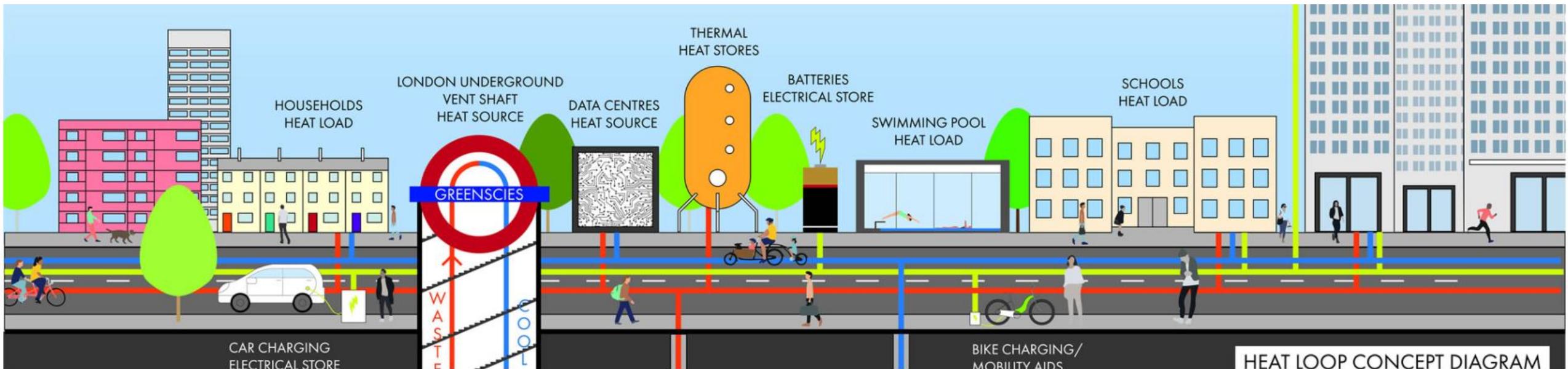




# GreenSCIES - Heat pump integration into 5th generation networks



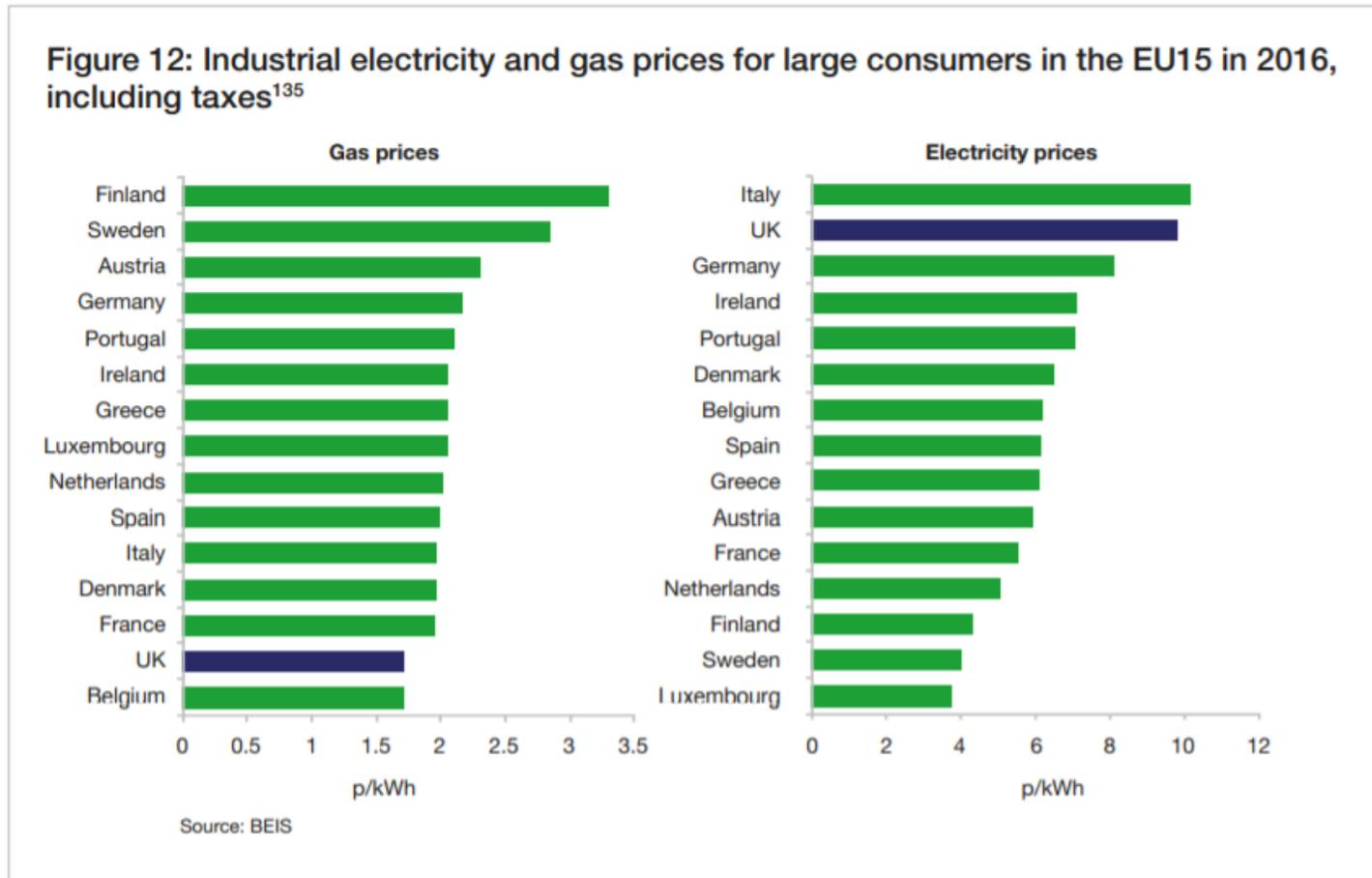
Chris Dunham  
Carbon Descent



HEAT LOOP CONCEPT DIAGRAM

# Key Challenge for Heat Pumps

- Gas vs electricity Price (without RHI Rebalancing)



CCL on gas rising year by year but no tax on domestic gas  
Lack of clarity around heat decarbonisation route & policy  
In stark contrast to petrol/diesel

# What is GreenSCIES Thinking?



## [GreenSCIES | Green Smart Community Integrated Energy Systems](#)

### 1. Sector Coupling/Integration

- Cooling produced as a byproduct of Heating – effective COP of ~6 (or secondary heat as a source)
- Mobility – shared capex but also V2G
- Power – PV earns higher value or EV/HPs receive lower cost elec

