Guys and St Thomas' NHS Foundation Trust

CHP case study
Joe Grice – Energy Manager

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Guys and St Thomas'

- 2 large acute Hospitals based in Central London
- Annual energy consumption 2008-09
- Gas – 21,000 tonnes CO_2
- Electricity – 50,000 tonnes CO_2

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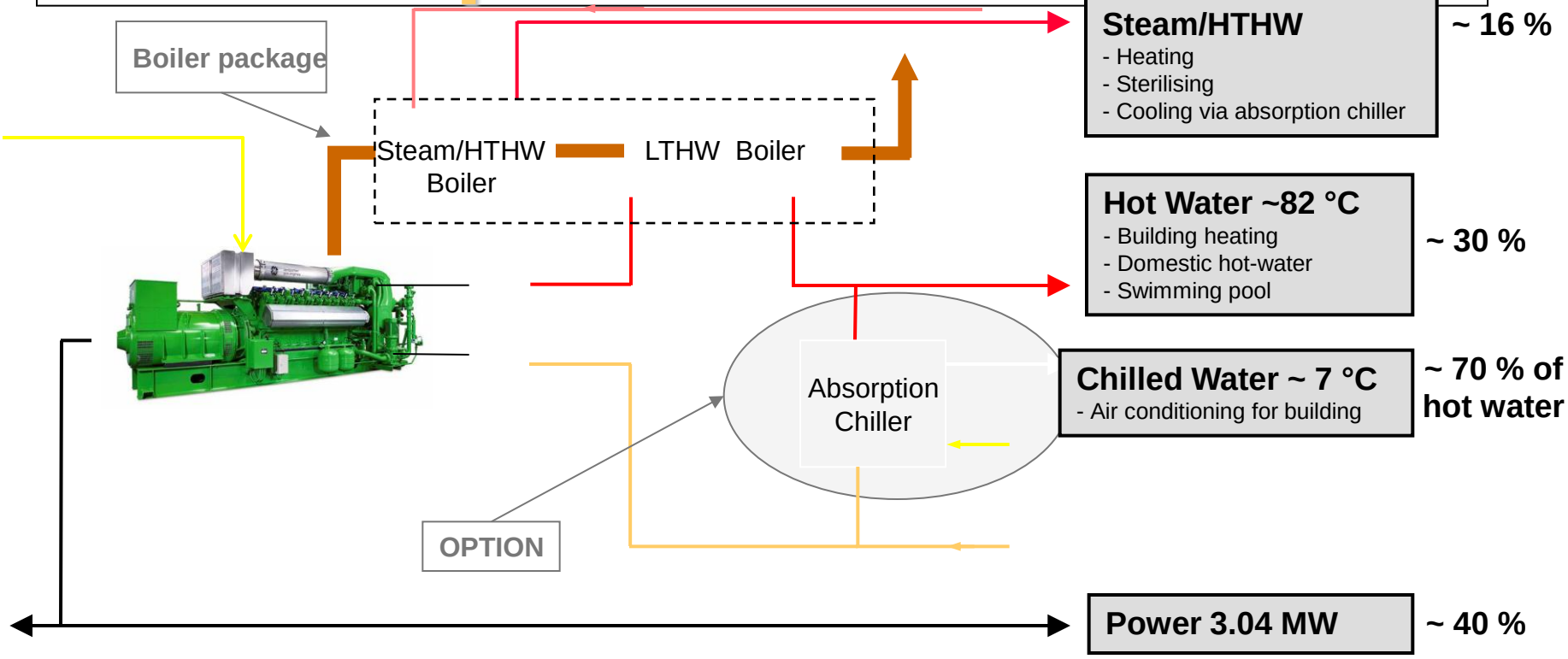
Energy saving measures

- Installation of motion sensors
- Inverters fitted to large supply and extract systems
- Upgrade T8 & T12 lamps to LED
- Power factor correction
- Staff awareness campaign

Carbon management plan

- GSTT was one of the first organisations to take place in Carbon Trust Carbon Management plan 2006-07
- Identified CHP as single best investment to provide significant energy savings

