



# To Decarbonise UK Heating

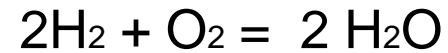
we must stop burning things

Edward Thompson

Director, ICAX Ltd

Vice Chair, Ground Source Heat Pump Association

Burning hydrogen in pure oxygen:



Burning hydrogen in air:

yields six times more NO<sub>2</sub> as burning “natural” gas in air.

Heat pumps can be used to heat any building:

Big or Small

Old or New

On Grid or Off Grid

Well-insulated or poorly-insulated

A High temperature heat pump is the **emerging technology**  
which allows us to **decarbonise old buildings stock**.

This is true for older buildings  
and for older heat networks.

- Available in units from 300KW to 2MW
- Available in ground, air, marine, and open source versions
- Temperature output up to 80°C
- Allows retrofit without changing heat distribution system in existing building
- Built in UK



A Swede is 35 times more likely to buy a heat pump than a Brit

*Not* because Swedes are greener than Brits

but because heat pumps are the cheapest way to heat houses in Sweden

And burning gas is the cheapest way to heat a house in the UK

Largely because of the UK tax regime.

# Decarbonising UK Heating

Westminster Forum

Edward Thompson

ICAX Ltd

[www.icax.co.uk/Fifth\\_Generation\\_District\\_Heating\\_Networks.html](http://www.icax.co.uk/Fifth_Generation_District_Heating_Networks.html)

## **A Fifth Generation Heat Network employs**

- an ambient temperature distribution loop
- a heat pump in each building to transfer heat into the building (or out of it)
- Demand Side Response to avoid peak loads on the Grid (and earn income)
- thermal energy storage to exploit heat pumps and Demand Side Response

## **A Fifth Generation Heat Network does *not* employ combustion**

- and therefore issues no on-site CO<sub>2</sub>
- and no on-site NO<sub>2</sub>
- and no particulates

## **A Fifth Generation Heat Network offers**

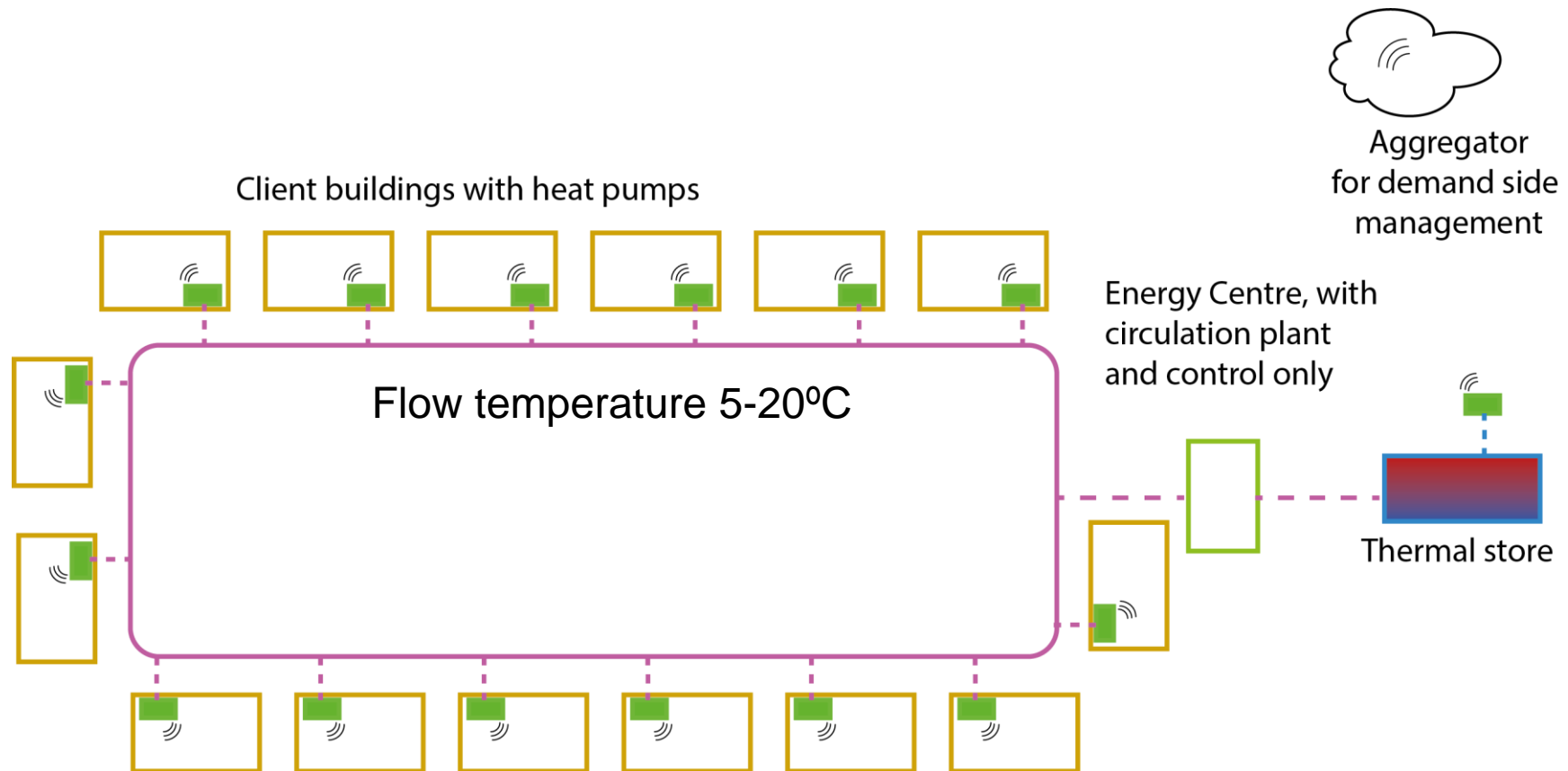
- radically cheaper installation cost
  - ability to recycle heat between buildings
  - the flexibility to expand or contract without major cost implications
  - ability to use waste heat at any temperature above 25°C
  - lower maintenance cost than combustion boilers
- ..... and, on top, the Heat Network Investment Project can help fund investment.



