



The French network of
public and private stakeholders
for sustainable cities

Innovative solutions for sustainable cities

Circular economy



URBAN INNOVATION IN DEVELOPING THE URBAN CIRCULAR ECONOMY

/// BACKGROUND: WHY TAKE ACTION FOR THE URBAN CIRCULAR ECONOMY?

Every single business sector and geography potentially stands to benefit from the circular economy. Cities, however, play a particularly central part in this transformation process, due to the amplifying power of the human concentrations found there.

The concept of the circular economy first made its appearance in French law with the Energy Transition Act for Green Growth (17 August 2015), aimed at «moving past the linear business model built around extracting, manufacturing, consuming and disposing, by ushering in a tempered and responsible way of making use of natural resources and primary raw materials». Cutting back the footprint left by cities is thus the major sustainable development challenge facing our societies.

Cities are hotbeds of activity and interaction. They are the driving forces of our economy, providing jobs and services, and can accurately be described as catalysts of creativity and innovation. Nearly 50% of the world's population (80% in Europe) live in urban environments, which in turn generate more than two-thirds of the world's GDP. However, they are also the source of dead-end situations, as already-developed or fast-growing societies find themselves inevitably incapable of concurrently doubling their urban growth rates and reducing their environmental footprint (the current environmental footprint per person on the planet is 2.3 ha, which already exceeds the Earth's capacity level of 1.8 ha). Lastly, the urban environment is the source of 70% of greenhouse gases and most of the waste production on the planet (5.5

tonnes per year and per inhabitant, including 452 kg of household waste).

By 2030, 600 cities across the world - 300 Northern countries and 300 Southern - will be home to two-thirds of the global population and concentrate 60% of the world's GDP.

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

The innovative ideas can be classified into 3 main categories:

► **The urban local economy:** It is in urban services that the greatest potential for resources can be found. The local circular economy approach makes it possible to use the waste and refuse from a production cycle, turning it into resources for another cycle, of the same or different nature. Geographic proximity is often a key success factor for production cycles of this kind. With cities and rural areas now located close to one another, there is real opportunity to develop new complementary modes of production.

► **Recycling, re-usage and reuse, eco-design:** circularity in material use and in usages makes it possible to optimise the consumption of natural resources. Circularity, in this case, encompasses all the responses available to companies interested in cutting back their resource consumption (re-use, re-sale, repair, recycling, etc.), but also in taking action upstream, by

designing products differently, based on analysis of the entire life-cycle and construction operations on the scale of a building, an urban development operation, or an infrastructure, and focusing in particular on looking for alternative sources of material and ways to reduce environmental impact.

► **The ownership economy:** This approach stands in for the sale of services and products: the seller, remaining the product-owner, has more to gain from improved product life cycles.

The innovative ideas shown in the pamphlet fact sheets illustrate each category of innovation separately -- but, on the ground, they can be combined or blended.

/// WHAT KINDS OF INNOVATION ARE INVOLVED?

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

► **Technological:** solely-technological innovation can be necessary, but is not necessarily the norm, nor the most frequently-chosen type of solution. That being said, the use of new information and communication technologies based on digital is, in most cases, a pre-requisite for rolling out and speeding up the spread of the targeted innovations.

► **Economic and legal** to enable the development of new business models and facilitate the integration of urban functions.

► **Organisational** to innovatively bring together players from very different walks of life (companies, local authorities, universities, citizens, etc.) around shared projects to reduce their city's environmental footprint, reduce raw-material intensiveness to provide the same service at lower environmental cost, by turning the waste from a service or production cycle into a resource for another cycle of a different kind.

Most of these innovative ideas need to be backed up by **behavioural change** on the part of the players involved, first and foremost, the users.

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

For many years now, France has designed its public policy to support development and experimentation with innovative techniques for saving raw materials in industrial processes and service provision. In 2016, the following programmes were of note:

► **The Investments for the Future Programme (PIA)** supporting innovation designed with an all-encompassing view of the life cycle;

► **The "Zero Waste Territories" programme** championed by the Ministry of the Environment, which supports and provides assistance to municipalities that have committed to considerably lowering waste generation and developing new avenues for re-use;

► **Mobilising the elected officials and civil society**, for instance by creating the Institute for the Circular Economy, the OREE Association, or ADEME's support for multiple initiatives on the ground;

► **Mobilising major corporations** working together at the French Association of Enterprises (AFEP), « Les entreprises s'engagent pour l'économie circulaire, Rapport des entreprises de l'afep » [Enterprises Committed to the Circular Economy, A Report Jointly Produced by the AFEP Enterprises], 2015.

Work group run by **Christian Levy**,
Ministry of Environment, Energy and the Sea,
Ministry of Housing and Sustainable Homes, with:
Alice Sarran, OREE,
Jean-Christophe Daragon, EuroMéditerranée,
Nicolas Prego, Suez.



THE SMART CONNECTED WASTE SORTING CONTAINER



INCREASING WASTE SORTING BY REWARDING CITIZENS

At the crossroads of the Internet of the Things and the collaborative economy, Terradona is revolutionising waste sorting with Cliiink, an interactive solution that gives everyone the opportunity to get involved: local authorities, citizens and retailers (see diagram on next page).

Following feasibility studies conducted in March 2014, prototyping in October 2014, and piloting the pre-industrial model in September 2015; the last phases consisted of a large-scale test with 70 smart containers in the Aix-Marseille Provence metropolitan area for one year (ending in March 2017).

INNOVATIONS

► Terradona (www.terradona.com) offers a unique solution (3 patents in collaboration with CEA LETI) to help smart cities increase waste sorting while also reducing costs for local authorities. The technology is able to characterise the nature of the waste on the fly (glass) like traditional waste sorting machines but in smaller spaces, hostile environments (e.g. with high levels of soiling, high temperature ranges, high pressure cleaning, strong shaking in the emptying phase, etc.) and with energy autonomy constraints. Moreover, the system can be simply 'plugged into' the waste container rather like a set top box is connected to the TV. In just 15 minutes, 20th century sorting containers turn into smart and connected urban hardware able to reward responsible citizens (www.cliiink.com) as well as providing real-time collection data to the local authority in order to reduce costs.

► Basically, it turns a boring everyday chore into a smart, fun and rewarding behaviour.

KEY DATA

- From evidence to action
 - 5 billion inhabitants will live in cities in 2030
 - Waste is the third biggest source of pollution
 - Recycled waste can become a resource
- In France
 - 56% of the French population do not sort waste or only occasionally
 - 70% of packaging is not recycled in cities
 - 300,000 waste sorting containers have been installed in the city
- Cliiink impact
 - €300 K/year reduction in costs / 100,000 inhabitants.
 - 750 t/year fewer CO₂ emissions for / 100,000 inhabitants.
 - €90 / increase in purchasing power per household
 - Improving local businesses due to increased traffic and turnover

STAKEHOLDERS

► A testing agreement was ratified between the Aix-Marseille metropolitan area and Terradona to test the technology under real conditions with the participation of EUROMED, Eco-Emballages, the Bouches du Rhône Département, the Provence Alpes Côte d'Azur region and ADEME.

► This large-scale test will be used as the basis for wide scale deployment in France and Europe by local authorities, metropolitan areas and EPCIs (public inter-municipality cooperation establishments).

IMPLEMENTATION

- ▶ **1.** An R&D partnership was formed with CEA Leti to study the feasibility of designing an on-board system able to characterise materials in a hostile environment without posing any risks or drawbacks for the user. Three design firms were involved in developing the electronic, mechanical and software aspects. The R&D costs (€700 K) were partly self-funded but mainly financed by IPO contributions.
- ▶ **2.** A testing agreement was validated by the metropolitan area of Aix Marseille to pilot the solution under real conditions i.e. 40,000 inhabitants, living both vertically and horizontally, with a representative sample of diverse socio-professional categories. Cost of €500 K.
- ▶ **3.** Schedule: Feasibility, prototyping, demonstrator, piloting, large-scale testing, and industrialisation.



