Systemx INSTITUT DE RECHERCHE TECHNOLOGIQUE

Accélérateur
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A Digital Twin Approach for Sustainable Territories Planning:
A Case Study of a French Suburb

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Leveraging data and Digital Twins for sustainable city

- Complexity of energy planning in an urban environment
- Develop decision-making tools to support the **energy transition** in the city
- Leverage, manage, visualize and analyze large and heterogeneous data
- Support the design of **energy planning strategies**
- Play, evaluate and optimize energy planning scenarios by leveraging **Digital Twin** technology

Key steps in the energy planning process

Step 1

Fusion, visualization and analysis of heterogeneous data

Step 2

Evaluation and exploitation of energy potential in the city

Step 3

Zone identification and contextual information

Step 4

Design of relevant energy scenarios

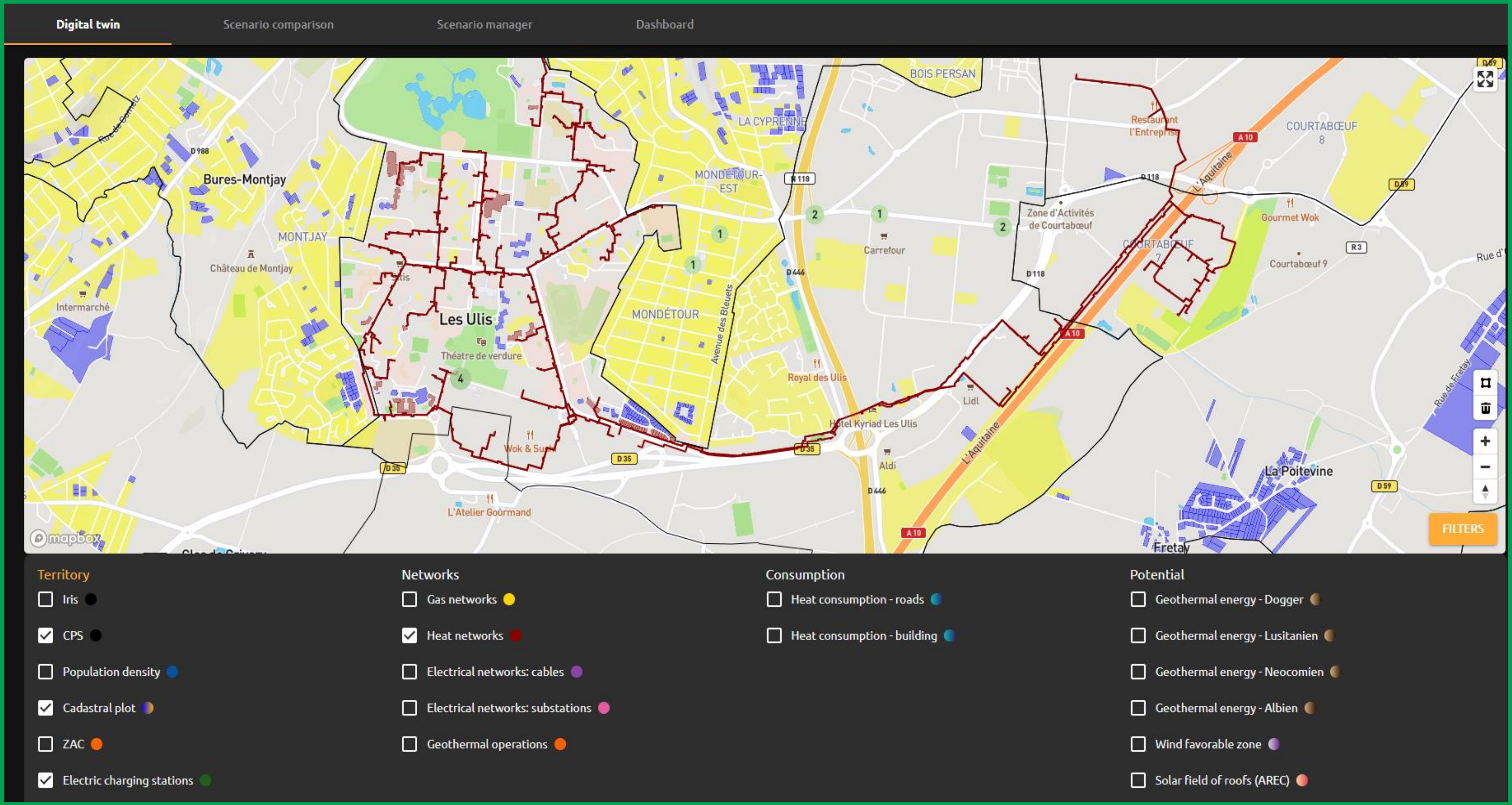
Step 5

Evaluation of candidate scenarios using Digital twins

City data sets

Fusion, visualization and analysis of heterogeneous data

Consumption
Energy
Production
Land parcel data
Energy networks
EV charging
Solar panels
Planned projects



