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# DECARBONATION OF AN EXISTING BUILDING ASSET ENERGY SUPPLY: A CASE STUDY ON LOW TEMPERATURE THERMAL NETWORK

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# Context – Liège Airport

**Request**

Decarbonise the heating of its buildings

**Condition**

Maintain current indoor temperatures and building configurations

# Proposed solution

**One of the proposed solutions is to implement a low temperature heating network**

→ Enables full decarbonisation using heat pumps, allowing the use of carbon-free energy sources such as renewables and waste heat

→ Low temperature networks offer numerous benefits
(Lund *et al.*, 2021 & Li and Nord, 2018)

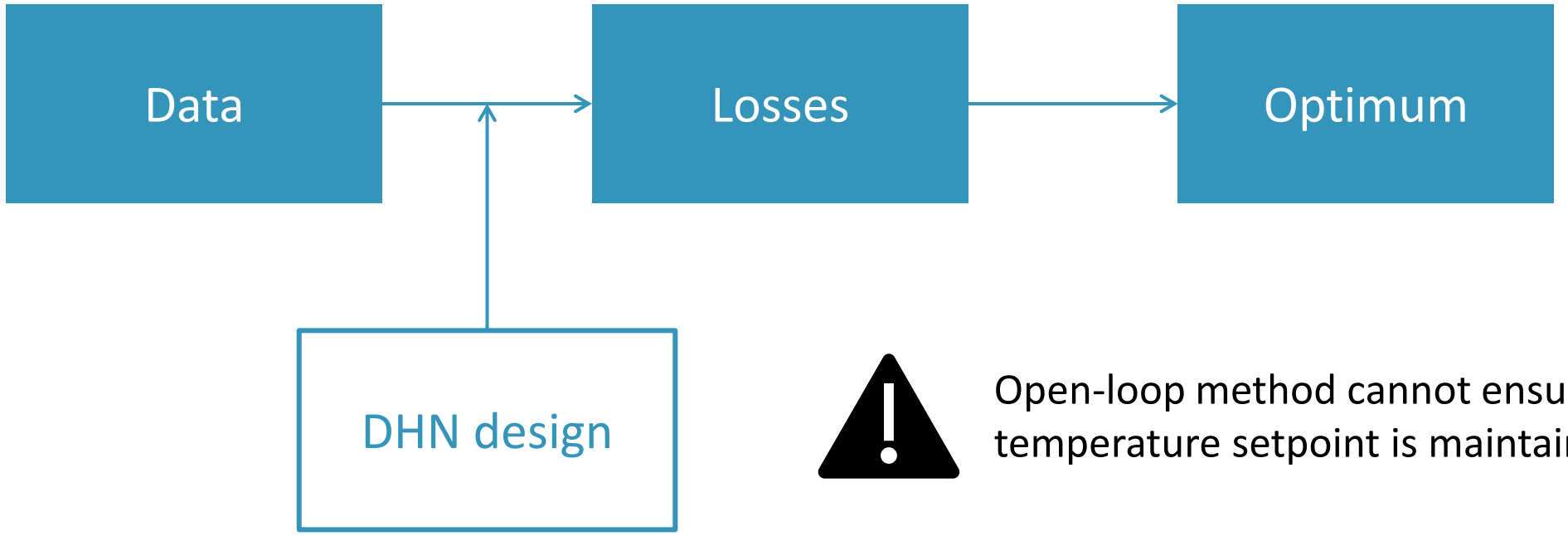
Higher distribution efficiency

Heat pumps, solar collectors and CHP units' efficiency increased

Seasonal thermal storage

Compatible with low-energy buildings

# Methodology often used by design offices




Open-loop method cannot ensure temperature setpoint is maintained

# Low temperature thermal networks present several challenges

Operation strategies

Type of heat sources and thermal storage

Design of district heating system

Buildings refurbishment

(Li and Nord, 2018, Averfalk, 2019 & Guelpa *et al.*, 2022)

