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

HEAT AND THE CITY

Rachel Coxcoon

CSE

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District heating: opportunities for rural authorities

~~Councillor~~ Rachel Coxcoon, ~~Cotswold DC~~
Climate Emergency Support Programme Director
Centre for Sustainable Energy

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Outline

- Introduction to CSE
- Benefits of district heating in rural local authorities
- How rural local authorities can champion district heating (evidence, engagement, policy, finance)
- Consumer protection issues

Who are CSE?

- Established in 1979, CSE is a charity that exists *'to tackle the twin challenges of climate change and fuel poverty.'*

Local and Community Empowerment	Research and Analysis	Household Energy Services
11 staff	12 staff	25 staff

Climate Emergency Strategic Support Programme

(draws on all teams for targeted projects and support to local authorities, town and parish councils)

Who are CSE?

- Established in 1979, CSE is a charity that exists *'to tackle the twin challenges of climate change and fuel poverty.'*

Communities team

- General support for community energy groups
- Dedicated programme for Neighbourhood planning groups
- Social science research into new approaches to tackling barriers to public acceptance of low carbon technologies.

Who are CSE?

- Established in 1979, CSE is a charity that exists *'to tackle the twin challenges of climate change and fuel poverty.'*

Household Energy Services team

- Domestic energy advice
- Home visits, benefits assessments
- Outreach and partnership work with NHS, local authorities etc

Who are CSE?

- Established in 1979, CSE is a charity that exists *'to tackle the twin challenges of climate change and fuel poverty.'*

Research team

- Data analysis
- Modelling (National Household Model, National Heat Map, Thermos)
- Fuel poverty and vulnerability mapping.

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Context for rural local authorities

- Detailed heat networks research to date principally commissioned by urban authorities
- More than 350 local authorities, and town and parish councils have made a climate emergency declaration since November 2018.
- All councils who've made a declaration quickly waking up to the need to decarbonise heat.
- Need to avoid obsessing only about new build!

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Opportunities for DH in rural areas

- Whole settlements off-gas
- Socio-cultural barriers are lower – good ‘fit’
- Less crowded utility space and more soft dig
- Local feedstocks and direct employment/ economy links
- DH often preferable to individual ASHP where heritage and visual impacts a consideration

Rural Local Authorities as DH champions

EVIDENCE AND DATA

- Heat decarbonisation studies at the district/borough level
- High level ranking of most economically viable –working with interested parishes (ff)
- Linking demand and supply – biomass production assessment, ALC mapping etc
- Land ownership research via properties team

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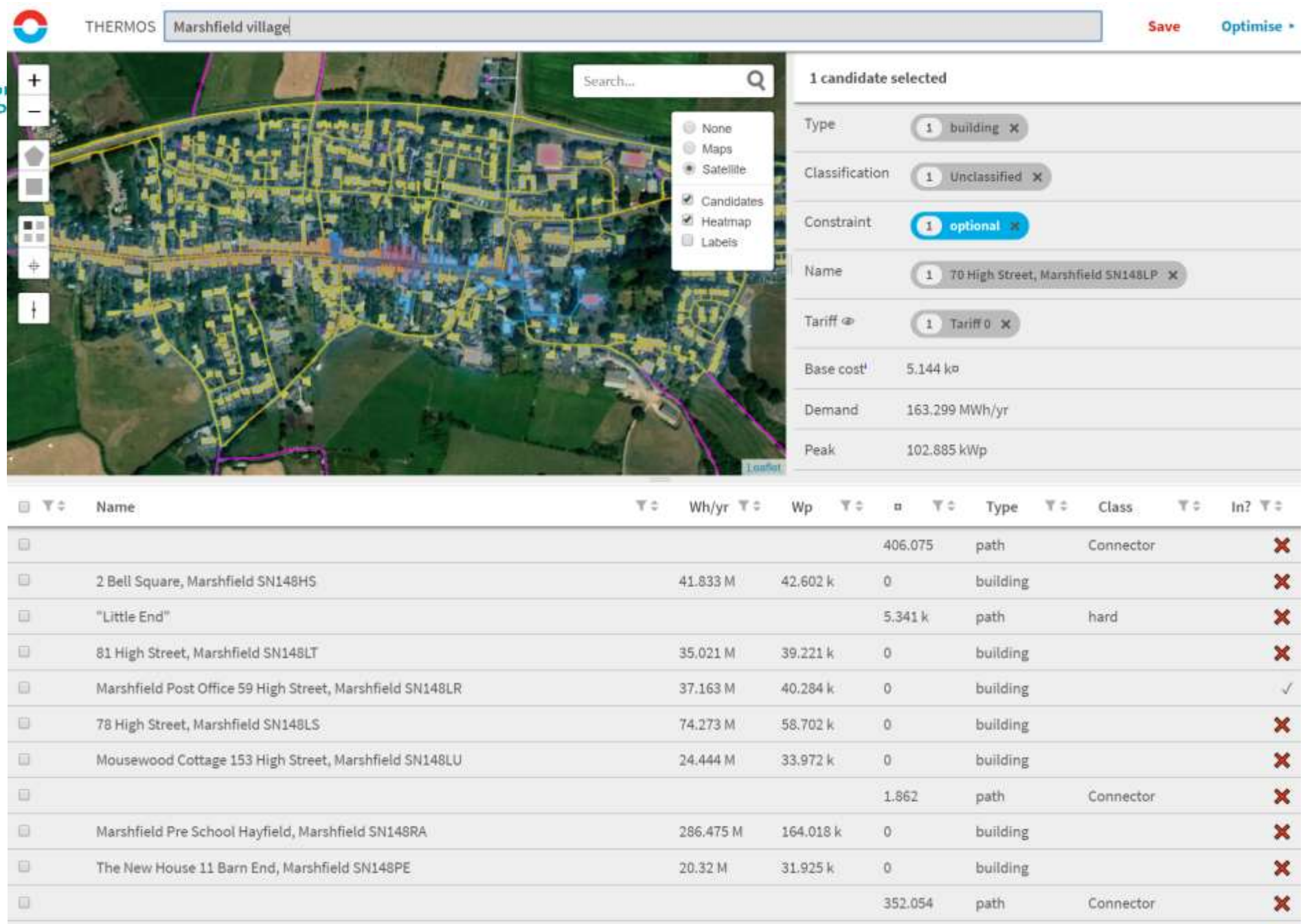

Name	Wh/yr	Wp	¤	Type	Class	In?
			406.075	path	Connector	✗
2 Bell Square, Marshfield SN148HS	41.833 M	42.602 k	0	building		✗
"Little End"			5.341 k	path	hard	✗
81 High Street, Marshfield SN148LT	35.021 M	39.221 k	0	building		✗
Marshfield Post Office 59 High Street, Marshfield SN148LR	37.163 M	40.284 k	0	building		✓
78 High Street, Marshfield SN148LS	74.273 M	58.702 k	0	building		✗
Mousewood Cottage 153 High Street, Marshfield SN148LU	24.444 M	33.972 k	0	building		✗
			1.862	path	Connector	✗
Marshfield Pre School Hayfield, Marshfield SN148RA	286.475 M	164.018 k	0	building		✗
The New House 11 Barn End, Marshfield SN148PE	20.32 M	31.925 k	0	building		✗
			352.054	path	Connector	✗

THERMOS whole village district heating analysis

Rural Local Authorities as DH champions

ENGAGEMENT AND FACILITATION

- Outreach and awareness raising – most successful DH projects have a public sector leader at the centre
- Can’t be done from behind a desk, and best done as part of a bigger conversation about energy strategies at the local level.

Future Energy Landscapes: CSE/CPRE

Rural Local Authorities as DH champions

PLANNING POLICY

- Local Plan policies (and use of SPD where plans already adopted). Vital for new build.
- Training and support for DM staff to challenge developers on proposals
- Use evidence to identify heat priority areas and/or development archetypes
- Clear planning policy also needed on DH installations to existing buildings, to avoid unnecessary barriers
- Beware the current consultation on Building Regs…

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Policy text

Proposals for the utilisation, distribution and development of new renewable energy capacity, including large-scale freestanding installations, will be encouraged.

In assessing such proposals the environmental and economic benefits of the proposed development will be afforded significant weight alongside considerations of public health and safety and impacts on biodiversity, landscape character, the historic environment and the residential amenity of the surrounding area.

Positive encouragement…

…clearly indicating that significant weight is given

DM officers must be trained to interrogate and challenge developer submissions. External support may be needed.

Heating and Cooling Systems

New development will be expected to demonstrate through its Energy Strategy that the most sustainable heating and cooling systems have been selected. This should include consideration of the proposed system as a whole, including the impact of its component materials on greenhouse gas emissions.

New development will be expected to demonstrate that heating systems have been selected in accordance with the following approach:

- Where possible, connection to an existing classified heat network or a new classified heat network from the point of occupation;
- Where it is likely that existing or proposed heat networks will grow, designing development with a communal heating system which could connect in the future;
- Elsewhere, employing sustainable alternatives to heat networks such as individual renewable heat or communal renewable/low-carbon heat.

Bath & North East Somerset Council

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A-Z | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z

Login

- Planning and Building Control
- Planning Policy
- Supplementary Planning Documents (SPDs) and other useful guidance
  - Bath City-Wide Character Appraisal SPD
  - Existing Dwellings in the Green Belt SPD
  - Planning Obligations SPD
  - Priston Village Design Statement
  - Sustainable Construction and Climate Change: Planning Documents

Home » Services » Planning and building control » Planning policy » Supplementary planning documents spds » Sustainable Construction and Climate Change: Planning Documents

Sustainable Construction and Climate Change: Planning Documents

Policy and Guidance Documents

Contents

1. **Sustainable Construction Checklist Supplementary Planning Document (SPD) to be submitted as part of all proposals within the scope in order to register an application**

Supporting documents:

2. Sustainable Construction Checklist SPD: Heat Networks Guidance Note to reference if the proposal is in a Heat Network Priority or Opportunity area

3. Sustainable Construction and Retrofitting Supplementary Planning Document (SPD) to review for locally-specific guidance on measures to meet the requirements of the Checklist SPD

4. Energy Efficiency & Renewable Energy for Listed Buildings and Undesignated Historic Buildings to review if the application is on a historic building

5. Informal Guidance Note: Renewable Energy in the Green Belt in Bath & North East Somerset for free-standing renewable energy applications

6. Sustainable Construction Policy: Evidence documents Background information; the evidence upon which policies are based and some case studies

Tackling climate change is a key priority for Bath and North East Somerset Council, and it is recognised that buildings which minimise carbon emissions and are resilient to the future climate can also provide greater occupant comfort and lower energy costs.

The adopted Placemaking Plan has a cross cutting objective to pursue a low carbon and sustainable future. A suite of policies to implement this objective can be found in the "Responding to Climate Change" section. **Applicants are advised to review the Placemaking Plan Climate Change policies in full since other policies may also apply to their application.** The documents below support applicants in meeting (and ideally exceeding) the planning requirements set out in this section of the Placemaking Plan.

Last updated: 9th November 2018

Services in Your Area

Post code
Post Code / Street N
Search
Find local information where you live

Events Listings

« November 2019 »

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

View all events | Council meetings

More like this

- Supplementary Planning Documents (SPDs) and other useful guidance
- Policies, Plans & Partnerships
- Index of Planning Policy Web-pages

Links

Sustainable Construction

https://www.bathnes.gov.uk/services/planning-and-building-control/planning-policy/supplementary-planning-documents-spds/sustain

Rural Local Authorities as DH champions

FINANCE

- Rural district heating well suited to community energy governance and finance structures (CIC, Registered Society, Community Shares)
- Local Authorities can support community DH via:
  - Signposting to risk funding (e.g. RCEF, £40k early feasibility, £100k detailed planning)
  - Aggregating projects for investment (e.g. Abundance Community Municipal Bond)
  - Joint investments with town/parish councils (PC precept rises are not capped)
  - Supporting non-profit service delivery via the General Power of Competence

Final word - consumer protection

- District heating is a largely unregulated market, CMA proposed regulation via Ofgem in 2018 (but nothing doing yet?)
- Where Local Authorities demand DH with *carbon reduction* as principal driver, consumers *may* end up paying more. How to ■ that ● ?
- The Heat Trust (heattrust.org). Voluntary, stakeholder-led industry scheme on best practice.

