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Tony Neul
Strategic Commissioning Lead
Energy & Environment

Energy~

An emerging vision for North East Lincolnshire

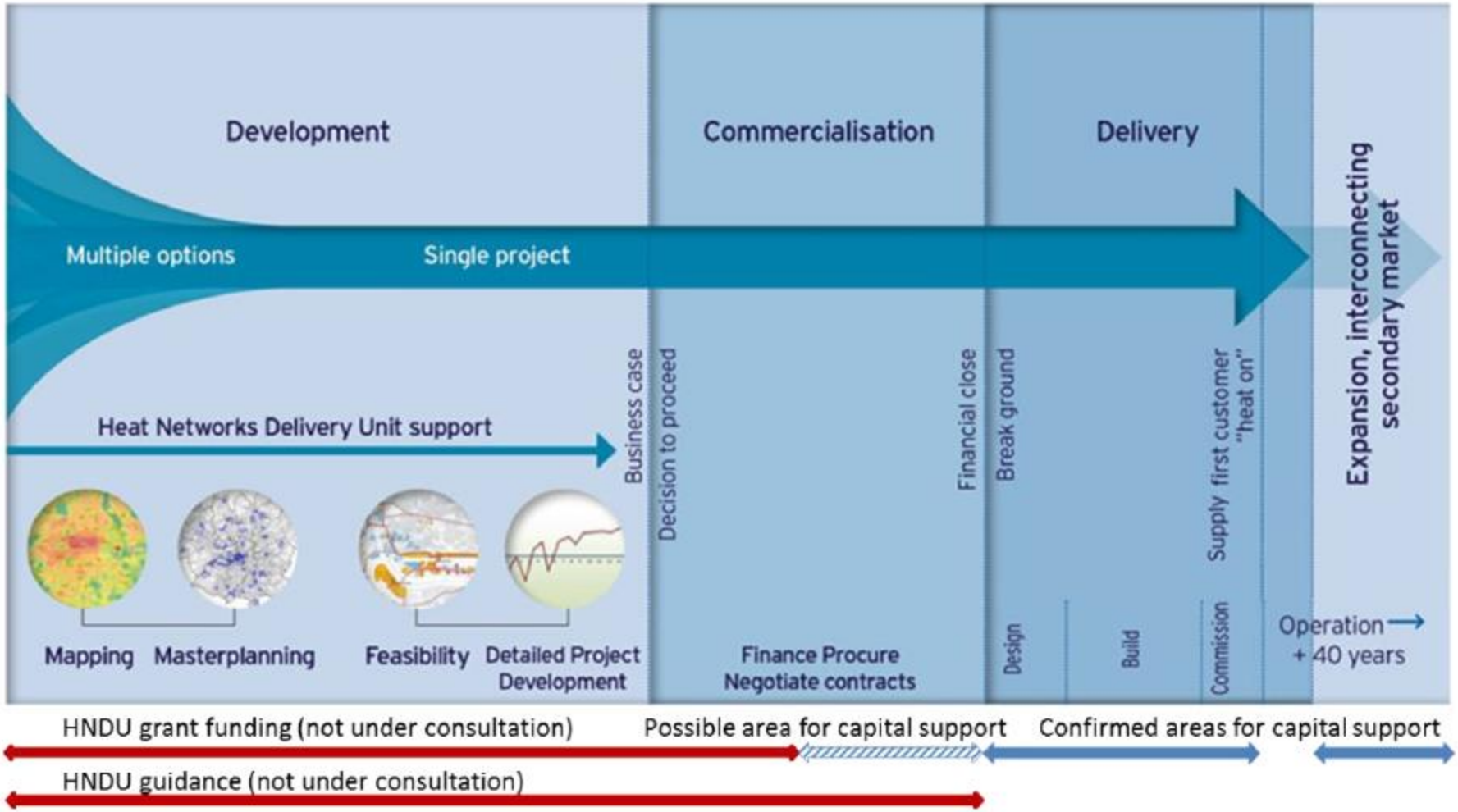
NORTH EAST LINCOLNSHIRE COUNCIL
www.nelincs.gov.uk

- ✓ **By 2032, North East Lincolnshire will be nationally and internationally recognised as the UK's leading region for low-carbon energy and the UK capital of the renewable energy industry.**

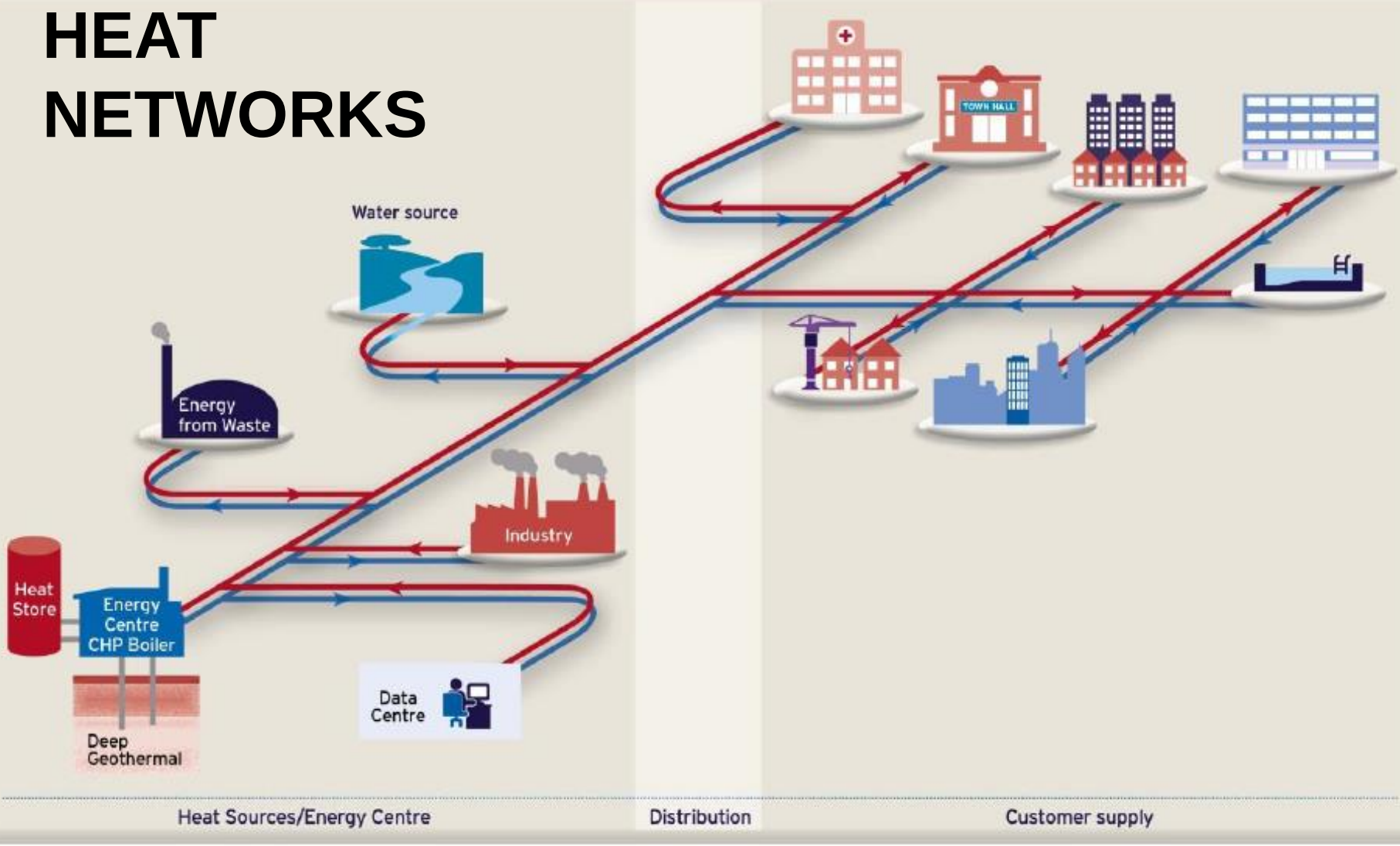
- ✓ **North East Lincolnshire will have developed a range of low-carbon, high-efficiency, renewable solutions to regenerate the region. This will deliver strategic and economic advantage for its businesses and affordable heat and power for its communities.**

- ✓ **The region's energy programme will have enough impetus that by 2050 North East Lincolnshire will not only be able to achieve its 80% carbon reduction target but will also be able to declare itself carbon neutral.**

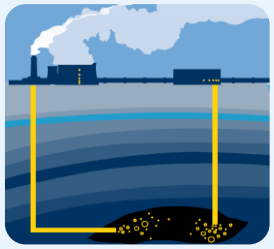
HNDU


Development
Commercialisation
Delivery
Multiple options
Single project
Expansion, interconnecting secondary market
Heat Networks Delivery Unit support
Business case
Decision to proceed
Financial close
Break ground
Supply first customer "heat on"
Mapping
Masterplanning
Feasibility
Detailed Project Development
Finance Procure Negotiate contracts
Design
Build
Commission
Operation + 40 years
HNDU grant funding (not under consultation)
Possible area for capital support
Confirmed areas for capital support
HNDU guidance (not under consultation)

HEAT NETWORKS









Heat mapping and masterplanning in North East Lincolnshire

North East Lincolnshire Council

Stakeholder briefing

13th June 2017

Element Energy Ltd

Sam Foster

Emma Freeman

Ian Walker

Agenda

- **Overview of project progress**
- **Stakeholder engagement**
- **Cluster selection for economic assessment**
- **Economic assessment**
- **Summary and recommendations**

A heat network could bring a number of benefits to North East Lincolnshire

A heat network could contribute to a number of local objectives

- **Low-carbon energy:** North East Lincolnshire (NEL) has an ambitious vision for energy. By 2032, NEL has ambitions to be recognised as the UK's leading region for the low-carbon and renewable energy industry.

