

Whitehall District Heating System (WDHS) - Road to Net Zero

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Whitehall District Heating System (WDHS) - Road to Net-Zero



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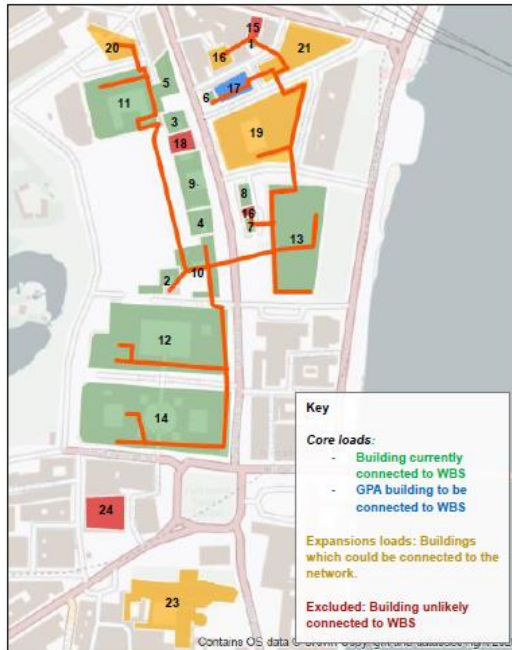
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Whitehall District Heating System - Background

The Primary heating source for the WDHS is located within Ministry of Defence (MoD) main building. The WDHS was designed and constructed during the 1940- 50s but only became fully operational in the 1960s. It has 22 km of flow and return pipework running through dedicated service routes to supply heating into 14 buildings across the Whitehall estate with future plans to connect 10 additional buildings.



Civil Service Club
10 Downing Street
Admiralty House
Dover House
Ripley Block (22-26)
55 Whitehall

Gwydir House
Banqueting House
Horse Guards
70 Whitehall
Old Admiralty Building
King Charles

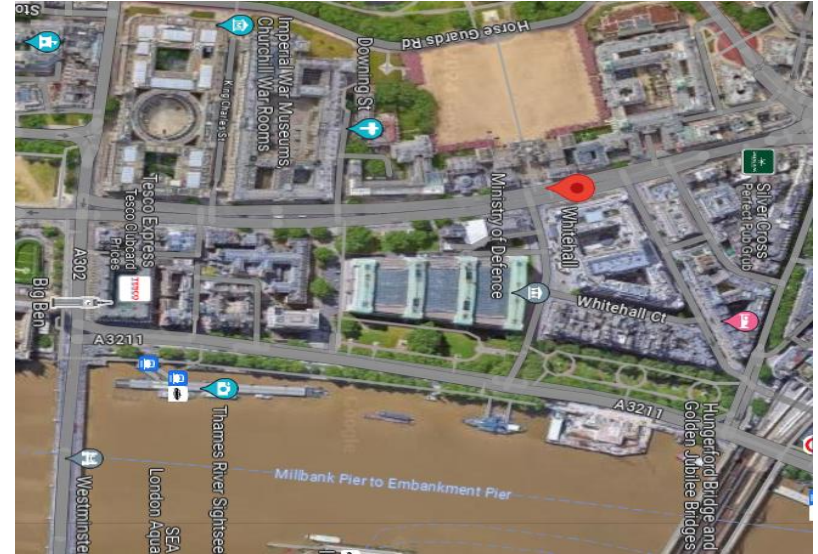
MoD Main Building
Treasury/HMRC
Northumberland
RUSI Building
3-8 Whitehall Place
36 Whitehall

Old War Office
Admiralty Arch
Corinthian Hotel
Great Scotland Yard
Westminster Abbey
QE2 Conference centre.

Whitehall District Heating System : Existing Network



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Whitehall District Heating System : Existing Network

Currently, the entire thermal provision for the WBS is generated by dual fuel gas/ oil boilers located within the MoD main building's Energy Centre (EC). The EC supplies circa 20 GWh of heat per year with a peak load of 10 MW.

The network currently operates **seasonally from October to May** with the main system being non-operational over the summer period to allow for Planned Preventative Maintenance (PPM). During this summer downtime, the MoD main building is supplied with heat via dedicated summer boilers, and all other buildings are supplied with hot water (not heating) through electric immersion heaters.

The network temperature is **currently** set at 140°C flow (with the return temperature varying as flow is constant).



The majority of customer heat load is for public sector offices, however a small proportion of this is for the OWO Raffles hotel.