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Thank you

rachel.coxcoon@cse.org.uk

www.cse.org.uk | @cse_Bristol | @RachelCoxcoon

HEAT AND THE CITY

Jon Selman

Plymouth City Council

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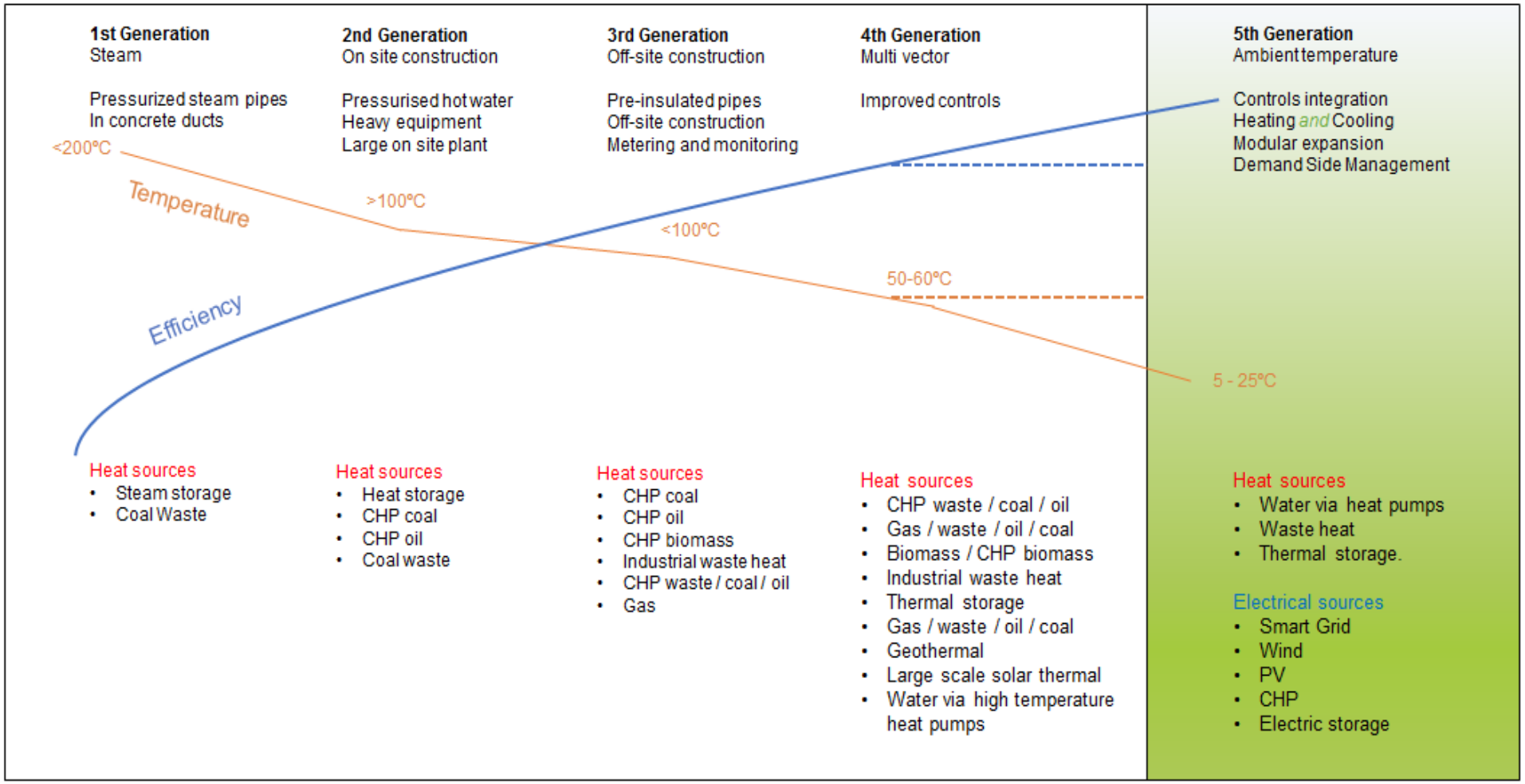
Developing 4th & 5th Generation District Heating within the UK

HeatNet NWE project

Interreg North-West Europe
HeatNet NWE
European Regional Development Fund

The overall objective of HEATNET NWE is to introduce and demonstrate the 4th generation DHC (4DHC) in NWE. The concept requires the development of new institutional and organizational frameworks.
The project will result in 15,000 t CO_2e saved per annum at its end.

District heating evolution



Heat network trends to lower distribution temperatures and higher efficiency

4th or 5th Generation District Energy?

4th Generation DHC

- Traditional centralised topology with energy centre(s) supplying heat.

- Supplying at around 55-45ºC and return temperatures at @ 25-15ºC

- Highly insulated, pre-insulated pipework that is more likely to be plastic.

- Usually needs supplementary boosting to supply DHW, and cooling would be a separate system.

5th Generation DHC

- Non-traditional topology with decentralised plant (usually heat pumps).

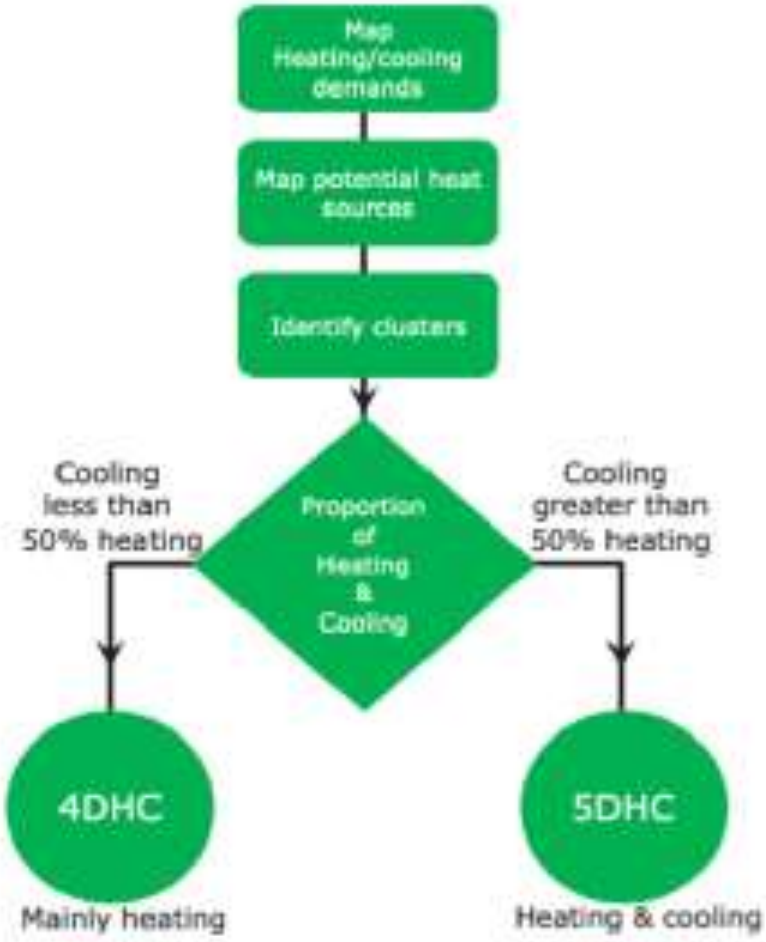
- Ultra-low temperature headers in a spine/backbone. 5DHC often consists of un-insulated plastic pipework.

- Supply at <45ºC, with return temperatures around 25-15ºC.

- Usually includes seasonal thermal storage.

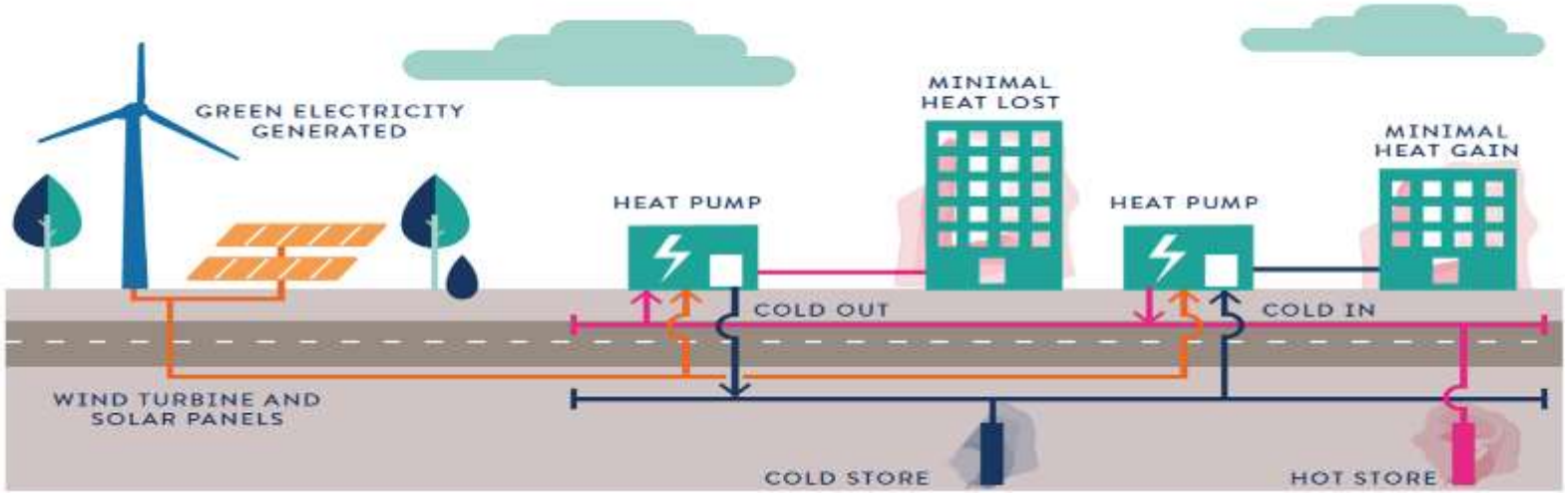
- Needs supplementary boosting to supply DHW temperatures.

- Built-in cooling supply and can interchange heating/cooling between buildings.



