VENJ – Viking Energy Network Jarrow

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- NE England coast; East of Gateshead, north of Sunderland
- 64.43 km^2 (25 sq miles)
- population 147,700 (2021)
- Towns: South Shields, Hebburn and Jarrow
- Villages: Boldon, Cleadon and Whitburn
- 2010 Covenant of Mayors
- Climate emergency July 2019 - net zero aspiration 2030
- Councillors: 38 Lab, 9 Grn, 6 Ind, 1 Con

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Decarbonisation projects

- 2006; 80kW wind turbine at main depot
- 2010s; property rationalisation, boiler replacements, fabric improvements
- 2015/16; 750kWp PV programme
- 2015 onwards – LED streetlighting (now 87%)
- 2015 heat mapping study:
  - 3 clear town centre district heat opportunities {Brown = STC; Blue = new devlp; green = heat source}
  - **Jarrow is the largest Council load concentration so logical first step**
  - Hebburn & South Shields schemes to develop further
- 2021 to 2023; PSDS GSHP & PV 2 schools, 1 pool, LED lighting
- 125% increase energy costs

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Viking Energy Network Jarrow (VENJ)

- First major energy scheme for STC, initial scoping / grant application 2016
- Innovative combination of renewable technologies; PV farm, water source heat pump from River Tyne, solar thermal
- Heat supplied to Jarrow Business Centre, Jarrow Town Hall, Ellen Court, Wilkinson Court, Monastery Court, Jarrow Focus, Mid Tyne Building, PHaB Club in 2.6km network
- Private wire electricity to Jarrow Town Hall (Grade II listed), PHaB club & two plant rooms
- CO2 reduction of 726t p.a. (ERDF C34 output), 4% of our 2030 zero carbon target
- Primary Energy reduction of 6,134MWh (ERDF C32 output)
- Completion October 2023
- Scope to expand to 20 buildings; GHNF feasibility complete, DPD start underway
- Reuses a brownfield site; the former 1936 Jarrow Coal Staithes as a heat source

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A mixture of plant displaced...

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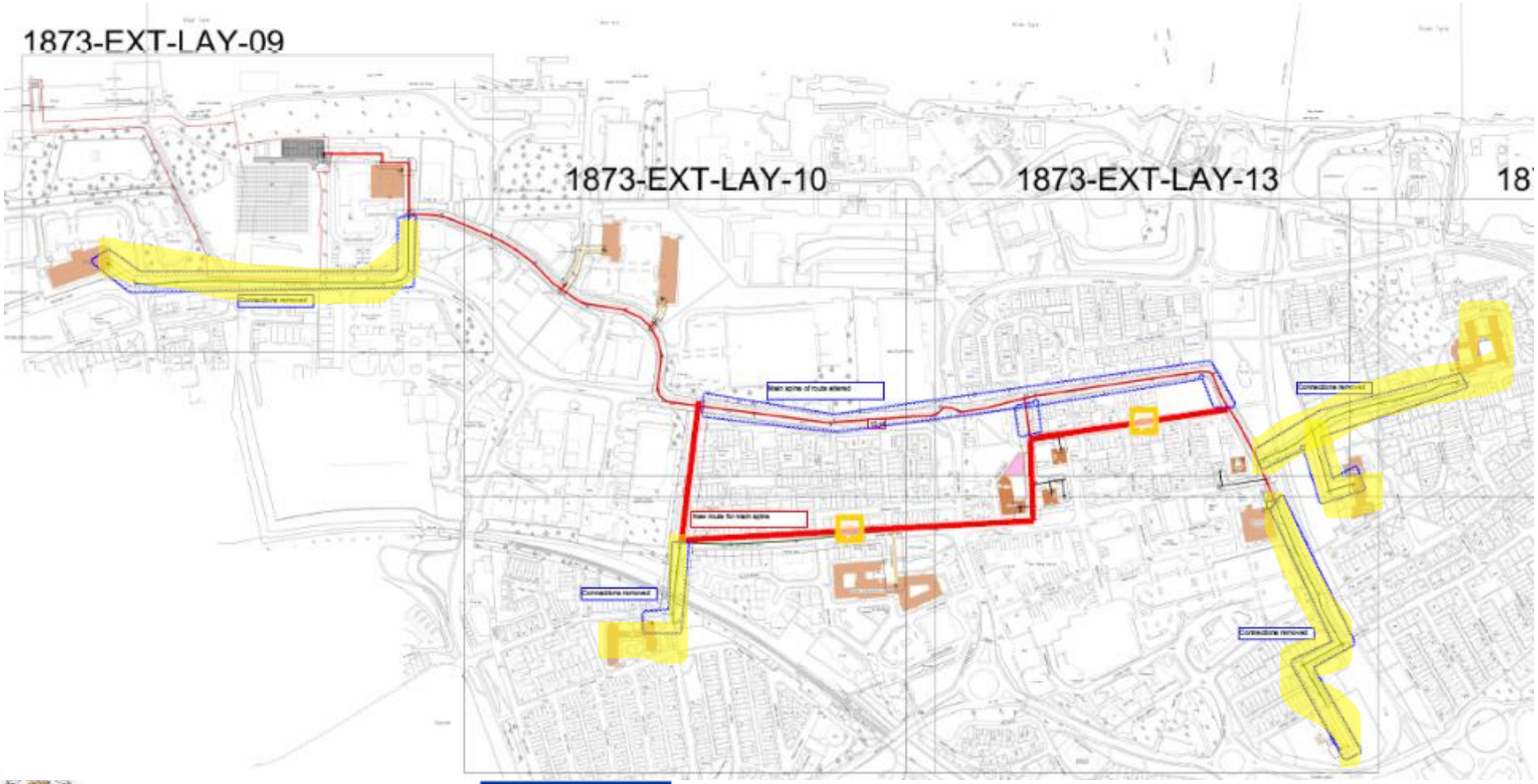
2020 tender - proposed network