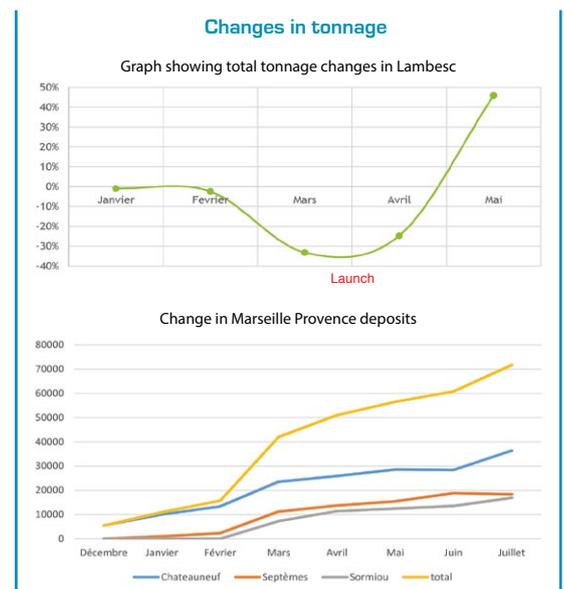
RESULTS

/// Results

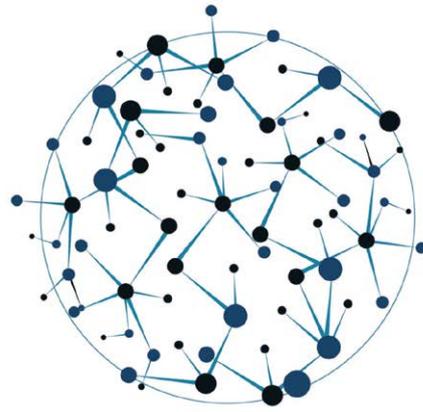
1. Increase of 10 % to 30% in terms of selective waste sorting depending on the sector
2. Reduction in costs (source: Eco-Emballages)
 - a. 1 ton of unsorted glass costs €171
 - b. 1 ton of sorted glass costs €68 → Gap: €103/ton saved
3. Optimised selective collection: €16/ton saved
4. 1 ton of sorted glass saves 700 kg of sand, 500 litres of water and reduces CO₂ emissions by 500 kg
5. Improves business for local retailers: 50% of shops report 1 to 3 extra sales a month
6. Increase in purchasing power: €90/year per household

/// Awards

CNRFID & GEMALTO prize in the contactless challenge, Captronic prize for innovative start-ups, RSE PACA prize, Pole Solutions innovation prize for secure communication solutions, Embedded France prize for on-board sensors, 1st prize in the Métha Europe competition, winner of the Réseau Entreprendre, winner of the Pays d'Aix Initiative, winner of the France Initiative, and winner of the Tremplin de la Provence.



- 70 pilot systems
- €1 M of R&D
- 3 patents registered
- 5 people employed
- + €400 K of funding already secured
- €2 M being raised
- 1st commercialisation planned for October 2016
- Industrialisation i.e. 1st deliveries planned for 2017



OPERATIONAL, INDUSTRIAL AND ECOLOGICAL PROGRAM

GRANDDE Pilot in Normandy of the PNSI program (Programme National de Synergies Inter-Entreprises). Two-year testing period in four regions (Normandy, Brittany, Rhone-Alpes and Aquitaine).

The PNSI involves companies of all sizes operating in all business sectors. The methodology identifies inter-company synergies in order to pool or optimise the use of resources owned by companies in the same region. This economic approach generates significant economic, environmental and social benefits for companies and regions.

INNOVATIONS

- ▶ The PNSI programme encourages collaboration between companies operating in the same region.
- ▶ **Helping companies.** The PNSI programme responds to the needs of businesses in a region (managing waste, supply chain, skills, etc.).
- ▶ **Free participation.** Open to all companies and organisations regardless of their size or sector.
- ▶ **Increasing company profits.** Optimising resources thanks to the identification of synergies.
- ▶ **Expanding networks.** Workshops bring together companies, experts and regional decision-makers.
- ▶ **Universal scope.** All resources are concerned: energy, waste, water, expertise, logistics, services, infrastructure, etc.
- ▶ **Making Sustainable Development a Reality.** The synergies lead to economic, social and environmental benefits.

STAKEHOLDERS

- ▶ **Governance:**
 - **GRANDDE:** Normandy Regional Coordinator
 - **Institut de l'Economie Circulaire (the institute of the circular economy):** Manager of the initiative
 - **International Synergie Limited:** provider of the deployed methodology
 - **Cabinet Aldérane**
 - **Local authorities and local partners:**
 - Urban community of Seine Eure
 - Urban community Caux Vallée de Seine
 - Rouen Normandie metropolitan area
- ▶ **Targets:**
 - **Companies and regions**
- ▶ **Funders:**
 - **Normandy region**

OBJECTIVE

→ To bring increased efficiency gains in terms of the regional deployment of industrial ecology as well as the acquisition of expertise by local stakeholders.

IMPLEMENTATION

► December 2015 - January 2017:

The PNSI brings together economic stakeholders in workshops thus increasing incoming and outgoing flows. Local technicians then help the stakeholders to make the identified opportunities a reality.

► Main steps:

1. Setting up a network of companies
2. Organising workshops and collecting data
3. Identifying and prioritising synergies*
4. Targeted visits/removing obstacles (facilitating negotiations/mobilising the necessary expertise)

* Synergy: A multi-stakeholder action that optimises the use of tangible resources (e.g. materials, energy, water, land, logistics services, etc.) and intangible resources (e.g. expertise and knowledge).



The programme brings about real benefits helping to improve the competitiveness of companies and the sustainable development of regions.

BOREALIS

An interesting and innovative initiative which "thinks out of the box".

EIFFAGE construction

It helped us realise that there are solutions out there which we hadn't considered and which can be applied on a daily basis.

TMN



RESULTS

/// In a very short time, this method is able to highlight possible substitution and resource pooling solutions.

/// Identifying synergies in half-day workshops:

- **Workshop 1:** 31 participating companies or associations – 215 identified resources – 248 identified synergies
- **Workshop 2:** 28 participating companies or associations – 216 identified resources – 437 identified synergies
- **Workshop 3:** 338 participating companies or associations – 220 identified resources – 368 identified synergies

/// The results of these implemented synergies will be available early in 2017.



FINANCIAL ASPECT OF THE OPERATION

EXPECTED BENEFITS

- Increase in: profits, sales, business opportunities, jobs, innovation, knowledge and investments
- Decrease in: CO₂ emissions, landfill requirements, costs, consumption of resources, pollution, risks and hazardous waste

/// Finance: €113,760

(Normandy Region, Ademe, IEC, Agglos, Grandde)

Consumption of resources, pollution, risks and hazardous waste

/// Costed results available in 2017

International Synergies
industrial ecology solutions



Institut de
réconomie circulaire





SUSTAINABLE BUSINESS AREA MANAGEMENT

SUSTAINABLE MANAGEMENT OF THE HARBOR ANGOT INDUSTRIAL AREA

INCREASING THE APPEAL OF THE BUSINESS AREA AND CONTRIBUTING TO COMPANY COMPETITIVENESS

Sustainable Business Area Management aims to:

- Increase the appeal of the area, implement all possible synergies between companies and detect savings opportunities;
- Implement all possible synergies between companies and local authorities;
- Find and implement practices that reduce the impacts on the environment and promote the environment via the development and management of a business park designed collectively;
- Strengthen social development by improving working conditions and promoting employment and the quality of life of business area users as well as local residents.

