

Water Source Heat Pumps – Cornwall’s Potential

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An introduction to water source heat pumps and the potential they have in Cornwall. Such technology can supply a low-carbon, renewable source of heat to both new build developments and retrofit properties as part of the UK’s commitment to achieve Net-Zero carbon emissions by 2050.

Water Source Heat Pumps – WHY

The benefit of water source heat pumps over air and ground source devices, is that they are often more efficient - heat transfers better in water than in air or soil. Water temperatures are also more stable than air temperatures throughout the year, and often more stable than shallow ground temperatures as well.

Sea temperatures in Cornwall range from 7°C in winter to 18°C in summer¹. Whilst minewater temperatures range from 16 – 25°C for mines >200m deep². These inlet temperatures can result in heat pump COP’s of >4 (400% efficiency).

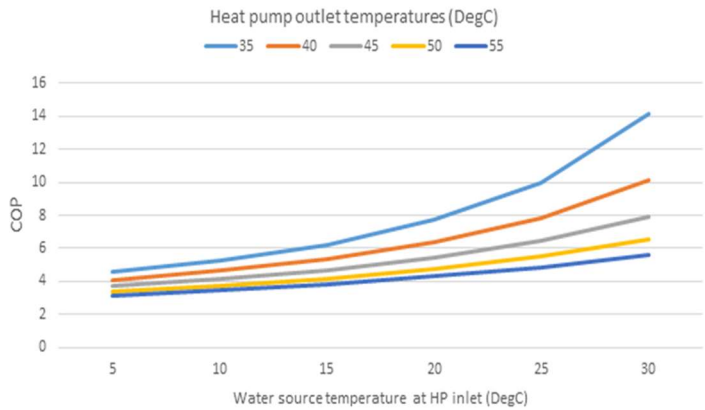


Figure 1: COP of water source heat pumps Data from 3

Water Source Heat Pumps – WHERE

Cornwall has two very large water resources that can be utilised for WSHPs: seawater and minewater.

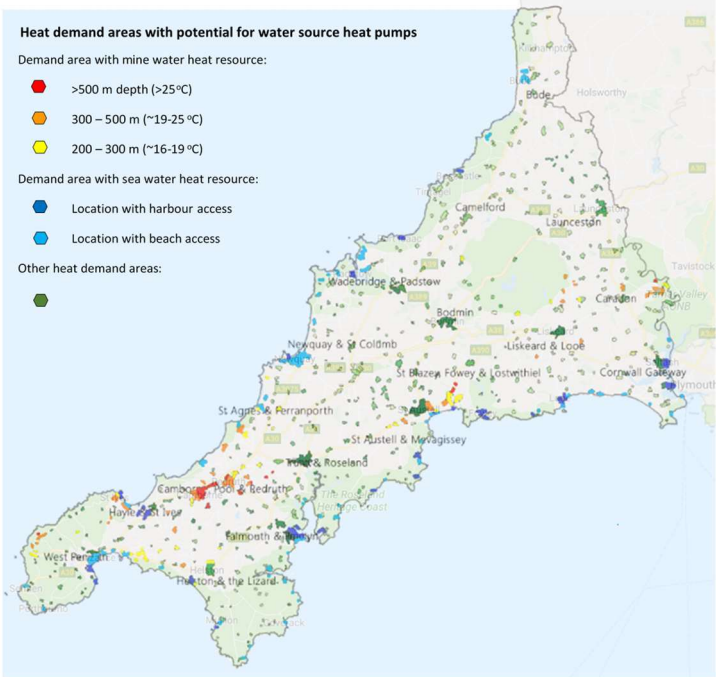
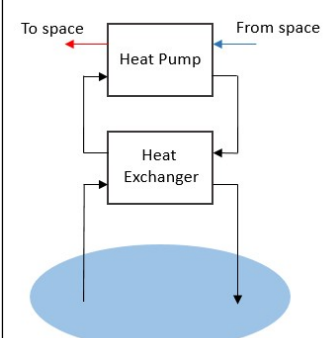
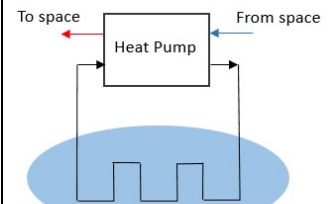


Figure 2: Map of Cornwall’s heat demand areas with potential for water source heat pump systems Data from 2 & 4

Water Source Heat Pumps – HOW

	Advantages	Disadvantages	Example
a) Open Loop 	<ul style="list-style-type: none"> Heat yield and COP is high Usually a straight forward install within the water body as minimal pipework is required Flexible – abstraction rates can be altered to meet demand Best suited to projects with large heat demand 	<ul style="list-style-type: none"> Intermediate heat exchanger required to protect heat pump from contamination – a gasketed plate heat exchanger allows regular servicing Corrosion protection measures may also be needed, especially for seawater systems Requires abstraction license, discharge permit, and sometimes mineral rights for minewater 	Plas Newydd House, Anglesey⁵ <ul style="list-style-type: none"> 300kW system Extracting water and heat from the Menai Strait Running with a COP of 3.0 – 3.2 (good considering the low average sea temperatures of North Wales) Provides enough heat for 96% of the year
b) Closed Loop 	<ul style="list-style-type: none"> No water is abstracted, so issues relating to water chemistry and contamination are avoided Low maintenance Less stringent regulations for permissions Best suited to projects with small heat demand 	<ul style="list-style-type: none"> Heat yield and COP are lower More complex install within water body – Pipework and heat exchanger must be submerged Submerged heat exchanger and pipework may still need to be cleaned regularly to stop efficiency dropping 	Kensa heat pump factory, Truro <ul style="list-style-type: none"> 24kW system Heat exchanger pipes submerged in flooded mine shaft Mine water ~16°C Running with a COP of 4.5 – 5.5 Saving 8.9 tCO2/year compared to gas

1. Cornwall Beaches. (2019) Current sea temperature in Cornwall. Available at: <https://www.cornwall-beaches.co.uk/sea-temperature>

2. EGS Energy Ltd. (2018) Heat resource potential from abandoned metal mines in Cornwall

3. Sarbu, I. & Sebarchievici, C. (2016) Using Ground-Source Heat Pump Systems for Heating/Cooling of Buildings

4. BuroHappold (2016) Cornwall Strategic Heat Opportunities Study

5. Kimpton Ltd (2020) Marine Source Heat Pump at Plas Newydd Revisit. Available at: <https://www.kimpton.co.uk/marine-source-heat-pump-plas-newydd/>