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2023 connected buildings

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Brownfield site – former 1936 coal staithes

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Construction challenges – EC Foundations

- Original design assumed standard ground bearing concrete floor slab
- Site Investigation delayed by Covid until May 2021
- Results showed buried refuse on EC site
- Presence of slag required fully piled solution through to bedrock (18m down)
- Presence of methane (from decaying matter) requires suspended structural floor capable of supporting 22 tonne HP, 50 tonne thermal stores
- 5 months delay

Construction challenges; Civils, trenching, disruption

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Water abstraction & discharge

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Scheme Technologies

- 700kWth river source heat pump, COP 3.09 @ 65/55'C network, 10/7'C source (EN14511)
- 1000 kW Solar PV and 100m3 thermal storage for summer operation
- 500kWh, 200kW LiOn battery store and 43kWe CHP for extra heat for shoulder periods, peak shaving & winter
- 90 no. (225m^2) solar thermal collectors add up to 158kW to preheat river water, or heat thermal stores for network night time use
- Potential uplift of COP by 10-15%; somewhat unknown as genuine UK first at this scale

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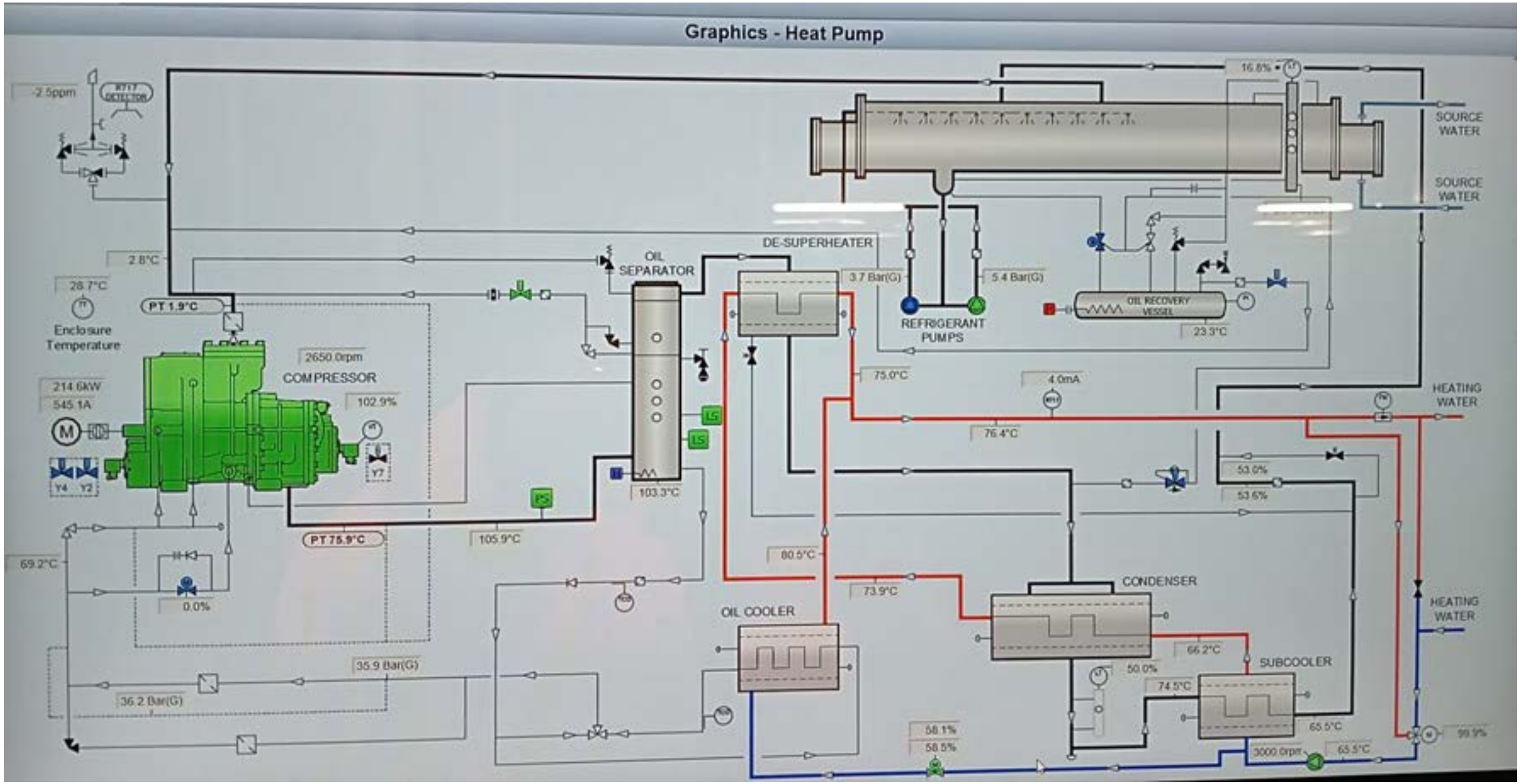
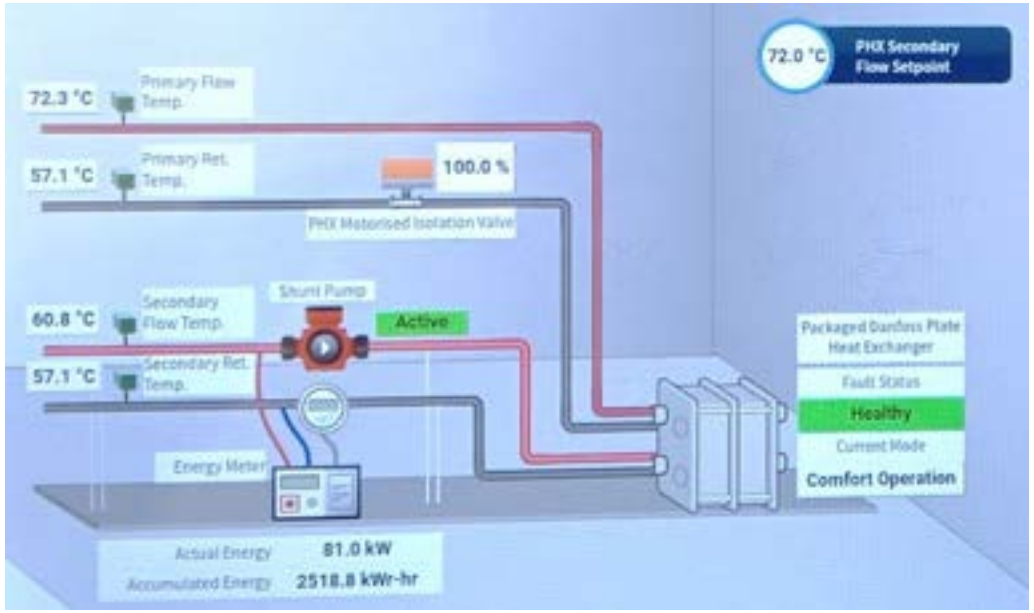
HP graphic and control screen



Problems encountered.....

- Mostly existing secondary circuits
- High return temperatures esp. flats
- Poor existing building balancing
- Crossed flow & return pipes
- Air locking and blocked strainers
- BMS configuration & modbus comms
- Heat pump PSU glitches; ‘high temp’ trips



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Project lessons learnt

- Ensure supporting policies are up to date - CEEQUAL points, transition through planning, top level support ensures co-operation, resourcing, finance
- Design stages; RIBA Stage 4 <> BSRIA stage 4A
- ICP – don't - no cost saving, significant delays with legals, poor site engagement
- Conduct detailed ground Site Investigation pre-contract, ideally predesign
- Policy changes from funders and stakeholders (NWL, NPG, NHS,ERDF, Brexit, DCLG/MHCLG/DLUHC suppliers) – requirements can change over time
- State Aid, easements, grants, legals take months (years)
- Never assume, keep your head & *focus on the end result*!

