

Towards an energy open science approach at district level Application to Grenoble Presqu'île

Sacha Hodencq – Frédéric Wurtz – Benoit Delinchant
UMR CNRS 5269 - Grenoble-INP – Université Grenoble Alpes



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Sequence of the presentation

■ **Energy systems design & operation**

- General context
- The role of energy communities
- Interest of Open Science in energy modelling

■ **The Grenoble Presqu'île district**

- Sustainable district energy systems: the LNCMI study case
- Open data management
- Open models & platforms

■ **Open source processes for the energy transition**

- From open design to open hardware?

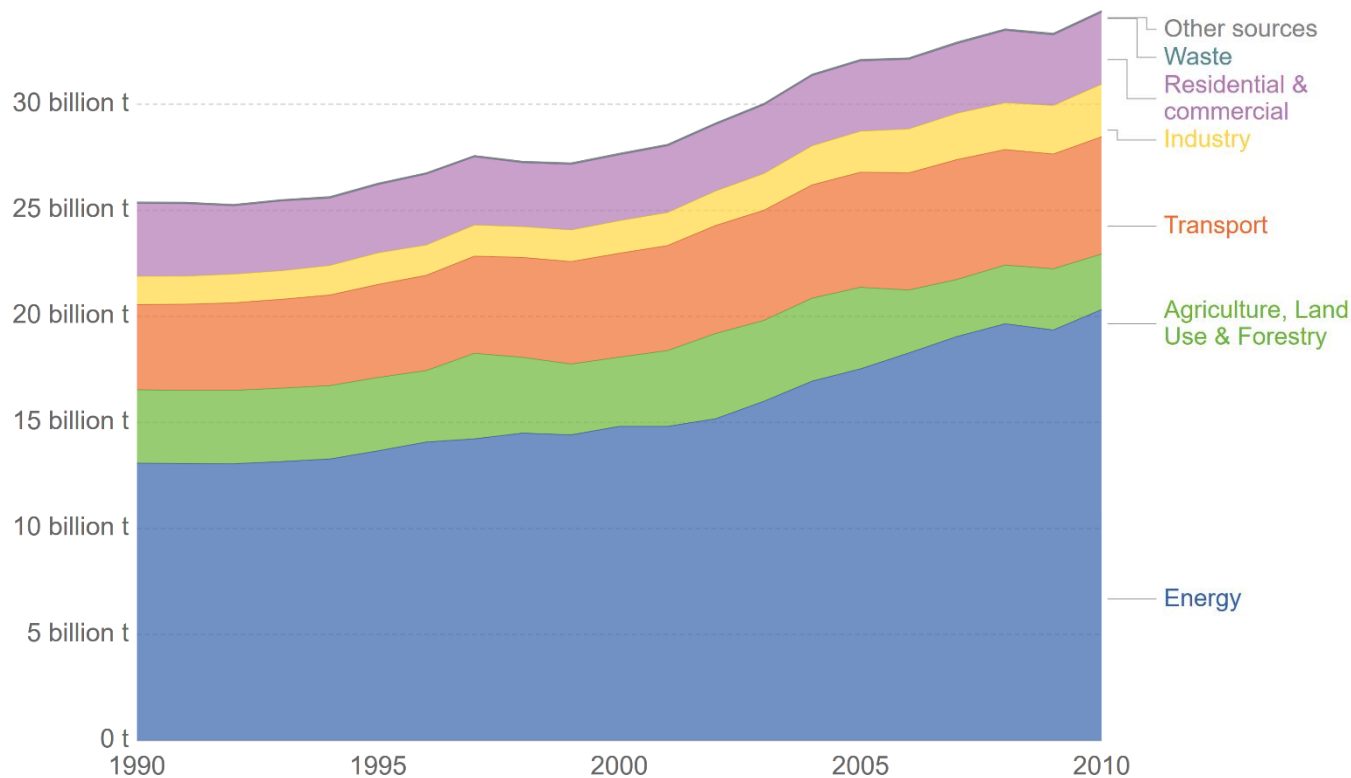
Context of energy systems design & operation

■ Struggle against climate change: how to decarbonise our energy consumption ?

Carbon dioxide emissions by sector, World

Carbon dioxide (CO₂) emissions by sector, measured in tonnes per year.

