HEAT AND THE CITY

Heat Networks: Planning for a Zero-Carbon World

UK Local Authority District Energy Vanguards Network

Bristol, 19 November 2019

VATTENFALL

FVB natural power switch2

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Paul Barker

Bristol City Council

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ENERGY SERVICE BRISTOL

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Heat Networks in Bristol – Update

Paul Barker
Energy Infrastructure – Programme Manager


Climate
Emergency

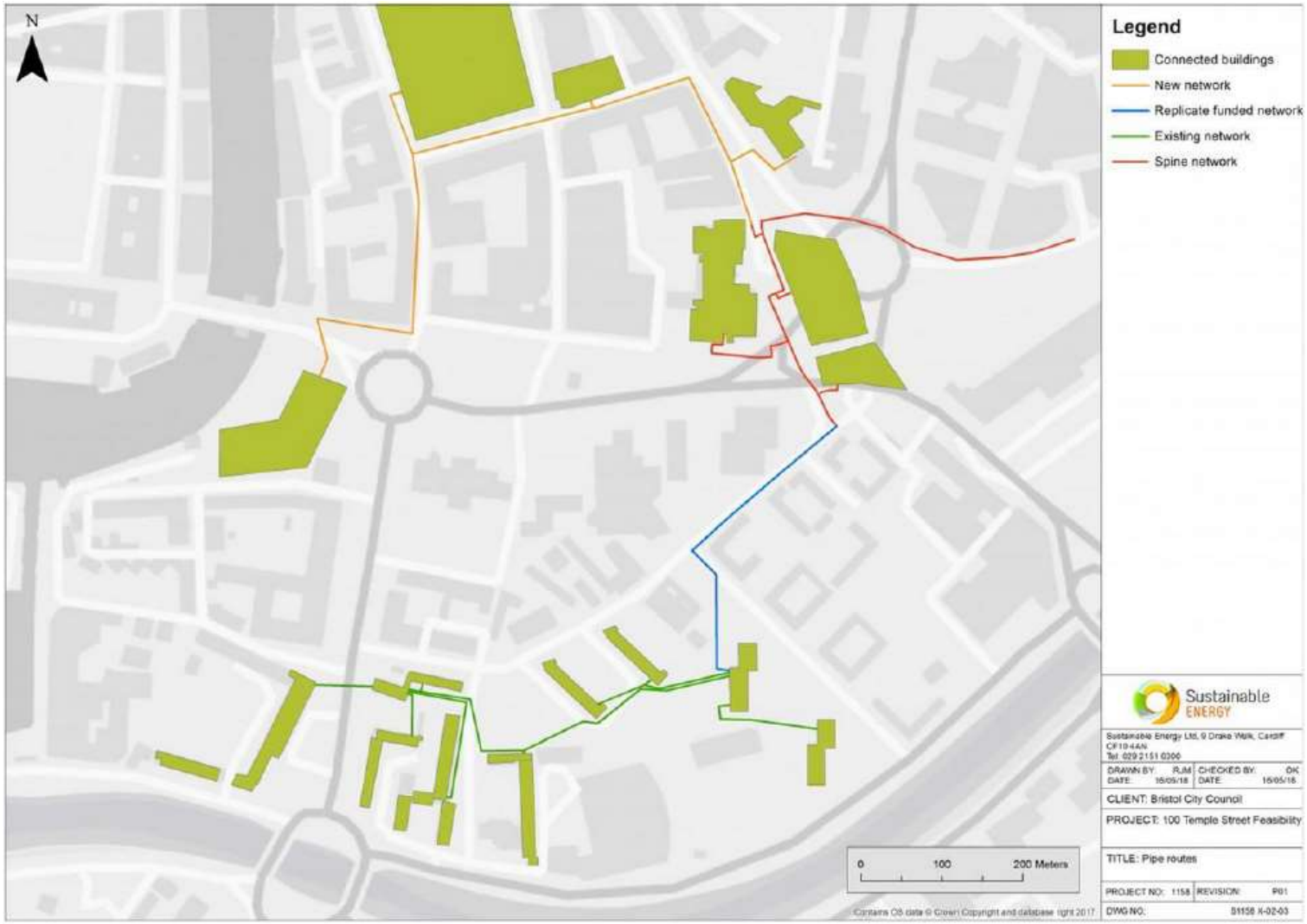
A New Climate Strategy

- New goal is for Bristol be to be carbon neutral by 2030, as a whole city
- And that Bristol will become climate resilient to deal with the impacts of climate change – flooding, heatwaves etc.
- Being led by the City Office and involving all the boards – economy, homes, transport
- Adoption in Feb. 2020
- This will inform new policy in all areas

What it means for heat decarbonisation

- End of gas in Bristol by 2030
- Heat networks supplying thousands of buildings in Bristol
  - Heat pump led (large)
  - Gas CHP an interim solution only
- Thousands of individual heat pumps supplying remaining buildings

Redcliffe Heat Network



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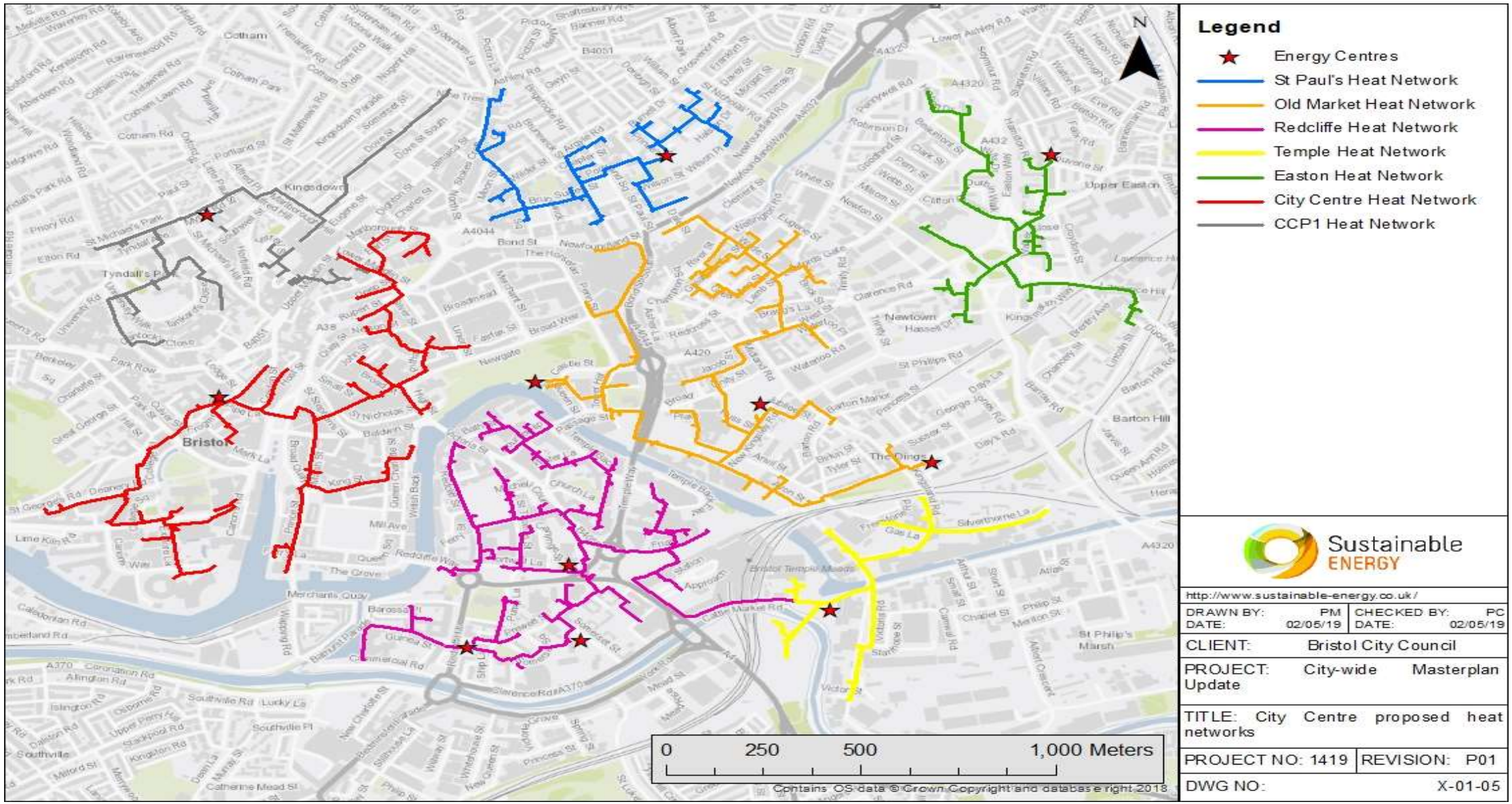
Redcliffe Phase 1 – Operating since 2016