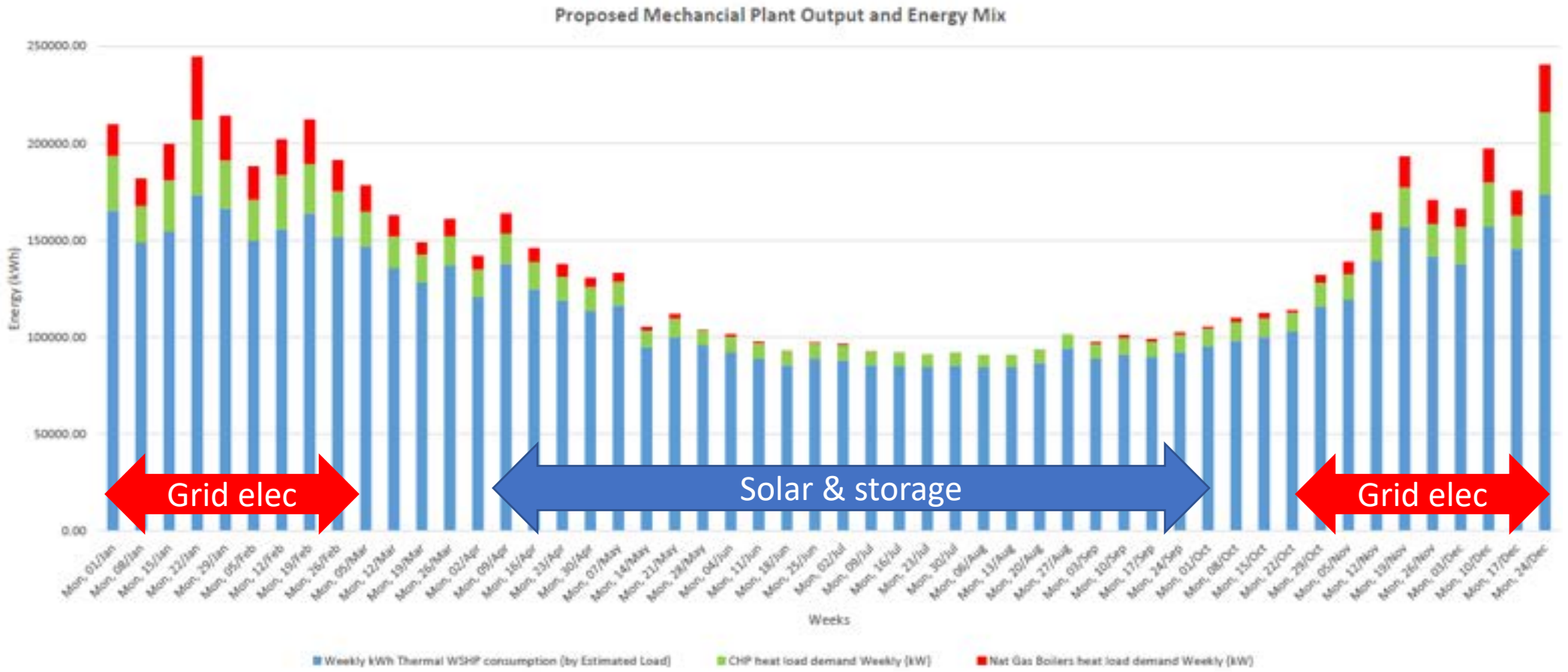
Performance

- System is very reliable; no outages since 4.9.23
- PV system will export on bright days, even in December with HP running
- HP teething troubles; basic COP is 2.1 (December)
- high return temperature effects on sub cooler (61 rather than 55)
- year average COP is about 2.2 with some improvement from solar preheat (not yet quantified). Compressor oil ‘keep hot’ electricity is not insignificant.

Financials

- Original projected savings around £500k p.a, latest calc around £400k
- Gas / Electricity pricing; all in exVAT approx. 24p/kWh electricity, 8.7p gas
- HV supply with low load...35p/kWh.
- Project NPV calc is positive around year 12/13
- Basic cost of HP heat = 12.11p/kWh
- boiler efficiency 84.9%; heat cost 11.3p/kWh
- based on metered consumption only; does not include solar output
- Cost of carbon - ?? £20/tonne CCL buy-out rate .v. green book supplementary guidance 2023; values £134, £269, £403...

