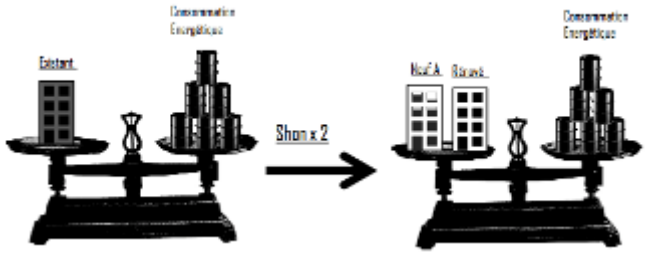


(2) Energy development scenarios to estimate of the district's future demand

The energy development scenarios were defined by common accord between the Part-Dieu mission, its project team and the Transform project team.

A general slogan illustrates by a simple formula the energy objectives sought: "the doubling of the constructible capacity with a constant energy balance".

At the scale of the Part-Dieu district, **the objective is to maintain overall energy consumption (for primary energy), despite the planned increase in area in the order of a doubling of the floor space.**



To test whether this objective is achievable at the 2030 horizon (date of completion of the urban project), a specific method has been set up to assess the impact of a set of intervention orientations and defined which are the required actions to achieved the energy transition of the Part-Dieu district.

The method selected consisted of integrating the scheduling in sqm of future buildings to be constructed or refurbished and allocating a forecast consumption figure calculated on the basis of the future use of the building and the performance level it is deemed to achieve by acting on the following orientations: energy performance of buildings' envelop, behaviour of buildings' users and energy carriers used to cover heating and cooling demand.

Orientation no. 1: energy efficiency of new buildings and buildings to be rehabilitated

In order to meet the objective of a constant energy balance as proposed for the Part-Dieu district, an extremely ambitious system needs to be put in place to promote the energy performance of new and existing buildings.

To estimate the impact of each measure on the energy consumption of the Part-Dieu district in 2030, Three scenarios of energy demand for the buildings envelop have been selected, taking the followings aspects into considerations:

- to ensure that newly constructed buildings will be highly energy efficient and are tending to be energy positive buildings
- to offset the consumption caused by the construction of additional m^2 by the renovation of the existing building stock with a view to coming as close as possible to the consumption performance levels of new buildings.
- to encourage renovation over demolition/rebuilding, to minimise the embodied energy cost of schemes,

Table 1: Description of buildings' energy performance in the scenarios 1, 2 and 3

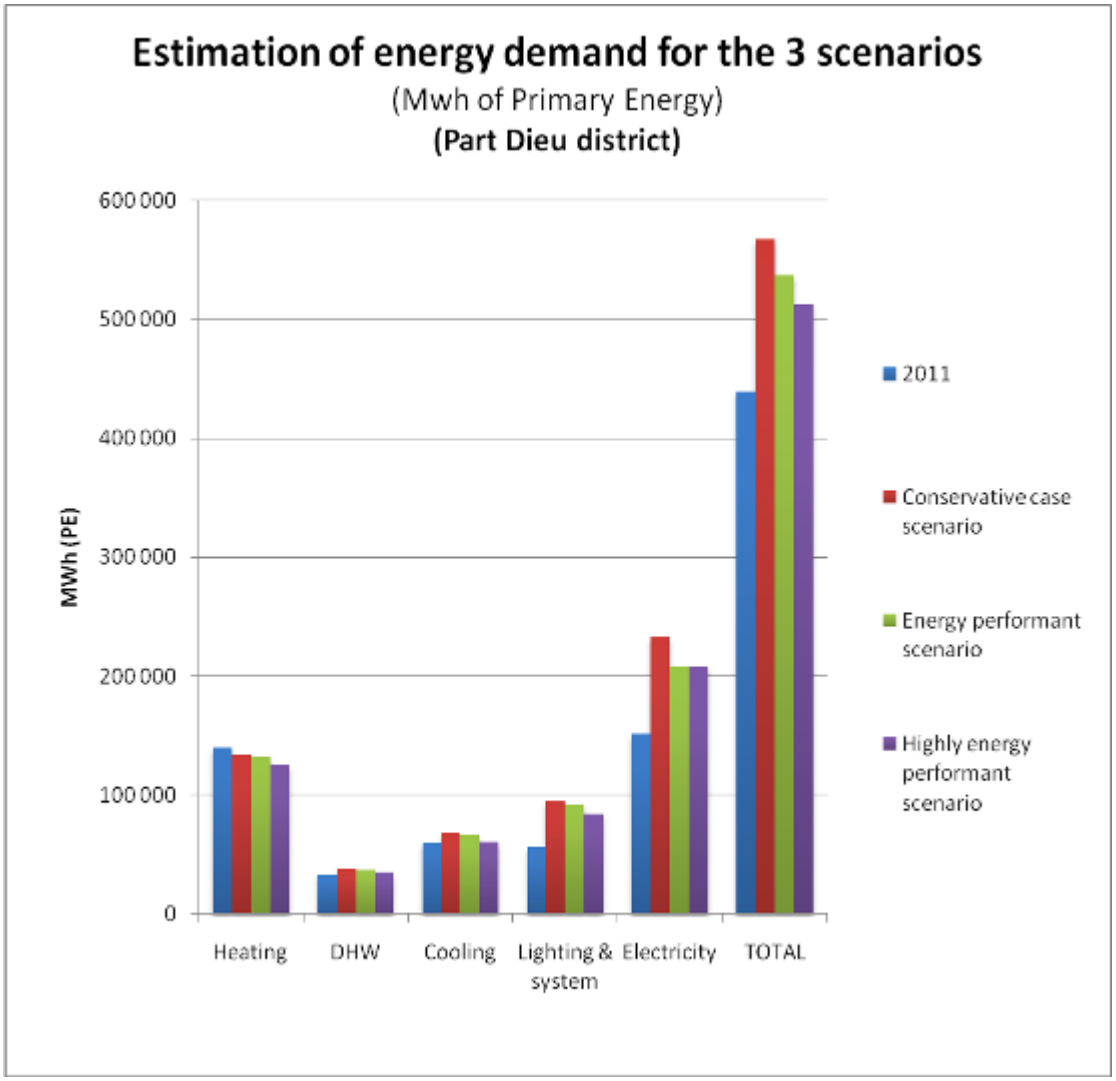
Scenarios		Scenario 1 Conservative case		Scenario 2 Energy Efficient		Scenario 3 Highly energy Efficient	
Building delivery date		2014-2020	2020-2030	2014-2020	2025-2030	2014-2020	2020-2030
Energy efficiency level	New buildings	RT2012	RT2012 -20%	RT2012	RT2012 -40%	RT2012 -20%	RT2012 - 40%
	Refurbished building	Standard retrofitting	BBC Effinergie	BBC Effinergie	BBC Effinergie -20%	BBC Effinergie	BBC Effinergie -20%

Thus, in the graphic below the current energy consumption (Part-Dieu 2011) is estimated at 439,500 MWh of primary energy for 1,174,000sq m floor space.

This area rises to 2,042,000 sqm in the prospective scenario over a 30-years period.

Depending on certain performance conditions of the rehabilitated buildings and those newly constructed, the total energy consumption may increase from 17% (513,000 MWh) to 29% (567,000MWh) depending of the scenarios

Graph 1: Estimation of the energy demand for each purpose for Part-Dieu district in 2011 and for 3 scenarios for Part-Dieu 2030



The Graph 1 above details interesting figures explaining which are the main purposes that are impacting the energy consumption of the district:

- There is a slight reduction of heat demand in all 3 scenarios compared to 2011
- For domestic hot water (DHW) and cooling, the demand is slightly increasing expected for the “highly energy efficient scenario” where it is remaining at the level of 2011
- The main difference between 2011 energy consumption and the trends for 2030 are related to use of electricity (lighting, systems and specific use of electricity).:
  - Electricity consumption for lighting and systems might increase by 50-68% compared to 2011 This is quite logical since it is more difficult to achieve

significant energy saving on the electricity use for the systems (ventilation, pumps for auxiliaries, etc.) than for the thermal purposes (heating, cooling, DHW)

- In the meantime, the specific use of electricity might increase by 37-53%. In the scenario 1, we considered that specific use of electricity will remain constant compared to 2011 figures (increase implied by new appliances will be compensated by a higher efficiency of the appliances). In scenario 2 & 3, the specific use of electricity is reduced by 20% compared to 2011. This can be achieved by combining the improvement of appliances' energy efficiency and energy savings resulting from a change of behaviour of citizens (inhabitants, workers, etc.). But at this stage, no "pro-active" hypothesis on the specific use of electricity have been taken because it do not depend of the real-estate developers and building constructers but rather more on the behaviours of building users (inhabitants, workers, etc.).