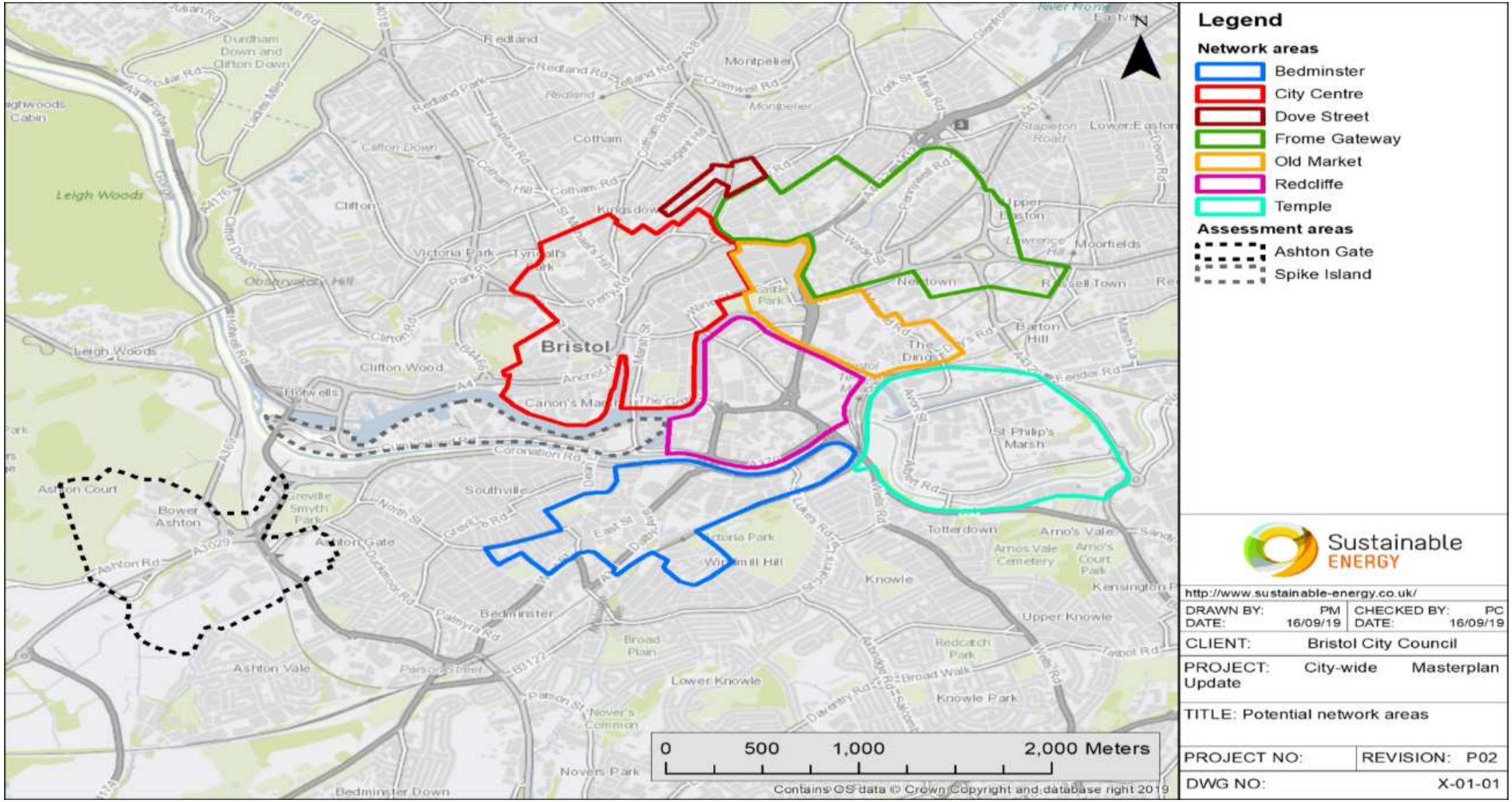
Redcliffe Phase 2 – in construction

Temple Gate

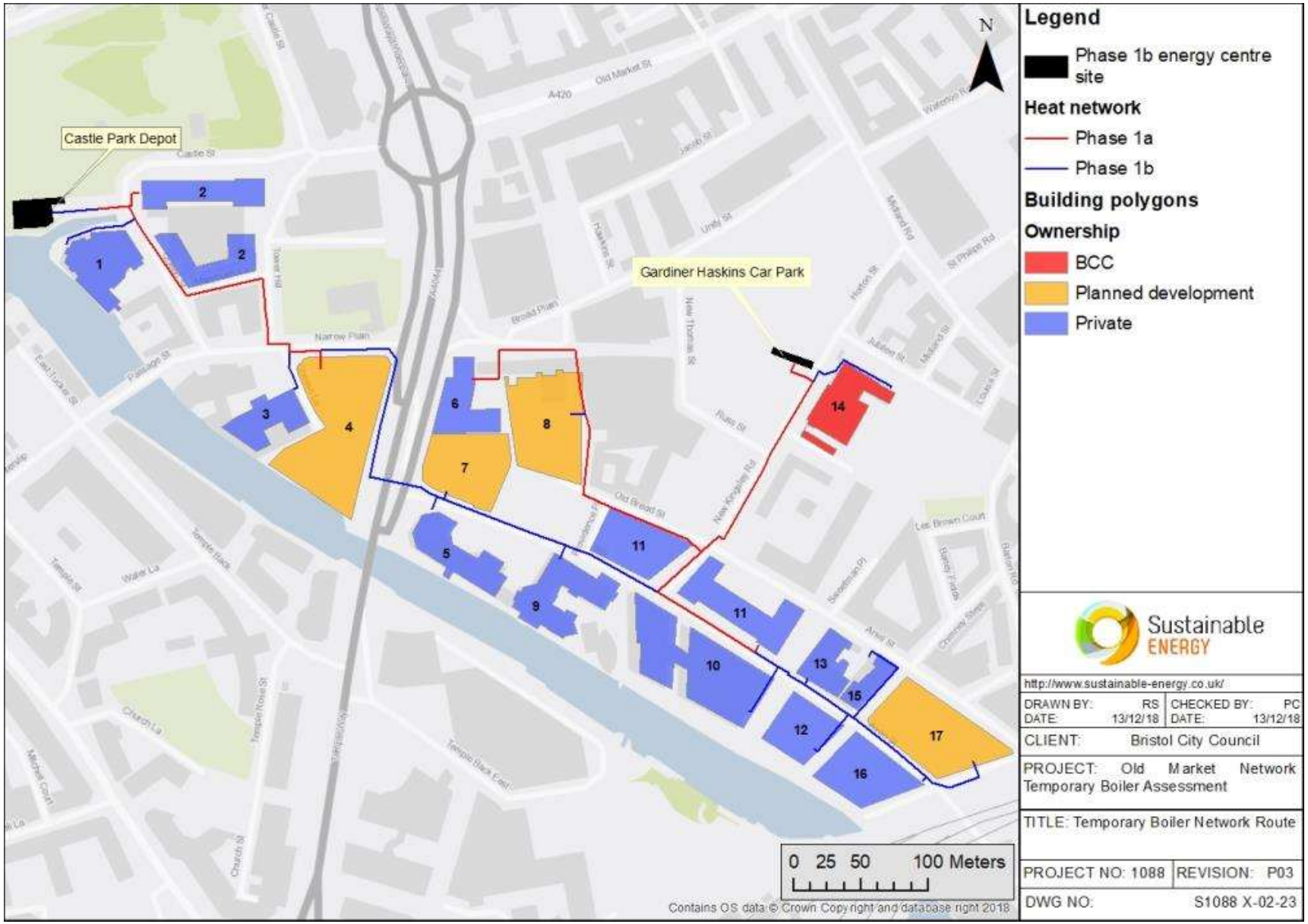
City centre heat networks



2019 City Centre networks



Old Market Heat Network



Castle Park View & Energy Centre

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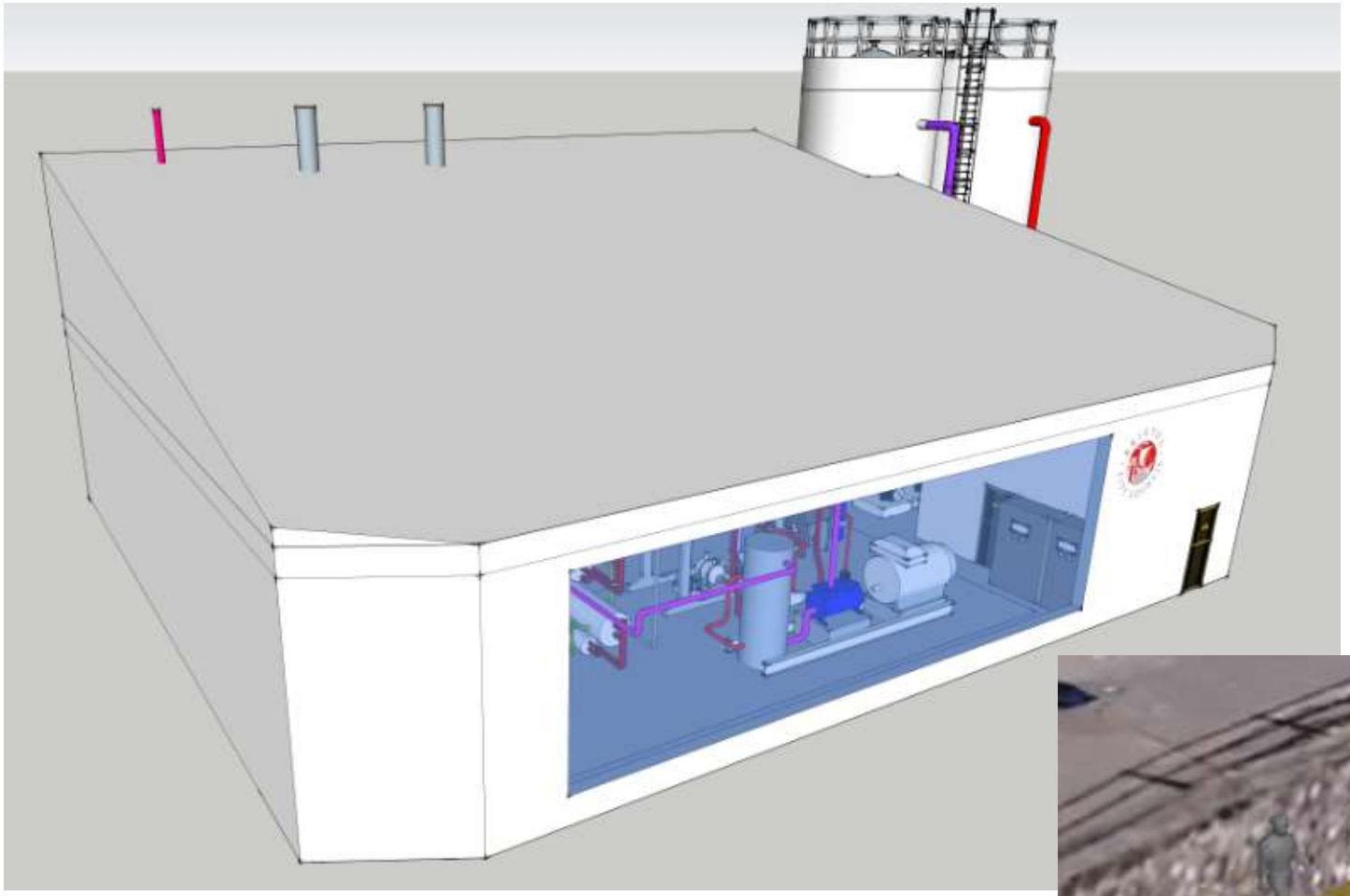
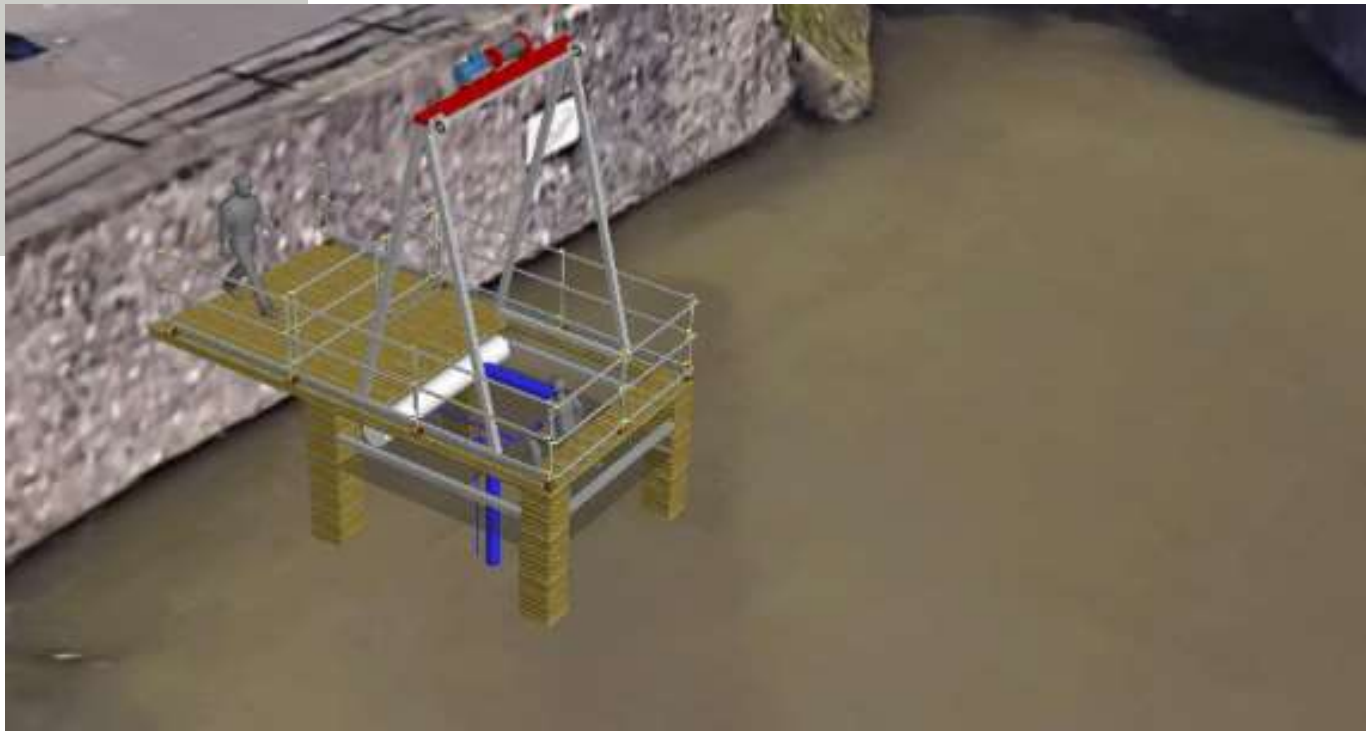




Heat exchange plant

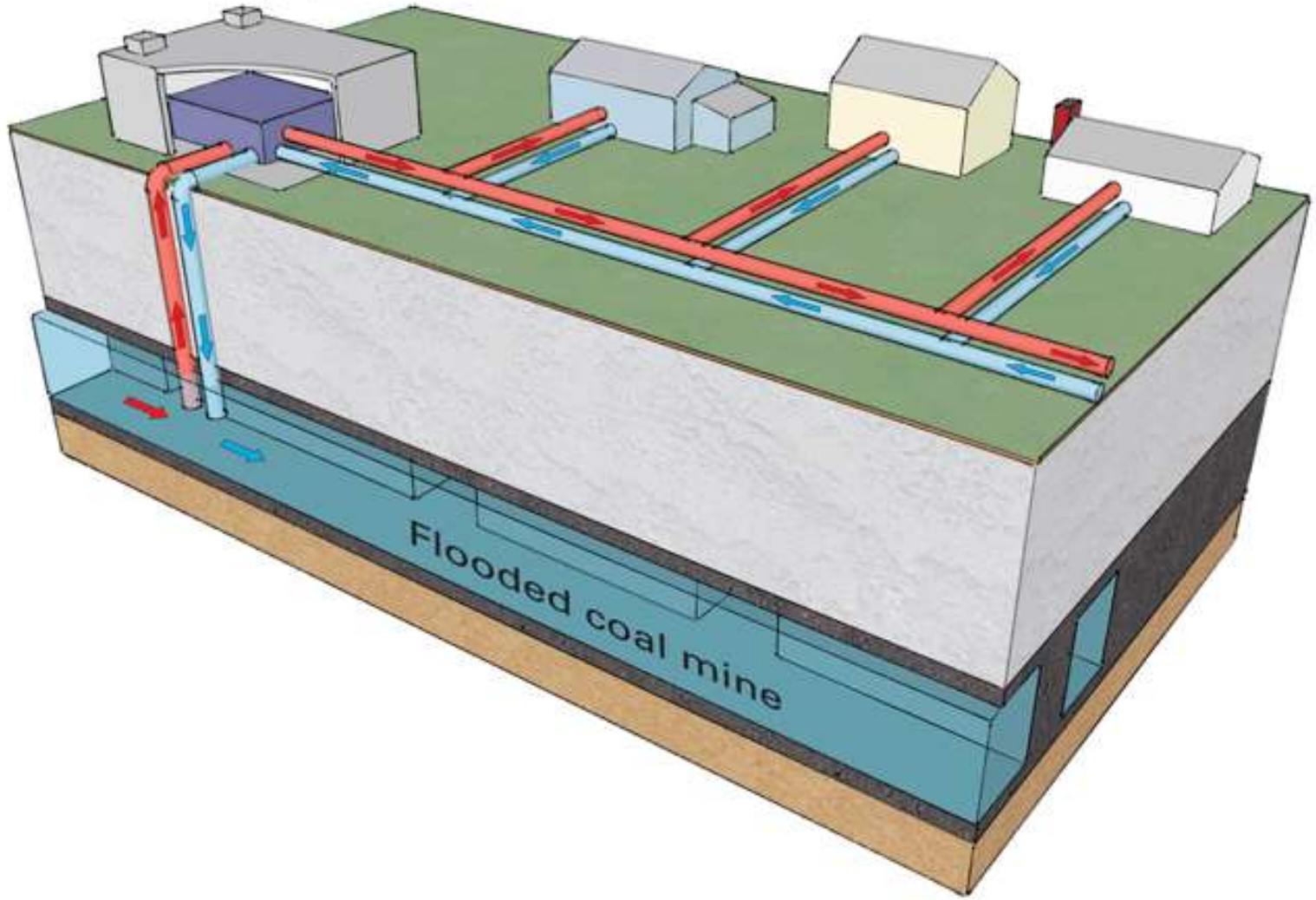
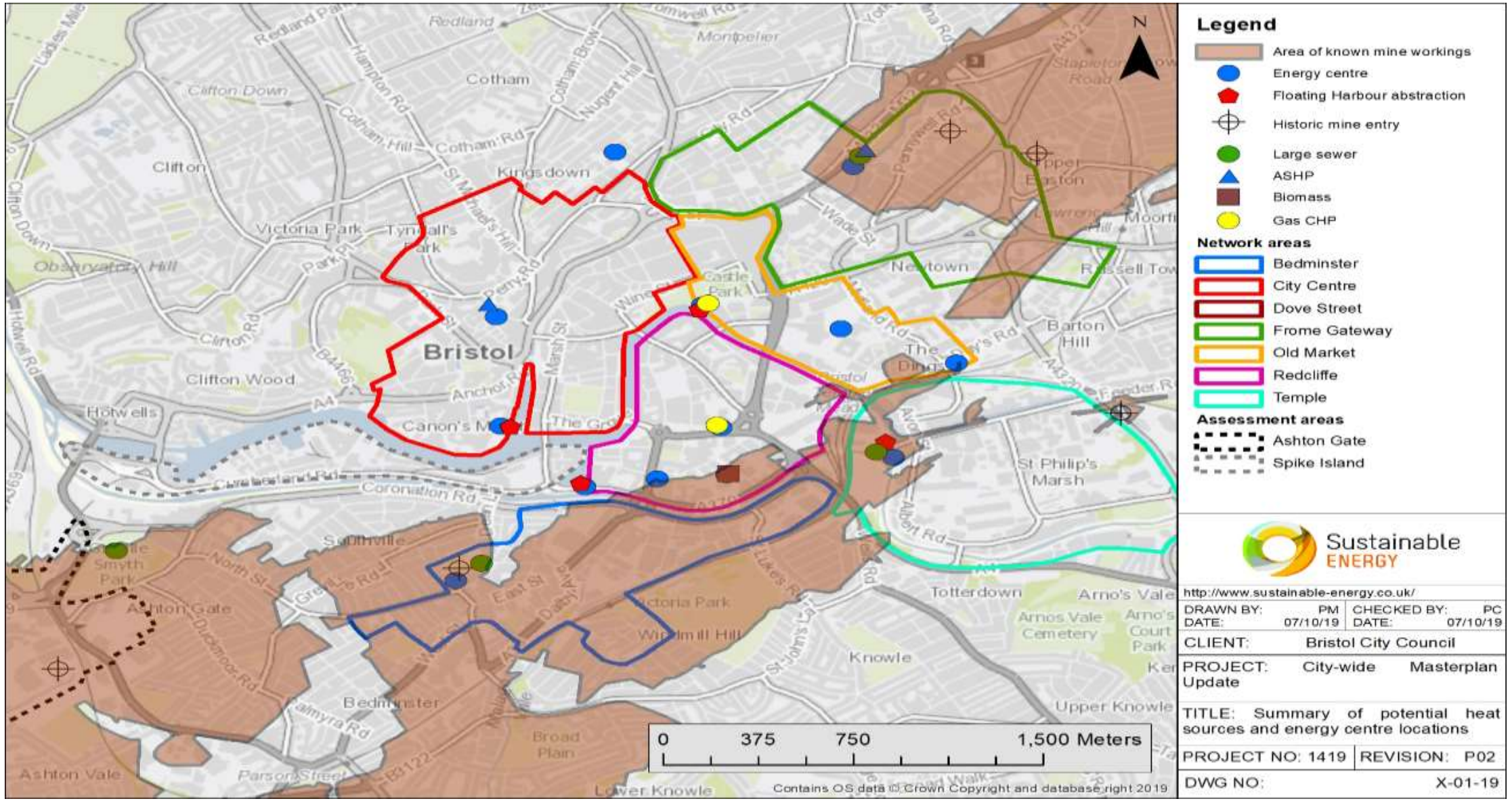
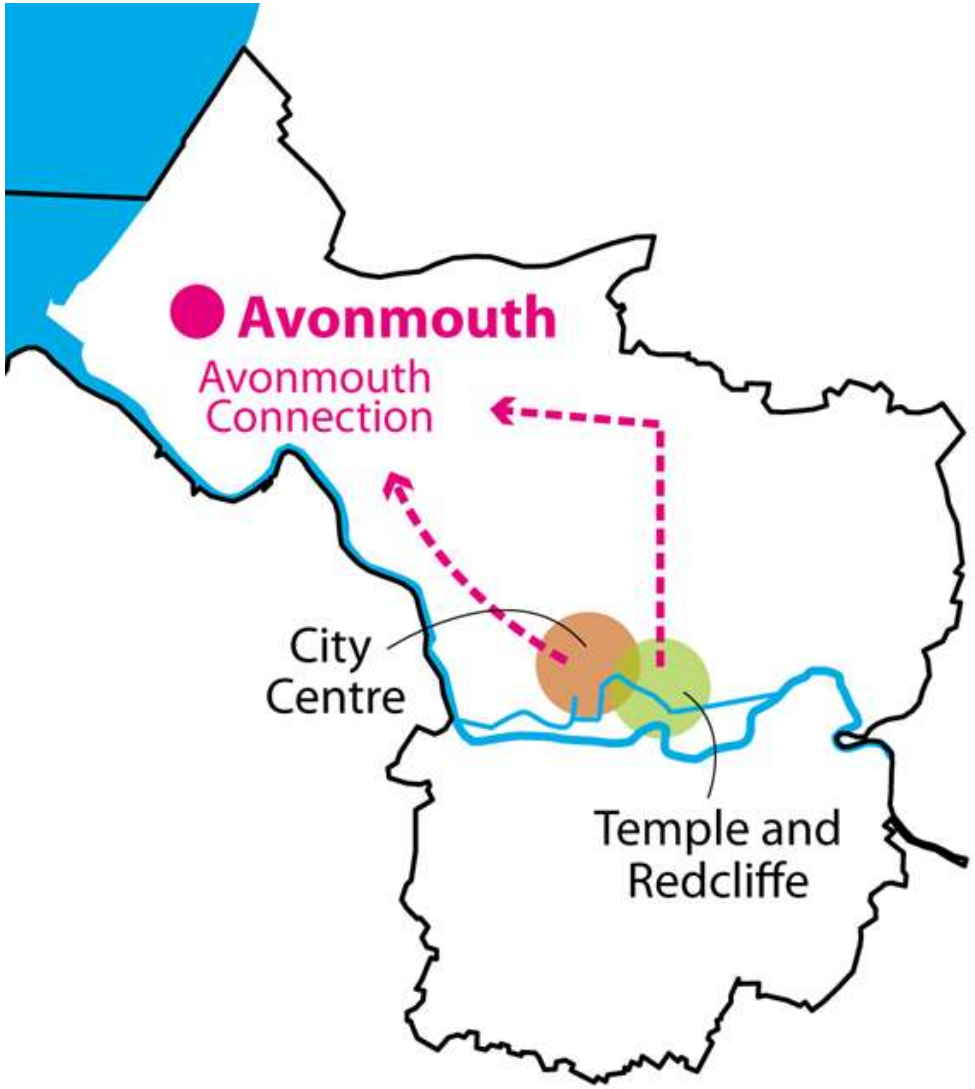


