Oxford Energy Network

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Dr. Matthew Trewhella

Ground Source Heat Pump Innovation

CONTENTS

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Matthew Trewhella

BSc Astrophysics – 1993 – Cardiff

PhD Astrophysics – 1996 - Cardiff

Postdoc - JPL/Caltech

NASA funded studying dust in spiral galaxies

2000-2013 – Independent Energy.

Solar thermal, Solar PV, Wind, Biomass, ASHPs, GSHPs, UFH, controls, system integration

2013 – present. The Kensa Group - GSHPs

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INTRODUCING KENSA

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Kensa Heat Pumps
A KENSA GROUP COMPANY
Kensa Contracting
A KENSA GROUP COMPANY
Kensa Utilities
A KENSA GROUP COMPANY

THE KENSA GROUP

- UK market leader
- Established 1999
- UK's only GSHP manufacturer near Truro in Cornwall
- Specialist GSHP Nationwide Installation Contractor
- Industry accredited
- 10,000+ Kensa GSHPs in use
- Multi award winning

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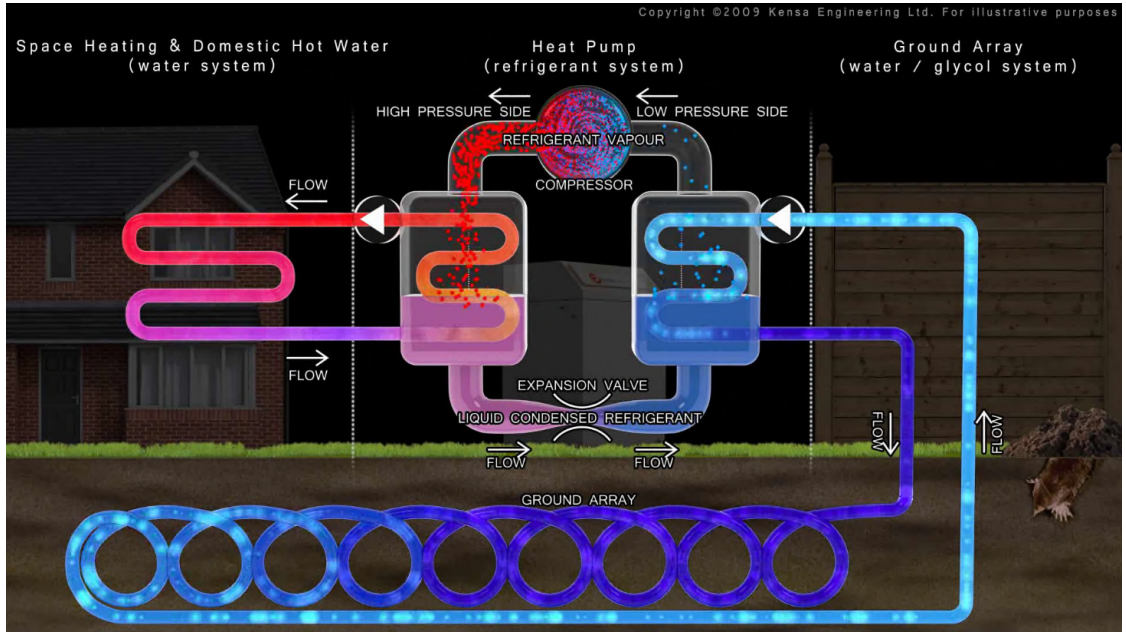
HOW A GSHP WORKS

The basics:

- Non combustion heating system
- Produces more heat energy than electricity consumed
- Ground provides a highly efficient source of heat
- Unaffected by air temperature
- Recharged by solar energy and rainfall
- Ground type (thermal conductivity) needs to be factored into sizing calculations
- Correct sizing is important to avoid over extract



