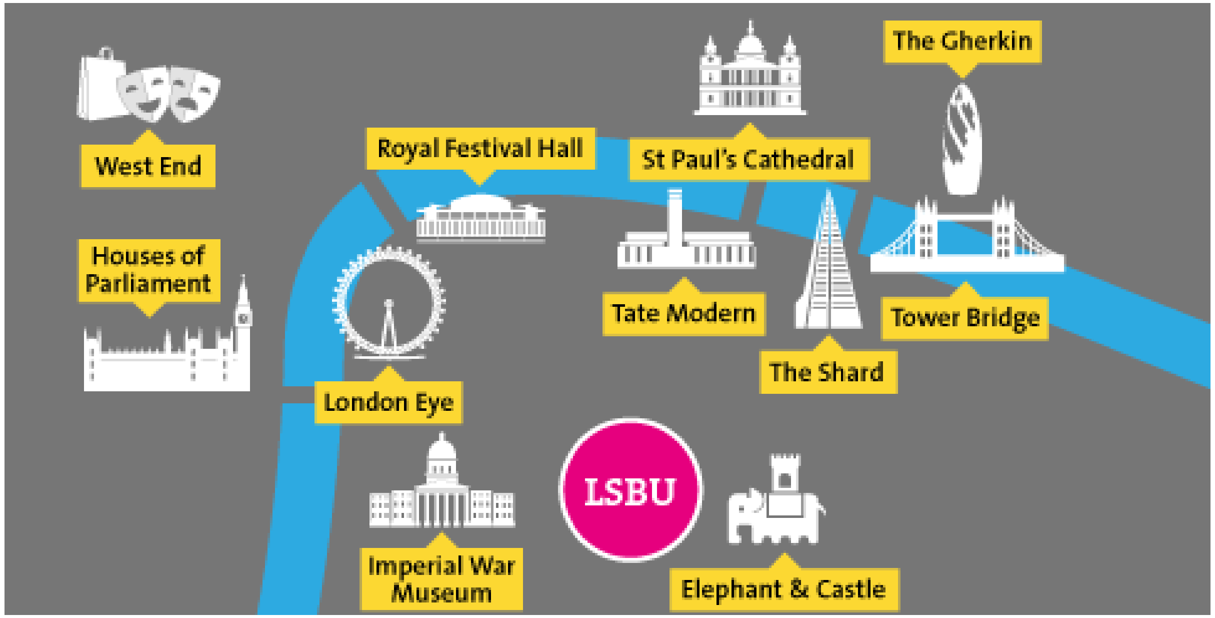
SECONDARY HEATING AND COOLING OPPORTUNITIES IN URBAN AREAS

AKOS REVESZ | Research Fellow|revesza2@lsbu.ac.uk

London South Bank University

EST 1892

London South Bank University



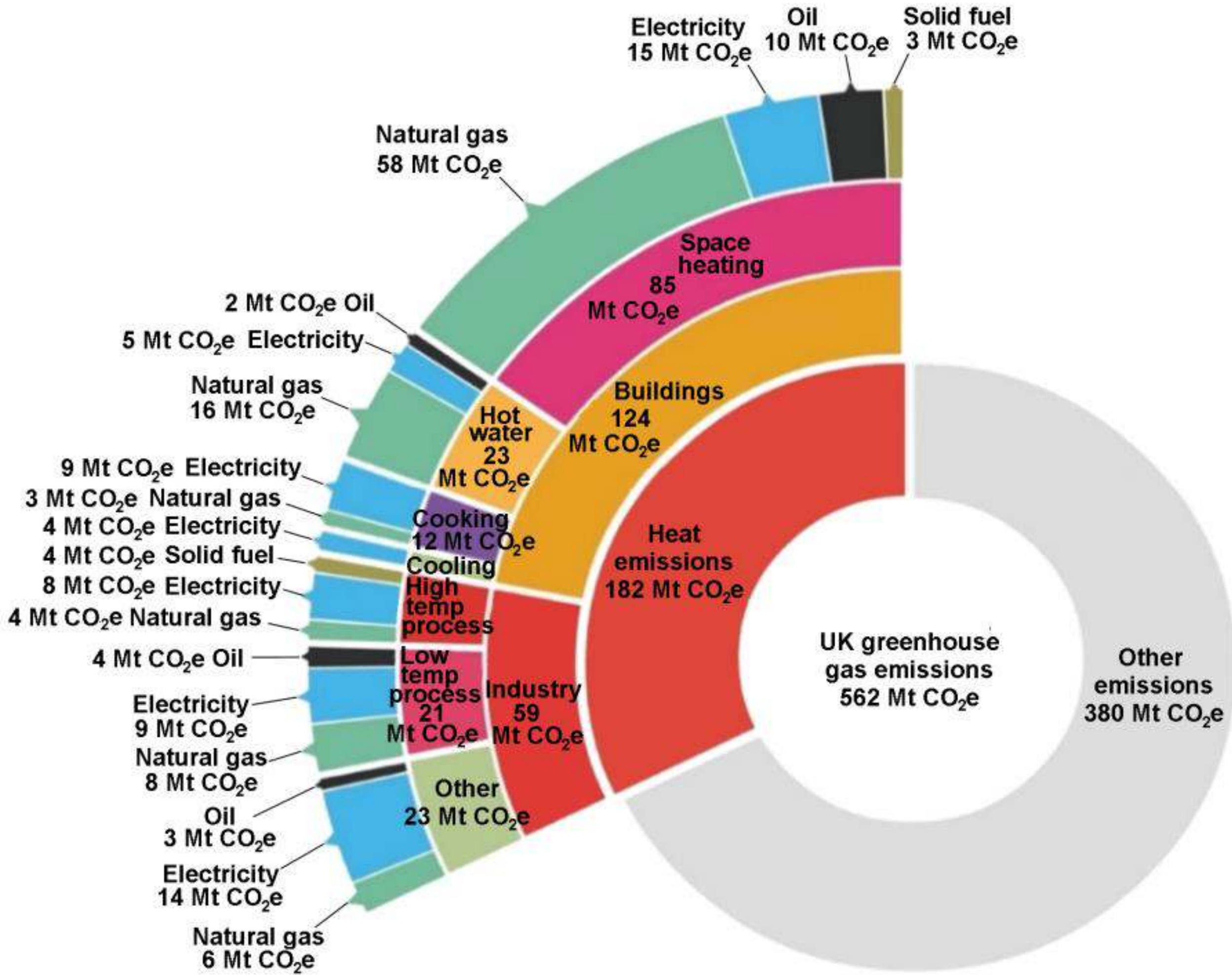
Centre for Refrigeration, Air-Conditioning and Heat Pump Technologies

http://www.lsbu.ac.uk/research/research-interests/sites/centre-air-conditioning-refrigeration-research

London South Bank University

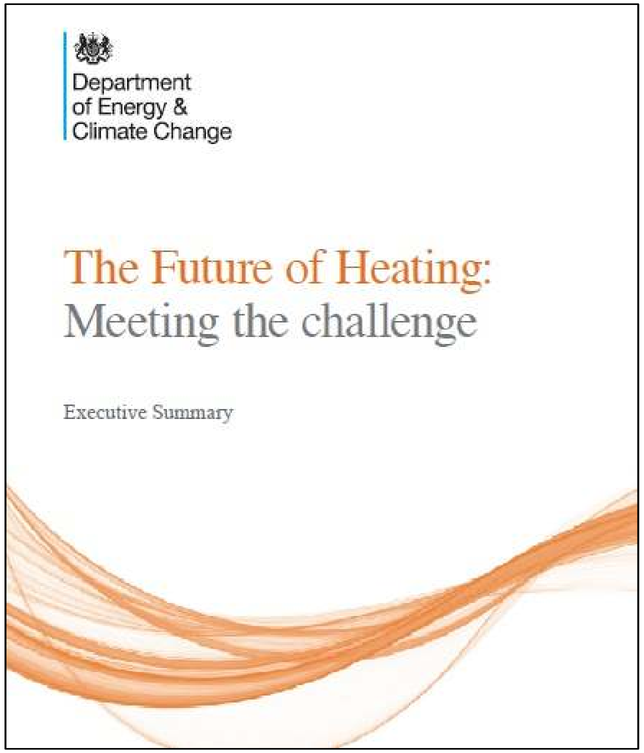
Heating challenge in the UK

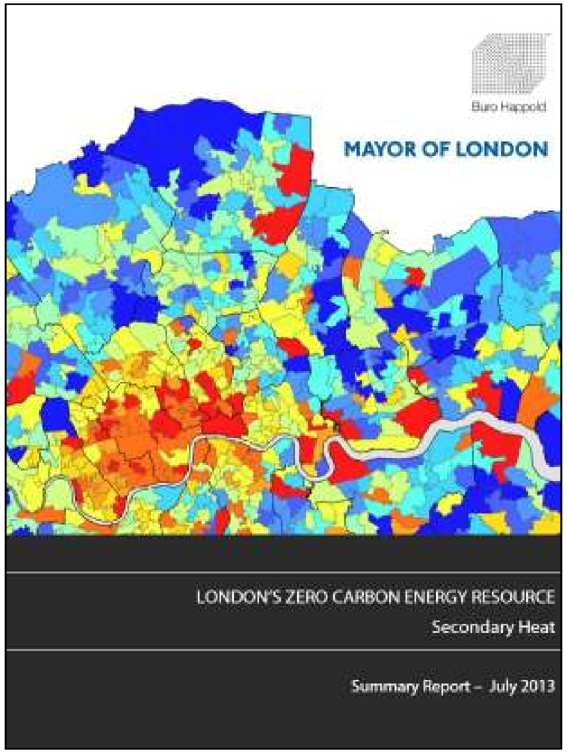
Climate Change Act 2008



London South Bank University

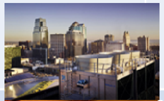
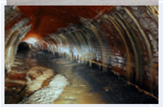
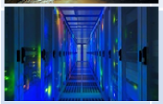
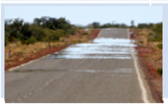
What is the plan?