Our World in Data



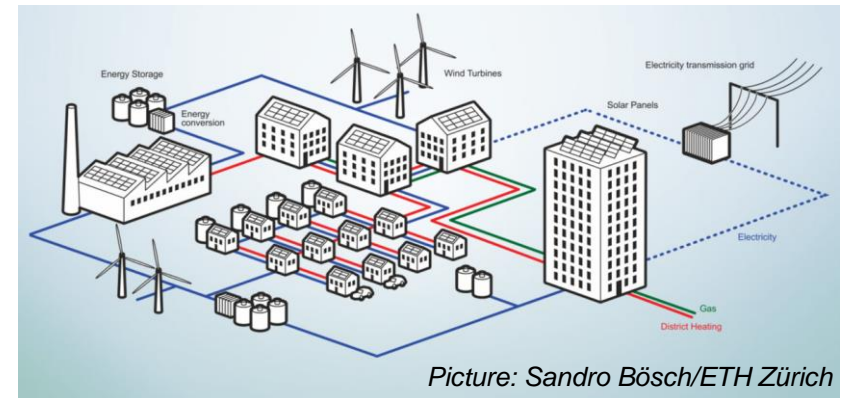
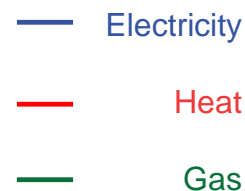
Context of energy systems design & operation

■ Cities dominate the global energy demand...

- Urban areas accounted for about **64%** of the global primary energy use [IEA]

■ ... but they can also be the next place for energy production

- Decentralised renewable energies
- Energy recovery potential



■ New challenges & solutions for the new energy sources

- **Intermittence:** flexibility, multi-carrier energy systems, storage
- **Decentralised:** well designed and operated energy networks
- **New actors:** prosumers, local authorities, energy communities

→ Complex modeling

The role of energy communities

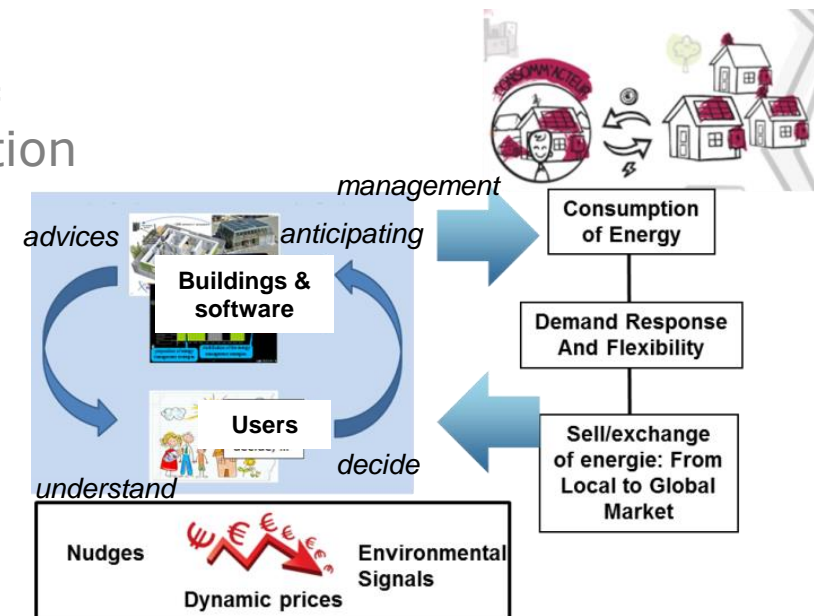
■ Citizen energy communities defined in the EU regulation [EU1]

- Collective self-consumption
- Arrange the sharing of renewable energies

DIRECTIVE (EU) 2019/944 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 5 June 2019
on common rules for the internal market for electricity and amending Directive 2012/27/EU

■ New concepts

- Enernet [COL]= internet of the energy = decentralised low-carbon energy production + information & energy networks + prosumers
- Human in the loop approaches [WUR]



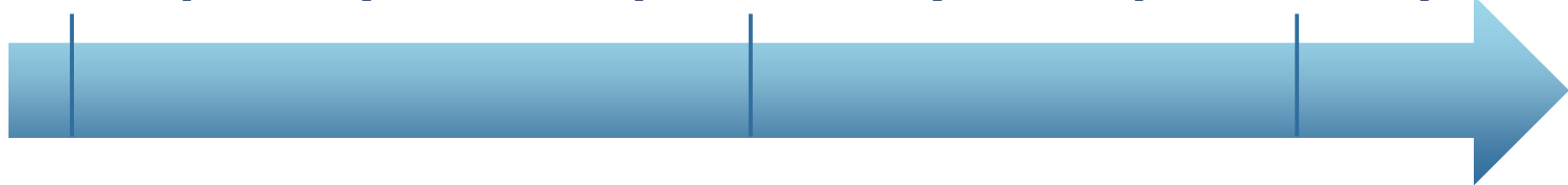
Interest of Open Science in the energy modeling [PFE, MOR]