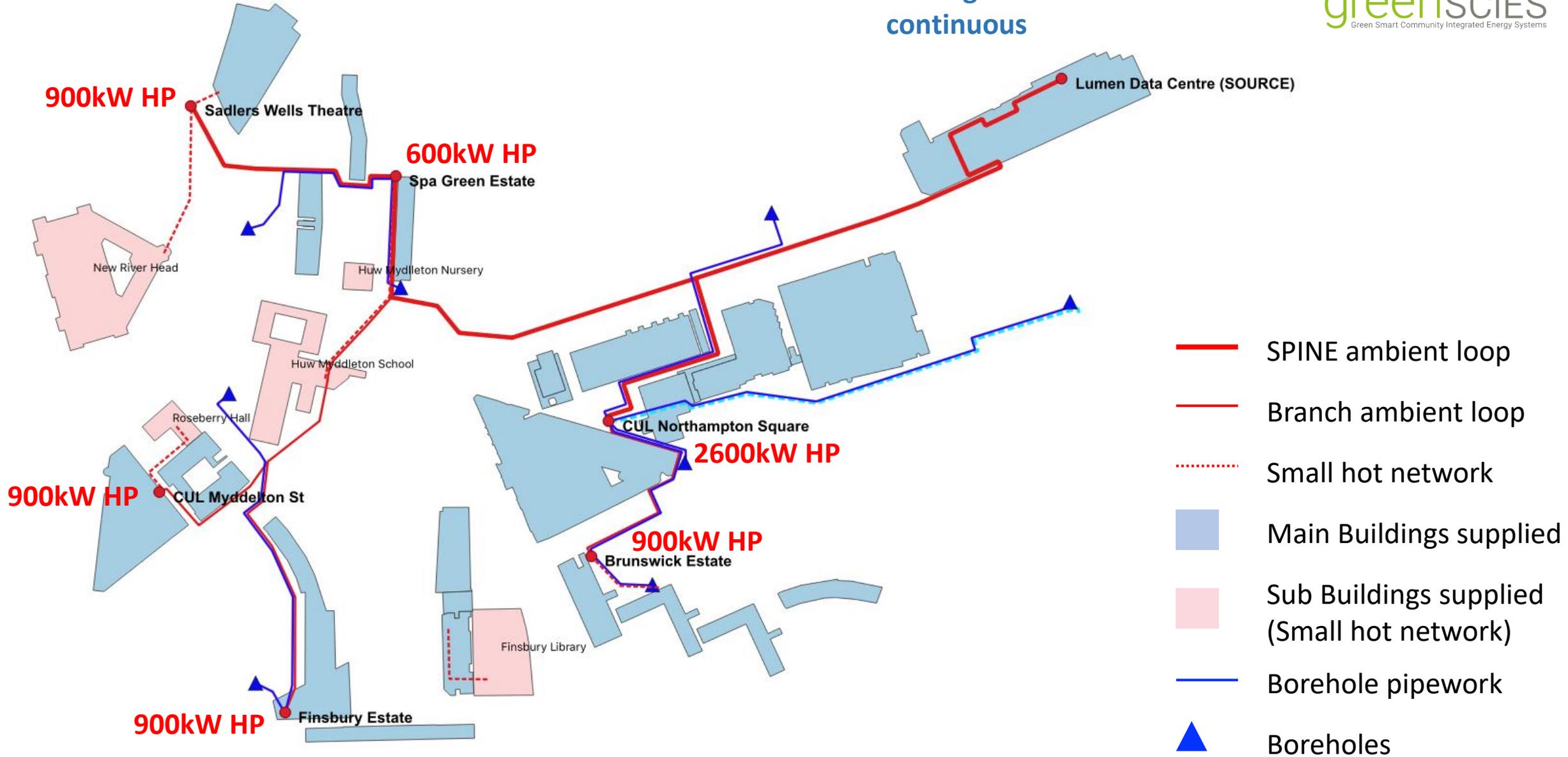
### 2. Flex

- Picking the cheapest price periods reduces elec cost for HPs/Evs (and reduces carbon)
- Additional flex services: Capacity Market, Balancing Mechanism, FFR

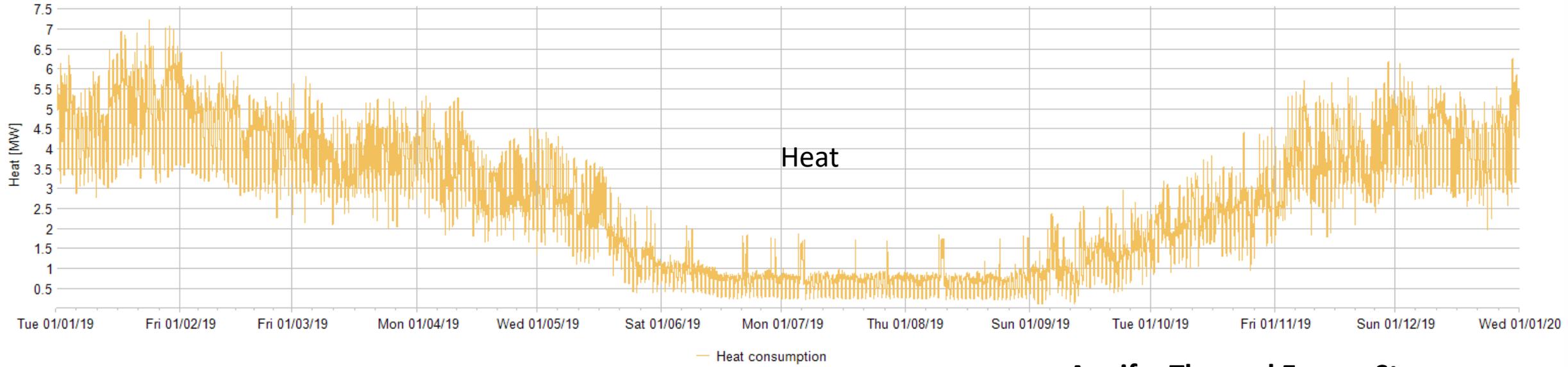
*Heat/coolth/power storage critical to maximise this*