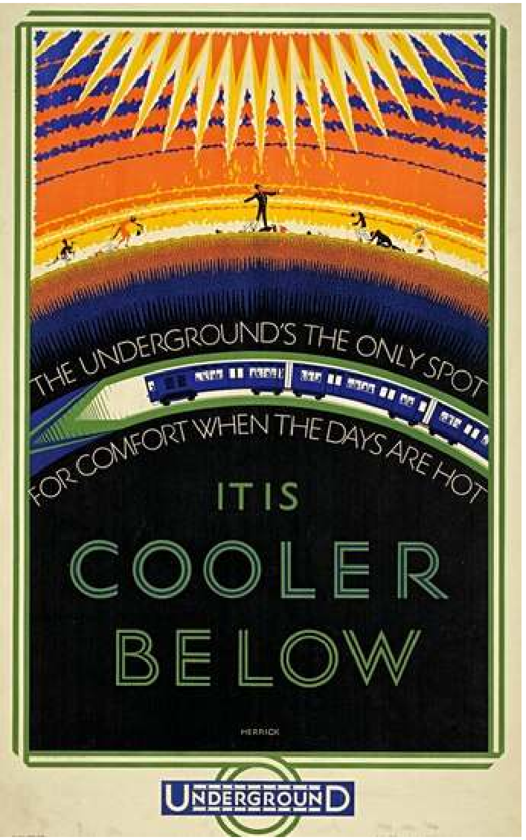
London South Bank
University

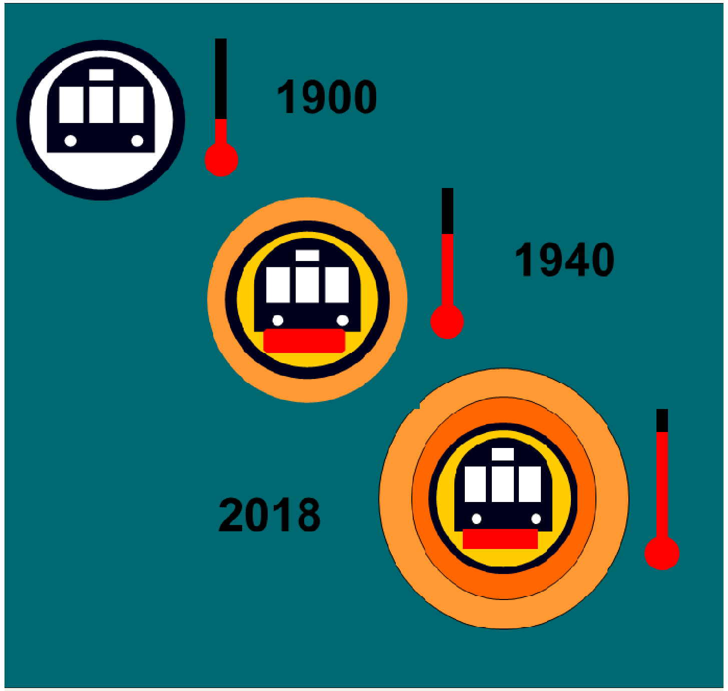
Secondary heat sources

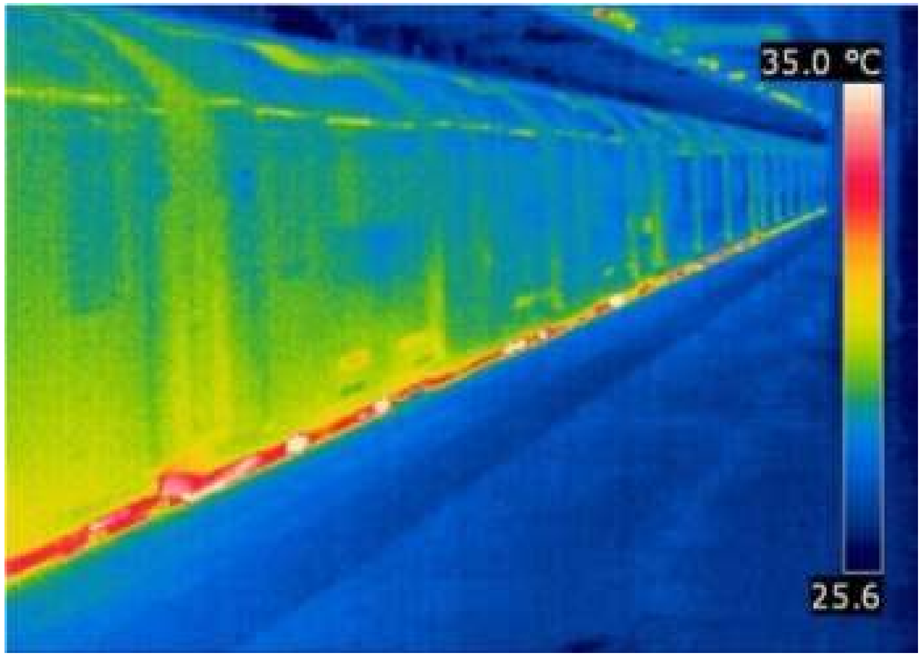
Heat Source		Proximity to heat demand	Available year round	Typical source temperature
Power station rejection		✗	✓	35°C
Buildings		✓	✗	28°C
Industrial heat		✗	✓✓	35-70°C
Underground Railways		✓✓	✓✓	32°C
Electricity substations		✓✓	✓✓	50°C
Sewer heat mining		✓✓	✓✓	14-22°C
Data centres		✓✓	✓✓	35°C
Cable tunnels		✓✓	✓✓	Up to 40°C
Roads / Car parks		✓	✓	25°C