Open data and models in the energy field is crucial:

Public transparency

Reproducibility

Open Development



- Peer review
- Reliability
- Open research for public fundings [OSP]
- Citizen involvement [ROT]

- Reducing parallel efforts
- More effective collaboration between science & policy

- Identifying and reducing biases
- Need for an open platform & licensing

Remaining locks: institutionnal inertia, fear of exposure, ...

Connection with Open Hardware ?

The Grenoble Presqu'île district

■ Coexistence of different energy networks in the Presqu'île district

- Electricity,
- Heat,
- Gas.



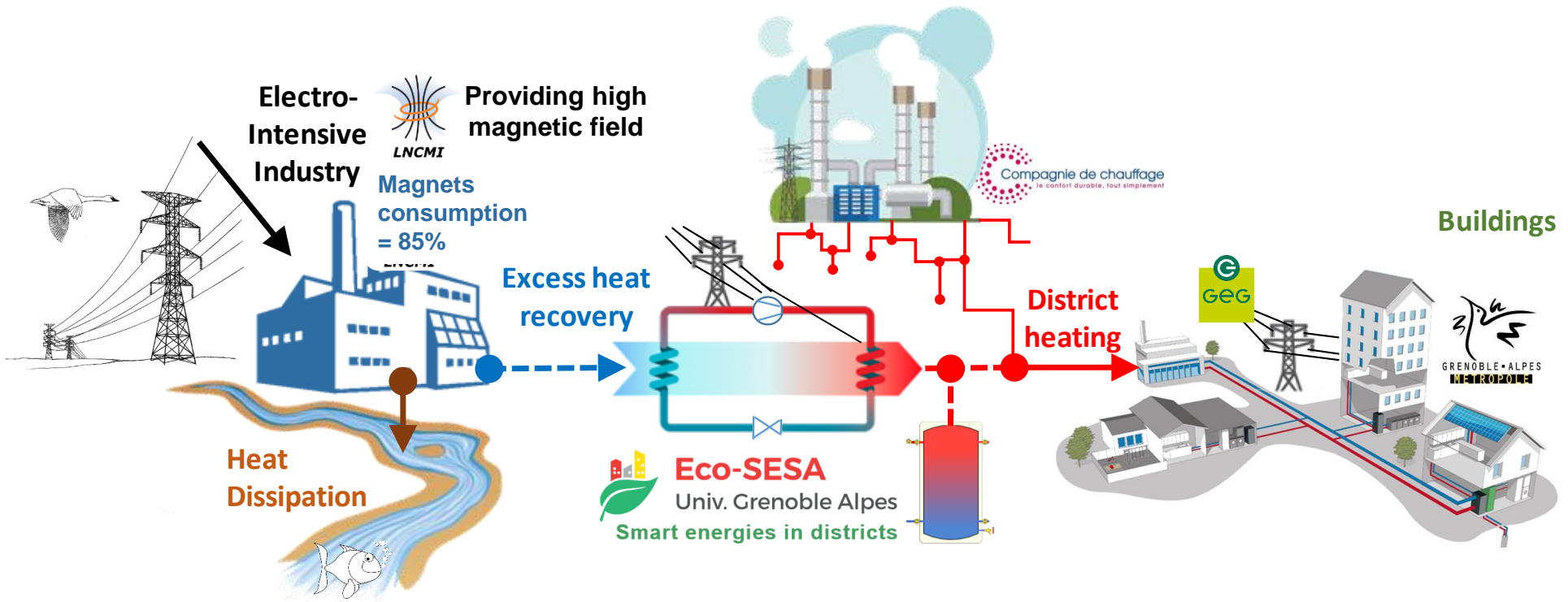
The Grenoble Presqu'île district: LNCMI study case

- The LNCMI (National Laboratory for High Magnetic Fields) is located on the CNRS site in the Grenoble Presqu'île district.