# 5G district heating loop with heat pumps

## Balanced Energy Network

- provides the lowest possible carbon emissions
- allows heat sharing between customers, increasing energy efficiency
- single circuit provides heating and cooling simultaneously



## Balanced Energy Network

- Ambient temperature network allows polymer pipework with limited insulation
- Radically cheaper than installing heavily insulated (often steel) pipework
- From 4th generation steel pipes to 5<sup>th</sup> generation polymer



# BEN district heating network

## Balanced Energy Network

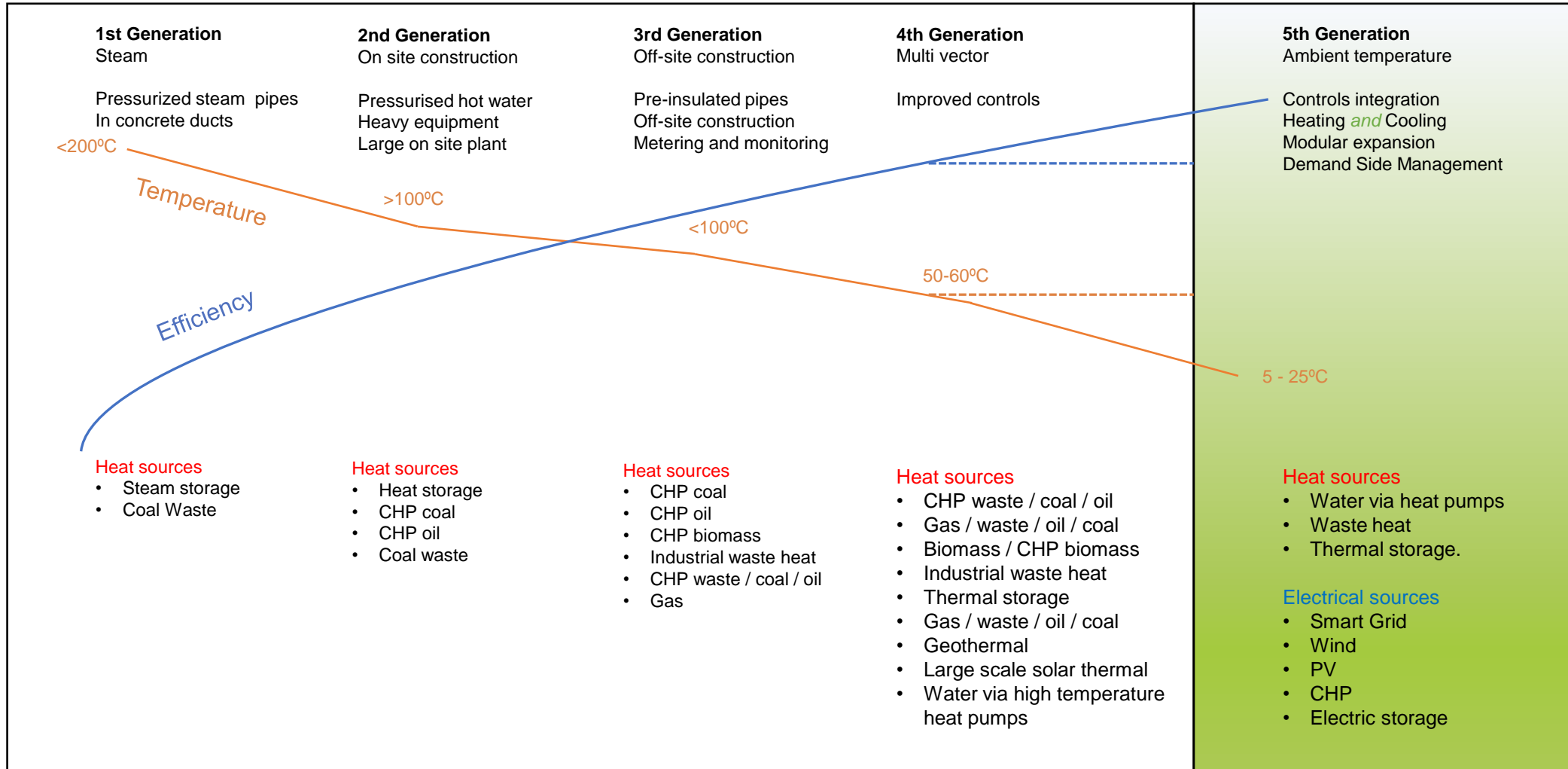
- No combustion involved
- No CO<sub>2</sub> emissions
- No NO<sub>2</sub>, SO<sub>2</sub>, no particulate emissions



