



The French network of
public and private stakeholders
for sustainable cities

Innovative solutions for sustainable cities

Integrated urban utilities



URBAN INNOVATION IN THE FIELD OF INTEGRATED URBAN SERVICES

/// BACKGROUND: WHY TAKE ACTION IN THE AREA OF INTEGRATED URBAN SERVICES?

► Increasingly urban

Between 1950 and 2050, the world's urban population will have grown from 1.5 billion to nearly 10 billion. Between 2000 and 2050, more than 3 billion people will have settled in cities.

► How urban areas contribute to CO₂ emissions.

Urban areas are home to three major factors conducive to CO₂ emissions and lower air quality: automobile-based mobility (2/3 of the total), housing (80% of total) and tertiary buildings (80% of total). Urban areas generate 70% of total greenhouse gas emissions.

► Demand for urban services

In addition to the considerable demand for urban services, the quality requirements set by global guidelines (in particular European) require major investments, which befall the public and private operators. The issues of governance, management modes, and network performance are gaining prominence, due to tighter environmental standards and rationalised local organisation concepts. All of these imperatives combined make it a necessity to rethink cities as whole urban units, in particular as regards parking, mobility and real estate, as well as the creation of future urban services through integrated approaches (frequently referred to as Smart Cities) during land planning projects.

/// WHAT ARE THE MAIN AREAS FOR INNOVATION WHEN IT COMES TO INTEGRATED URBAN SERVICES?

The challenge for urban services will thus be to move away from traditional sector-by-sector building-block thinking to put forward a comprehensive approach, consisting of innovative and structure-building projects, in line with sustainable development targets, and the local industrial, agricultural and craft sectors, all of which are energy transition catalysts. France's offers also shine for their expertise in choosing the right optimisation strategies for steering urban services and reflect the many benefits that can be gained through good cooperation between private and public players which it proudly champions. While the methods for integrating them continue to be developed, innovation in urban services can already be defined as falling within one of five major categories:

► Urban area design and the environment

Water cycle management; material recycling; work-stream and complex project logistics; dynamic environmental modelling and simulation tools; digital design and monitoring tools for urban projects; land planning incorporating ecosystem services in cities, heat island effect reduction, phytoremediation of polluted soils, local agriculture, etc.

► Buildings and usage

Demonstration buildings or islands offering high environmental performance, reduced energy consumption and reduced greenhouse gas emissions; building modelling and monitoring with a view toward improv-

ing management and ownership by users of building functionalities (digital tools and services, etc.); use of local resources to lower grey energy consumption, etc.

► Energy and grids

Energy-efficient, low-GHG urban grids; renewable energy production and co-generation; fatal energy recovery systems; energy storage; short-cycle power distribution to prevent loss; smart grids and smart metering systems; behavioural change and user support.

► Mobility

Public recharge infrastructures for electric vehicles; shared vehicles, car-pooling; real-time information systems; facilitated inter-modality via single ticketing, mobility plants, etc.; shared parking; logistics and distribution via intermodal platforms in densely-populated areas, digital platforms, carbon-free fleets, access management, etc..).

► Innovative urban services

Digitisation and creation of urban databases; smart management for public grids and systems (lighting, etc.); domotics and home care services; optimised waste collection and sorting systems at the EPCI level; access control or vehicle flow management systems.

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

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

► At the neighbourhood level, **the national ÉcoQuartier label** has been designed to encourage an integrated approach to the technical aspects of sustainable development: water, waste, biodiversity, mobility, tempered energy use and renewable energies, urban density and forms, and ecoconstruction;



► **The Investments for the Future Programme** has earmarked 668 million euros for this area, managed by the Caisse des Dépôts. “Ville de Demain” has been working since 2010 across 31 territories, including 13 in the Ile-de-France Region on integrated urban projects aimed at building attractive and resilient cities that preserve the environment, social cohesion and quality of living for residents, all stellar examples of environmental excellence and innovation in major French metropolitan areas.

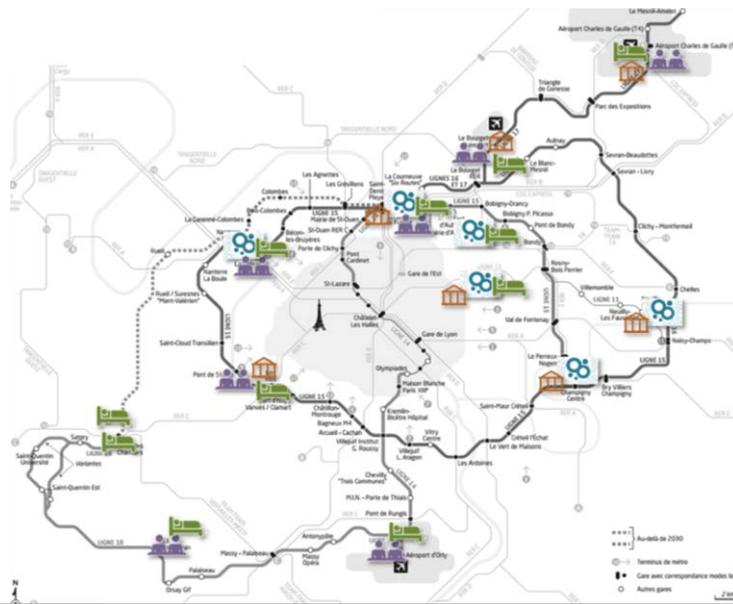


► **Sustainable cities and territories.** The central aim of this call for projects is to spark creative responses to the challenges raised by sustainable cities (building performance, energy and environmental approach, mobility, etc.), and thereby improve quality of living (and available spending budget) for residents. **The Investments for the Future Programme** has been endowed with 71 million euros in subsidies to support the most innovative initiatives developed in 20 selected neighbourhoods.

► **The “Integrated Territorial Projects for the Energy Transition”** project is aimed at enabling “Positive Energy Territories for Green Growth” initiatives, as well as consolidating local, industrial, agricultural and craft-sector undertakings, all energy transition catalysts. Loans to SMEs are available through this programme to the most exemplary projects enabling innovation or energy performance.



Work group run by **Franck Faucheu**,
Ministry of Housing and Sustainable Homes, with:
Amandine Crambes, Ademe,
Jacques Perrochat, Schneider Electric,
Adrien Ponrouch, TERAQ.



-  Potential site for accommodation
-  Potential tourist / cultural / leisure site
-  Potential business tourism site
-  Potential urban destination



GREATER PARIS AND TOURISM

URBAN ENGINEERING TOOLS TO PUT AHEAD TOURISM AS ATTRACTIVENESS'S OPPORTUNITY WITH THE GREAT PARIS!



In the context of the implementation of the "Grand Paris" (Greater Paris) project, in particular its transport (Grand Paris Express) and institutional components (Métropole du Grand Paris), Artelia considered the changes in the tourism sector in the world's leading tourist destination in relation to the development of the metropolitan region.

This research pinpointed the potential impact of the Grand Paris Express metro on tourism and the accessibility of the different areas in order to develop innovative transport offerings. Urban projects in the vicinity of the "super metro" stations will provide significant opportunities for development. The institutional changes undergone by the "Métropole" provided insight into the catalysts for developing tourism.

These changes bring new opportunities for the tourism and leisure sector, raising the profile of Greater Paris for tourists and local inhabitants alike.

INNOVATIONS

► **The theme of "developing tourism in Greater Paris" to understand the challenges for the future metropolis:** surprisingly, tourism had not been included in the (political and institutional) debate triggered by the Greater Paris project despite the fact that it is one of the area's main economic activities.

► **Analysis and assessment of the tourism sector and the development issues:** this was done on the scale of "Paris" as a destination perceived and experienced by tourists themselves: it thus includes the entire Greater Paris area ("Ile de France") and some sites further afield (Giverny, Mont Saint Michel, etc.).

► **Simulation of the new areas that will open up to tourists thanks to the GPE metro:** these were illustrated in two accessibility maps showing the places located within 45 min and 1 hour from Paris city centre, one with the current public transport provision and the other with the future GPE.

► **Cross-analysis of transport/accessibility/urban project approaches to identify the "spaces" with high tourism potential.** The locations with the most potential in these areas, to be enhanced by developing tourist accommodation, business tourism as well as tourist, cultural and leisure facilities, were also identified.

STAKEHOLDERS

► The study was undertaken by Artelia but it is intended for many public- and private-sector players concerned by Greater Paris.

► This assignment led on to the organisation and coordination of a conference in April 2016, which was co-organised by Artelia and CNAM. It addressed the topic of "How can Greater

KEY DATA

- **Greater Paris:** world's leading tourist destination
- **Three major internal changes:** major projects, a new governance with the Greater Paris metropolitan authority and enhanced access to the region with the Grand Paris Express metro
- **New trends in the tourism sector:** safety concerns, technological development, growth of the collaborative economy, changing customer requirements
- **High-profile attractions:** 75 million visitors to the top 10 attractions in Greater Paris.

Paris help France maintain its position as the world's leading tourist destination?". The working group presented its innovative findings to the (public- and private-sector) local and tourism-sector players, who are all concerned by the implementation of the Greater Paris project.

