Efficient district heating and cooling as a backbone to local energy transitions

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Introduction

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Efficient DHC grids often provide an evolutive backbone to balanced energy transitions

- DHC grids can be supplied by **a very broad range of renewable or recycled energies**
- Efficient DHC grids are also **linked, at the other end, to energy efficiency policies in buildings**, both as regards new construction and renovations
- Other factors will allow further energy optimization to occur within those DHC grids (e.g. **energy exchanges, connection between heating & electricity systems**, etc.)

The development of those efficient DHC grids relies on a new balance between cooperation and competition within open, evolutive systems

- DHC grid models have changed quite radically:
  - Some of the existing grids were developed in an altogether different energy context
  - New DHC systems follow different goals and development paths, and rely on partly different economics

→ 2 examples from our European Tilia projects

Implementing a holistic new energy concept in an old DHC system: a powerful local value creation (1/3)

The example of Querfurt (Sachsen Anhalt)

- Old, rather inefficient gas fueled district heating system, high CO2 emissions
- Expensive energy supply due to disconnection of large customers and heavy fixed costs falling back on households (~130 euros/MWh)
- Social and economic problems linked to inefficient energy supply
- Huge wind power production surrounding the city, little relation to its intrinsic energy needs
- Concerns as regards an overall energy strategy that would fit the city development plans

Implementing a holistic new energy concept in an old DHC system: a powerful local value creation (2/3)

- Elaboration, benchmarking and prioritisation of a whole range of potential projects
- Design, development and financing of a new methanisation-cogeneration system and optimisation of the district heating network
- Identification of new heat offtake potential from large, unconnected potential customers; identification of new customers, support to the constitution of the agricultural JV (waste providers)
- Contract negotiation with waste providers and heat off-takers, procurement, construction and operation of the new methanisation and cogeneration plants

✓ **Return on equity for the investing municipal entity > 25%**

✓ **30% decrease of the district heating heat bills compared to basic plan**

✓ **40% decrease of CO2 emissions from the district heating system**


Implementing a holistic new energy concept in an old DHC system: a powerful local value creation (3/3)

Replicable key factors of success

- Opening the scope : starting with in-depth needs forecast
- Thoroughly comparing options : avoid one sided enthusiasm
- Think long term: link systemic innovation to operational optimisation from the start
- Focus on implementation and capacity building in local companies and systems
- Think gradually: a project is a dynamic step in a long system history

The Smart Heating and Cooling network of Paris Saclay

Matching high performance DHC supply with energy efficient buildings, based on local resources and grid innovation

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- Paris Saclay, a project of cluster of excellence gathering :
  - the top French engineering and business schools
  - state-of-the-art research laboratories and many private companies

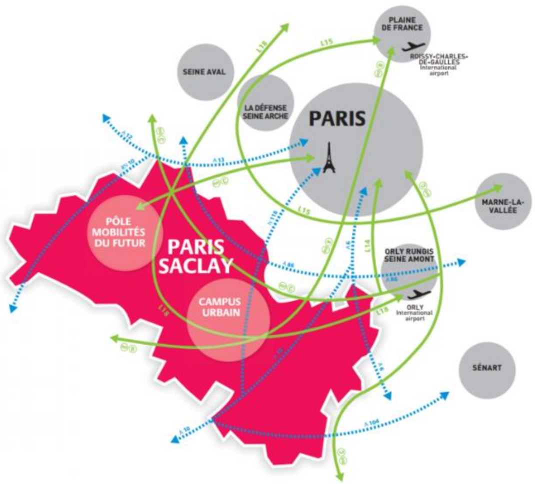
- Objective
  - build a world renowned center of scientific research
  - a center of innovation and economic development …
  - together with a new urban nexus and vivid housing area

- PARIS-SACLAY constitutes a major scientific, economic and territorial development project

60 000 ÉTUDIANTS
60,000 STUDENTS

- 25 000 au niveau Master
  25,000 Masters students
- 5 700 au niveau Doctorat
  5,700 Doctoral students