# Fifth Generation Heat Network



trends to lower heat distribution temperatures and higher efficiency



1880 →  
<200°C

1930 →  
>100°C

1980 →  
<100°C

2010 →  
50-60°C

2017 →  
5 - 25°C

Heat network trends to lower distribution temperatures and higher efficiency

Pollution:

*“A child born in London in 2010 will lose two years of life expectancy because of air pollution”*

[https://www.london.gov.uk/sites/default/files/shorthand/cleaner\\_vehicles/](https://www.london.gov.uk/sites/default/files/shorthand/cleaner_vehicles/)

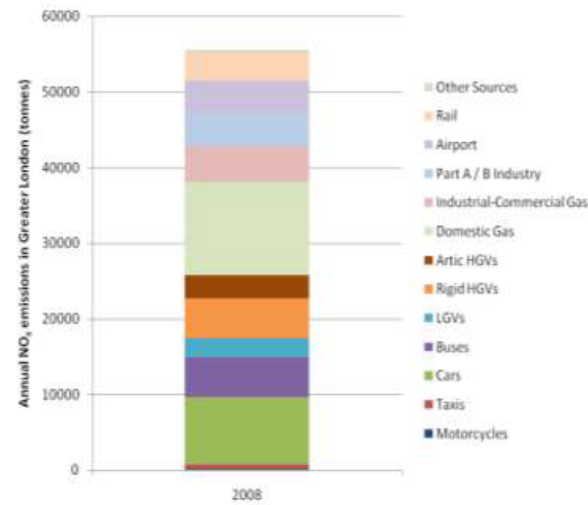
Contribution of Gas boilers:

*“The direct sources (as opposed to external sources produced outside of London) of NOx in Greater London in 2008 are presented in image 2 below. This shows that road transport contributed 46% and gas boilers 22% of the total NOx emissions.”*

Air Quality in the City of London

*“The Mayor’s Energy for Londoners programme will support the transition from old inefficient gas boilers to ultra low NOx gas boilers and low carbon (and low-pollution) heating alternatives, such as heat pumps. This will help make London’s air cleaner.”*