This presentation was completed by a debate on the resources and methods for realising this potential for tourist, urban and social development.

IMPLEMENTATION

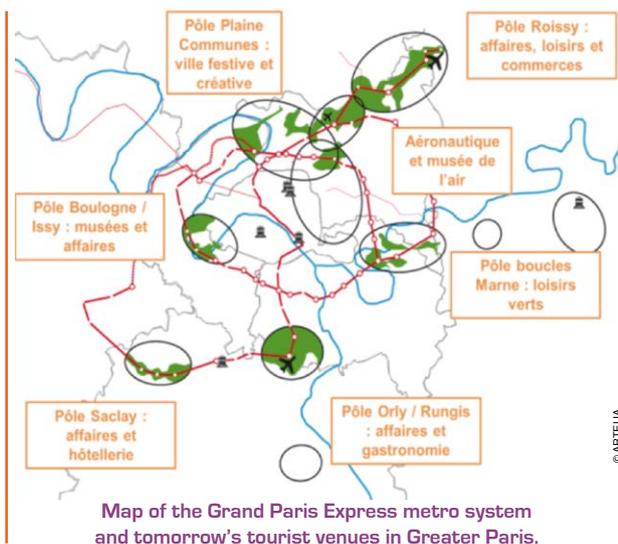
- ▶ **Identification of the most significant tourism, leisure and retail projects** on the scale of Greater Paris, including a cross-analysis with the areas made accessible by the GPE metro.
- ▶ **Production of the future accessibility map** based on data from studies simulating travel times from GPE stations and an existing application that calculates pedestrian journey times.
- ▶ **Production of opportunity maps**, by cross-analysing supply, demand, accessibility and real estate aspects.
- ▶ **Organisation of a conference** in partnership with CNAM to present the results of the research and open the discussion to other players.

Matthieu LEVY,

Senior consultant in Artelia Ville & Transport's tourism & leisure department

“ The Paris metropolitan area is a destination undergoing profound changes; it must make the most of the new potential from improved accessibility to develop tourism throughout Greater Paris. The high-potential tourist attractions identified during our study complement and reinforce Paris' existing wealth of attractions and facilities. The objective is to provide a destination geared even more closely to customer expectations, particularly for "repeaters", in order to maintain or even reinforce Paris' position as the world's leading destination, faced with increasingly fierce international competition. The sector now needs to invent innovative or alternative offerings geared toward tourists who are immersed in digital technologies and looking for something out of the ordinary. **”**

RESULTS



/// Reinforcing the economic appeal of Greater Paris: targeting the tourist potential of the Paris metropolitan area is a means of boosting economic development and creating thousands of direct and indirect jobs.

/// Stronger social cohesion: this includes identifying the potential for developing leisure activities, improving the living environment and creating jobs for youngsters joining the professional world or people rejoining the labour market. This feeling of benefiting directly from the spin-offs of tourism in Greater Paris gives local inhabitants a renewed sense of pride in these places thanks to the fresh perspective brought by tourists visiting their city.

/// Publication of an article entitled "Innovation: Greater Paris, the laboratory of tomorrow's tourism in France?" in the Espaces magazine (publication specialising in tourism and leisure), in the context of the "Reinventing France as a tourist destination" survey.

FINANCIAL ASPECTS OF THE OPERATION

KEY FIGURES

- 445.9 million tourists per year (French & foreign)
- 170.8 million bed-nights per year
- 20.8 billion euros generated by tourism per year
- 122 euros: average amount spent per day per tourist

/// The study was funded by Artelia.



COVERING OF AN URBAN HIGHWAY AND NOISE MITIGATION MEASURES IN A DENSE SETTING

A6B MOTORWAY: REDEVELOPMENT OF THE SOUTH ENTRANCE TO PARIS



The A6b motorway was brought into service in 1969 without any particular covering measures to reduce noise. It is now used by more than 110,000 vehicles daily. As well as creating a spatial barrier, the motorway exposes more than 10,000 local residents to significant levels of noise and pollution.

The urban redevelopment project including building a noise-mitigating roof over the A6b was launched in 2008 and completed in 2014. It was necessary in order to improve the safety of this obsolete infrastructure at the south entrance to the city.

The particular feature of this innovative, highly technical project is the 1650-metre length of the roofing, which alternates between complete and partial coverage.

INNOVATIONS

- ▶ **Reconciling compliance with standards and urban development needs:** the motorway roofing alternates between semi-covered structures to avoid having to comply with standards applicable to tunnels (for lengths exceeding 300 metres), which would have resulted in a colossal project with astronomical costs.
- ▶ **Reducing noise with roofing suited to an urban environment:** 5 heavyweight structures, 2 lightweight structures and 4 "latticed" noise reduction slabs were placed alternately over the 1650-metre length. Lastly, 3 new road bridges were created.
- ▶ **Extracting fumes while keeping in the noise** in the open sections, thanks to a highly innovative ventilation system.
- ▶ **Preventing sun glare in the partially covered sections:** Thanks to Artelia's stroboscopic studies, the angle of slab tilt was adjusted meticulously in order to prevent drivers being dazzled by the sun.

KEY DATA

- Noise pollution was affecting more than 10,000 people
- A motorway used by more than 110,000 vehicles daily
- 1650 metres of roofing spanning 3 localities in south Paris: from the "Poterne des Peupliers" crossroads (located in Gentilly and Le Kremlin-Bicêtre) to the RD61 road at the "Quatre Chemins" crossroads (located in Arcueil).

▶ **Safety improved thanks to remote surveillance:** "Smart" cameras were installed in order to improve the surveillance system on the A6b. Visual displays of traffic disruption enable operators to respond more quickly in the event of an incident.

▶ **A sustainable construction programme:** The work site had a responsibility to limit noise, treat wastewater and dispose of waste through appropriate channels. New jobs were also created during the works, promoting employment in the Val-de-Bièvres urban area.

STAKEHOLDERS

▶ The Greater Paris Regional and Interdepartmental Infrastructure and Development Agency (DRIEA) conducted the operation in close collaboration with the Greater Paris Roads Directorate (DiRIF), and in association with engineering firms specialising in bridges and tunnels.

▶ The process of designing and building the motorway roofing successfully involved the



MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET SOLIDAIRE

MINISTÈRE DE LA COHÉSION DES TERRITOIRES

departmental and regional councils, the local authority and the local residents. As a consequence of these consultations the project was shared and hence accepted, in spite of the disruption caused during the works phase.

- ▶ A highly collaborative methodology was chosen in order to share, validate and evaluate the research and innovations deployed.
- ▶ Artelia Ville & Transport, lead firm and engineer for the entire project, was involved from the preliminary design studies through to acceptance of the works.

IMPLEMENTATION

- ▶ **The location of the project made the works particularly complex.** The works entailed completely closing one carriageway of the motorway (south-bound) for several months as well as both carriageways during the night on multiple occasions. The towns concerned had to face constraints relating to the removal of parking spaces and reduced pavement and road widths. A temporary car park was created to partially offset the shortage of parking spaces.
- ▶ **The time taken to complete the roofing was reduced from 36 months to 20 months,** because the constraints of

this exceptional site required lead times to be significantly reduced.

- ▶ **A vast-scale communication campaign** was implemented to inform drivers and local residents of changes to traffic flows and the progress made with the works.

Laurent VIGNEAU,

Innovation Director at Artelia Ville & Transport.

“ The A6b is a perfect illustration of the way we address ultra-complex technical, regulatory and economic issues thanks to major world-class innovations. It also illustrates the way we manage works with impressive reductions in lead times and impacts. Most of all, we gain satisfaction from successfully optimising the trade-offs, from inception through to commissioning, to give 10,000 local residents the best possible living environment. They also benefit from the user-friendly redevelopment of the spaces on top of the roofing. ”

RESULTS

/// **Covering a long section of motorway while avoiding having to comply with regulations applicable to tunnels.**

/// **Significantly improving the inhabitants' living environment** thanks to the substantial noise reductions brought about by covering the motorway and to the new urban development and landscaping measures (new public spaces on the covered-over area, landscaping and cycle paths). This has created an attractive environment that will enhance the inhabitants' well-being.

/// **Restoring urban continuity between Gentilly, Le Kremlin-Bicêtre and Arcueil has sparked real social cohesion** between the three towns, reviving exchanges between local inhabitants who were previously separated by the motorway.

/// **The success of this operation is a good example of how an urban expressway can be integrated** into a dense urban environment from the standpoints of the technical issues involved and the development of public spaces.



FINANCIAL ASPECT OF THE OPERATION

- Budget of €125m, of which €60m for civil engineering aspects of the roofing and €20m for safety
- 4 years of consultations and 10 public meetings with local residents
- 20 months of works
- 7 months of motorway closures
- 40% of materials from motorway demolition works recycled in-situ

/// The cost of the operation was 125 million euros. It was co-funded by the State (36%), Ile-de-France regional council (32%), Val-de-Marne departmental council (25%) and the Val-de-Bièvres urban area authority (7%).