- **Regeneration and Economic Growth:** A secure, affordable, low-carbon heat supply is expected to attract businesses and investment, driving economic growth and development in the region.

- **Reduced energy costs:** The cost of energy is rising and in the long-term is not likely to deviate from this trend. Fuel poverty in NEL is above the national average so reducing energy costs is a priority.

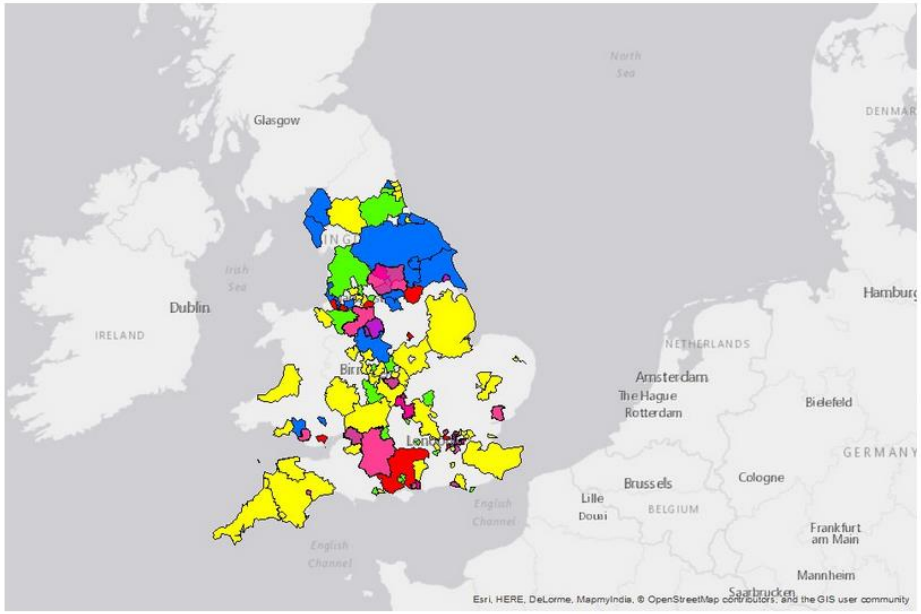
NELC has received funding from the government's Heat Network Delivery Unit (HNDU) to undertake this study

The UK Government is supporting local authorities to develop heat network opportunities

- The **Heat Network Delivery Unit (HNDU)** was established in September 2013 by the Department of Energy and Climate Change (now part of the Department for Business, Energy and Industrial Strategy) to provide grant funding and guidance to local authorities in England and Wales.

- HNDU has already awarded support to **200 unique projects** across 131 local authorities, totalling £14 million of grant funding.

Results of Rounds 1-5



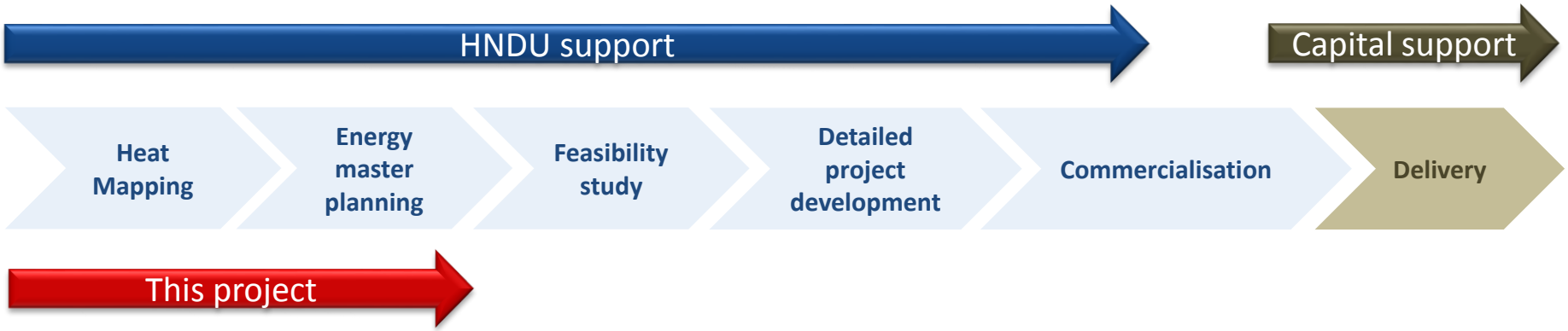
Map of successful HNDU rounds 1-5 Local Authorities. Round 1 - red. Round 2 - blue. Round 3 - green. Round 4 - yellow. Round 5 - pink

The study will provide the early stages of development of heat network projects

This project covers the first two development stages for heat networks

- HNDU grants are provided to support local authorities through a number of stages:
  1. Heat mapping
  2. Energy master planning
  3. Feasibility study
  4. Detailed project development
  5. Commercialisation

- This project will cover the **first two stages**: Heat mapping and Energy master planning



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Summary of stakeholder data collection process

More than 200 stakeholders have been contacted to request energy demand data

- Stakeholders were contacted for more than **200 private, public and educational organisations** in North East Lincolnshire according to expected relevance
- In addition, **16 internal stakeholders** were contacted from various sectors, including Social Housing, Planning, Assets, Highways & Transport and Economic Development
- NELC/ENGIE provided energy demand data for **93 public sector buildings**
- Some further data has been received from external stakeholders
- A summary of responses is shown in the table

Summary of stakeholder engagement	
Number of stakeholders contacted to request data:	**236**
Number of stakeholders at the briefing sessions:	**45**
Number of responses:	**49**
Data provided (no. of buildings):	**156**
Energy demand data (no. of buildings):	152
Floorspace data (no. of buildings):	2
Other data:	2

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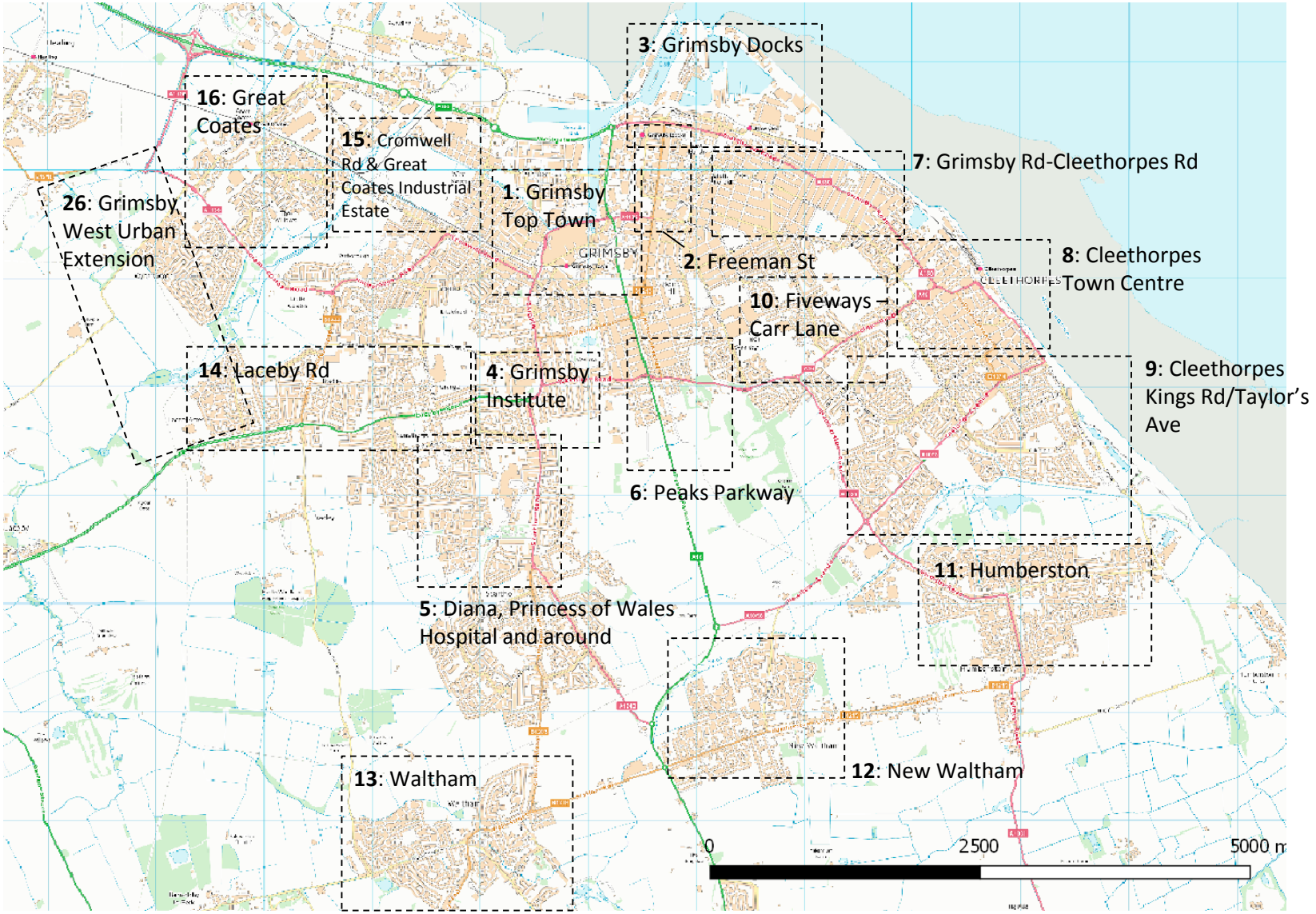
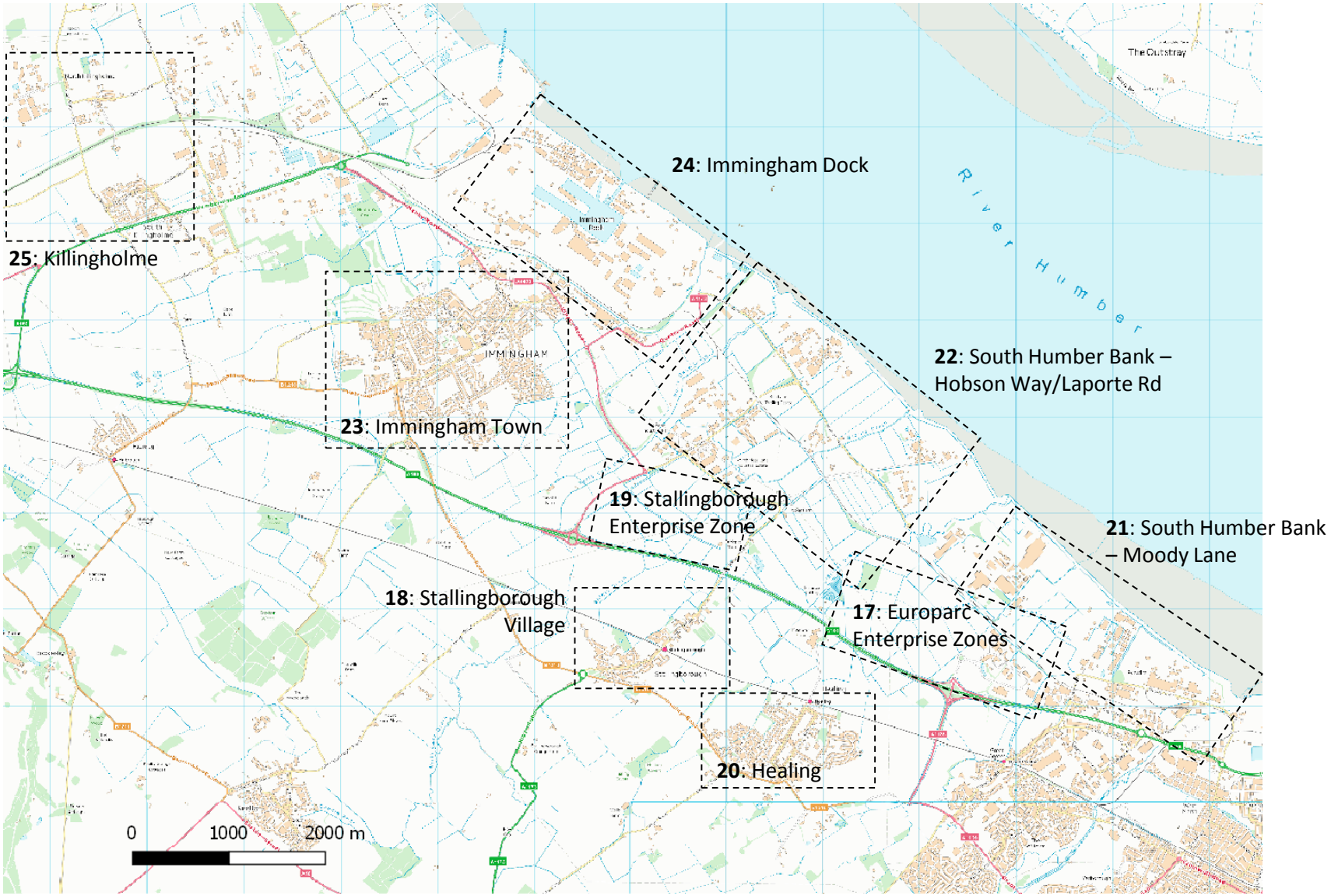
We assessed an initial longlist of cluster areas against key attributes (1)