INNOVATIONS

N°	Description
1	Internet
2	Safety/security of the AREA
3.1	Communication - Company signage in the area
3.2	Communication with the outside
4	Knowing the neighbours
5	Medical monitoring of workers
6	Catering
7	Lorry "waiting" area
8	No parking
9	"Road traffic" risk
10	Training employees in the area
11	Informing the companies in the area of the technology risk prevention plan (PPRT) recommendations
12	Concierge service
13	Booking nursery places
14	Collection of "paper/card" waste

STAKEHOLDERS

- ▶ **Introducing the PUBLIC and PRIVATE stakeholders involved:**
 - GRANDDE network
 - Seine Mer Normandie Chamber of Commerce and Industry (CCI) (Elbeuf)
 - Voies Navigables de France
 - Saint-Aubin-lès-Elbeuf town hall
 - Rouen Normandie urban area
 - Companies in the area
- ▶ **Governance:**
 - One daily facilitator (GRANDDE) with support from partners
 - 1 Technical Committee
 - A steering committee (including elected representatives from all structures)
 - Meetings/working groups with the companies involved

KEY FIGURES

- 68% of companies involved, accounting for 85% of the workers in the Port Angot area
- 24 stakeholders questioned
- 25 topics covered

IMPLEMENTATION

► **Méthod: How does Sustainable Business Area Management work?**

Three intervention phases involved in this innovative approach:

- **Area analysis**

Territorial diagnosis.

Collection of views from stakeholders.

- **Customised company diagnosis**

Performance diagnosis and flow analysis.

- **Collective action phase**

Looking for potential synergies between economic stakeholders.

Definition and implementation of a collective action plan.

This approach is based on the guidelines on societal responsibility in NF ISO 26000 and NF P 14-010-1 dedicated to the sustainable development of business districts.

Stakeholder views.

BASF AGRI



Based on the ISO 26 000 standard, areas for improvement are identified, balanced and put forward to the directors, who may then take the chosen action. At the same time, compilation work is conducted at business area level to bring out the common areas for progress and issues.

What does the action programme entail?

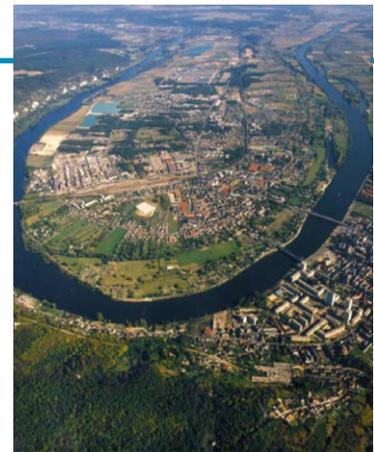
Having identified the opportunities for progress, specific to each entity, common areas are addressed. Then, voluntary working groups are formed to study the common solutions to be implemented.



RESULTS

/// Gains with respect to the 6 main objectives of the ISO 37101 standard:

- **Economic attractiveness:** guaranteeing economic development by ensuring the long-lasting establishment of companies (two additional companies setting up in the area)
- **Well-being:** favouring user quality of life (signage, medical monitoring, training, etc.)
- **Social cohesion:** Proposing services (catering, concierge service, nursery places, etc.)
- **Protecting/improving the environment, resilience, responsible use of resources:** guaranteeing compliance with environmental regulations, collection of paper/card waste and risk prevention.



Industrial area of Port Angot

FINANCIAL COMPONENT OF THE OPERATION

/// Overall cost of the operation: €58,850

/// Savings made for the companies: Internet: from €5,000 to €50,000 per company (cost of civil engineering)

Security component: from €2,600 to €6,591 per company

Pooled purchasing and training: being assessed

KEY DATA

→ Participation of VNF: €5,000

→ Participation of the Normandie Seine chambers of industry and commerce (CCI) (Elbeuf delegation): €5,000



UNION EUROPEENNE
Fonds Européen de
Développement Régional



REPUBLIQUE FRANÇAISE
Ministère délégué
à l'Équipement,
à l'Environnement
et à la Région
NORMANDE



RÉGION
NORMANDE



ADEME
Agence de l'Environnement
et de la Région de France



vnf
voies
navigables
de France



CCI SEINE MER NORMANDIE



RECONSTRUCTION OF THE PLANTINS WASTE WATER TREATMENT PLANT IN BEYNES

The Plantins de Beynes plant is located in the heart of a remarkable site surrounded by an archaeological area to the South and agricultural fields to the North. The architectural team aims to create a dialogue with the surrounding rural areas while respecting the biological balance in place and giving the development complex, using landscaping and architectural treatment. Started in January 2009 by the city of Beynes, the tender for building construction was won by consultant Naldeo and AR ARCHITECTES in 2010. Construction works began in May, 2011 and the plant is operational in August 2012.

INNOVATIONS

- ▶ **The architectural and landscaping design of the construction**, its volumes, heights and coverings is in a harmonious relationship with its environment.
- ▶ **The building design is bioclimatic** with a passive design.
- ▶ **Use recyclable materials** (wood, gabions, green roofs).
- ▶ **Renewable energy** (Thermal solar panels, Canadian well and VMC turbofan).
- ▶ **Innovative organic bio filters** which treats and extracts polluted air.
- ▶ **Mud treatment is achieved by the use of Reed beds** (4,000 m² of filtering gardens treating 25,000 m³ of mud/year).

KEY DATA

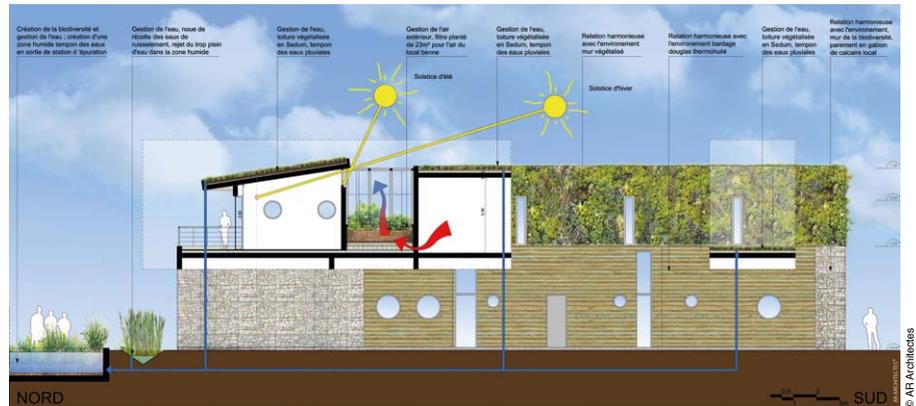
- Client: City of Beynes
- Project: Construction HEQ® of a bioclimatic building open to the public
- Mission: Architecture HEQ® and landscaping
- Consultant Designer: AR ARCHITECTES, NALDEO
- Contractors: DEGREMONT FA, ZUB, WATELET
- Area: 465 m² (16 460 m² site area)
- Cos: 4 500 k€ HT
- Date: 2010 - 2013

STAKEHOLDERS

- ▶ The project, financed by the Yvelines General Council, the l'Agence de l'eau Seine Normandie and the city of Beynes was launched in 2009 and won by the project management group compounds of Naldéo, engineering company and AR ARCHITECTS (Architects and landscape HQE).
- ▶ The construction works contract was won by: Degremont (equipment), ZUB (civil engineering) and Watelet TP (Roads system and urban public utilities).

IMPLEMENTATION

- ▶ The building had an old water area. The rehabilitation of an old hydraulic retention basin installation collects rainwater and streaming water thus creating ecological habitats and ensuring an available water reservoir for fire-fighters. Valorization of excavation by creating a rustic observatory accessible for everybody.
- ▶ An archaeological site on the plot led to a one-year construction delay. Indeed, the municipality had to buy a new field to dig the planted ponds for the mud treatment, initially planned on the excavation site.



RESULTS

/// Current situation

4 738 éq/h (40%) – 284 kg/d (40%) – Rate of flow 2 100 – 3 500 m³/d

/// Mud results

Volume 18,994 m³ – Solids 107 t

/// Consumption

Ratio of 0,71 kWh/m³ of purified water (operating 8 months)

This project received the Janus Price of the City in 2014.



FINANCIAL DIMENSION OF THE PROJECT

/// Financial report

Economics 85,000 €/year (transport for mud treatment)

/// Cost of water treated

1.16 €/m³ instead of 1.70 €/m³

KEY FIGURES

- Budget: 4,500 k€ HT
- Building works: 1,215,650 € HT
- Subvention: 3,625,171 €, 76% of the total investment





WASTE HEAT RECOVERY IN THE HALLUIN WASTE-TO-ENERGY (WTE) PROCESSING PLANT

CONSTRUCTION OF AN ENERGY HIGHWAY TO RECOVER HEAT FOR URBAN HEAT NETWORKS IN THE URBAN METROPOLIS OF LILLE (MEL)

This project entails recovering waste heat produced by the WtE plant in Halluin (800 GWh per year) during the treatment of municipal waste, superheating water to 120°C, then transporting it more than 20 km to supply the Lille and Roubaix urban heat networks.