LA MANTILLA, CITY BLOCK DEMONSTRATOR

A 32,000 SQ. METER CITY BLOCK FEATURING APARTMENTS, OFFICES, AND BUSINESSES, BUILT ON EXEMPLARY ENERGY INNOVATIONS: HIGH-PERFORMANCE CONSTRUCTION, RENEWABLE HEATING AND AIR CONDITIONING, AND DISTRIBUTED INTELLIGENCE.

This program covers a floor surface area of 32,000 sq. meters, combining apartments and offices, with businesses on the ground floor. This group of buildings comprised an ideal setting for practical applications of the various innovative actions in the EcoCité City of Tomorrow project, notably:

- *High-performance construction, exceeding thermal regulations.*
- *The first building equipped with renewable heat and air conditioning sources.*
- *A system of digital information exchange to optimize the distribution and use of energy.*
- *Engaging sustainable behavioral changes.*

This program is comprised of seven buildings, placed across the commercial lots, with the ground-floor and parking garage as a foundation. The buildings are organized around a vast central block area featuring nearly 2,000 sq. meters of green space.

Installed since May 2015.

INNOVATIONS

► La Mantilla assets:

- Heating and air conditioning originating from over 80% renewable energy.
- A large part of energy needs compensated by wood co-generation electricity production.
- The goals of EcoCité city block demonstrators focus on energy performance, shared energy consumption, and connection to a common network. It leverages a mechanism of "distributed intelligence".

STAKEHOLDERS

- The City of Montpellier, originator of the major urban Port Marianne project.
- SERM, the Montpellier Regional Development Company, responsible for developing the Jacques Coeur district and project owner for creating the parking garage.
- Caisse des Dépôts, as part of the France's "Investments for the Future" program, on behalf of the State.
- Montpellier Méditerranée Métropole, as part of its EcoCité and Smart City projects.
- **Project owners:**
 - Bouygues Immobilier, developer and agent for the project team.
 - Sogeprom Commerce & Services, developer.
 - PragmA, developer.
- **Social housing operator:**
 - ACM – Office Public de l'Habitat de Montpellier Méditerranée Métropole.
- **Architects:**
 - Jacques Ferrier, chief architect.
 - A+ architecture, associate architect.
- **Design office:**
 - André Verdier, structural design.
 - BETSO, fluid design.

IMPLEMENTATION

- ▶ This city block provides an opportunity for real-life testing of new forms of sustainable city development for the city of tomorrow.
- ▶ The combined block, with housing, activities, and commerce, is a way to optimize the use of space for city's various time-frames for specific uses, including connected urban services benefiting from digital solutions in real-time: energy, parking, car-sharing, urban transportation, waste management, and more.

KEY FIGURES

- Created on top of a 738-space parking garage, this combined property program with 32,000 sq. meters floor surface includes:
 - 407 apartments
 - 3,500 sq. m of offices
 - 5,700 sq m of street-level businesses

RESULTS



/// High-performance construction, exceeding thermal regulations.

Building design was the focus of particular attention to ensure effective control over energy consumption in both summer and winter.

/// The first building equipped with renewable heat and air conditioning sources.

La Mantilla gets its energy from a tri-generation plant that produces renewable heating, cooling, and electricity simultaneously. With all of these high-performance components, La Mantilla leverages green sources for over 90% of its energy for heating, and over 50% for cooling.

/// A system of digital information exchange to optimize the distribution and use of energy.

The Smart Network system was developed at the city block scale. It collects and manages data from over 1,000 sensors (hot water, cold, electricity, and more) installed in each apartment and building access controls. The network also integrates outside data, such as: weather, tramway schedules, underground parking, and more.

/// This information is transmitted to residents and users via videophones in their apartments or at a dedicated site. A powerful tool for steering and managing consumption, this interface is available to residents, building managers, and concessionaires. It also enables new digital services to be deployed.

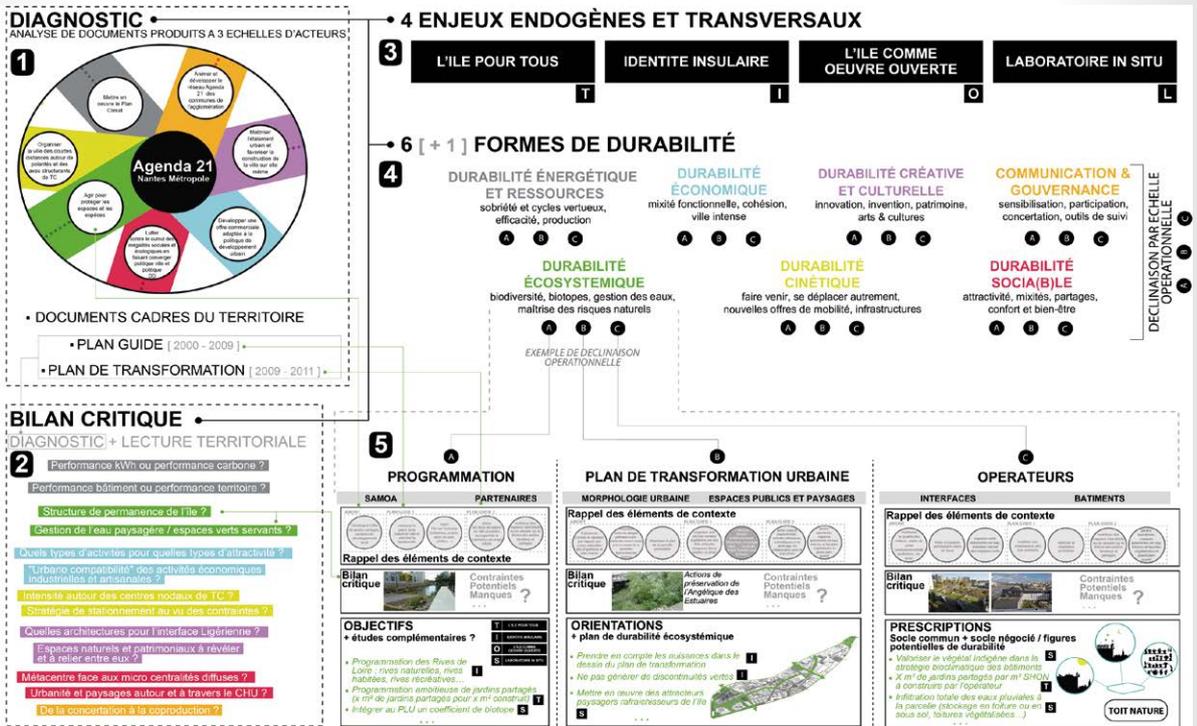
/// Engaging sustainable behavioral changes. While data restitution systems are highly useful, they alone are not enough to change people's behavior profoundly. As such, personalized assistance leveraging a GD6D system provided by the company E3D, seeks to sustainably modify residents' practices in terms of eco-citizenship and help them reduce their environmental impact visibly while encouraging people to live together. Above and beyond individual assistance efforts, collective moments create a collective synergy that benefits all participants. In order to evaluate the method's impact, consumption by similar groups is being studied at the same time.

FINANCIAL ASPECTS OF THE OPERATION

/// La Mantilla is an EcoCité action that benefits to a large degree from financial aid for the "City of Tomorrow" program, part of France's Investments for the Future managed by Caisse des Dépôts on behalf of the State.

→ Overall program cost: 35 M€ (pre-tax)





ISLAND LABORATORY

AMO DD: WRITING OF A SPECIFIC CHARTER OF SUSTAINABLE DEVELOPMENT FOR THE ISLAND OF NANTES

The second phase of development of the Island of Nantes. Assistant project manager for Sustainable development: writing a specific charter of sustainable development, and elaboration of a negotiated prescription methodology based on figures of conception / design or « figures of durability » to insure the continuity of the reflection already begun during the Plan Guides 1 of Alexandre Chemetoff.

INNOVATIONS

- ▶ The mode of prescription regarding sustainable development on the scale of the operation is the object of a negotiated approach.
- ▶ The CPEDD acts as a first frame of prescriptions, non mentionless frame, that must evolve with projects, depending on the opportunities and constraint wich will be revealed according to the aspiration of the future occupants, to the architectural, design, landscape, technical choices, wich will be expressed at the competition stage. The objectives of the method is to make stakes environmental not constraints which are imperative upon the operation but of advantage, elements of integrated and shared projects. The insurance of consideration of the requirements of sustainable development is allowed by a follow-up, realized by the SAMOA and its AMO.