We assessed an initial longlist of cluster areas against key attributes (2)



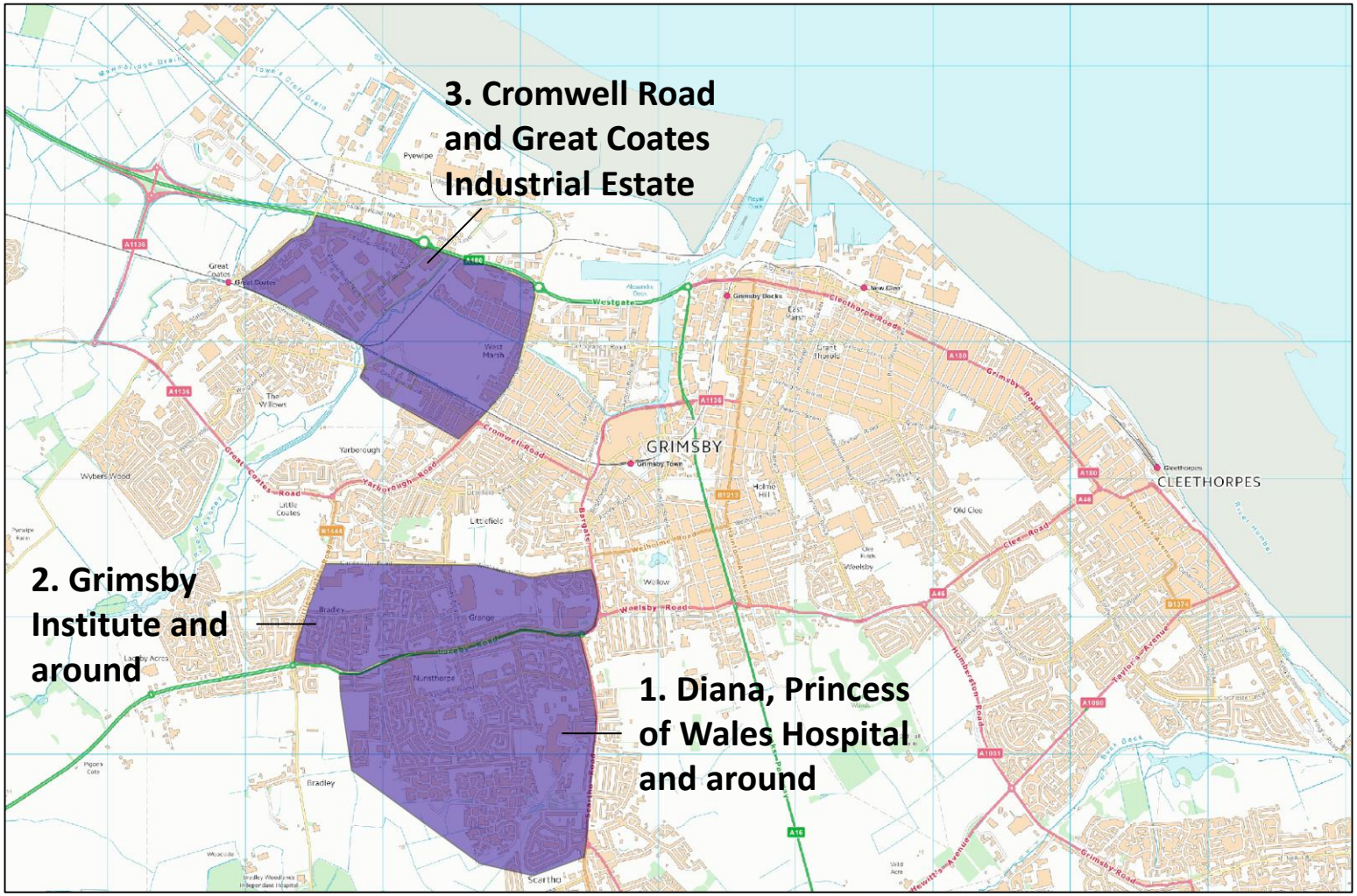
Based on this initial assessment, five clusters were selected to take forward to the economic assessment

ID	Cluster	Weighted score	ID	Cluster	Weighted score
5	Diana, Princess of Wales Hospital and around	**34**	22	South Humber Bank – Hobson Way/Laporte Rd	**25**
17	Europarc Enterprise Zones	**34**	21	South Humber Bank – Moody Lane	**25**
4	Grimsby Institute and around	**33**	9	Cleethorpes Kings Rd/Taylor's Ave	**25**
19	Stallingborough Enterprise Zone	**31**	25	Killingholme	**23**
15	Cromwell Road and Great Coates Industrial Estate	**31**	7	Grimsby Rd-Cleethorpes Rd	**23**
6	Peaks Parkway	**31**	24	Immingham Dock	**22**
23	Immingham Town	**29**	11	Humberston	**21**
1	Grimsby Top Town	**29**	10	Fiveways – Carr Lane	**21**
2	Freeman St	**28**	3	Grimsby Docks	**20**
8	Cleethorpes Town Centre	**27**	20	Healing	**19**
26	Grimsby West Urban Extension	**26**	18	Stallingborough Village	**18**
16	Great Coates	**26**	13	Waltham	**18**
14	Laceby Rd	**26**	12	New Waltham	**18**