The Grenoble Presqu'île district: LNCMI study case

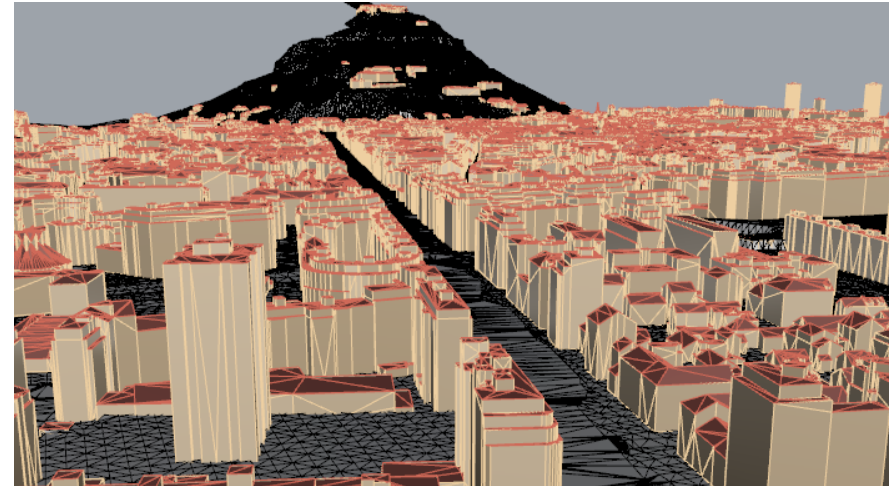
Principle diagram



The Grenoble Presqu'île district: open data

Need for proper data management

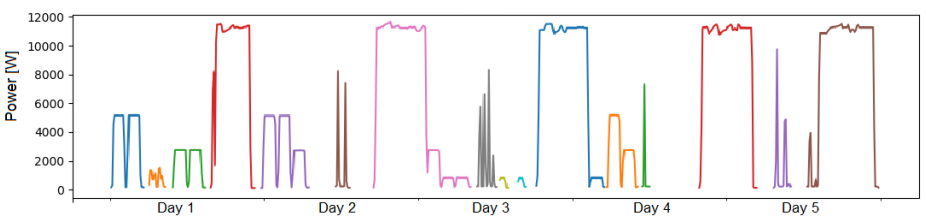
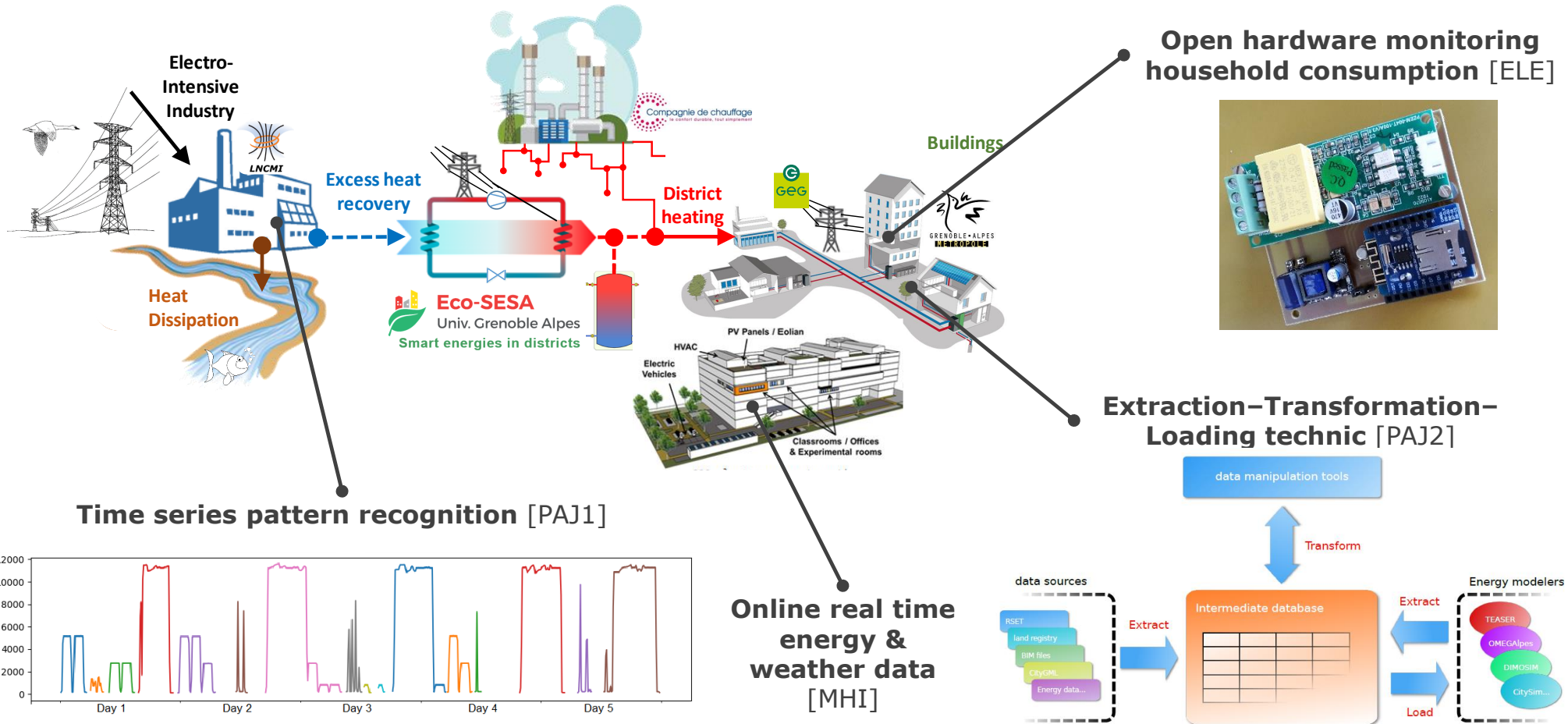
- Data coming from various actors with various privacy levels
 - Open data city portals
 - Building databases
 - Energy certification / rating files
 - On-site surveys
 - Consumption data
- Difficulties of:
 1. Accessibility
 2. Variability
 3. Heterogeneity
- Data should be “as open as possible, as closed as necessary” [EU2]