STAKEHOLDERS

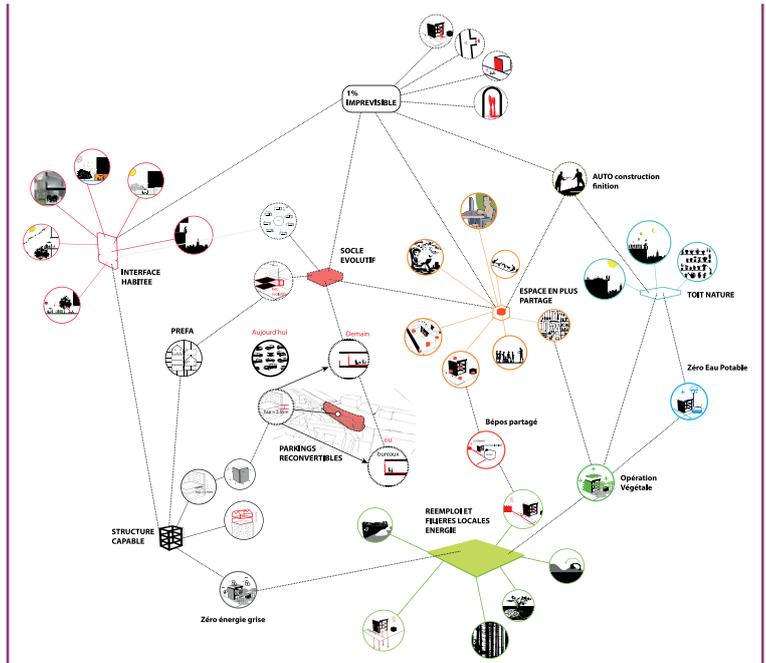
- ▶ For the charter:
 - Clients SAMOA
 - Urban planners: Marcel Smets + UAPS
- ▶ For the organization and lead of the workshops:
 - Clients SAMOA
 - Assistant project manager: Franck Boutté Consultants

WORKSHOPS'S THEMES

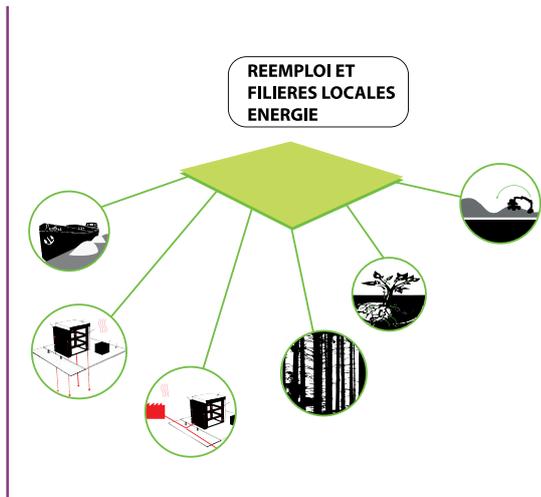
- Energy Supply with the stakes of Smartcity
- Alternative Management of rainwaters, landscaped atmospheres, biodiversity
- Alternative Management of waste
- Alternative Mobility

IMPLEMENTATION

► The method forms itself around mandatory requirements and negotiated requirements. The specificity of the prescriptions also lives in the proposal of a specific peculiarity, taking the shape of a figure of potential sustainability. The figures of potential sustainabilities are concrete translations of the ambitions of sustainable development. They are transverse and solve widened problems. They are in connection with the prescriptions; every figure lights several prescriptions, in a logic of transversality. For designers, choose one or several figures, it already is to begin to rank the projects expectations.



RESULTS



/// To implement the opened prescriptions the Franck Boutté Consultants agency with SAMOA organizes and leads several series of workshops: at first with the planners, the services administrators (Nantes Metropole) and the promoters to share the ambitions and free bolts between design and management guaranteeing the impact strength of the projects and the responsive use for resources. Secondly, workshops between planners, real estate operators and representatives of the civil society are going to be organized to present and share the qualities of uses and the environmental innovations brought to the projects. This second series of workshops also allows to lead actions of pedagogy with the aim of impeding virtuous behavior on behalf of the future inhabitants by making sure of the good understanding of the ambitions of project allowing well to be and social cohesion.

/// Label: **Ecocité**

FINANCIAL DIMENSION OF THE OPERATION

/// Amount: €3.50/m²

KEY DATA

- Surface 337 ha
- Project date
 - 2013- 2014 Charter
 - 2015- 2016 Workshops



HUBLO: HYPERVISION OF LYON MÉTROPOLE'S DRINKING WATER SERVICE

CONTINUOUS GLOBAL SUPERVISION OF THE DRINKING WATER SERVICE FOR METROPOLITAN LYON

To improve the performance and drinking water services for the city, a new tool for centralized, overall supervision of the system in real time was implemented on February 3, 2015.

Known as HUBLO, this software runs 24 hours a day, seven days a week, on a secure and robust technical architecture. Lyon Métropole and Eau du Grand Lyon services are able to access it in real time from the operational hub.

INNOVATIONS

► HUBLO allows real-time access to information from all functional areas related to providing service, in particular information related to remote management, water quality throughout the service, hydraulic management of the network and interventions and work, as well as to user information (complaints, incidents, consumption).

With a visual interface based on a mapping application, as well as tools for analysis, forecasting, alert generation, modeling and simulation, HUBLO allows operators to optimize service (supervising installations, interventions, water quality and users) and makes it easier for Lyon Métropole to supervise by using only one view that consolidates the main service data. In addition, HUBLO is also a tool that facilitates decision-making in case of crisis.

KEY DATA

- HUBLO is the world's first operating overall supervision system for drinking water
- Easy to use and transparent, information is available 24/7
- Data from various sources is pooled for greater performance

STAKEHOLDERS

► Lyon Métropole is the authority that organizes public drinking water services; it is in charge of the strategy and tracking of the contract for delegating this public service.

► Eau du Grand Lyon, a subsidiary of VEOLIA, is dedicated to providing drinking water services for Lyon Métropole; the company has implemented HUBLO according to the needs stated by Lyon Métropole and in collaboration with VEOLIA technical services and software editor IBM.

IMPLEMENTATION

- ▶ The signing of a new drinking water service contract between Lyon Métropole and Eau du Grand Lyon provided an opportunity to modernize the computer control system by implementing appropriate IT tools to optimize performance and operation (improvement of yield, detection of leaks, etc.).
- ▶ This led to the implementation of a new hypervision tool called HUBLO in February 2015. HUBLO was developed jointly with VEOLIA technical services and IBM and was built on the basis of an application infrastructure provided by the software editor.
- ▶ Implementation involves three phases, which will be finished in 2018, and will include analysis, simulation and forecasting functionalities.

HUBLO and the Internet of Things

In HUBLO, connected sensors provide feedback on various types of information:

- 360,000 connected meters (remote readings),
- 5,500 leak sensors located on the network («Gutermann» sensors),
- 63 water quality sensors («Kapta 3000» sensors),
- mobile consumption (500 «Mobil'eau» suitcases),
- sensors on hydrants (opening/closing),
- remote management sensors,
- geolocation of service vehicles.

RESULTS

- /// Service management assistance that allows better preparation by giving the precise location of interventions (with Google Street View), a view of nearby events (work, leaks, etc.), traffic conditions (Lyon Métropole Opendata) and the location of service vehicles.
- /// Smoother relations with users by providing agents with the subscriber's characteristics, consumption data and work planned for the account and grouping this with events occurring in the vicinity of the user's home. This is possible thanks to the installation of connected meters in homes (360,000 meters will be installed by end 2018 over the metropolitan area).
- /// Simplified supervision for Lyon Métropole. From their offices, metropolitan agents can use HUBLO to have a quick view of service operation (operating conditions of the network and installations, water supply interruptions, on-going work, customer interventions, etc.).

FINANCIAL SCOPE OF THE OPERATION

- /// Funding for HUBLO is included in the budget of the new drinking water service contract between Lyon Métropole and Eau du Grand Lyon.
- /// The HUBLO tool will remain the property of Lyon Métropole when the contract ends.

KEY FIGURES

- €730,000 of contract budget invested in the HUBLO project
- 45 performance goals with corresponding indicators





CONTROLLING INDUSTRIAL EMISSIONS AT SOURCE

CONTROLLING INDUSTRIAL EMISSIONS AT SOURCE

The aim of the project is to strengthen the Kingdom of Morocco's capacity to control the state of the environment using a mobile laboratory able to measure air pollution.

Aims: *To prevent pollution, to deploy tools to inform decision-making, to help polluting firms be compliant, to contribute to the implementation of waste management standards and ensure they are complied with;*

Area of intervention: *Environmental and regulatory controls.*

- **PROJECT OWNER:** Department of the Environment under the responsibility of the State Secretariat for Water and the Environment.
- **BENEFICIARIES:** The Moroccan people and in particular vulnerable individuals (the elderly, asthmatics and children) and the LNESE, whose capacity will be strengthened due to the acquisition of equipment and new technologies.
- **FINANCE:** Department of External Relations/Division of International Cooperation/Principality of Monaco.
- **LOCALISATION:** Large industrial Moroccan conurbations.

INNOVATIONS

- ▶ Manufactured by Environnement S.A, the turnkey mobile laboratory was specifically designed to measure emissions from different types of industries: thermal power stations, gas turbines, cement works, chemical and petrochemical industries, etc.
- ▶ Using a vapour tube, the laboratory is able to simultaneously measure polluting gases such as SO₂-HCl-HF-CO-CO₂-O₂-NO/NO₂, total volatile organic compounds (TVOC), non-methane hydrocarbons (NmHC), methane (CH₄), flow parameters, temperature and pressure. The laboratory uses benchmark methods.
- ▶ A data acquisition system/data reporting system using iséo WEX software (a company of the Groupe Environnement S.A) was included in the laboratory.