UDERGROUND RAILWAYS

Heat on underground railways

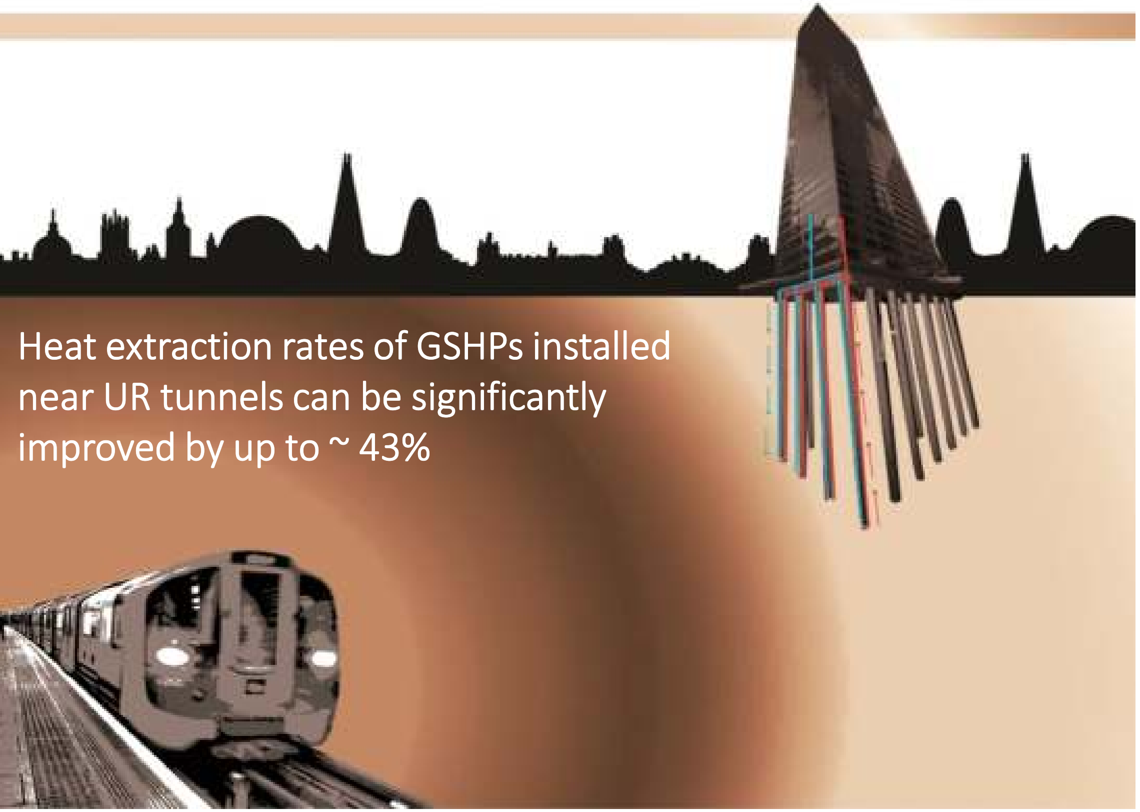


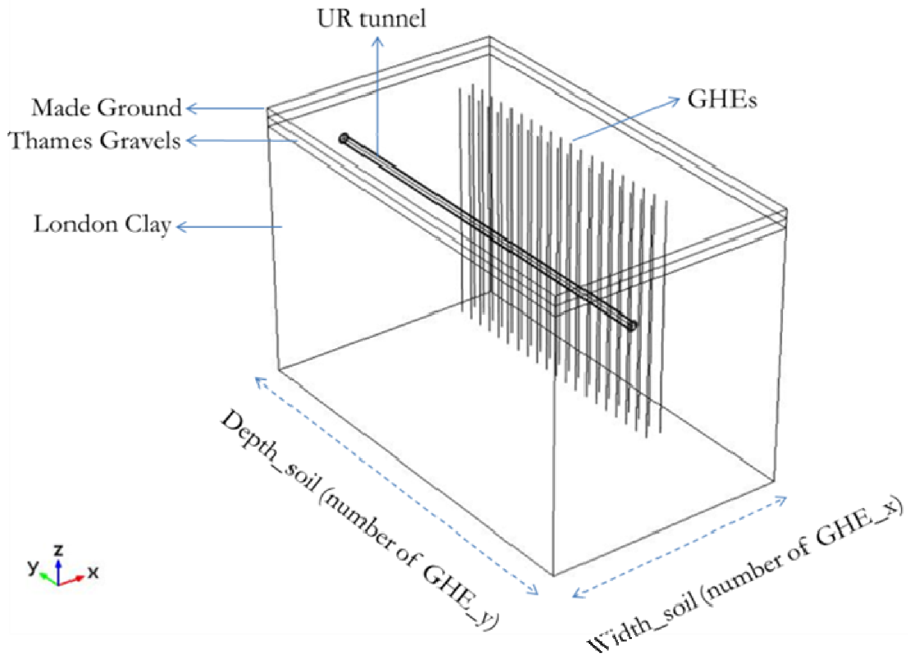




London South Bank University

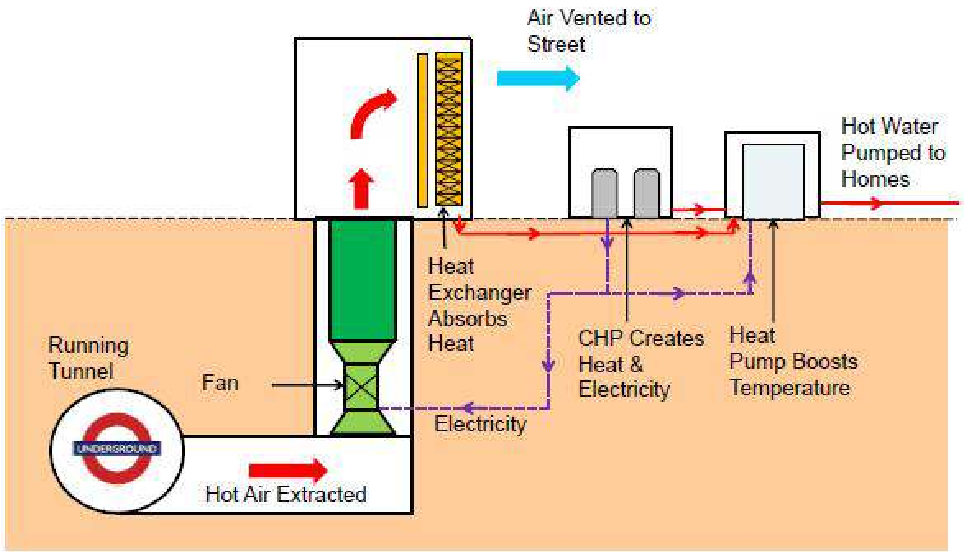
Ground heat exchangers

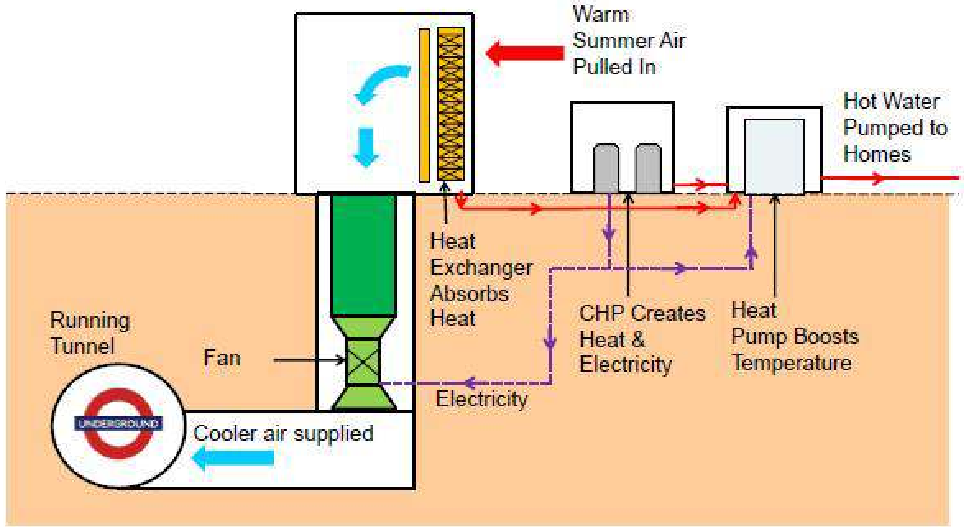




London South Bank University

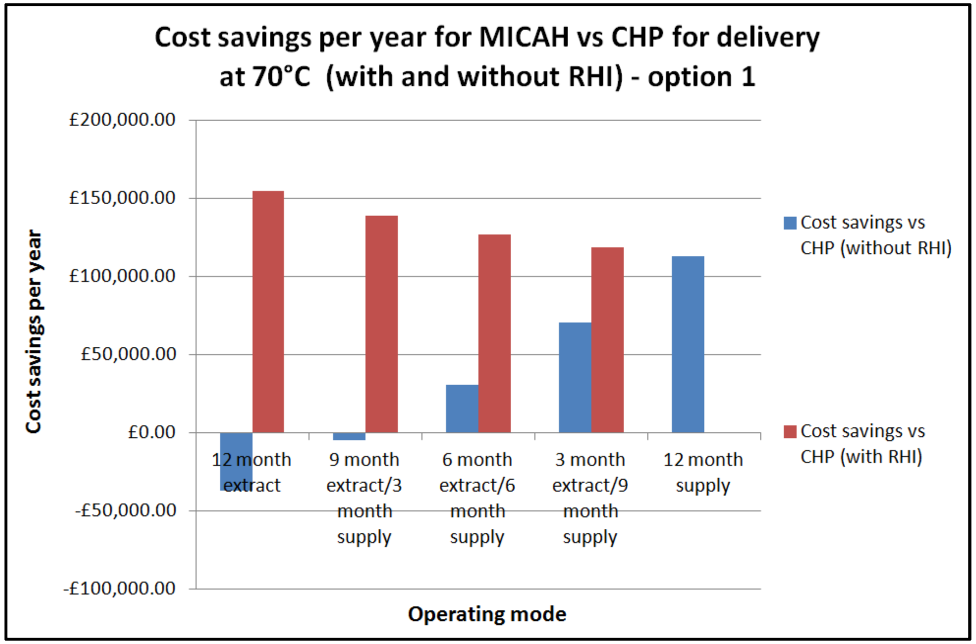
Ventilation shaft waste heat recovery and cooling - MICAH