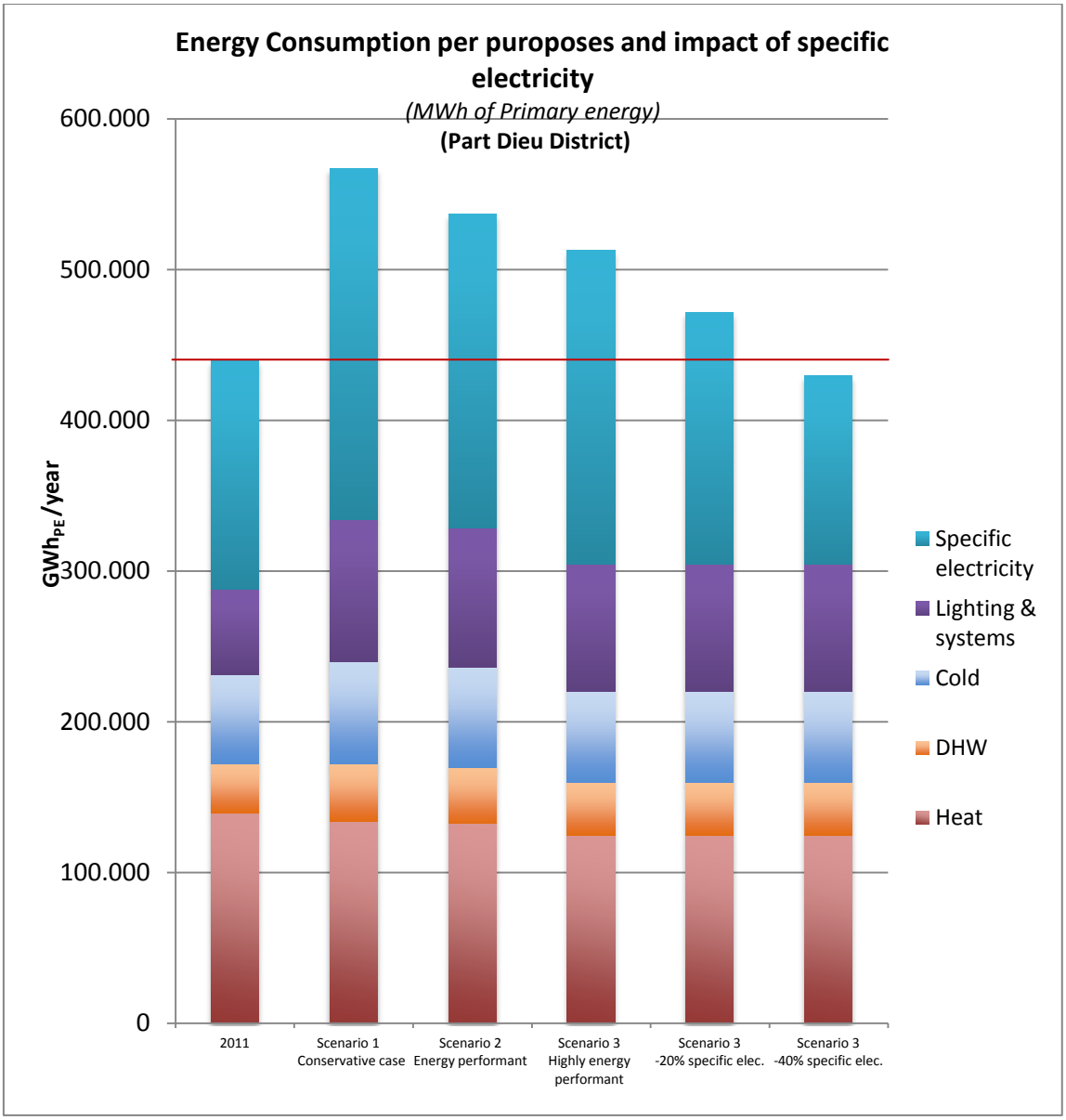
In conclusion, by acting only on the performance of the building envelop and of the systems it is not possible to achieve the overall objective to doubling of the constructible capacity for a constant energy balance.

Orientation no. 2: Strategy to decrease specific electricity consumption (non building related electricity consumption)

Specific electricity consumption is independent from the energy performance of the building envelop. It is therefore important to understand the impact of this purpose on the overall energy consumption of the district. The main elements that are influencing the specific electricity consumption are:

- Efficiency of the appliances use in the buildings (computers, hifi, electric household appliance, data servers, etc). It depends of the improvement of the market but also from rate of the renewal of older appliances
- Behaviours of workers and inhabitants that made significant energy savings by modifying their habits and behaviours. This implies important information and awareness raising targeted to the different groups of users of Part-Dieu district.

Graph 2: Energy consumption per purpose for Part-Dieu 2030 including measures on specific electricity consumption



- Typologies of activities in the tertiary sector is a third elements that can significantly impacted the specific electricity consumption. For example, a company that requires data server for its activity (ex. banks) will consume more specific electricity compare to standard offices. We have the same situation if we compare a shoes shop with a food shop that will need electricity for cold rooms. The urban project of Part-Dieu district is providing detailed information on the typologies of buildings to be constructed or refurbished (housing, offices, shops,

etc.) but it is impossible to foresee what would be the activities to be hosted by the buildings. This implies significant approximations for the calculation of the specific electricity consumption of the area that are totally independent from energy efficiency measures that can be implemented by the municipality and local stakeholders.

In conclusion, the objective of maintaining the energy balance of the district is achievable only in combining with highly energy efficient buildings (scenario 3) together with very strong specific electricity consumption reduction (- 40% compared to the specific electricity consumption of the scenario 3). However, the objective of reducing the specific electricity consumption by 40% compare to the scenario 3 seems to be not realistic.

The scenario 3 with a reduction of 20% specific electricity that seems to be more realistic but is leading to an increase of 7% of the overall primary energy consumption of the district compared to 2011.

Orientation no. 3: strategy for rolling out the energy vectors in the district

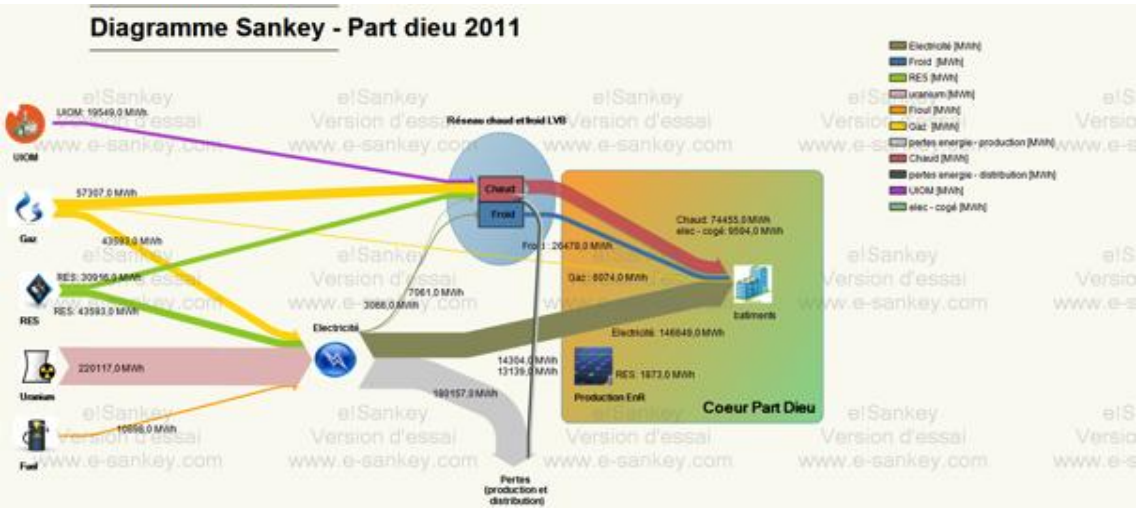
In the two previous paragraphs, no evolution of the energy mix has been taken into consideration, and the ratio for the conversion of the final energy to primary energy used is the official ratio of the French regulation of 2012.

To make a comprehensive analysis of the energy transition of the Part-Dieu district, it is necessary to look beyond the perimeter of the district and to consider the energy system as a whole and to consider:

- the energy carriers used to supply the energy demand for heating, DHW and cooling
- the energy mix of energy carriers (electricity, district heating and cooling networks, gas network).

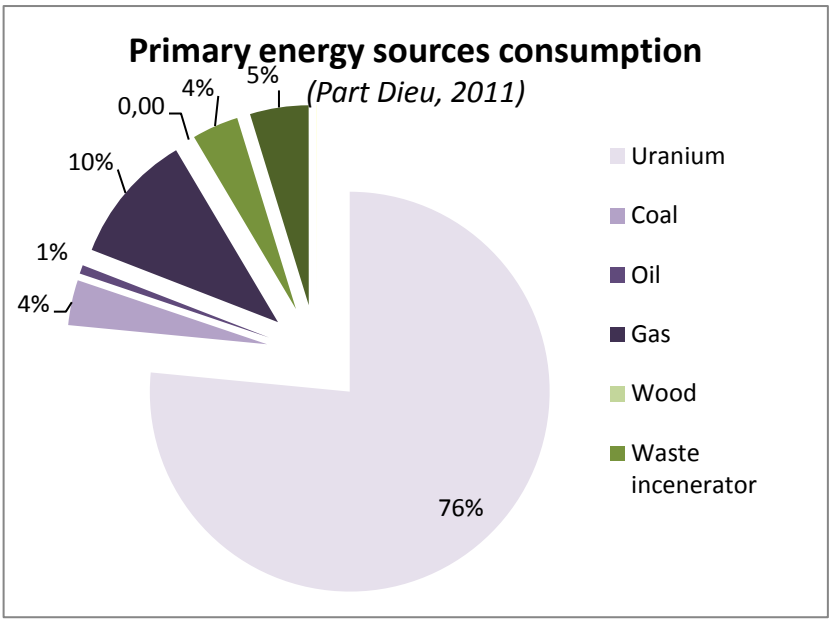
Analysis of the whole energy chain beyond the district borders

A sankey diagram is typically used to visualize energy flows and transfer between processes at local or national level. The diagram below represents the energy consumption of Part-Dieu district (right part), the energy processes to produce heat, cold and electricity (central part) as well as the primary energy sources (left part)



This approach enables to assess the entire energy chain and to calculate the real amount of primary energy sources required to supply Part-Dieu district, instead of using the normative ratios used in the French thermal regulation of 2012.

Graph 3: Primary energy sources consumption for Part-Dieu district in 2011



A similar approach has been used for the Part-Dieu 2030 scenarios to assess the impact of the energy carriers on the energy balance of the district. Graph 4 shows alternatives of the scenarios detailed in the previous paragraph, depending of the energy carriers that are supplying heat, cold and DHW.