10 500 CHERCHEURS ET ENSEIGNANTS-CHERCHEURS
10,500 RESEARCHERS AND RESEARCH PROFESSORS



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- AgroParisTech
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- Supélec
- Systematic
- Synchrotron Soleil
- Université Paris-Sud
- Université de Versailles-Saint-Quentin-en-Yvelines

The Smart Heating and Cooling network of Paris Saclay

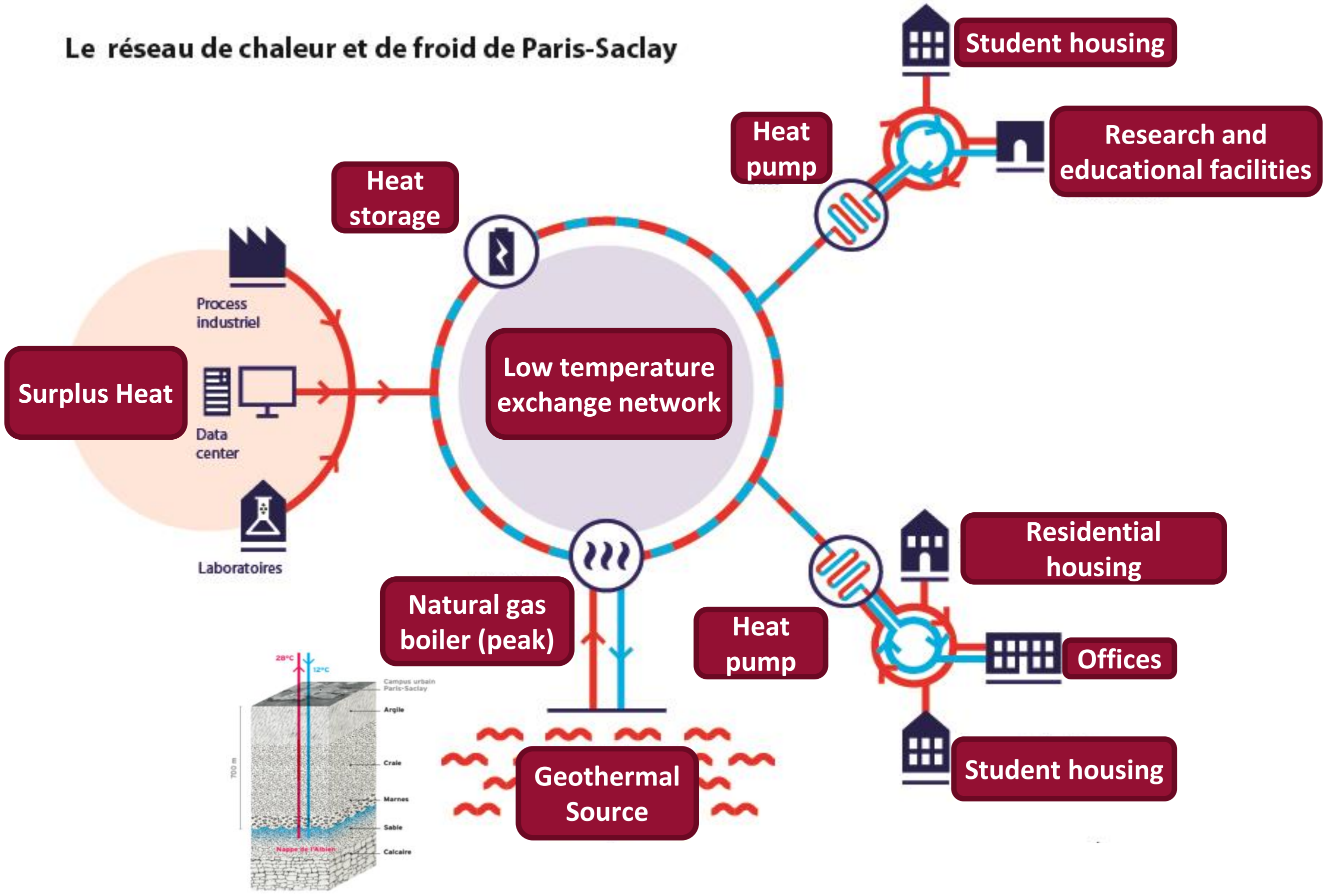
The Urban Development project

- Paris Saclay : an urban development project
  - **1 740 000 m²** to be build between **2015 and 2028** with associated infrastructure
    - 550 000 m² education and research institutions
    - 560 000 m² of business
    - 380 000 m² family housings
    - 168 000 m² student housings
    - 86 000 m² of shopping facilities, public equipment etc..

- Total invest
  - **1,5 billions €** for real estate projects
  - **1 billion €** devoted to laboratories, scientific facilities and collaborative institutes

The Smart Heating and Cooling network of Paris Saclay

General principle

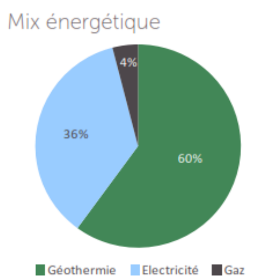


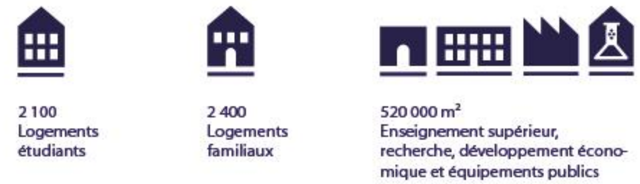
The Smart Heating and Cooling network of Paris Saclay

Key figures and advantages

- Network key figures :
  - Investment : 50 millions €uros
  - 10 km network
  - Two geothermal drills 700 m depth
  - 1 200 000 m² connected to the network within 2021

- Main advantages
  - **Low carbon** emission (< 100g CO_2 / kWh) and **> 60% Renewable** energy based on **local resource** (geothermal)
  - Possible **energy exchange** at low temperature (30°C)
    - Industrial or research center processes (Synchrotron, CEA)
    - Data centers
  - Possible **balance** of heating needs and cooling needs between buildings (residential <-> offices <-> educational facilities)
  - **Competitive** price compared with natural gas price
  - Possible **electrical and heat demand response and**
  - **real time optimization**





The Smart Heating and Cooling network of Paris Saclay