The heating systems within connected buildings are coupled to the WDHS via (hydraulically separate) plate heat exchangers (PHE)

Whitehall District Heating System - Decarbonisation Strategy

Government Property Agency (GPA), together with the Department of Business, Energy, and Industrial Strategy (BEIS) have undertaken a feasibility study looking at how the network can decarbonise its operations. This is split over 3 phases.

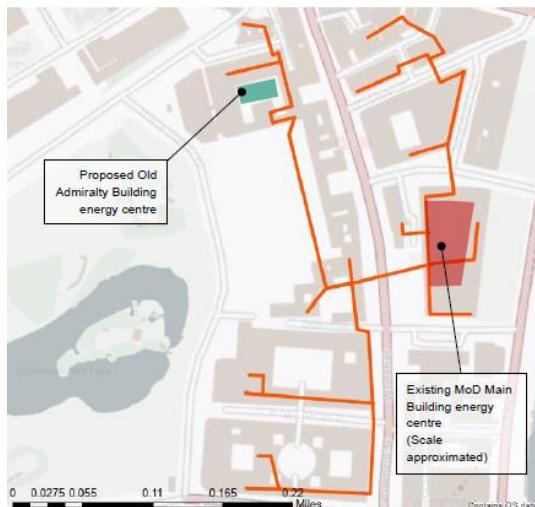
Phase 1 - Lowering operating temperatures and reduce heat losses.

- **Phase 1: Project (a) Completed** reduced heating losses from our pipework assets by removing and upgrading the original thermal insulation to the existing HTHW (high temperature hot water) pipework. Completed in September 2021 and is producing a significant 55% reduction in heat losses and saving 26.7 tonnes of CO₂/year.
- **Phase 1: Project (b) Current** replacing all Plate Heat Exchangers across the systems to facilitate lowering the operating temperatures and moving from a high (140°C flow) down to medium temperature hot water system (95°C flow) Upon completion of Phase 1 this will see us achieve a further 17.1% reduction in Carbon against the 2014 baseline.

Phase 2 and 3 – Future New Energy Centre and Wider network connections

- **Phase 2: (2025 +)** WBS transition to heat pump technology and move away from gas boilers, subsequently moving to a low temperature hot water system operating at 60°C aiming for a 60.5% reduction in carbon.
- **Phase 3:** Expand the WBS connecting to an area wide network achieving 89 -94% carbon reduction.

Whitehall Boiler System: Phase 2 – Existing and New Energy Centres



Existing - MoD Energy Centre

The main EC for the Whitehall Boiler System is currently located within the MoD Main Building. The network is supplied with heat from 4 no. 5MWth dual fuel winter boilers and 2 no. 1.5 MWth summer boilers (for the MoD building alone).

Due to the security constraints, and other issues the GPA have proposed that no additional plant will be installed within the MOD EC. However, existing plant will be retained in the MoD building.

The MoD EC is not categorised has low zero carbon plant but it must be currently retained for the boiler plant to provide resilient /peaking plant for WBS.



Whitehall Boiler System: Phase 2 – Existing and New Energy Centres



New -Old Admiralty Building (OAB) Energy Centre

There is opportunity to utilise available or redundant space within Old Admiralty Building to host new low carbon thermal generation plant.

Several spaces within the building footprint have been identified as suitable locations for new plant. An advantage of utilising this space is that it has much of the required physical and organisational infrastructure in place to host the new EC.



