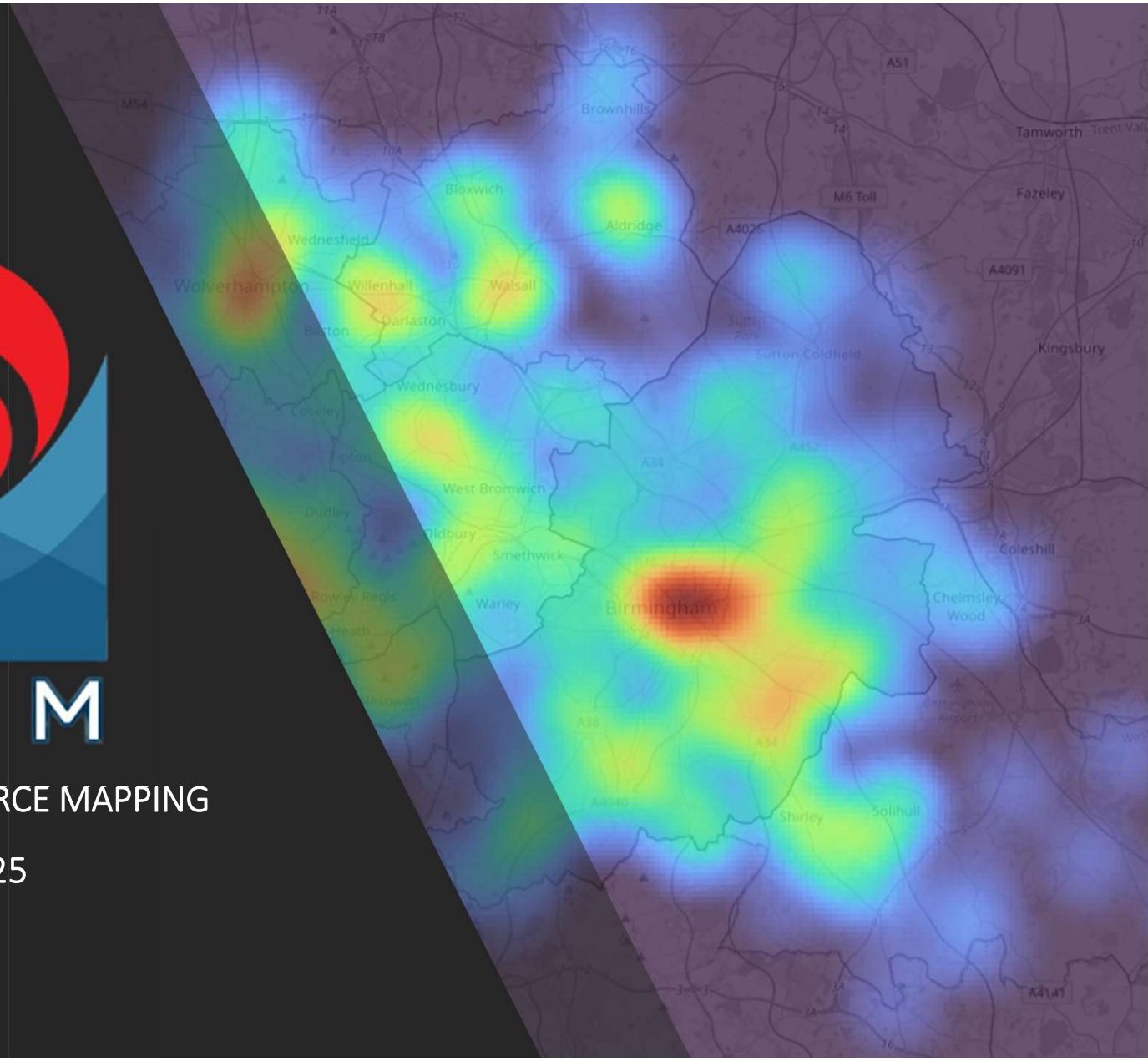
WHARM

WASTE HEAT ASSESSMENT AND RESOURCE MAPPING

REEF-UKC WORKSHOP | 19 JUNE 2025



THE WHARM PROJECT

Project aim, structure and collaborating partners

Aim: to develop a georeferenced waste heat database for the city of Birmingham, with key techno-economic parameters provided as attributes to points (e.g. capacity, temperatures, profiles, levelised costs, stakeholder info).