https://www.kensaheatpumps.com/how-a-ground-source-heat-pump-works/

TYPICAL METHOD

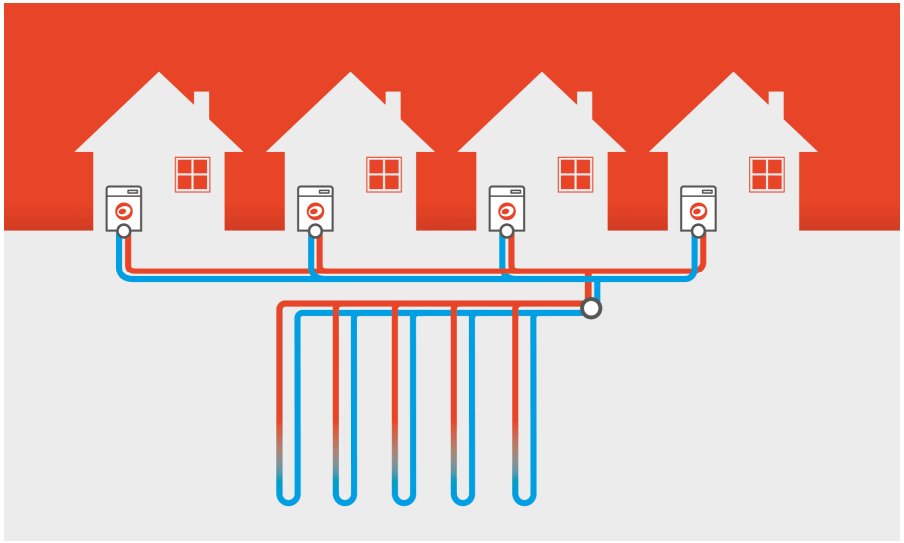
- One property
- One heat pump
- One ground array
- Suited to self build
- Often off gas grid
- Rural or semi-rural properties with gardens

SHARED GROUND LOOP ARRAYS

Shared ground loop arrays are a form of ultra-low temperature heat network connecting Kensa ground source heat pumps inside individual dwellings.

A different approach:

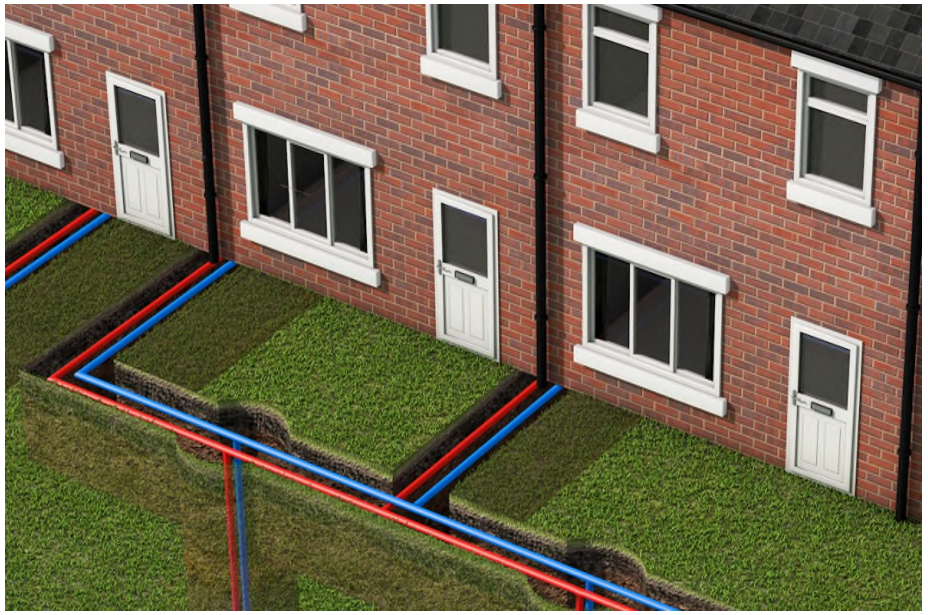
- Link as few as two properties
- Infinitely scalable for large developments
- Suitable for single and multiple occupancy dwellings
- Communal ground array pipework
- Individual heat pump in each dwelling
- Mimics a traditional gas framework



https://www.kensaheatpumps.com/the-technology/heat-sources-collectors/shared-ground-loop-arrays/

SGLA BENEFITS

- Scalable and flexible solution
- Ambient temperature distribution
- No district heat losses and no overheating
- Potential for free summer cooling
- Individual heat pump in each dwelling
- Powered from occupants own electricity supply
- Householders able to switch energy suppliers
- Lowest running costs
- Independent billing and independent heat
- Split ownership permitted
- Ground arrays 100> year lifetime
- Planning exempt