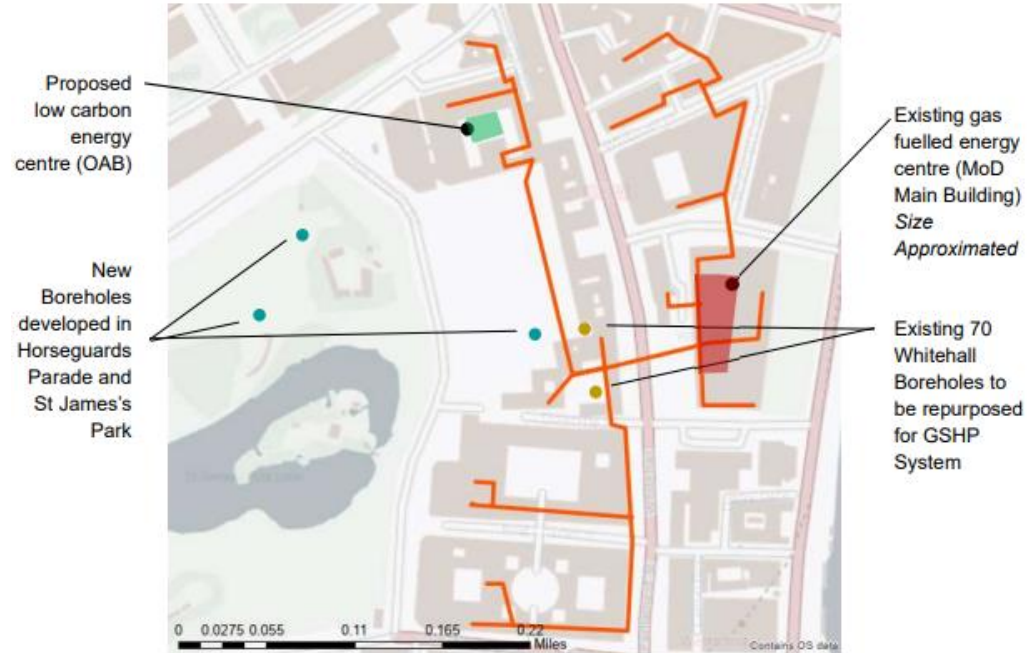
WDHS: Phase 2 – New Energy Centre & Ground Source Heat pump

The proposed low carbon heat source is a 2.2MWth Open Loop Ground Source Heat Pump (GSHP) array, with the heat pump plant installed in the sub-basement of the Old Admiralty Building (OAB) –The majority of plant required to enable the heat pump scheme would be located within the OAB utilising available / redundant space within the sub-basement areas.

It is proposed that 2 no. existing boreholes (BHs) within the Estate which currently serve cooling to 70 Whitehall could be repurposed as abstractions boreholes for the GSHP system.

To complement the existing BHs, 1 no. new borehole would be drilled in Horse Guards Parade to supply the heat pump system in OAB.

To conclude the system's BH array, and in order to enable reinjection of water back into the aquifer, an additional 2 no. reinjection boreholes required needed. These boreholes are proposed to be drilled in St James's Park.



Whitehall District Heating System : Carbon Reduction

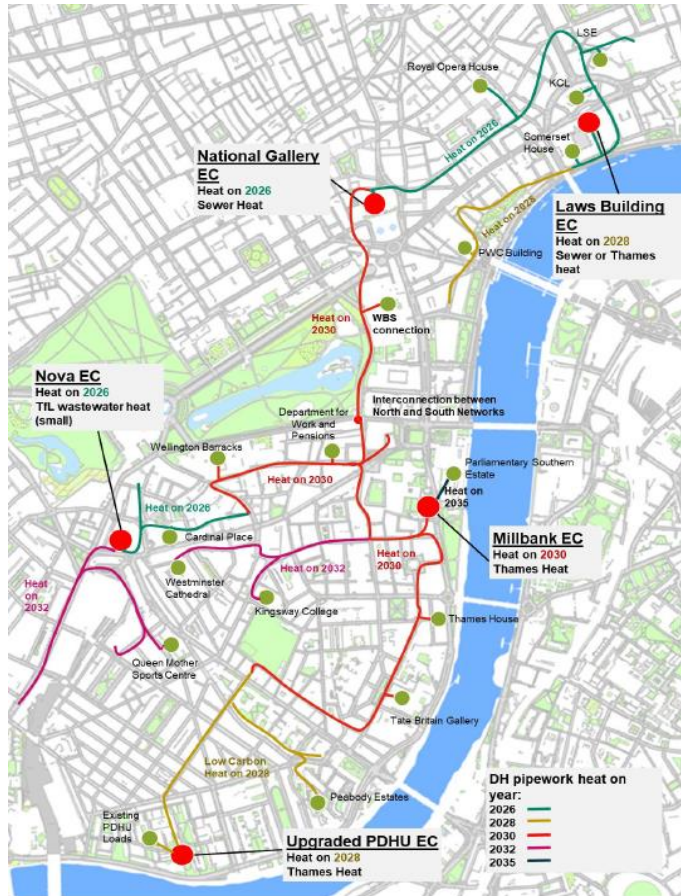
The proposed GSHP would provide 66% of the annual heat required by the WBS heat network. This would reduce carbon emissions by 60.5% compared to the BAU / post-Phase 1 system as heat pumps produce lower carbon emissions than the existing gas boilers.