Grenoble buildings geometry (CityGML)


The Grenoble Presqu'île district: open data

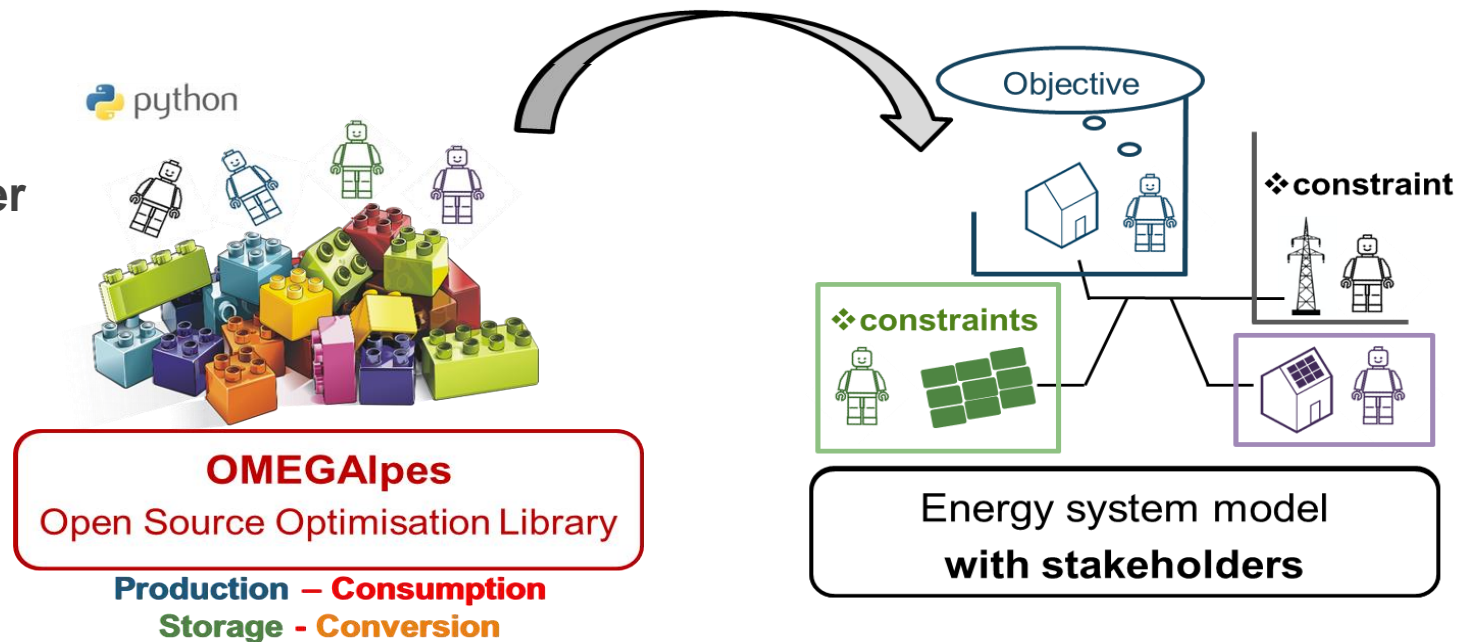
Open data & hardware in the Presqu'île study case