Diagram illustrating the use of water from a flooded coal mine to heat and cool a district. The heat pump cycle uses refrigerant to extract heat from the mine water, which then goes to the exchange plant that provides heat to the buildings. The process can be reversed to provide cooling during warmer periods of the year.

Potential heat sources



Strategic Heat Main



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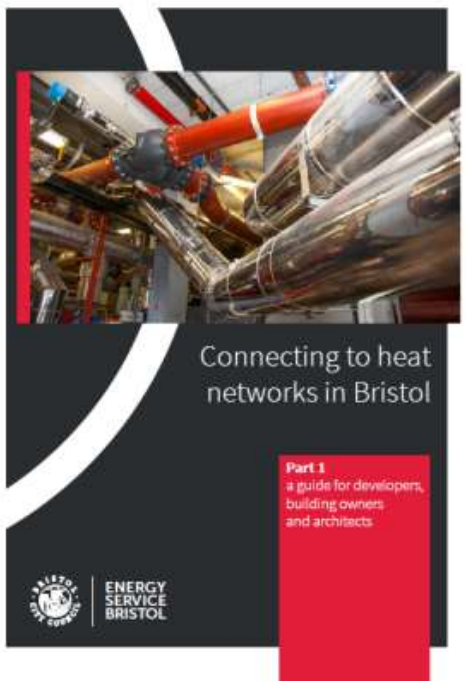
Connecting to heat networks in Bristol

Key documentation:

- BCC Carbon Factor
- Connection Pack Part 1
- Connection Pack Part 2
  - CIBSE Code of Practice
- Legal Documents
  - S106 agreement
  - Heads of Terms
  - Heat Connection Agreement
  - Supply Agreement



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Next steps and challenges

- City Leap - Securing a Joint Venture Partner
- Identify heat network and heat pump zoning
- Connect existing buildings (non LA buildings)
- Develop all zero carbon heat (mine workings, sewer heat, further water source heat pumps, EfW)
- Speed up delivery!

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Questions?

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HEAT AND THE CITY

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A decade of GB heat policy and thoughts on the future

Richard Lowes

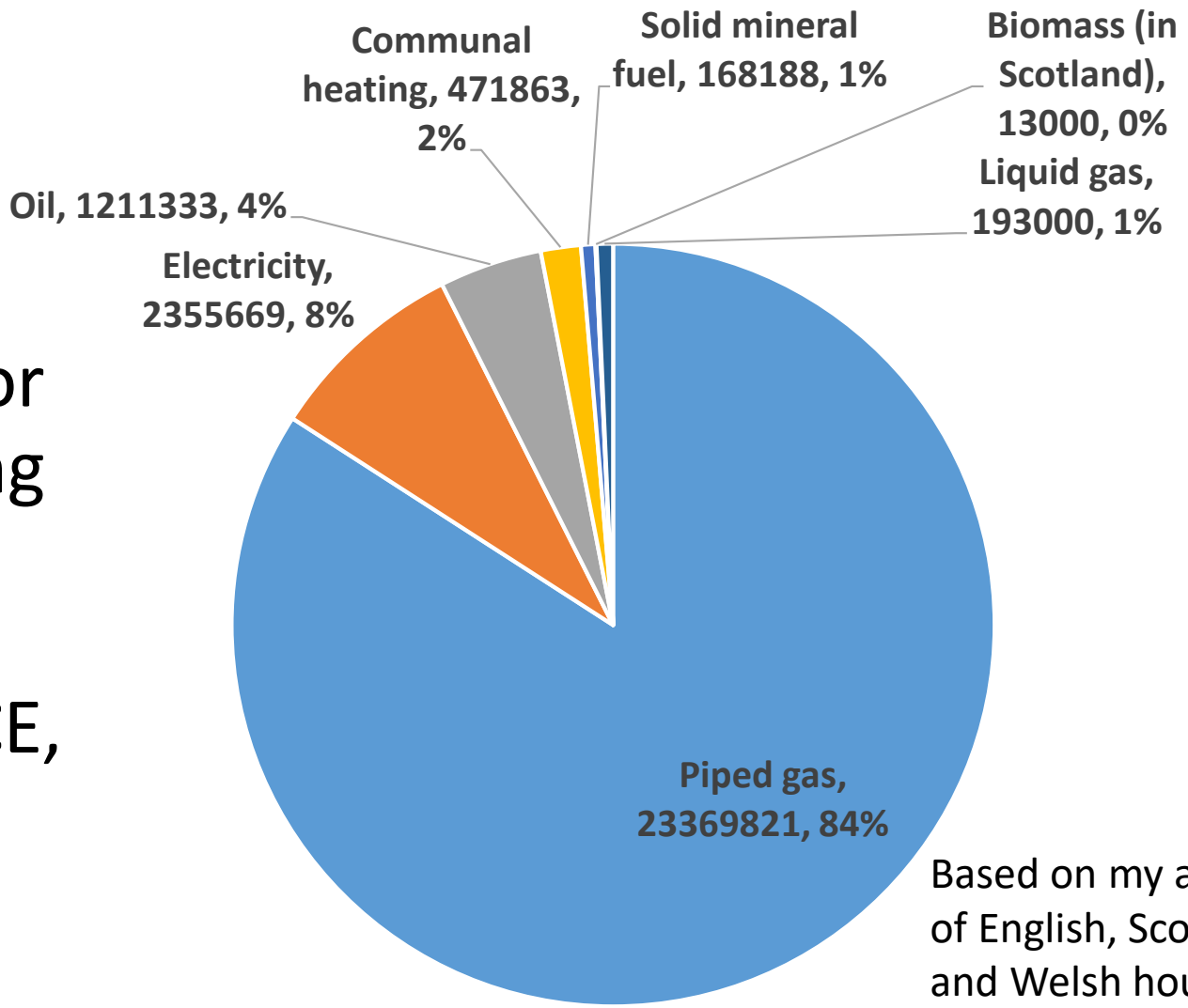
@heatpolicyrich

UNIVERSITY OF EXETER Energy Policy Group

UKERC

Current domestic UK primary space heating

- Geographical variation in terms of gas coverage
- Worth bearing in mind poor energy efficiency of housing stock and high levels of unaffordability relative to other similar countries (ACE, 2015)



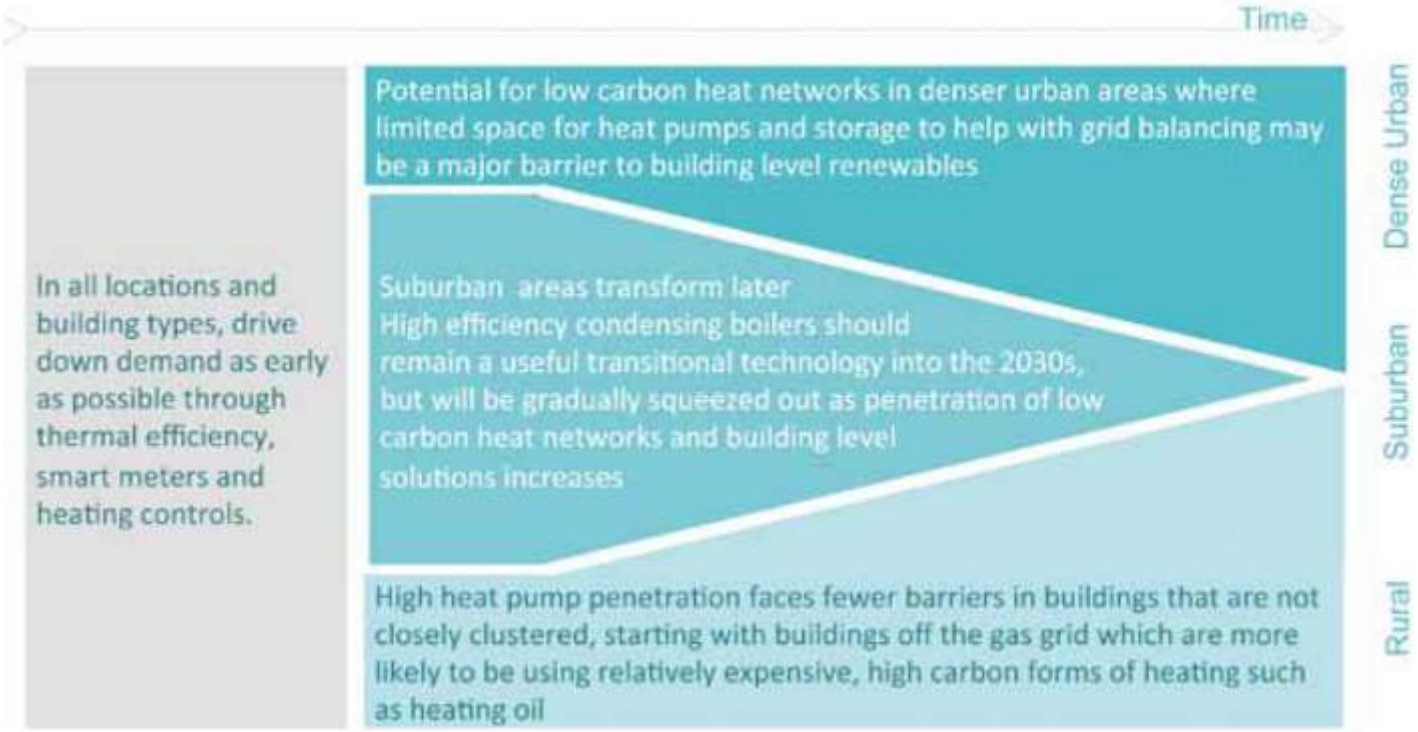
Based on my analysis of English, Scottish and Welsh housing survey data

Where do we need to get to for heat?

- Heat totally decarbonised by 2050 – this is now more explicit. It was implicit under the 80% reduction target;
- Replacement of all fossil fuel heating systems alongside major deployment of energy efficiency measures;
  - Possibly need for more rapid decarbonisation, particularly if equity issues are taken into account .

'11) Fossil fuels (including natural gas) have no substantial role in an EU 2°C energy system beyond 2035 The Paris 2°C and equity commitments, buttressed with the IPCC's carbon budgets, demand a minimum reduction in EU energy-only carbon emissions of around 95% by 2035.' (Anderson and Broderick, 2017)

What about the technologies?



'Strategic framework for heat in buildings' (DECC, 2012)

- Electrification (often using heat pumps) alongside energy efficiency and district heating has repeatedly been suggested to be the key route to decarbonised space and hot water heating (e.g. UKERC, 2009; DECC, 2010; Committee on Climate Change, 2010; DECC, 2012; Element Energy and AEA, 2012; DECC, 2013, Committee on Climate Change, 2019).
- Low carbon electricity (renewable and nuclear) used for heating.
- Bio-energy limited in availability and primarily used where high temperatures are needed.
- Few scalable options

Some recognition of the flexibility (peaking) value of gas was recognised in further analysis

Figure 7: Updated strategic framework for low carbon heat in buildings over time

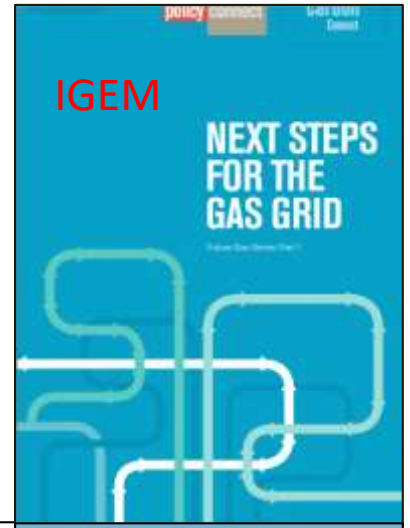
DECC, 2013

- The high GB heat peak linked to lots of gas and poor energy efficiency meant that some modelling suggested using a hybrid heat pump approach may be the most cost-effective option.
- This was alongside gas industry lobbying where the industry appears to have had some success over this change (Lowes, 2019).
- Interestingly, Strbac et al (2018), think this hybrid option may be the most cost effective approach.
- Fundamentally this remains to be mass electrification+

Incumbents are lobbying heavily around ‘green gas’ and hydrogen

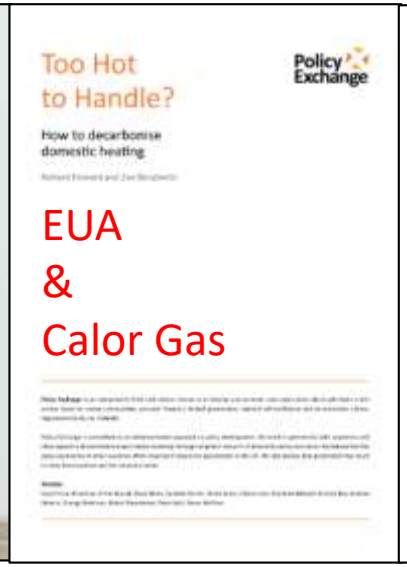
- Gas industry involved with lots of policy engagement on heat.
- Interviewees frequently mentioned political engagement and lobbying.
  - Linked to maintaining the gas system, decarbonising the gas grid
  - Clearly linked to gas networks and appliance manufacturers
  - The large incumbents have the capital to fund this work
    - New entrants struggle
  - Number of policy relevant reports funded by gas industry which promote and ongoing role for gas:

(Lowes et al., 2018)

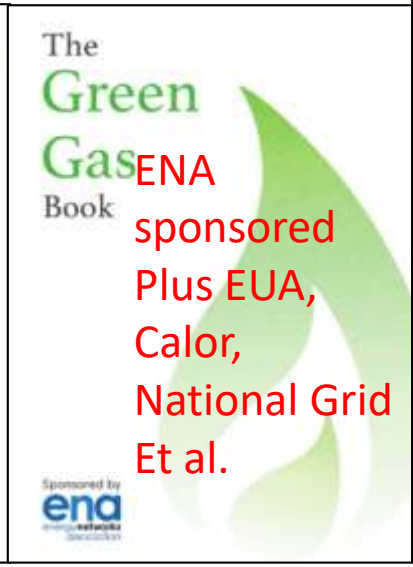


IGEM

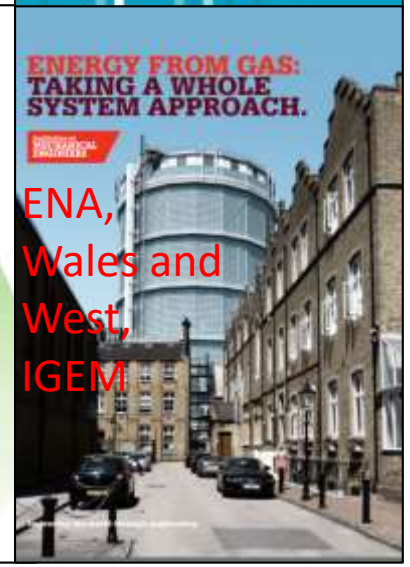
ENA Gas Futures Group



EUA & Calor Gas

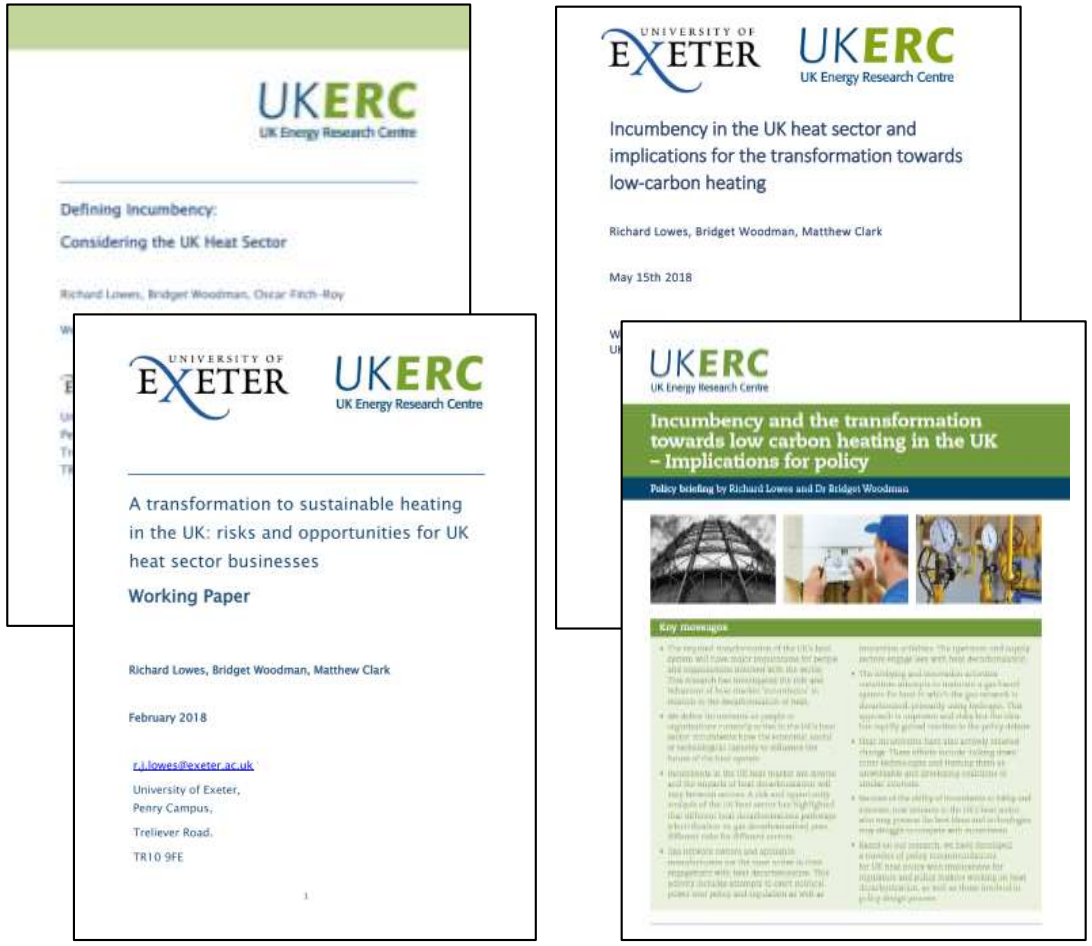


ENA sponsored Plus EUA, Calor, National Grid Et al.



ENA, Wales and West, IGEM

Incumbency impacts



Full project detail is contained in these papers which are hyperlinked (click)

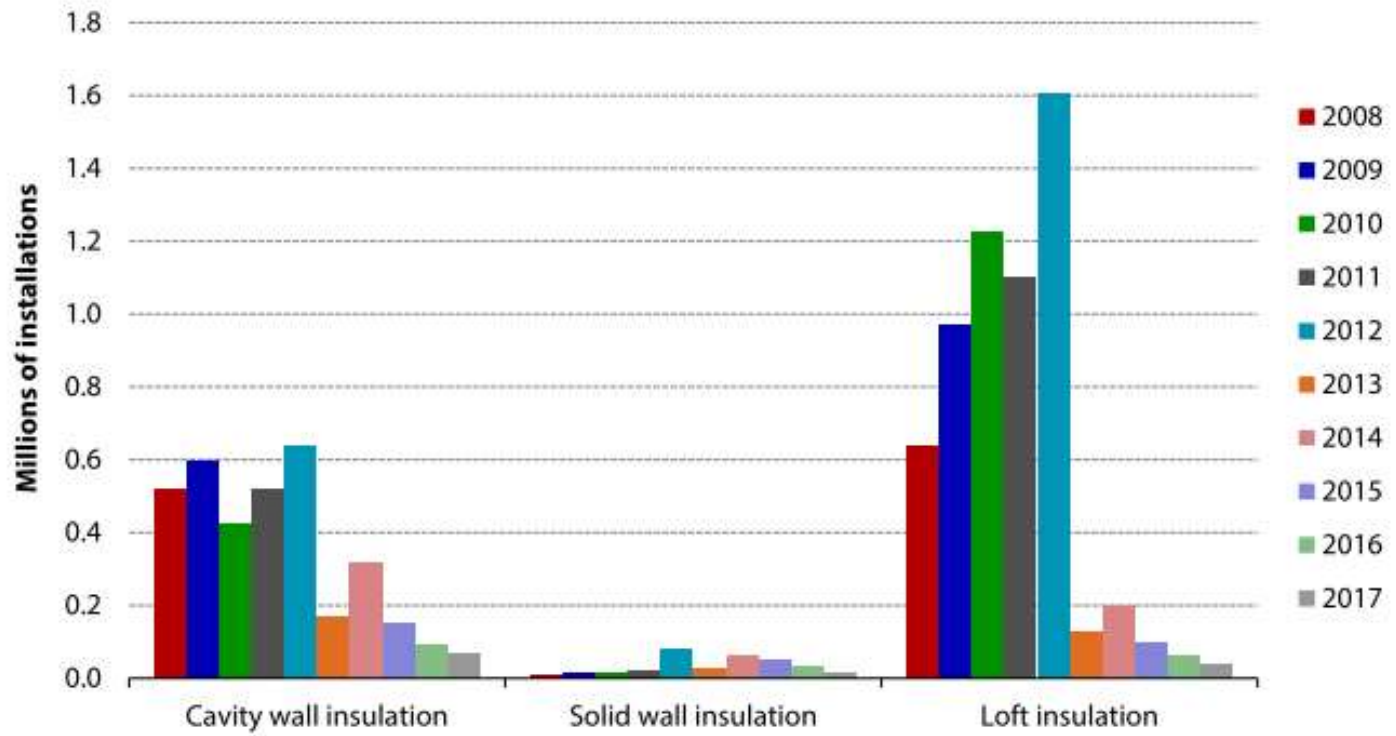
- Incumbents have capacity to do things at a scale which new entrants/small players cannot:
  - Lobby;
  - Fund innovation.
- Gas appliance manufacturers and gas networks the most active heat incumbents.
- As heavy influencing around hydrogen and low carbon gas took place, hydrogen has rapidly risen up the policy agenda as a potential low carbon heat solution.

Net zero report and clean growth strategy

- *There are a number of low carbon heating technologies with the potential to support the scale of change needed, including heat pumps, using low carbon gases (such as hydrogen) in our existing gas grid and district heat networks. However, at present it is not certain which approaches or combination of them will work best at scale and offers the most cost-effective long-term answer. Decarbonising heat is our most difficult policy and technology challenge to meet our carbon targets.*
- But, across all pathways 17% of heating was expected to be delivered via district heating in 2050 (BEIS, 2017, p75)
- The CCC have been fairly explicit that they don't see the hydrogen as a like for like replacement for current gas demand as a good approach.
- Their core scenario has 5 million homes on heat networks and 17 million heat pumps of some variety (CCC, 2019).

Domestic energy efficiency deployment

Figure 3.4. Annual insulation installation rates (2008-2017)



Source: BEIS (2018) *Household Energy Efficiency National Statistics;* previous DECC publications.
Notes: Installations under Government schemes.

Committee on Climate Change, 2019

The RHI

- 12% of all GB heat from renewables by 2020
- ‘Prepare the market for mass roll out in the 2020s’ (DECC, 2013b)
- The scheme was split into domestic and non-domestic
  - Non-domestic opened 3 years after legislation passed
  - Domestic 5 and a half years after legislation passed
- But:
  - According to the NAO, 65% less renewable heat delivered than it was originally expected to by now (NAO, 2018)
  - Cost-effectiveness of heat delivered appears OK but is questionable (NAO, 2018)
    - I would add that the significant lean towards biomass also makes the scheme look more cost effective than it would otherwise be
  - It is not clear what impact ‘gaming’ or ‘loopholes’ has had on scheme delivery (NAO, 2018)
    - But there are significant issues

Expected vs. actual delivery under the non-domestic scheme

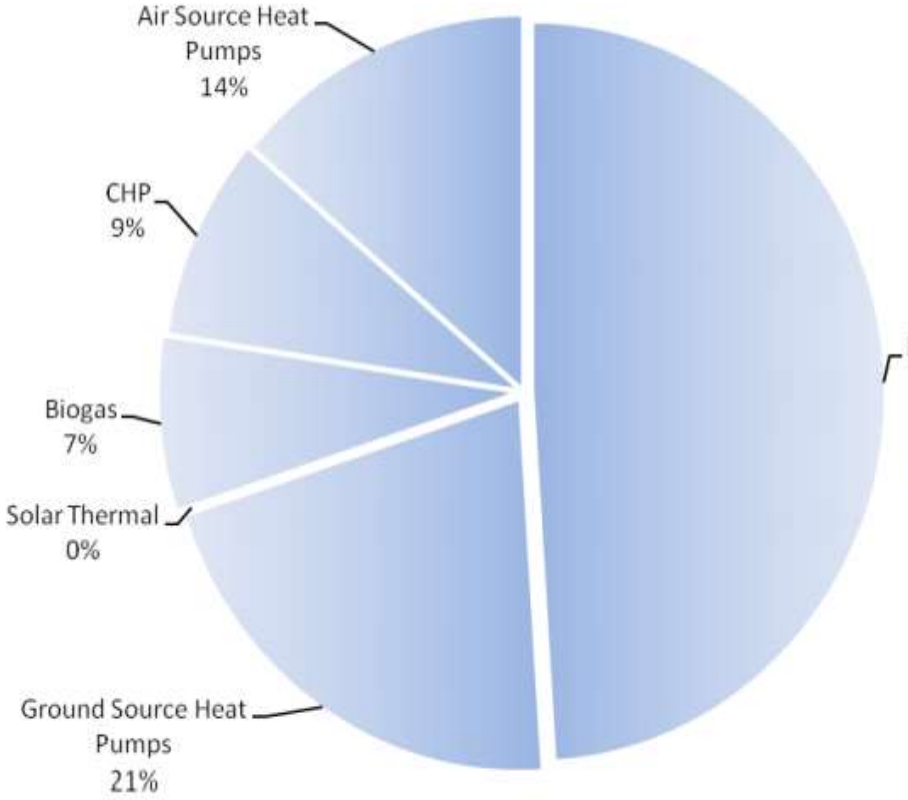


Figure 1. Modelled heat to be delivered under the non-domestic RHI scheme in the 2011 impact assessment (DECC 2011)

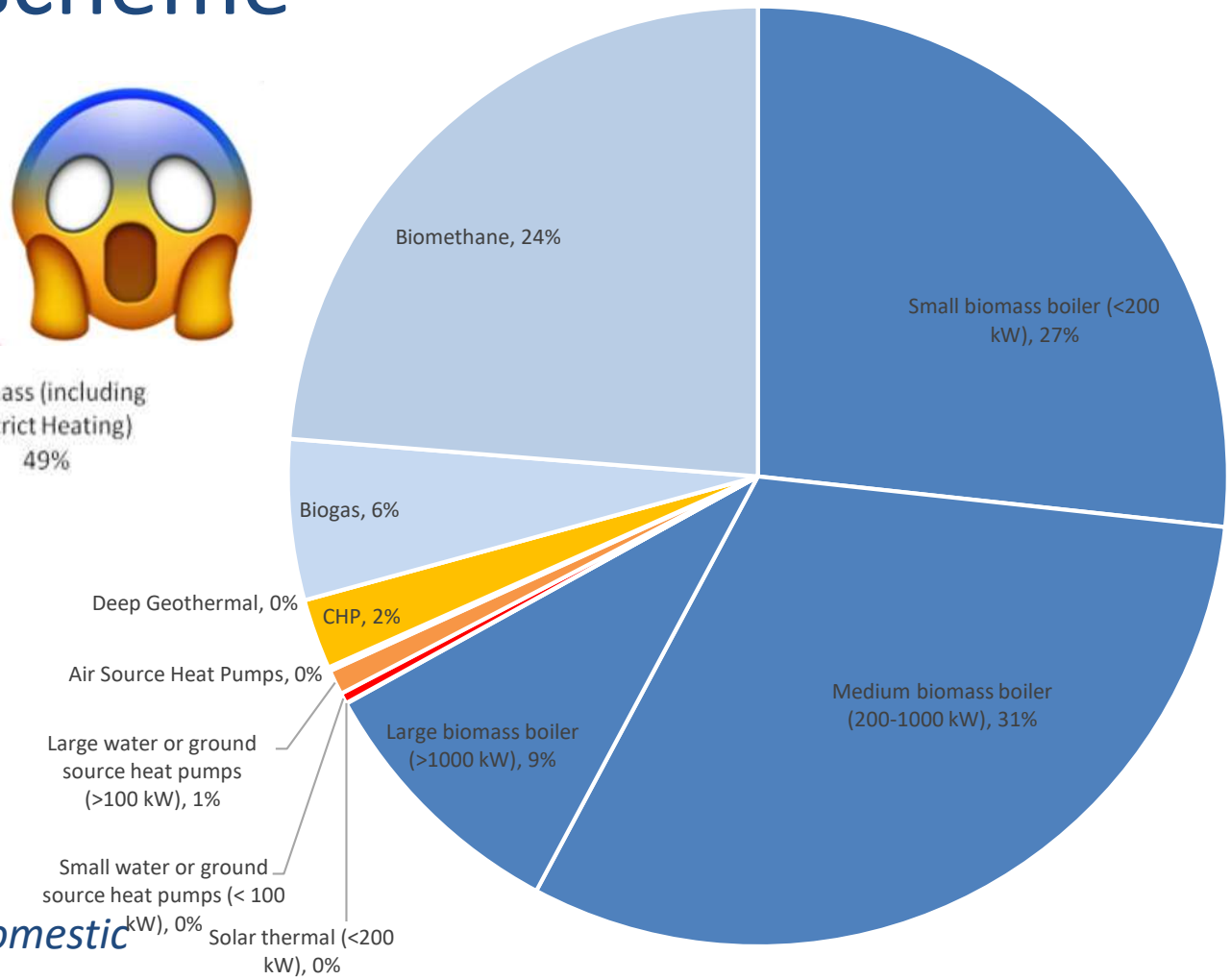


Figure 2. Heat delivered under the non-domestic RHI split by technology up to September 2019 ((BEIS 2019)