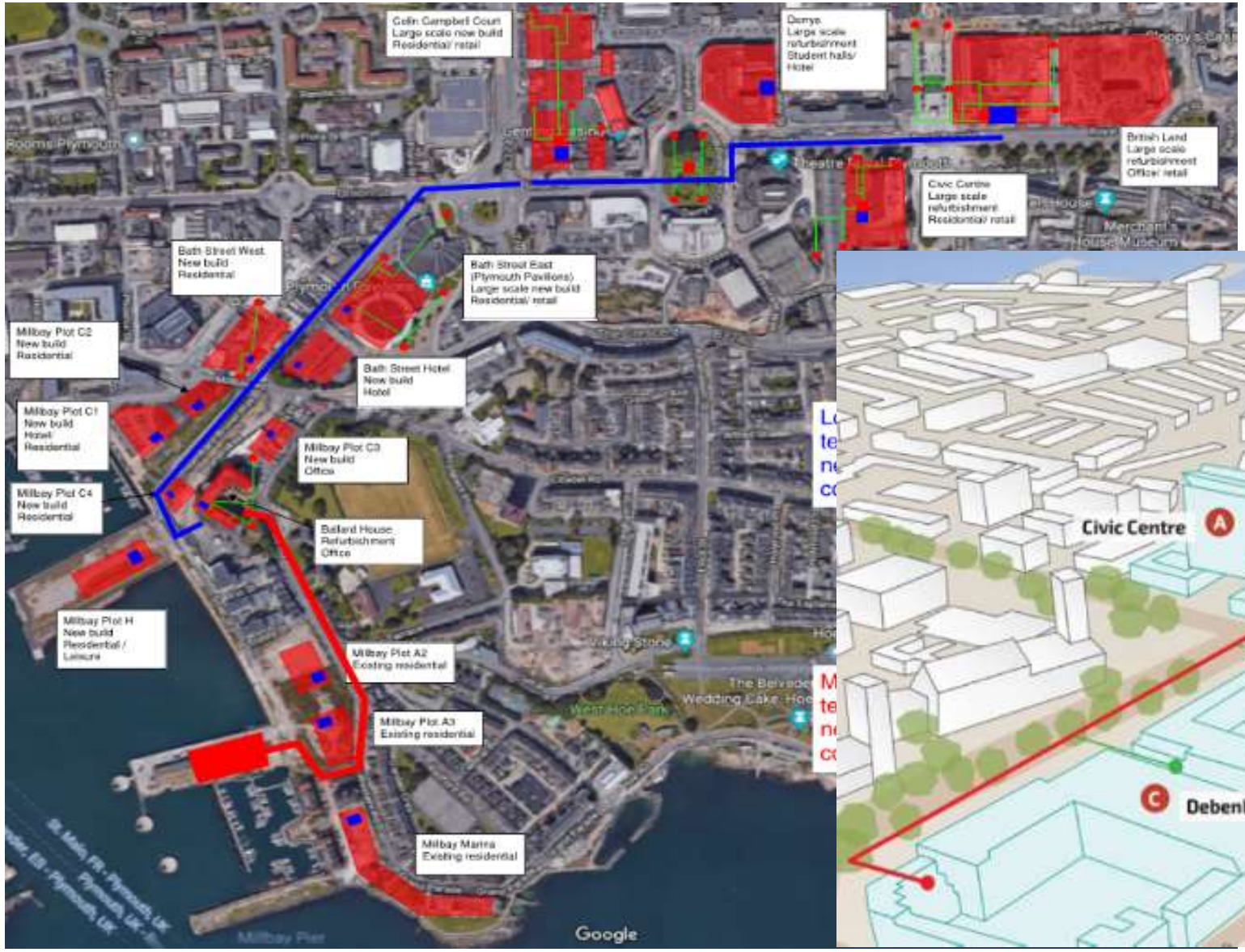
5th Generation - Benefits

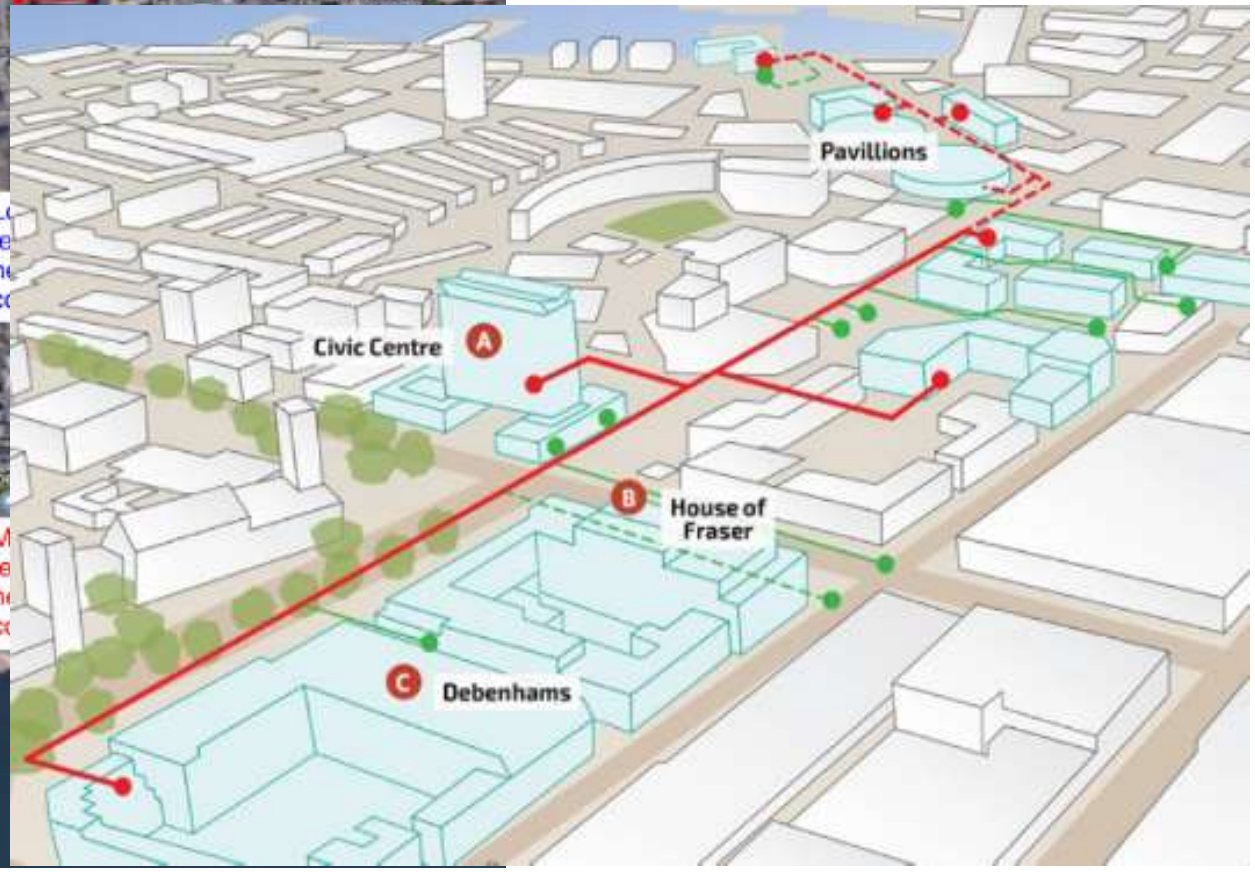
- Resilient to climate change- cooling and heating
- Rejected energy recovered and shared, reducing primary energy
- Helps buildings achieve future compliance
- No flues or emissions- air quality benefits
- Flexible- plug and play (decentralised)
- Allows greater use of renewable energy and waste heat sources
- Opportunity to offer ‘grid services’ to electricity network



Plymouth Pilot

Interreg North-West Europe
HeatNet NWE
European Regional Development Fund



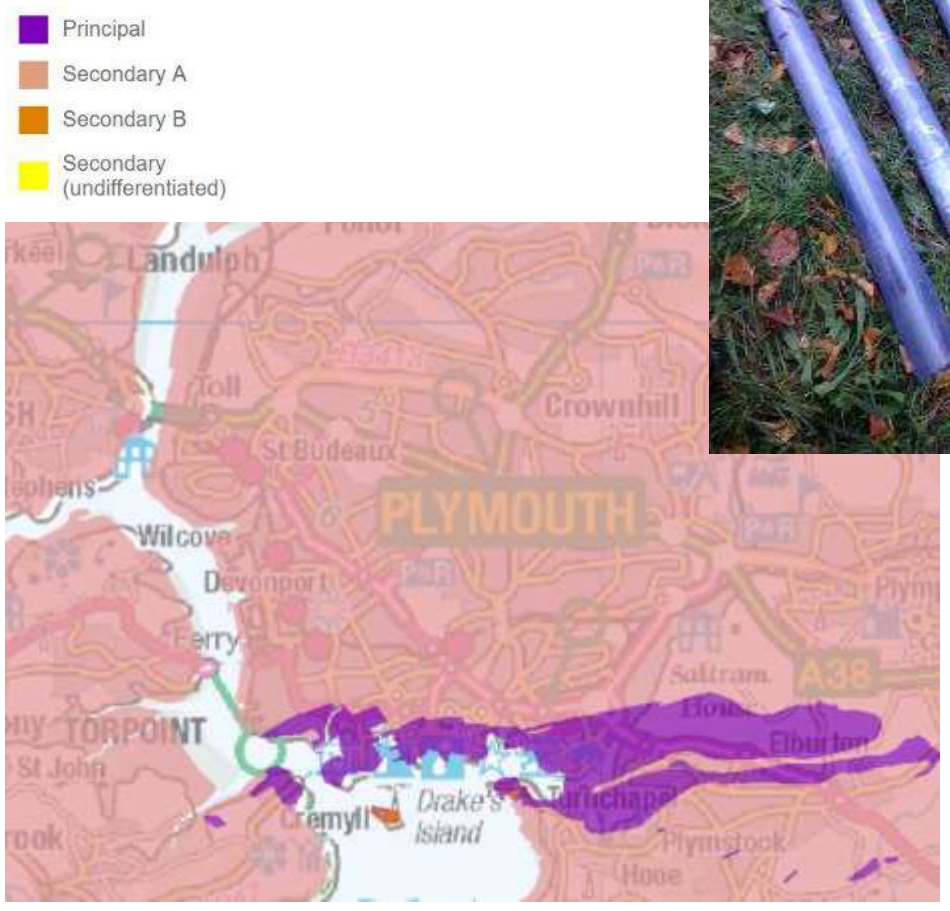


Plymouth Pilot

Interreg North-West Europe HeatNet NWE

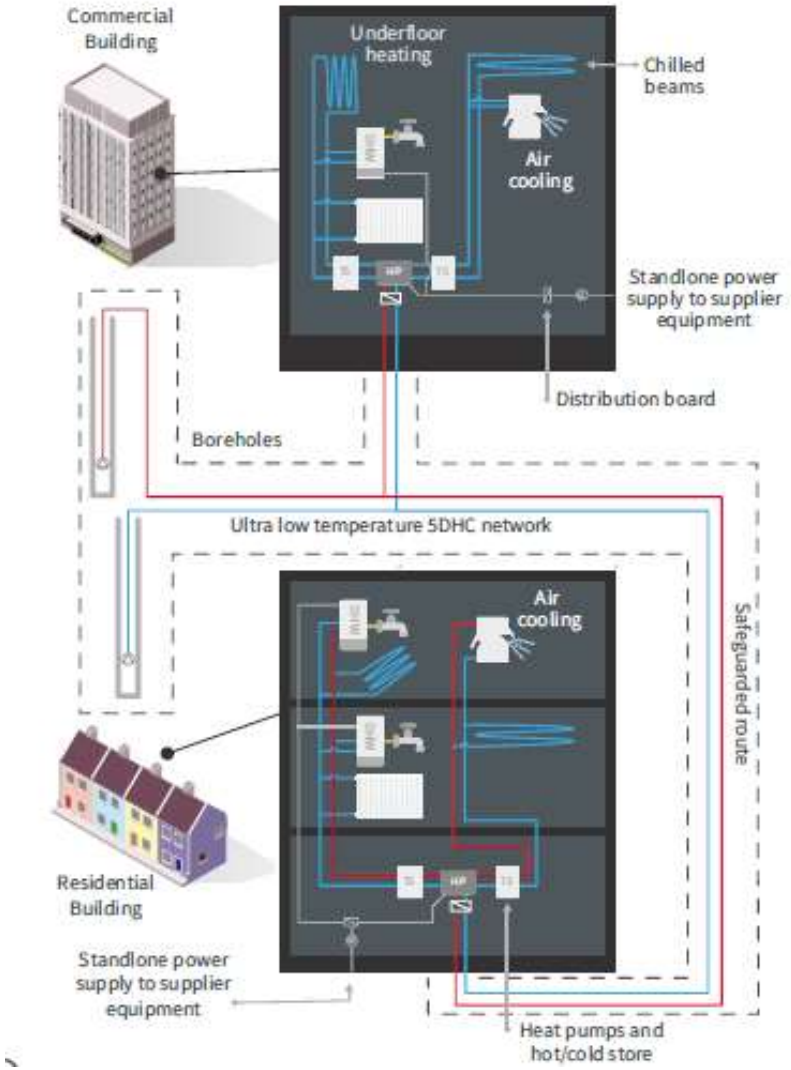
European Regional Development Fund

Aquifer Bedrock



Plymouth Pilot

Interreg North-West Europe
HeatNet NWE
European Regional Development Fund



Q&A

Any questions?

Jonathan Selman
Low Carbon City Officer /Plymouth County Council
Jonathan.Selman@plymouth.gov.uk

Interreg

EUROPEAN UNION

North-West Europe

HeatNet NWE

European Regional Development Fund

Thank you!

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Tony Norton, Howard Smith & Andy Wood

Exeter and East Devon

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Local perspectives – the power of planning? Exeter's journey - so far