Project Duration:
February to August 2025

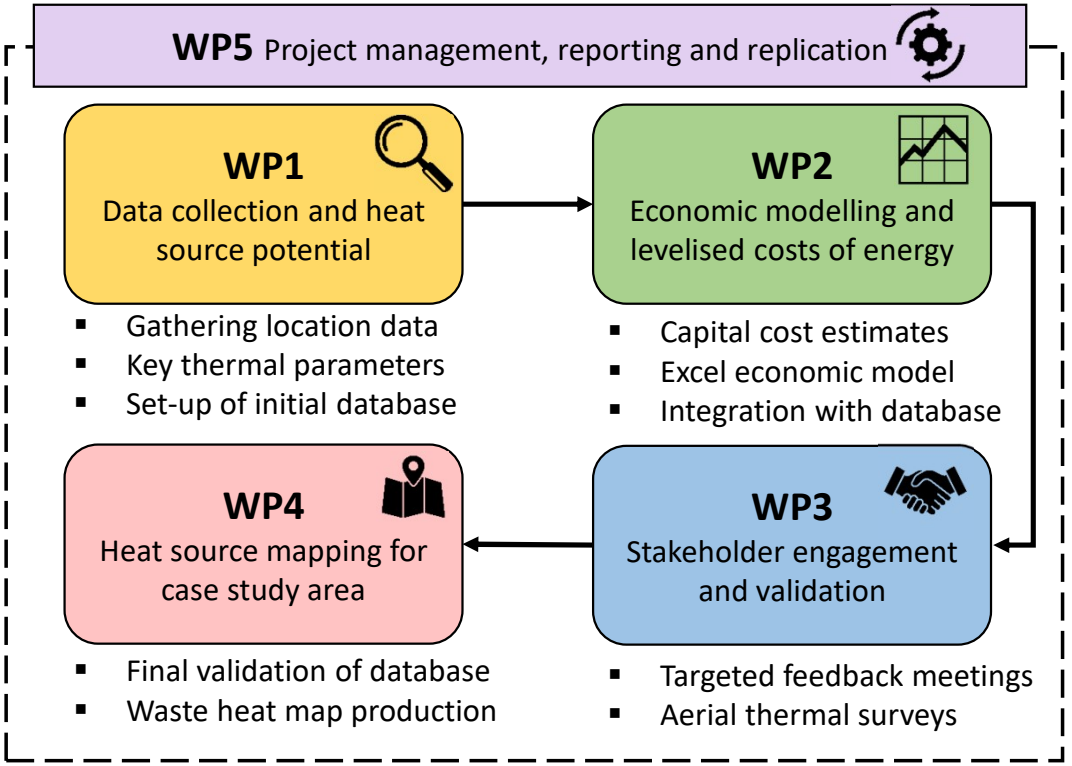
LSBU
Project lead

Aston University BIRMINGHAM UK
Stakeholder engagement

STAR REFRIGERATION
Industrial support

Birmingham City Council
Local engagement support

SKILLED MAPPING
Technical support



BACKGROUND & RATIONALE

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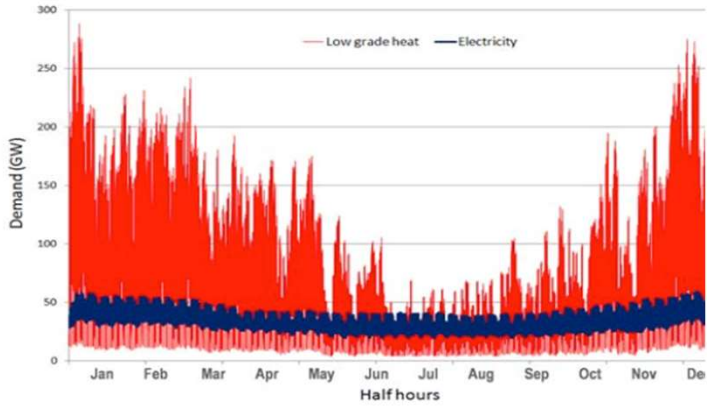
Heat recovery can unlock the potential for district heating in UK cities