The project will cost an estimated €60M, and will improve recovery of waste-to-energy in the form of heat as well as develop new heat networks.

Work is scheduled to begin in 2018 and will go into effect in 2020.

INNOVATIONS

- ▶ An objective to recover 300 GWh per year of waste energy in the form of heat.
- ▶ More than 50 MW of power available for urban heat networks, unique in France.
- ▶ An “energy highway” of more than 20 km in an urban setting.
- ▶ An investment that will lower the cost of waste treatment and will recover sustainable and economical energy for urban heat networks.

STAKEHOLDERS

- ▶ This project is above all a concrete illustration of the advantages of expanding the MEL’s competences to the territorial level.
- ▶ Before 1 January 2015 and the MATPAM law, the metropolis had jurisdiction over waste management, and towns were responsible for heating networks. The result is that heat waste was only partially recovered in the form of electricity at the WtE site.
- ▶ After 1 January 2015, when the MEL took on its new competences, there was an opportunity to recover heat produced in the WtE plant in the metropolis’ urban heat networks.
- ▶ The project stakeholders are the MEL, the operators of the WtE plant and the heat networks, the cities, and ADEME for the project funding.

KEY FIGURES

- 300 GWh of waste energy recovered for the heat networks
- More than 20 km of transport networks
- €60M investment over 20 years entirely covered by the sale of heat

IMPLEMENTATION

► A 20 km network of two pipelines (DN 500) will be installed to transport heat at 120°C along a semi-urban and then urban route. Construction and operations will be entrusted to the operator of the municipal waste incineration plant as part of a concession for the modernisation and operation of the plant.

This route will need to be adjusted in response to obstacles in its path, such as canals, highways, tramway lines, and the many existing networks. The route will also be chosen based on the development potential for future customers.

► Lastly, a tripartite contract between the MEL, the plant operator, and the operator of the Lille and Roubaix heat network will be established to define the technical and economic conditions for purchasing heat from the WtE plant.

Erwan Lemarchand,
the MEL's Energy Director



This is a major project for the territory demonstrating the advantage of transferring competences to the metropolis: improved waste recovery thanks to oversight of the heat networks, the development of the territory's renewable energy for the benefit of its inhabitants, and long-term cost control for energy and waste treatment. It's the proof that a territory can make a concrete contribution to the energy transition.



RESULTS

/// The Hauts-de-France region has some of the highest energy consumption in the county due to its industrial activity, and is also among the lowest producers of renewable energy. The MEL's Territorial Climate Energy Plan set an ambitious target to produce 3,000 GWh of renewable and recoverable energy for its own consumption by 2020. With this project, 10% of that target will be met.

/// This project will also cover 50% of the heating needs of 60,000 equivalent housing units that are now heated by an urban heat network.

/// Customers will also benefit from a VAT that is reduced to 5.5%, thus reducing their energy bill.

/// Lastly, recovering heat from the WtE plant for the MEL's heat networks will significantly improve the energy efficiency of the WtE plant with R1 status (used as a reference at the national level, particularly to calculate the TGAP tax, a general tax on polluting activities), which will go from 64% to more than 75%.



FINANCIAL ASPECTS OF THE PROJECT

/// A 20-year investment of €60M, with €50M to develop the energy highway and €10M to modernise the urban heat networks.

/// ADEME will provide financial support for this project.

- Coverage of 50% of the heating needs of the 60,000 housing units connected to an urban heat network
- 30,000 tonnes of oil equivalent recovered, and 7,000 tonnes of coal equivalent removed
- VAT reduced to 5.5% for the sale of heat to customers



AMÉTYST METHANIZATION PLANT

A TREATMENT PLANT FOR HOUSEHOLD AND SIMILAR TYPES OF WASTE THAT USES ANAEROBIC BIOLOGICAL METHODS (METHANIZATION) WHILE PRODUCING HEAT AND ELECTRICITY AT A MONTPELLIER MÉTROPOLE SCALE – 450,000 RESIDENTS

Amétyst comprises two distinct treatment lines for:

- Residual household waste from door-to-door collection. This waste is also referred to as the “gray trashcans”.
- The fermentable portion of household and similar types of waste (bio-waste), comprised of purely organic waste. Part of this waste comes from individual households, the remainder originates from other producers such as restaurants, markets, and businesses.

After mechanical sorting, waste is conveyed to eight dedicated digesters. Implementing a process of anaerobic biochemical reactions, these digesters transform part of the organic matter into biogas.

After treatment, the biogas produced by household waste digestion is then transformed by co-generation units into:

- Electricity, which is injected into the network
- Heat, which is used by the plant itself for process needs
- Heat, which is used by SERM for the collective heating and cooling network for the new Grisettes district in Montpellier.

Residual organic matter is then set aside for maturation to produce compost that can be used for farming and landscape development needs, or otherwise stabilized before being transported to a non-dangerous waste disposal site.

KEY PRODUCTION DATA FOR 2015

- 18,724 MWh electricity, sold to EDF
- 6,740 MWh thermal power transferred to urban heating network for Grisettes district, etc.
- 2,568 MWh heat consumed for the plant's own needs.
- Saint Roch clinic connected to the heating network.
- In the long-term, 2,300 apartments in the Grisettes zone will be supplied by Amétyst.

INNOVATIONS

- ▶ 1st heating network connected to a methanization plant.
- ▶ High energy yield, unparalleled with respect to other methanization sites.
- ▶ The consistent quantity and quality of produced biogas enables optimal operation of cogeneration engines, with regular delivery of heating for apartments and businesses in the Grisettes zone, a certified eco-district.

STAKEHOLDERS

► Construction:

Project owner: Montpellier Méditerranée Métropole
Builder: VINCI Environnement (2006/2008)
Process: KOMPOGAS (CH)

► Operation:

Public Service Delegation on behalf of Montpellier Métropole: SITA SUEZ - 10-year contract starting Jan. 1, 2015



IMPLEMENTATION

► Implementation: 2008

New SUEZ contract: January 1, 2015

Commissioning of new equipment: March 1, 2016 (14 months of work without interrupting service)

► The plant implements technologies developed by Vinci Environnement and SITA SUEZ to transform waste into energy and compost.

► All of the residual household waste and bio-waste collected in 2015 within the Montpellier Métropole territory was treated by the Amétyst plant, representing 125,839 tons of household waste and 2,697 tons of bio-waste in 2015.

► Challenges:

- Controlling the methanization biology
 - Compost compliance via ultra-screening
- Patents filed by SUEZ with INPI.

RESULTS

/// 2015 was marked by the kick-off of a new public service delegation contract signed with Novergie to operate the Amétyst methanization plant. Major work projects were undertaken successively, totaling about €9.5 million, by the delegated contractor to significantly improve plant production results in the long-term, by over 30,000 tons of standardized compost, and 10,000 tons of solid recovered fuel (SRF).

/// The work was completed on February 29, 2016, as stipulated in the terms of the public service delegation contract.

/// At the end of the first few months of service and ramp-up of the new equipment, the production of standardized compost reached 2,800 tons (March 1 to July 31), in compliance with fixed goals, compared to 175 tons of compost produced in 2014.



FINANCIAL ASPECTS OF THE OPERATION

/// The plant implements technologies developed by Vinci Environnement to recycle matter and transform it into energy and compost.

/// Co-funding by Région Languedoc-Roussillon Midi Pyrénées and ADEME.