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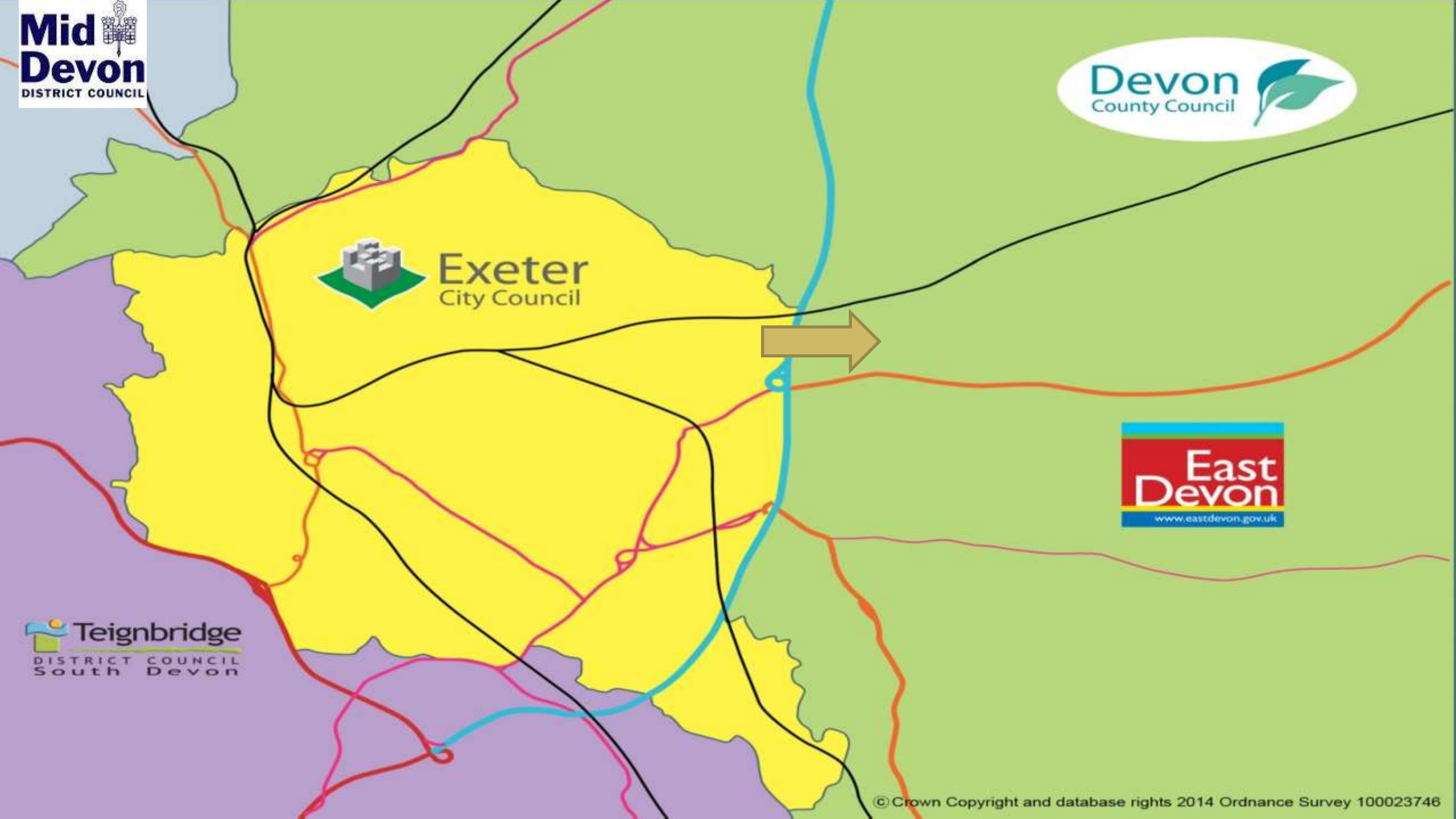
Mid Devon
DISTRICT COUNCIL
Devon
County Council
Exeter
City Council
East Devon
www.eastdevon.gov.uk
Teignbridge
DISTRICT COUNCIL
South Devon
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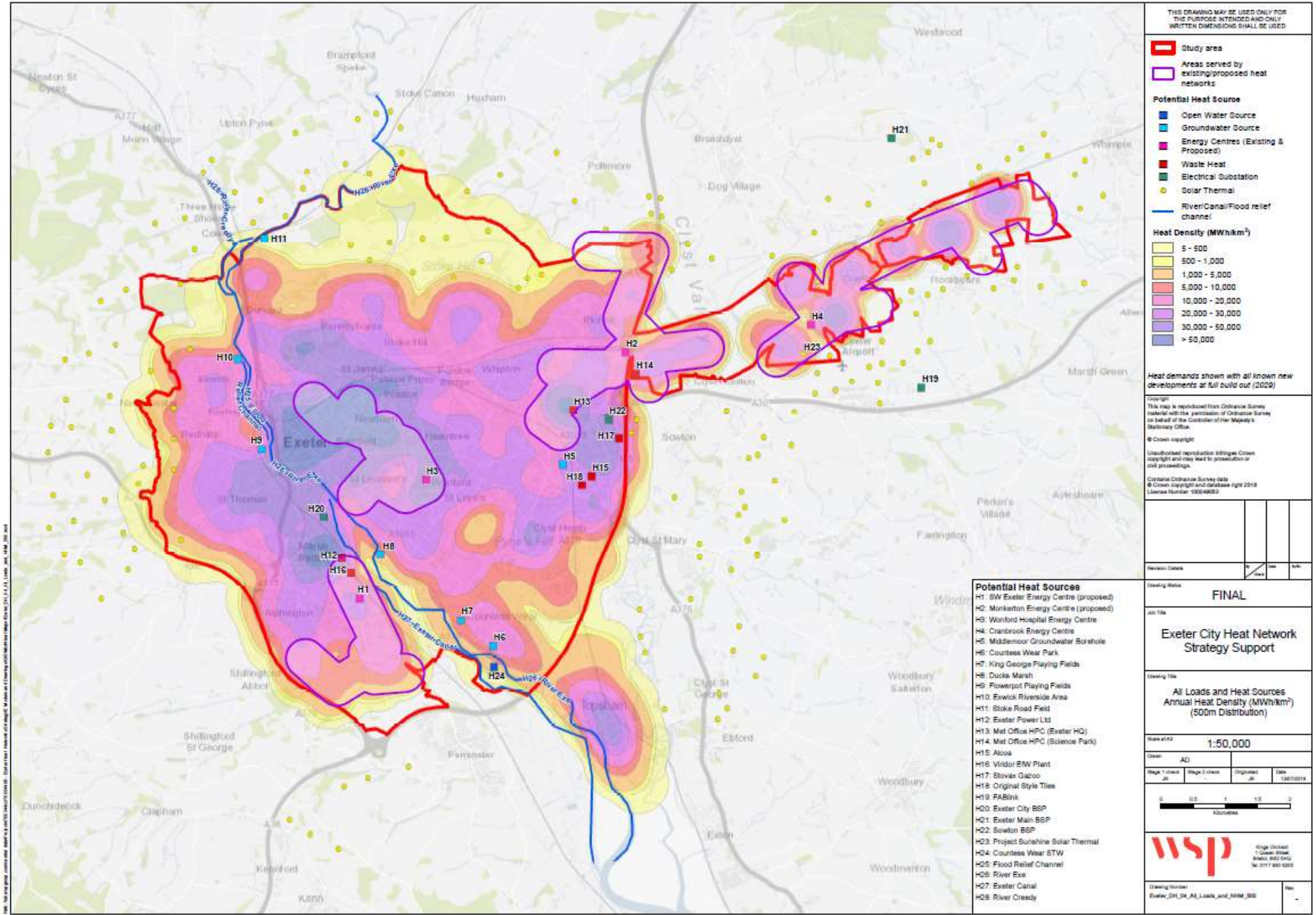
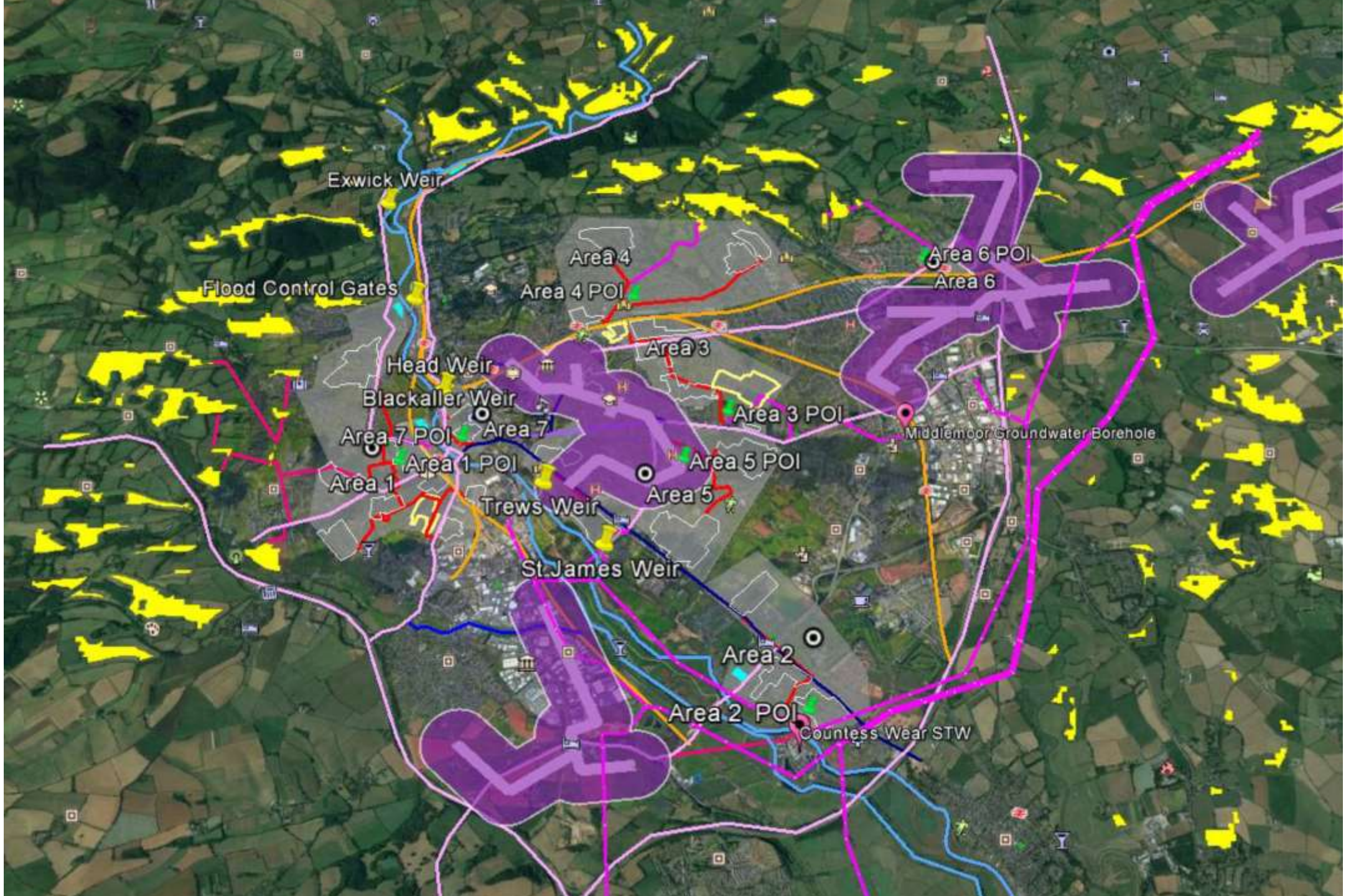
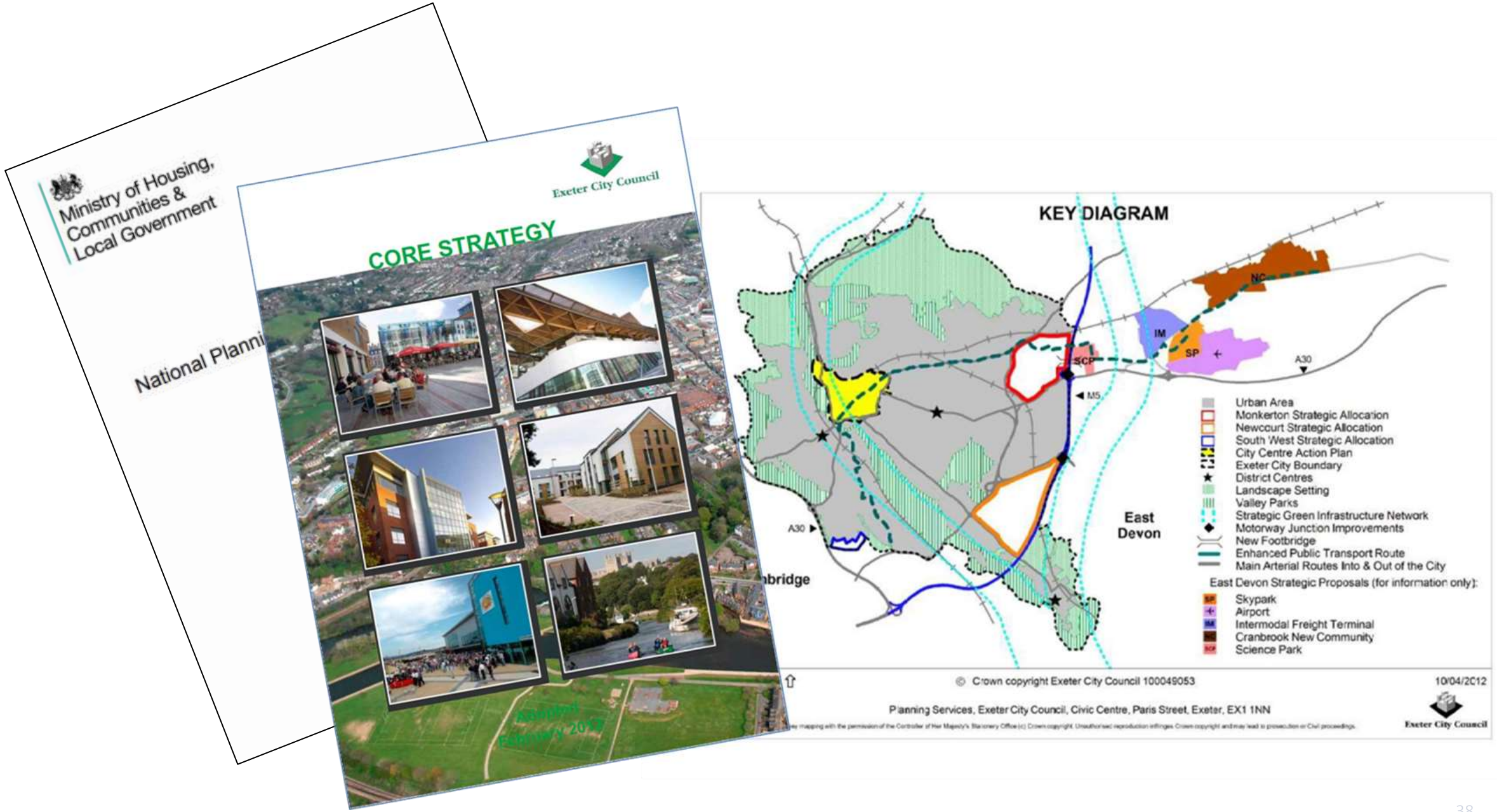

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED
Study area
Areas served by existing/proposed heat networks
Potential Heat Source
Open Water Source
Groundwater Source
Energy Centres (Existing & Proposed)
Waste Heat
Electrical Substation
Solar Thermal
River/Canal/Flood relief channel
Heat Density (MWh/km²)
5 - 500
500 - 1,000
1,000 - 5,000
5,000 - 10,000
10,000 - 20,000
20,000 - 30,000
30,000 - 50,000
> 50,000
Heat demands shown with all known new developments at full build out (2029)
Potential Heat Sources
H1: SW Exeter Energy Centre (proposed)
H2: Monkerton Energy Centre (proposed)
H3: Wonford Hospital Energy Centre
H4: Cranbrook Energy Centre
H5: Middlemoor Groundwater Borehole
H6: Countess Wear Park
H7: King George Playing Fields
H8: Ducks Marsh
H9: Flowerpot Playing Fields
H10: Exwick Riverside Area
H11: Stoke Road Field
H12: Exeter Power Ltd
H13: Met Office HPC (Exeter HQ)
H14: Met Office HPC (Science Park)
H15: Alcoa
H16: Viridor EfW Plant
H17: Stovax Gazco
H18: Original Style Tiles
H19: FABlink
H20: Exeter City BSP
H21: Exeter Main BSP
H22: Sowton BSP
H23: Project Sunshine Solar Thermal
H24: Countess Wear STW
H25: Flood Relief Channel
H26: River Exe
H27: Exeter Canal
H28: River Creedy
FINAL
Exeter City Heat Network Strategy Support
All Loads and Heat Sources Annual Heat Density (MWh/km²) (500m Distribution)
1:50,000
AD
wsp