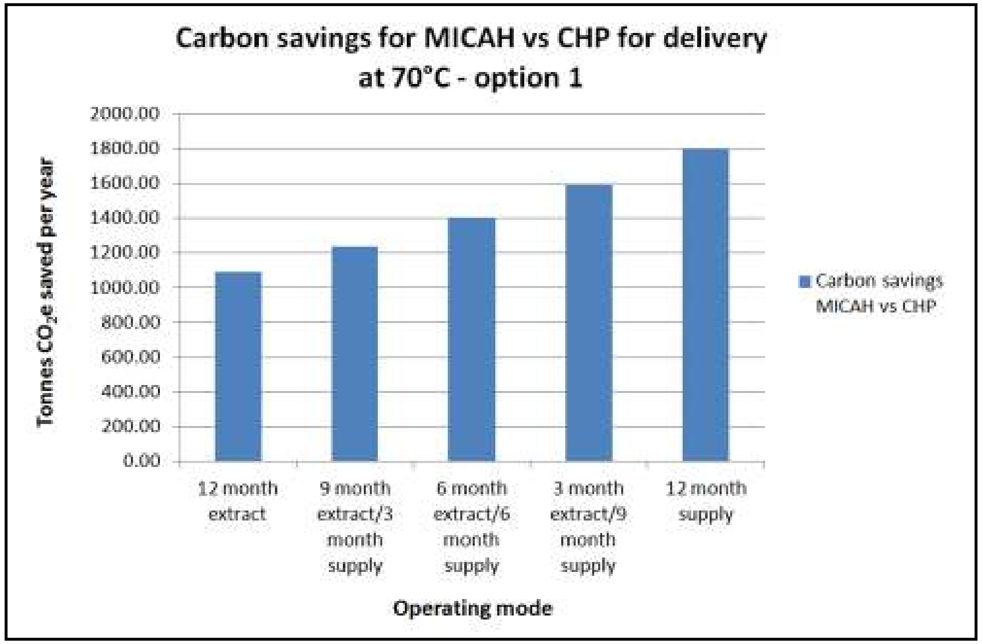




London South Bank
University

Ventilation shaft waste heat recovery and cooling - MICAH





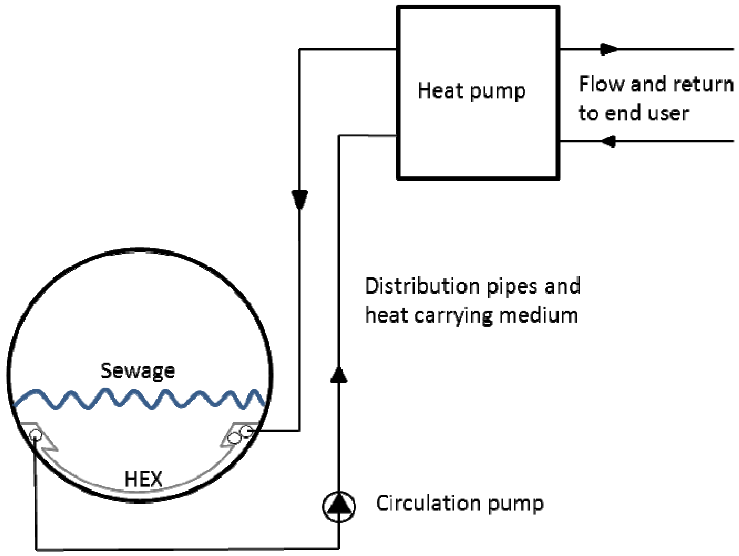
Sewers

Map of interceptor sewers and underground rivers

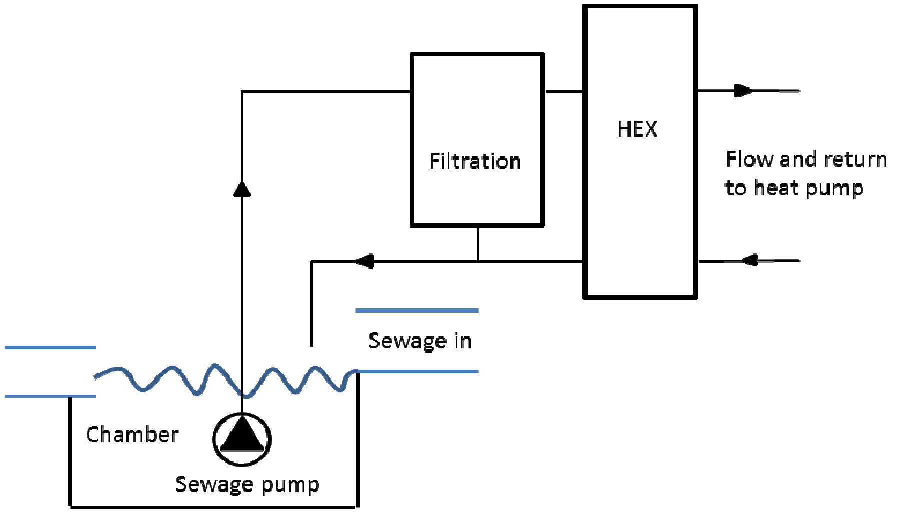
Many hundreds of km
of sewage network in London

London South Bank
University

Waste heat recovery from sewers - options



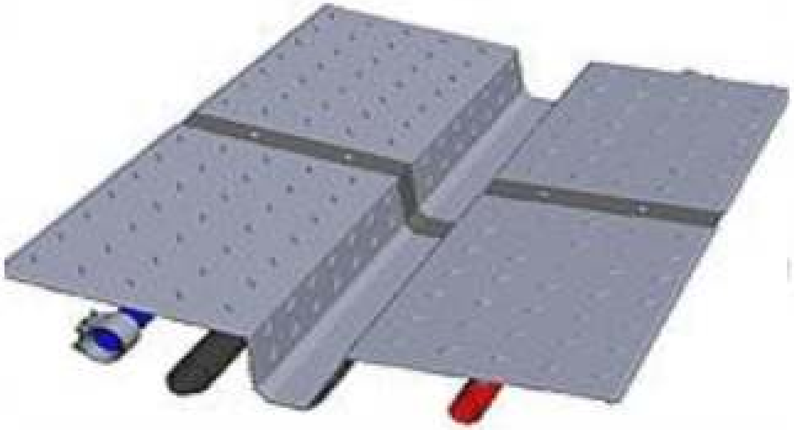
(a) Integrated heat exchangers



(b) External heat exchangers

London South Bank University

Waste heat recovery from sewers – Integrated heat exchangers



"Walk-in channel" heat exchanger

Integrated in the concrete pipe

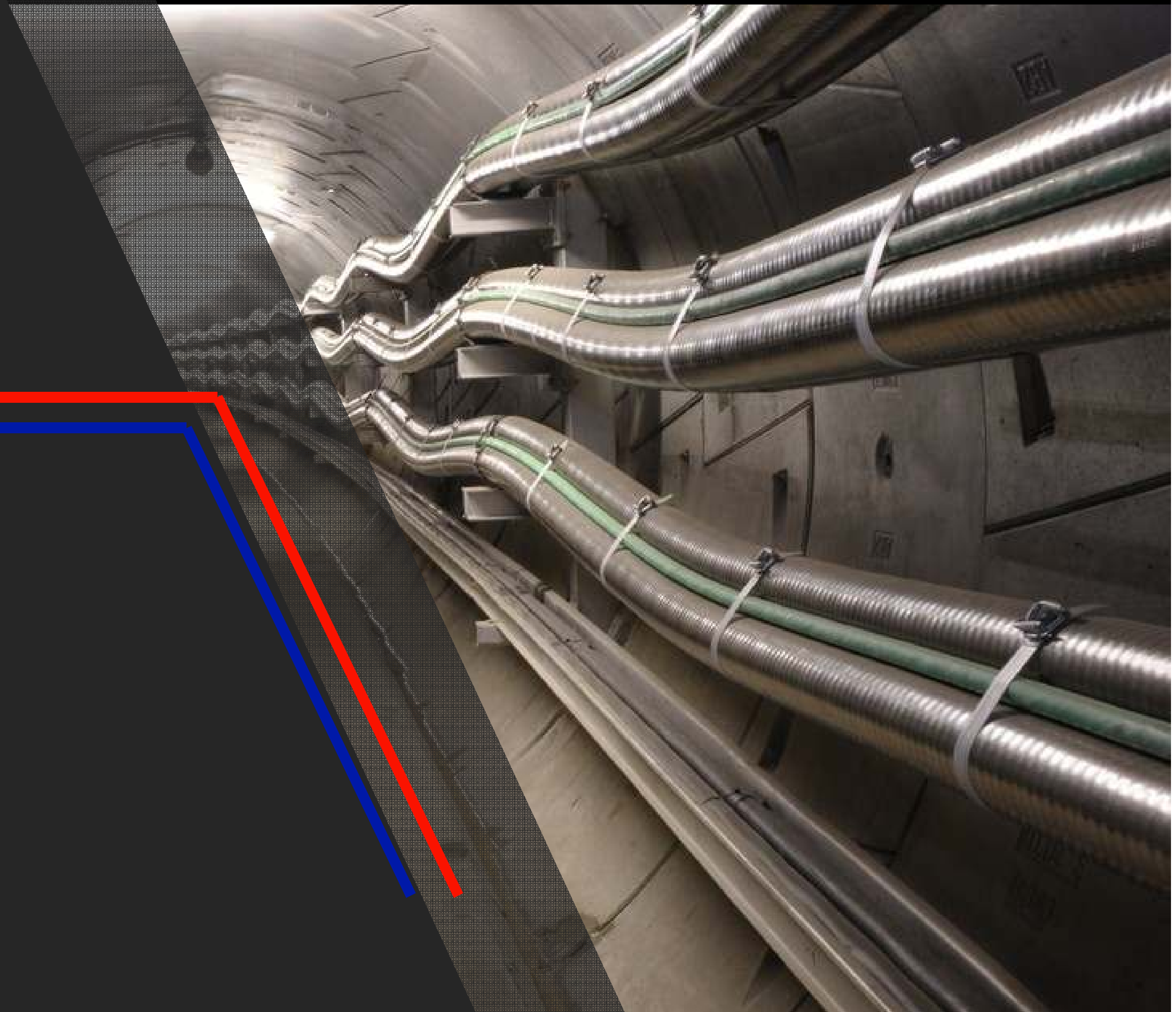
~ 2.5 kW/m² of heat exchanger surface can be achieved