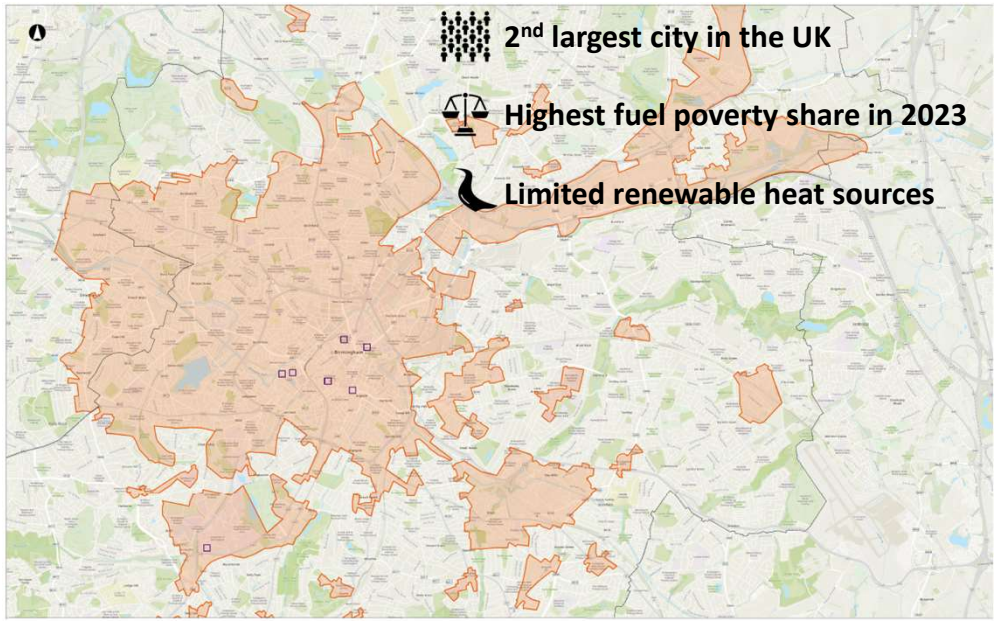
From **2%** to **20%** in 2050

Is the potential for growth in demand met by heat networks according to DESNZ

- District heating: economies of scale = lower costs!
- Waste heat: higher efficiencies and cooling opportunities
- Electrification: waste heat can reduce impacts on the grid



- Heat zones to be introduced for cities across England
- Great opportunity to think holistically: integrate H&C!



Heat network zoning map for Birmingham City

PREVIOUS RESEARCH

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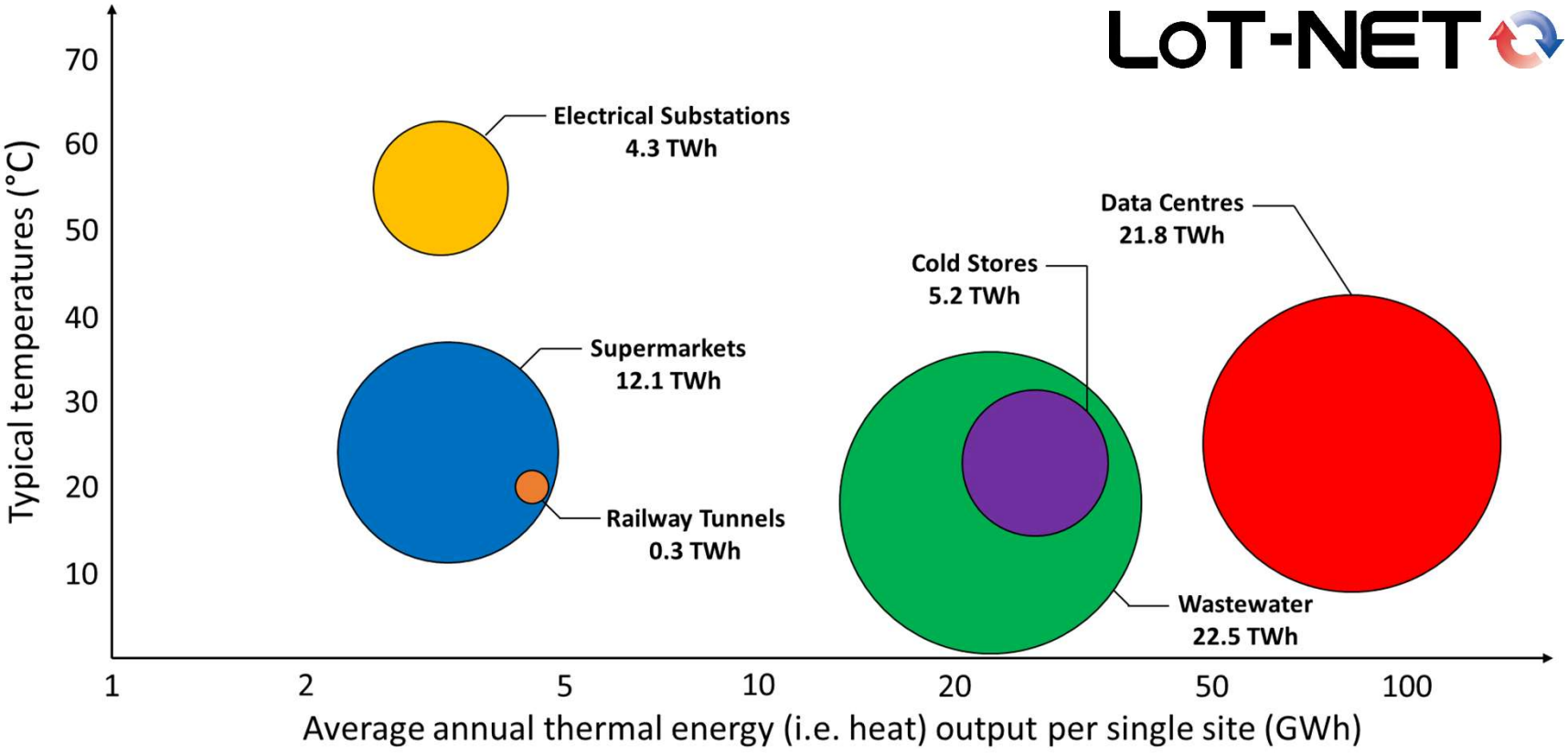
Significant opportunities from unconventional sources that need cooling