- The first column represents the consumption of primary energy sources of Part-Dieu in 2011, as already detailed in the graph above.
- The second and the third columns (scenario 3.1 and 3.2) represent a variation of scenario 3 “highly energy efficient buildings”. In scenario 3.1, heating, cooling and DHW needs are mostly supplied with district heating and cooling networks and the in scenario 3.2 they are supplied by electricity as it is detailed in the Table 2 below:

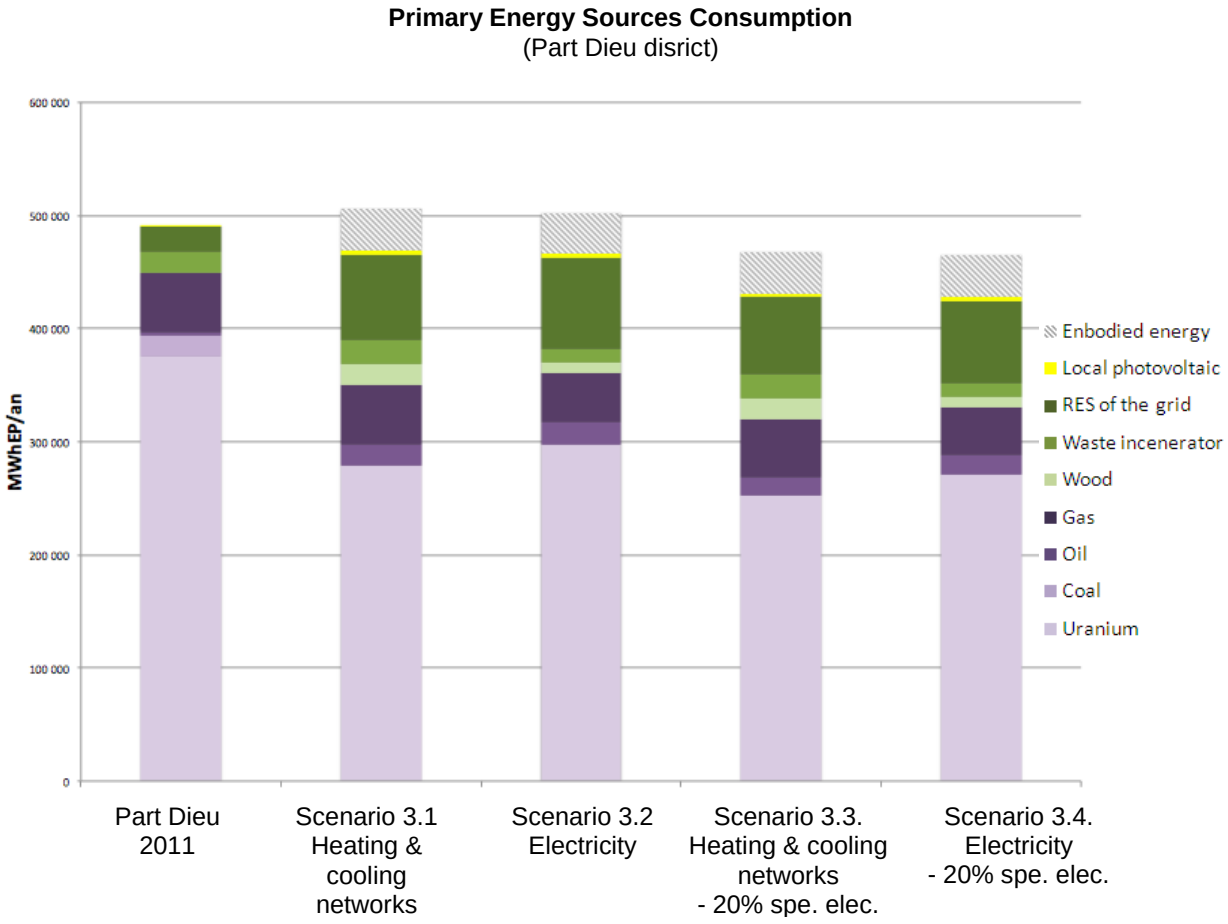
Table 2: Description of the energy carriers used to supply energy demand for heating, DHW and cooling in the scenarios 3.1 and 3.2

		Scenario 3.1 Highly Energy efficient – District heating and cooling		**Scenario 3.2 Highly Energy efficient – electricity**	
Building delivery date		2014-2020	2020-2030	2014-2020	2020-2030
Energy supply scenarios	**Housing: Heating & DWH**	Gas	District heating network	Gas	Electricity
	Offices: Heating	Electricity	District heating network	Electricity	Electricity
	Offices: Cooling	Electricity	District cooling network	Electricity	Electricity

The fourth and fifth columns (scenario 3.3 and 3.4) are respectively equivalent to scenario 3.1 and 3.2 but with a reduction of -20% of the specific electricity consumption.

These four scenarios are based on the same hypothesis for the energy mix of electricity and heating and cooling grid. They correspond to intermediate trends between the “business” as usual trend and very pro active trend to include large amount of RES in electricity, heating and cooling energy carriers (cf. Table 3). In addition, the embodied energy necessary for the construction and the refurbishment of the buildings have been included in the energy consumption of the district to offer decision makers a global overview of all energy consumption implies by the urban project.

Graph 4: Primary energy Sources consumption for Part-Dieu 2030 using real energy conversion factors



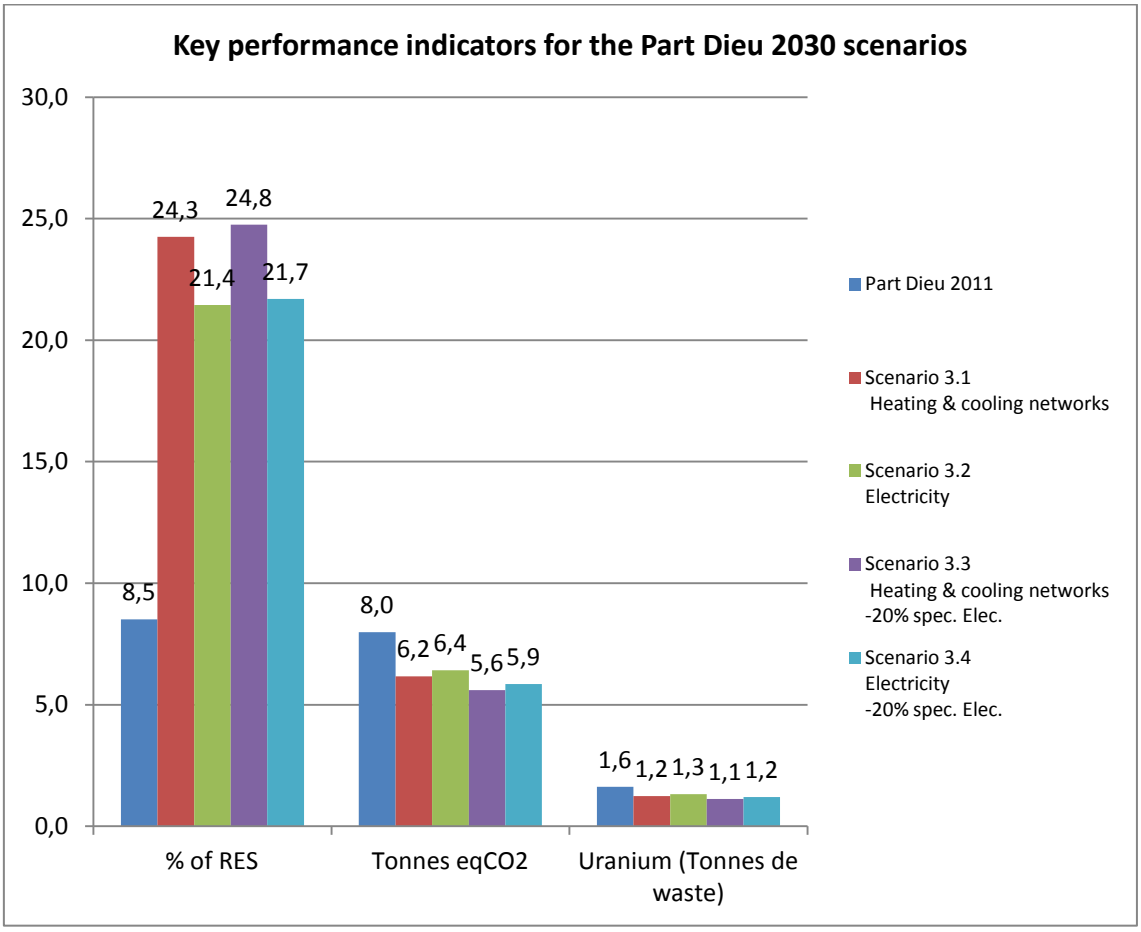
Comparison of the main energy scenarios

For each scenario, the following indicators have been assessed:

- ★ KPI 1 = Total primary energy consumption (cf. Graph 4)
- ★ KPI 2 = Share of RES
- ★ KPI 3 = Emission of CO_2
- ★ KPI 4 = Production of nuclear waste

Regarding the KPIs 2, 3 and 4, the best scenario is the scenario 3.3. The share of RES is 24,8% (compared to 8,5% in 2011) and it will produce yearly 5,6 tonnes equivalent CO_2 (compared to 8 in 2011) and generate the production of 1,1 tonnes of nuclear waste (compared to 1,6 in 2011).