Waste heat recovery from sewers – External heat exchangers

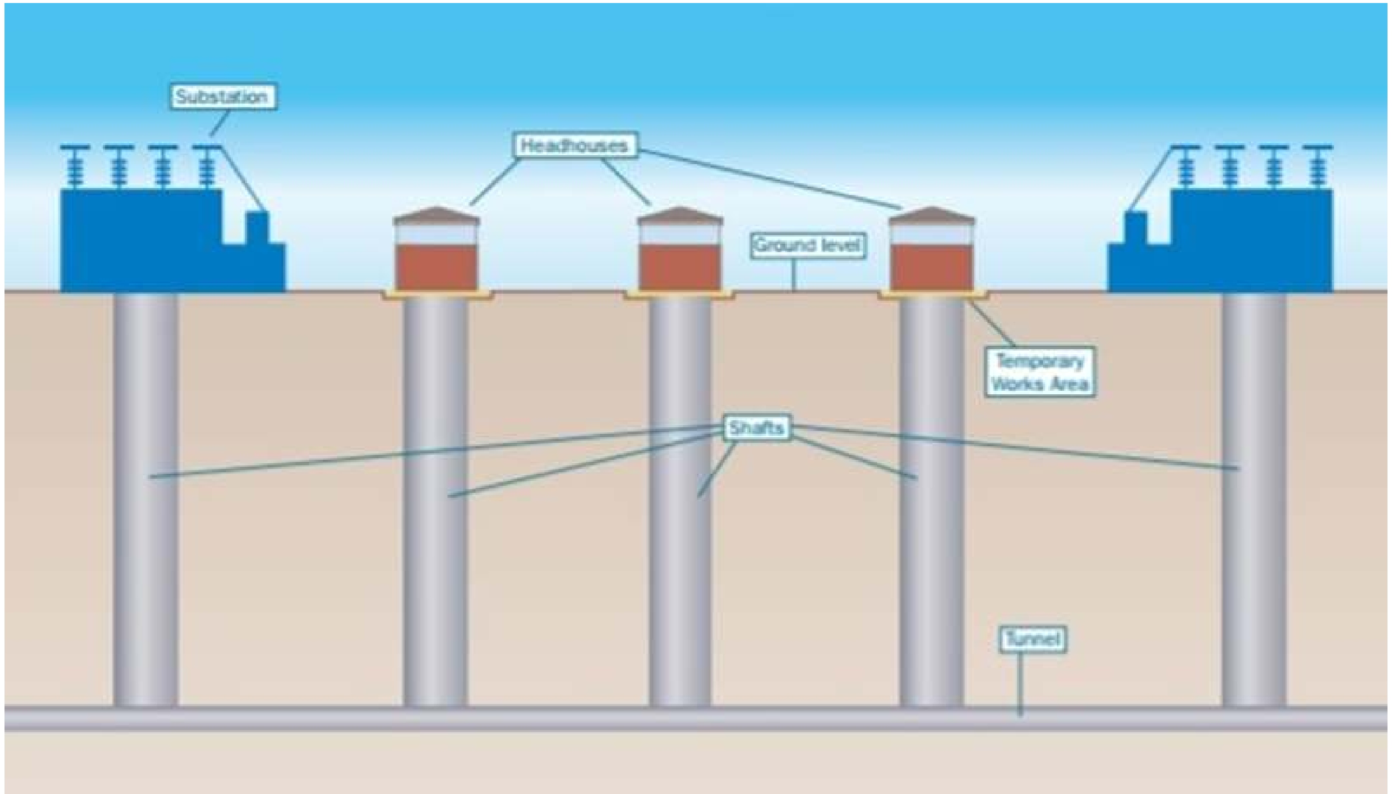
- Scottish Borders Campus in Galashiels
- 400 kW system
- Energy centre houses the heat recovery equipment along with the heat pumps, all associated pipework, vessels and the control systems
- HP CoP~4

London South Bank University

CABLE TUNNELS AND SUBSTATIONS

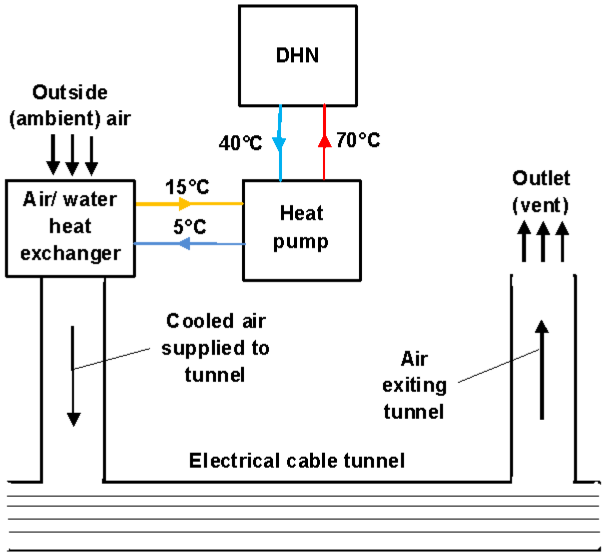


Cable tunnels

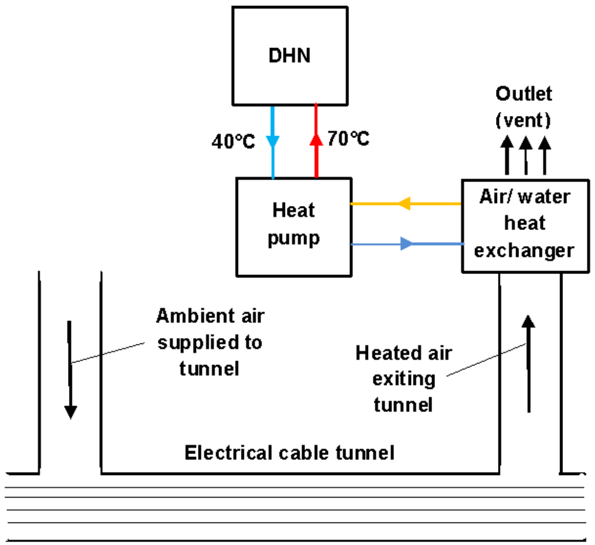


London South Bank
University

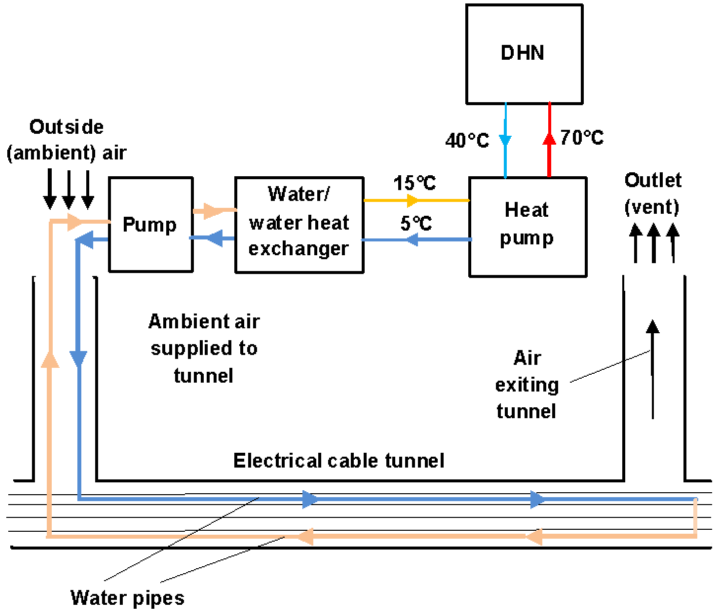
Waste heat recovery from cable tunnels - options