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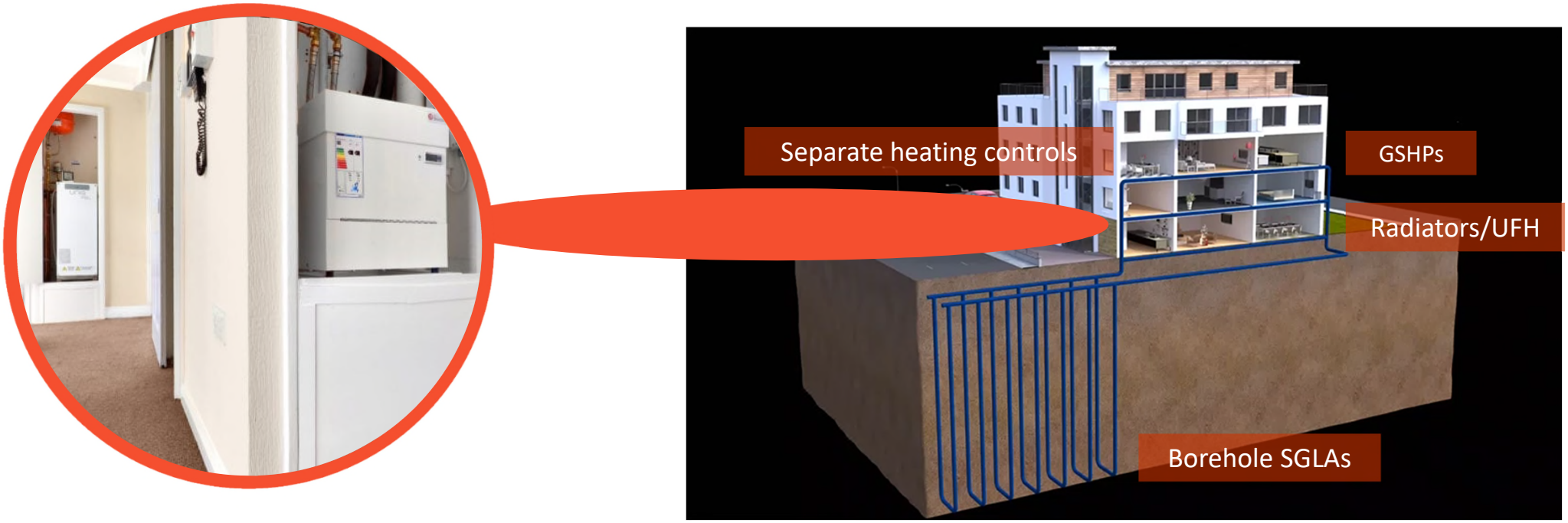
HOW IT WORKS

SGLAs

An individual Kensa heat pump inside each dwelling provides independently controllable heat and hot water for each property.



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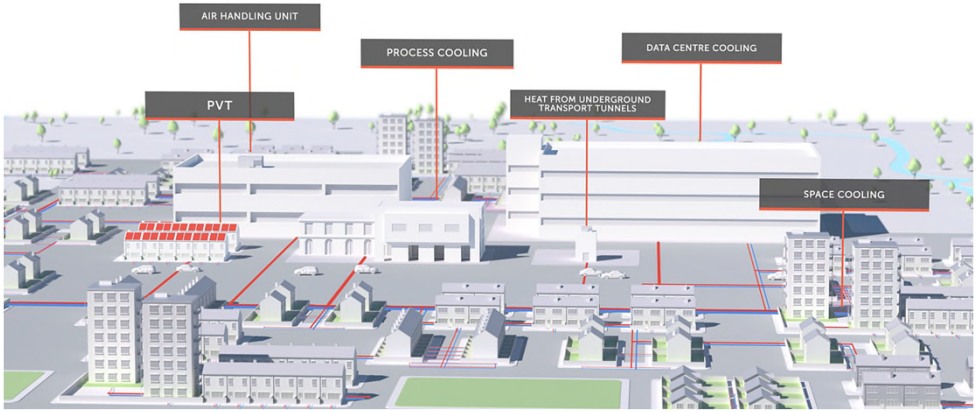
NETWORKED HEAT PUMPS

- Network of pipework delivering low grade heat energy at 0-20^{o}C
- Individual Heat Pump in every property
- Temperature upgraded inside the thermal envelope
- Heat Pump size and temperature tailored for each building
- Heat pumps can also provide cooling and deliver waste heat back into the network
- Multiple Sources of Energy complementing the ground and boosting input temperatures
- COP can reach 5 or 6 without changing the heat pump