The weekly energy supply over a year



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Winter & night - wind turbine feasibility

- Feasibility study completed, recommends repowering 2003 turbine at EcoCentre to ease planning
- Various options; generation approx. 1500-2300 MWh p.a.
- Aim is to cover winter heat pump use
- E.g. EWT 900kW turbine; 50m hub, 27m blade length, est 1750MWh p.a.
- Ecology and heritage studies underway to inform planning application
- Submit November 2024

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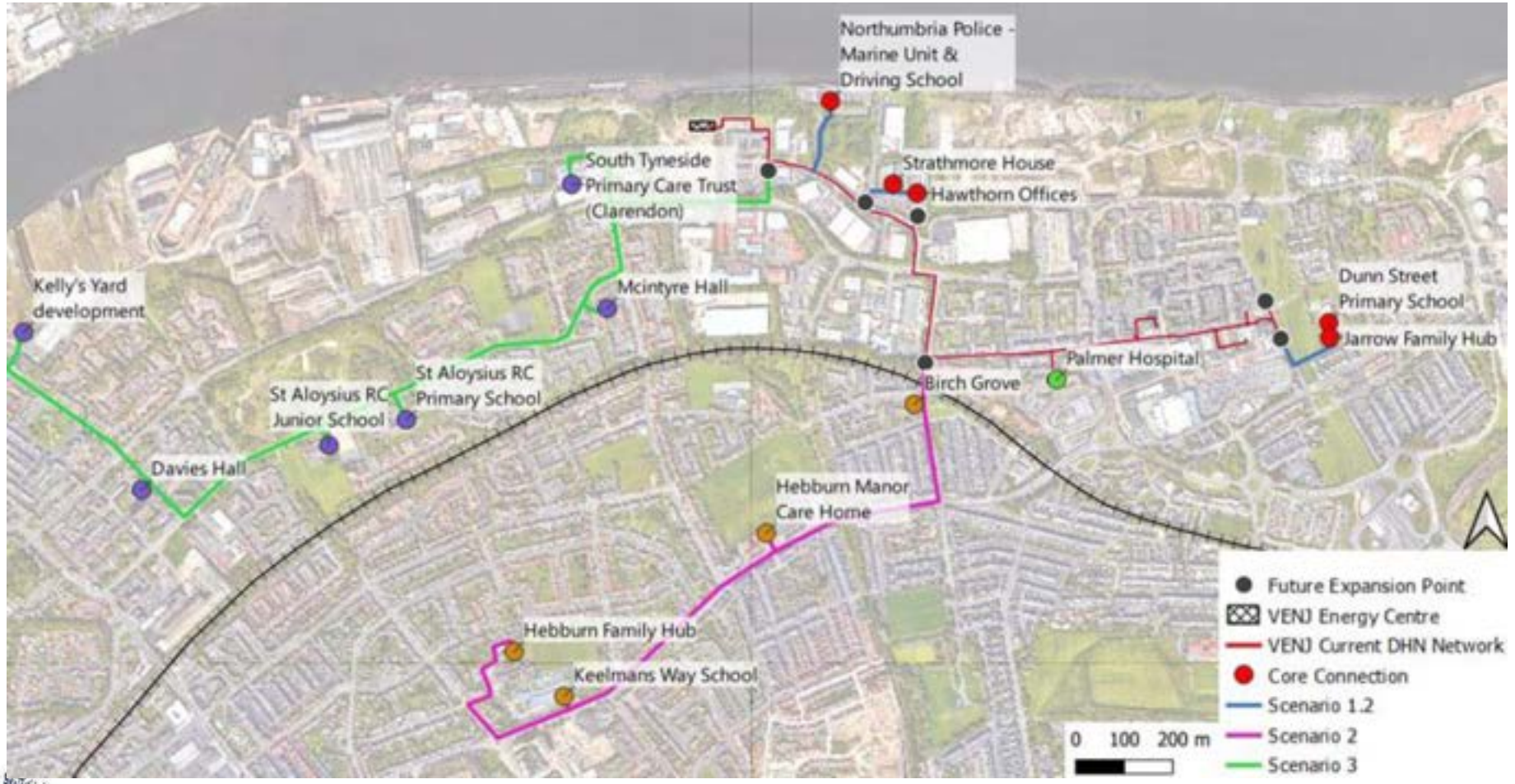
VENJ Expansion - techno-economic feasibility results



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