STAKEHOLDERS

- ▶ **Partners:**
 - State Secretariat for Water and the Environment/Ministry of Energy, Mines, Water and the Environment
 - Department of Monitoring and Risk Prevention
 - Laboratoire National des Etudes et de la Surveillance de la Pollution (LNESE) (NB: in English, national laboratory for research and pollution monitoring)
 - Société Environnement S.A and Envirotec; its exclusive distributor in Morocco
- ▶ **Technical service provider:**
 - Environnement S.A, a key player in environmental pollution analysis, has considerable expertise in the following key areas: monitoring air quality, monitoring processes and smoke emissions, analysing gas engines, etc.

IMPLEMENTATION

► Since 2001, the Principality of Monaco has supported (installing the first monitoring and measuring station in Morocco) the development of a national network for monitoring and controlling air pollution in Morocco. This partnership focuses on the development of an air quality monitoring network that includes around twenty measuring stations acquired using Monegasque and Moroccan funds. An agreement signed in 2008 aimed to help LNEP in its mission to control pollution by acquiring new tools and by training professionals and laboratory technicians.

Large conurbations in Morocco, like many other large international cities, have seen enormous urban and industrial growth over the last twenty years. While this development has increased production, generated significant employment opportunities for hundreds of thousands of families, it has also negatively affected mobility and the quality of the environment.

The issue of air pollution in Morocco, especially in large cities and industrial cities (e.g. Casablanca, Rabat, El Jadida, Safi, etc.), is a major concern for local authorities and citizens alike.

RESULTS

- /// Acquisition of a mobile laboratory for measuring air pollution
- /// Training LNEP employees to use and maintain the new instruments/tools
- /// Strengthening the Kingdom of Morocco's capacity in terms of various environmental protection initiatives:
 - resolving environmental conflicts related to industrial and artisanal activities
 - advising and providing analysis services for industries wishing to improve their environmental record
 - producing a register of air pollutants and mapping the concentration of pollutants in Moroccan conurbations



FINANCIAL ASPECT OF THE OPERATION

- /// Implementation: 2012
- /// Budget: €205,100





ECO-CONSTRUCTION OF THE FRENCH EMBASSY AND AMBASSADOR'S RESIDENCE IN DOHA (QATAR)

THE GREEN VALLEY

The French embassy in Doha responds to a desire of the Ministry of Foreign Affairs in France to realize an exemplary diplomatic campus with a strong French expertise in matter of sustainability. The major idea is to protect buildings from high temperatures, offering at the same time a pleasant design integrated in its environment. Northern Facades are opened on a garden localized in the heart of the site, designed like a green valley bringing freshness and protection. The green valley goes from East to West and is planted by palm groves and filtering ponds created for cleaning sewage water coming out of the buildings.

KEY DATA

- Client: Ministry of Foreign Affairs in France
- Location: Doha (Qatar)
- Project: Construction of the french diplomatic campus
- Mission consultant: Matta Contracting Qatar, SUD Architectes, AR Architectes, Auberger-Favre, RBS, Europtima
- Area: 5,282 m² (10 000 m² land)
- COS: 10,000,000 €
- Date: Wining competition in january 2016, on going project

INNOVATIONS

The building design is bioclimatic with a passive design (sun and refreshing winds have been taken into consideration).

- ▶ **Constructive choices:** sustainability, adaptability and easy maintenance of the materials of construction; design of an earth insolation wall on the South and wooden fiber insolation on the northern facades.
- ▶ **Energy management:**
 - renewable energies are used for cooling (heating pump);
 - thermodynamic for water heaters;
 - low energy consumption internal and exterior artificial lighting.
- ▶ **Water management:**
 - sewage water treated by filtering ponds: purification of sewage water in ponds that are planted with adapted plants (papyrus), water is then stored into a buried tank, water is recycled for sanitary use and for irrigation;
 - exceptional rain water will drop onto green roofs: water will be evaporated then driven into infiltration wells localized close to each building;
 - infrastructure materials are porous: rain water can easily be infiltrated into the earth.

STAKEHOLDERS

► The project was financed by the state of Qatar and the Ministry of Foreign Affairs in France and won by the Following design and build team:

- Matta Contracting company: local company
- SUD Architectes: chief designer
- AR Architectes: landscaping designer and environmental consultant
- Auberger-Favre: MEP consultant engineer
- RBS : Structure engineer
- Europtima: project and financial manager



IMPLEMENTATION

► The construction of the French diplomatic campus has for final goal to obtain the double green certification delivered by Cerway in France: HQE® Building and HQE© Fitting out assisted by the engineering consulting consultant SETEC.

► The construction site will be certified as a green construction site according to both French (SOGED, green Construction site) and local specifications.



RESULTS

/// French diplomatic campus in Doha has an objective to obtain the certification HQE® delivered by CERWAY and will be an exemplary project to follow for future diplomatic constructions in the world.

/// Bioclimatic buildings will offer a qualitative environment for future users with a limited impact on the surroundings and the local environment. As a green valley, this design will bring shade and freshness, like an oasis in the heart of the desert: presence of intelligent buildings designed in an extreme warm weather, adapted vegetation and planted ponds that recycles water, a rare resource that have to be restored and protected.

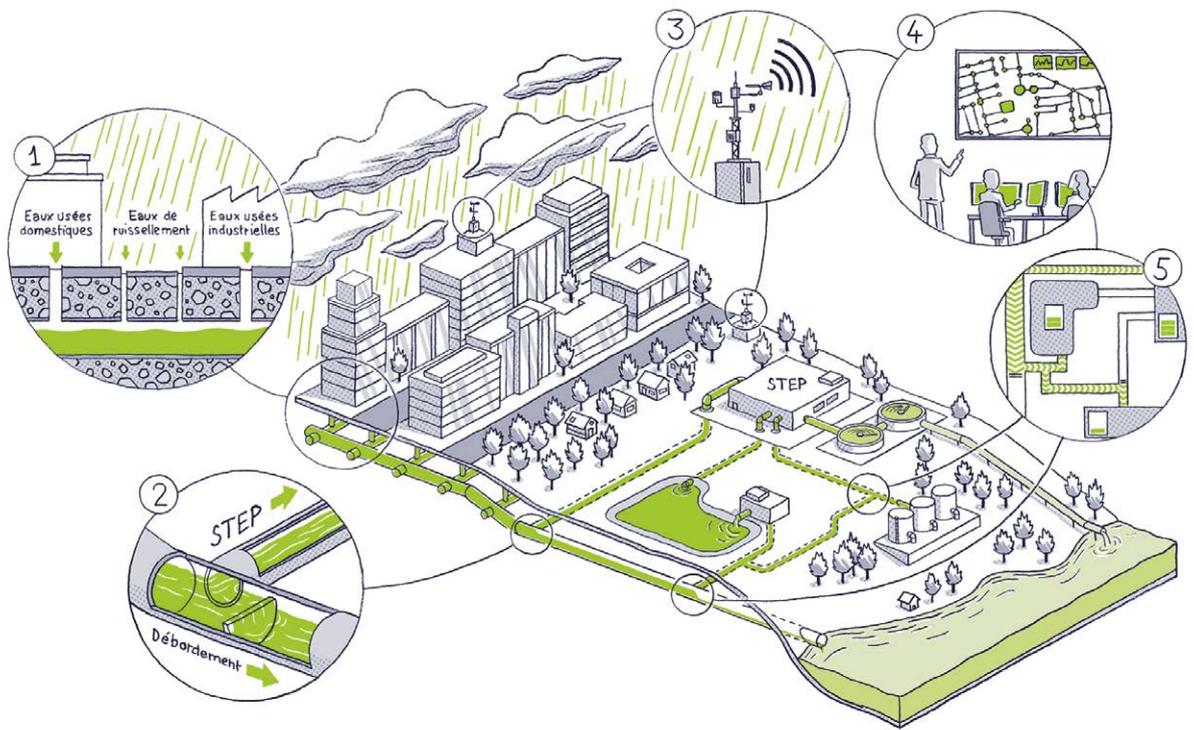
/// This project will show that it is possible to design with the climate by offering a way of creating shade, water and life into a warm desert environment. This project could be an ambassador of a vernacular architecture and out fitting that leads to fight against heat islands in dense and urban areas in the city.

FINANCIAL DIMENSION OF THE PROJECT

/// Financing was made by the state of Qatar and the Ministry of Foreign Affairs in France.

→ Budget : 10 000 000 € HT





INFLUX

PREDICTIVE AND DYNAMIC MANAGEMENT OF SEWAGE SYSTEMS

Bordeaux Métropole faced strong flood risks. In 2012, it called upon SUEZ to deploy INFLUX, a predictive and dynamic tool for the management of sewage systems and rain water, for a better preservation of the natural environment.

INNOVATIONS

In real time, INFLUX provides:

- ▶ An **OVERALL VIEW** of the operation of the entire sewage system based on validated metrological and meteorological data
- ▶ **DEVELOPING TRENDS** in the sewage system for the next 24 hours in dry weather, and six hours in wet weather
- ▶ **OPTIMUM MANAGEMENT STRATEGY** applied automatically or manually. The aim of the strategy is to optimize the volumes stored in the water retention works and in the system itself, to increase the volume of wastewater to be treated in order to reduce outfalls into the natural environment while limiting flood risk.