Exwick Weir
Area 4
Area 4 POI
Flood Control Gates
Area 6 POI
Area 6
Area 3
Head Weir
Blackaller Weir
Area 7
Area 7 POI
Area 3 POI
Middlemoor Groundwater Borehole
Area 1 POI
Area 5 POI
Area 1
Area 5
Trews Weir
St James Weir
Area 2
Area 2 POI
Countess Wear STW

Exeter milestones


- 2008 Exeter and East Devon Growth Point Energy Strategy
- 2009 HCA funding for Cranbrook heat network
- 2010 Cranbrook development commences
- 2012 Exeter City Council Core Strategy policies adopted
- 2012 Cranbrook energy centre opened
- 2012 Exeter City Centre feasibility study
- 2016 Dextco Ltd formed by ECC, DCC, TDC, RD&E, UoE
- 2017 City Centre network market engagement day
- 2019 South West Exeter network market engagement day
- 2019 2000 homes built at Cranbrook


Ministry of Housing, Communities & Local Government
National Planni
Exeter City Council
CORE STRATEGY
Adopted February 2012
KEY DIAGRAM
NC
IM
SP
SCP
A30
M5
East Devon
A30
Urban Area
Monkerton Strategic Allocation
Newcourt Strategic Allocation
South West Strategic Allocation
City Centre Action Plan
Exeter City Boundary
District Centres
Landscape Setting
Valley Parks
Strategic Green Infrastructure Network
Motorway Junction Improvements
New Footbridge
Enhanced Public Transport Route
Main Arterial Routes Into & Out of the City
East Devon Strategic Proposals (for information only):
Skypark
Airport
Intermodal Freight Terminal
Cranbrook New Community
Science Park
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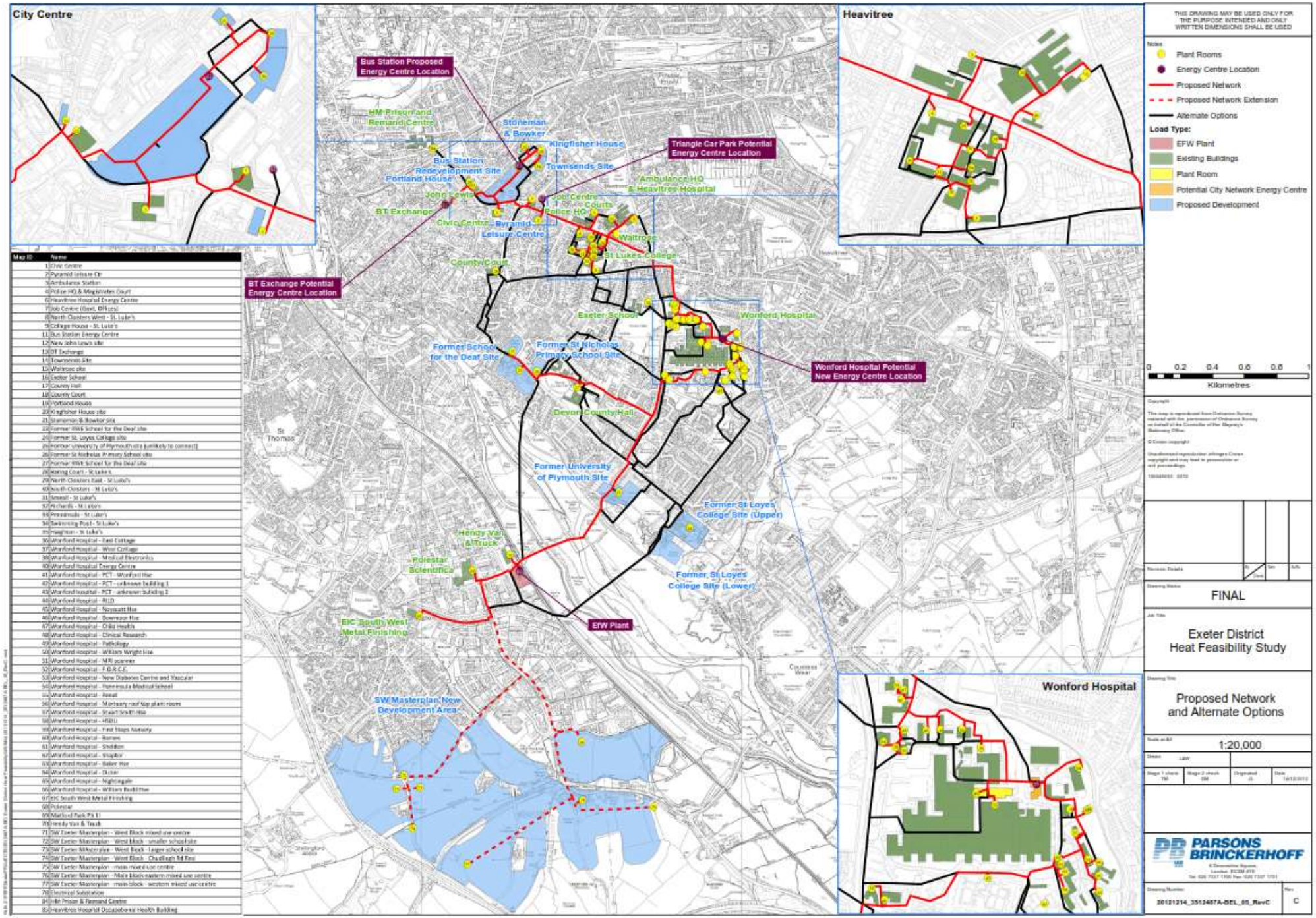
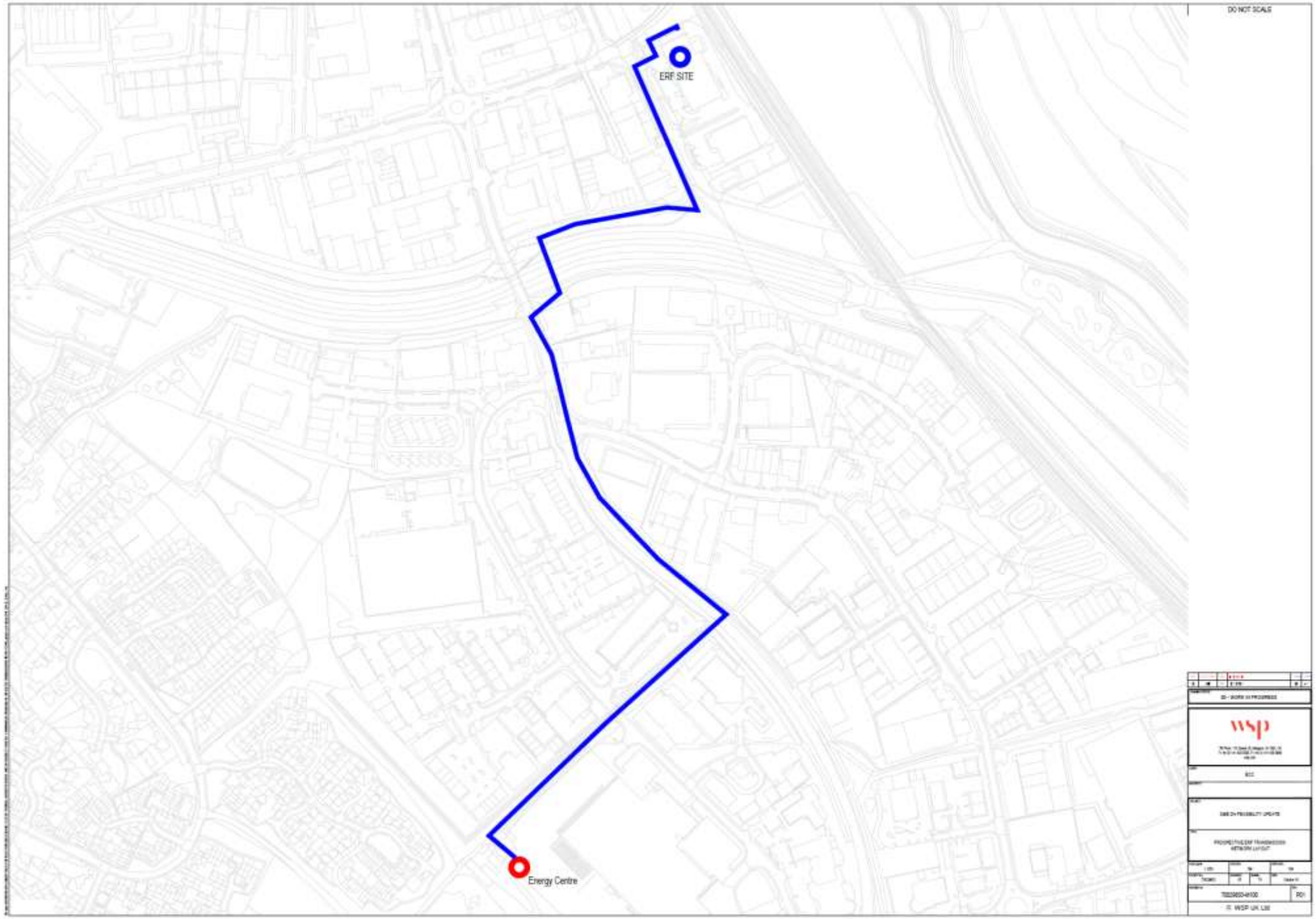
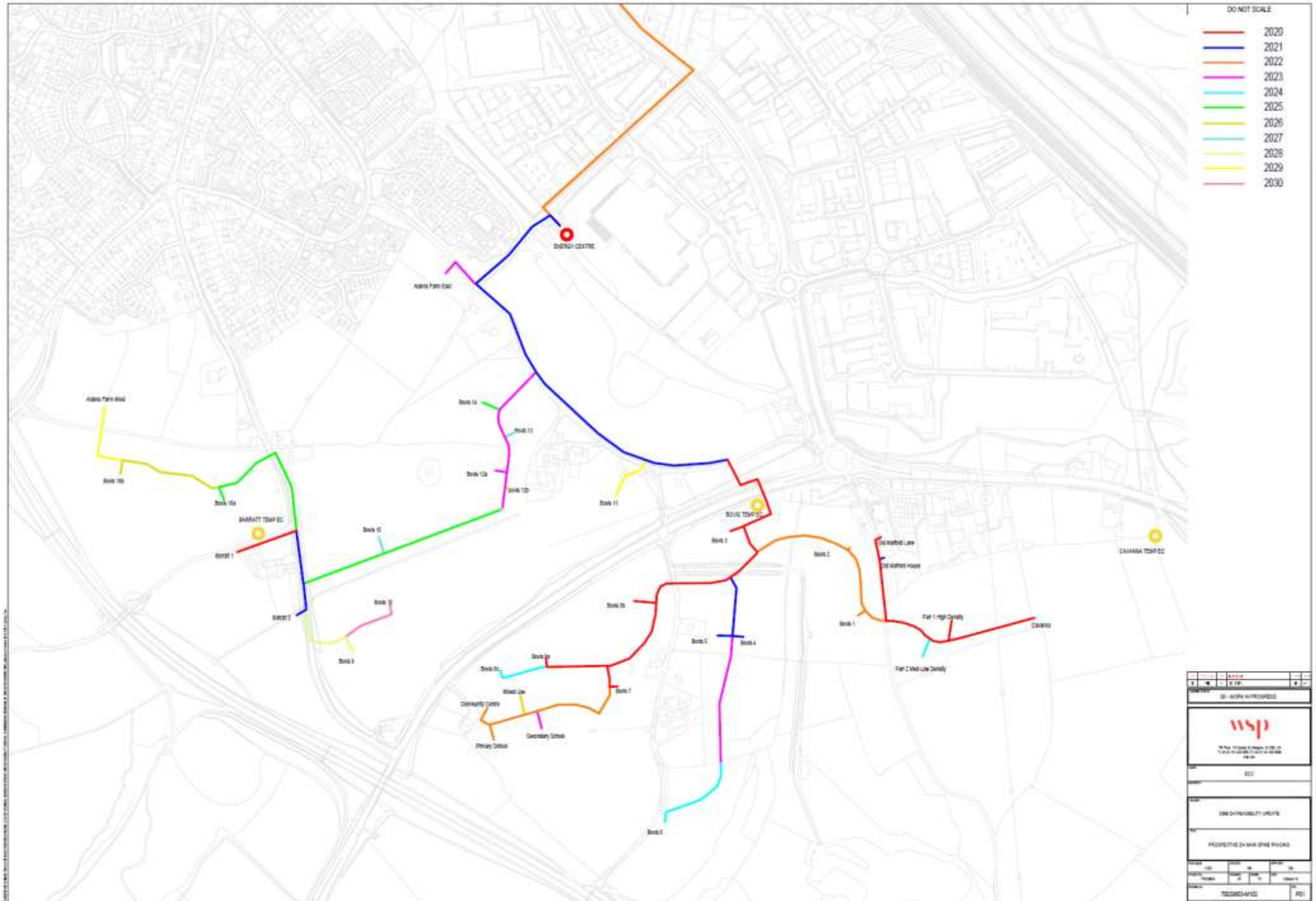
10/04/2012
Planning Services, Exeter City Council, Civic Centre, Paris Street, Exeter, EX1 1NN
Exeter City Council