Graph 5: Key performance indicators for the main Part-Dieu 2030 scenarios



Sensitivity analysis of the impact of the energy mix of electricity in France

The four scenarios, displayed in the Graph 4 and Graph 5 above, are based on the hypothesis for the energy mix of electricity in France in 2030. Even if the municipality and local stakeholders have no lever to influence this energy mix, it is important to understand how it impacts the energy balance of Part-Dieu district in 2030. Table 3 below details the scenarios that been used to carry out this sensitive analysis:

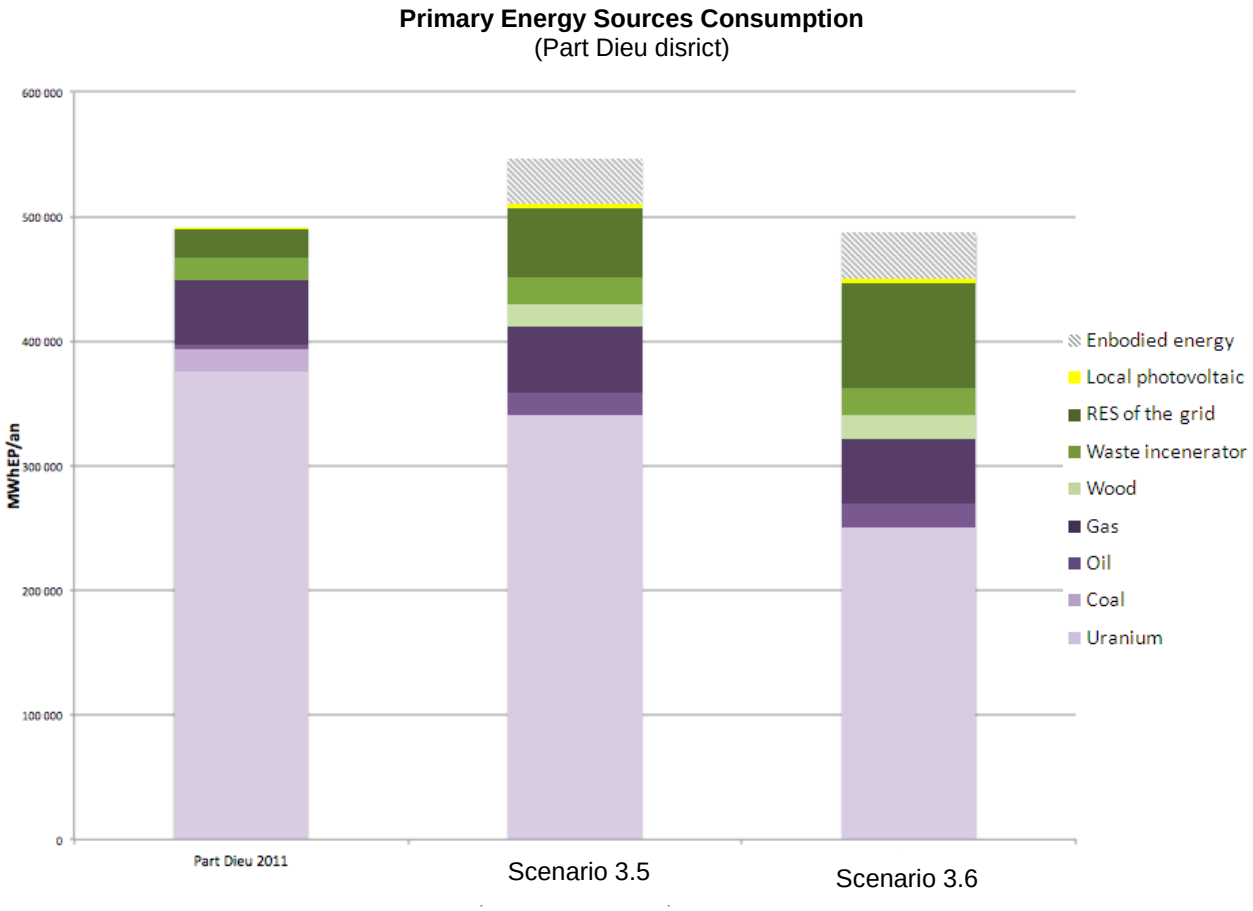
- Scenario 3.5 corresponds to the “conservative case” very the part of RES in the French energy mix of electricity is following the current trends that are below national objectives.
- Scenario 3.6 corresponds to an ambitious scenarios proposed by the French National Agency for the Environment and Energy (scenario ADEME 2030)
- The energy mix used for the scenarios 3.1 – 3.4 detailed in the previous paragraph is an intermediate scenario

Table 3: Scenarios for the energy mix of electricity in France in 2030

	Scenario 3.1, 3.2., 3.2 & 3.4	Scenario 3.5	Scenario 3.6
Uranium	51	63	45
Oil	5	4	5
Gas	4	3	4
RES	40	30	46

For the scenario 3.5 and 3.6 displayed in the Graph 6 below, the sensitive analysis has been made on the basis scenario 3: highly energy efficient buildings but no additional efforts on the specific electricity energy consumption.

Graph 6: Sensitive analysis of the impact of the electricity energy mix in 2030 for Part-Dieu district primary energy consumption



Graph 6 illustrates that the energy mix of electricity will have a very strong impact on the primary energy consumption of the Part-Dieu district in 2030. In the case of

scenario 3.5. the objective to doubling of the constructible capacity for a constant energy balance is not achievable while is it achievable in the case of the scenario 3.6.

Orientation No. 4: Design of energy networks

An enhanced coordination between local authorities and GRD will lead to the building of most robust concerted local energy scenarios and in the image of a vision between the community and the GRD, with the aim:

- to optimise the scheduling of investment in the various energy networks (electricity, gas, heating & cooling)
- to optimise the planning of the energy distribution infrastructures
- to increase the integration of renewable energy sources
- to gear the planning to the local energy mix objectives

These scenarios will enable network distribution operators (GRD), to understand the variability of needs in space and time across the territory to anticipate the needs and accurately evaluate the investments needed in the medium and long term, by identifying projects that are uncertain and require delicate work to be carried out (cost/deadline).

The GRD will then be able to prospectively define the technical and economic value of alternatives to strengthen the network or solutions to defer investments in the network that will need a lot of flexibility.

This flexibility can be of two types, static (renovation of buildings, modification of energy vectors for thermal (heating and cooling), adjusting the design of facilities, etc.) or dynamic uses (effacement of diffuse, driving demand in the tertiary sector, etc.) compared to the “classic” network erasure solutions. While the first concerns the dimensioning of networks, the second involves the management of the latter, particularly through the development of intelligent control solutions (smart grids)

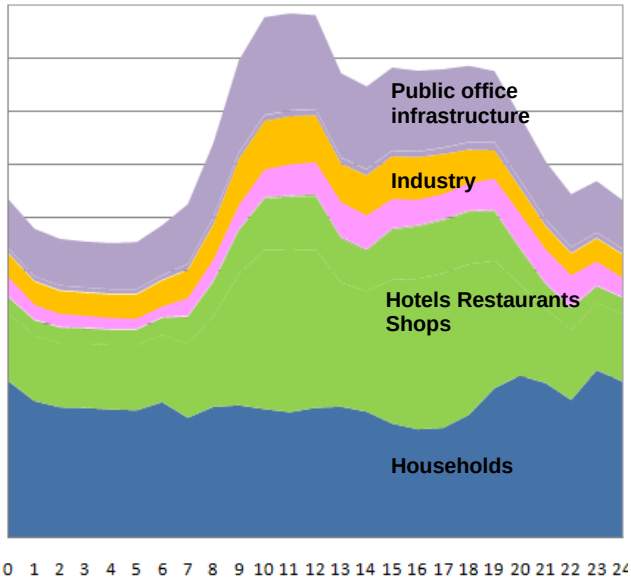
This identification of alternative capacity needs by the GRD and the characterisation of available flexibility resources will launch a consultation phase with the local community to identify local solutions that can meet the specifications. These local solutions can be classified into different categories according to their nature, the areas of competence concerned, their implementation dynamics, their area of operation in firm energy, etc.

Orientation No. 5 – Operation of energy networks

The networks are designed for a maximum flow that will occur during the year (i.e. peak demand). It means that the peak demand has a direct impact on the investment costs on distribution networks. Reducing the peak demand will systematically reduce investments costs. First solution is to work on the design phase to avoid as much as possible peak demand (cf. orientation 4), but this can be combined with peak demand management solution.

This will be achieved especially through erasure. It first entails identifying the load curve of a source substation or a distribution station and identifying the uses responsible for the power demands. Once these uses have been identified, we need to understand how they can be moved in time to reduce the peak and thus smooth out the load curve to the maximum. This is done mainly by managing a number of uses (heating, ECS, cooling, ventilation, etc.) and the putting in place of communicating meters.

The chart below shows the load curve of the Part-Dieu district which experiences a maximum peak power between 10 am and 2 pm. This is due to the strong presence of the tertiary sector in the district. More detailed studies to be conducted within the framework of TRANSFORM on the structure of the load curves of Part-Dieu district will offer a number of solutions that will be used to limit the extent of the latter and therefore reduce network strengthening costs.



In the same way, 4 scenarios previously described allow to measure the impact of the future demand linked to the network of urban cold and the potential of deployment to plan (investment).

An identical work will be made on the urban network of heat by the future agent.

(3) Supporting the urban project and the stakeholders in the district with regard to energy issues

At the same time as producing the district's energy development scenario, the urban project/Transform team considered the operational resources to be used to allow the proposed energy transition scenario to be implemented.

The energy transition scenario is rolled out by: 1) mobilising the key stakeholders in the district and 2) formalising an operational action plan to drive the transition process forward.

Three main actions were identified:

- Support for real-estate investors in the construction of efficient buildings and the renovation of their existing building stock,
- Launching of an examination with the owners/occupiers/managers of office buildings in the Part-Dieu district with regard to:
  - their perception of the performance of their building (in terms of comfort, cost of energy costs etc.)
  - their strategy with regard to energy (real estate, operation – maintenance)
  - their demand in terms of energy services and data,
- Awareness-raising among employees as to controlling consumption.