KEY FIGURES

→ Construction: 86 M€
[pre-tax]

→ Operation: 150 M€
over 10 years

FRANCE
URBAINE
MÉTROPOLES, AGGLOS ET GRANDES VILLES

Montpellier
Méditerranée
métropole



VINCI



URBAN WASTE HEAT RECOVERY

STUDYING THE POTENTIAL FOR WASTE HEAT RECOVERY WITH A VIEW TOWARDS THE OVERALL EFFICIENCY OF THE URBAN SYSTEM: THE RECOV'HEAT TOOL

What is waste heat? Waste heat is the heat generated by a process which creates heat without it being the purpose of that process. This energy is lost, with potential disruptive impacts on the environment, unless recovered or recycled. Why is it important to recover waste heat? Recover waste heat from urban buildings as water treatment plant (also called sewage), data centers, stations, urban factories, shopping centers, is a way to increase the value of the energetic urban mix and to allow cities to become leaders in the energetic transition.

Saisissez les surfaces de la zone d'étude

BUREAUX (m ²) :	20000
LOGEMENTS (m ²) :	30000
MAISONS INDIVIDUELLES (m ²) :	10000
ECOLES (m ²) :	4000
COMMERCES (m ²) :	3000
CRECHES (m ²) :	1000
Surface totale (m ²) :	98000

Sélectionnez le type de source (*) :

Eaux-usées Data Center Blanchisseries Verretries Biscuiteries

Paramétrez les données de production & distribution

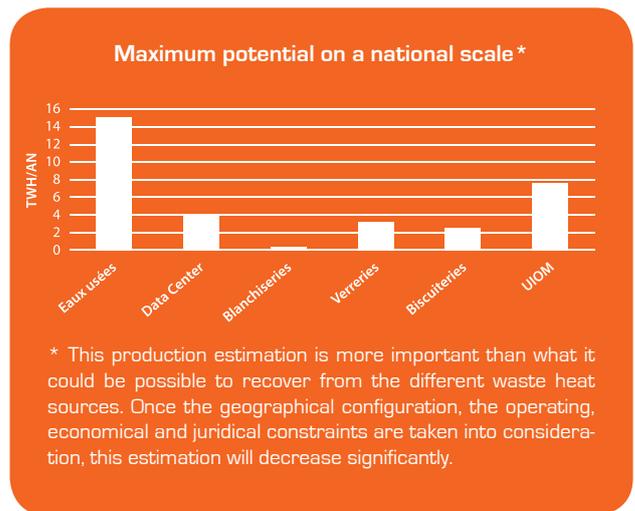
Température d'usage (*) : Moyenne température (55-85°C)

Usages du chaud : Chauffage ECS

Distance source - réseau (m) (*) : 500

Eaux-usées

Indiquez le nombre équivalent d'habitants connectés au collecteur ou à la STEP (*) : 7500



► The RECOV'HEAT tool provides a quick estimation of a waste heat source, with a view towards the overall efficiency of the district. It compares heat sources to the energetic needs, and determines whether it is pertinent to exploit the waste heat source. What sources? Waste water, data centers, incineration plants, biscuit factory, glasswork factory.

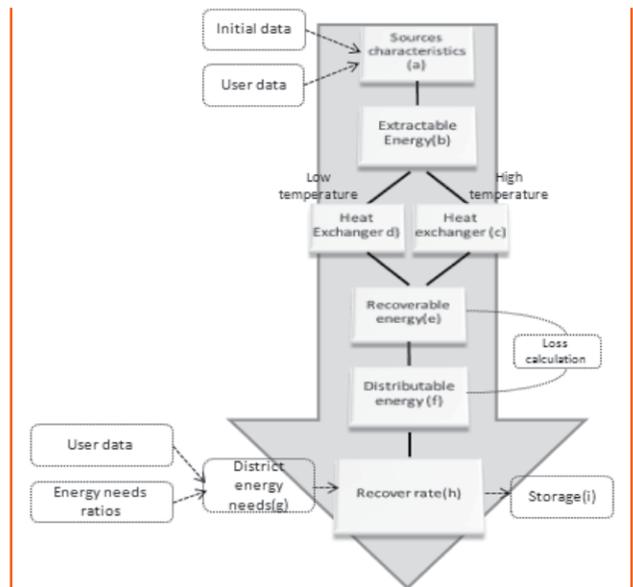
TO WHOM IS IT ADRESSED

- Energy and urban network operators
- Territorial collectivities: elected representatives and technical services
- Citizens, associations
- Waste heat producers: industrials, service companies, etc.

METHOD

► Each source has a proper algorithm. It uses at least one data asked to the user and physical properties of the selected source. For example, starting points of heat recovery potential calculation from a sewage network are the flow, the temperature and the water heat of combustion value.

► The diagram sums up the method developed, which is the same for all algorithms: it evaluates step by step the extractable energy, the recoverable energy after the use of extracting technologies, the distributable energy after heat loss calculation and finally, the monthly recover rate, according to thermal needs of a district, sized by the user.



Recov'Heat algorithm

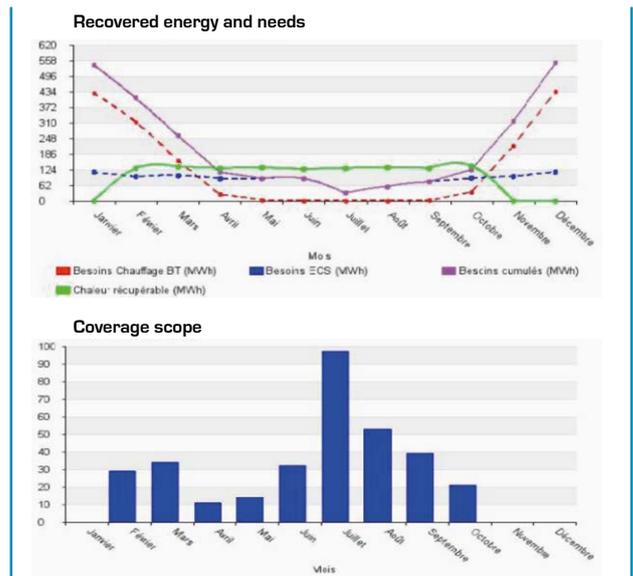
RESULTS

/// Simulation results

- The annual energetic assessment sums up:
 - the yearly distributable energy quantity (MWh);
 - the yearly recover rate according to district needs;
 - the recovery conditions according to the studied source (compatibility with use temperatures...).

/// Model validation

- Real data from already existing waste heat recovery projects (waste incinerator, datacenter, sewage)
- The absolute difference is quite low. Recov'Heat calculate a maximal potential (MWh) without any constraint. It is often higher than real projects.



Simulation example with heat recovery potential on sewage

PERSPECTIVES

/// The first version of Recov'Heat gives a quick energy potential of a waste heat source, during a year with a monthly detail.

/// The next version of the tool, in developing process, would propose more detailed calculation (hourly stages), geographic information system (GIS) to localize and evaluate more precisely sources, and economic assessments in order to appraise the heat recovery relevance.

- Sewage from 100 inhabitants could be used as heat for about 10 inhabitants.
- 100% of electricity consumption of data-center servers is dissipated in heating form.



PORT MARIANNE WOOD COMBUSTION TRIGENERATION

BIOMASS HEAT, COOLING, AND ELECTRICITY PRODUCTION FOR CITY BLOCKS FEATURING FUNCTIONAL DIVERSITY (HOUSING, COMMERCE, ACTIVITIES, EQUIPMENT).

The 9th plant in the Montpellier network, this site produces three types of energy from wood: renewable heat, cold, and electricity. In the long-term, the plant will supply 6 districts.

Unique in France and Europe in terms of size, this equipment offers:

- *Centralized production of hot water and electricity*
- *Decentralized production of cooling, using water absorption machines installed in buildings.*

The plant uses wood from the nearby Haut Cantons area, and Class A salvaged wood from within 120 kms.

The project's relevance is also based on its application to city blocks offering functional and program diversity, featuring housing, commerce, activities, and equipment. This diversity makes it possible to imagine practical pooling of resources for energy production and consumption, based on the city's time-frames for a given use: home time is different from office time, which is also not the same as business time.

The principle of trigeneration makes it possible to meet the varying needs of users in real-time.