Energy potential

Evaluation and exploitation of energy potential

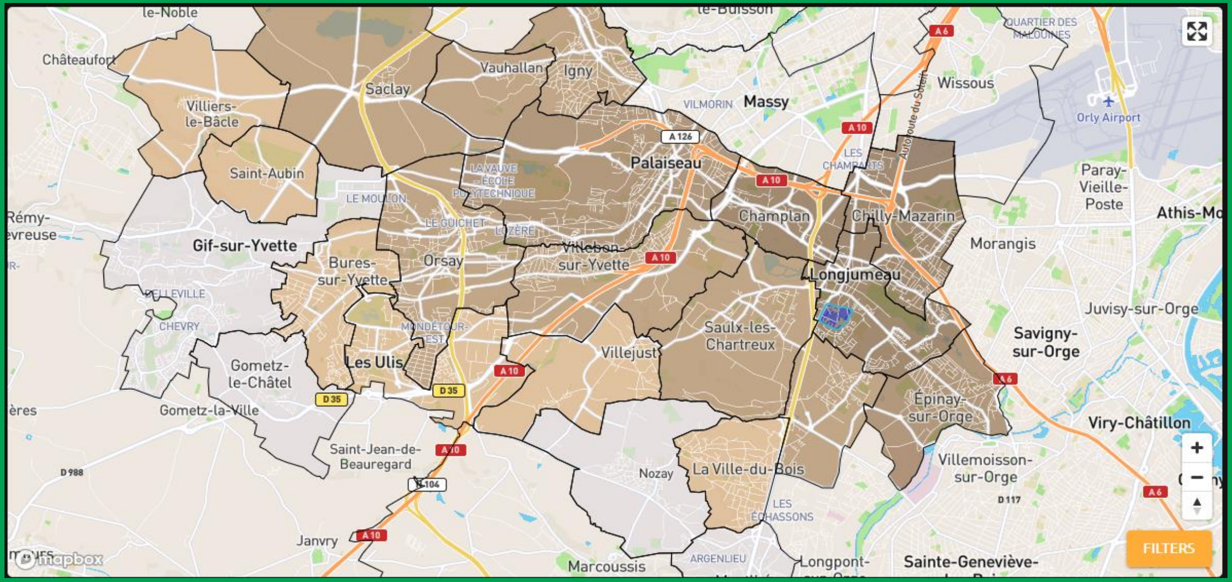
Data center heat recovery

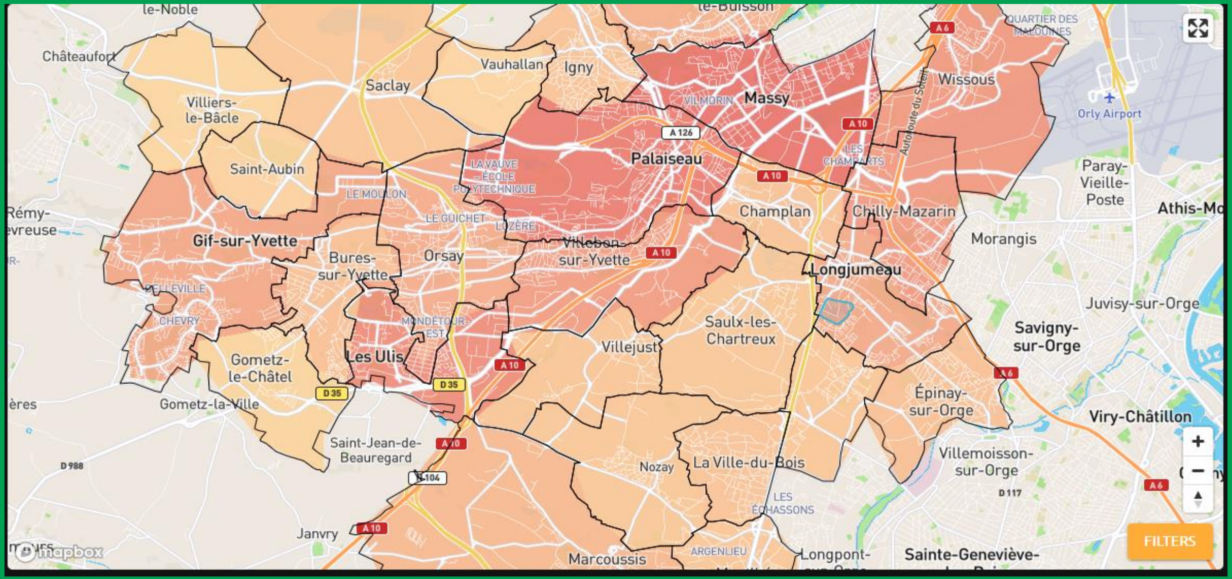
Geothermal energy

Biomass

Solar (AREC)