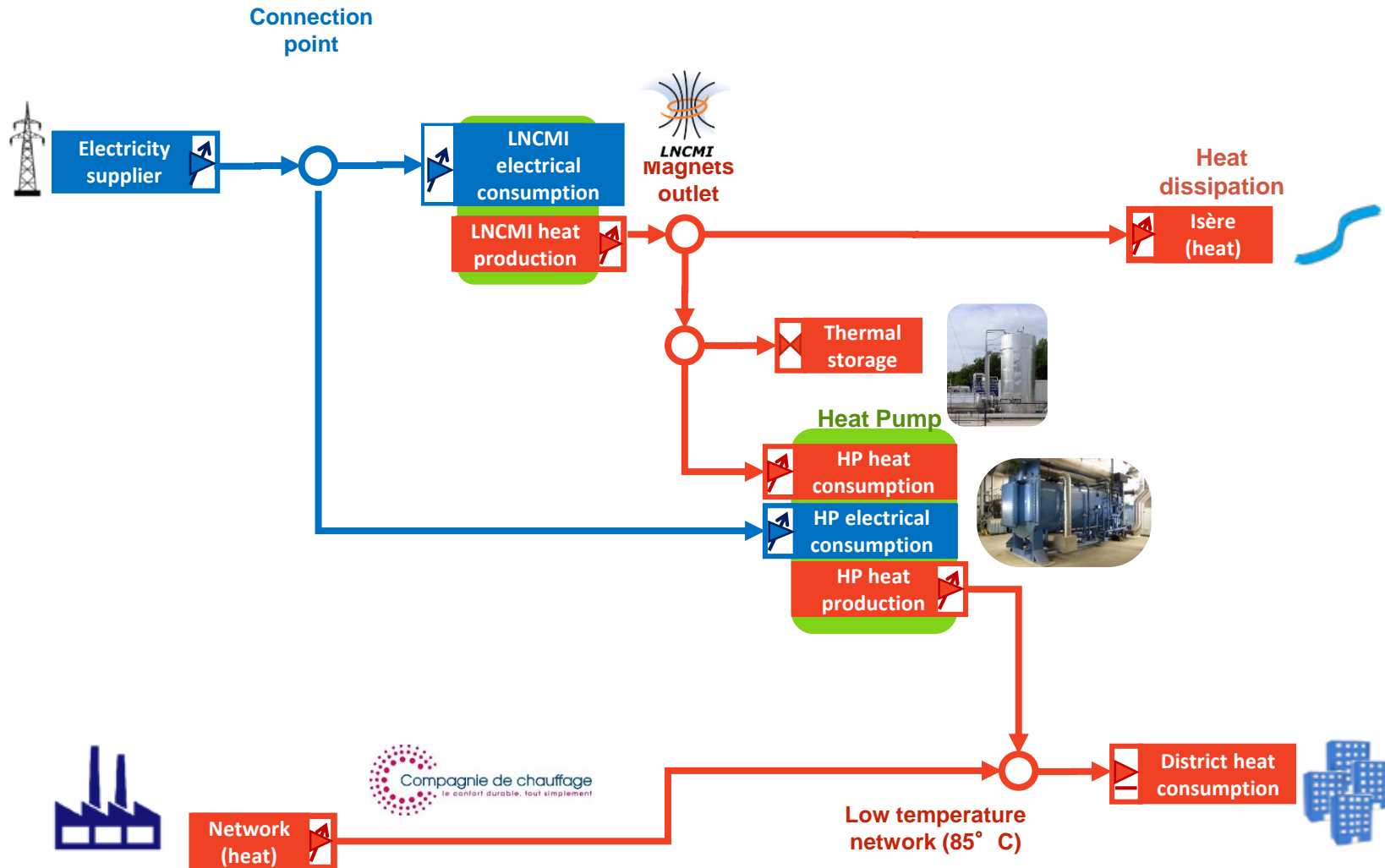
The Grenoble Presqu'île district: open models & platform