Installed since April 2015

INNOVATIONS

The project integrates several innovations:

- ▶ **Wood-based electricity production at this large of urban scale**
- ▶ **Cooling production from wood-based renewable energy**
- ▶ **Priority on heat production (1st thermal cogeneration in France)**
- ▶ **All year round simultaneous production of renewable electricity, heating, and cooling.**

The startup ENERTIME developed the ORCHID 1 MW Organic Rankine Cycle module, which transforms heat into electricity and operates like an inverted heat pump. This technology is particularly well suited for producing electricity from low temperature heat sources (< 300°C).

KEY FIGURES

- **With a capacity of 8 thermal MW** to cover 80% of needs for heating, the plant provides 100% green electricity production using a 500 KWe turbine powered by renewable heating.
- **6,200 tons of carbon are saved annually** (compared to a natural gas based solution).
- **5,200 apartments, 300,000 sq meters of offices, businesses, and public infrastructure** are supplied.

STAKEHOLDERS

An initiative of the City of Montpellier, in partnership with SERM, Montpellier Méditerranée Métropole, the French government, Caisse des Dépôts, and ADEME

- ▶ **Licensor:** City of Montpellier
- ▶ **Project owner/Concessionaire:** SERM



- ▶ **Architect:** Imagine
- ▶ **Main project manager:** SETEC environnement
- ▶ **Network project manager:** ALTERGIS
- ▶ **Companies:**
 - Technical controller: APAVE
 - SPS coordinator: Qualiconsult
 - Roads, networks, and outdoor spaces: GUINTOLI
 - Main structure and interiors: DUMEZ SUD
 - Wood process: WEISS France
 - ORC: ENERTIME
 - Climatic engineering: SPIE SUD OUEST
 - High-voltage electricity: CEGELEC
 - Automation – CTM: REYES INDUSTRIE
 - Heating network: SOGEA SUD
 - Wood supplier: EUROPEENNE DE BIOMASSE
 - Operation and maintenance: IDEX

RESULTS

- /// Cogeneration yield: 84%
- /// Renewable heating over 90% all year round.
- /// Heat production globally without carbon impact (low impact balanced by electricity produced).
- /// 6,200 tons in annual carbon savings.
- /// Ample wood resources within 120-150 kms of Montpellier.

The trigeneration plant is EcoCité certified.
It is recognized as innovative by the Derbi Competitiveness Cluster.



FINANCIAL ASPECTS OF THE OPERATION

- PIA – City of Tomorrow – Wood trigeneration: 4,962 K€
- Ademe – heating fund: 2,674 K€
Total subsidies: 7,636 K€
SERM: 13,740 K€

PROJECT COSTS

- Wood cogeneration: 9,350 K€
- Heating network and exchange substations: 5,230 K€
- Cooling production by absorption: 6,526 K€
- Total project costs: 21,106 K€

/// Investment of €19,200,000.

/// Benefited from co-funding from the EcoCité Fund for the City of Tomorrow, €4,962,000 - supported by France's "City of Tomorrow" Investments in the Future program (PIA).





ASTUCE & TIC



PREDICTION OF THE IMPACT OF URBANIZATION AND CLIMATE CHANGE ON ECOSYSTEMIC SERVICES (WATER AND SOIL)



Astuce & Tic is a unique network of experts bringing together scientific researchers, economists and engineers specializing in agronomy, water and soil resources, and information technology.

Thanks to models available for spatial and dynamic simulation of the environment, Astuce & Tic brings a dimension of prospecting, which is indispensable for decision-making tools in order to anticipate and minimize foreseeable effects of territorial development policies along with the integration of climate change impacts. It is a tool to assist public authorities and stakeholders of a given territory towards decision making.

This 3-year project was coordinated by G2C Ingénierie (subsidiary of Altereo), and brought together the competences of Orange labs (Group France Telecom-Orange), INRA of Aix-en-Provence and Avignon (GSE, EMMAH, Agroclim), CEREGE, as well as MEED SA.

The area selected for demonstration was the Plaine de la Crau in the Bouches-du-Rhône department in the South of France. This zone, with an area of 60,000 hectares, is located within the Rhône to the West, the Berre Lake to the East, and the Alpilles to the North. There is a large water table and the climate is Mediterranean. The water for the irrigation of the grasslands (that produce the famous Crau hay, used to feed racehorses) uses 75% of the available water.

INNOVATIONS

Astuce & Tic assisted local public authorities in:

- ▶ **Acquiring a global and integrated vision of their territory** thanks to a set of indicators (artificial land alteration, quality and quantity of water resources and their interactions with land resources, agricultural production, etc.),
- ▶ **Testing multiple scenarios that integrate diverse variables** such as legal constraints, socio-economic dynamics and climate change,
- ▶ **Obtaining a prospective vision of the evolution of resources**, specifically those concerning water and soil.

This integrated approach of the Astuce & Tic program has the primary objective of understanding and anticipating the impact of different pressures (urban expansion, soil impermeability, reduction of available agricultural lands) on the quantity and quality of water resources.

STAKEHOLDERS

Astuce & Tic was developed by a joint consortium comprising of public and private partners.

- ▶ **Public partners:** IINRA (National Institute for Agronomic Research) Lab, CEREGE (European Center for Research and Education in Geoscience and Environment) of the Aix-Marseille University.
- ▶ **Private partners:** G2C Ingénierie, MEED SAS and Orange Labs (Group France Telecom-Orange).

Astuce & Tic was recognized by the competitive cluster "Territorial Risks and Vulnerabilities".

IMPLEMENTATION

The territory of the Plaine de la Crau is subject to various types of pressures, all linked to the pattern of urbanization.

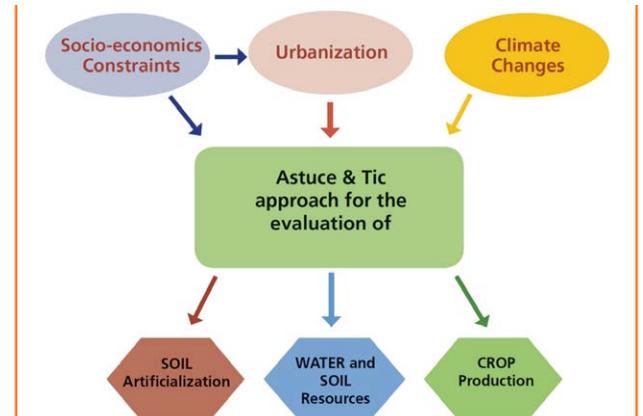
- ▶ Industrial and urban pressure concentrated towards the South and related to the industrial area of Fos,
- ▶ Extension of the urbanization of the communes of Saint-Martin de Crau, Miramas, Salon-de-Provence, and Arles,
- ▶ Stress on the groundwater: sampling, expansion of sewage sludge, rejects,
- ▶ Development of fruit orchards using intensive agricultural practices.

Given the context, it was necessary to equip development actors with the necessary tools to evaluate the environmental impacts of policy-making.

With A&T, land occupation trends are modelled via cellular automaton that allows the calibration of the changes and

provides and estimation of future alterations through the verification of multiple scenarios.

High-res satellite images allowed for the evaluation of the progress and the loss of arable lands.



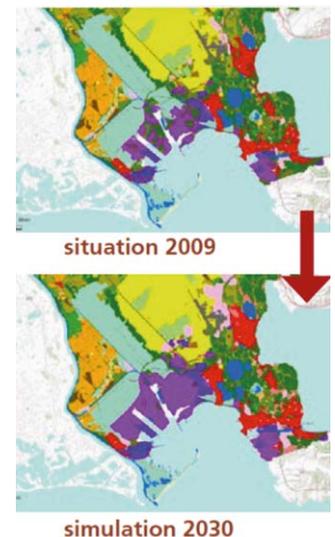
RESULTS

/// In the Plaine de la Crau, A&T proved useful to:

- Measure qualitatively and quantitatively the impact of urban sprawl on land use
- Show that past urbanization has irreversibly destroyed a part of the best agricultural soils, as soil quality was not considered in urban planning
- Evaluate the rapid influence of land use changes on groundwater quality
- Stress the importance of irrigation infrastructure and processes dating back to 16th century. Gravitational irrigation has a protective effect on soil quality (buffering of soil pH)
- Offer a reliable estimation of water demand and withdrawal in all sectors particularly in agricultural species and
- Simulate scenarios of water restriction up to 30%, and show that technical solutions can alleviate its impact on groundwater recharge, water quality (pH, salinity) and crop production.