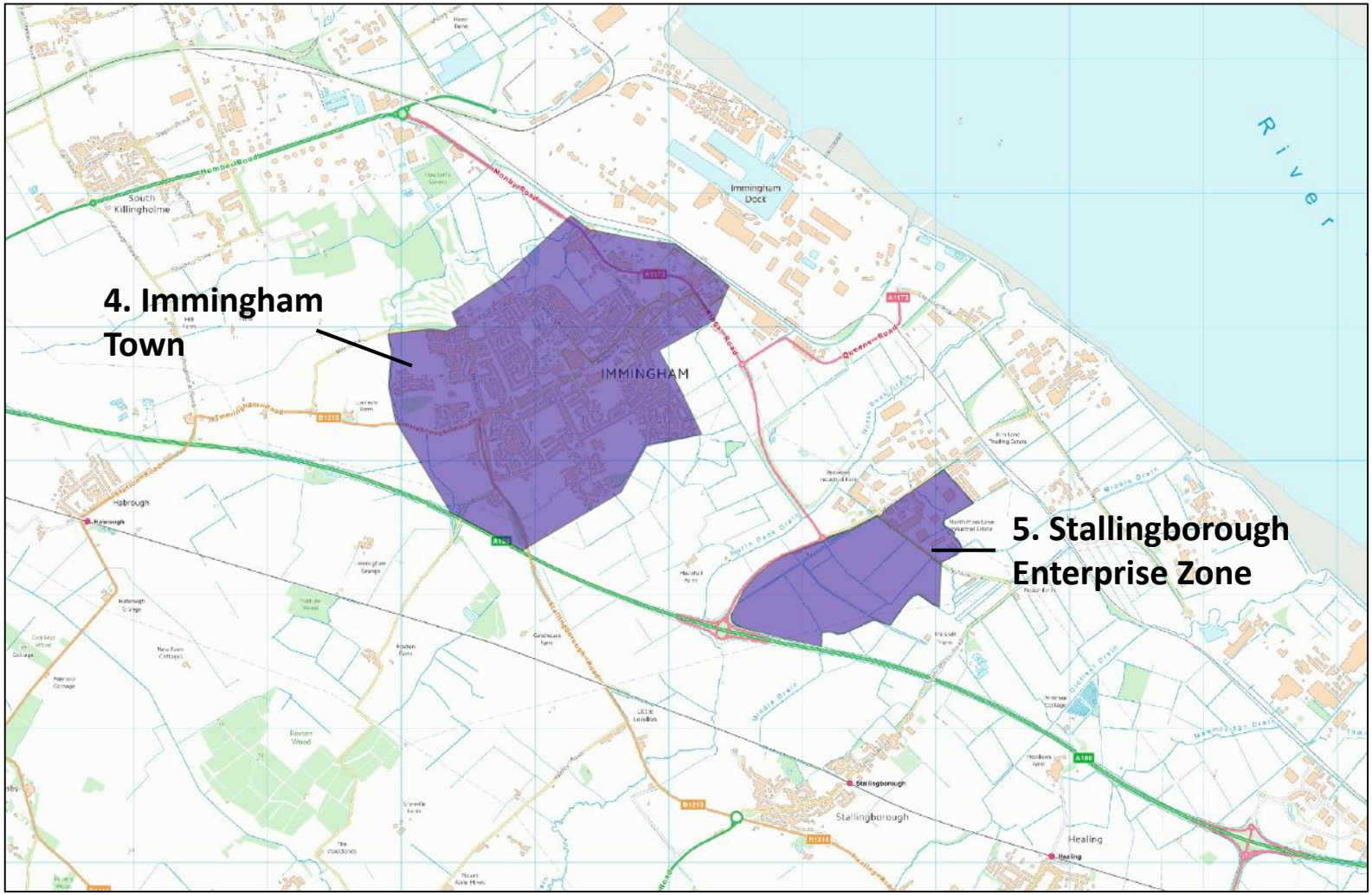
Five clusters were selected for economic assessment based on the weighted score agreed with NELC and additional strategic considerations

ID	Cluster	Weighted score
1	Diana, Princess of Wales Hospital and around	**34**
2	Grimsby Institute and around	**33**
3	Cromwell Road and Great Coates Industrial Estate	**31**
4	Stallingborough Enterprise Zone	**31**
5	Immingham Town	**29**

Map of high-level extent of clusters 1-3



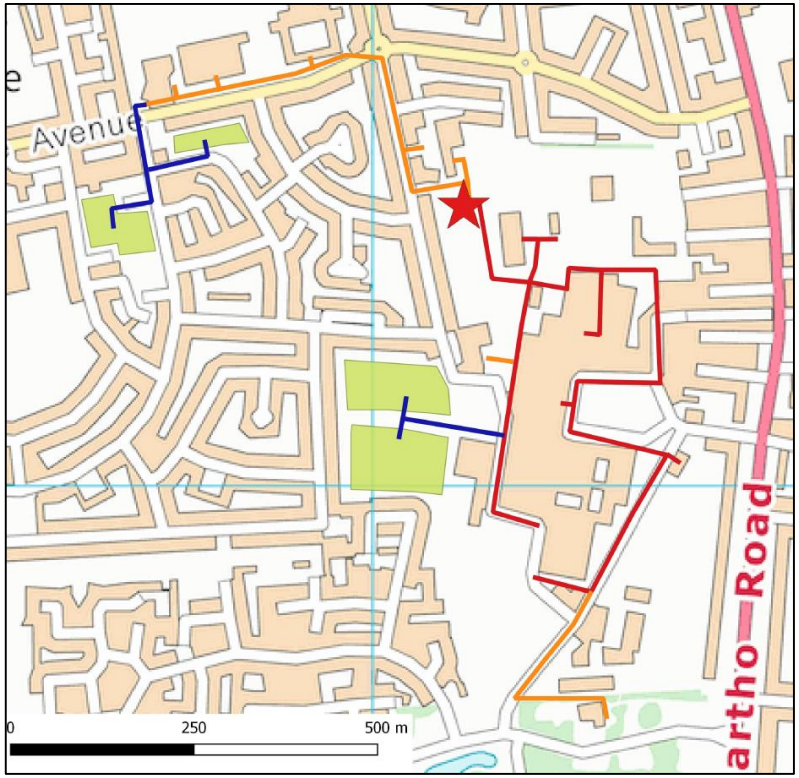
Map of high-level extent of clusters 4-5



DPoW Hospital and around – scheme options

Scheme options: Customers and heat network routes

Customer	S1.1	S1.2	S1.3
Diana, Princess of Wales (DPoW) Hospital	✓	✓	✓
Day Nursery	✓	✓	✓
Nunsthorpe and Bradley Park Children's Centre		✓	✓
Oasis Academy Nunsthorpe		✓	✓
Assisted housing		✓	✓
Nunsthorpe Community School		✓	✓
The Orchard – Grimsby Manor care home		✓	✓
Scartho Hall student accommodation		✓	✓
Sevenhills Academy		✓	✓
Scartho Top/Second Avenue (19 resi units)			✓
Hospital site (233 resi units)			✓
Sutcliffe/Second Avenue (100 resi units)			✓
Winchester Avenue (60 resi units)			✓



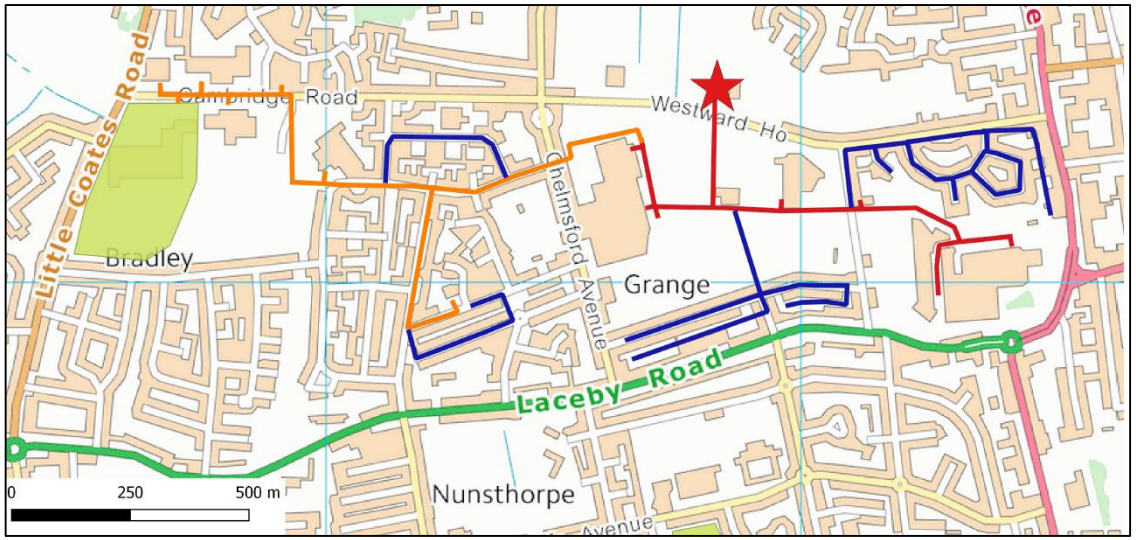
Scheme 1.1
Scheme 1.2
Scheme 1.3
Energy centre

Grimsby Institute and around – scheme options

Scheme options: Customers and heat network routes

Customer	S2.1	S2.2	S2.3
Grimsby Institute for Further and Higher Education	✓	✓	✓
Franklin College	✓	✓	✓
The Academy Grimsby	✓	✓	✓
Ormiston Maritime Academy	✓	✓	✓
Little Stars Nursery	✓	✓	✓
Grange Primary School		✓	✓

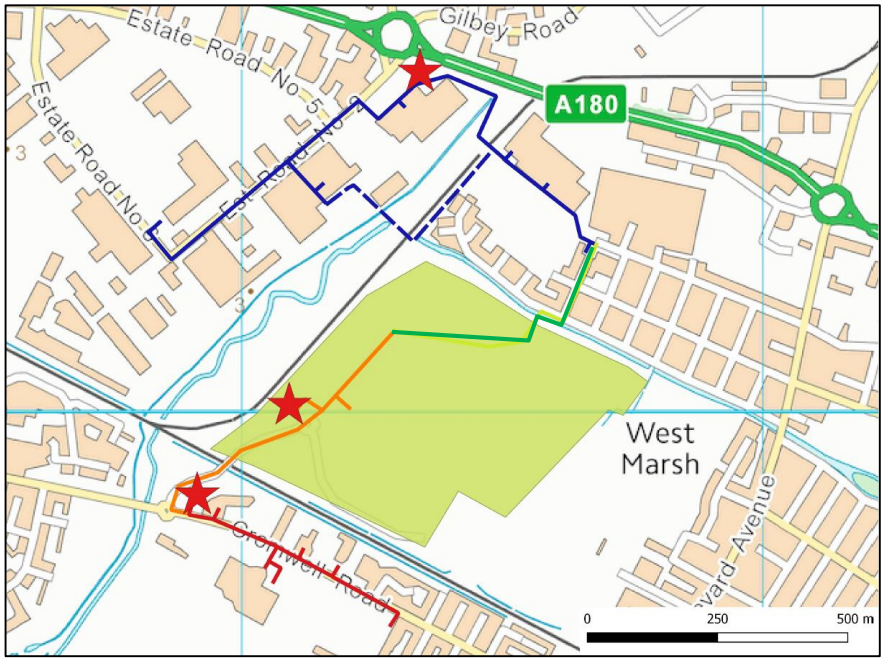
Customer	S2.1	S2.2	S2.3
The Cambridge Park Academy		✓	✓
Fairways Care Home		✓	✓
Masonic Hall House		✓	✓
Cherry Blossom Court		✓	✓
Former Western School site (425 resi units, 3 non-resi)		✓	✓
Existing residential (644 houses)			✓