Cooling of air supplied to tunnel with waste heat recovery



Waste heat recovery from air exiting tunnel

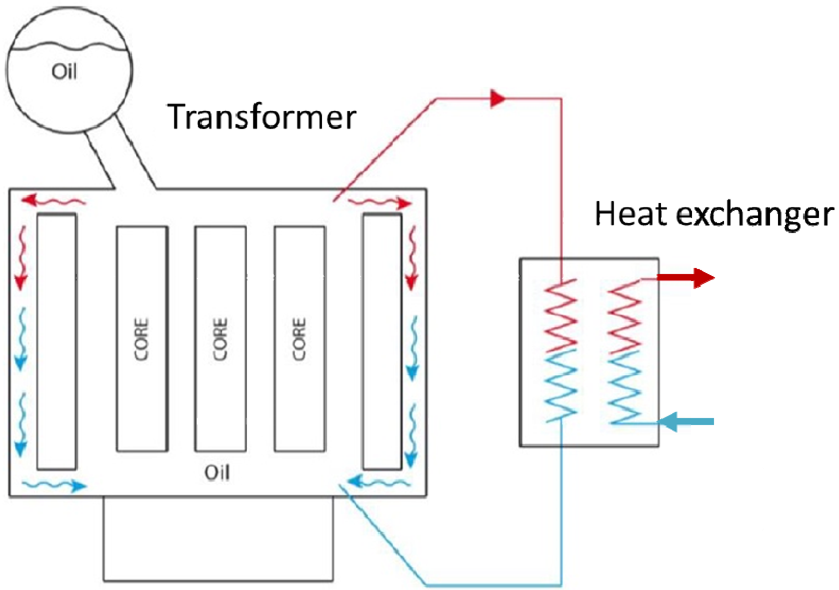


Cooling of air in tunnels using water pipes, with waste heat recovery

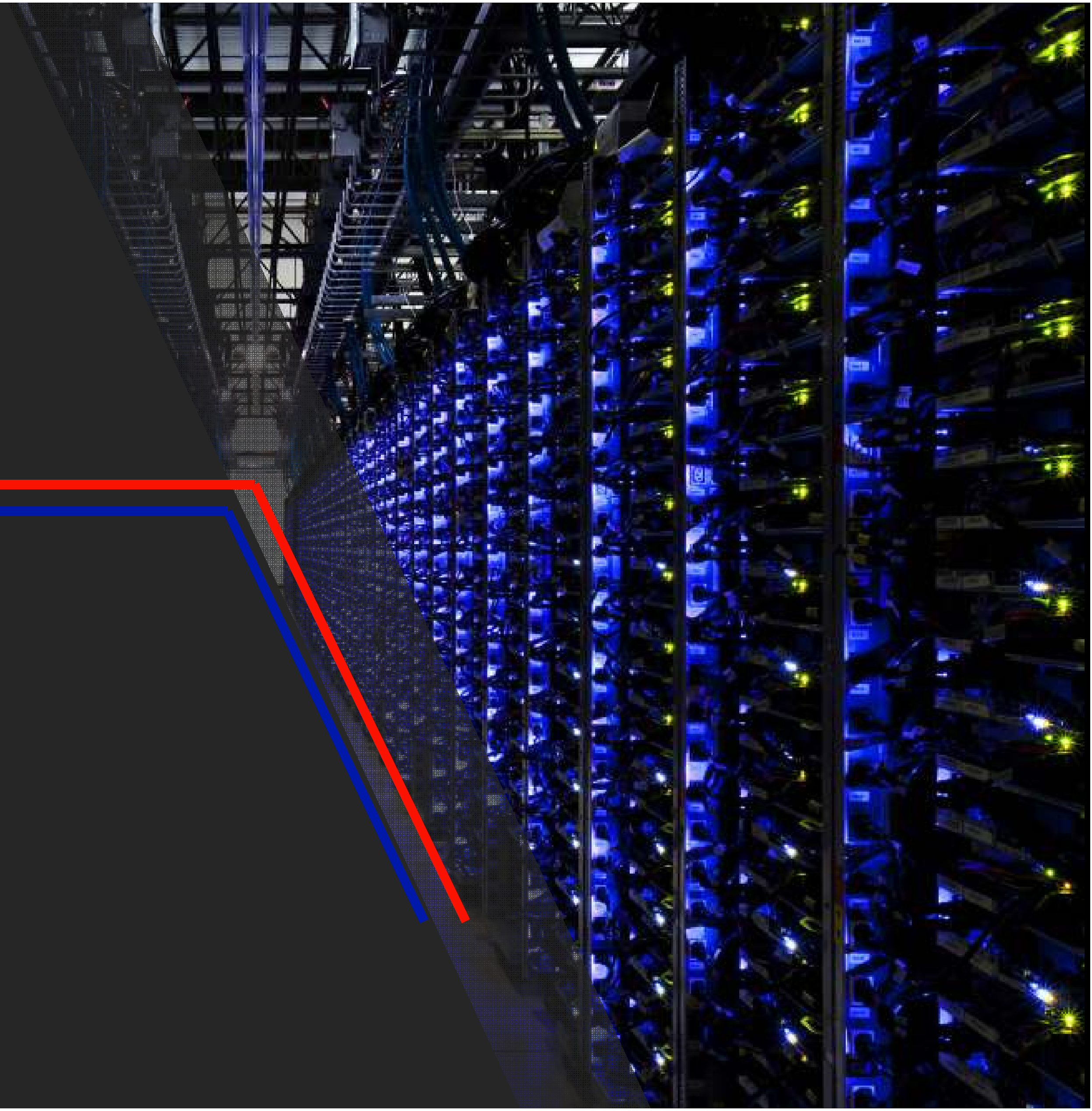
London South Bank University

Waste heat recovery from transformers

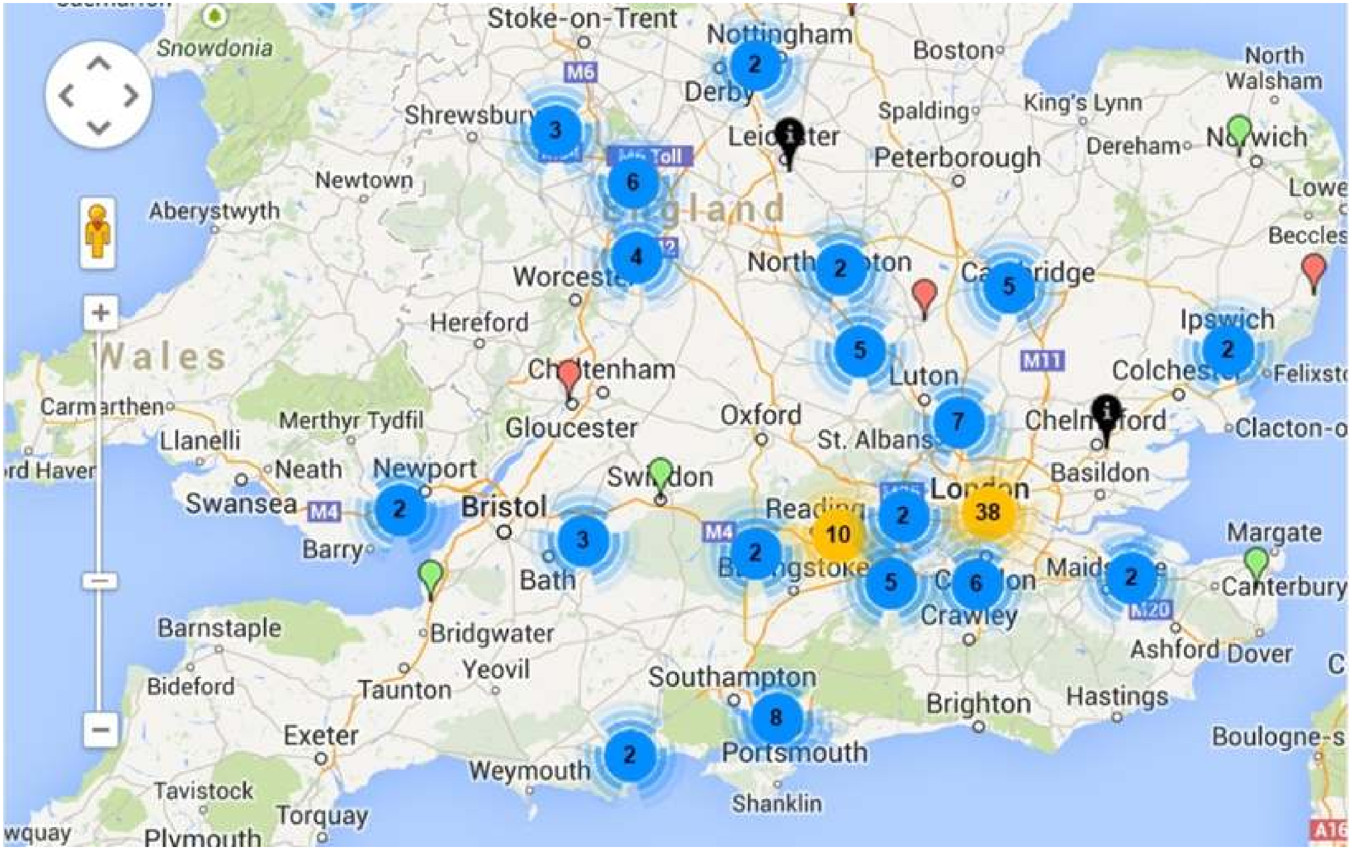
- Tate Modern case study
- UKPN transformer
- 1 MW of waste heat recovery system
- 7000 MWh per year
- Saving 1400 tonnes of CO_2e