# New River Scheme

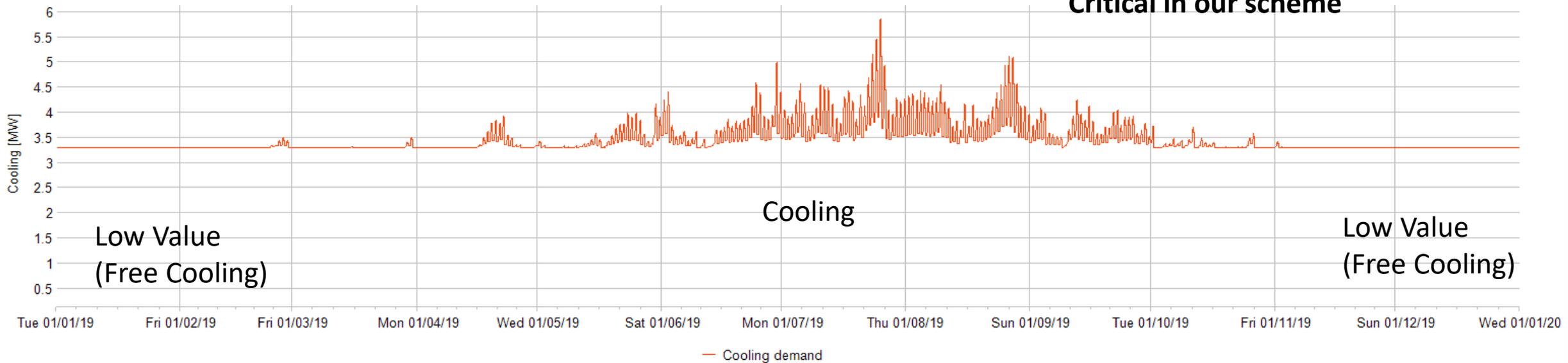
Data Centre  
cooling 3.1MW  
continuous