Cromwell Road and Great Coates Industrial Estate – scheme options

Scheme options: Customers and heat network routes

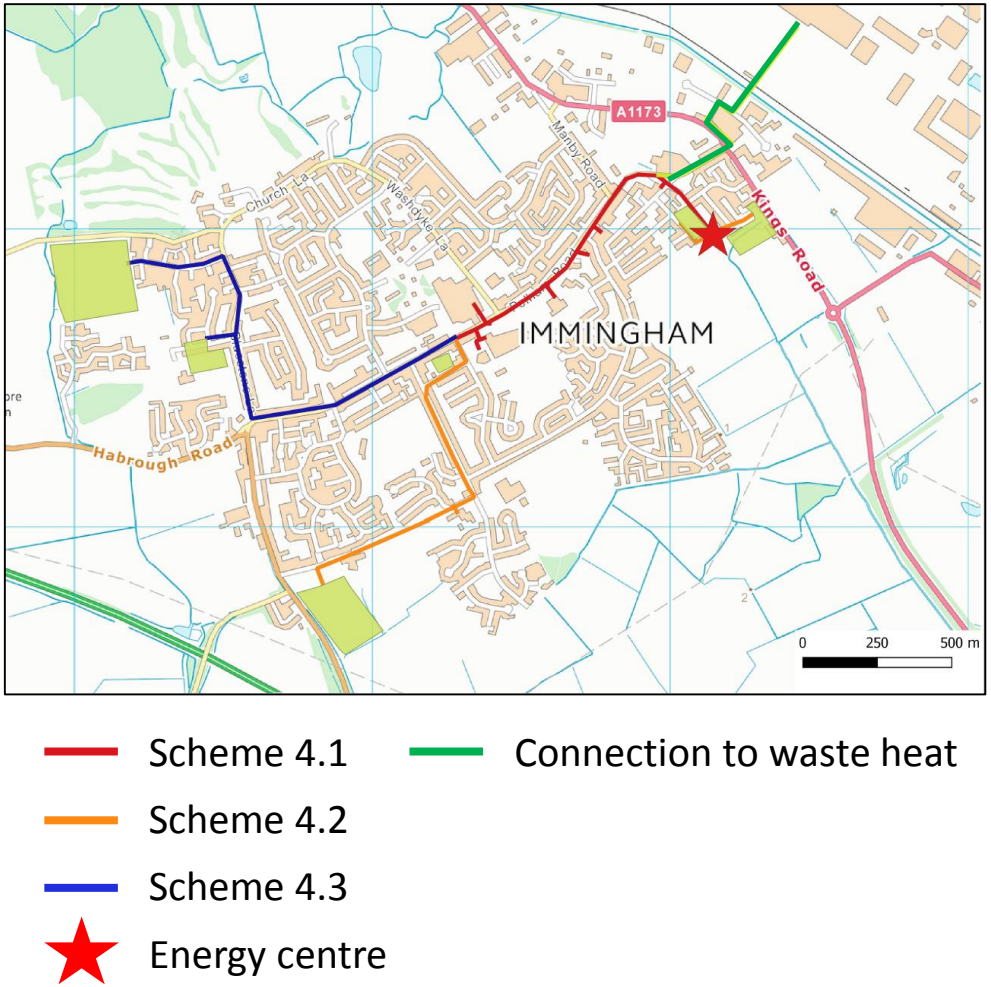
Customer	S3.1	S3.2	S3.3	S3.4
Grimsby Swimming pool - New	✓	✓		✓
Grimsby Leisure Centre	✓	✓		✓
Grimsby Auditorium	✓	✓		✓
Cromwell Road Fire and Rescue Service	✓	✓		✓
Local Police Team Base	✓	✓		✓
Resource Centre	✓	✓		✓
Private Care Centre	✓	✓		✓
Land off Macaulay Street Grimsby (250 resi units)		✓		✓
HSH and SAL - Coldstores			✓	✓
ACS & T - Coldstores			✓	✓
DFDS - Coldstores			✓	✓
Icelandic Seachill - Coldstores			✓	✓
Littlecoates Primary Academy			✓	✓



Immingham Town – scheme options

Scheme options: Customers and heat network routes

Customer	S4.1	S4.2	S4.3
Oasis Immingham	✓	✓	✓
Immingham Leisure Centre	✓	✓	✓
Stark Lincolnshire and Goole Hospital	✓	✓	✓
Canon Peter Hall CE Primary School	✓	✓	✓
Humberside Police Station	✓	✓	✓
County Hotel	✓	✓	✓
Havenmere Care Home	✓	✓	✓
Eastfield Primary Academy		✓	✓
Craik Hill Car Park, Humberville Road (22 resi units)		✓	✓
Waterworks Street (32 resi units)		✓	✓
Land to the east of Stallingborough Road (540 resi units)		✓	✓
Trenchard Close (18 resi units)		✓	✓
Roval Drive (79 resi units)			✓
West of Pilgrims Way (178 resi units)			✓

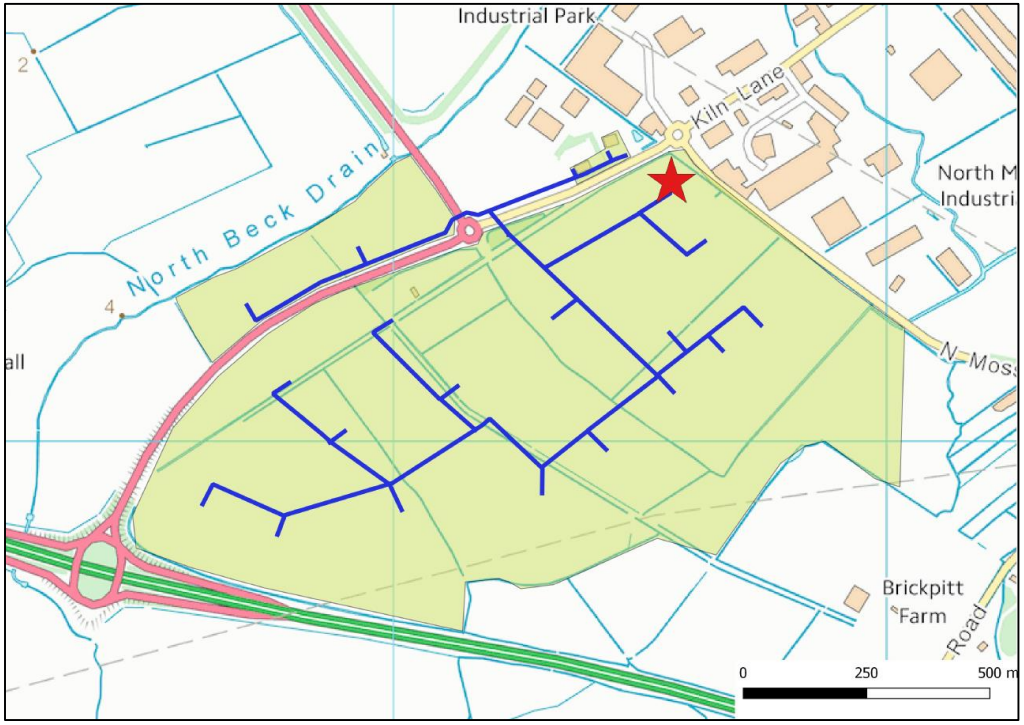


Stallingborough Enterprise Zone – scheme options

Scheme options: Customers and heat network routes

Customer	S5.1	S5.2
HCF Catch	✓	✓
Immingham East Fire Station	✓	✓
Stallingborough Enterprise Zone ≈135,000 m² of B1, B2 and B8 (Two scenarios for heat demand considered)	✓	✓

- Schemes 5.1 and 5.2 have the same customers
- Scheme 5.1: Low heat demand - based on expected development on Stallingborough Enterprise Zone (storage and light industry)
- Scheme 5.2: High heat demand – based on development of heat intensive industry on Stallingborough Enterprise Zone



Agenda

- Overview of project progress
- Stakeholder engagement
- Cluster selection for economic assessment
- **Economic assessment**
- Summary and recommendations