DATA CENTRES



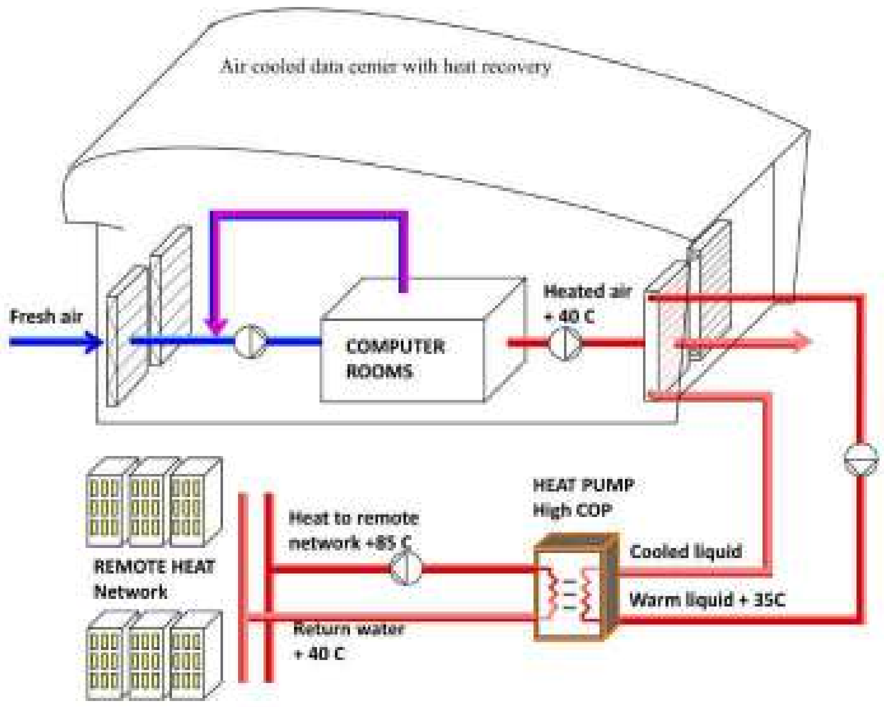
Waste heat recovery from data centres



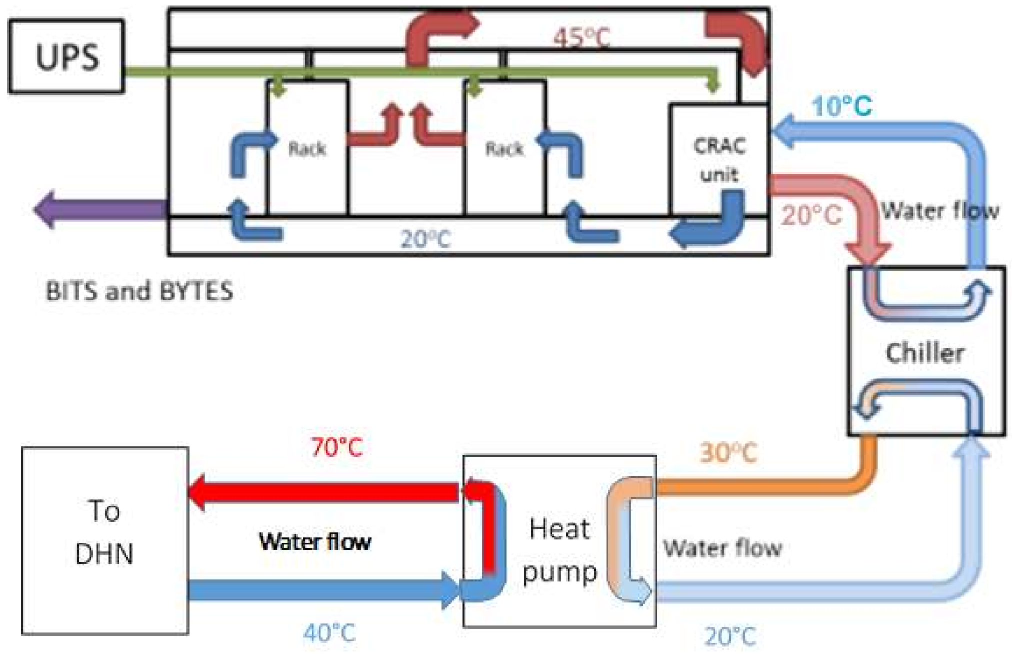
Total heat output of the sector in London is ~ 86 MW

London South Bank
University

Waste heat recovery from data centres - options



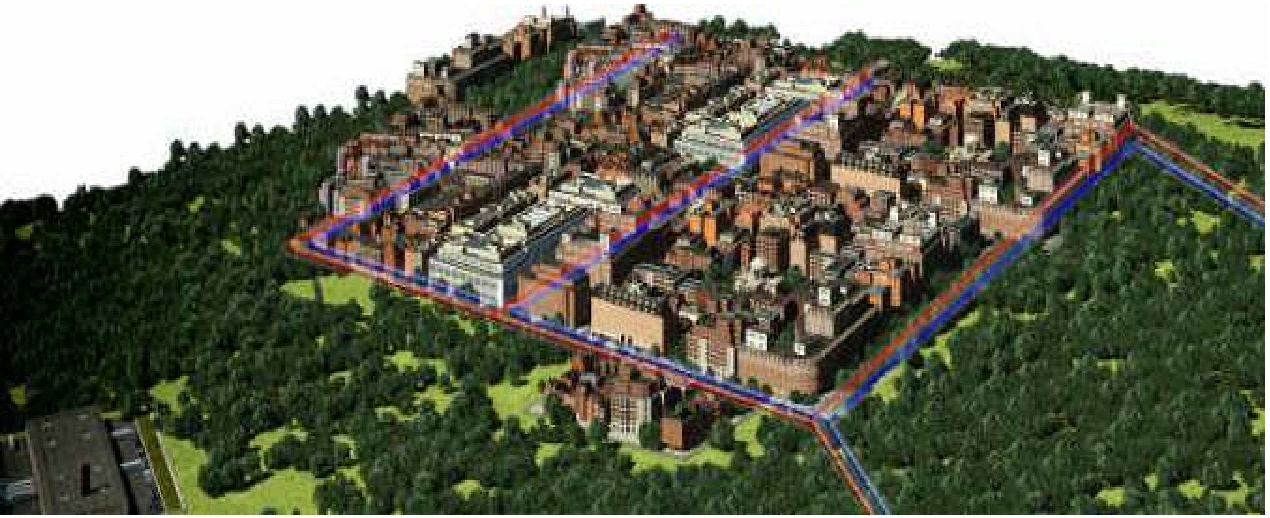
(a) Recovery of heat from air in data centre room