# New River Scheme - Combined Annual Heating and Cooling Demands



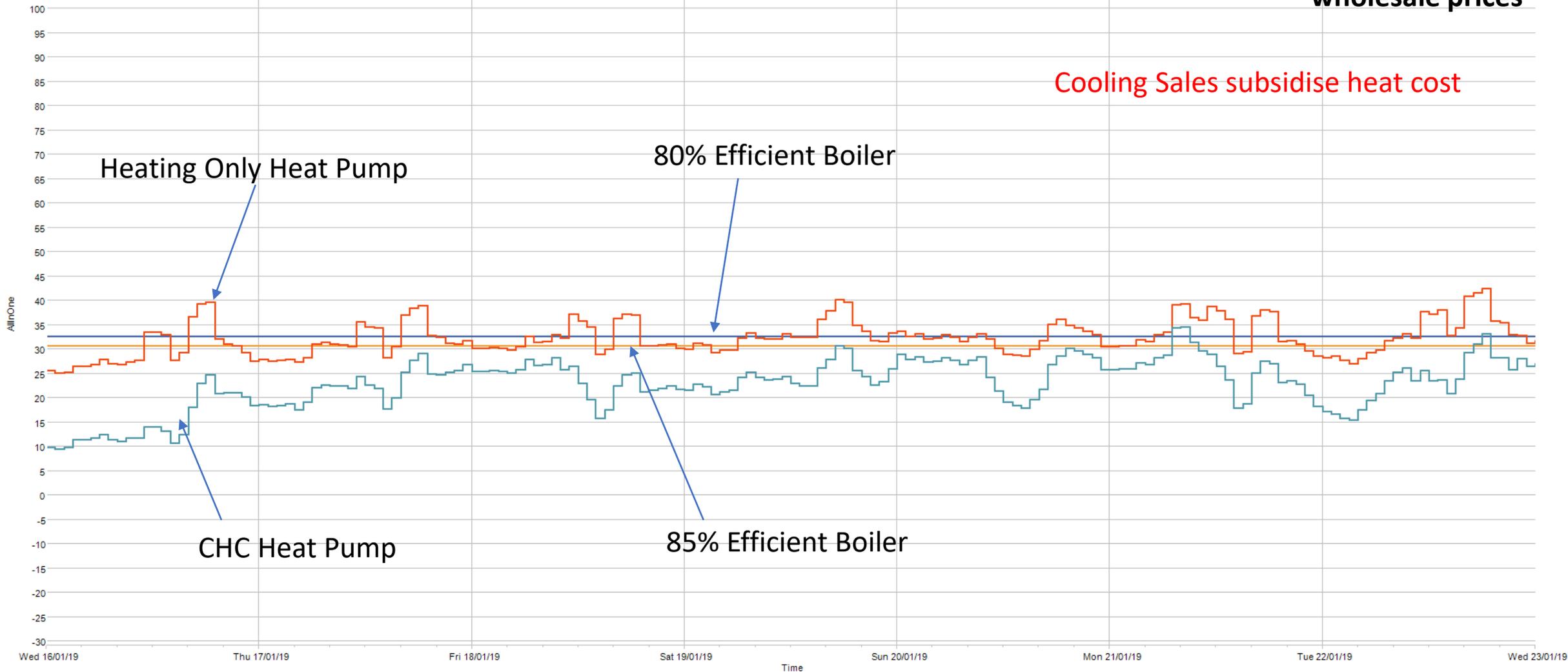
**Aquifer Thermal Energy Storage  
Critical in our scheme**