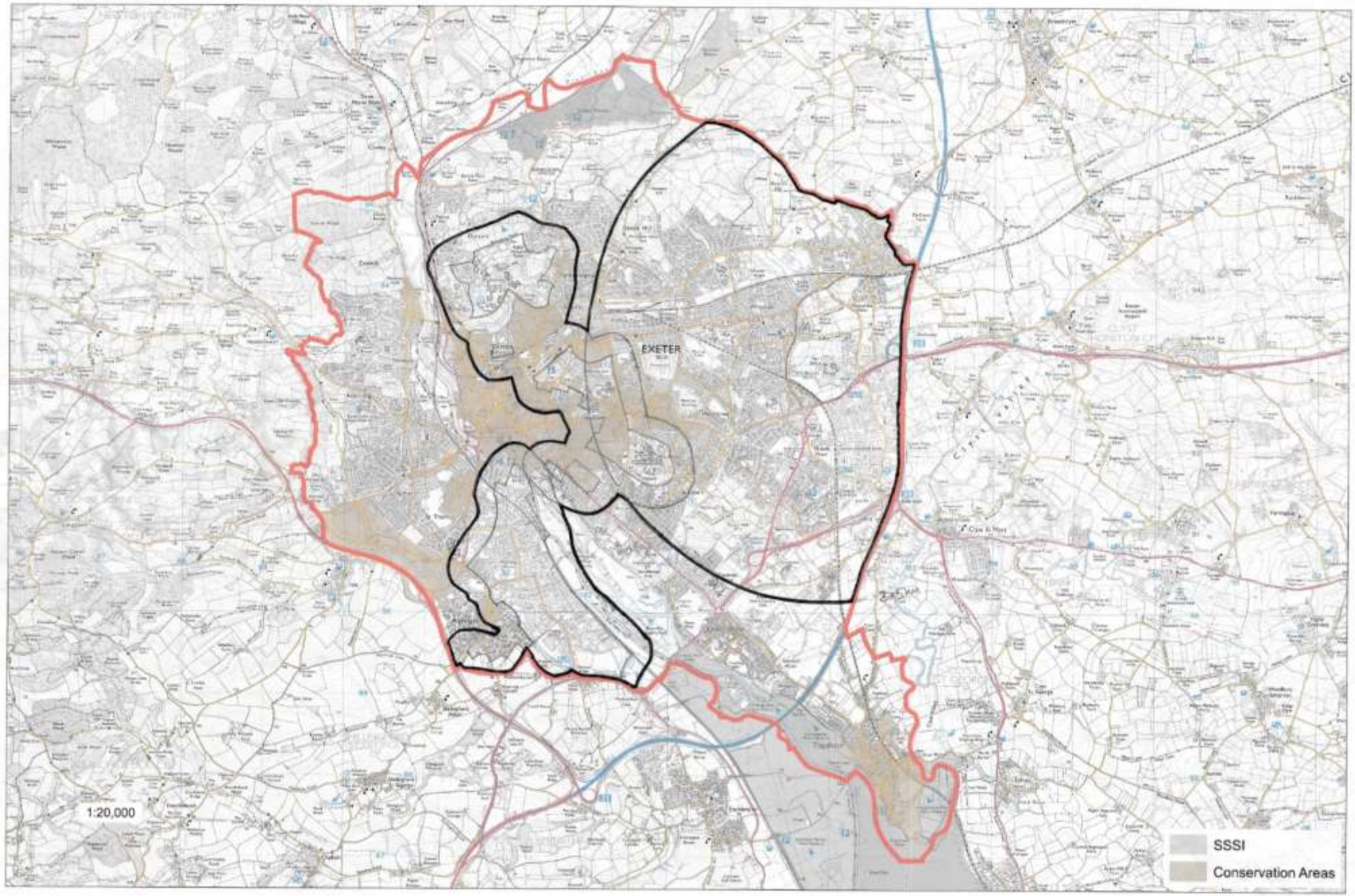
Map ID	Name
1	Civic Centre
2	Pyramid Leisure Ctr
3	Ambulance Station
4	Police HQ & Magistrates Court
5	Heavitree Hospital Energy Centre
7	Job Centre (Govt. Offices)
8	North Cloisters West - St Luke's
9	College House - St Luke's
11	Bus Station Energy Centre
12	New John Lewis site
13	BT Exchange
14	Townsends Site
15	Waitrose site
16	Exeter School
17	County Hall
18	County Court
19	Portland House
20	Kingfisher House site
21	Stoneman & Bowker site
22	Former RNID School for the Deaf site
23	Former St. Loyes College site
25	Former University of Plymouth site [unlikely to connect]
26	Former St Nicholas Primary School site
27	Former RNID School for the Deaf site
28	Kearing Court - St Luke's
29	North Cloisters East - St Luke's
30	South Cloisters - St Luke's
31	Stowell - St Luke's
32	Richards - St Luke's
34	Peninsula - St Luke's
36	Swimming Pool - St Luke's
38	Hoopton - St Luke's
39	Wonford Hospital - East Cottage
40	Wonford Hospital - West Cottage
41	Wonford Hospital - Medical Electronics
42	Wonford Hospital Energy Centre
43	Wonford Hospital - PCT - Wonford Hse
44	Wonford Hospital - PCT - unknown building 1
45	Wonford Hospital - PCT - unknown building 2
46	Wonford Hospital - RLD
47	Wonford Hospital - Nonsuch Hse
48	Wonford Hospital - Bowmoor Hse
49	Wonford Hospital - Child Health
50	Wonford Hospital - Clinical Research
51	Wonford Hospital - Pathology
52	Wonford Hospital - William Wright Hse
53	Wonford Hospital - MRI scanner
54	Wonford Hospital - F.O.R.C.E.
55	Wonford Hospital - New Diabetes Centre and Vascular
56	Wonford Hospital - Peninsula Medical School
57	Wonford Hospital - Reveal
58	Wonford Hospital - Mercury roof top plant room
59	Wonford Hospital - Stuart Smith Hse
60	Wonford Hospital - HSDU
61	Wonford Hospital - First Steps Nursery
62	Wonford Hospital - Rennes
63	Wonford Hospital - Sheldon
64	Wonford Hospital - Hospital
65	Wonford Hospital - Baker Hse
66	Wonford Hospital - Dicker
67	Wonford Hospital - Nightingale
68	Wonford Hospital - William Budd Hse
69	EIC South West Metal Finishing
70	Polestar
71	Matford Park Ph III
72	Hendy Van & Truck
73	SW Exeter Masterplan - West Block mixed use centre
74	SW Exeter Masterplan - West Block - smaller school site
75	SW Exeter Masterplan - West Block - larger school site
76	SW Exeter Masterplan - West Block - Challegh Rd Res
77	SW Exeter Masterplan - main mixed use centre
78	SW Exeter Masterplan - Main block eastern mixed use centre
79	SW Exeter Masterplan - main block - western mixed use centre
80	Electrical Substation
84	HM Prison & Remand Centre
85	Heavitree Hospital Occupational Health Building


DO NOT SCALE
ERF SITE
Energy Centre
wsp


DO NOT SCALE
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
ENERGY CENTRE
Adams Farm East
Adams Farm West
Block 15b
Block 15a
BARRATT TEMP EC
Barratt 1
Barratt 2
Block 15
Block 9
Block 14
Block 13
Block 12a
Block 12b
Block 11
BOVIS TEMP EC
Block 2
Block 1
Old Watford Lane
Old Watford House
Part 1 High Density
Part 2 Medium Density
Cavalera
CAVANNA TEMP EC
Block 6
Block 5
Block 4
Block 7
Block 8
Mixed Use
Community Centre
Primary School
Secondary School
wsp


ExeterAirport
Part of Regional & City Airports
South Western
Railway
A30


Cranbrook
HEALTHY TOWN
e·on
flybe.
amazon
LiveWest
A home for everyone
LIDL
PERSIMMON
BARRATT
HOMES
The Environmental Futures & Big Data
impact lab
Met Office
EXETER
SCIENCE
PARK
e·on
Linden
HOMES

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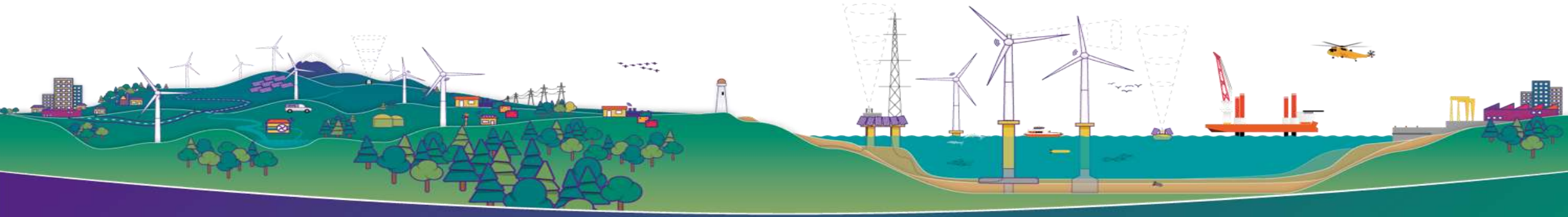
Local Heat and Energy Efficiency Strategies (LHEES)

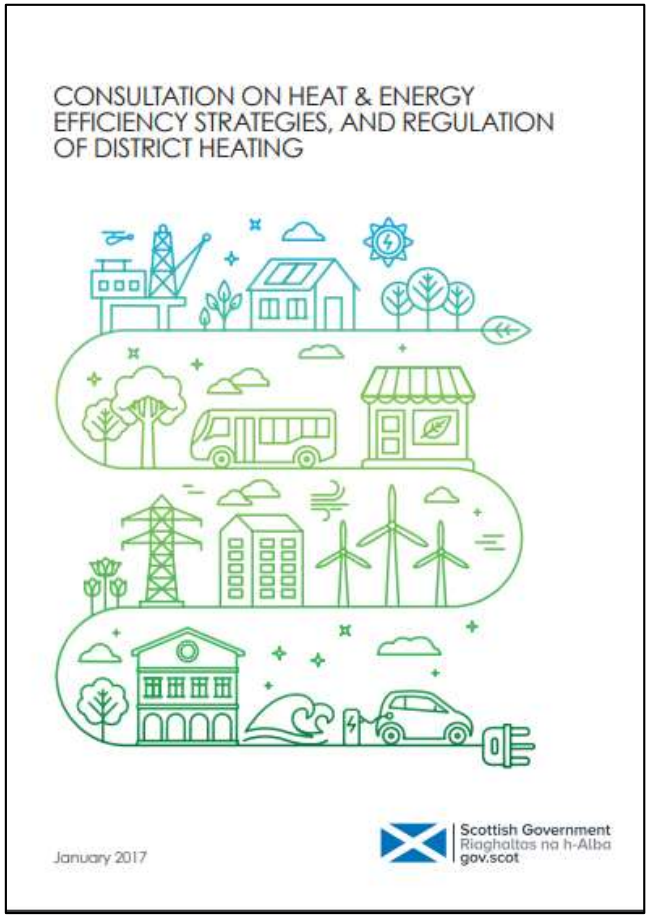
Vanguards – Bristol 2019

Date: 19th November 2019

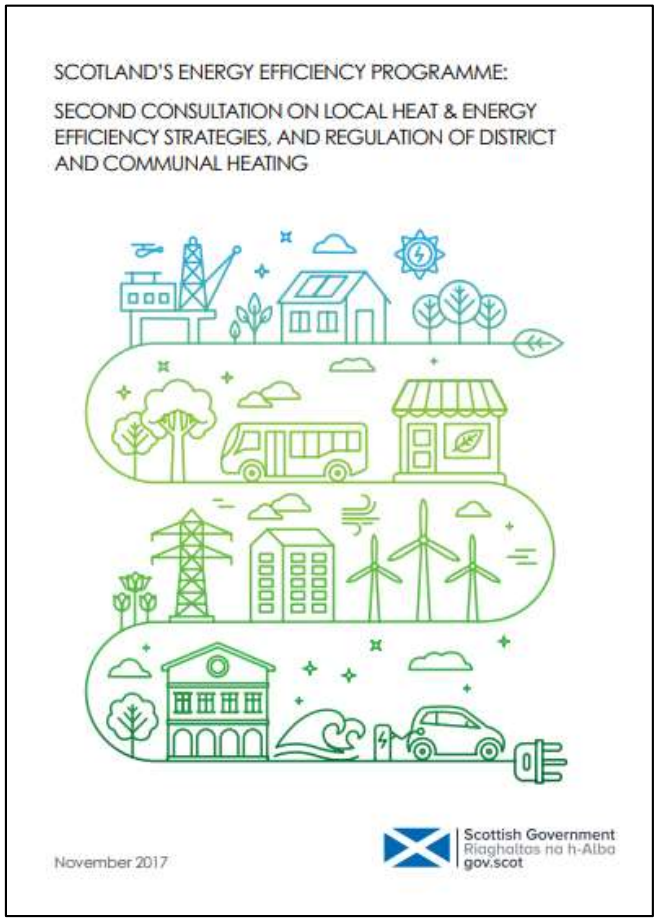
Produced By: Andy Yuill

Produced For: Vanguards





January 2017



November 2017

Heat, Energy ***Efficiency*** are devolved

Some aspects of Energy Policy (including gas and electricity) are reserved, or in the process of being devolved.