(b) Recovery of heat from chiller condenser

London South Bank University

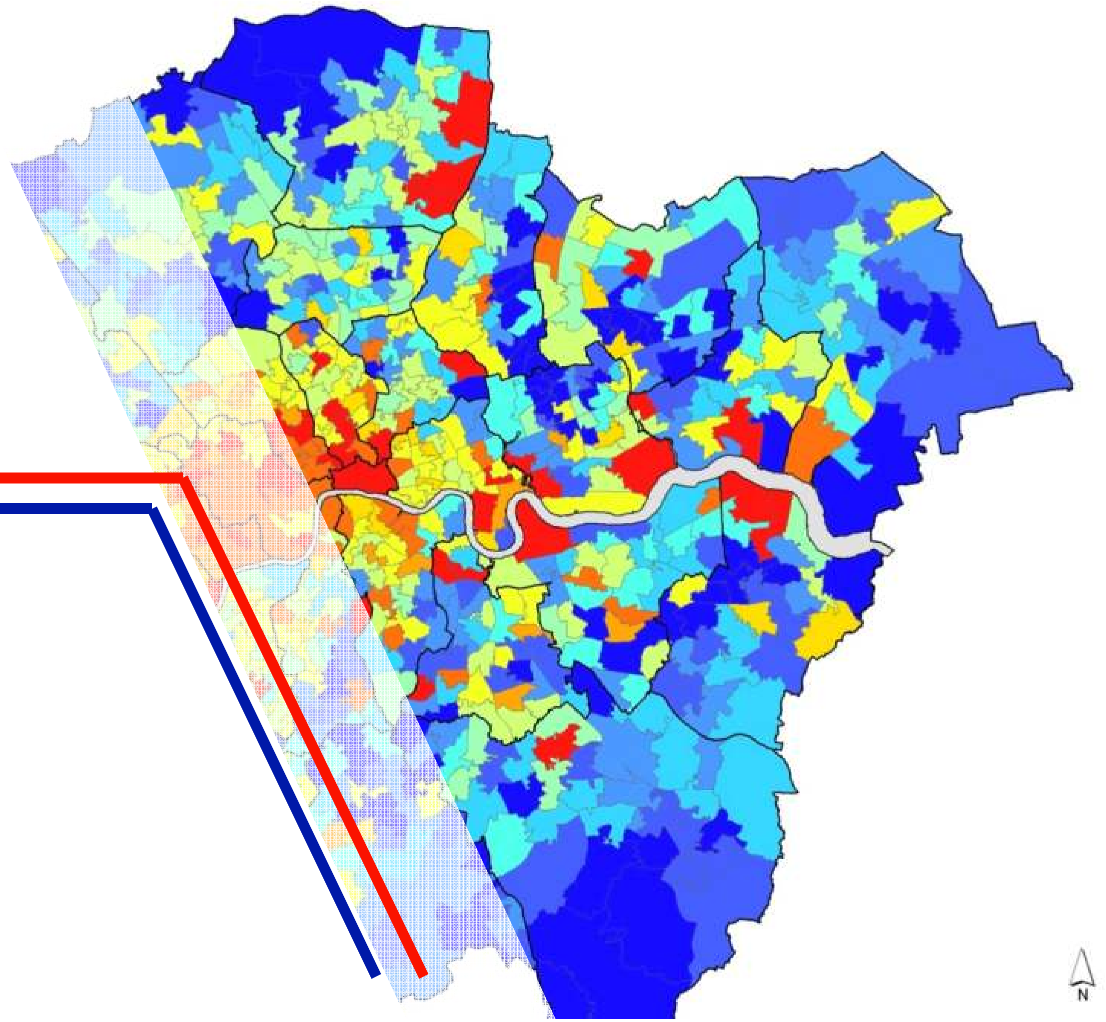
Waste heat recovery from data centres - Example



Mäntsälä, Finland

- Using six heat pumps
- Total capacity 4 MW
- Supply enough heat for 1500 homes

MAPPING OF SECONDARY HEAT SOURCES



EPSRC

London South Bank University

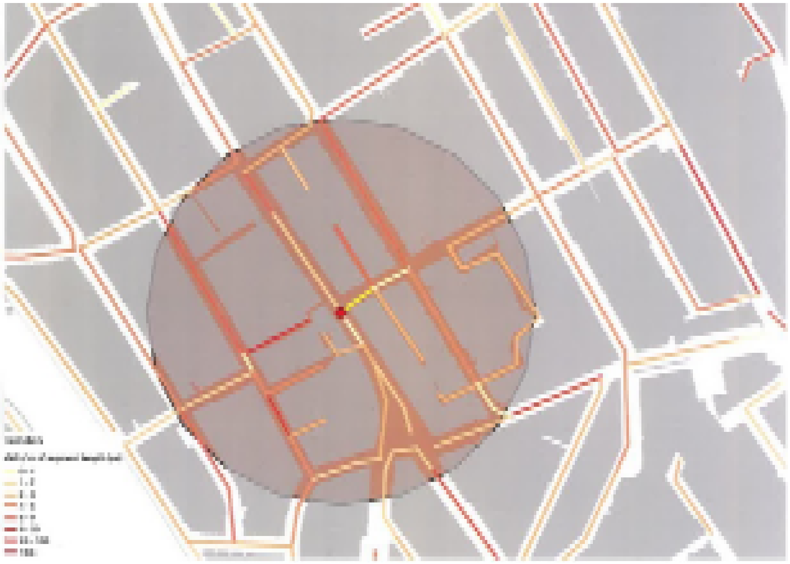
&

UCL

London Urban Sub -Terrain Energy Recovery

London South Bank University

3D Stock Model - UCL



London South Bank University

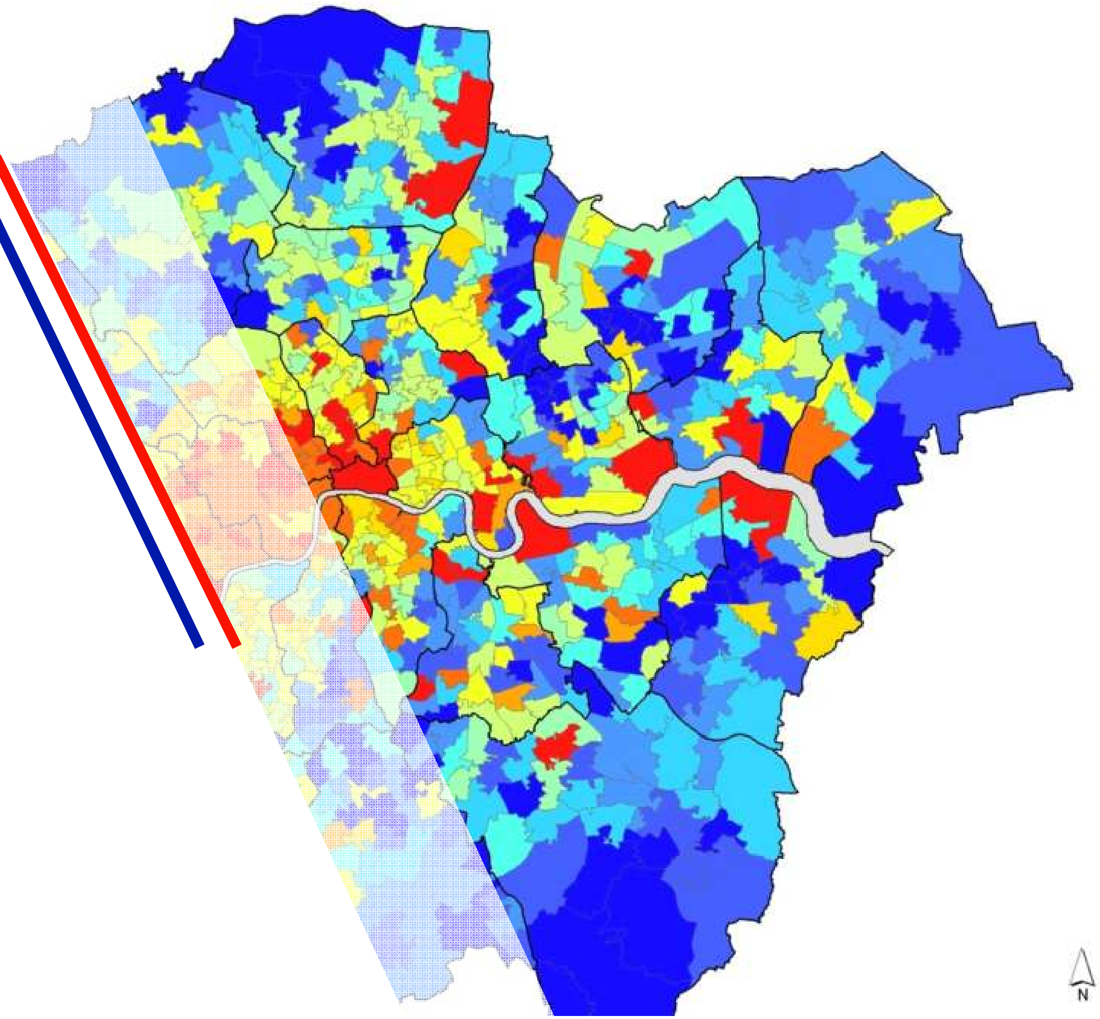
CHALLANGES AND TASKS

- Develop fit for purpose technical solutions
- Optimise complex energy system of multiple renewable and secondary energy sources
- Develop new business models which will allow optimal operation / potential revenue streams
- Disseminate findings and results

London South Bank University

SUMMARY

- Large quantity of secondary heat available in cities
- Already some great examples
- Important to establish new commercial models



London South Bank University

THANK YOU

Akos Revesz
London South Bank University
revesza2@lsbu.ac.uk

London South Bank University