# Contribution objective

Operation strategies

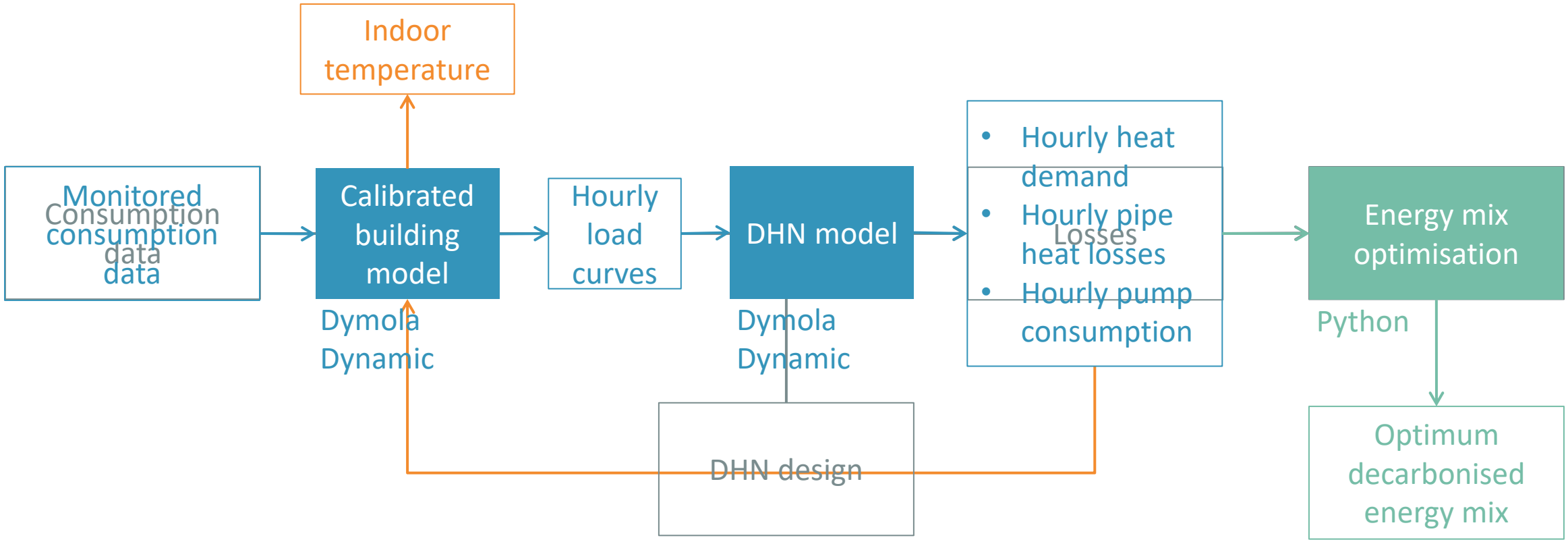
Type of heat sources and thermal storage

Design of district heating system

Buildings refurbishment

➔ Show the capability of a low temperature thermal network to best meet the heating demand while minimizing the environmental impact

# Proposed methodology



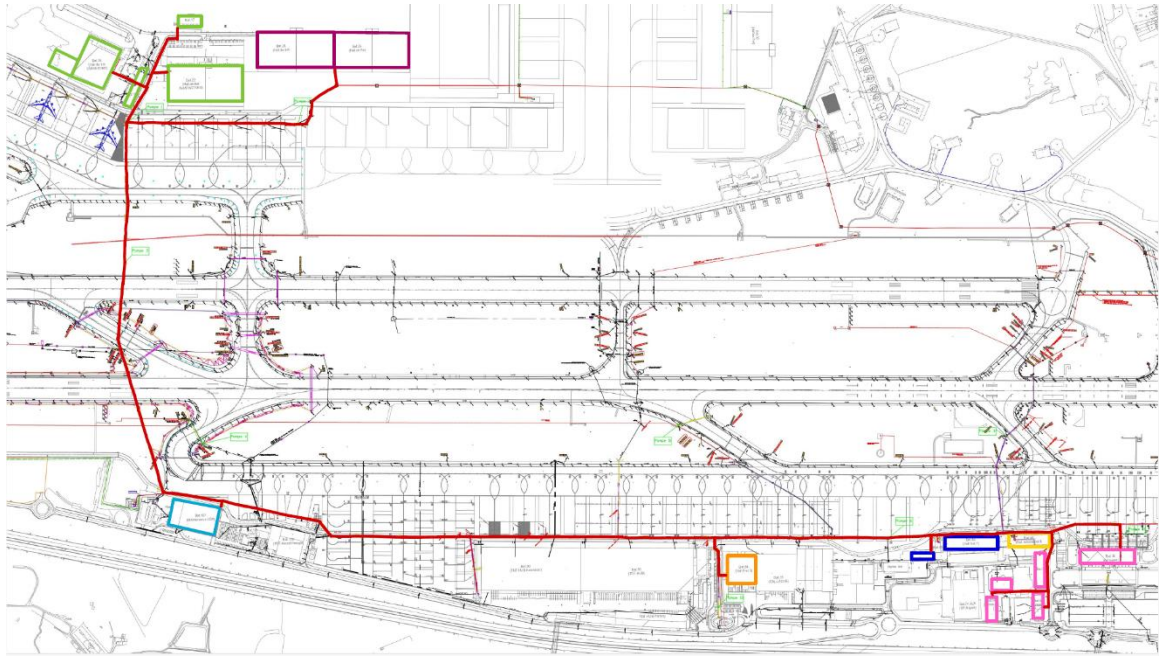
# Test case – Liège Airport (Belgium)