LHEES is reflective of the evolving nature of devolution

Heat, Energy ***Efficiency*** and Planning are devolved

Some aspects of Energy Policy (including gas and electricity) are reserved, or in the process of being devolved.

LHEES is reflective of the evolving nature of devolution.

Policy is ***decided*** at a national level

BUT

Implementation is ***directed*** at a local level

"Recognising local differences"

What is an LHEES?

It's a process not a plan

Stage 1:
- An assessment of existing local and national strategies and data availability.

Stage 2:
- Authority-wide assessment of existing building stock's energy performance and heat supply

Stage 3:
- Authority-wide setting of aggregate targets for heat demand reduction and decarbonisation of buildings – for the short-term strategy period and for the long-term duration of SEEP.

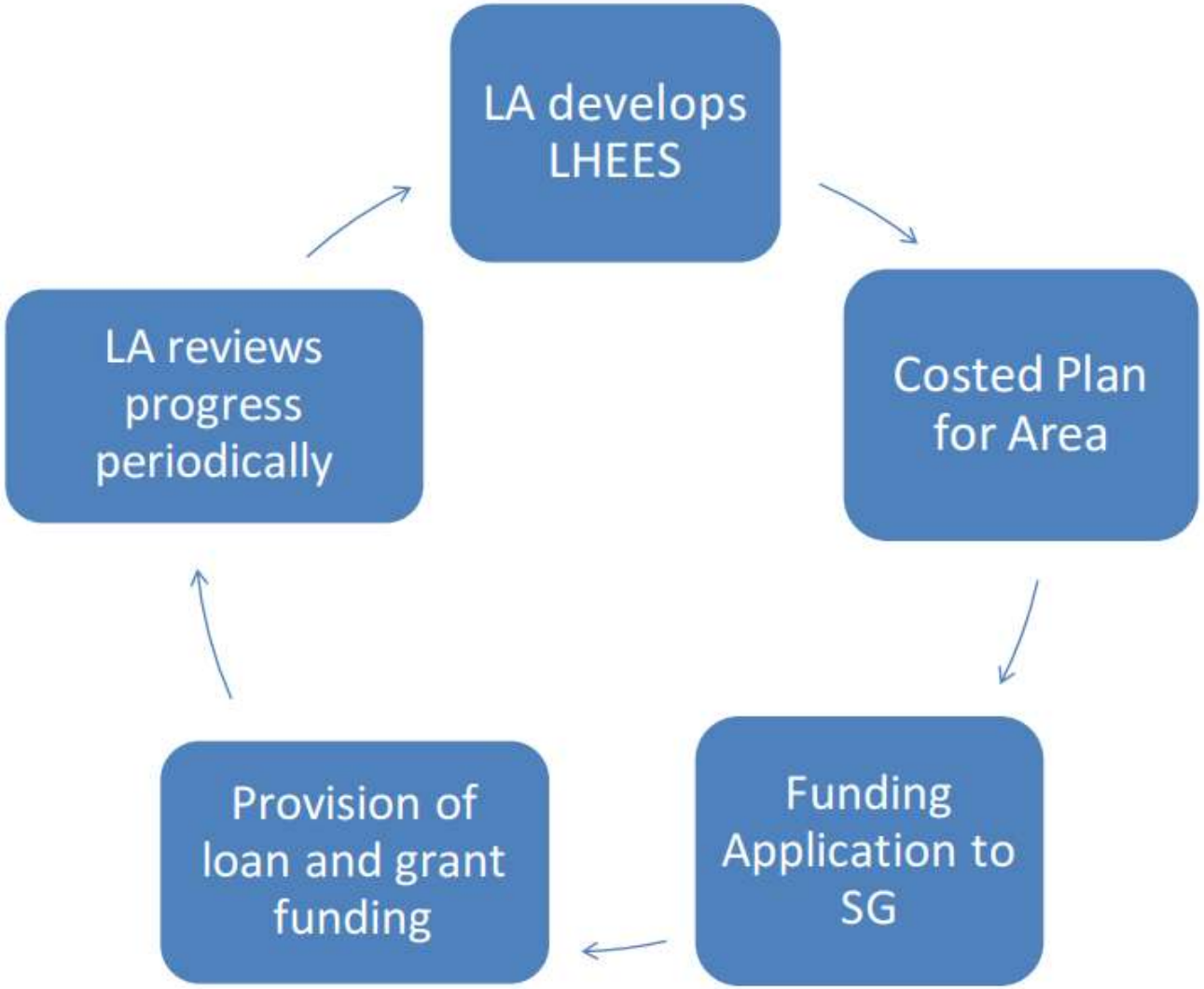
Stage 4:
- Conduct a socio-economic assessment of potential energy efficiency and heat decarbonisation solutions.

Stage 5:
- Selection of areas/prioritisation of opportunities for energy efficiency and/or heat decarbonisation, leading to the designation of zones.

Stage 6:
- Costing & phasing of delivery programmes

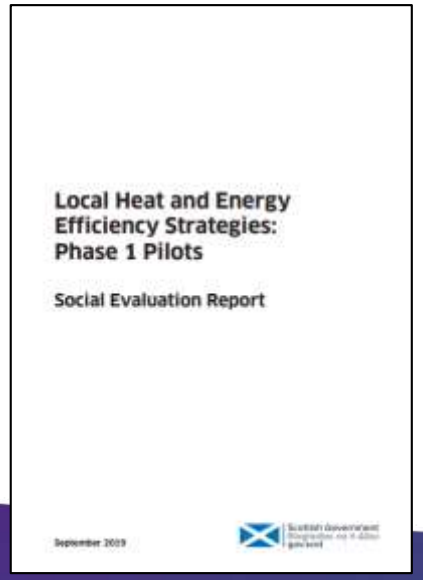
LHEES

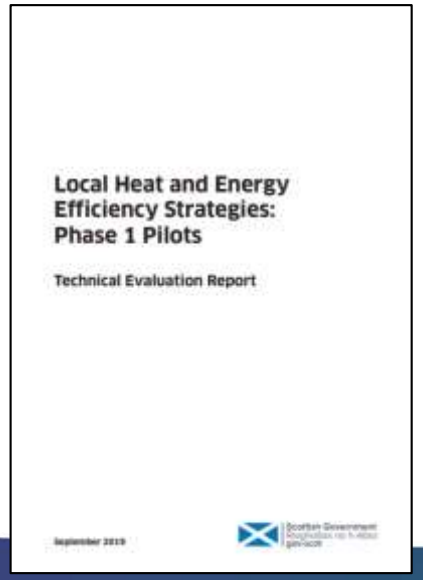
Iterate and keep current



Pilot Phase 1 (Delivered by SEEP)

- Between September 2017 and March 2019, 12 local authorities participated in the first round of LHEES pilots
- Funding of between £50-70k was provided to each LA
- The aims of the pilots were:
  - to test and develop methods for creating an LHEES,
  - identify relevant sources of data (and any data gaps),
  - gain a fuller understanding of the resources and capabilities required to deliver an LHEES





Pilot Phase 2 (Delivered by SEEP)

- Further 11 local authorities participated in the second round of LHEES pilots
- Work is ongoing and analysis of findings is about to start

Pilot Phase 3 (Delivered by EES)

- Final 9 local authorities invited to undertake a pilot LHEES study
- Funding round closed October 2019

Finding from LHEES

Stage 1:
- An assessment of existing local and national strategies and data availability.

Stage 2:
- Authority-wide assessment of existing building stock's energy performance and heat supply

Stage 3:
- Authority-wide setting of aggregate targets for heat demand reduction and decarbonisation of buildings – for the short-term strategy period and for the long-term duration of SEEP.

Stage 4:
- Conduct a socio-economic assessment of potential energy efficiency and heat decarbonisation solutions.

Stage 5:
- Selection of areas/prioritisation of opportunities for energy efficiency and/or heat decarbonisation, leading to the designation of zones.

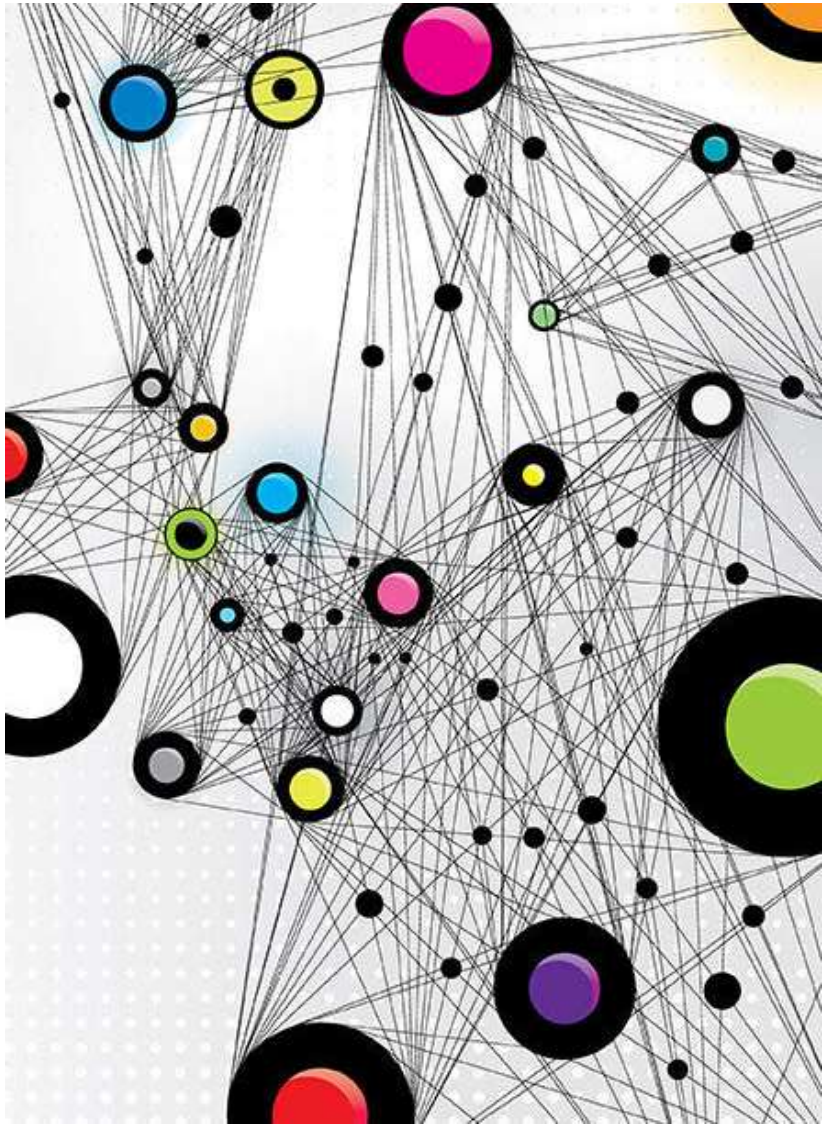
Stage 6:
- Costing & phasing of delivery programmes

Issues

- Lots of questions
- Limits of substantive control
- Interdependency on other strategies / policies
- Hierarchy with other legislation
- Sequencing
- Resourcing

Benefits

- Lots of questions
- Value as a Strategy to produce Policy and Projects
- Engagement
- Toolkits and processes
- Understanding the complexity of the problem



Next Steps

Finalise Pilots

Develop Legislation

Statutory Duty

HEAT AND THE CITY

Josh Thumim

CSE

VATTENFALL

FVB

natural power

switch2

THERMOS

Accelerating the development of
low-carbon heating & cooling networks

THERMOS

Joshua Thumim

Head of Research at the Centre for Sustainable Energy, Bristol

UK District Energy Vanguards Network Event

Bristol, 19 November 2019

Aims of this presentation

- Introduce you to THERMOS
- Give you an idea of how it might be useful in your work
- Answer your questions
- Show you how to register to use THERMOS for free