COFFEE: Collaborative Open Framework For Electrical Engineering

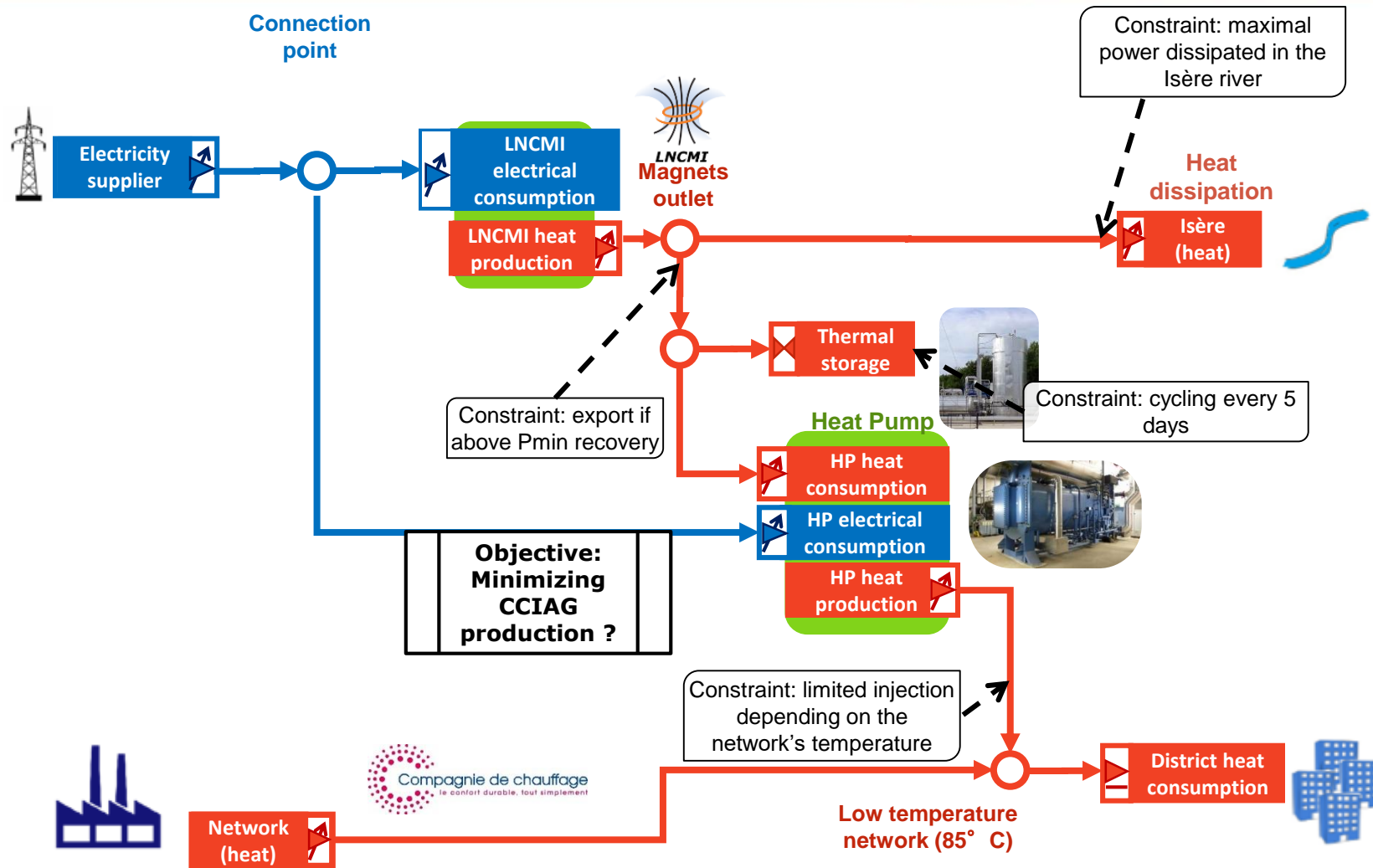
- Versionned models library
 - Freeware
 - Open source: NoLOAD,  **OMEGAAlpes** [PAJ3]
- Documentations
- Tutorials & beginner examples
- Execution environnements
- Forum