CHP gas engines integration with Hospitals



Excess generation of power sold to the grid

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Project overview

- NIFES Consulting Group commissioned to undertake feasibility studies for both sites
- Study appraised and presented various CHP options
- Including outline design, capital costs and revenue savings
- Scheme approved by Trust board
- £10m Department of Health grant secured post approval

Project overview

- NIFES appointed by GSTT as designers and project managers.
- Detailed design to tender and managed procurement
- Identified total savings and costs to confirm benefits
- Managed the construction contracts as 'Engineer'
- Obtained utility and Local Authority permits and planning consents
- Responsible for overall project delivery and performance testing

Project overview

- Clarke Energy supplied engine and boiler package
  - GE Jenbacher Engine
  - Cochran Boilers
- Clarke operate and maintain the equipment on an ongoing contract against agreed performance guarantees.
- Mitie Engineering won tender for the mechanical, electrical and civil enabling works package.
- Package works tendered to OJEU standards

Feasibility - Guys

- Potential electrical demand to allow 4mWe engine.
- Constant HTHW demand from heating and absorption chillers
- Constant low-grade(82ºc) heating demand from DHW and swimming pool
- 3MWe engine deemed most economically viable

Feasibility – St Thomas'

- Potential electrical demand to allow 3MWe gas engine
- Base steam demand for CSSD (Sterilising) with peak heating demand
- Constant low-grade(82ºc) heating demand from DHW
- 3MWe reciprocating gas engine deemed most economically viable

Engine Specification

- GE Jenbacher J620 GS gas engine
- 3.04 mW Electrical output at 11kV
- HTHW/Steam output (170ºc) approx 1400kW
- LTHW 1333kW(82ºc)
- Lube oil 290kW (50ºc - not utilised)
- Specified efficiency 78%

Technical Barriers - Guys

- Lack of accessible low-grade heat demand required detailed engineering design to access 7 plant rooms
- Additional low-grade absorption chiller not economically feasible
- 4mWe engine downsized
- 3mWe electrical deemed best compromise between maximum and minimum heat loads
- 100% thermal back-up required

Physical barriers - Guys

- Boiler house floor requires reinforcement
- Acoustic enclosure required
- Boiler shut-down required
- Removal of existing boiler
- Use of existing redundant 150m flue
- Potential cooler noise and visibility for planning