The detailed presentation of the actions undertaken is described in chapter IV: "Operational implementation of the strategy and measures".

(4) Perspectives: towards an energy plan for the conurbation

The **TRANSFORM** project is a very important lever which feeds the thinking about Greater Lyon's energy strategy, in the context of its new energy responsibilities under its new status as a metropolis.

In particular, it has helped to feed the production of the future energy master plan for the metropolis with regard to various aspects:

Energy governance/stakeholder involvement:

When the Transform project was launched, a multi-partner discussion entity called the "platform for urban and energy planning stakeholders" was created at the initiative of Greater Lyon.

The workshops then held, which brought together a number of institutions and associations which are stakeholders in the areas of urban planning and energy, were intended to allow:

- a common culture to be established in relation to energy and urban planning issues,
- the framework to be prepared for the production and the organisation by the partners of a future energy master plan,
- input and involvement in the research and development work to be carried out in the context of WP 4, in particular regarding the construction of an energy diagnosis on the scale of the Part-Dieu district, which could then be reproduced at the scale of the entire conurbation.

In order to meet the first 2 objectives, a proposal was made to the workshop members to undertake an analysis of all the existing approaches up to that time in terms of urban and energy planning in order:

(1) to assess the level to which energy was taken into account in the outline urban planning documents and in the development project, and reciprocally the level to which urban planning was taken into account by the energy providers in their planning processes for energy networks (electricity, gas and heating).

(2) to identify the margins of progress of the current planning approaches and to assess the capacity to produce a plan of the energy system (in particular the networks) at the same time as an urban plan in order to respond to the challenges of Greater Lyon's PCET (Territorial Climate and Energy Plan).

In the course of the various meetings, the following planning tools were examined:

- territorial coherence plan (SCOT),
- local urban development plan (PLU),
- planning of the gas distribution network,
- planning of the electricity distribution network,
- Greater Lyon's territorial climate and energy plan (PCET),

- the urban transport plan and the modelling tools used or being made in the field of transport,
- the regional climate, air and energy plan (SRCAE),
- the regional renewable energy connection plan (S3e ENR),
- the gas and electricity concessions.

The work started by analysing the strengths/weaknesses/risks of each of these planning exercises with regard to the following aspects:

- **Vision :** is energy taken into account in the vision provided by the urban planning documents? Is this vision consistent with that provided by the strategic and planning documents with regard to energy?
- **Governance :** what level of interaction is there between the urban political stakeholders and the energy stakeholders and at what juncture do they interact, and how do they do so?
- **Regulatory urban development :** in what way do the regulations currently in force constitute a brake on or a power for the integration of energy in urban development and thus the putting in place of an energy plan and the roll-out of an energy strategy in the urban world?
- **Financial levers :** what financial tools are there to support the approaches or actions?
- **Modelling and territorialisation tools :** analysis of the quality of existing tools (analysis mesh and precision) and access to data.
- **Timescales :** ability to implement the energy plan integrated in the urban plan in terms of the timing of each planning document (time horizon covered by the document, frequency of revision etc.).

Development of tools and databases

In addition to the constitution of an energy/building database, which allowed the 1st energy diagnosis to be carried out on the scale of a district, the Transform project helped to test a modelling tool (conceived in the context of WP 3).

While Greater Lyon's energy commission responsible for producing the future energy master plan considered the relevant modelling tools on the scale of the entire conurbation to support the production of prospective scenarios, the modelling tool proposed by the WP 3 leader was tested on the Part-Dieu district.

It was possible to carry out a detailed analysis of its characteristics, and the opportunities offered in terms of scenario production in association with the energy commission.

State of the art of the national and local energy context

The Transform project furthermore allowed a detailed analysis of the national and local energy context to be conducted (via WP 1). The following in particular were studied: the institutional context, the key stakeholders and their roles.

Putting this into perspective appreciably helped the energy commission responsible for producing the future master energy plan, in particular in the context of identifying the stakeholders to be included in the discussion.

4.3 Future management and organization of the SUL

The Part-Dieu project was launched before the start of the Transform project and until 2012 worked on the basis of the organisation described above. Since the announcement of the results of the invitation to tender for the Transform project, this organisation has developed to integrate the people responsible for the Transform project and above all to adapt to the expectations of WP 4, i.e. to produce an implementation plan.

Thus, the teams responsible for the Transform project and the teams of the Part-Dieu commission have defined a working method and a mode of operation which can be summarised as follows:

- responsibility for the Part-Dieu urban project lies with the Part-Dieu commission,
- responsibility for the implementation plan lies with the conurbation strategy department (which furthermore steers the Transform project), within the prospective and conurbation policies department (DPPA).

A committee for the technical monitoring of the Transform project was put in place; this brings together Greater Lyon (the Energy Commission and the Conurbation Strategy Department) and the partners of the Transform project (Hespul, ERDF).

On the political level, as the Part-Dieu project is considered one of the flagship projects of Lyon, the Mayor and President of Greater Lyon is the political reference contact for this project.

Since the Transform project was accepted by the European Commission, two vice-presidents and reference contacts have been appointed to monitor the implementation of this European project. Ms Karine Dognin Sauze, vice-president for new technologies, and Bruno Charles, vice-president with responsibility for the climate plan and sustainable development. A Transform steering committee, chaired jointly by the two aforesaid vice-presidents, was put in place and has met twice to date.

The municipal elections in March 2014 resulted in a slight change to the political backing of the project with the appearance of a new vice-president for energy, in the shape of Ms Hélène Geoffroy, who is now joint reference contact for this project with Ms Karine Dognin Sauze, whose term of office was renewed.

The year 2014 also saw the change in status of the Part-Dieu mission, which was transformed into a Société Publique Locale (Local Public Company) (SPL).

This organization will implement delegation procedures of project management (concession-type) or development operations.

Law No. 2010-559 since 28 May 2010 gave local authorities the right to create SPLs that have a regime similar to that of sociétés d'économie mixte locales (local semi-public companies). They are governed by the provisions of the code général des collectivités territoriales (General Code of Local Authorities) (CGCT) and the Commercial Code, and have the following characteristics:

- 100% of shares are held by the public including at least 2 local authorities or groups of local authorities,
- An activity exclusively beneficial to its shareholders, in a single territory,
- The possibility for its shareholders to sign contracts with the SPL without

This tool allows the reconciling of public control, corporate management and flexibility offered in terms of contracting, risk control based on the distribution of share capital and a high scalability of the structure.

The Rhône-Alpes Region, which is interested in this project, can later join the shareholders.

The Lyon Part-Dieu SPL will thus be commissioned to determine the strategy, conduct studies, coordinate and carry out the activities of the Lyon Part-Dieu's urban and economic projects.

The Part-Dieu SPL will operate exclusively on behalf of its members in the Lyon Part-Dieu area of operation which is located in the territory of local authorities and local authority groups which are members.

In addition to the institutional stakeholders (departments of Greater Lyon and the City of Lyon) and the partners of the Transform project (ERDF, Hespul), the stakeholders of the implementation plan are:

- the operator of the heating and cooling network,
- GRDF, as the operator responsible for the gas distribution network,
- the developers and builders,
- the owners/managers of property,
- the Part-Dieu shopping centre and more generally all the companies based in the buildings in need of rehabilitation,
- Lyon Part-Dieu station.

The involvement of the stakeholders in the Transform project is managed in the context of a working group called the “energy and urban planning workshop”. All the urban planning stakeholders are present: the urban development agency, the study and programming syndicate of the conurbation of Lyon (SEPAL) responsible for the SCOT, the Urban Planning Department of Greater Lyon and the institutional stakeholders for energy (ERDF, GRDF, the City of Lyon, and the local energy agency).

This very institutional governance of stakeholders is supplemented by the involvement of the district’s economic stakeholders, since the Transform project team worked with an existing group called the “Club Part-Dieu”, made up of the 60 largest businesses present in the Part-Dieu district.

The partnership approach which developed with the Club Part-Dieu is described in the following chapter.

The Part – Dieu district will be monitored in detail just like the monitoring for the elaboration of the energy audit.

Grand Lyon will solicit operators of electricity networks, gas and heat and cooling system to periodically update consumption data of buildings across the island.

From the first full year of occupancy of new buildings, it will be possible to measure the actual performance of buildings constructed within the framework of the Part-Dieu project.

This data will then be translated into a map format and integrated into a geographic information system (GIS) to help measure changes in the global consumption of the district, through an energy carrier.

5. Implementation measures, key actors for future realization

As previously mentioned, the energy objectives of the Part-Dieu project relate to various diverse aspects: new buildings, rehabilitated buildings, networks (development of energy vectors, roll-out strategies, optimisation of demand via work on peak demand etc.), and production (development of the energy mix in the urban heating and cooling network).

For each of these aspects, an approach has been taken in the form of either a programme of actions, a reference framework, or a project scheme.

5.1 Energy systems and networks

Programme approach (changes in the shares of the various energy vectors)

To achieve the overall energy performance objective-doubling of constant primary energy consumption SHON, we must both work on the intrinsic performance of buildings and equipment, and also reflect on the energy mix of the district. This is one of the objectives of the task of scenario creation. For each scenario we can know the envisaged primary energy consumption and the renewable energy coverage rate. Moreover, these scenarios will be complemented by technical and economic studies which will reveal the costs involved in strengthening the network. This multicriteria analysis will allow the local community, together with the network operators, choose the energy mix that will help achieve the environmental objectives, while ensuring an economic optimum.

In addition, an important point was to reflect jointly on the development of the heating and cooling network. This will involve programming the future roll-out of this network and building a strategy to facilitate the connection of future buildings and existing buildings alike.

Reflection on reducing the peak demand and the fossil energy demand on the heating and cooling networks

On the heating network, fossil fuel is used during high demand periods. In order to reduce this consumption, hot water storage and smart systems are encouraged with the same strategy than the one used on electricity network.