Expected vs. actual delivery under the domestic scheme

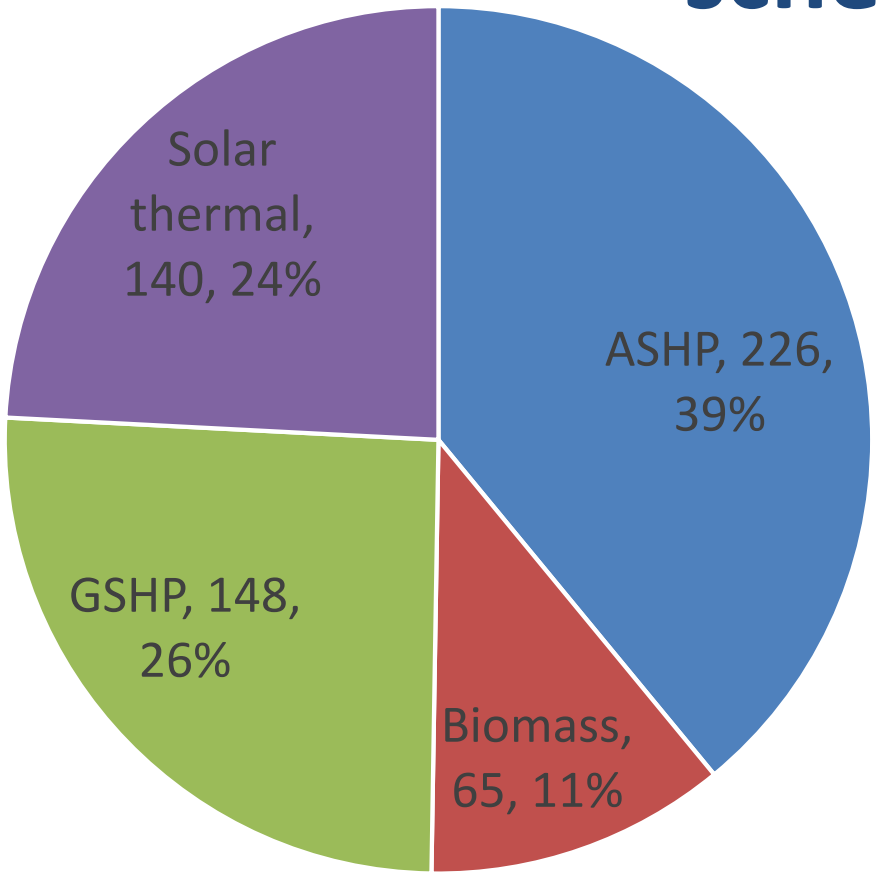


Figure 3. Expected deployment from 2013 impact assessment, (thousands of installations) (DECC, 2013)

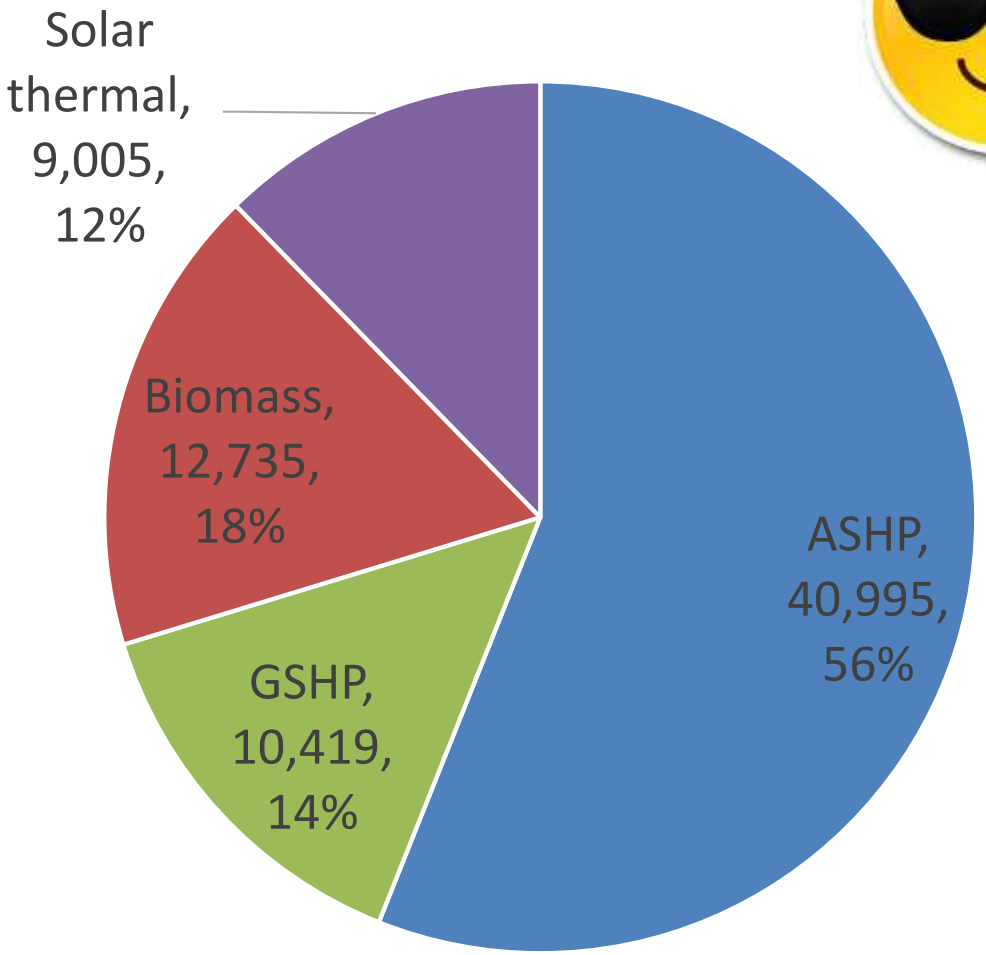
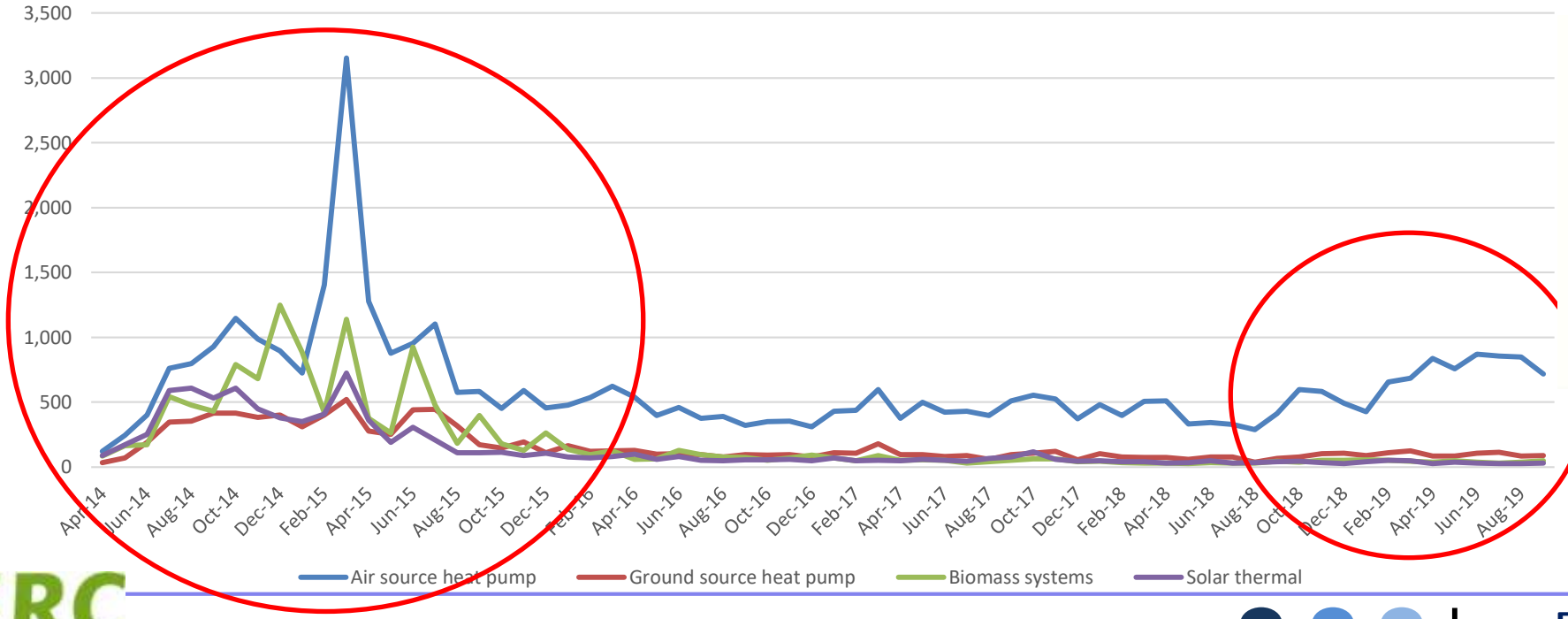


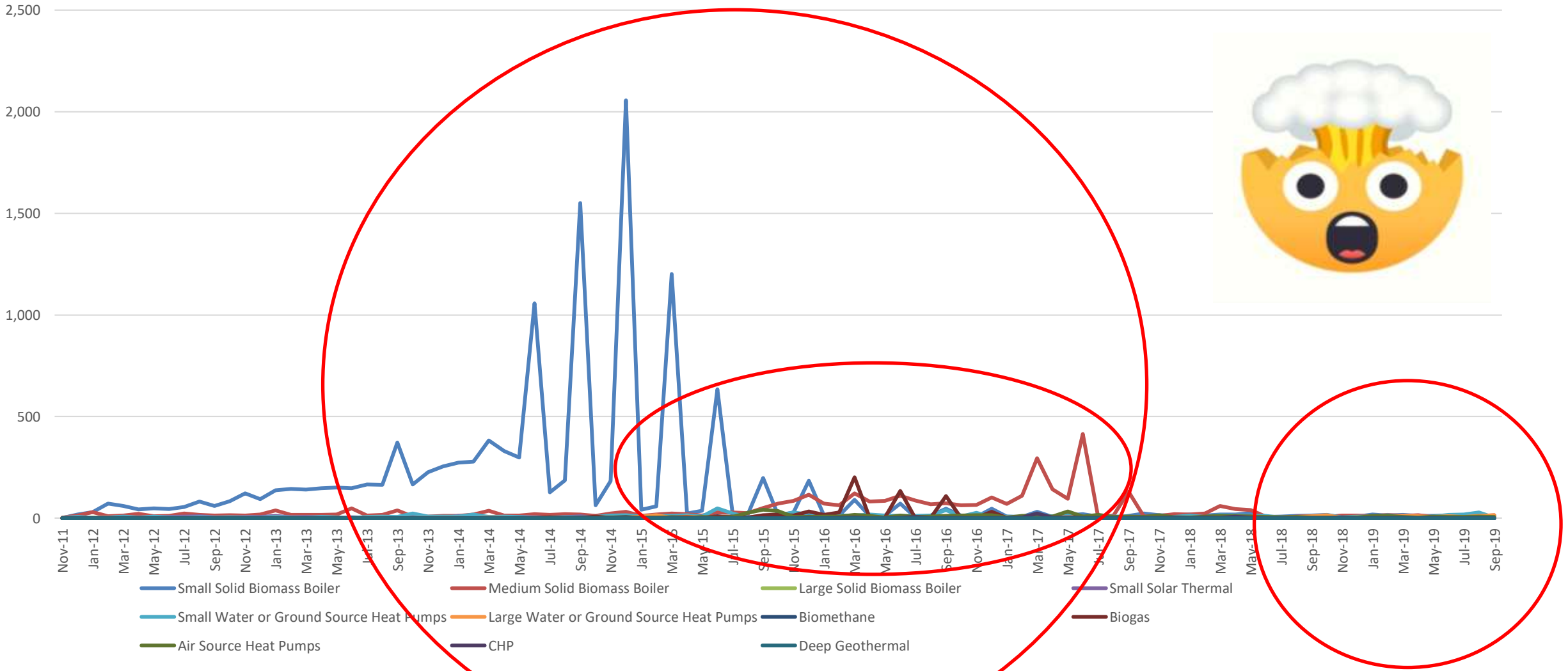
Figure 4. Actual deployment in terms of installations by end September 2019 (BEIS, 2019)

Overall:

- Around 9 x as much heat has been delivered by the non-domestic scheme compared to the domestic
  - The actual heat delivered by the non-domestic scheme has been dominated by bio-energy which dominates the scheme overall
- Both elements are well below the expected levels of deployment.
- The domestic heat pump market has ‘flat-lined’ since the RHI was introduced (CCC, 2016) despite being a vitally important technology
- The changes to domestic tariffs in 2018 have increased domestic ASHP deployment slightly



Deployment under non-domestic is a mess



How are heat networks growing?

Overall GB heat decarbonisation is not in a good way.

- 1. The key policy to decarbonise heat isn't doing any where near enough and much of it has delivered on the wrong areas.
- 2. The debate about the long term future is dominated by incumbents and uncertain (and disruptive) in policy maker's eyes – could this happen here for oil and gas?
- 3. Meanwhile, around 100k homes are connected to the gas grid each year
- 4. Energy efficiency deployment remains at low levels.

What does the future hold?