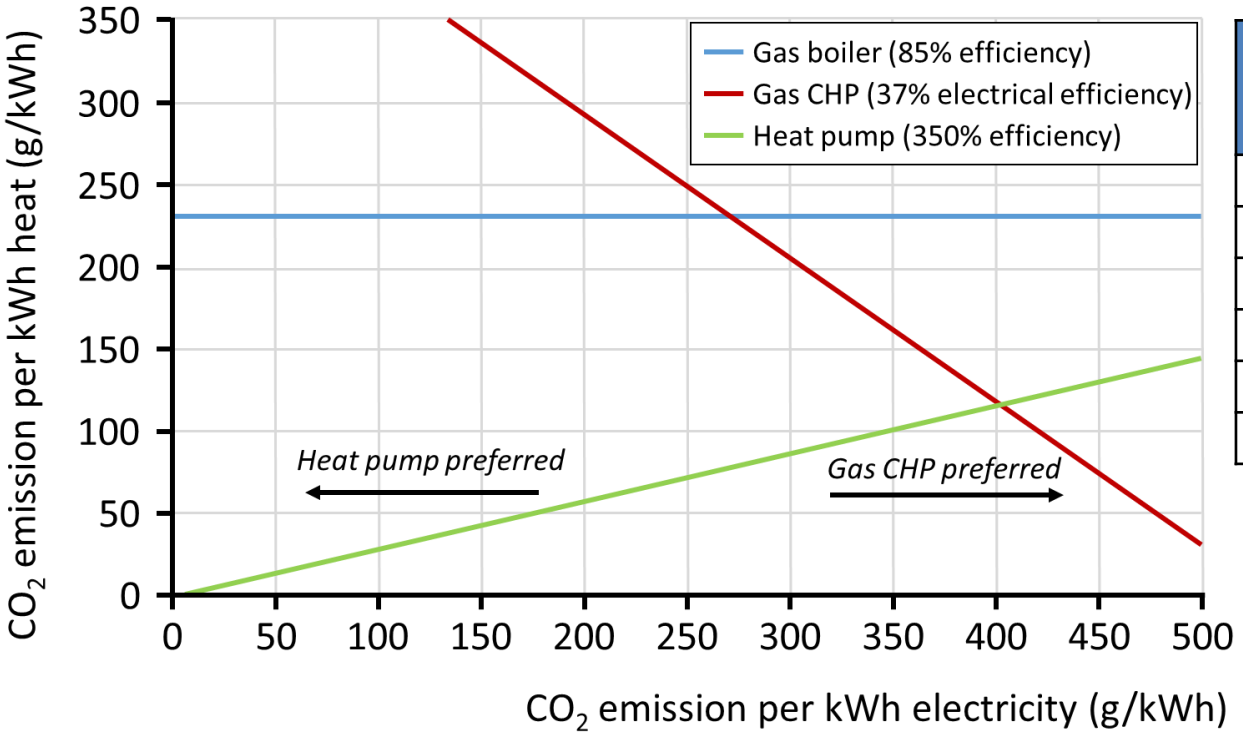
A range of heat supply options have been considered

Option	Pros	Cons	Image
Waste heat from industry, power and Energy-from-Waste plants	✓ Potential to be **very low cost heat** ✓ **Very low carbon** (if treat counterfactual as heat not used)	• Unless close to demand centres, **heat transmission cost can be high** • Likely to have some **downtime so additional backup plant** required	
Water-source heat pumps (WSHP)	✓ Potential to be very **low carbon** ✓ Can be relatively cost-effective where **supported by RHI** ✓ Where **cooling** is also required, economics improved significantly*	• High **capital cost** • Requires substantial **electrical grid capacity** • Some **risk of RHI support being reduced/withdrawn**	
Geothermal	✓ Potential to be very **low carbon** ✓ Can deliver heat without need for heat pump **if temperature sufficiently high** ✓ **Supported by RHI**	• High **capital cost** • **Uncertainty over suitability of resource** until test well drilled • Some **risk of RHI support being reduced/withdrawn**	
Gas combined heat and power (CHP)	✓ **Mature and proven** technology ✓ Relatively **cost-effective** without subsidy ✓ Opportunity to deliver **on-site electricity**	• Fossil fuel-based, so **carbon savings may not be large** (and may be negative in future)	
Biomass boiler	✓ Potential to be very **low carbon** ✓ Cost-effective option where **supported by renewable heat incentive** (RHI)	• **Regular deliveries and/or large storage required** for biomass • **Air Quality** and **environmental issues** • Some **risk of RHI support being reduced/withdrawn**	

*Heating and cooling are complementary processes for heat pumps, as cool water is produced as a 'by-product' of heating using a heat pump, and warm water is produced as a 'by-product' of cooling using a heat pump. In this way, winter heating 'charges' the water body with cool water, which can be used for cooling in the summer.

As the electricity grid decarbonises, heat pumps lead to larger CO_2 emissions savings whereas Gas CHP can lead to an *increase* in emissions

CO_2 emissions per kWh of heat as a function of grid electricity carbon intensity[1]



	CO_2 emission per kWh electricity (marginal)[2], g/kWh
2015	307
2020	260
2025	198
2030	118
2040	48
2050	25

(1) Figure adapted from 'A Heated Debate: Sustainable heat for a low carbon future', Graeme Gidney and Paul Woods, Aecom, 30/10/12; (2) HMT Green Book Guidance Table 1 (March 2017)

Key parameters presented in the economic assessment – Definitions

Definition of key economic assessment parameters

- **Price of heat**, expressed in pence/kWh, is the price at which heat is sold to heat network customers.

- **Counterfactual price of heat**, expressed in pence/kWh, is the price the customer would have paid for heat in the counterfactual case of no heat network.

- **Net Present Value (NPV)** is the sum of the cash inflows (benefits) minus the sum of the cash outflows (costs) of the scheme, including upfront costs and ongoing/fuel costs. It is calculated over a stated project economic lifetime and using a stated discount rate. **A positive NPV is achieved when benefits outweigh costs.**

- **Internal Rate of Return (IRR)**, expressed as a percentage (%), is a measure of the **profitability** of an investment, and is equal to the discount rate at which the NPV is equal to zero. The IRR is often a key metric in investor decision-making, where the investment is required to surpass a 'hurdle rate' or minimum threshold IRR.

Key parameters presented in the economic assessment – Default values

Default values for economic parameters in results presented here

- Unless otherwise stated:
  - Price of heat is fixed as a **10% reduction on the counterfactual** price of heat
  - NPV and IRR results presented assume a **25 year project economic lifetime**
  - NPV results presented assume **a 6% discount rate**
  - **Renewable Heat Incentive (RHI)** revenues **are** included for currently eligible technologies
  - **Grant** support is **not** included

- The 6% discount rate is chosen to reflect a typical IRR requirement for a **public sector-led scheme** of **at least 6%**, assuming the public sector body would have access to low cost finance

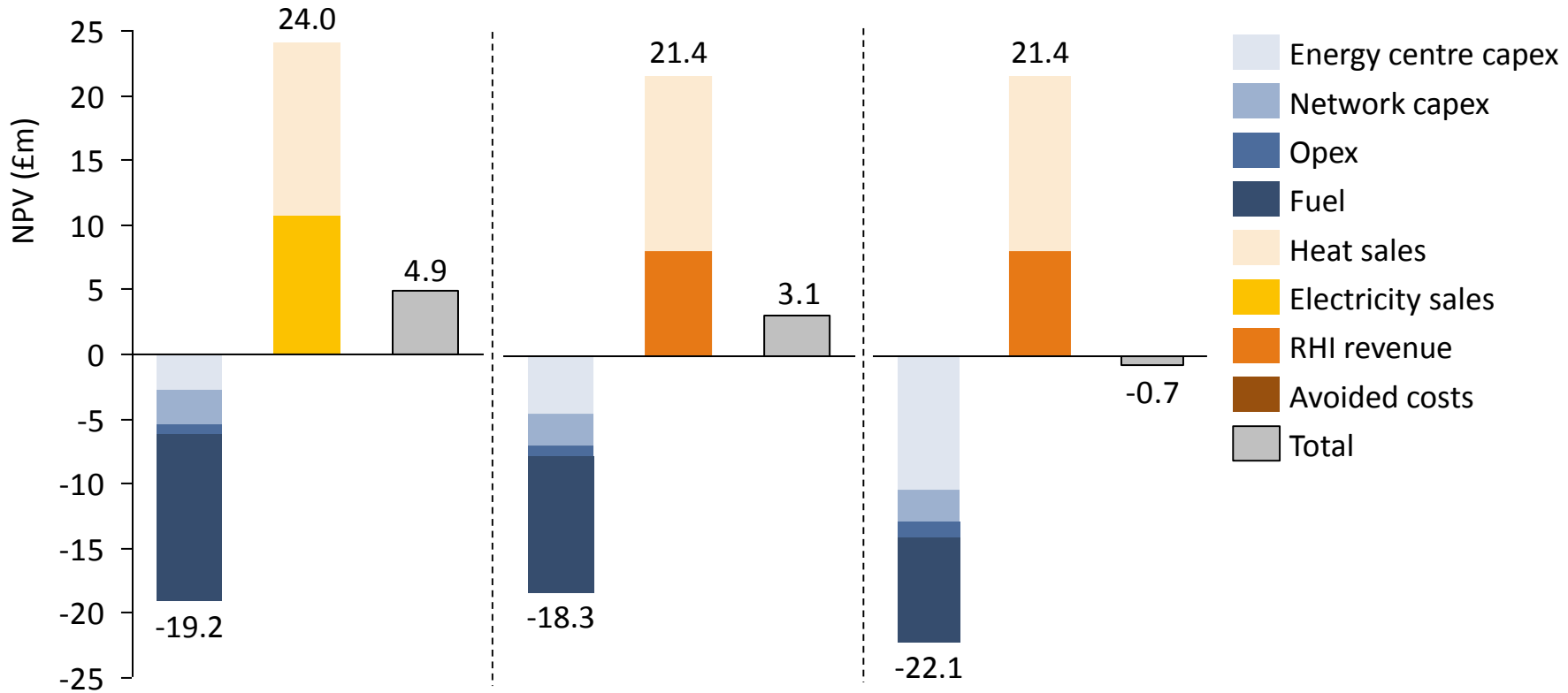
- A **private sector-led scheme** is likely to require an IRR in excess of **at least 10% IRR**

DPoW Hospital and around – Scheme technical data

Category	Item	Scheme 1.1	Scheme 1.2	Scheme 1.3	Unit
Final Annual heat demand	Domestic	-	0.3	1.9	GWh/year
	Non-domestic	22.0	23.4	23.4	
	Total	22.0	23.7	25.3	
Peak heat demand	Peak Demand	8.1	8.7	9.2	MW
Number of connections	Domestic	0	3	415	Connections
	Non-domestic	8	12	12	
	Total	8	15	427	
Main heat supply	Capacity	2.8	3.1	3.4	MW
Additional heat supply	Auxiliary boiler capacity	8.6	9.4	10.1	MW
Network route lengths	Distribution pipe length	2.2	3.6	6.3	km
	Service pipe length	0.2	0.3	2.4	
	Distance from closest source of waste heat	8.7	8.7	8.7	
Network temperature	Network flow/return temperature	80/50			°C
	Network delta T	30			
Linear heat density	Heat density	**9.3**	**6.1**	**2.9**	GWh/yr/km