LoT-NET

66 TWh

released annually from low-grade heat sources

81%

of the projected increase in annual heat demand for district heating in 2050

THE VISION

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Addressing the big questions to identify the waste heat potential

- Industrial Facilities
- Data Centres
- Supermarkets & Cold Stores
- Substations
- Wastewater
- Crematoria

…. and more!

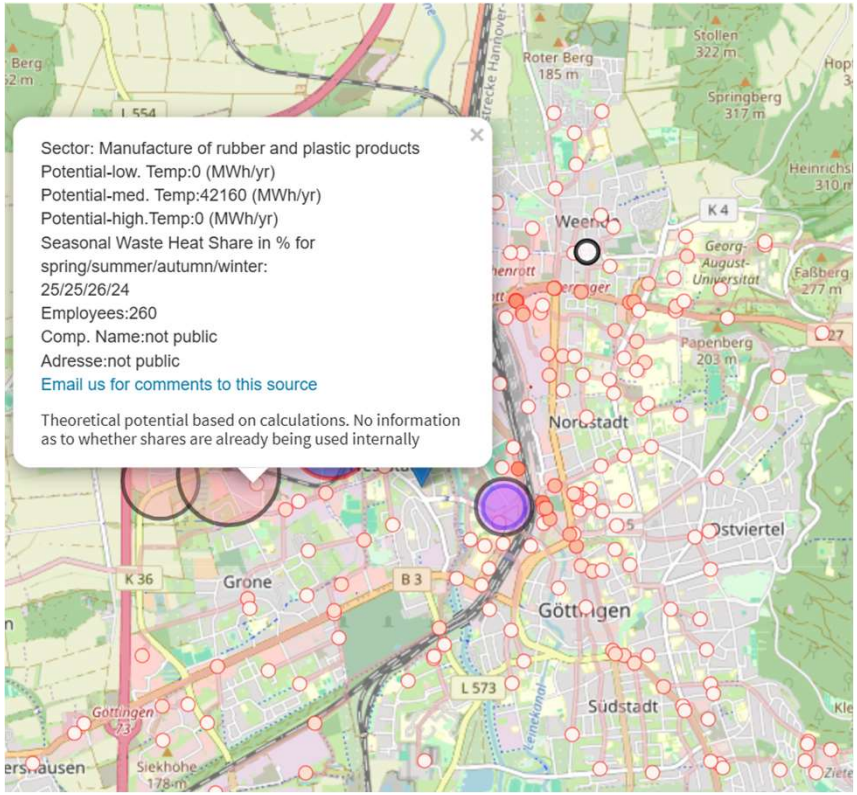
What are their capacities, temps and locations?

Is it possible to integrate heating and cooling?

What is the cost of capture and delivery?

Are the key stakeholders interested?