Future Homes Standard

- Introduced by 2025 (only a decade late, if it happens).
- '*The Future Homes Standard will require new build homes to be future-proofed with low carbon heating and world-leading levels of energy efficiency*'.
- Out for consultation so have your say;
- Issues:
  - Will developments with existing planning be able to get through?
  - What will the standard actually look like?
  - It's complicated, combination of carbon and costs model to avoid developers going for electric resistive as standard? Why not a demand level?
  - No sight of a ban, which would be simple to implement
  - Gas industry opposed, not sure about house builders
- CCC suggest between now and 2050, 500,000 new homes connected to HN and 7 million on heat pumps under all scenarios (Element Energy and UCL, 2019)

BEIS submission to Sci. and Tech Committee:

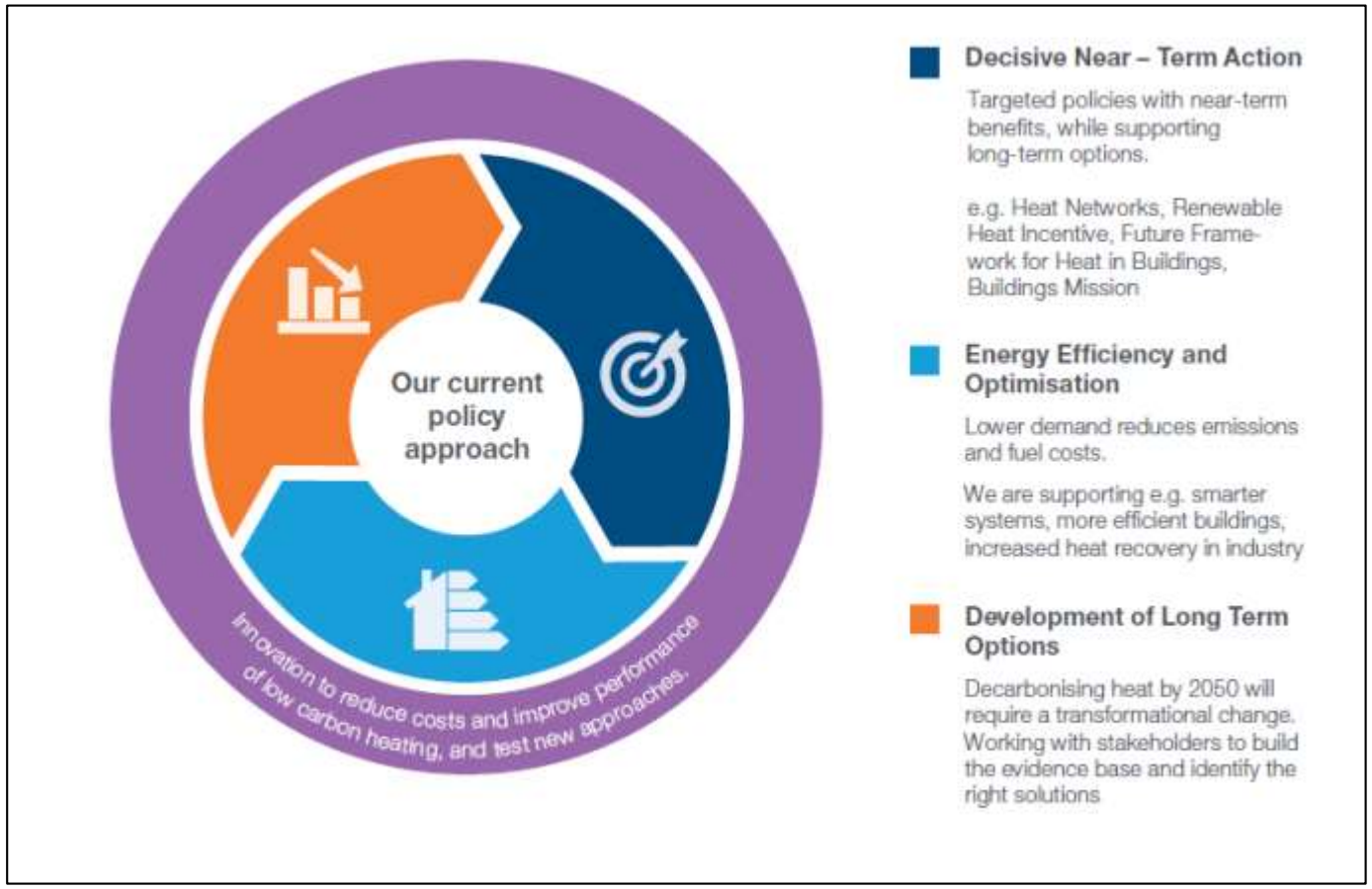
- '*There are **several options** with the potential to play an important role in a transition to low carbon heating and we are examining the mix of technologies and consumer options needed to decarbonise heat at scale*.'
- *'We have committed to publishing a **policy roadmap in summer 2020**, setting out the programme of work required to enable **key strategic decisions in the first half of the 2020s** on how we achieve mass transition to low carbon heating*.'
  - N.B. the RHI was supposed to prepare the market for mass transition from 2020
- '*We also acknowledge the need for **large-scale trials** to support future decision-making and have made funding available to demonstrate new low carbon heating technologies. This includes the £16.5 million **Electrification of Heat Demonstration Project** which aims to demonstrate the feasibility of a large-scale roll-out of heat pumps in Great Britain by installing heat pumps in a representative range of 750 homes, alongside new products and services designed to overcome barriers to deployment*.'

RHI beyond April 2021/off-gas grid

- *'The government has committed to phasing out the installation of high carbon fossil fuel heating systems in off gas grid properties and will be consulting on options in early 2020.'*
- There is no commitment to continue the RHI which I have seen.
  - The non-continuation of the RHI is not necessarily a bad thing but something needs to fill the gap. Deployment will not just happen, it's tough even with economic pull and disruptive.

Heat Networks Investment Project

- Main scheme closes March 2022 – no clarity on anything after but:
- BEIS: '*We aim to consult on policy options for the framework in Summer 2019*' following 2018 consultation (BEIS 2018b)
- It's now Winter 2019
- But what about retrofit? Do we need to start zoning? When will Ofgem get involved?

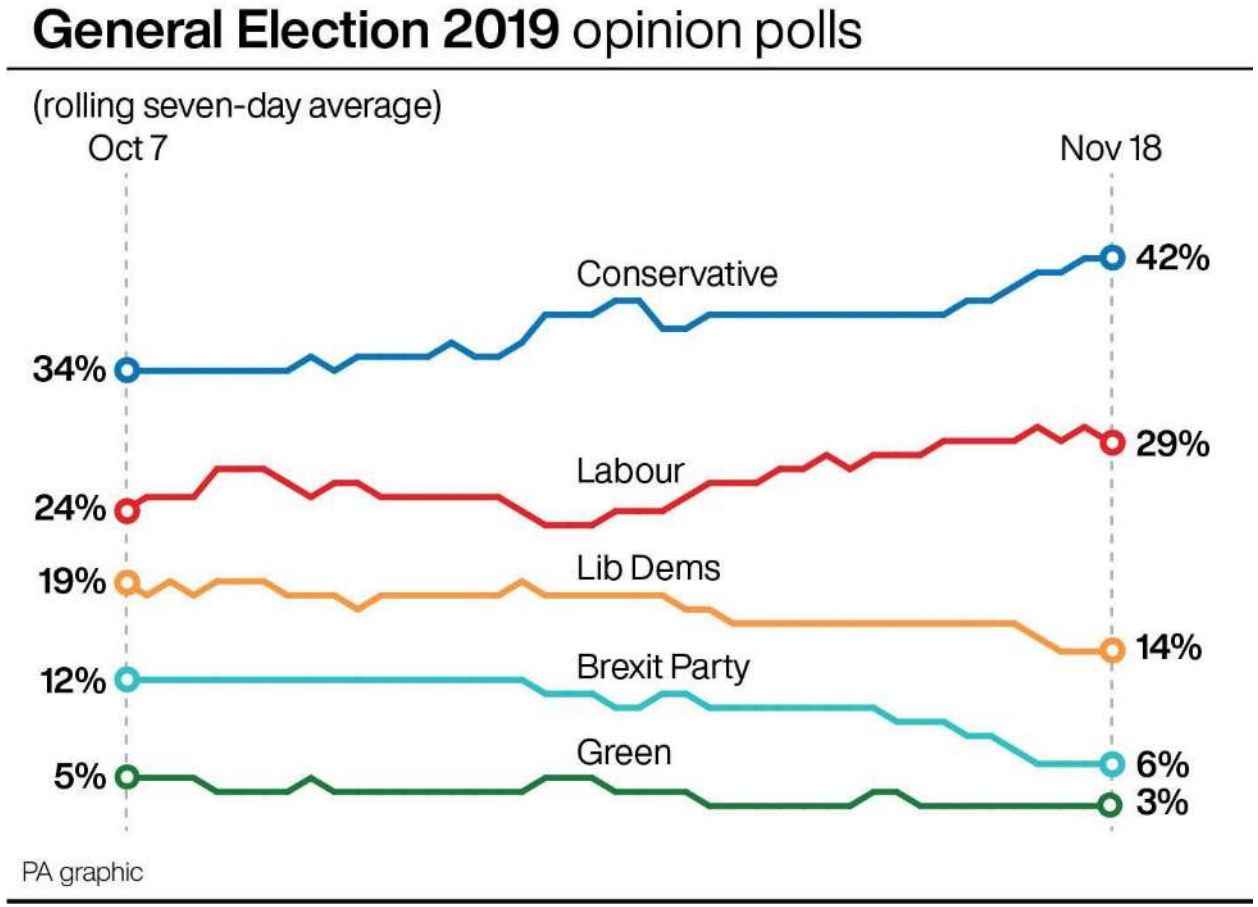

Our current policy approach
Innovation to reduce costs and improve performance of low carbon heating, and test new approaches.
Decisive Near – Term Action
Targeted policies with near-term benefits, while supporting long-term options.
e.g. Heat Networks, Renewable Heat Incentive, Future Frame-work for Heat in Buildings, Buildings Mission
Energy Efficiency and Optimisation
Lower demand reduces emissions and fuel costs.
We are supporting e.g. smarter systems, more efficient buildings, increased heat recovery in industry
Development of Long Term Options
Decarbonising heat by 2050 will require a transformational change. Working with stakeholders to build the evidence base and identify the right solutions

BEIS, (2018b)

=?

Political commitments

- Conservatives
  - No manifesto but presumably aligned with current Government?
- Labour by 2030 (https://labour.org.uk/wp-content/uploads/2019/10/ThirtyBy2030report.pdf)
  - No manifesto but: Every home 'upgraded'
  - 8 million heat pumps
  - Renationalisation
- Lib dems
  - No manifesto but all homes retrofitted during parliament!
  - All low income homes insulated by 2025 https://www.libdems.org.uk/plan-for-the-future-climate
- Greens – net zero by 2030



In conclusion

- A lost decade of heat decarbonisation despite the introduction of tougher long term targets;
- Fear of disruption and uncertainty dominates the thoughts of policy makers;
- Warm words politically but NOTHING is in legislation apart for the net zero target to drive heat decarbonisation,
- I have a 12 point plan: http://blogs.exeter.ac.uk/energy/2019/08/09/a-heat-and-buildings-decarbonisation-policy-framework-for-a-zero-carbon-uk/

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HEAT AND THE CITY

Rufus Ford

Vattenfall

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natural power

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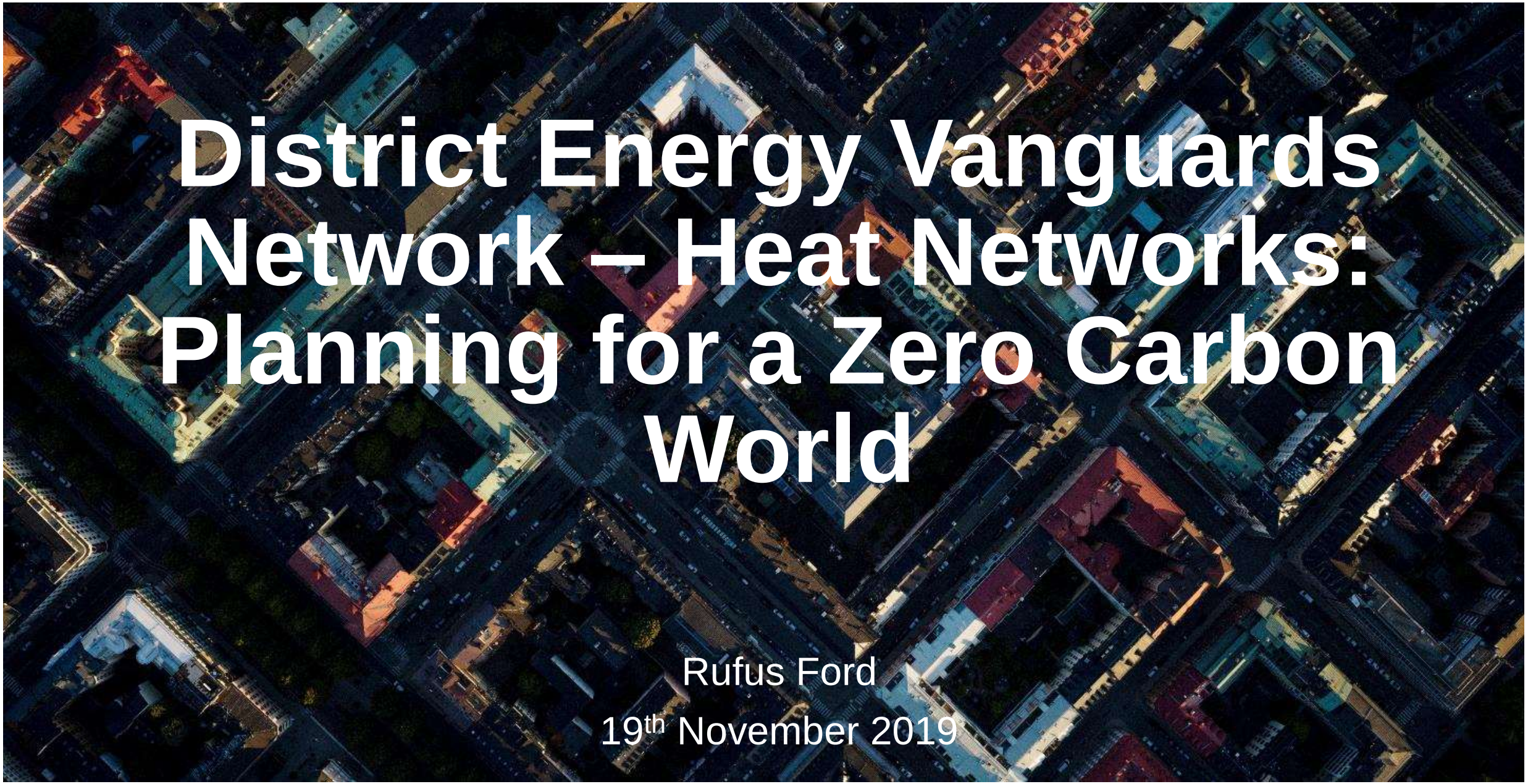


District Energy Vanguards Network – Heat Networks: Planning for a Zero Carbon World