Replicable key factors of success

- Measuring value full scope, long term
  - **Pricing externalities, if a relevant carbon price is missing**
  - **Comparing comparables** (difficult with standalone solutions: performance gap; systemic hidden costs)
  - **Pricing stability and instability (scenarios)**

- **Working harder on needs opens new optimisation fields**

- Managing uncertainty over time matters in new projects : **finding fair risk sharing agreements with cities and developers** when the break-even point of a project depends on city development, and unclear building patterns

- Having the right tools to push a solution, once it is thoroughly justified: **community value for money comes first**

- Finding pragmatic, smart **compromises and combinations between autonomous solutions and collective ones.**

Some potential EU policy guidelines and questions

- **Supporting the in-depth design and comparison of optimal new local systems**
  - Programs and initiatives supporting in-depth, upstream, pre-optimisation work (pre-conception and modelling work) are helpful
  - Holistic assessment of energy supply options, criteria to be decided by local authorities and disclosed (enhanced transparency)

- **Revisiting regulatory patterns**
  - National benchmarks and contractual patterns/guidelines
  - Stronger customer involvement at local level

- **Better supporting cogeneration and trigeneration**
  - CHP and tri-generation plants as the cornerstone of a smart local system including DHC grids systemic benefits
  - Market design and corresponding support schemes should better value the positive systemic externalities of these production sources

- **Putting a greater focus on DHC grids in the overall smart grid and innovation programs**
  - Focus on multi-energy systems, integrate a stronger DHC grid component
  - Up-scale new European research programs to enable public authorities to develop a new system architecture (improved flexibility, link with e-mobility…)