# Jan Week: Cost of Heat Compared – Boilers (80% & 85%) vs Heat only & CHC Heat Pump

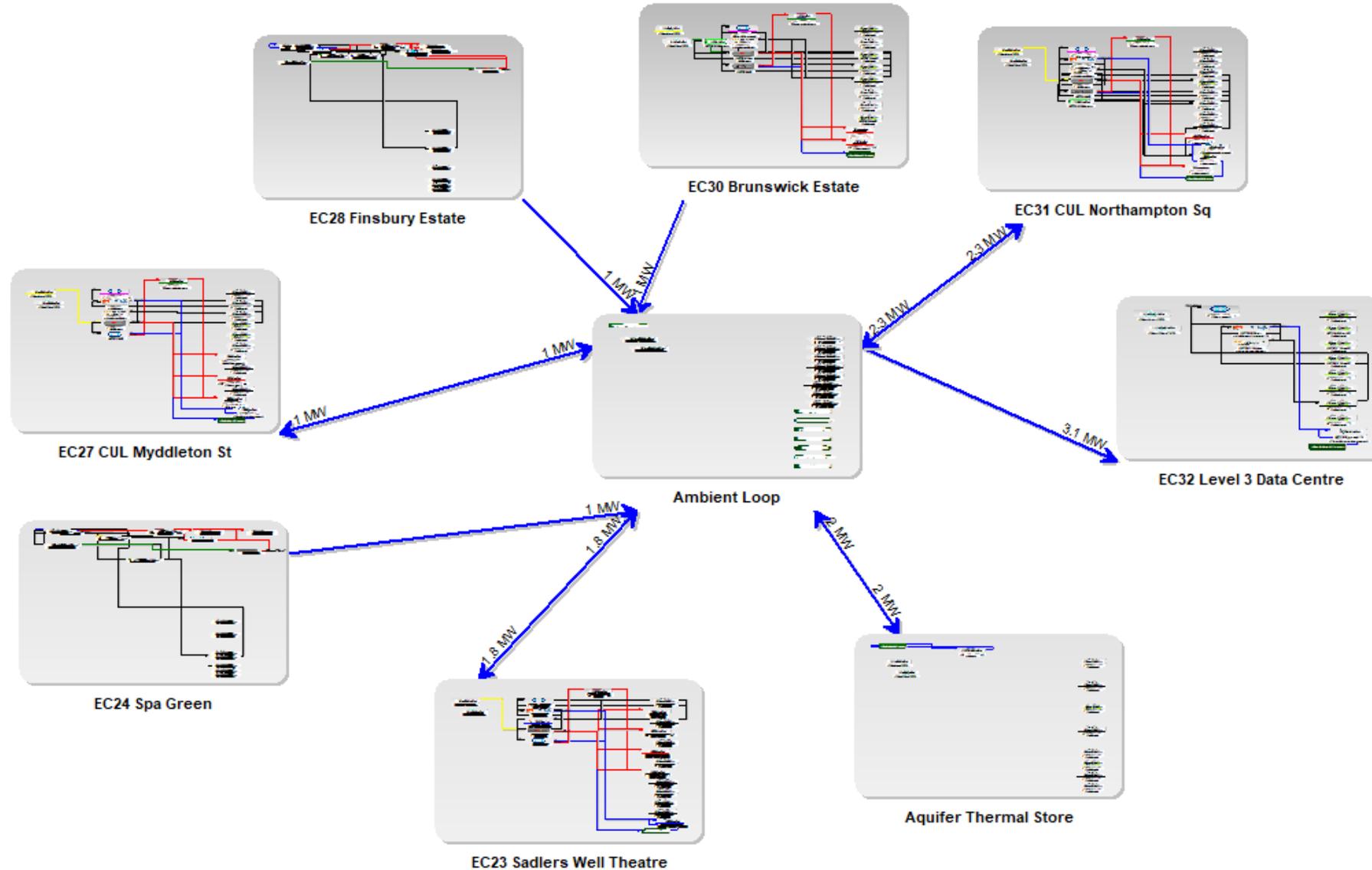
Based on 2019 wholesale prices

Cooling Sales subsidise heat cost

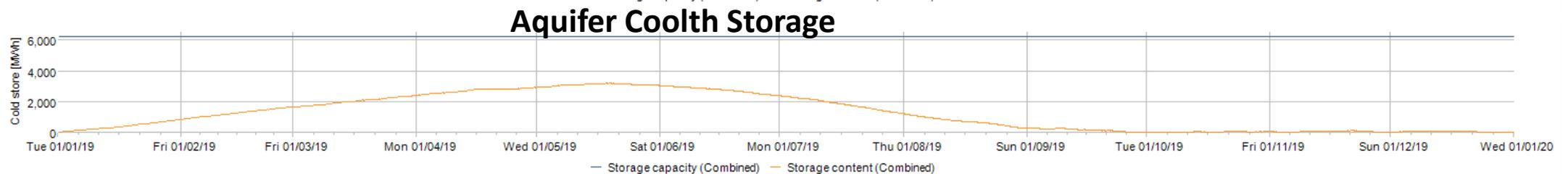