Rufus Ford

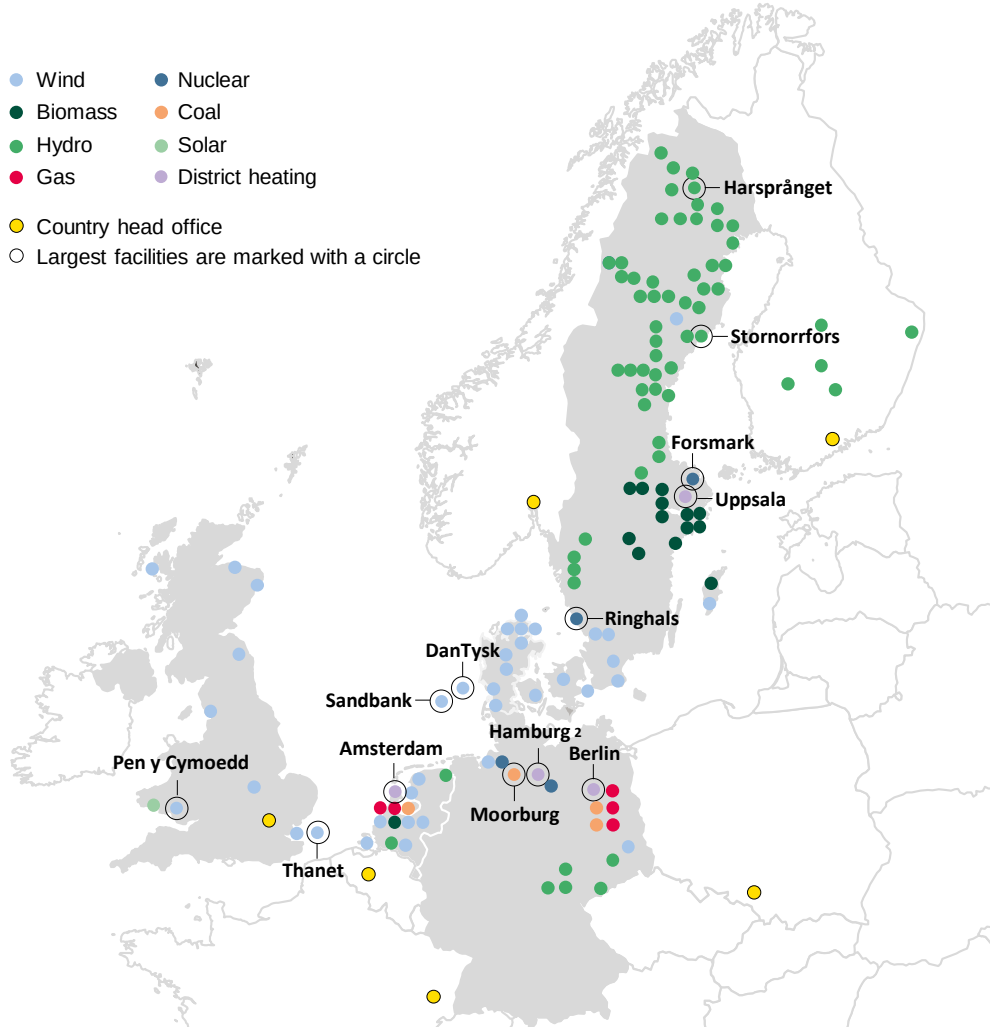
19th November 2019

This is Vattenfall

Basic Facts

- One of Europe's largest producers of electricity and heat
- Main products: electricity, heat, gas and energy services
- Main markets: Sweden, Germany, Netherlands, Denmark and the UK
- About 22,000 employees
- 100% owned by the Swedish state

Location of our operations and major plants



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£3.5 billion

Vattenfall have invested in the UK to date

Managed District Energy

Making the largest, most complex projects work for everyone

Brent Cross

Preferred partner to deliver the district heating for 180-acre development in London

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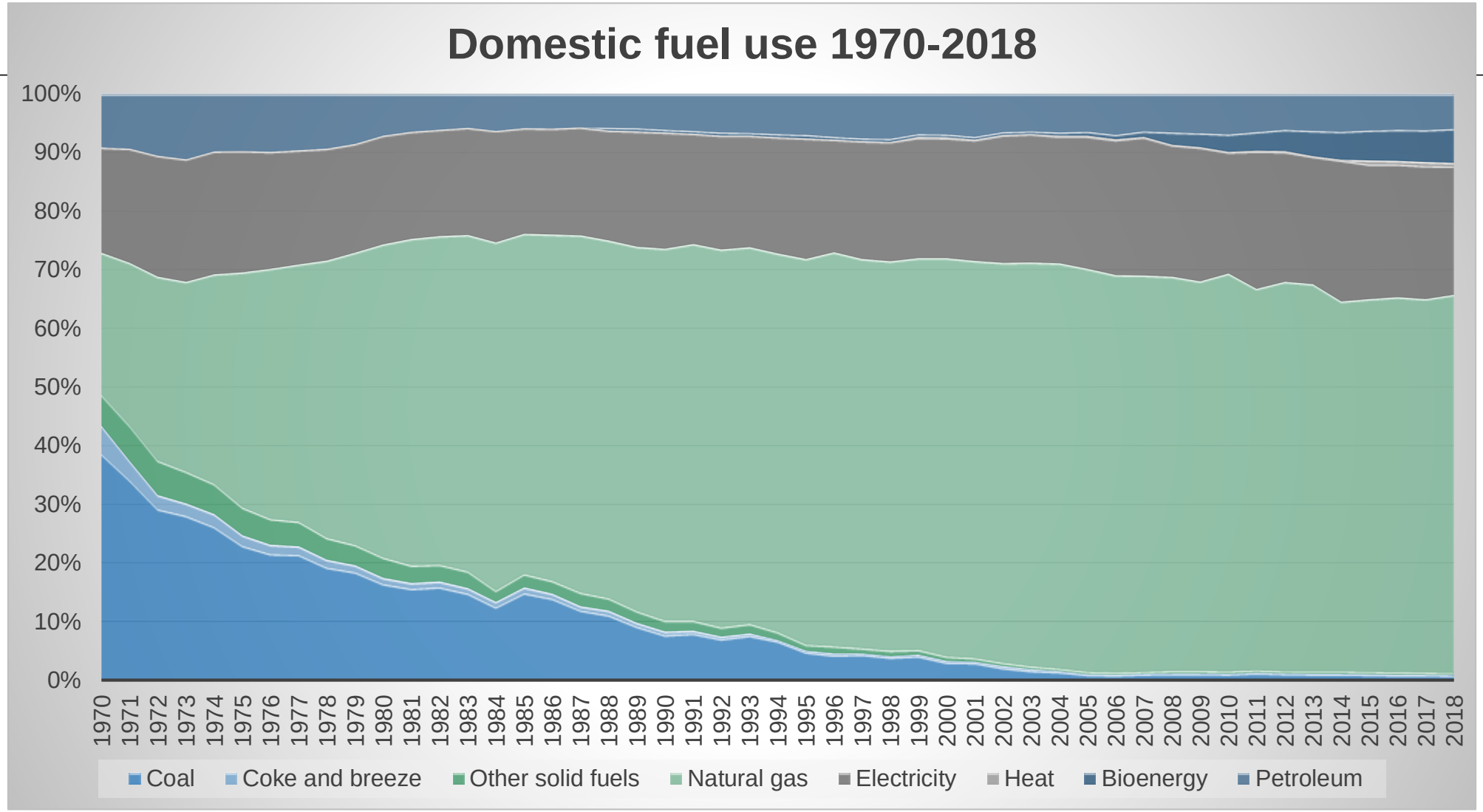
Fossil Free Within One Generation

…and heat is an exciting challenge!

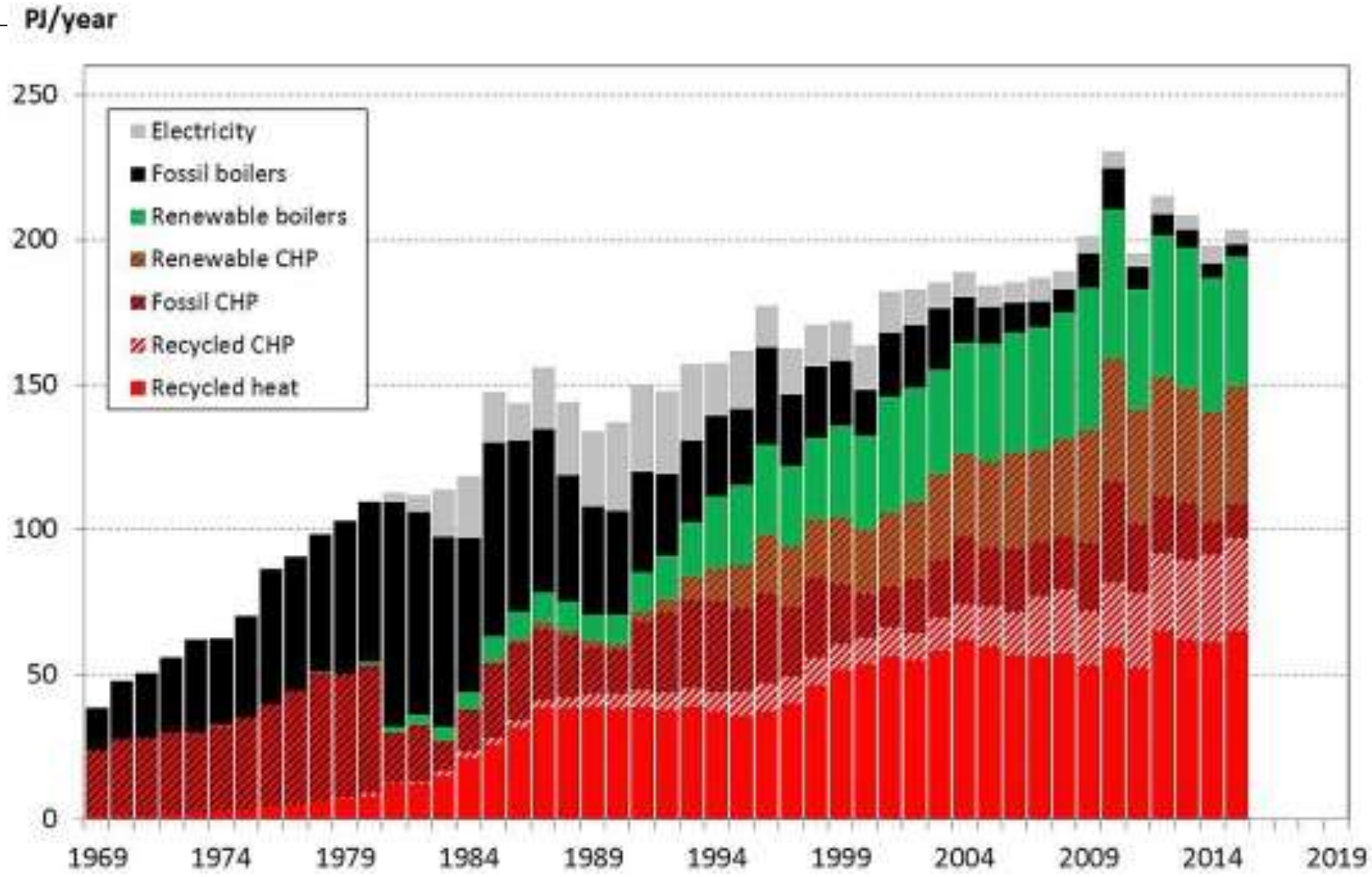
Heating fuel transitions have happened before and can happen again



https://www.gov.uk/government/statistics/energy-consumption-in-the-uk

Heating fuel transitions have happened before and can happen again

Heat sources in Swedish DH systems, 1969-2015



https://www.sciencedirect.com/science/article/pii/S0360544217304140#fig2

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How are Vattenfall decarbonising our heat networks in Europe?


Planned link of two networks - 2021
2015
1994
2005
2000
2005
Amsterdam
Almere
1998
2012
2012
1994

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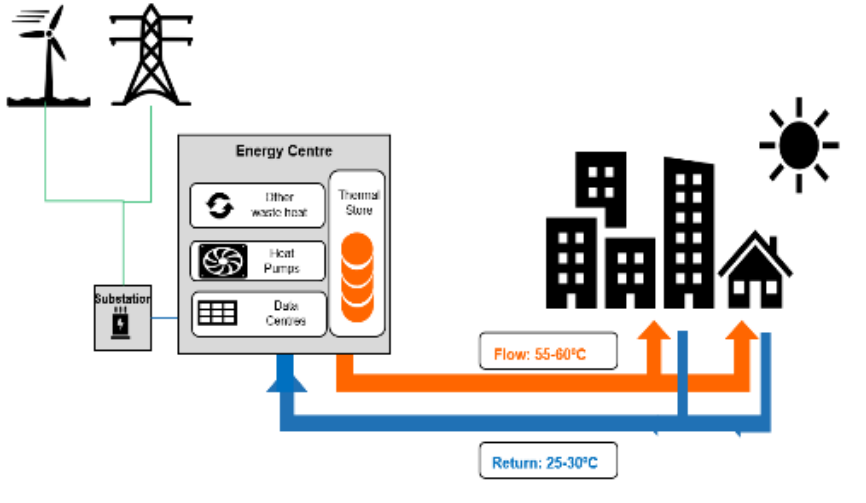
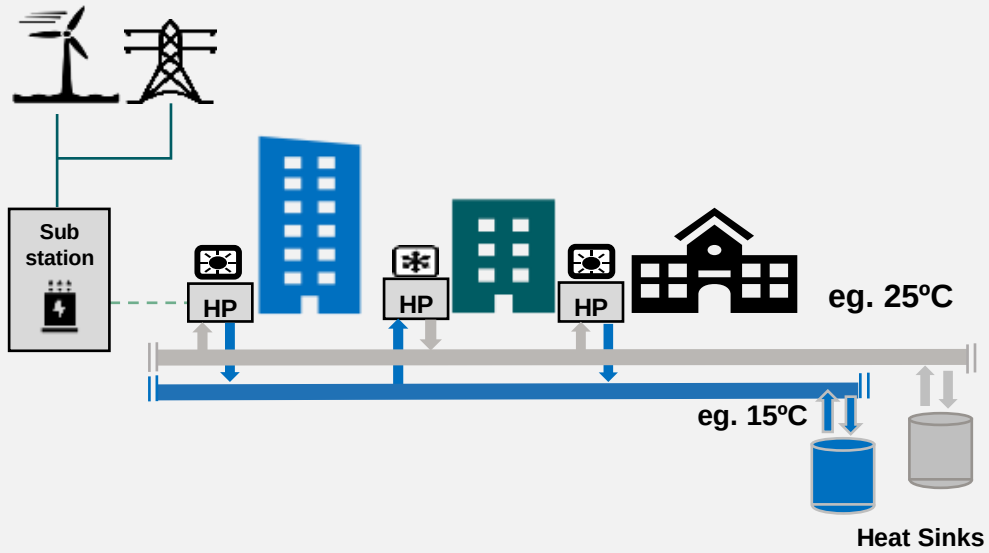
Planning for low carbon heat networks in the UK



4th generation and/or ultra low temperature district heating networks



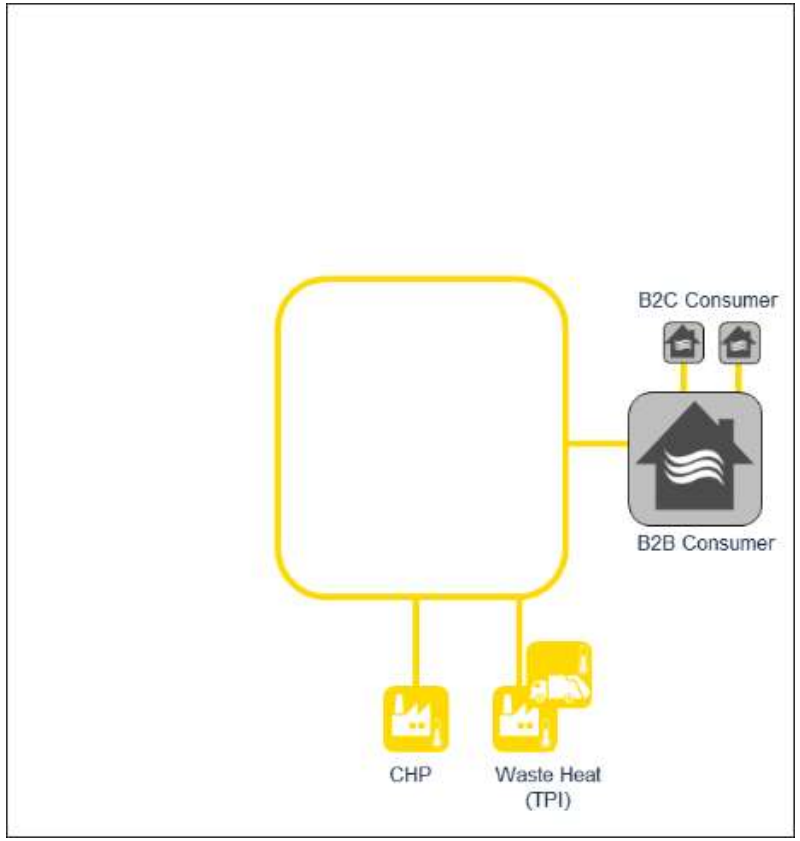
Ambient temperature network/loop for heating and cooling