Guys CHP enclosure

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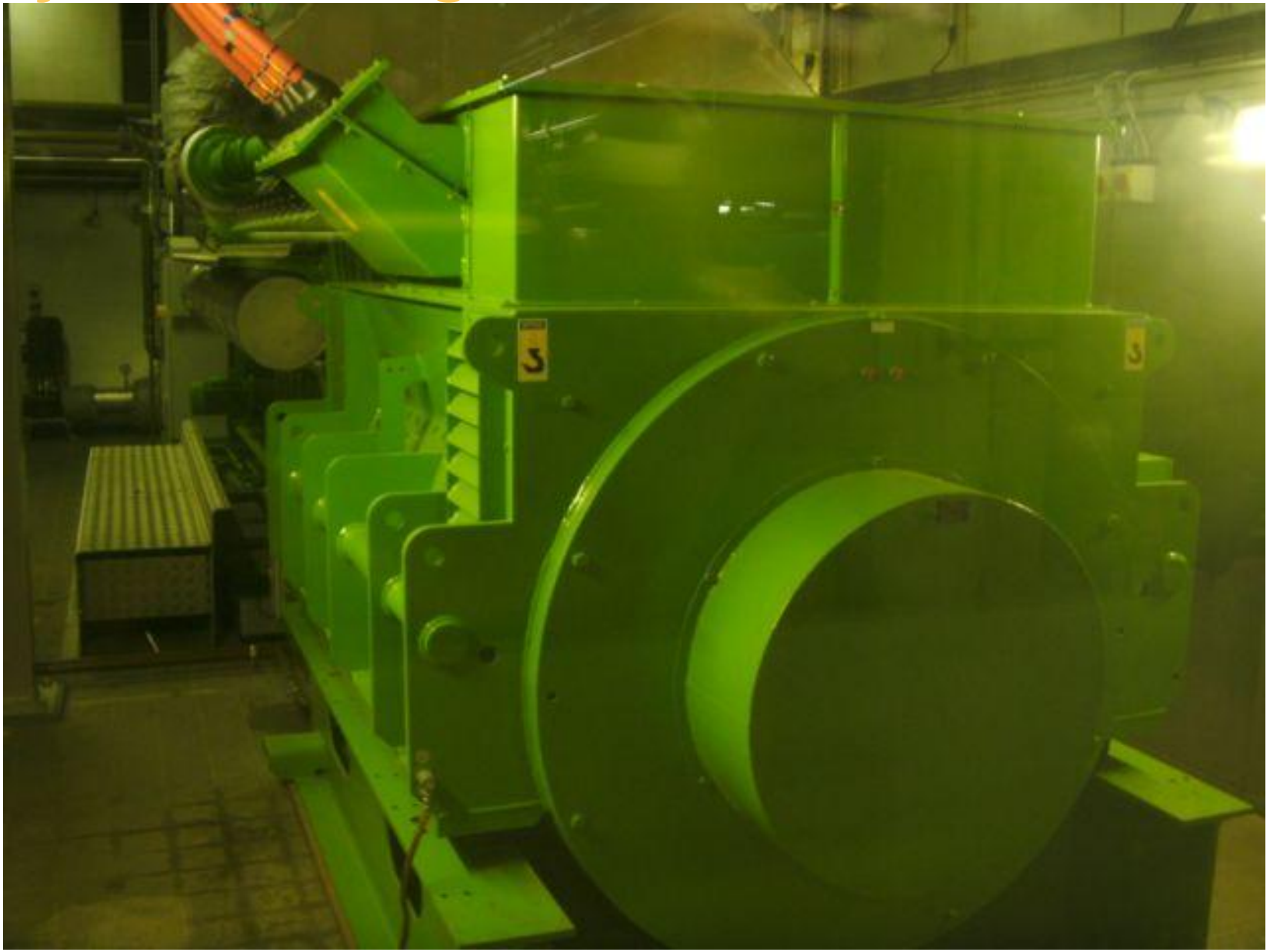
Guys CHP engine – Generator end



HV Switchgear

CHP engine – Heat-recovery end

Technical Barriers – St Thomas'

- Lack of space for waste heat boiler meant relocation of medical gases
- Air quality management area - Emissions modeling by NIFES for LA planning approvals
- Infrastructure of existing HV supply and ring main re-configuration
- 100% back-up required
- Boiler heat metering infrastructure required

Physical barriers – St Thomas'

- Steam services run in tight sub-ducts or narrow risers
- Engine located in proximity to boiler house
- Relocation of medical gas store
- New complex horizontal flue required to access existing 50m stack.
- Crane lift required for engine
- New dedicated gas supply and booster required
- Screen required for planning as conservation area