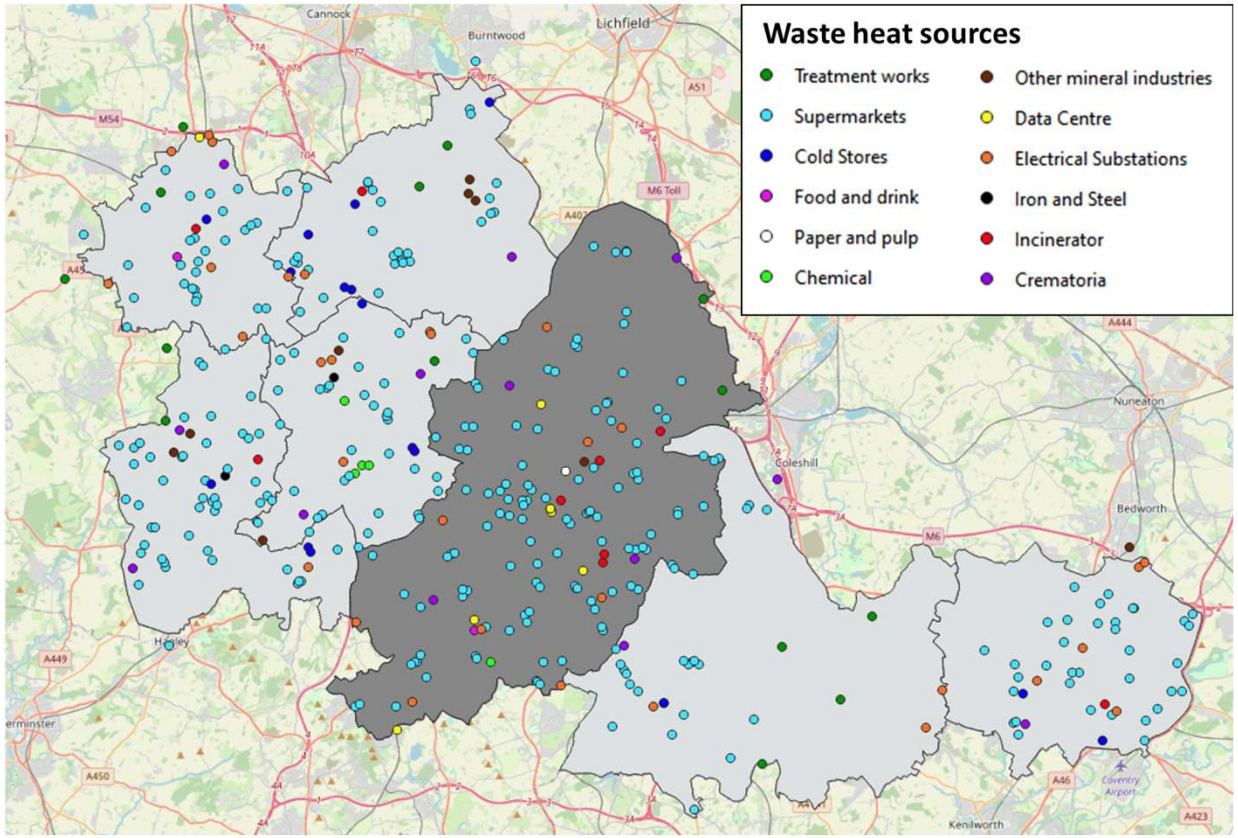
Memphis Project, IEA DHC Technology Collaboration Programme



Example of Waste Heat Explorer tool for Göttingen, Germany

PROGRESS TO DATE

Initial map of waste heat sources in Birmingham & WMCA



Data sources:

- LoT-NET waste heat research (DESNZ)
- DNO data, Cremation Society, WWTD
- VOA rating lists, CCA emissions data

Waste heat KPIs:

- Annual waste heat potential (MWh)
- Average and peak outputs (kW)
- Assumed source temperature (°C)

Birmingham:

- 11 types of sources (12 in WMCA)
- 165 sites, 35 excluding supermarkets
- 273 MW of heat, 1.7 MW per site
- 2.4 TWh/yr, 14 GWh/yr per site
- 7.3 TWh was the heat demand in 2005

PROGRESS TO DATE

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Final list of waste heat sources in Birmingham