- 17 buildings
  - Offices
  - Passenger terminal
  - Cargo halls
- Annual thermal energy demand = 14 GWh
- Peak demand = 6 MW
- Thermal storage (930 kWh ≈ 40 $m^3$)
- PV panels (1.5 MW)
- Decarbonised grid connected

# Test case – Liège airport (Belgium)

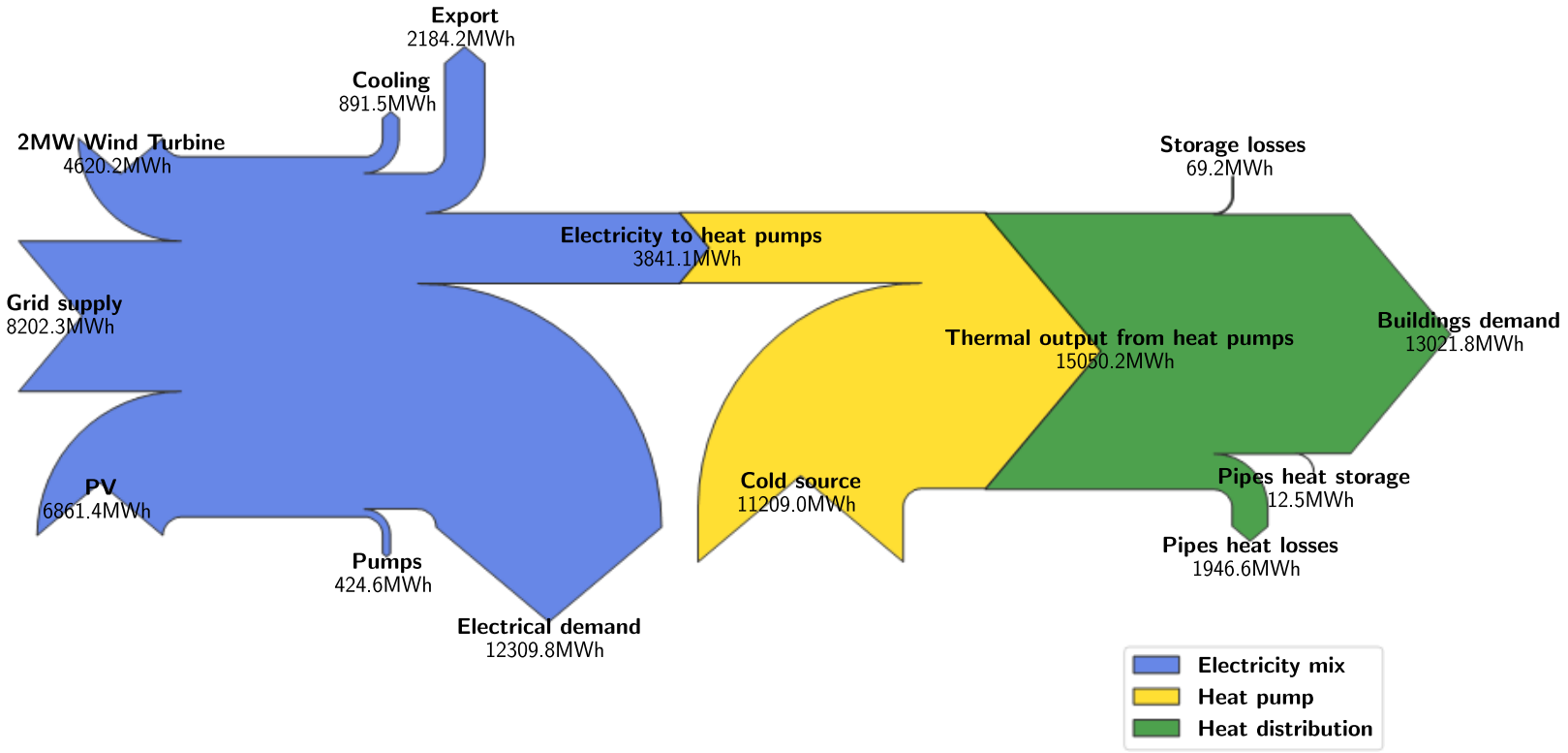
**Objective = decarbonise the heating of the building stock**

- New low temperature DHN 50°C-30°C
- Fully decarbonised energy mix
- Total length of one-way = 4.2 km
- 20°C setpoint temperature for the buildings