St Thomas' - Engine lift

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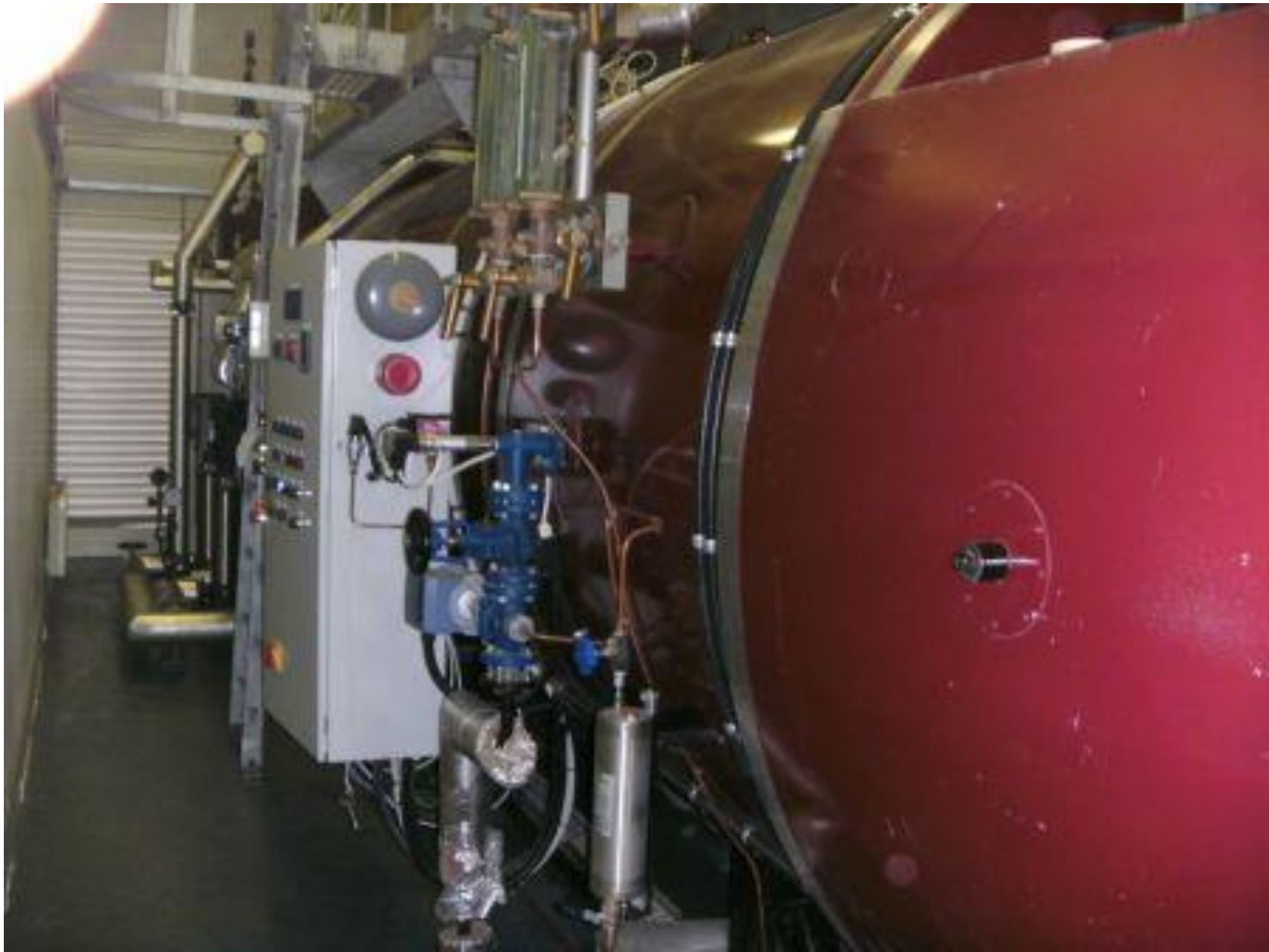
St Thomas' – Acoustic CHP enclosure