Birmingham - Top 15 Sources						
Name of site	**Source Type**	**Status**	**Within heat network zone?**	**Postcode**	**Estimated average output (MW)**	**Total heat available (GWh/yr)**
Minworth WWTP	Treatment works	Operational	Yes	B76 9DJ	69.5	609
Tyseley EfW	Incinerator	Operational	Yes	B11 2BA	65.6	574
Hay Hall Road ERF	Incinerator	Planned	Yes	B11 2AU	27.8	243
Landor Street MBT	Incinerator	Operational	Yes	B8 1AE	27.0	237
Washwood Heath	Incinerator	Planned	No	B8 2UW	21.0	184
Fort Parkway EfW	Incinerator	Operational	Yes	B35 7RD	17.2	151
Cole Valley Data Centre	Data Centre	Operational	Yes	B11 3RF	8.1	71
Six Degrees Birmingham Central	Data Centre	Operational	Yes	B9 4EX	3.3	29
Sungard Laburnum House	Data Centre	Operational	Yes	B30 2BA	2.4	21
Atos Data Centre	Data Centre	Operational	No	B31 4PT	2.4	21
Kitwell 275kV (Grid Supply Point)	Electrical Substations	Operational	No	B32 4JX	1.2	11
Nechells 275kV (Grid Supply Point)	Electrical Substations	Operational	Yes	B24 8LR	1.2	11
Athena Data Centre	Data Centre	Closed	No	B6 7AY	1.2	10
ASDA Minworth Supercentre	Supermarkets	Operational	Yes	B76 1XL	0.8	7
Six Degrees Birmingham Central	Data Centre	Operational	Yes	B9 4EX	0.8	7

Suggested focus on top ranking sources that require cooling:
Incinerator (EfW), Data Centres, Electrical Substations and Supermarkets

HEAT SOURCE ASSESSMENTS

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Review of database assumptions prior to stakeholder engagement

1. How much waste heat is available annually (MWh or GWh)?

2. How is that waste heat distributed seasonally (MW)?

3. How many and what are the heat recovery opportunities for each source?

4. What are the flow and return temperatures of each waste heat stream (°C)?

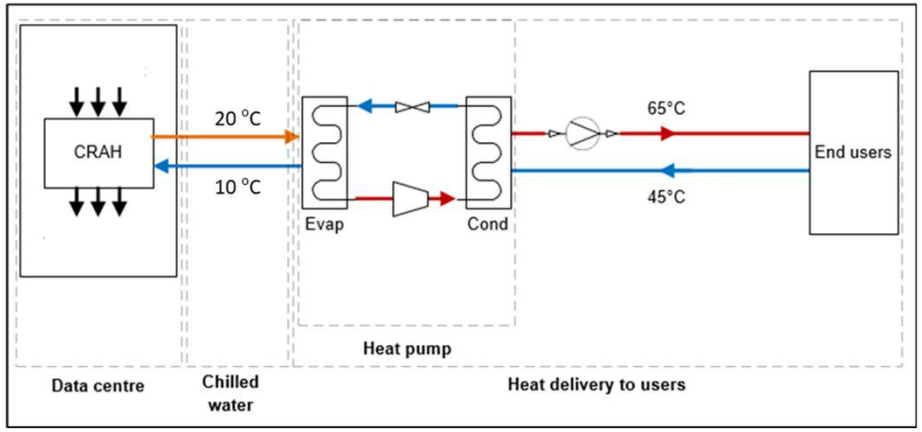
DATA CENTRES

Validating estimations of annual waste heat potential

Site name	Assumed source temperature (°C)	Average IT load (MW)	Assumed PUE	Waste heat output (MW)	Annual heat capture potential (GWh)
Six Degrees/nLighten	35	2.57	1.3	3.34	29.3

Waste heat = average IT load x PUE ✓

Cooling system	Cooling medium	Waste heat source	Temperature range (°C)	Recovery possible?
Remote air cooling	Air	Air	25–35	Yes
		Chilled water	10–20	Yes
Local air cooling	Air	Air	25–35	No
		Chilled water	10–20	Yes
Hybrid liquid/air cooling	30–40% Air	Air	25–35	Possibly
	60–70% Liquid	Liquid	50–60	Yes
All liquid cooling	Liquid	Liquid	50–60	Yes



- Air cooling is most common, and chilled water heat recovery reduces disruption.
- Heat pump likely to be needed even with low DH temps