Wind power

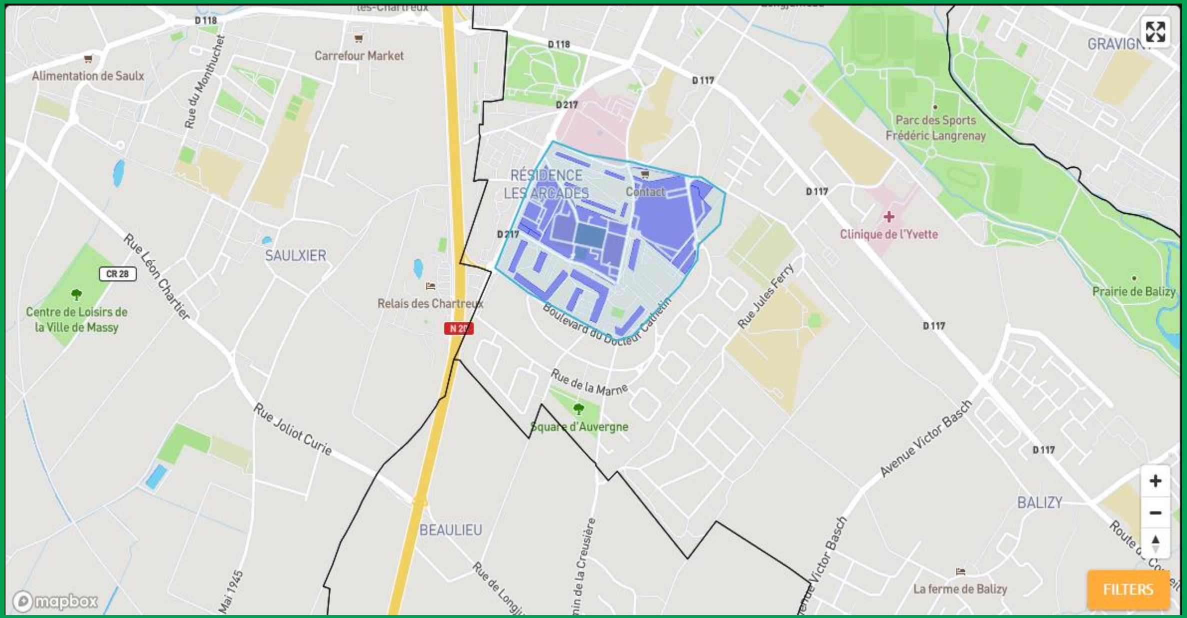


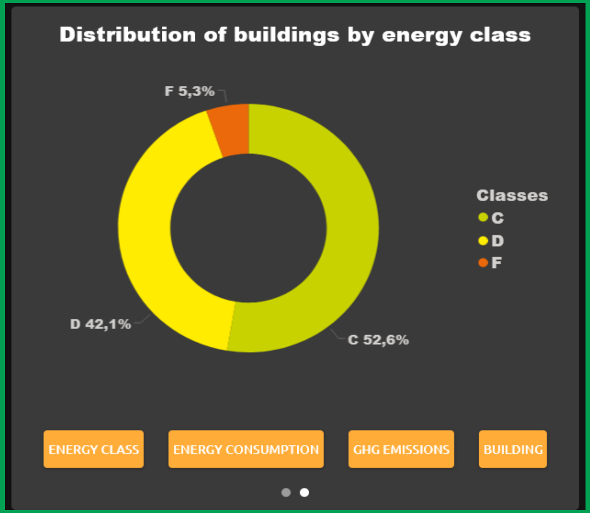


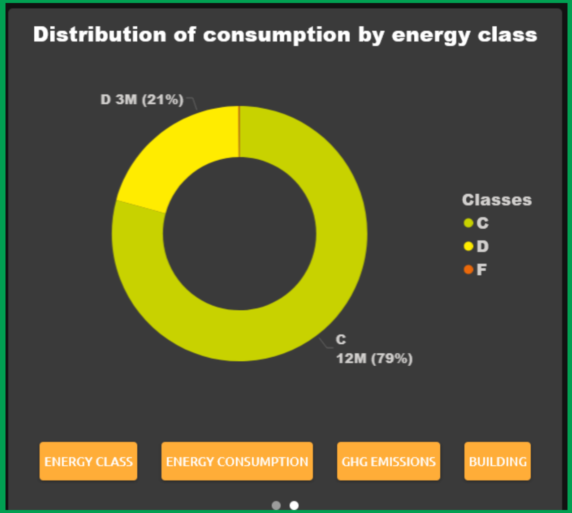
Potential

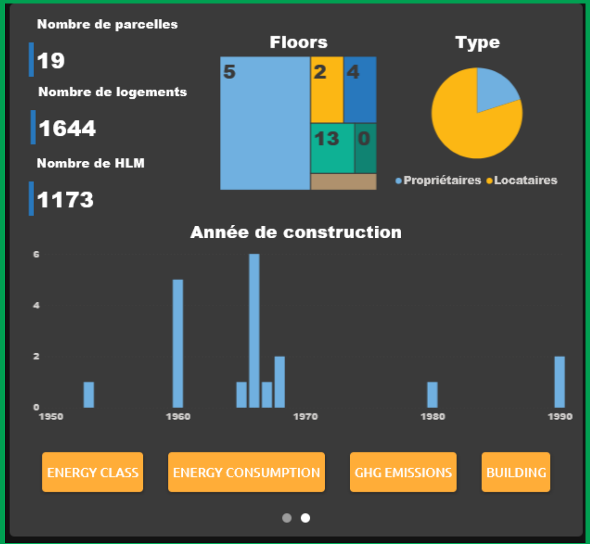
- Geothermal energy - Dogger
- Geothermal energy - Lusitanien
- Geothermal energy - Neocomien
- Geothermal energy - Albien
- Wind favorable zone
- Solar field of roofs (AREC)

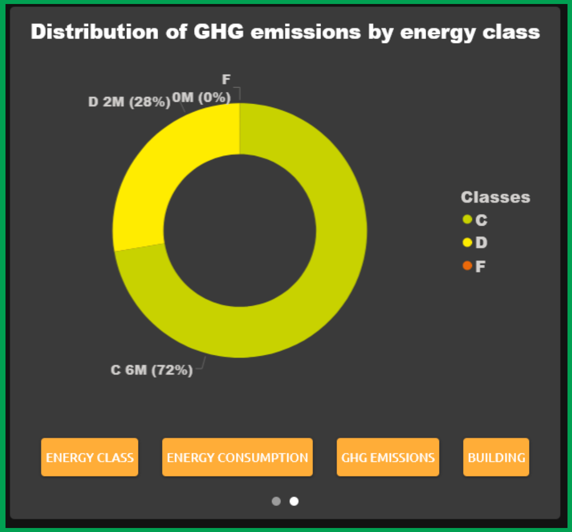
Selection of the area of interest and display of the corresponding contextual information