Systems Vision Animation

Green Street

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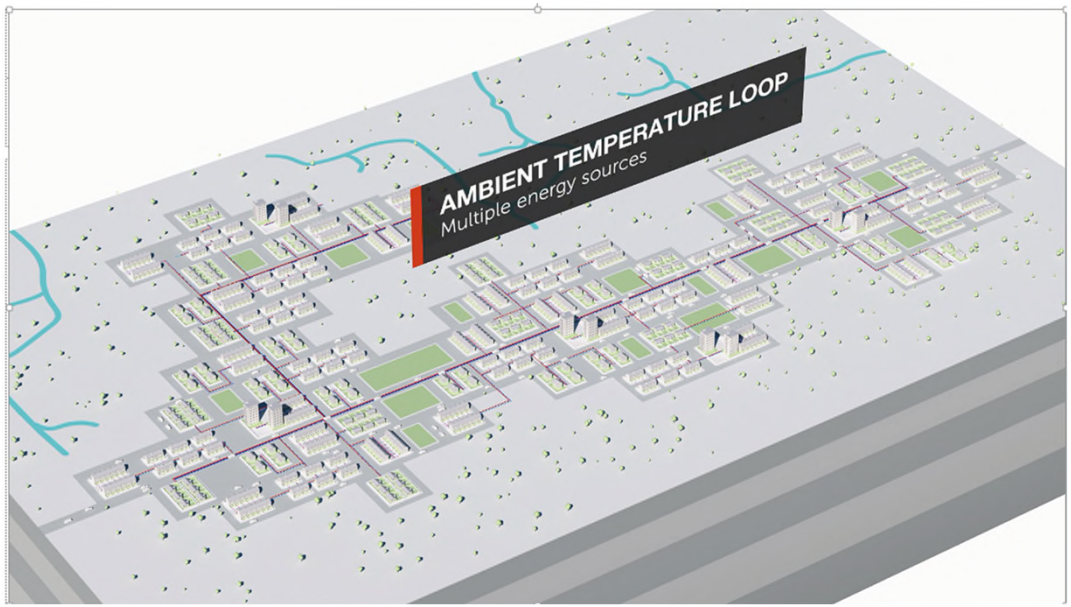
SPLIT OWNERSHIP

- Infrastructure in the street is deployed as a utility style investment
- Householders connect over time with
- Consumer choice of heat pump brand, installer and electricity supplier
- Triggers include green motivation or boiler breakdown
- Incentives can include grant, stamp duty, council tax, green mortgages, future gas disconnection date
- Householders pay a “standing charge” for access to the utility infrastructure



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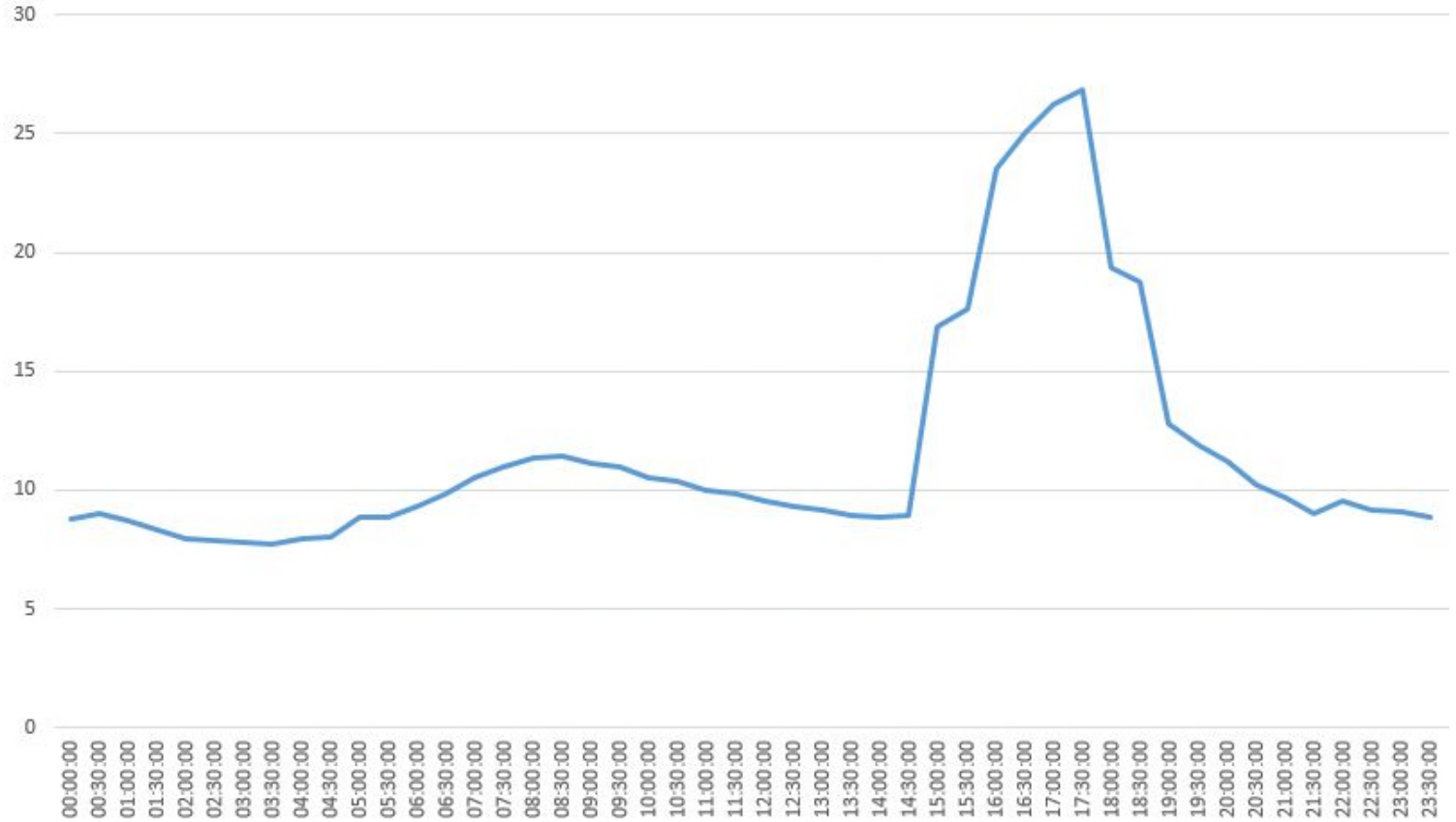
ENERGY SUPERHUB OXFORD (ESO)