KEY FIGURES

- Forecasts over 6 hours in wet weather
- INFLUX takes into account 4,000 parameters updated 24h/24 all week round
- 15 to 30% possible reduction in spills

STAKEHOLDERS

- ▶ Bordeaux Métropole was heavily impacted by floods.
- ▶ SUEZ (Lyonnaise des Eaux and Ondeo Systems, ex-SUEZ ENVIRONNEMENT subsidiaries) deployed the solution.
- ▶ The international research center on water and environment (CIRSEE) developed INFLUX with the Lyonnaise des Eaux research center in Bordeaux (LyRE).

IMPLEMENTATION

- ▶ Bordeaux Métropole chose the technology RAMSES developed by Lyonnaise des Eaux, a subsidiary of SUEZ ENVIRONNEMENT, at the beginning of the 1990s. Since then, the remote control tool has evolved. It became MAGES in 2007 and INFLUX, a dynamic tool for rain water management, in 2012.
- ▶ INFLUX was developed by the International research center on water and environment (CIRSEE), with the Lyonnaise des Eaux research center in Bordeaux (LyRE).

The BENEFITS of INFLUX:

- OFFER overall and transparent management;
- OPTIMIZE the use of existing sewage system and avoid new investments;
- PRESERVE the natural environment and the standard of living of city dwellers.

RESULTS

- /// Thanks to the RAMSES INFLUX technology, Bordeaux did not experience any major floods since the 1990s. In the course of the past few years, the technology minimized the impacts of 120 floods. Each year, 15 to 20 alerts are issued for three violent storms on average.
- /// By reducing overflow amounts, INFLUX controls their impact on the natural environment. A storm can pollute 10 to 50 times more than a wastewater treatment plant.
- /// INFLUX was also deployed in Paris, for the SIAAP (in charge of wastewater treatment in the Parisian metropolis).

FINANCIAL DIMENSION OF THE OPERATION

- /// INFLUX aims at optimizing treatment capacities of Bordeaux's water treatment plants and the investments made in flow management infrastructures.

CONCERNED AREA

- City center water collection area
- 96,970 m³ storage volume
- 300,000 concerned inhabitants
- 7,700 ha





CREATING THE WATER NETWORK GIS FOR THE CITY OF PHNOM PENH

With its 1,500,000 inhabitants, 1,800 km of water mains, 270,000 service connections and an annual water supply capacity of 145 million m³, Phnom Penh, the economic and political center of Cambodia, possesses an extremely efficient water supply system. Whilst the average non-revenue water level is more than 25% in France, for instance, it doesn't exceed 6% in Phnom Penh. The city has become a leading example in Asia in this respect.

Within the framework of the "Greater Phnom Penh Water Supply System project", which aims to structure water service within the metropolitan area, PPWSA acquired the service of G2C informatique (subsidiary of Altereo) to set up a GIS for the management and capitalization of the information relating to drinking water production and distribution infrastructures. This compact project commenced in May 2015 and lasted 5 months.



INNOVATIONS

- ▶ Altereo proposed its latest generation of GIS for this project. KIS Water is a 'full web' solution offering the whole feature panel traditionally proposed by desktop GIS software. KIS stands for Knowledge Information System.
- ▶ KIS Water provided the PPWSA managers and operators with:
 - a complete 'water supply' toolbox, ranging from navigation and topology features (paths, valve closure simulation, catchment areas, etc.) to the management of workflows (complaints, interventions, bursts, etc.),
 - furthermore, KIS Water is expected to be a turnkey solution delivered to PPWSA.
- ▶ In addition to this, KIS Admin is an additional module for customisation. GIS specialists and system administrators will have a simple and ergonomic tool to:
 - model and integrate data,
 - manage users and rights, and
 - set up applications, forms and even workflows.
- ▶ It will allow PPWSA to directly manage the evolution of the system according to new requirements, including data exchange with third-party applications in different formats.

STAKEHOLDERS

- ▶ **Phnom Penh Water Supply Authority (PPWSA)**
N°45, Street 106, Sangkat Srah Chork, Khan Daun Penh, Phnom Penh, Cambodia.

Municipal water authority - functioning under the supervision of the Ministry of Industry and committed to the sustainable development of its potable water supply services.

IMPLEMENTATION

- ▶ KIS Water is a 'full web' solution offering the whole feature panel traditionally proposed by desktop GIS software and stands for Knowledge Information System.
- ▶ There was no previous information on service connections and customer mapping. Altereo provided the aerial map and supervised the customer mapping process.
- ▶ One of the first challenges that awaited the team and PPWSA was the positioning of each of the 270,000 customers. This was necessary to be able to access the location of each and every customer within the system, and to consult the substantial billing database from the GIS interface.
- ▶ To achieve this, an experienced engineer with a double competency in both water networks and GIS/utility workflows was deployed to work full-time in Phnom Penh. The engineer was assisted by four PPWSA staff appointed on the very first day.
- ▶ 110 PPWSA agents were trained in groups of 10 so as to undertake this task during the following months. Customers were positioned with the help of GPS devices and maps during of the meter reading campaigns (held every two months) of the year 2015.

KEY DATA

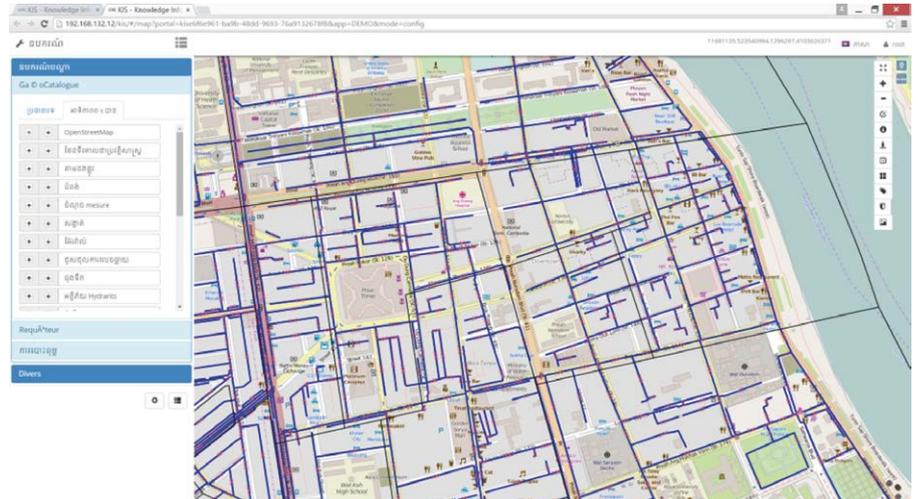
- Dates: May - October 2015
- Project Duration: 5 months
- Population: 1,500,000

FIGURES

- 2,450 km of drinking water supply network
- 285,000 connections
- 15,000 connections added each year
- 140 km additional networks/year

RESULTS

- /// The project merged the supply and installation of KIS Water for managing information on drinking water supply networks with:
- the definition of a GIS data model as well as the migration of descriptive data from existing networks,
 - the reorganization/creation of the process by which different services within the enterprise can be conducted using GIS,
 - the creation and supply of a mobile application, templates, GPS material and assistance towards the cartographic position of 285,000 clients and works within the network,
 - the training of users, administrators and contributors.



FINANCIAL DIMENSIONS OF THE PROJECT

→ Total project budget:
442,000 €

/// The project was financed by PPWSA (Phnom Penh Water Supply Authority).

/// Altereo carried out its tasks within a highly efficient system already in place. In 2015, the annual revenue of PPWSA was 27.5 M€. The objectives of the project included continued capacity building within the Agency in order to better manage the challenges brought about by rapid urbanization through the positioning of each new customer.

KEY FIGURES

- Lines: 1,800 km
- 100 member municipalities
- Population: 83 865 (INSEE 2007)
- 41,283 subscribers
- 157 reservoirs, 100 production facilities
- 7,734,494 m³ of water consumed in 2009



CASE STUDY ON A COMPREHENSIVE APPROACH FOR ASSET MANAGEMENT

WITHIN A LARGE-SCALE RURAL SETTING

FROM THE CONSOLIDATION OF EXPERTISE TO AN IMPROVED PROGRAMMING OF PIPELINE RENEWAL USING THE EXPERT SYSTEM SIROCO®



One feature of the mission included the organization of human asset during the difficult phase of information acquisition.

The Association provided an apprentice under the supervision of G2C Ingénierie team. This full-time, on-site resource significantly facilitated what would otherwise have been a considerable amount of work, and the results, in terms of improved access to information, were obtained rapidly. This arrangement allowed the SIVOM to maximize collection efforts whilst controlling costs and offering a technical know-how as well as support from subject matter experts.

Another feature of this mission was regular presentations to the general assembly of the Association. The objective of these procedures was to raise awareness among officials regarding asset management and the on-going studies. This also allowed for securing a budget for renewal in the upcoming years and a guarantee of concrete follow-up on the studies for an improved renewal program.

a dedicated individual for this task who was a licensed user of GIS Cart@jour and supervised by G2C Ingénierie. All necessary data for the application of the SIROCO® methodology were simultaneously consolidated: soil typology, road traffic levels, the quantity of hydraulic pipelines, unit costs, etc.