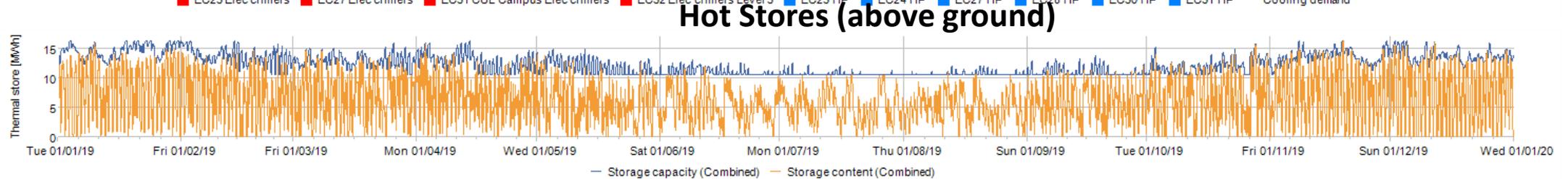
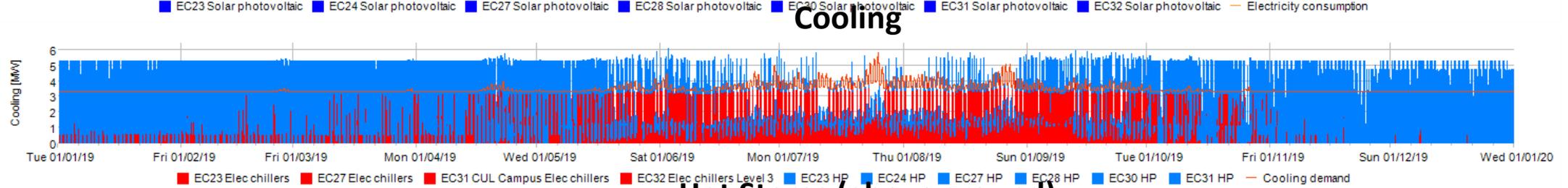
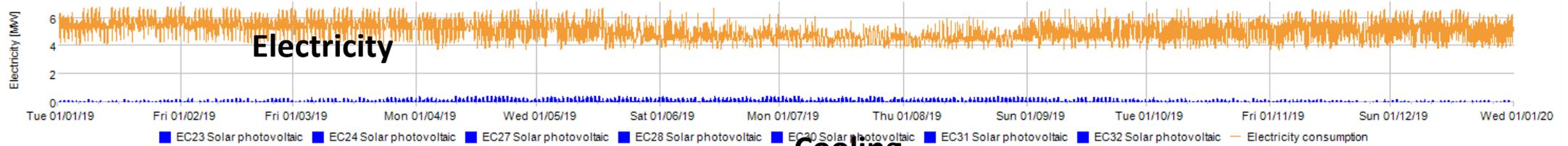
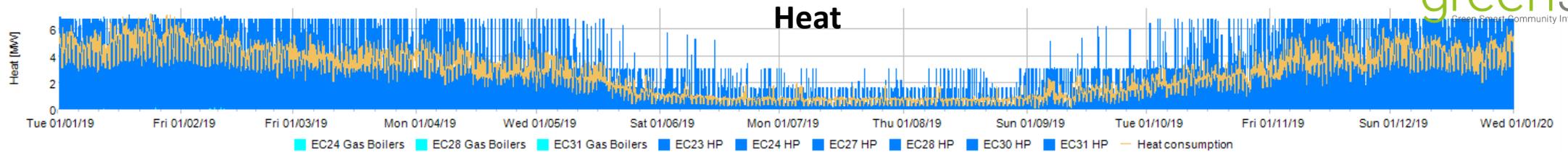


Heat Prices Ex CCL 80\_ Heat Prices Ex CCL 85\_ Heat Only Heat Pump Heat and Cooling Heat Pump