On the cooling networks, the target is to avoid having the peak demand during the electricity peak demand, because all the production units run on electricity. To do so, cold water or ice storage are studied at La Fayette plant and the potential gains of this measure are studied in accordance with the whole modelling of the district electricity network.

The optimisation of demand and the management of electricity demand peaks

A study on the impact of the different scenarios on the electricity distribution network is currently being carried out in partnership with ERDF, Part-Dieu Mission, Hespul and Elioth. This study aims at estimating the need of strengthening the network involved in the urban project, and this for each scenario, in order to deduce the implied connection costs. Based on this study, Grand Lyon, together with ERDF and the Part – Dieu mission can implement a strategy to limit the impact on the network. For this, a certain number of actions will be carried out, from amongst the solutions currently being discussed :

- promote connection to the heating and cooling system
- impose restrictions on the developer regarding the connection capacities as is already done in energy performance in many projects
- implement centralised (e.g. storage of iced water on the cooling network) or decentralised (control of CAP-level storage buildings, etc.) erasure solutions
- educate users (residents, employees, etc.) to save energy, especially for specific electricity consumption.

5.2 Buildings, industry and services – framework and tools for energy demand and energy efficiency

Mixed development zone and possession of land

In most urban projects, the local community owns all or part of the land. If this is not the case, it may acquire it either directly or via the developer. The legal framework of the ZAC (Mixed Development Zone) allows the community to acquire land by expropriation if this proves necessary. When the local community owns the land, it may then impose the restrictions it wants on the prospective buyer of the lot (developer, landlord, etc.) via the Land Transfer (CCTT) specifications. This particularly enables the local community to impose strong energy, architectural and environmental requirements. In the particular case of Part-Dieu, the local community does not own the land and does not wish to acquire it. This therefore means that in the case of this urban renewal project, the local community cannot impose architectural and environmental performance requirements within the framework of the CCCT. Grand Lyon and Transform partners will therefore have to devise other more or less stringent levers to ensure the achieving of desired energy performances.

The production of a reference framework for environmental issues and for the energy performance of buildings

When the project was launched, the Transform project team and the Part-Dieu commission were aware of the need for action to improve the energy performance of existing buildings, whether for reasons of comfort and building value or to help Greater Lyon's energy/climate objectives to be achieved.

There was however no framework for acting on this will effectively, given that existing buildings in the district belong for the most part to private investors and also para-public institutional investors and public administrations.

Everything rested on finding out how to reach these investors and persuade them that substantial intervention was worthwhile.

The approach taken was based on two measures:

A reference document: the “Sustainable Part-Dieu” guide

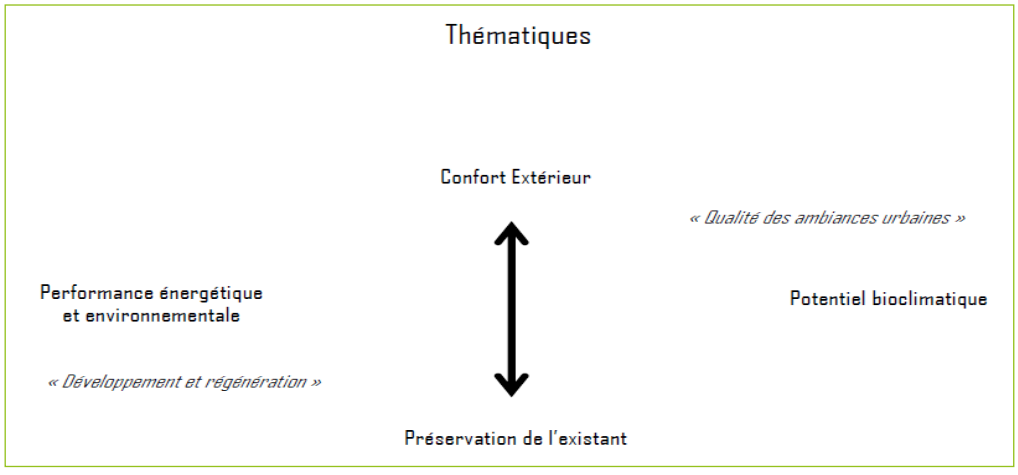
This document, produced by the environmental engineering office, a service provider to the Part-Dieu commission, in association with the Transform project team (Greater Lyon, Hespul) aims to highlight the environmental and energy problems associated with the Part-Dieu district and to propose requirements to be imposed on each project.

It should be stressed that the Part-Dieu district is the subject of a general sustainable development approach backed by Greater Lyon and its project team.

Indeed, the very significant increase in density envisaged will result in a far-reaching transformation of the district. From the environmental point of view, this increase in density will have a major impact, in particular on the quality of the public spaces and on access to light, sunshine and views from existing buildings.

The concept of sustainable development is based on 2 major themes:

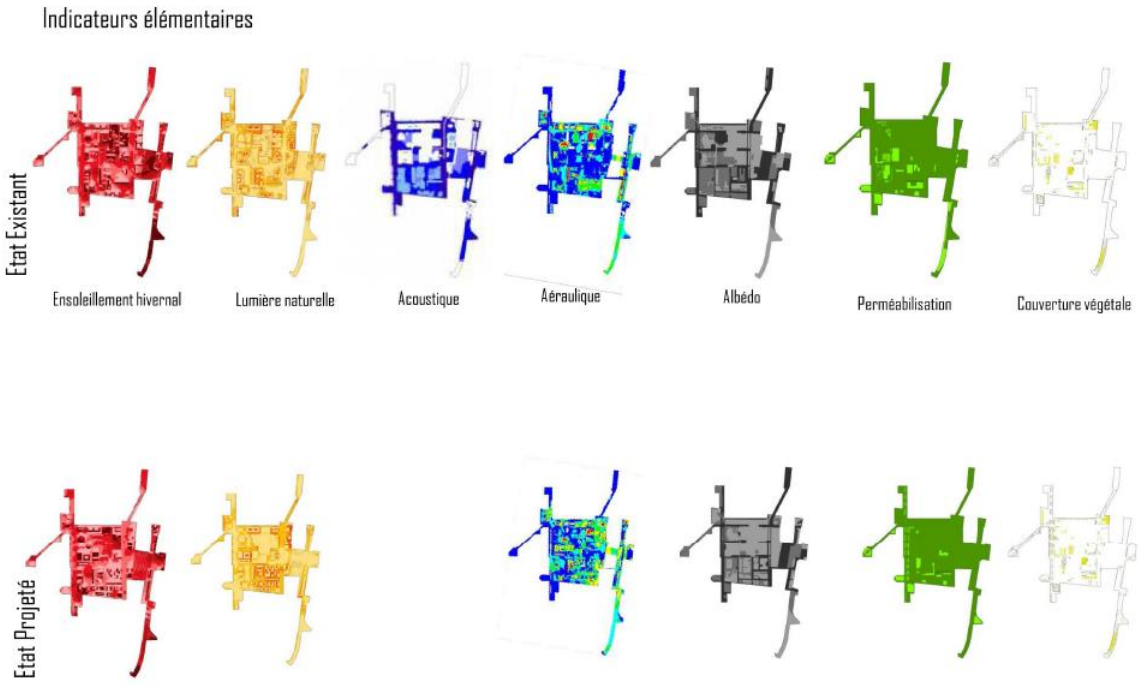
- ★ the quality of the urban ambiance, in particular by an analysis of the bioclimatic potential and the project’s impact on this potential,
- ★ development and regeneration, in particular by means of a global energy approach.



Quality of the urban ambiance

The guiding principle proposed aims to ensure that each new structure can make a positive contribution to the quality of the urban ambiance. It is therefore the responsibility of the project developer to have this aspect examined in a very detailed way by competent engineers.

A series of indicators allows the impact of any new building project on the quality of the urban ambiance to be estimated.



Each indicator must be assessed in terms of the existing situation. The project's impact on each criterion is assessed with regard to this reference situation and a score is awarded. This approach allows the project's impact on the quality of the urban ambiance to be quantified.

A global analysis is required at sketch scheme phase, and is updated when planning permission is applied for. A preliminary assessment can be made from the ambiance maps of the master plan.

As the contribution needs to be positive overall, a compensatory solution is to be put forward by the Developer where a particular quality of ambiance is poor.

Development and regeneration in particular by means of a global energy approach

The principle decided upon is that each developer, assisted by his project team, has to calculate the energy impact of their building project.

This approach involves calculating not only the overall energy of rehabilitated or newly constructed buildings but also that of the existing building in its initial condition, for reference purposes (embodied energy).

For each project, this reference calculation is to be produced on the calculation sheet entitled “Global Energy Approach of Project”, on the basis of data provided or on the basis of more specific and precise data, duly supported by an audit of the existing situation (for example).

The guiding principle of a constant global consumption for the district is rolled out at the level of each plot:

- In the case of a pre-existing building, relative to one m^2 of floor space, the final situation must represent a 60% reduction from the initial situation. The Project Developer may demonstrate the achievement of the 60% target by having this aspect examined in a very precise manner by competent engineers. An engineer can then use the “Global Energy Approach of Project” calculation sheet, which allows forecasts to be refined at each project stage by replacing the theoretical consumption figures used in the preliminary studies by more precise data. These data will come from engineering studies provided by the Developer by way of supporting documentation for the global consumption figures presented.
- For new structures, if it is difficult to establish a reference (bare plot, change of programme etc.), this objective is deemed achieved where the Effinergie+ energy performance level is reached.

Moreover, the Part-Dieu guide includes the sustainable residential and office reference guides of Greater Lyon which have been used since 2004 (version 1) and 2007 (version 2) for urban projects steered by Greater Lyon and for all social housing building.