- Waste heat source integration
- Demand side response and energy storage
- Future decarbonisation opportunities

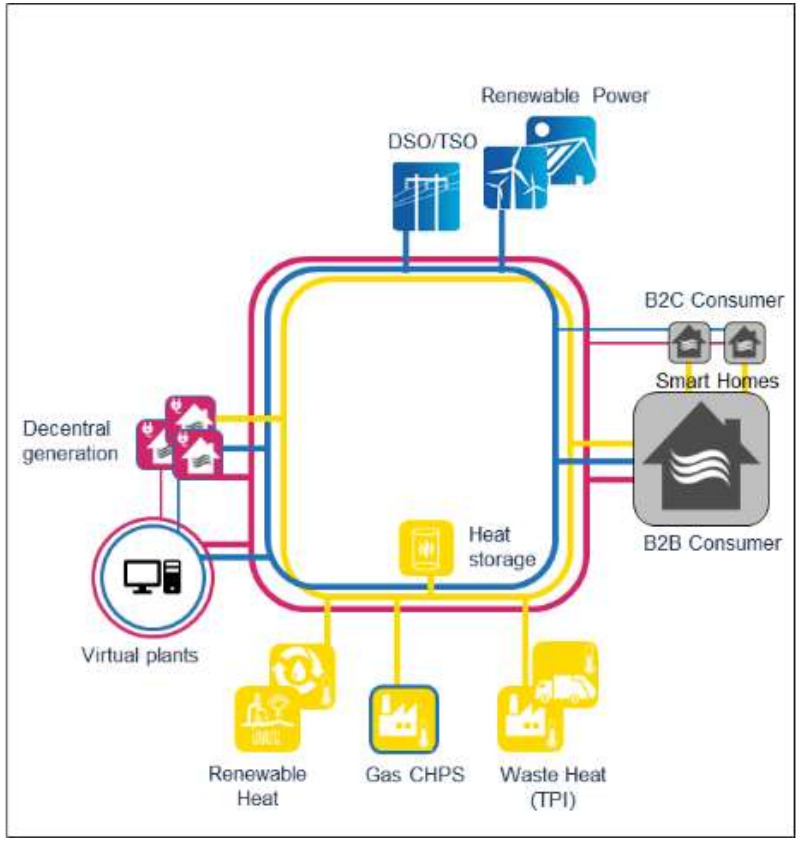
- Heating and cooling integration
- Easily expandable network
- Decarbonisation as grid decarbonises

District heating is a key enabler to a modern low carbon energy system

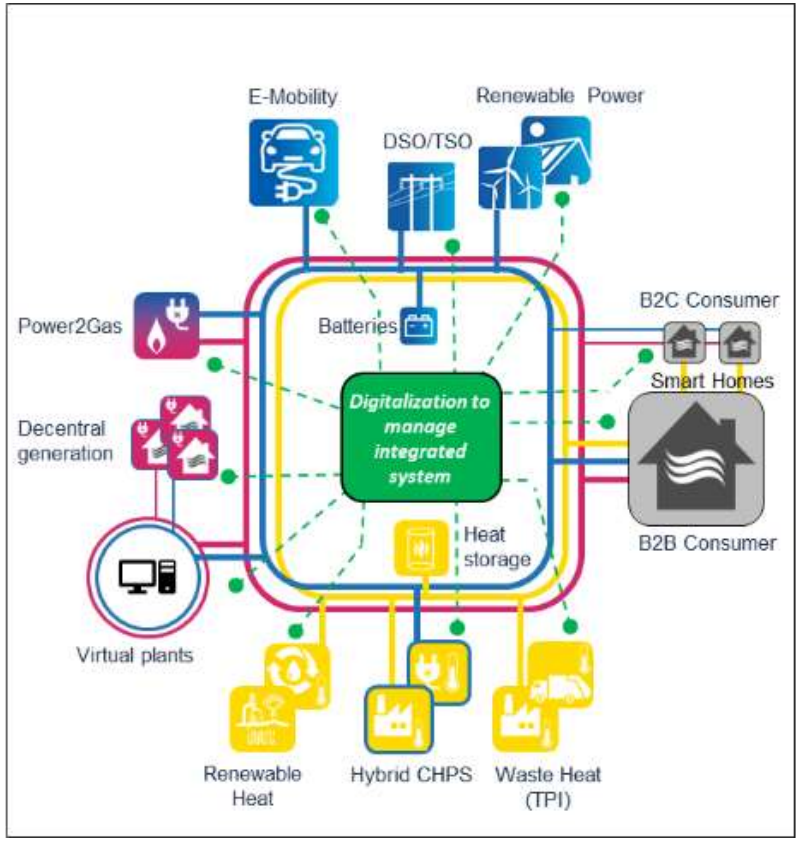
District heating traditionally is a passive system



… but has scope to be a true enabler decoupling supply and demand



With potential to deliver a low carbon energy system through integration



Power grid / applications Gas grid / applications Heating grid / applications Digital applications

What do we need to deliver the vision?

- Establish heat network concession zones
- Confer exclusivity to a HeatCo
- Connect to the heat network unless…
- Enable sources of low- and zero-carbon heat
- Prohibit the installation of direct acting electrical heating

Get building → Plan for flexibility → Achieve scale → Use low carbon sources → Displace fossil fuels


Thank you!
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HEAT AND THE CITY

Jon Buick

Bristol City Council

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Common issues with district heating policy

Jon Buick

Energy Infrastructure – Project Officer

Common issues

1. **Planning policy is not sufficiently focused on delivery**

2. **Policy maps go ‘out of date’ quickly**

3. **Energy and heating hierarchies are not sufficiently robust**

“I've often thought that if planners were botanists, zoologists, geologists, and people who know about the earth, we would have much more wisdom in such planning than we have when we leave it to the engineers.”

William O. Douglas

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Connection Ready Condition

District Heat Networks – Connection ready:

No development shall commence excluding site preparation works, site investigation works (including environmental investigations) and works of demolition until the applicant submits to and has secured written approval from the LPA on evidence demonstrating that the development has been designed to enable connection of the site to an existing or future district heating network, in accordance with the London Heat Network Manual (2014).

Reason:

To demonstrate that the site heat network has been designed to link all building uses on site (domestic and nondomestic) and to demonstrate that sufficient space has been allocated in the plant room for future connection to wider district heating in accordance with London Plan (2015) policies 5.5 and 5.6.

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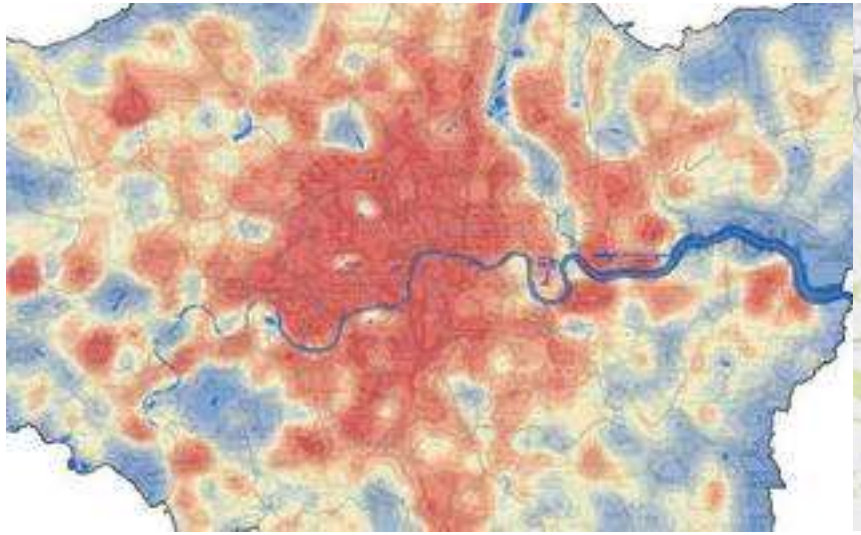
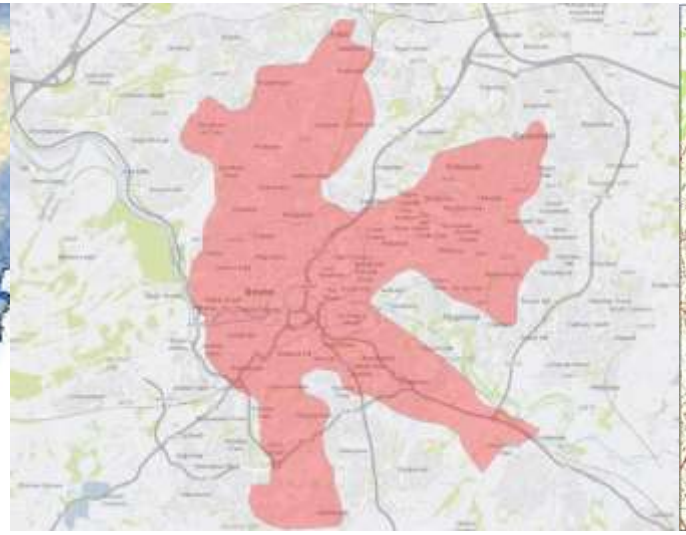
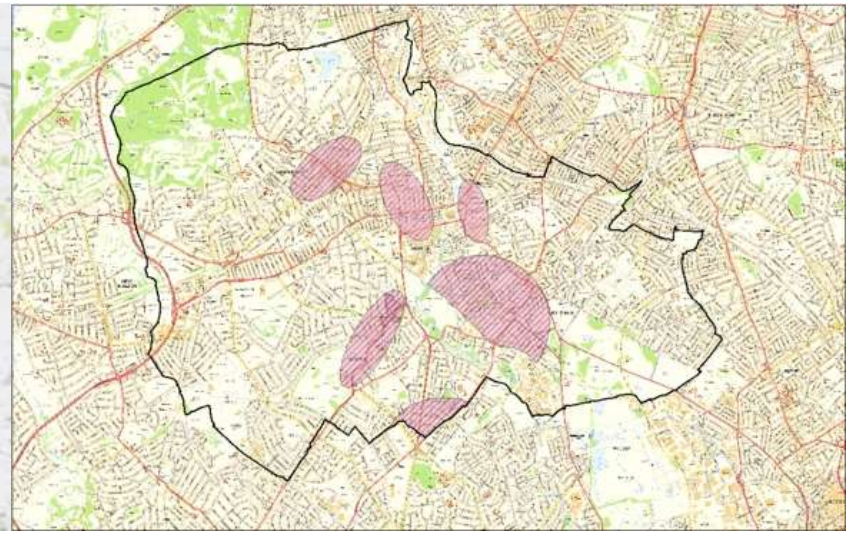
What do these opportunity areas have in common?







Heat Map Condition

District Heat Networks – London Heat Map:

‘Unless otherwise agreed in writing by the Local Planning Authority, no part of the development hereby approved shall be used or occupied until evidence has been submitted to the council confirming that the developer has provided appropriate data and information pertaining to the sites Combined Heat and Power (CHP) system to the Greater London Authority (GLA, environment@london.gov.uk) to allow the site to be uploaded to the London Heat Map (https://www.london.gov.uk/what-we-do/environment/energy/london-heat-map).’

Reason:
To ensure that the development contributes to the London Plan targets for decentralised energy production and district heating planning. Development Plan policies for Merton: policy SI3 of the London Plan [Date] and policy CS15 of Merton's Core Planning Strategy
2011.

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Policy Hierarchies

BCS14 - Sustainable Energy

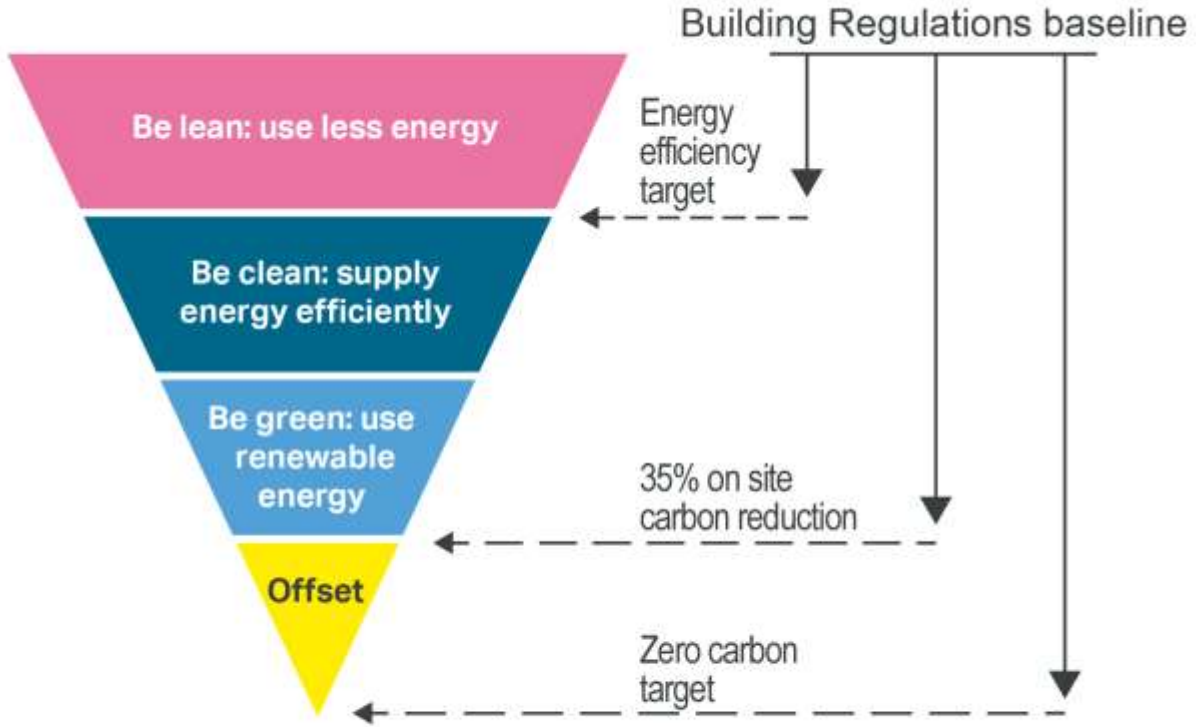
The Energy Hierarchy

1. Minimising energy requirements;
2. Incorporating renewable energy sources;
3. Incorporating low-carbon energy sources.

The Heating Hierarchy

1. Connection to existing CHP/CCHP distribution networks
2. Site-wide renewable CHP/CCHP
3. Site-wide gas-fired CHP/CCHP
4. Site-wide renewable community heating/cooling
5. Site-wide gas-fired community heating/cooling
6. Individual building renewable heating

The London Plan energy hierarchy



Source: Greater London Authority

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Hierarchy of Policies

Core strategies: Energy and Heating hierarchies

Qualitative priorities that provide overarching objectives.

Kept simple and changed infrequently.

Supplementary Planning Documents: Policies that support delivery

Introduction of triggers and definitions of compliance with deferent levels of the core strategy hierarchies.

Relies on policy hooks in core strategy but reduces subjectivity and provides clarity on policy interpretation.

Climate Change and Sustainability Practice note: Detailed description of application requirements and policy interpretation

Quantitative information linked to adopted policy.

Easily updated and refreshed.

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Key points

Make better use of conditions:

Planning conditions can be used to improve and ensure delivery and help develop future networks and policy.

Move towards dynamic mapping:

Policy maps need to keep pace with evolving opportunity areas.

End the over reliance on high level policy hierarchies:

Hierarchies are good for high level policy documents but need to be supported by supplementary policy and guidance.

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Questions?

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HEAT AND THE CITY

Heat Networks: Planning for a Zero-Carbon World

UK Local Authority District Energy Vanguards Network

Bristol, 19 November 2019

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