	Heat Pump Seasonal Efficiency	Annual Carbon Intensity of Heat (gCO ₂ /kWh)	Carbon Savings Vs BAU / Post Phase 1 system (Tonnes per year)	% Carbon Savings Vs BAU / Post Phase 1 system
GSHP Project / Phase 2	2.92	84	2,816	60.5%

The proposed GSHP / Phase 2 project reduces carbon emissions from heating by c. 60.5% in WBS buildings. The reduction in carbon emissions is limited by the maximum thermal capacity of the GSHP limited by the anticipated borehole flow rates.

To reach net zero - It is recommended that Phase 3 is pursued since roughly 1/3 of heat would still be generated via gas boilers installed within the MOD building.

Whitehall Systems – Phase 3 Post 2025



Phase 3 – Extend the network wider

The best source of external low carbon heat in Whitehall is likely to be the proposed ‘South Westminster Area Network’ (Project SWAN) or a smaller variant on this project.

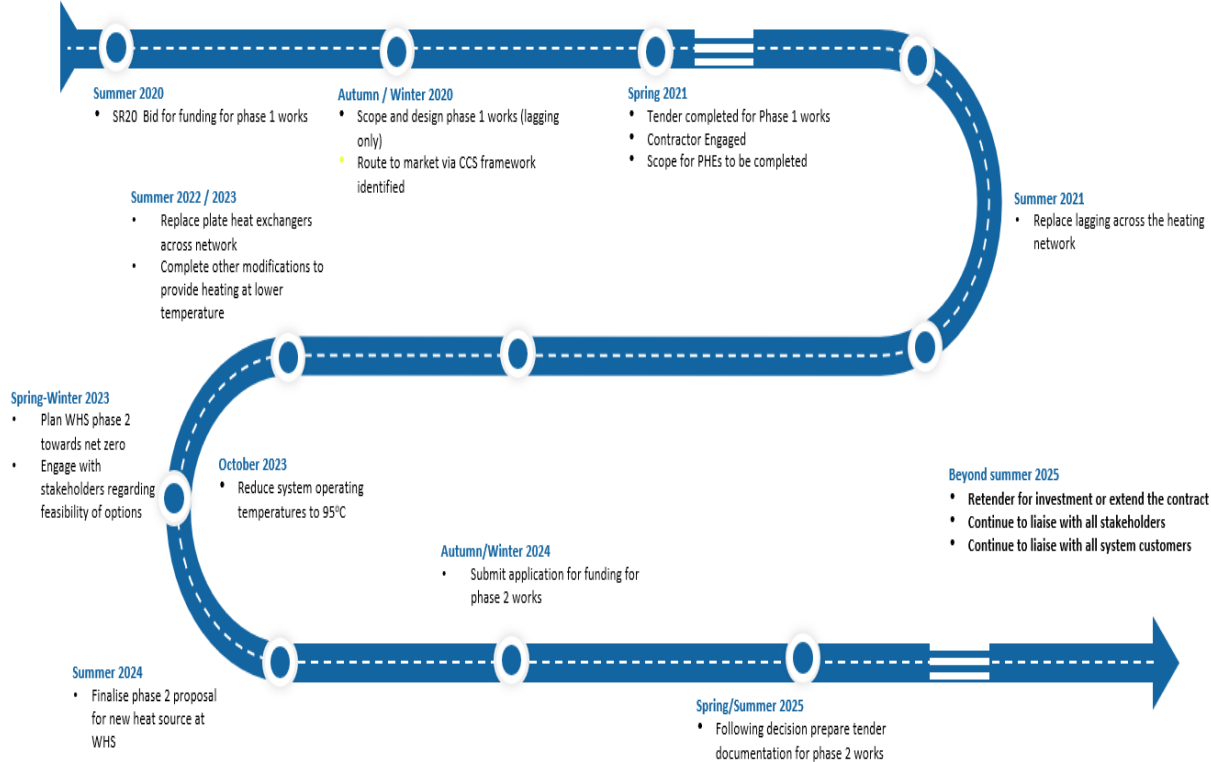
This area wide low carbon heat network would primarily use heat from the River Thames

The first year of heat being delivered to Whitehall is currently modelled as 2029 and the network will provide up to 92% carbon savings by 2040 versus gas boilers.

This technical option provides the best opportunity for the public estate (in this area) to reach net zero.

Source: Feasibility Study 2020

The roadmap below sets out some of the key steps over the first five years of the strategy period.



Questions