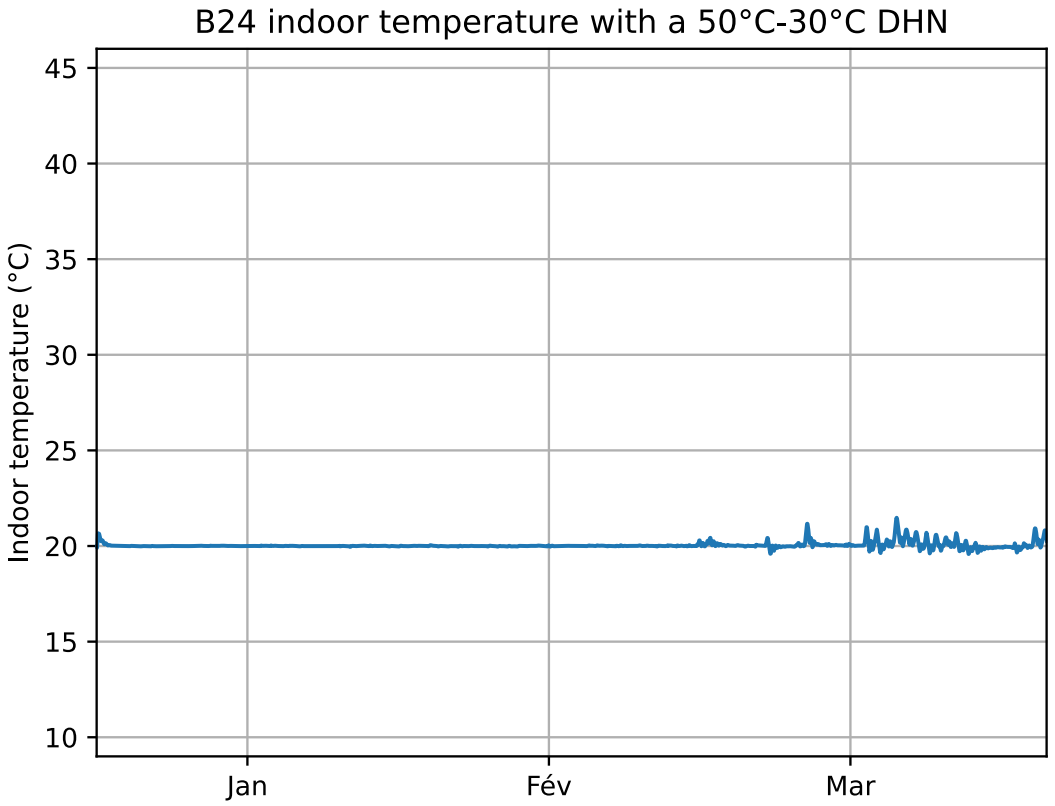
# Results – Focus on #Challenge 1

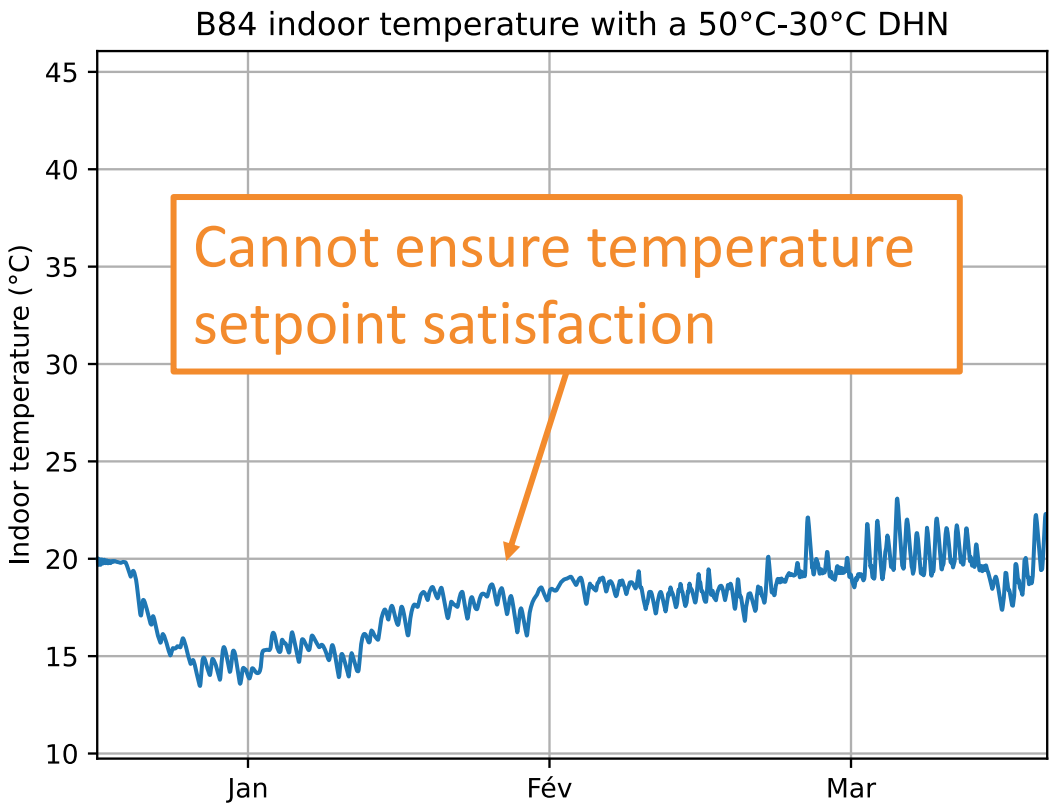
## Type of heat sources and thermal storage