London Environment Strategy



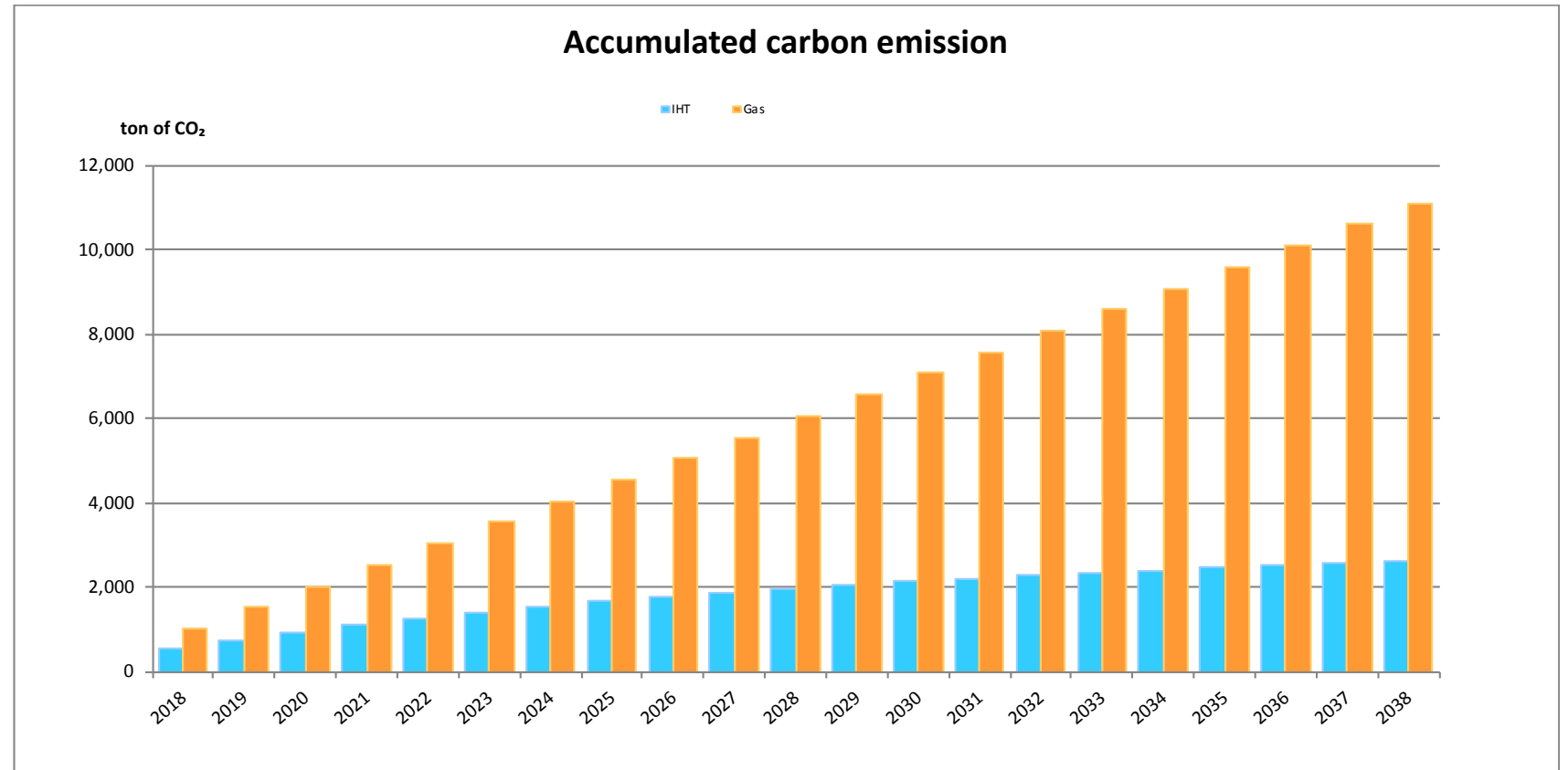
MAYOR OF LONDON

LONDON LOCAL AIR QUALITY MANAGEMENT (LLAQM)  
Policy Guidance 2016 (LLAQM.PG (16))

## AIR QUALITY IN CITY OF LONDON: A GUIDE FOR PUBLIC HEALTH PROFESSIONALS

MAYOR OF LONDON

- 77% carbon emissions reduction compared with a gas boiler over 20 years
- No NOx emissions



# Fifth Generation Heat Networks

Westminster Forum

Edward Thompson

ICAX Ltd

[www.icax.co.uk/Fifth\\_Generation\\_District\\_Heating\\_Networks.html](http://www.icax.co.uk/Fifth_Generation_District_Heating_Networks.html)