Gas CHP is the most economically viable option for Scheme 1.1 but WSHP also achieve an IRR above 6% with the RHI

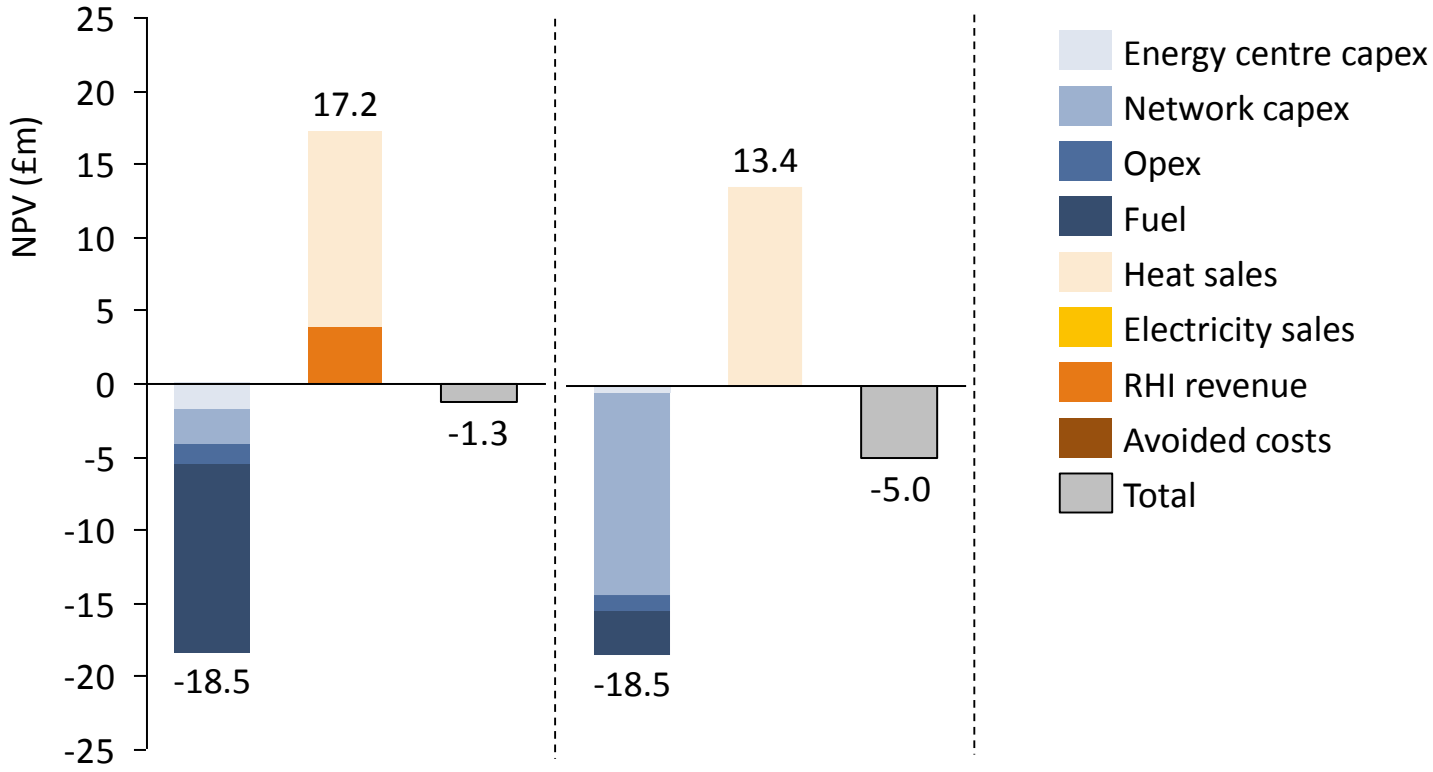
Comparison of different heat supply technologies for Scheme 1.1



IRR	13.2 %	9.3 %	4.7%

Neither Biomass Boiler nor Waste heat appear to be economically viable for Scheme 1.1

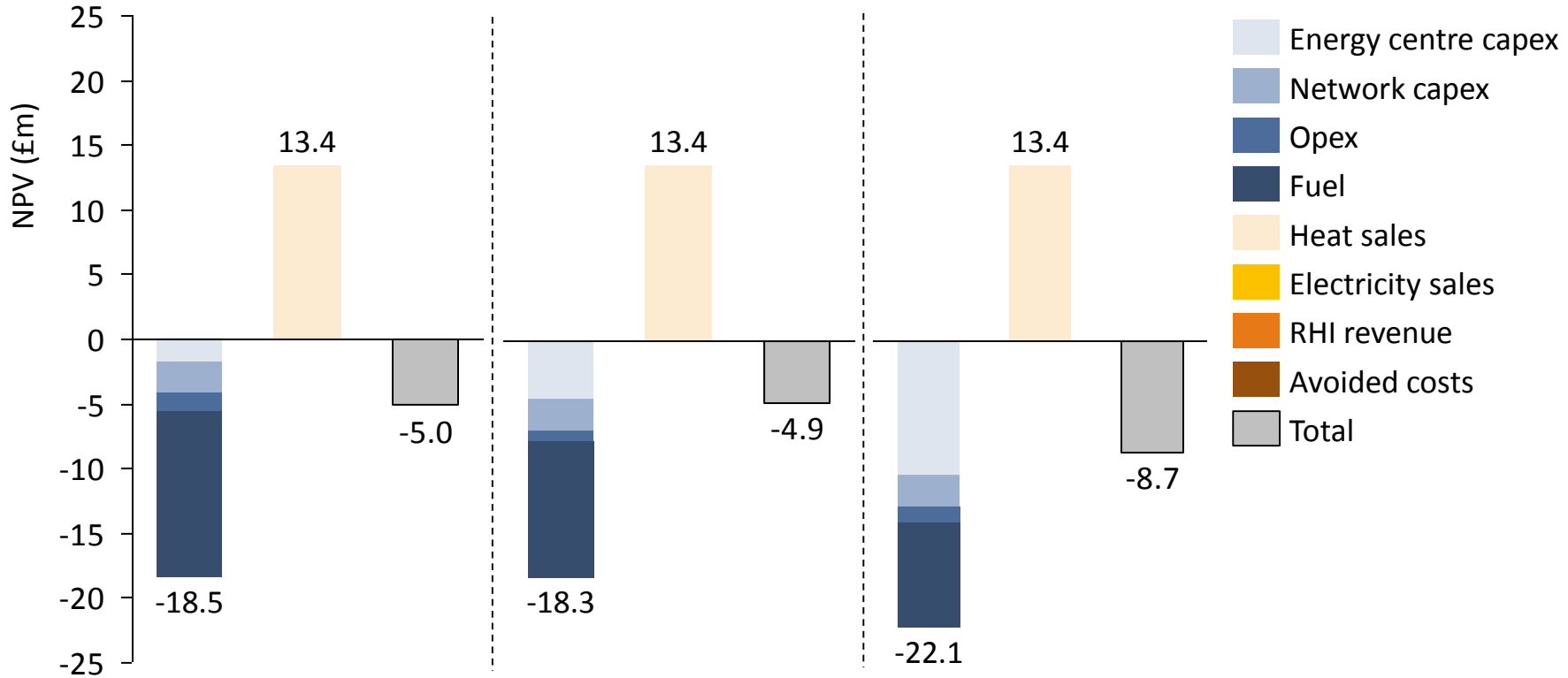
Comparison of different heat supply technologies for Scheme 1.1