► During a second phase, after acquiring the maximum amount of information possible, the consolidated data was analyzed using the SIROCO® methodology.

SIROCO® sequentially allowed for gathering data on:

- forecasting breakage in the pipelines,
- the potential impacts of these breakages on multiple parameters of network performance,
- the simulation of anticipated benefits from various renewal strategies,
- the determination of an optimal techno-economic effort for renewal,
- prioritizing the pipelines needing renewal, and
- the establishment of operational work sites.

INNOVATIONS

► The initial necessity was to examine the network database (Layout, materials, diameters, installation dates) from all angles using GIS. Information was collected from the SIVOM maps, the GIS of the delegate, work archive and from conversations with the hundreds of member municipalities of the Association.

For the duration of this mission, the Association appointed

STAKEHOLDERS

► Project owner:

SIVOM (Multi-purpose intermunicipal association) of the Issoire region and the municipalities of the sud Clermontoise suburb.

8, avenue de la Libération
63114 COUDESS

IMPLEMENTATION

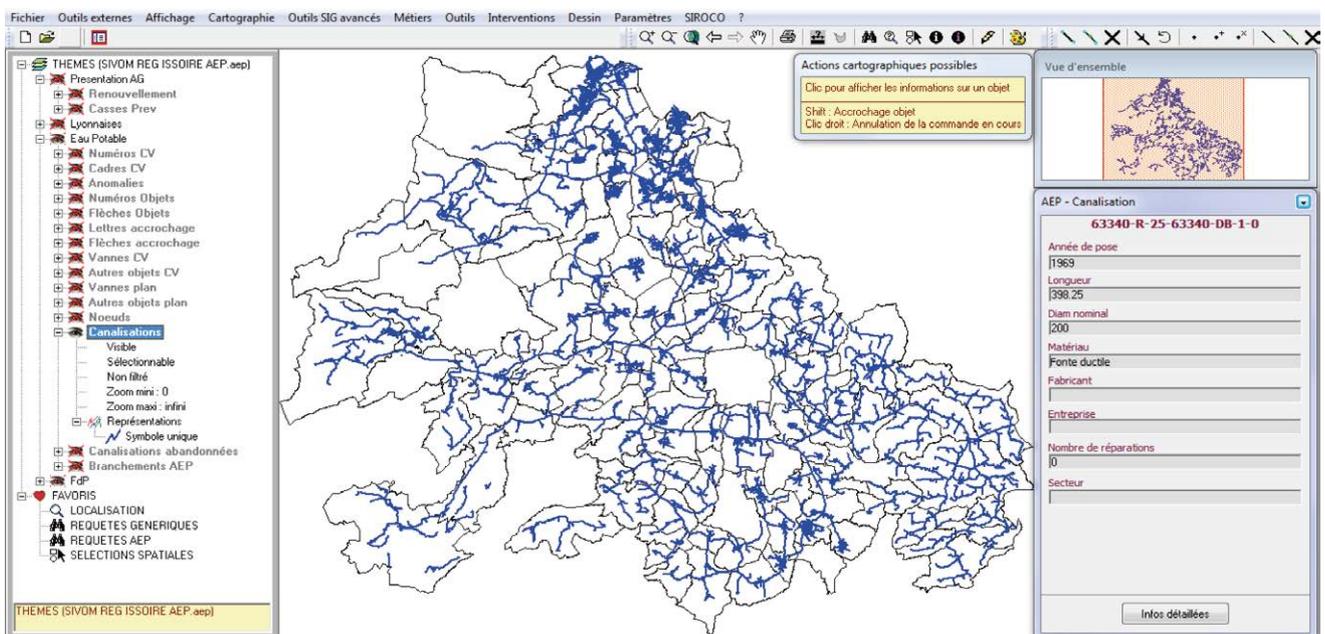
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RESULTS

- /// Robust knowledge of the available assets in full compliance with the requirements of the decree of 27 janvier 2012 on the knowledge of all assets related to drinking water and reduction of leakages.
- /// A high-performance model for renewal programming.
- /// A public work program with a duration of 11 years, improved with the objective of responding to local needs and technical priorities.

Priority criteria included in the SIROCO® analysis are hydraulic criticality, water loss, traffic disturbance and repair costs.



FINANCIAL DIMENSIONS OF THE PROJECT

→ Project total: 30,000 €
excluding taxes

/// The provisional investment program, established for the 11 upcoming years represents 10% of the total lines. The idea is an update every 2-3 years with the help of new data. The improved program includes the establishment of 1.25% of the lines in the first 2 years, then an average of 0.83% of the lines in the following years for a total investment of up to 2.7 million euros.

Note: a 'classic' strategy based on pipeline age, frequent breakage and theoretic service life (an initial scenario studied during the study) would have caused the renewal costs to be the double of that mentioned above. The economy-performance link of the target program is thus very visible.



IMPLEMENTING THE EXPERT SYSTEM INDIGAU®

WITHIN THE SCALE OF THE METROPOLIS OF LYON



TOWARDS AN EFFICIENT ASSET MANAGEMENT SYSTEM



The Metropolis of Lyon was one of the active partners of the INDIGAU research project, financed by the National Research Agency (ANR) and led by the INSA of Lyon and G2C Ingénierie (subsidiary of Altereo) between 2008 and 2010.

Towards the completion of this research project, which gave birth to the Indigau® expert system, the metropolis expressed the desire to deploy this solution in order to optimize the management of assets relating to the sanitation network.

The project, led by G2C Ingénierie, thus aimed to implement the Indigau® application and to ensure that the agents become capable of autonomously using the application.

The main expectation of the Metropolis of Lyon included the capacity for processing large quantities of data in a homogeneous manner in order to perform an initial screening of undamaged sections (classes G1-G2) and those in poor or very poor conditions (classes G3-G4). The goal:

- *classify immediately, a substantial number of inspections requiring no further actions,*
- *identify the sections requiring follow-up or more detailed study,*
- *alert the relevant departments on the matter of the most vulnerable sections.*

INNOVATIONS

- ▶ **Indigau® is a SaaS (Software as a Service)** and is available in the form of a complete Internet service comprising of software modules.
- ▶ It is an innovative expert system for automatic inspection of CCTV for large numbers of sanitation networks and has provided decision-making support towards the rehabilitation of sanitation networks. The automatic scoring model

allows for the evaluation of the state of all of inspected sections in a non-biased manner, resulting in the comparison of the sections and the prioritization faster and more reliable.

- ▶ Within the Metropolis of Lyon, the Indigau® expert system managed to process 260 km of inspected sections within a few minutes.

STAKEHOLDERS

- ▶ **The Metropolis of Lyon:** a unique territorial collectivity created through the fusion of the Lyon Urban Community and the Rhône General Council, and comprising of 59 municipalities that make up the territory of Greater Lyon.

KEY FIGURES

- 2,800 km of networks
- 700 km of accessible networks
- 2,100 km inaccessible networks
- 123 grit chamber basins
- 200 drinking water basins
- Over 2000 filter wells
- **Asset:**
 - Estimated value 4-8 B €
 - 0.5%: rate of renewal



MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET SOLIDAIRE

MINISTÈRE DE LA COHÉSION DES TERRITOIRES

IMPLEMENTATION

- ▶ As part of preventive measures for network asset management, the Metropolis of Lyon has undertaken CCTV inspection campaigns, adhering to the EN 13508-2 standard and supporting the non-accessible sanitation networks, at an average rate of 40 km/year.
- ▶ The commercial version of the INDIGAU® expert system has been implemented at the scale of the Metropolis of Lyon since the beginning of 2012. It is available via a web

platform and operated by the operations service of the Water Directorate.

- ▶ This service manages a total of 2800km of sanitation networks within the territory of the agglomeration, of which 2,100 km is non-accessible.
- ▶ 12%, or a total of 260 km of networks, of the non-accessible asset has already been inspected according to the EN 13508-2 standards.

The underlying methodological approach in the programming of rehabilitation works for the Indigau® expert system is based on components 5 and 6 of the RERAU (Rehabilitation of Urban Sanitation Networks) reference guide.

The CCTV inspections need to be carried out according to EN 13508-2 standards, which codifies the observations and report formats, introduces the notion of electronic file exchanges for all information on the inspections. This facilitates computerized interpretation of the data – already one of the primary functions of the Indigau® system.



RESULTS

- /// 300 km of CCTV analyzed
- /// 17% (51km) classified as G3, 5% (14km) as G4 due to 'infiltration'
- /// 14 km of works



FINANCIAL DIMENSIONS OF THE PROJECT

→ Project total:
50,000 €

- /// The efficiency of the system and the significant amount of time saved contributes directly towards the return on investment of the system.





COPENHAGEN, DANEMARK: A CITY RESILIENT TO FLOODING

PREPARE THE CITY FOR FUTURE CLIMATE CHALLENGES

To turn Copenhagen into a flood resilient city, Veolia through its Danish subsidiary Krüger, developed a modelling and management tool, STAR Utility Solution™.

Those smart and adaptable software solutions are based on the deployment of a smart grid connected with a weather surveillance system and help to prevent the discharge of wastewater into the environment during stormy weather.