Structure

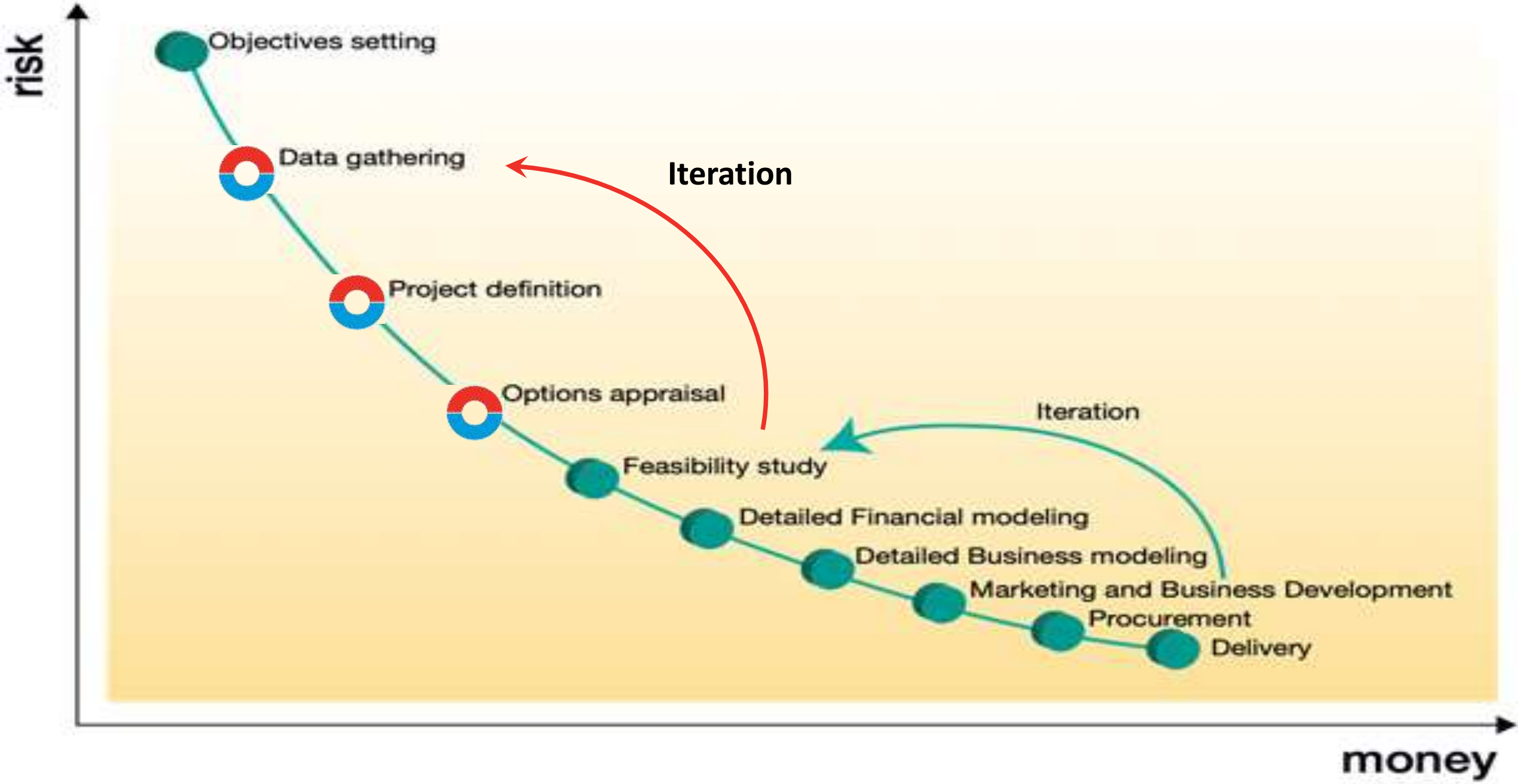
1. **What is THERMOS?**
   Making a map
   A solution
   A problem
2. **Technical details**
   What is being optimised?
   What is represented in the model?
   How do we estimate building demands?
3. **Planned new features**
4. **How does THERMOS add value?**

What is THERMOS?

"Thermal Energy Resource Modelling and Optimisation System"

Web-based software for detailed pre-feasibility analysis of heating and cooling network options

Designed to support project development from area-wide mapping and masterplanning, through to detailed consideration of optimal network layouts


risk
Objectives setting
Data gathering
Iteration
Project definition
Options appraisal
Iteration
Feasibility study
Detailed Financial modeling
Detailed Business modeling
Marketing and Business Development
Procurement
Delivery
money

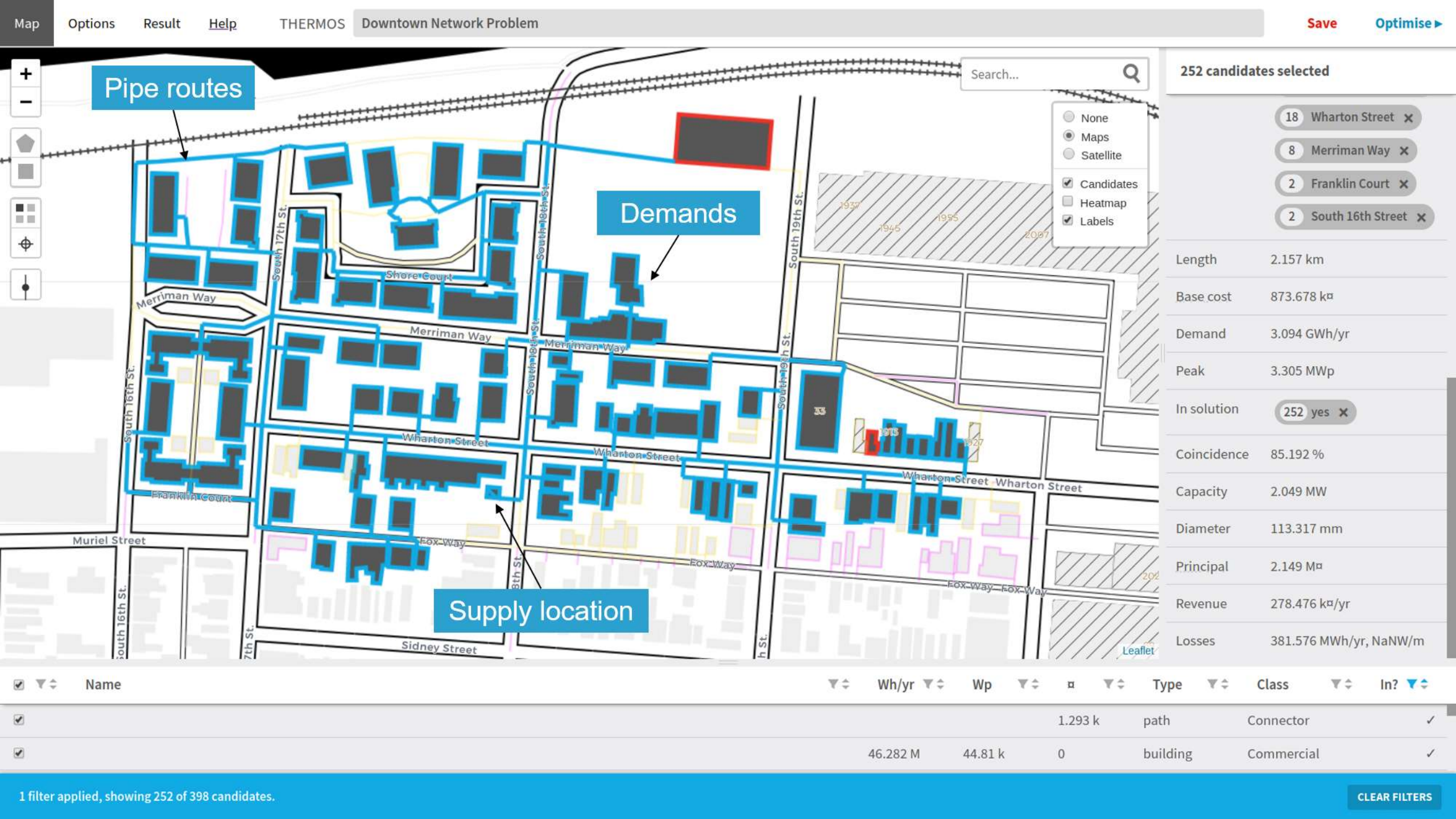
What does THERMOS tell you?

- A THERMOS solution is a sized and costed geographic and topological description of a heat distribution network (cooling is coming in the new year):
  - Supply sites and sizes
  - Pipe sizes, routes and connectivity
  - Connected demands, sizes and peaks
  - Revenues, Costs -> NPV
- Two objectives:
  - Maximise network NPV; or
  - Minimise whole-system costs – insulation and alternative heating option

Making a map

- THERMOS includes features to enable you to create a map for the area you are interested in
- The map provides the geographic inputs to problems
- **So you need to do this before you can use THERMOS to define and solve problems**
- Maps can be created either automatically from OpenStreetMap, or from your own shapefiles
- They comprise locations of supplies and demands, and paths along which these can be connected to form a network
- *Demand estimates can be calculated automatically* based on 3D building geometries (assuming LIDAR is available), or you can provide your own values in the shapefiles

Viewing a solution


Map
Options
Result
Help
THERMOS
Downtown Network Problem
Save
Optimise ▸
Pipe routes
Demands
Supply location
Search...
None
Maps
Satellite
Candidates
Heatmap
Labels
252 candidates selected
18 Wharton Street
8 Merriman Way
2 Franklin Court
2 South 16th Street
Length 2.157 km
Base cost 873.678 k¤
Demand 3.094 GWh/yr
Peak 3.305 MWp
In solution 252 yes
Coincidence 85.192 %
Capacity 2.049 MW
Diameter 113.317 mm
Principal 2.149 M¤
Revenue 278.476 k¤/yr
Losses 381.576 MWh/yr, NaNW/m
Merriman Way
Shore Court
Wharton Street
Franklin Court
Muriel Street
Fox Way
Sidney Street
South 16th St.
South 17th St.
South 18th St.
South 19th St.
Leaflet
Name
Wh/yr
Wp
¤
Type
Class
In?
1.293 k path Connector ✓
46.282 M 44.81 k 0 building Commercial ✓
1 filter applied, showing 252 of 398 candidates.
CLEAR FILTERS

Framing and solving a problem

Name	Wh/yr	Wp	¤	Type	Class
			1.293 k	path	Connector
	46.282 M	44.81 k	0	building	Commercial
			269.685	path	Connector

Repeatedly solve this, while increasing the heat sale price:

Map | Options | Result | Help | THERMOS | Downtown Network Problem | Save | Optimise ▸

0 candidates selected

Name	Wh/yr	Wp	¤	Type	Class	In?
			1.293 k	path	Connector	✓
	46.282 M	44.81 k	0	building	Commercial	✓

1 filter applied, showing 223 of 390 candidates. CLEAR FILTERS

What is being optimised?

- In *network mode* THERMOS optimises a model of a heat network, maximising NPV by deciding:
  - For each place where a pipe could go, whether a pipe should be there
  - For each place with demand, whether to meet the demand
  - For each place where a supply could go, whether to put a supply there
- Given these choices, it then decides:
  - For each pipe, how large the pipe has to be
  - For each supply, what the supply capacity has to be
- From this the costs and revenues are calculated, and NPV maximised

What is being optimised?

- In *whole-system mode* THERMOS minimises the total cost of meeting the heat demands, by deciding:
  - For each building, whether or not to insulate, and in parallel, whether to install an individual system or connect to a network
  - For each place where a pipe could go, whether a pipe should be there
  - For each place where a supply could go, whether to put a supply there
- Given these choices, it then decides:
  - For each pipe, how large the pipe has to be
  - For each supply, what the supply capacity has to be
- From this the costs are calculated, and minimised

What is being modelled?

- The network model accounts for:
  - Annual and peak demands on buildings
  - Pipe capacity @ ΔT=> Pipe diameter => Installed pipe cost
  - Heat losses from the network
  - Load diversity in the network
  - Heat supply cost
  - Heat sale price
  - Amount and value of emissions associated with supply
  - Amount and value of counterfactual emissions

Recap

- THERMOS computes optimal layouts for heat networks
- It can also identify a least-cost strategy including but not limited to networks
- You specify which buildings and routes are either *allowed* or *required* to be in the solution, and the location(s) at which heat supply can be provided
- Solution times vary with complexity, but problems comprising hundreds of buildings can be solved in seconds or minutes (and remember that for 100 buildings there are approximately 10^{30} distinct sets, so this cannot be done by hand)
- THERMOS can be applied anywhere there is appropriate mapping data available – either provided by the user, or imported directly from OSM
- The system incorporates a demand-estimation method based on building geometries. This requires LIDAR coverage for 3D features.

Planned new features

The project runs til June 2020, by which time we will have added:

- Supply optimiser (including thermal storage)
- Cooling network model
- UI enhancements

Where does THERMOS create value?

1. Better network design at the prefeasibility stage – current practice does not attempt to identify optimal solutions
2. Significantly faster assessment of options, so many more options are considered, at greatly reduced cost
3. Enables analysis of the sensitivity of the optimal network design to a range of assumptions (supply cost, heat sale price, cost of finance, etc.)
4. All of this means reduced risk of wasted time at detailed design stages
5. Automation of mapping processes eliminates time and cost to get started – anywhere in the world
6. Browser based application – no local deployment needed
7. Our goal: accelerated rollout of the right thermal networks in the right places, leading to carbon emissions reductions.

Try THERMOS yourself

Project website:	www.thermos-project.eu
Training materials and videos:	www.thermos-project.eu/resources/publications/
User guide:	tool.thermos-project.eu/help/index.html
Quick start guide:	tool.thermos-project.eu/help/quick-start.html

Get started with a free account at tool.thermos-project.eu

We would welcome any feedback!

Questions?

Joshua Thumim
Head of Research
Centre for Sustainable Energy, Bristol
THERMOS Project Coordinator

joshua.thumim@cse.org.uk
www.cse.org.uk
@cse_bristol

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