# Results – Focus on #Challenge 2

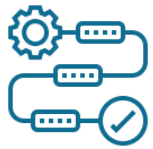
## Building refurbishment



# Conclusions

Implementing a low temperature thermal network to decarbonise airport heating while meeting demand



Dynamic DHN model coupled to dynamic physical building models and optimisation energy mix tool

- Heat demand may not be satisfied for every building
- Methodology highlights low temperature network's challenges

➔ Integrating building models and DHN models with energy mix optimization is crucial to avoid design, control, or refurbishment errors when implementing low temperature networks

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# THANK YOU FOR YOUR ATTENTION

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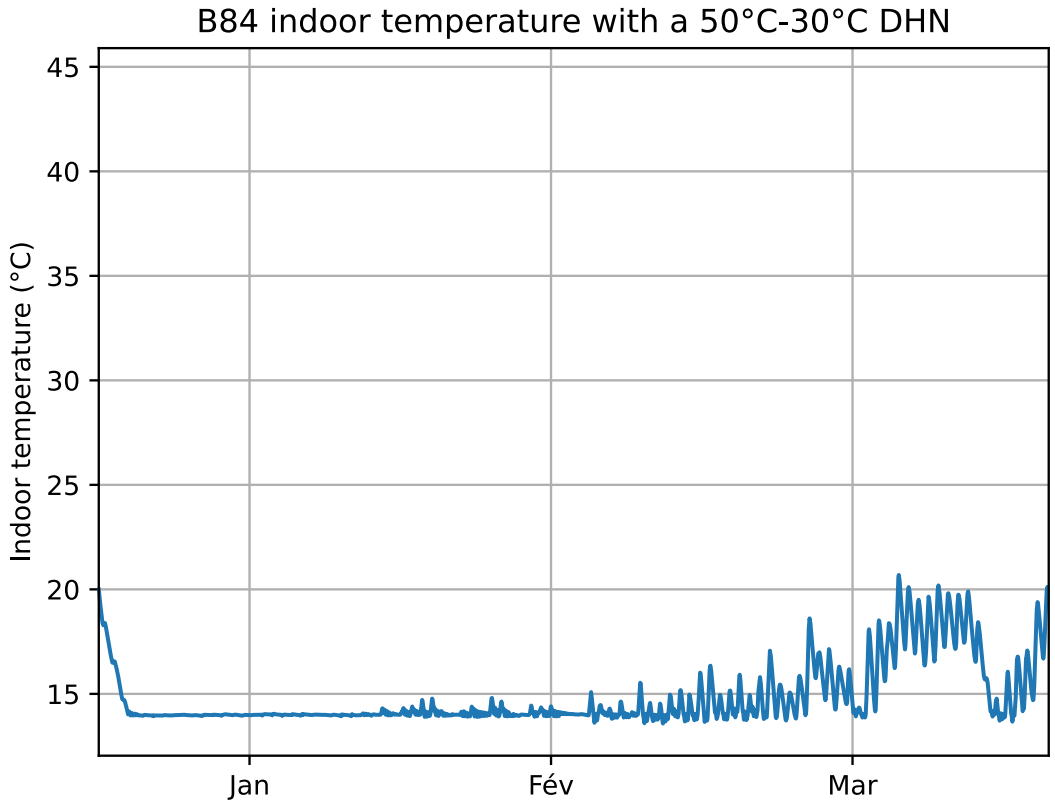
# Results - #Challenge 2
# Building refurbishment




By choosing energy sobriety and reducing the setpoint temperature to 14°C, it is possible to meet the demand