These reference works define, in addition to a performance level to be achieved with regard to the various aspects of the environmental quality of the built environment (healthy materials, acoustic comfort, visual comfort, insulation etc.), a real environmental management approach rolled out at every stage of the project. The process for monitoring the application of the reference guides by developers and builders is described in item IV – 3.

The constitution of an authority to monitor the environmental aspect of new building projects

In order to monitor the implementation by developers/builders, of the sustainable Part-Dieu guide and the sustainable home and office reference guides, a tracking process was put in place by Greater Lyon, in conjunction with the engineering office responsible for monitoring the environmental aspect of the Part-Dieu project (RFR Elements) and the *Agence locale de l'énergie de l'agglomération lyonnaise* [Local Energy Agency for the conurbation of Lyon].

It should be stated that the *Agence locale de l'énergie de l'agglomération lyonnaise,* which is a non-profit association, has produced the reference works for Greater Lyon since 2004, and is responsible for a monitoring mission, on behalf of Greater Lyon, to ensure application of these reference guides.

The follow-through process can be summarised as follows:

- during operator consultations, the Part-Dieu mission produces a ⇨kind of meeting relating specifically to the project's environmental quality. The local energy agency and RFR Eléments assist the client and his project management in producing an environmental programme for the project and check that the bioclimatic, technical and structural choices will be able to raise the project to the standards required by the aforesaid reference guides.
- It should be emphasised that this measure was put in place in early 2014, in the context of WP 4 of the Transform project. Building schemes which were the subject of a consultation of operators prior to this date are not part of this configuration. The majority of them have developed label approaches (Bream or Leed) like the Incity tower, currently being built, which is seeking the following certifications in France: HQE® (Haute Qualité Environnementale), BREEAM® (Building Research Establishment Environmental Assessment Method) Excellent and BBC (Bâtiment Basse Consommation).

5.3 Local renewable energy sources

Reflection on the changes to the energy mix of the urban heating and cooling networks

The target is to increase the renewable and recovered heat sources within the energy mix of both network. Several solutions are currently studied, within the Part-Dieu area and outside.

On the heating network, Grand Lyon is willing to increase the renewable and recovered energy mix from 50% to 60% while doubling the size of the network. To do so, the construction of a biomass powerplant is planned by 2018. This power plant will be located outside the Part-Dieu area, and will complement the incineration plant which currently provides 50% of the heating demand.

In addition, the conditions to adapt the network to local low-temperature productions have been studied and a map of the potential from heat recovery in Part-Dieu district (data center, electrical power house of St Amour, Cold power house of La Fayette, heat recovery on sewage, mine water from car parks, etc.) has been produced.

On the cooling network, water from Rhône river or mine water from car parks could improve the efficiency of the production units.

Studies to identify the technical and economical feasibility of these opportunities are currently on-going.

5.4 Mobility

5.4.1 National and local framework

With 35% of energy consumption at the national level, the transport sector is the largest GHG (greenhouse gas) emitter, with 27% of total emissions in 2011. At the level of the Grand Lyon territory, this sector represents the first GHG emission position with 29% of total emissions and the third post in energy consumption (24%) after the industrial and housing sector.

It is within this context that the State set since 2009, goals and means of reducing GHGs via its national plan for the development of electric vehicles (EV) and plug-in hybrids, the Grenelle II law (July 2010) and attendant decrees and orders.

The government's goal, in 2020, is to see 2 million EVs circulating in France and attain 4.4 million charging points on-street and in private areas, with 90% to be installed in condominiums, main residences and office buildings. The new draft law on energy transition sets even more ambitious goals for the development of EVs, with 7 million charging points in 2030 and sets the framework for the development of a clean mobility in the broad sense. National legislation also imposes that 10% of parking spaces should be provided with charging sockets for EVs.

At the local level, the Grand Lyon PCET, has set a goal of 5% EVs by 2020. This goal, though less ambitious than the national one, allows locally to meet the 3X20 objectives while being more representative in the local context of the evolution of the EV Park.

In parallel Grand Lyon has embarked in its territory on a set of public policies intended to reduce the use of private cars and optimize the logistics around the transportation of goods in towns.

The steps taken particularly focus on the development of car sharing devices, car sharing platform, providing visibility tools in traffic, facilitating access to public transport, using soft modes via bike share services for example.

5.4.2 The Part-Dieu project

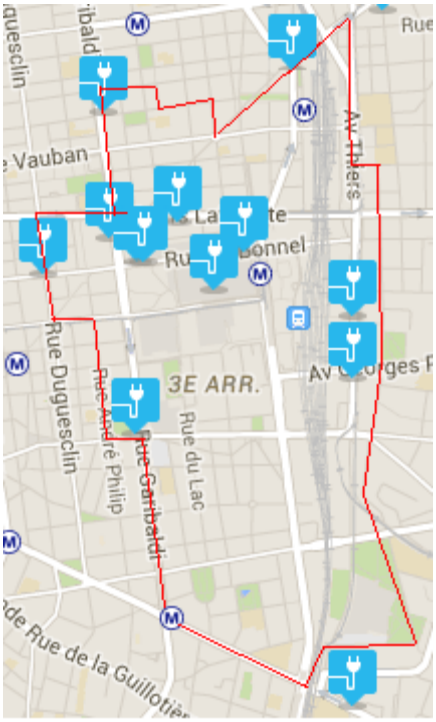
The Part-Dieu district with its bus station, high concentration of offices and its largest urban shopping centre in Europe is the largest transportation hub of Grand Lyon; in addition to the Part-Dieu station, where 120,000 people pass daily.

The district has a very dense public transport network (tram, bus, metro) as well as bikes and car sharing electric vehicles (paid service).

As part of the Transform project, we looked more closely at the EV deployment strategy in the area and the impacts they can have on the electricity distribution network.

To date, the Part-Dieu district has 5 normal EV charging stations (3 kVA) on public roads for the charging of every 5 car sharing EVs. Out of the 5 chargings, 1 is for the

public. The stations and the car sharing service are managed by a private operator Bolloré. Of the 7 private car parks accessible to the public, a total number of 16 normal charging sockets were identified. The total number of charging sockets identified in the car parks accessible to the public and the car sharing stations is 41.



Within the Part-Dieu area, a projection of local objectives for combined mobility with national regulations, allowed us to make projections on the development of charging sockets devoted to EVs within the urban project timeframe.

Additional developments would be:

21 additional charging points accessible to the public with 20 of them with normal charging (3 kVA) already under construction operated by Bolloré and 1 hypothetical fast charging point (50 kVA).

Between 600 and 1300 normal charging (3 kVA) points at the level of parking lots of buildings.

These assumptions have been incorporated into energy scenarios (Section 5.1) used to study the electric load curve of Part-Dieu by 2030.

5.5 Use of TIC and smart grids

Using the aforementioned energy scenarios (see section 5.1), French partners are leading a global study on the impact of the evolution of the district on energy networks. This study encompasses several studies led successively or in parallel, which are listed here and described further below:

- Study of pre-sizing subscribed power of all buildings to be constructed and refurbished in Part-Dieu by 2030 following the four scenarios
- Study of the technical and economical impact on the electricity grid of the evolution of the electrical subscribed power based on the pre-sizing study
- Study of the cold demand on the district cooling network in the four scenarios
- Modelling study of the electrical load curve of the Part-Dieu district in the four scenarios
- Study of the flexibility potential based on the analysis of the load curve

Pre-sizing subscribed power of all buildings to be constructed and refurbished in P-D by 2030

The land planner Mission Part-Dieu has mandated one of its consultants, Elioth, to realize a pre-sizing of the electrical subscribed power of all buildings to be constructed and refurbished in Part-Dieu by 2030 based on hypothesis of energy performance and energy vector (electricity, gas or district heating/cooling) used to supply the heat/cold/ hot water demand that are described in the four scenarios. For this, Elioth has used the available information on buildings provided by Grand Lyon, which often summarizes to surface area, type of activity (residential, offices, shops, hotels), and date of construction/rehabilitation.

Elioth has realized a first study based on its own sizing ratios. This first study has allowed partners In a second phase, Elioth will adjust ratios based on additional knowledge on high performance buildings provided by external parties and on actual subscribed power of four specific buildings in Part-Dieu. A sensitivity analysis will also done on parameters that are important sizing factors. This study is the first that uses the scenarios as a basis and hence leads to adjustments of these scenarios to provide contrasted prospective images of Part-Dieu in 2030.

Technical and economical impact on the electricity grid of the evolution of Part-Dieu district

Based on Elioth's study and on additional land planning data (indication of road works – when and where they will occur, etc.), ERDF will analyse the impact on the electricity grid of the new developments and plan the construction works needed over time. This study is part of the land planner's business as usual. However the originality of this work is that the analysis will be done over the four scenarios in order to highlight the different in grid reinforcement and extension costs both for the DSO and Mission Part-Dieu (in France, land planner pay 60% of grid development costs, which is then paid back by building developers, the rest being paid by the DSO and thus by all grid users through the distribution grid tariffs). Thus grid development costs will be another argument (in addition to energy consumption, greenhouse emissions, percentage of coverage by renewable energy, etc.) to orient political choice of one scenario over the other.

Furthermore, ERDF's analysis of the evolution of the grid will fuel further study on flexibility potential. Indeed, it may identify areas of constraints on the grid (undervoltage, congestion on a medium voltage line, etc.), which will then be further analysed by modeling a load curve and estimating the flexibility potential of a series of measures (control strategies, heat/cold storage, etc.).

Study of the cold demand on the district cooling network

Grand Lyon has missioned its district cooling engineering firm, BERIM, to analyse the cooling demand in the four scenarios, and deduce installed power needed based on different technologies (high performance heat pumps, different sources of cooling water, etc.).