IRR	2.4 %	1.8 %

The RHI is critical to the economic viability of the WSHP-based scheme

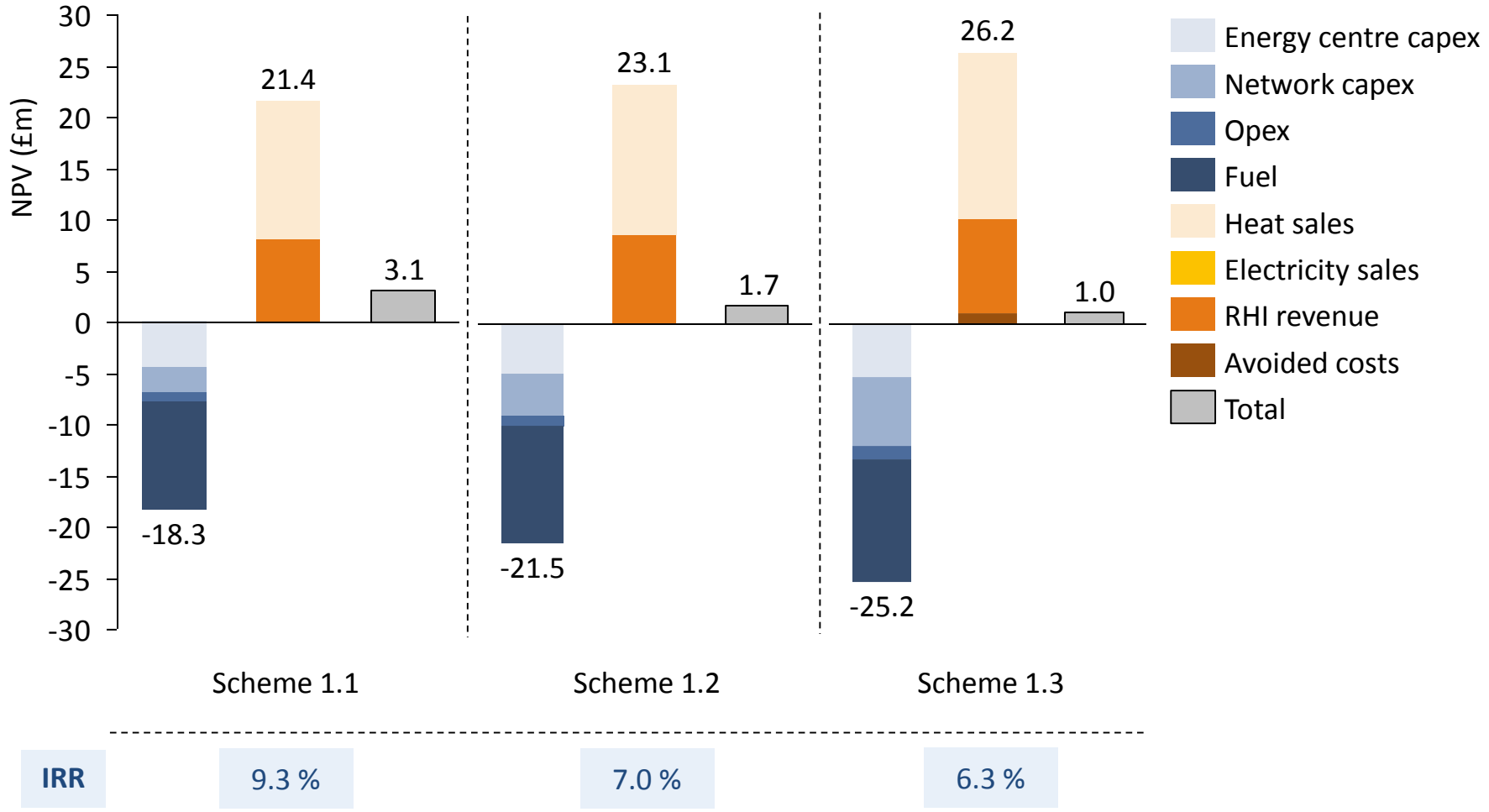
Comparison of heat supply technologies for Scheme 1.1 without RHI revenue



IRR	< 0 %	< 0 %	< 0 %

All scheme options in the Hospital cluster could achieve an IRR greater than 6% using WSHP with RHI revenues

Comparison of different scheme options at the Hospital cluster (based on WSHP)



IRR	9.3 %	7.0 %	6.3 %

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To inform the scheme option prioritisation, the following critical success factors have been agreed

List of critical success factors

Critical success factor	Description	Proposed metric
Reduced energy costs	Lifetime cost of supplying kWh of heat	p/kWh
Meeting climate targets	Lifetime CO_2 emissions reduction	tCO_2
Number of households served	Number of households served	No. of connections
Economic Value / GVA	Likely impact on gross value added to the region - *Attracting new commercial heat users* - *Reducing energy bills could increase business growth (larger schemes have larger impact)* - *Using local sources of waste heat could increase growth/investment in EfW/biomass*	Qualitative assessment 1-10
Fuel poverty impact	Number of fuel poor households served	No. of connections
Air quality impact	Impact on the local air quality - *Using waste heat has the most positive impact* - *Gas CHP more negative impact than waste heat/WSHP* - *Biomass boiler likely to have most negative impact* - *Impact more negative in densely populated areas*	Qualitative assessment 1-10

A shortlist of key scheme options have been scored against critical success factors

Score achieved by key scheme options for the critical success factors

Scheme Option	25 year IRR*	Critical success factors					
		Lifetime cost of supplying heat (p/kWh)	Lifetime CO_2 emissions reduction, ($ktCO_2$)	No. of households served	Gross value added to the region (Qualitative assessment 1-10)	No. of fuel poor households served	Impact on the local air quality (Qualitative assessment 1-10)
DPoW – S1.1 WSHP	9.3%	3.2	67	0	5	0	7
DPoW – S1.1 Gas CHP	13.2%	3.0	-35	0	5	0	4
DPoW – S1.3 WSHP	6.3%	4.6	74	415	5	0	7
DPoW – S1.3 Gas CHP	8.2%	4.1	-51	415	5	0	4
GIFHE – S2.1 WSHP	5.0%	4.8	17	0	5	0	7
GIFHE – S2.1 Gas CHP	6.5%	4.3	-11	0	5	0	4
Cromwell Rd – S3.1 Gas CHP	6.6%	4.3	-7	0	5	0	5
Cromwell Rd – S3.4 WSHP	2.0%	5.9	45	250	5	0	8
Immingham – S4.2 Waste heat	2.3%	7.9	30	613	7	0	9
Stallingborough EZ – S5.2 Waste heat	5.6%	4.9	81	0	10	0	10

*Including RHI for eligible schemes; excluding any grant support

Of the 10 key scheme options shown, some are likely to be deliverable only via a public sector-led model, and possibly only with Grant support

Economic viability of the schemes

Deliverable with private sector-led model: >10% IRR

- The **Hospital core scheme** (Scheme 1.1) with **Gas CHP** is the only scheme option that achieves an IRR above 10%, a typical requirement for private-led delivery, without Grant support

Deliverable with public sector-led model: >6% IRR

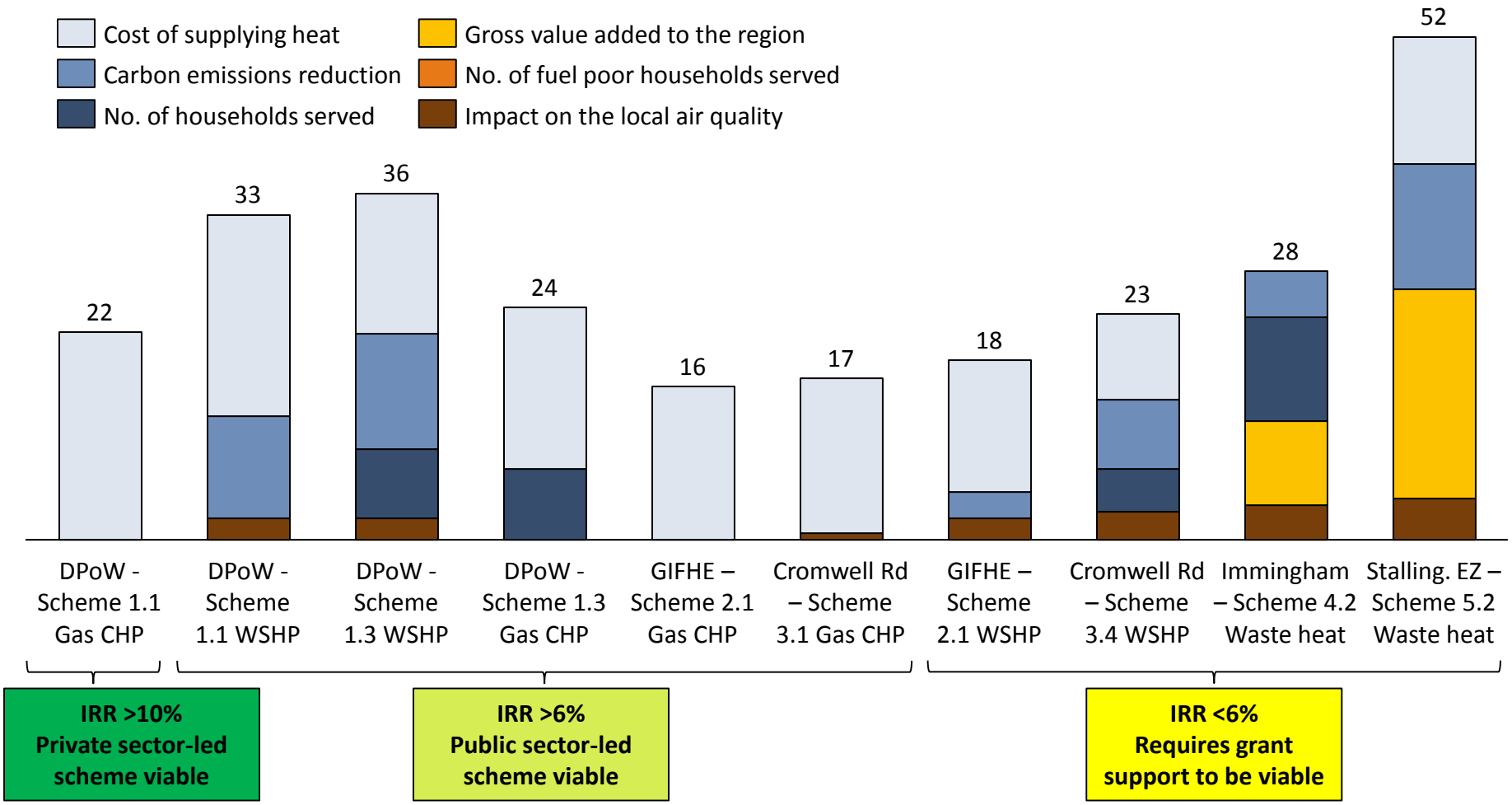
- A range of scheme options achieve IRRs between 6% and 10%, including the **extended Hospital scheme** (Scheme 1.3) with WSHP, the **Grimsby Institute core scheme** (Scheme 2.1) with Gas CHP and the **Cromwell Rd core scheme** (Scheme 3.1) with Gas CHP
- These schemes could be economically viable using public sector-led delivery

Deliverable only with Grant support: <6% IRR

- Other schemes are only likely to be viable with additional Grant support (e.g. through HNIP)
- The extended **Cromwell Rd** scheme (Scheme 3.4) with WSHP, the extended **Immingham** scheme (Scheme 4.2) with waste heat and the **Stallingborough** scheme (Scheme 5.2) with waste heat could become economically viable through public sector-led models with an upfront grant of between 20-40%

Assessment of key scheme options against critical success factors

Assessment of key scheme options against critical success factors



Thanks for your attention

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