Energy planning scenarios and strategies

Design of planning scenarios

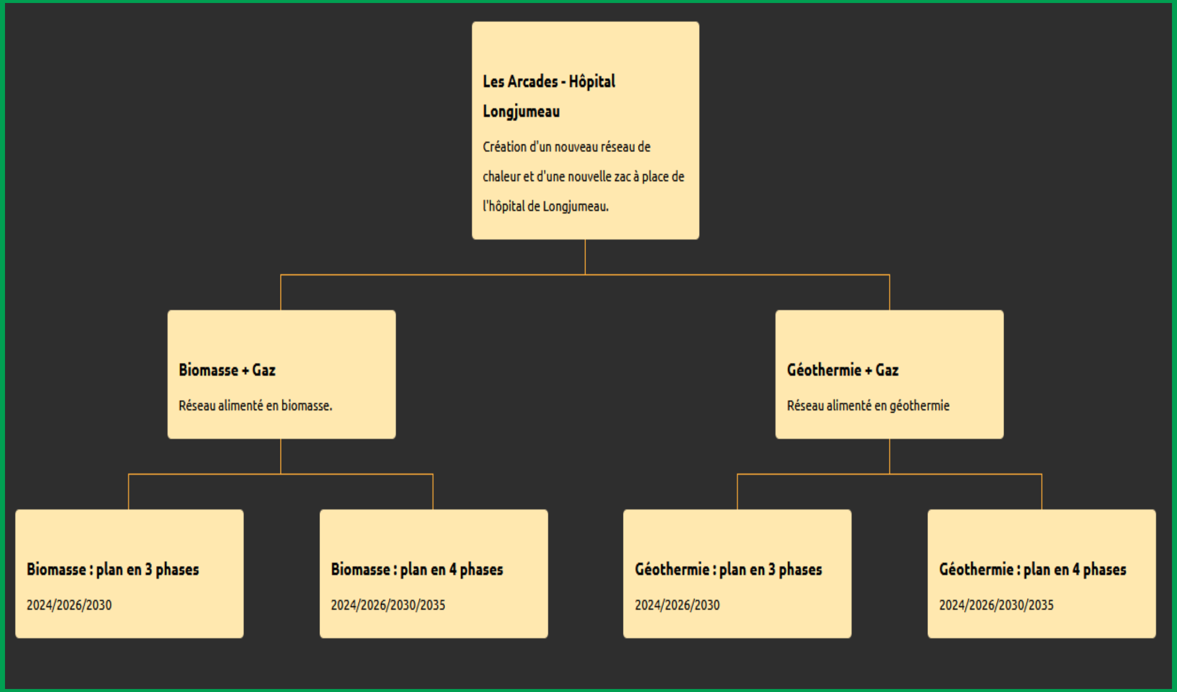
Creation and extension of heat networks

Building renovation

Recommendations

Exploitation local and renewable energies

Maximization of energy recovery



Settings of the alternative scenario

NETWORK CREATION | PRODUCTION SOURCES | NETWORK CONNECTION | RENOVATION | RENEWABLES PRODUCTION | ZAC CREATION

Connection network	Priority	Controllable	Max power (in MWh)	Greenhouse gas rate (in kgCO2e/kWh)	Supply cost (in €/kWh)	Maintenance cost per month (in €)	Investment cost (in €)	Type	Implementation date
Reseau_Longjumeau_Le:	1	Yes	3	0,011	0,027	300	4000000	Geothermal	2024
Reseau_Longjumeau_Le:	2	Yes	1,6	0,54	0,076	200	900000	Gas	2024