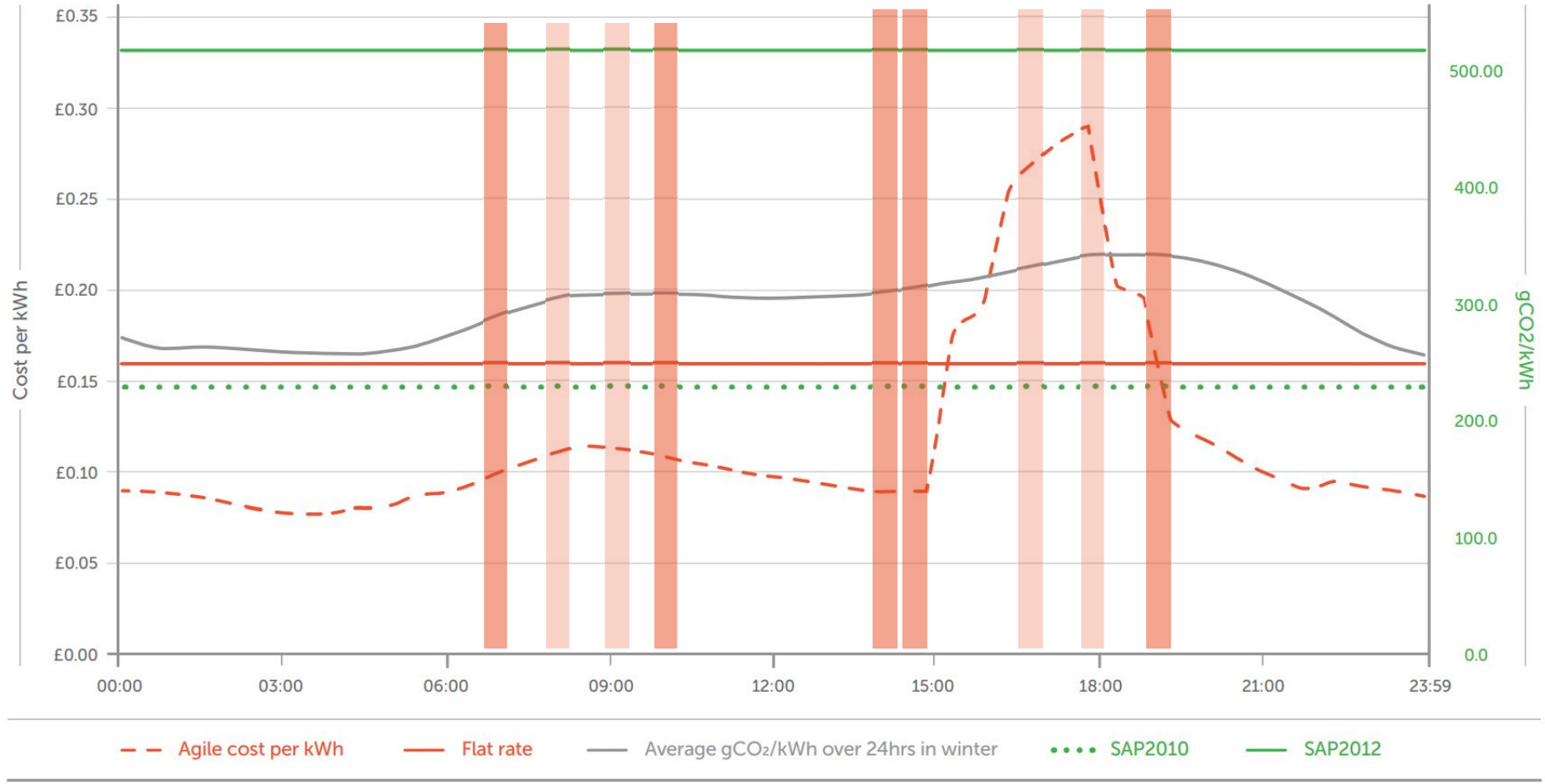
SITE DETAILS

- Part of a larger demonstration project addressing grid balancing, transport and heat in the Oxford area
- Heat site is located on the Blackbird Leys estate in South East Oxford
- 60 properties owned by Stonewater Housing Association
- Shared Ground Array system using boreholes
- Smart Controls – internet connected wall thermostat
- Operation of heat pumps timed to synchronise with times of high electrical availability

Average price by half-hour segment. Octopus Agile Tariff - 23/5/2017 – 23/5/2018



THE VARIABLE PRICE OF ELECTRICITY



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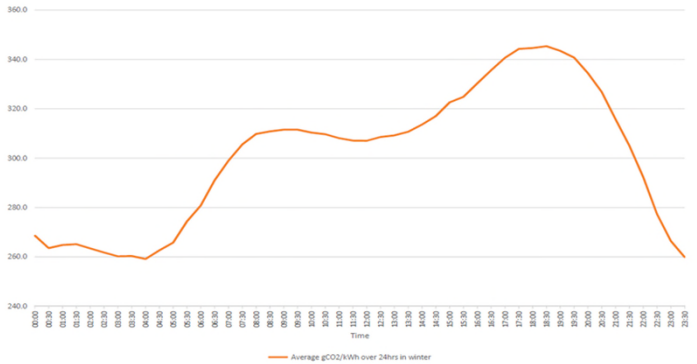
SMART CONTROLS

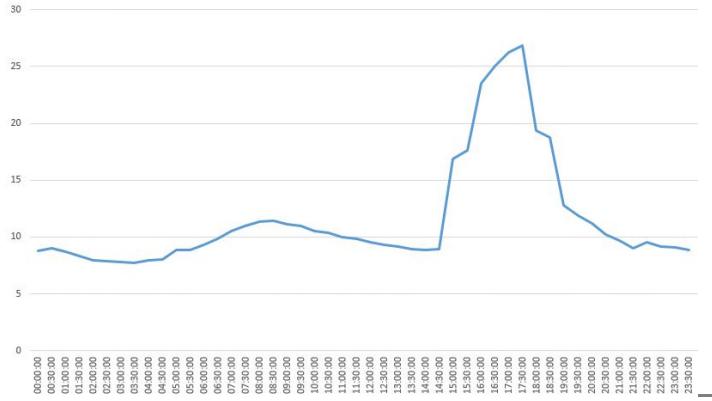
LOAD SHIFTING

- Operation of the heat pump focussed on periods of low carbon electricity generation (i.e. through the night or when the wind is blowing)
- The ground is a very stable temperature heat source allowing you to run the heat pump at the same efficiency any time of day or night
- Thermal mass of property can shift 2-3 hours worth of heat by 2-3 hours
- Savings can be 25-40% and make heat pumps cheaper than mains gas
- Combined local energy storage local can shift 2-3 hours worth of heat by 12-18 hours to maximise carbon savings
- Smart operation will reduce investment required in electricity generation and distribution

Average carbon intensity by half hour (1/11/2017 – 31/3/2018)



Average price by half-hour segment (23/5/2017 – 23/5/2018)



Questions??

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Accreditations

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