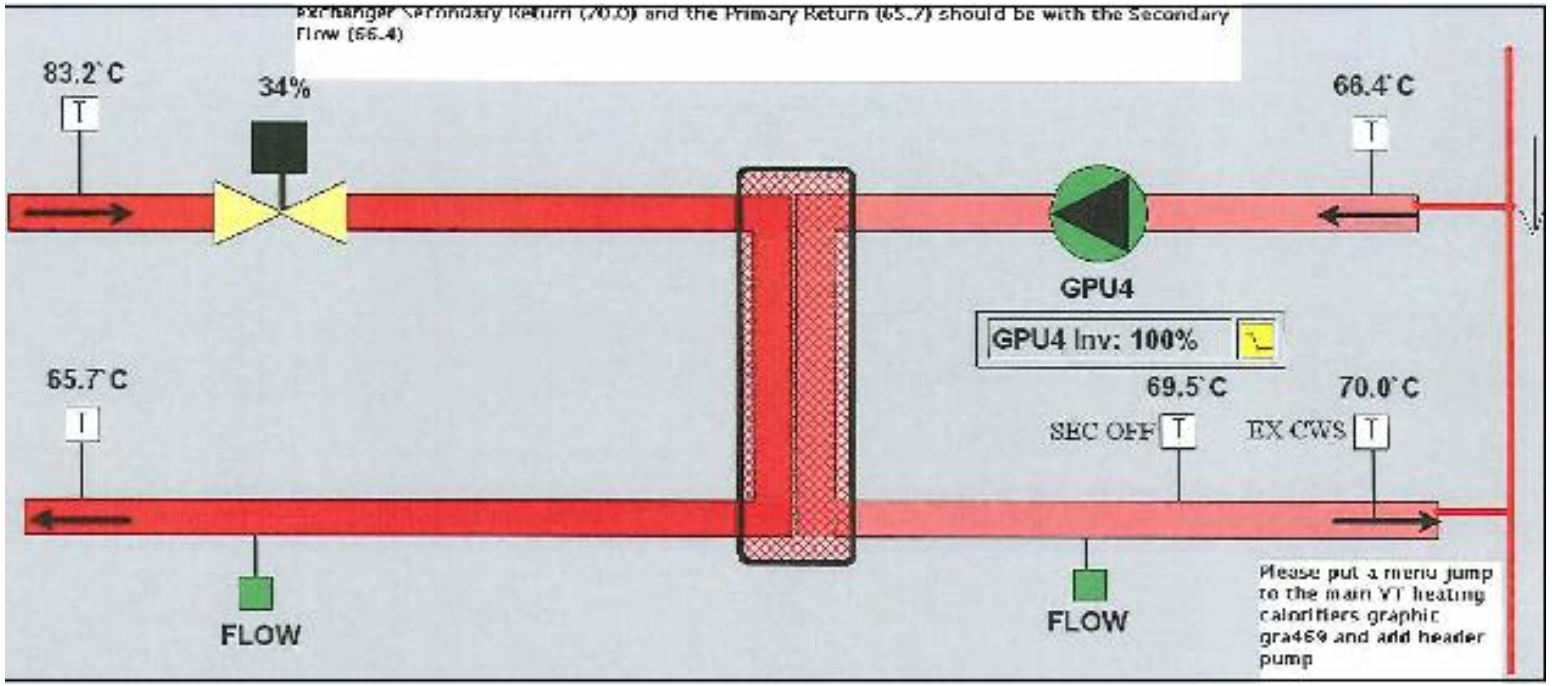
St Thomas' CHP engine

StThomas' waste heat boiler



Typical heat-exchanger

- CHP waste heat used to pre-heat heating circuits



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Benefits

- Financial savings
- Reduction in CO_2 emissions
- CCL reduction/exemption on gas
- Additional EU-ETS and possibly CRC credits
- Increased future resilience
- Reduced TRIAD charges

GSTT Annual benefits realised

- Financial savings – £2.1 million
- Reduction in CO_2 emissions – 12,303 tonnes CO_2
- CCL exemption on all gas – Approximately £170k total but could be higher
- Additional EU-ETS and possibly CRC credits – 6, 658 credits per engine
- Increased future resilience – Feasibility stage
- Reduced TRIAD charges – Approx £180k maximum

Points to consider

- Discuss district heating options first
- Accurately monitor thermal loads
- Consider future site plans
- Consider all benefits holistically
- Ensure maintenance contract is robust
- Retrofitting is expensive but capital engine cost is relatively low
- Discuss revenue savings with finance department

Ongoing projects

- Guys waste heat boiler re-plumbed to act as a recuperator
- Adjusting BMS setpoints to optimise performance
- Consolidate maintenance to optimise revenue savings
- Island mode to allow CHP to synchronise with generators and provide emergency power
- Review demand response options
- Reviewing LTHW absorption chiller options

Any questions?