INNOVATIONS

- ▶ STAR Utility Solution™ is a modelling and control tool managing the flow running into the network and the three wastewater treatment plants connected with a weather surveillance system developed by the Danish Meteorological Institute to predict raining occurrences.
- ▶ The tool allows real-time control of the network (optimization of the floodgates, pumps and weirs) and switching the wastewater treatment plants to “rainy weather mode” to prevent overflow.
- ▶ The weather warning enables to plan ahead the systems to put in place during heavy rainfalls and the safety measures for the inhabitants several hours before they occur (6 to 12 hours).
- ▶ The solution allows enhancing existing infrastructures while significantly limiting investments compared to what would have been needed for the creation of new infrastructures on the network.

KEY DATA

- 90% elimination of the overflow situations per year
- 93% reduction in the investment needed to achieve the same outcomes as with standard storage basins solution
- 10-15% less energy needed to treat wastewater achieved at a plant already controlled by PLC
- and online measurements corresponding to 10-12% reduction in green-house-gas emissions
- 1/3 less pollution from the overflows running into the sea around Copenhagen.

STAKEHOLDERS

- ▶ The City of Copenhagen,
- ▶ The Danish Meteorological Institute (DMI),
- ▶ The Technical University of Denmark (DTU), Utility company for network (HOFOR)
- ▶ Utility company for wastewater treatment plants (BIOFOS),
- ▶ Krüger (filiale de Veolia).

IMPLEMENTATION

- ▶ The Copenhagen's resilience to flooding project is part of a major initiative launched in the 1990s by the public authorities. From the beginning, Krüger, subsidiary of Veolia, was an important and active player, deeply involved in finding solutions.
- ▶ The «Star Utility Solutions™» has been implemented by Krüger between 2012 and 2013, after a giant storm had caused a lot of damages in 2011. That event increased the City's focus on climate change and resilience to flooding.

Cooperation between operators and engineers, training and execution of pilot tests contributed to a successful implementation despite prior differing opinions.

One of the challenges was to combine the recommendations of all stakeholders involved: public water services, local authorities, research centers and residents.

RESULTS

/// Environmental results

- Improve the city's resilience to flooding (90% of the overflow situations per year were eliminated). Less pollution from the overflows running into the sea around Copenhagen (1/3 less).

/// Social/societal results

- An effective tool to plan the measures to be taken during a heavy rainfall event before it occurs. Bathing water in the Harbour District.

/// Technical

- An early warning system able to forecast floods 6 to 12 hours before they occurred.
- An optimization of the existing wastewater treatment plants and network control systems.

FINANCIAL ASPECT OF THE OPERATION

- /// An accurate estimate of the saving in terms of reduction of costs related to flooding is hard to present. However, the flood in 2011 amounted to 700 million euros and a reduction of only 5% owing to a flood-warning system would have saved Copenhagen the cost of 35 million euros.

KEY DATA

- Smart investment in infrastructure dedicated to rainwater and wastewater management
- Less energy needed to treat wastewater (10-15%)





ANTICIPATION OF LYON'S PUBLIC TRANSPORT NETWORK IN 2030

ANTICIPATING PUBLIC TRANSPORT INFRASTRUCTURE IN LYON BASED ON FUTURE USES

The major development projects in Lyon are now permanently transforming the city of Lyon. The construction of the 60,000-seater stadium, the complete redevelopment of the Part-Dieu station district... these major projects have a significant impact not only in terms of quality of life and environmental footprint, but also in terms of transport infrastructure.

To anticipate the impact of these major urban projects on the public transport network, and thus on the accessibility and attractiveness of the territory, Keolis asked ForCity to adapt its prospective urban simulation platform on its behalf.

The tool allows Keolis to represent its respective projects in a digital city lab in the form of actions, behaviours and trends pulled together into scenarios, the results of which are used in the form of numbers, graphs, and in a 4D visual representation of the city.

It has already allowed Keolis to perform simulations on the access to Grand Stade de Lyon during Euro 2016 matches. These simulations have confirmed the capacity of the current network to serve the stadium, even in exceptional circumstances.

INNOVATIONS

This tool is the first to combine all the factors that allow tomorrow's city to be anticipated.

► **Grouping 4D visualisation and simulation functions on a single Software as a Service platform:** the two functions are combined within a single turnkey, which allows users to focus on a holistic business approach to understand and anticipate urban development;

KEY DATA

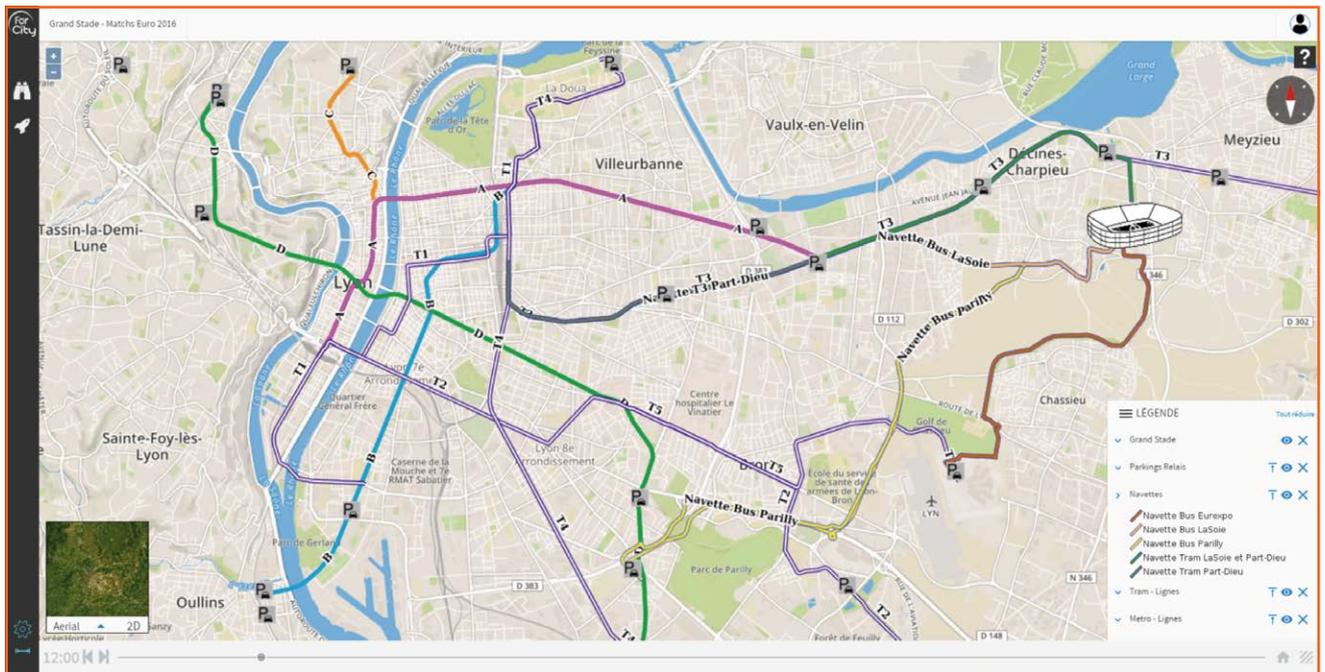
of the Metropolis of Lyon during Euro 2016

- 1.5 million inhabitants
- + 300,000 visitors expected in Lyon for the 6 matches of EURO 2016
- 59,186 seats in the stadium
- 13,000 spectators transported by tram
- 23,400 spectators transported via bus or shuttle bus
- 60 buses mobilised for the outward service and up to 120 vehicles for the return service

► **Systemic approach:** the simulations combine the determinants of housing, mobility, population and energy etc. including socio-economic and behavioural aspects;

► **Transposable platform from one territory to another:** the models describing urban development are developed independently of the territory and can be transposed quickly onto another town;

► **Platform developed by a neutral player:** local players can simulate their local strategies without restrictions and collaborate without a second thought.



RESULTS

/// Scenarios of improved service, waiting times and comfort

The modelling platform enabled Keolis to identify areas in the network where to strengthen the service and the direction of travellers, to significantly reduce waiting times and to bring user comfort to the same level as that of non-match days. In addition to the expertise and essential professional experience of Keolis, the ForCity platform has allowed phenomena to be imaged and revealed, including chain reaction effects that are difficult to grasp other than by systemic modelling. Thus, the ForCity platform provided Keolis with tangible evidence allowing it consolidate its expertise with SYTRAL.

/// Awards

The ForCity solution won the 2016 Le Monde Grand Prize for Innovation.

Le Monde
SMARTCITIES
Les prix de l'innovation

Pascal Jacquesson,
Director Keolis Lyon

In a neighbourhood like Part-Dieu, which will change dramatically until 2030, with ForCity, which gives us digital data on the evolution of jobs, residents ... we can prepare the transport network of tomorrow and today, we can do in a few months what, for example, in 2011 it took 3 to 4 years to do.

BUDGET

→ A few hundred thousand euros

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

www.cohesion-territoires.gouv.fr/vivapolis

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

Work groups jointly run by:

Circular economy:

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

Citizen participation:

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

Energy:

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

Integrated urban utilities and digital platforms:

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

Mobility:

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

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

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