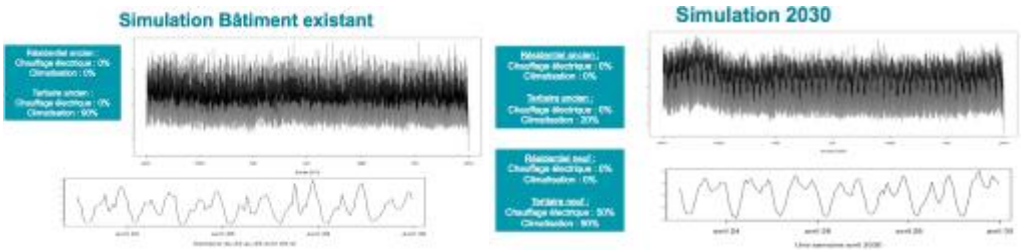
Based on these results and the analysis of the electrical load curve due to today's cooling demand on the district, different solutions will be evaluated, such as installing a large ice water tank in order to shift part of the demand outside peak hours. This work will fuel the study on flexibility potential.

Modeling study of the electrical load curve of the Part-Dieu district

ERDF has developed a simulation tool that takes in parameters on each building (surface area, age, level of envelope performance, number of stories, equipment description, etc.) and generates an electrical load curve. This tool is being tested in other smart grid projects in France.

In TRANSFORM, ERDF has tested it on one building operation that combines rehabilitation of a very large housing building and new construction of an office building. The load curves of the existing building and of the rehabilitated building + extension (see figure below) have been modelled for 2030. ERDF plans on measuring the actual load curve of the existing building in order to calibrate its model.

Figure 1: ERDF's "MOSAIC" simulation tool generates electrical load curve based on a series of the description of a building or series of building



Here the exercise is done on a existing building (left image) and on the building rehabilitated and extended with offices (right image).

The next step is to model all buildings in the Part-Dieu district in order to generate a district load curve. On the existing buildings, ERDF will use Hespul's diagnosis of usages covered by electricity, which has been deduced from an extensive analysis on date of building construction, annual energy consumption of the three vectors (gas, electricity, district heating/cooling) and other parameters. In addition, ERDF will use all available information on future building operations. This is an opportunity to test the strength of the model when few parameters are available. Indeed, for new operations starting after 2020, there is very little that is known (surface area, distinction between residential/shops/hotels/offices, date of construction). More is known on rehabilitated buildings.

The results of this study may also be crossed with Elioth's estimation of subscribed power for future and rehabilitated buildings. Since methods are quite different, differences may appear but should be of a reasonable magnitude.

Based on load curves generated by ERDF and the analysis of potential constraint zones on the grid, a more in depth work will be done on the aggregated load curve of certain buildings in other to highlight flexibility potentials. This work will also take into account the load curve of the district cooling network.

Reliability (immediate and over time) and costs (implementation and maintenance) of identified solutions will be compared with grid reinforcement and extension costs.

5.6 Other important issues – A process intended for the district's economic stakeholders

The Club des Entreprises de Lyon Part-Dieu [Lyon Part-Dieu Business Club] was born in May 2012 from a meeting of businesses in this area based on shared views about the economic, urban and operational challenges of France's second business district. In particular, it allowed a discussion process to be engaged with the Part-Dieu commission on the Part-Dieu urban project, in which the businesses wished to be stakeholders. The preliminary reflections allowed the Club's 3 major objectives to be identified:

- a **sharing of experience** in practices in the district (with regard to transport, services for employees, changes in the building stock and the environment) to move towards greater innovation and mutualisation,
- **the expression of the business' expectations** with regard to the transformation of the district,
- **the upgrading and promotion of the district** to help with its development and that of the metropolis of Lyon.

In mid-2013, the Transform project team approached the Club Part-Dieu to propose a framework of exchanges about the energy challenges linked to the Part-Dieu project and the existing business activities in the district.

The objective sought was to engage in a debate and a sharing of the thinking as to the expectations of the various stakeholders with regard to energy and regarding the role which the businesses in the district could play in the achievement of the 3X20 objectives.

The first stage of this partnership approach took the form of a conference, debate and presentation of the Transform project and what was expected of it:

- presentation of the energy objectives and the energy transition process sought,
- avenues for consideration as to the energy choices for the district (supply, distribution, innovation relating to smart grids),
- collaboration sought with the district's economic stakeholders to understand the challenges relating to the existing building stock and energy, the key decision-making factors in favour of major rehabilitation, raising awareness among employees about the energy issues associated with the workplace and building operation/maintenance.

A second conference was held in April 2014, relating to Greater Lyon's tools and policy with regard to sustainable development and more particularly in favour of building performance (sustainable residential habitat and office reference guides).

At this conference, Greater Lyon asked the members of the Club Part-Dieu to attend Lyon's Intensive Lab Session in the month of July 2014 and in particular the themed workshop no. 2 "Operation/maintenance and awareness-raising of users".

This workshop covered all the regulatory tools and practices in force by the economic stakeholders of the Part-Dieu district on these issues.

ILS 02/07/2014
Operation/maintenance/awareness-raising of users
Workshop agenda

Morning

1. *Presentation of the example of the Part-Dieu tower*

- *What are the actions currently underway with regard to management/operation/maintenance?*
- *Are changes expected in the near future? If so, what are they?*
- *What difficulties have been encountered?*
- *What is the nature of the operation/maintenance contract? Is there a profit-sharing part? Are we moving toward a model energy performance contract?*
- *What is the position with regard to CPE?*
- *Does the Part-Dieu tower benefit from an operating/maintenance certification? HQE operation, BREAM in use?*
- *Are awareness-raising actions for employees being conducted? If so, what are they? Green options leaflets?*

2. *Discussion about new regulatory tools, in particular the green lease.*
- ★ *Is the green lease a fad or a real lever available to developers/managers?*
- ★ *Feedback of experience about how a developer has approached the issue of the green lease*

3. *Discussion about the certification procedure*
- ★ *What can the operation/maintenance certification bring for a developer/manager?*
- ★ *Does the certification improve the operation/maintenance conditions of a building?*

Afternoon

1. *Commissioning/putting in place operation/maintenance contracts.*
- ★ *What tools help facilitate this key stage between installer and operator? How to prevent and manage disputes?*
- ★ *Focus on contracts: profit-sharing, energy performance contra (CPE).*
- ★ *Discussion on the issue: What would be the ideal contract from the point of view of the various stakeholders?*
- ★ *How should a contract be written where it aims to optimise the energy performance of a building and to reduce its consumption?*

2. *Awareness-raising measures for employees.*
- ★ *Feedback of experience from an approach to raise the awareness of occupants, and presentation of a behaviour application intended for tenants in low-rent housing*
- ★ *Feedback of experience from an example of employee training and on the family approach to positive energy*

Discussion: How to change behaviours (incentivisation/rules)?

What would be the content of an appropriate training offer for people working in office buildings?

To follow up on the Intensive Lab Session, further exchanges are planned with the Club Part-Dieu in the forthcoming months in order to assess the chances of putting ideas into practice, either in terms of rehabilitation of the existing building stock or in terms of employee training/awareness-raising in the area of controlling energy usage at the workplace.

6. Reflection – preliminary assessment

6.1 Social impact of new developments

Changing the image of the Part-Dieu district

A bustling district, Part-Dieu has the benefit of being very well known. Anyone living in Lyon and many from further afield are familiar with its name, and even use it to refer to the station or the shopping centre. The major asset of this site is its functionality: in Part-Dieu, people shop in one of France's largest shopping centres; they catch a train in the biggest station outside of the Ile-de-France in terms of passenger numbers; or they go to work there in the business district. As the station is right next door to Lyon's major multimodal hub, close to 500,000 journeys are recorded on the site every day.

But at present, the functional values of Part-Dieu seem rather devoid of impact. This is demonstrated by studies on perceptions of this district: Part-Dieu has little in the way of emotional value and, where it does, the value tends to be unpleasant. People swing from hyper-busy to total quiet, via a "stressful" district to a "boring" district. Indeed, the environment offered by Part-Dieu evokes stress and rushing, or a deadly dull ambiance outside business hours.

Part-Dieu has such strong functional values that they prevent its image from being too bad. Part-Dieu is efficient in all the services it provides to the Metropolis, although to obtain these services, people have to enter an urban sequence which can be unpleasant. The feeling of satisfaction for the service provided is stronger than any feeling of attachment.

The urban project thus set itself an objective of upgrading the urban ambiance, the quality of life and the use of the district which in the medium term should allow an improvement in the urban and social perception of this district by the people of Lyon and others alike.

Increasing the real-estate and utilisation value of housing and tertiary buildings

The building stock of the Part-Dieu district, mostly comprising buildings from the 1960s to 1980s, suffers from obsolescence both in functional terms and in terms of energy

performance. The tertiary buildings in particular are no longer adequate for current working conditions.

The planned rehabilitation programme should allow this built heritage to be brought up to standard and thus improve the comfort of use, and reduce energy costs while at the same time increasing its financial value.

Improving travelling conditions within the district

The Part-Dieu project puts a great deal of emphasis on the need for “easy ground”, i.e. to improve the clarity of the district to help people travel and find their way around.

The concept of separating flows (pedestrians, motor vehicles) which led to a podium-style urban development needs to disappear in order to restore to everyone the use of the real ground level.

Moreover, the aim sought is to make the Part-Dieu district ultra-connected by new real-time information systems – contemporary signage, interactive terminals, mobile apps etc. The traveller will be able to combine modes of transport “à la carte”, resulting in greater convenience and safety.

Moreover, Lyon Part-Dieu station will be opened up to the city and double in area to become a station that is used like a public space. There will be greater access to the platforms via a new station entrance and the intermodal connections (vehicle hire, taxi ranks, bike parks etc.) will be better distributed around the road terminal.