# energyPRO Model



# Annual Heat, Cooling, Elec & Storage

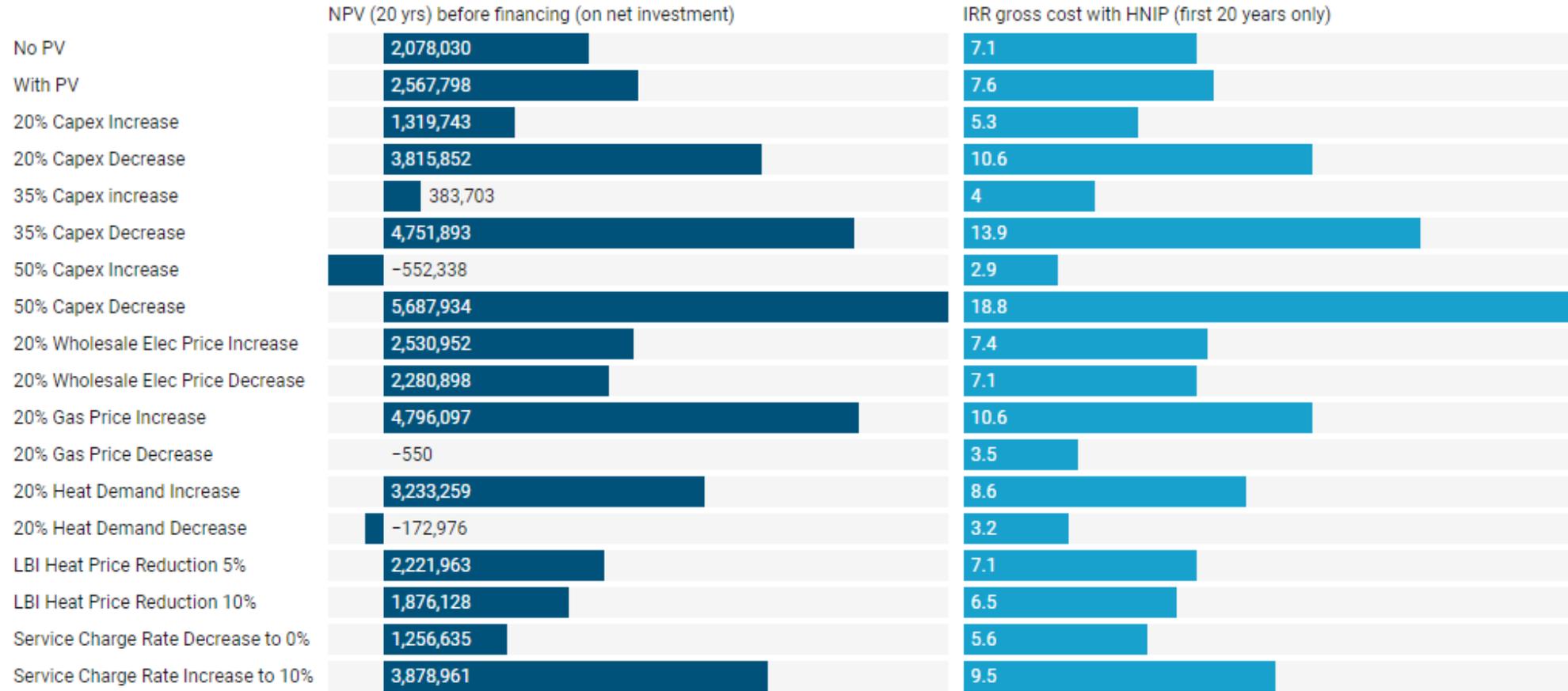


# Viability & Sensitivity Analysis



## Sensitivity Analysis

■ NPV (20 yrs) before financing (on net investment) ■ IRR gross cost with HNIP (first 20 years only)



Key items - Cost overruns, heat demand, gas price(=heat price)

Fix heat price?

# More Challenges!



- Lack of certainty around reinforcement costs and grid capacity
- Flat price tariffs
- Will the aquifer behave? Interaction with existing boreholes.
- Islanding – makes networks less viable
- Space - in central London
- Permanence of secondary heat sources
- Flex value is at 2 levels & DNO level is more valuable

# Open Questions



- What is the right location for the heat pump?
  - Centralised
  - Semi centralised
  - In each building
- Should we keep the boilers for back up?
- Should we size the heat pumps for peak demand?
- What is the peak demand - Climate: Newfoundland or Barcelona?
- Does the regulatory/fiscal framework reflect the true cost of achieving Net Zero?

# Conclusions



- Opportunities exist for more optimal decarbonisation through sector integration
- Rebalancing of electricity/gas prices required for wider heat decarbonisation (or a boiler ban)



**Carbon Data Resources**



**CULLINAN STUDIO**