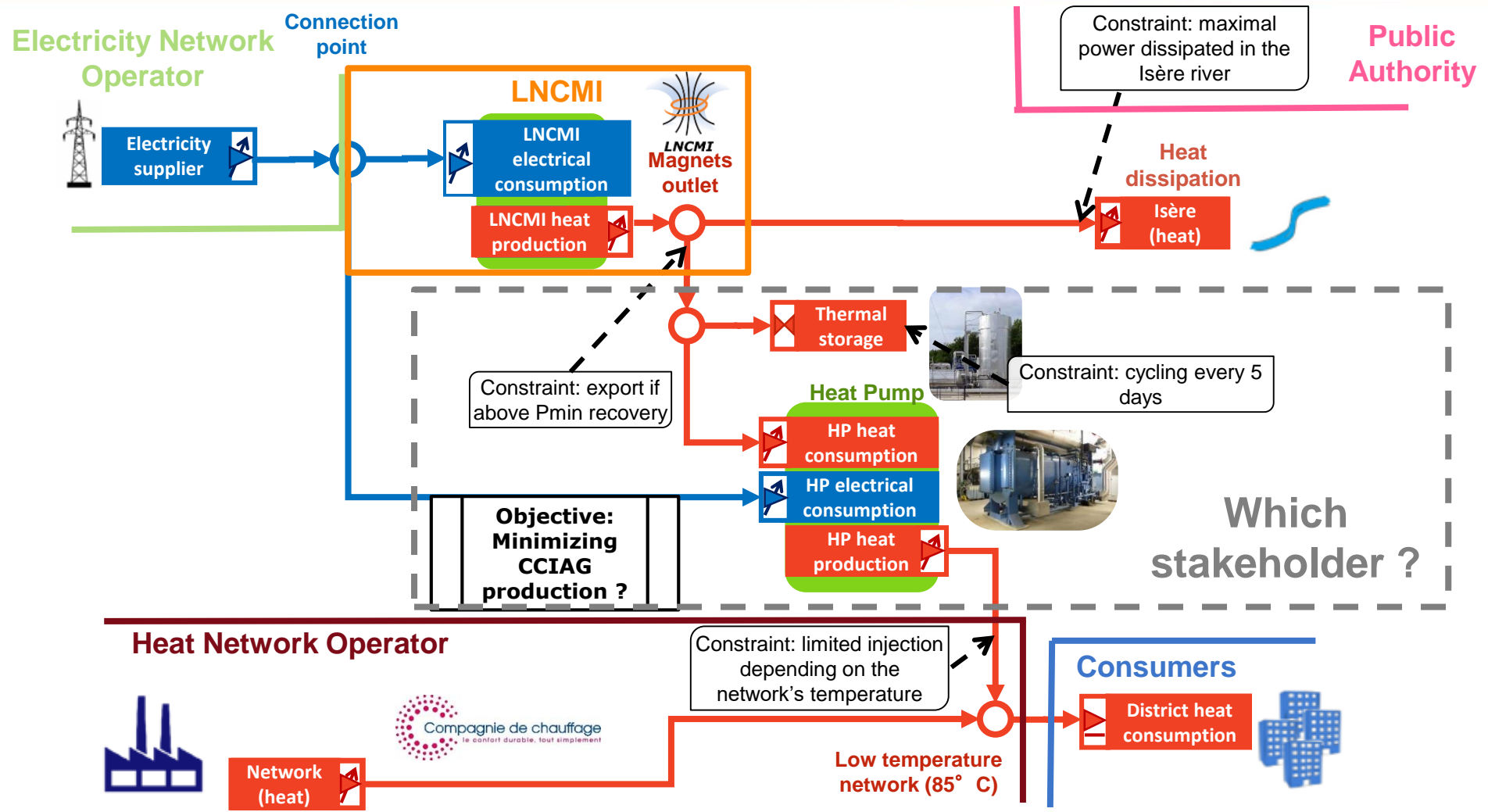
The Grenoble Presqu'île district: multi-actors open design ?



The Grenoble Presqu'île district: multi-actors open design ?



The Grenoble Presqu'île district: multi-actors open design ?



Which open design processes for the energy transition ?

■ Actors ?

- Traditional stakeholders: district heating operator, electricity providers or system operator, ...
- New actors: prosumers, citizen energy communities

■ Topics ?

- Waste heat recovery
- Sobriety, flexibility, efficiency
- Local renewable energy production: photovoltaic, wind, ...

■ Items ?

- Software for design & operation of energy systems
- Hardware for metering, production, storage

■ New collaborative and open organisations

Sources

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- [EU2]: Open access - H2020 Online Manual, https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/open-access_en.htm
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Thank you for your attention



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