Digital Twins for Economic and Environmental Assessment

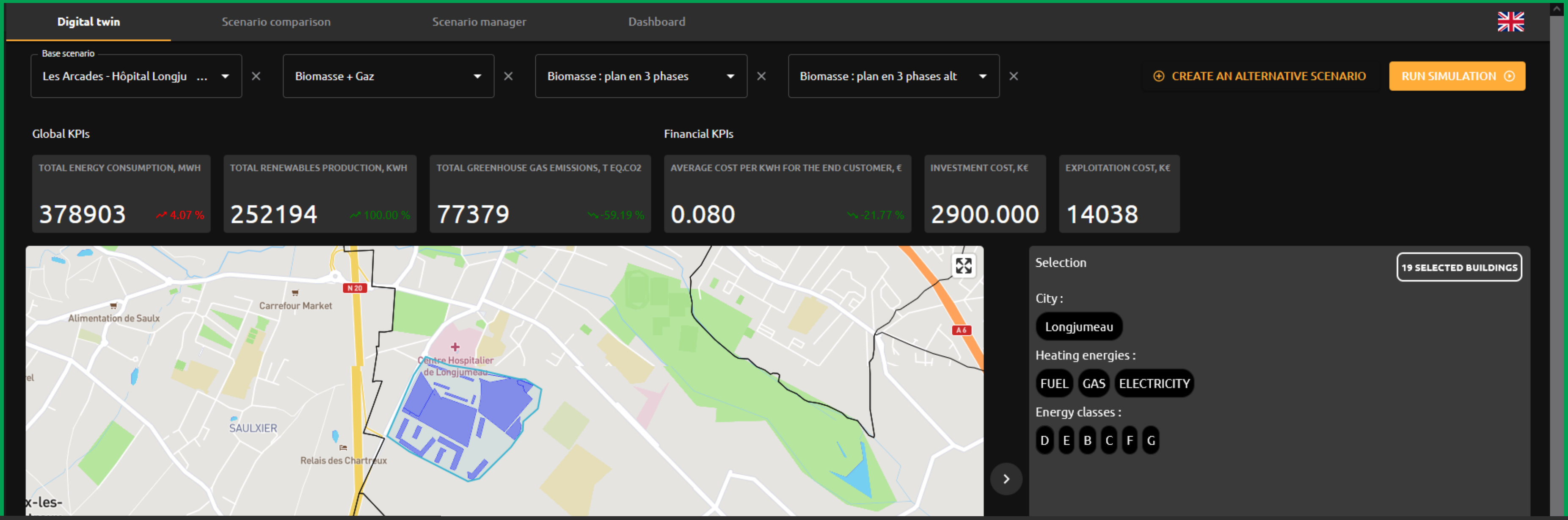
Energy consumption

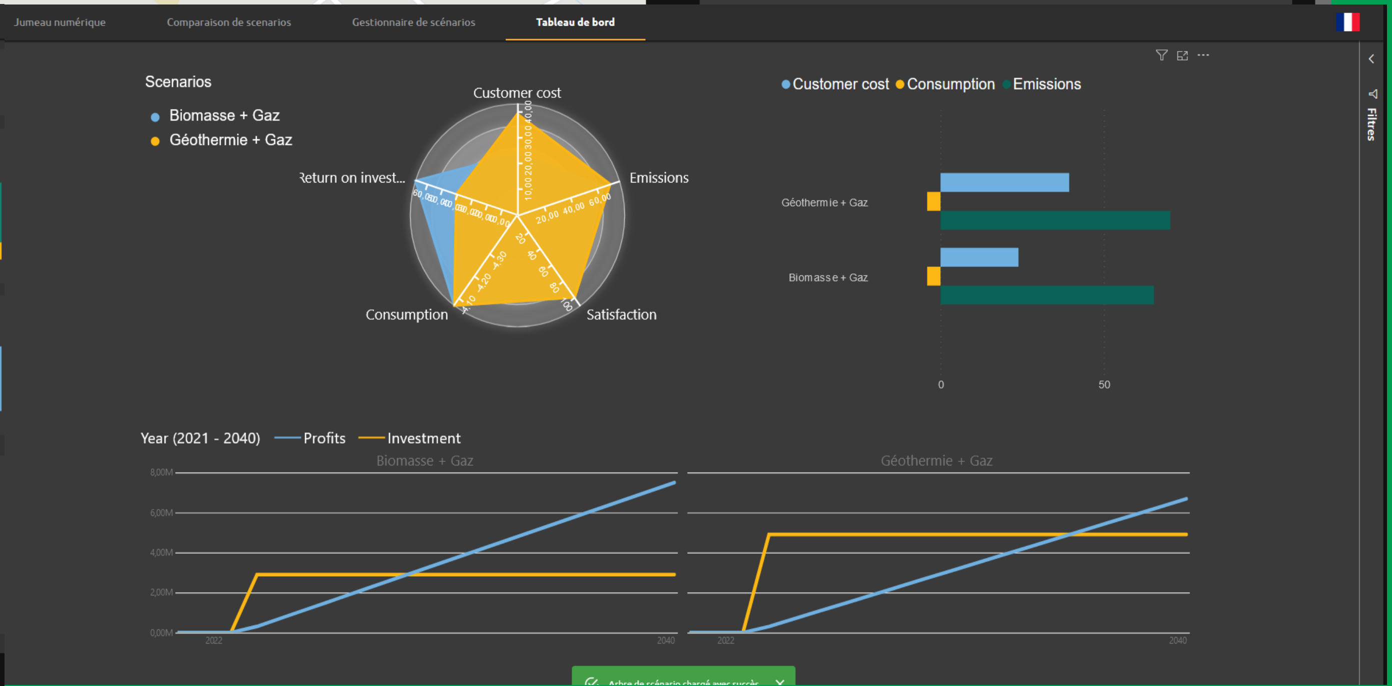
Satisfaction

GHG emissions

Cost/Return on investment

DT to evaluate the impacts of the scenarios





Technical architecture

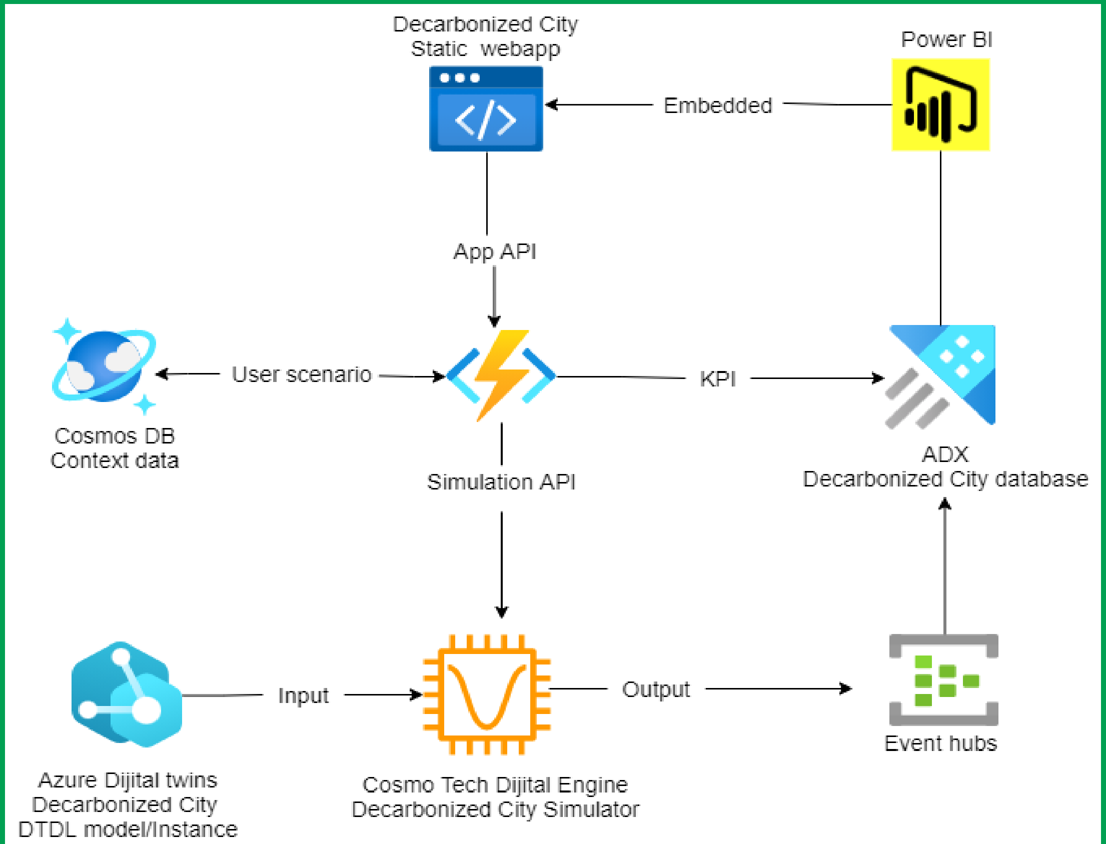
Architecture

<u>Storage</u>: Cosmos DB

<u>Simulation</u>: Cosmo Tech and Azure Digital Twin

<u>GUI</u>: Javascript (REACT)/ Power BI

<u>Cloud</u>: Services cloud Azure



Conclusion and perspectives

- Complexity of **energy planning** in an urban environment
- Develop decision-making tools to support the **energy transition** in the city
- **District heating** is a relevant means to mutualize the infrastructure, reduce the costs and supply the maximum number of users
- Leverage **data-driven optimization** approach to select the best scenario based on several criteria
- Adaptation and application of the approach for **different cities** and other **sustainable planning** use cases