ELECTRICAL SUBSTATION

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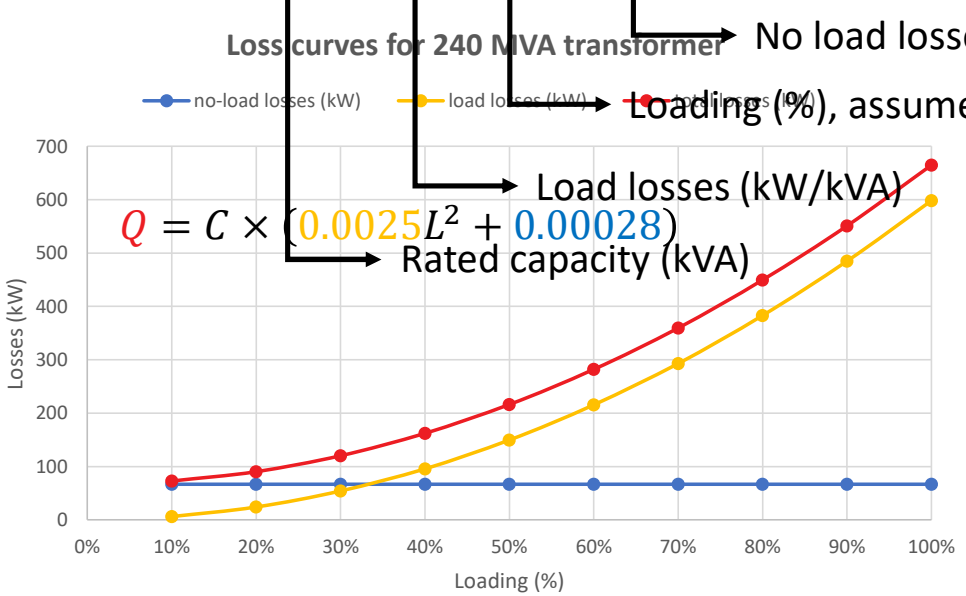
Validating estimations of annual waste heat potential

Method	Site name	Assumed source temperature (°C)	Capacity (MVA)	Load factor (%)	Waste heat output (MW)	Annual heat capture potential (GWh)
1	Nechells 275 kV	45	568	0.5	1.21	10.6
2	Nechells 275 kV	45	480	0.5	0.43	3.8

Estimation: $Q = C \times (0.0065L^2 + 0.0005)$ $= 568{,}000 \times (0.0065 \times 0.5^2 + 0.0005) =$ 1,206 kW ?



No load losses (kW/kVA)

Loading (%), assumed 50%

Load losses (kW/kVA)

$Q = C \times (0.0025L^2 + 0.00028)$

Rated capacity (kVA)

- Lower losses observed from data obtained for 240 MVA transformers
- Previous correlation was developed from 6 different transformers with lower capacities (3 to 90 MVA)
- Capacity seems to be 480 MVA for both Kitwell and Nechells (TBC through stakeholder engagement)

ENERGY FROM WASTE

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Findings from first meeting with plant owner (Birmingham Council)

Site name	Assumed source temperature (°C)	Waste heat output (MW)	Annual heat capture potential (GWh)
Tyseley EfW	90	65.56	574.3

?

- 370,000 – 380,000 tonnes of waste processed annually
- Electricity-led plant: 25 MW_e, 184 GWh generated per year
- Considering 25% efficiency, waste heat potential is 552 GWh/yr
- 6-8 MW estimated to be recoverable with minimal CAPEX
- What is the trade-off between electricity and heat?

£80/MWh for electricity → £25/MWh (2.5p/kWh) for heat only plant*?

***assuming 80% recovery**

CONCLUSIONS & NEXT STEPS

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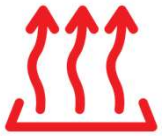
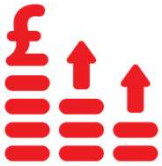
Dedicated meeting with stakeholders and economic model development



A comprehensive dataset has been developed, covering 11 heat sources and 165 sites, with a waste heat potential equivalent to 1/3 of Birmingham's heat demand

Validation of current understanding and estimated waste heat potential is still needed, as early calculations indicate some values in current dataset might not reflect actual potential of local sites

Skilled Mapping is planning to conduct aerial thermal surveys with drones at selected sites in July (largest of each shortlisted heat source), which will support validation



Next steps will also entail developing a methodology for estimating levelised costs of delivery at different temperature levels (3G, 4G and 5G), considering published OPEX and CAPEX figures

THANK YOU!

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Dr Henrique Lagoeiro
roscoeh2@lsbu.ac.uk

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