/// The models were used to evaluate:

- the capacity of the areas to supply water, food and nutrients
- production
- proper flow and quality of drainage



FINANCIAL DIMENSIONS OF THE PROJECT

/// R&D project financed partly by the DGCIS (Direction Générale de la Compétitivité, de l'Industrie et des Services) and partly by the PACA (Provence-Alpes-Côte d'Azur) region.

KEY FIGURES

- Overall Budget: 3,2 M€
- Altereo: 1 M€





MANAGEMENT OF WASTE WATER FROM THE VINEYARDS OF SAINT-EMILION IN FRANCE

A SMART AGRICULTURE CASE WITH THE MEDIATION OF STAKEHOLDERS THANKS TO THE GENERIC INTERNET OF THINGS PLATFORM COMMONSENSE

In the framework of the management of a water treatment plant in Gironde, France, for the treatment of Saint-Emilion vineyards' waste water, Vertical M2M was put in charge by CUMA Saint-Emilion to design and operate an Internet of Things management system of waste water tanks involving different stakeholders. Objectives were to make operating processes more fluid thanks to instant communication, monitor waste water production by winemakers and smooth the load supported by the water treatment.

KEY DATA

- Between 200 and 250 participant vineyards
- Project initiated in 2005 which continues today (2016)
- Capacity of the water treatment plant: 33,000 m³

INNOVATIONS

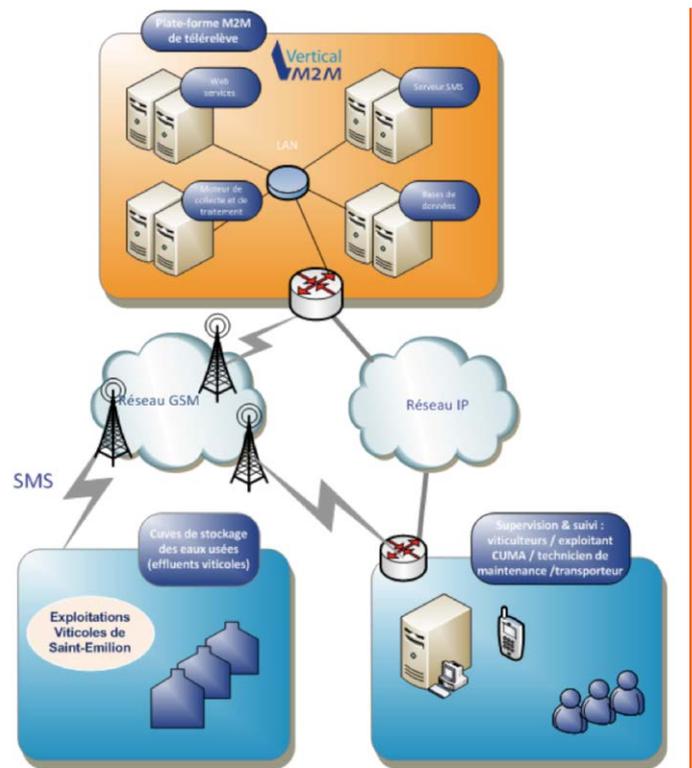
- ▶ The solution includes level sensors, cellular communication and the IoT CLOUD platform CommonSense. The platform behaves as the mediator for a better organization and global productivity:
 - Cellular connectivity and near real time data platform regarding tank levels;
 - Organizational mediation thanks to multi-level management with 4 groups of stakeholders' accounts:
 - 1. Winemakers: monitor the production of waste water
 - 2. CUMA, the operator is able to anticipate needs and communicate information about the water tanks to Saur (the water treatment plant operator)
 - 3. The maintenance technician: automatically alerted
 - 4. Transporter: automatically alerted.

STAKEHOLDERS

- ▶ **CUMA Saint-Emilion** (Coopérative d'Utilisation de Matériel Agricole – Machinery sharing cooperative): the tank stock operator.
- ▶ **Vertical M2M**: supplier of the IoT solution for tank management.
- ▶ **Saur**: the water treatment plant operator.

IMPLEMENTATION

- ▶ 2005: pilot project with a first tank
- ▶ 2006: hundreds of managed tanks
- ▶ 2015: new generation of sensors were installed
- ▶ Q4 2016: project of evolution towards a SIGFOX connectivity
- ▶ **Type of contract:** monthly subscription with annual revision
- ▶ **Issues encountered:**
 - Hardware integration and process to make the communication stream reliable due to environmental constraints and sensor reliability.
 - Organizational: at the beginning the special operations for emptying the tanks weren't followed by the transporter (to measure emptied water).



RESULTS

/// Responsible handling of natural resources coupled with preservation and improvement of the environment

- Optimization of the processing load supported by the water treatment plant
- Optimization of the transporter's runs
- Optimization of vineyards: monitoring of produced waste water by each winemaker

/// Economic attractiveness

Better management of the contribution for each CUMA's member thanks to precise monitoring of wastewater production.

/// Partners

- Saur: water treatment plant operator
- CUMA.

FINANCIAL ASPECT OF THE OPERATION

/// Funding

- European project
- CUMA Saint-Emilion

→ Funding envelope of about 40 000 €



LAOGANG, CHINE: RECOVERING ENERGY FROM LANDFILL FACILITIES

LANDFILL, A SOURCE OF RENEWABLE ENERGY

The project is a landfill gas recovery and utilization in Laogang (East China Sea coast in Shanghai, in the district of Pudong), on an existing landfill site. The main objective was to collect and utilize gas (mainly methane) to generate electricity by installing LFG collection and pre-treatment system, electricity generation system and LFG flaring system on site.

To date it is the largest facility of its kind in operation in Asia.

INNOVATIONS

- ▶ The Laogang landfill facility began operating in 1989. But before 2008, no gas extraction and utilization systems existed to increase energy efficiency and little effort was made to capture the methane generated from the landfill.
- ▶ In 2008, the creation of the Shanghai Laogang Landfill Gas-to-Energy joint venture made it possible to guide this activity towards energy efficiency.
- ▶ The site commenced generating power in isolated mode for site use in July 2008. By 2012, the project has transitioned from a single safety MSW disposal base to a resources recovery and recycling solid waste base. The site has been connected to the electrical power grid, making Laogang a major MSW disposal base in Shanghai.

KEY DATA

- 11 generators for an installed capacity of 15 MW
- Production potential of 120,000 MWh per year (102,000 MWh produced in 2014),
- Direct emissions reduction of 520,000 metric tons of CO₂ equivalent per year.

STAKEHOLDERS

- ▶ The project to recover biogas from the Laogang landfill facility was set up in 2007 by Shanghai Laogang Landfill Gas-to-Energy, a joint venture 60% owned by Shanghai Environment Group and 40% by Hong Kong Bloom Country Ltd, a 100% subsidiary of Veolia.

This project is supported by a public-private partnership contract of the BOO (Build-Own-Operate) type with a 25-year term.

IMPLEMENTATION

- ▶ Designed, built, and operated by Veolia under a 25-year contract, the solution implemented is based on 11 generators and various ancillary facilities, low-voltage distribution facility, transformation substation to ensure the correct voltage level for the network, flares to burn excess methane, etc.
- ▶ Veolia's brought its expertise and advanced technologies, (including gas collection, gas pretreatment, gas engines/

generators and grid connection systems) and excellence in terms of environmental protection (reduction of landfill gas pollution, clean processing and closed circulating cooling system, realizing zero discharge of wastewater and solid waste, and the emission of gas meeting national standard).

- In 2012 the benefits of this project in relation to Climate Change enabled it to register with the United Nations as a "Clean Development Mechanism" (CDM). Introduced by the Kyoto Protocol, this mechanism allows companies established in emerging and developing countries with GHG reduction targets to earn credits in exchange for implementing or co-financing projects that reduce emissions. The company is then free to allocate these credits to units located elsewhere or sell them on the carbon credit exchange markets.
- Veolia has for a long time been involved in the CDM, in particular by obtaining the registration of several other projects that capture, treat and recover biogas.

RESULTS

- /// • A substantial reduction in greenhouse gas emissions in the atmosphere, particularly of methane.
- In 2014, 60 million normal m³ LFG were collected and treated, and 102,189 MWh Green Power generated which resulted in 25,800 metric tons CH₄ reduced (60% methane), 542,000 tons CO₂ equivalent reduced.
- A registration with the United Nations as a "Clean Development Mechanism" (CDM).

- /// Job creation during the project construction phase and during the operational phase with jobs that cannot be relocated.

- Electrical generation capacity: 15 MW
- Green energy production of around 100,000 Wh/annum, (equivalent to the energy consumption of 100,000 families)

FINANCIAL COMPONENT OF THE OPERATION

- /// The production of green energy meets the needs of the site and allows to sell electricity to the public grid (East China Power Grid). Benefits are also associated with the implementation of a clean Development Mechanism (CDM) project approved by the United Nations Framework Convention on Climate Change.

- A public-private partnership contract of the BOO (Build-Own-Operate) type with 25-year term.





PÉCS: STRAW AND WOOD TO REDUCE CARBON FOOTPRINT

ONE OF THE FEW EUROPEAN CITIES USING RUNNING ON 100% RENEWABLE RESOURCES FOR ITS HEATING

Relying on local and renewable energy resources is one of the great achievements of the city of Pécs.

In November 2013, the largest biomass cogeneration heating network in Europe started operating: 180,000 metric tons of straw and 400,000 metric tons of wood now power every year the city's heating network and prevent the release of 400,000 metric tons of CO₂ into the atmosphere yearly.

INNOVATIONS

- ▶ Pécs is one of the only cities in Europe making use of 100% local, renewable resources for its heating needs. Operated by Veolia Hungary, the 35 MW electricity production unit using straw supplements complements another 50 MW electricity production unit which has been running on wood since 2004.
- ▶ In fact, the Pécs production unit represents 210 million m³ of natural gas saved per year and gives the city a true energy independence thanks to the use of local and renewable resources.

KEY DATA

- The Pécs heating biomass boiler feeds over 31,000 housing equivalents and some 450 public buildings.
- This production unit allows Hungary to save 210 million m³ of imported gas and prevents the release of 400,000 metric tons of CO₂ into the atmosphere, the equivalent of the yearly emissions of 27,000 French people.

STAKEHOLDERS

- ▶ The City of Pécs (170 000 inhabitants), the fifth largest city of Hungary
- ▶ Veolia

IMPLEMENTATION

- ▶ **2004** : Starting date of a 50MW production unit using wood.
- ▶ **2013** : Starting date of a new cogeneration unit producing 35MW fed by 180,000 metric tons of straw.
- ▶ Duration of the contract between Veolia and the Pécs municipality: 2008-2030 (22 years).

Zsolt Páva, the mayor of Pécs

“ I am delighted that this project allows Hungary to improve its performance in term of energy efficiency **”**

Renaud Capris,
country Manager of Veolia Hungary

“ It is extremely rare, if not unique, to have these two types of resources on the same site. For the Hungarian population and its elected officials, it is very reassuring to be able to rely on energy resources that significantly reduce their energy dependence and make it possible to create a considerable number of jobs that cannot be relocated. **”**

RESULTS

/// Environmental results

Supply from 2 cogeneration units solely running on straw and wood (replacing gas and coal). Using renewable energy, decreasing CO₂ emissions, optimizing energy consumption via the heating network.

/// Social/Societal results

Over 170 jobs created locally to manage the straw-fueled plant's entire procurement channel.

/// Technical results

For the 180,000 metric tons of straw a year, the plant has a storage area for the raw material. The boiler is powered by 4 automatic lines: the straw bales arrive via a conveyor belt before being shredded and injected into the boiler.

FINANCIAL ASPECT OF THE OPERATION

/// Reinforcement of the local economy, decrease of energy dependence (gas importation).

→ A 80 M€ investment to switch from gas to straw.





THE CREATIVE BANKS OF THE ESCAUT RIVER

TERRITORY COMMENDED FOR EXCELLENCE IN ENERGY POOLING



26 hectares at the heart of the Valenciennes Metropolitan Area, a former industrial fallow land (ex-Vallourec site), later granted ZAC status, achieving high energy and environmental performance. By pooling their needs and re-using the fatal energy generated by the Data Center, Vallourec's former drilling site was re-conditioned, creating a virtuous circle and making it possible to do without fossil fuel energy consumption entirely.

INNOVATIONS

- ▶ An up-to-date comprehensive cost study that takes into account ZAC development programme phasing (optimising offer and energy demand) As existing drilling facilities were re-used, investment were cut
- ▶ A technical first for a ZAC
- Fatal energy from the Data Center was recovered to supply an entire ZAC and carve out a 100% sustainable project (ENR&R), 70% of CO2 emissions were cut by 70% and ultra-deep geothermal energy and direct-exchange were used to concurrently satisfy heating and cooling needs.**
- ▶ Support was also provided to real estate developers to etch out a virtuous circle for the project.

KEY DATA

- A truly multi-faceted development programme (93,000 m²)
 - Digital Greenhouses
 - The Convention Centre
 - The Data Centre
 - Student housing
 - Offices and Shops
- A geothermal plant (2MW)
- Industrial, re-conditioned drilling units
- A temperate water loop enabling re-use of the Data Centre's fatal heat

STAKEHOLDERS

- ▶ **Project Manager:**
La communauté d'agglomération de Valenciennes.
- ▶ **Upstream study:**
 - Regulatory paperwork: TPFi
 - Technical, legal and financial feasibility: IFPEB - TPFi - PARME Avocats
- ▶ **Project Management Assistance and Public Service Delegation:** TPFi and PARME Avocats
- ▶ **Project Management Assistance to real estate developers:** TPFi and ANTEA
- ▶ **Project Manager:** TPFi (co-creative engineering)
- ▶ **Operator:** Groupement ENGIE et Eau & Force

IMPLEMENTATION

- ▶ The public authorities were committed to **re-conditioning this former industrial site** and turn it into an excellence area for digital creation, and sustainable and intelligent territory (**thermal smart grid**).
- ▶ Detailed upstream studies, with multiple scenarios reviewed, so as to give the project manager as many well-suited options as possible, from the technical, financial and legal standpoints
- ▶ **A multi-disciplinary approach and commitment to pooling energy**
A decision-making assistance tool
- ▶ **Support was provided throughout to the real estate developers** so that they understood every aspect of the cycle and could plan for compatible facilities



The Creative Banks of the Escaut ZAC, a truly sustainable and smart neighbourhood spans 26 hectares and multi-faceted programme combining many functions: housing, a city park, companies, offices, world-renowned schools, shops, and B-to-B firms. With a geothermal grid put to work across the site, the project became a living example of dynamic and sustainable energy management. The grid recovers fatal energy from the Data Center, the key component of the thermal smart grid. Secondary energy systems guaranteed to be compatible and optimised in the buildings connected to the geothermal loop, energy supply exactly tuned to building needs, and a design fostering energy efficiency and low-intensity consumption: all of these were key features in the project



RESULTS

/// Economic attractiveness:

ENR&R in place across the ZAC, energy spending completely under control, multi-use programme

/// Environmental conservation and enhancement

- An industrial fallowland was turned into a high-performance urban site
- Environmental footprint reduction: renewable energies (75%) and recovered energies (25%), energy pooling, geo-cooling, lower GHG emissions ($\text{CO}_2 < 50 \text{ g/kWh}$)

/// Responsible use of resources

Shallow geothermal technology and reinjection into water table

/// Well-being

- Comfortable heating in buildings
- Sustainable transport (tram)
- Landscaped park

Winner of the EU's «Territorial Excellence» call for projects



FINANCIAL ASPECT OF THE OPERATION

- /// Won the Energy Users' Award for highly competitive energy well-managed over time
- /// Investments, operating expenses and maintenance costs all shared
- /// New business model

KEY DATA

- 6 300 MWh/year
- $\text{CO}_2 < 50 \text{ g/kWh}$
- First 100%ENR&R project in France



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.