



Heatropolis Alpha End of Phase Meeting

18/04/2024

passiv

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Heatropolis – Project progress update since mid-point

Project headlines

- Project is **on track** and is in the final stages of closure, to original scope and budget
- All contracts have been signed; Purchase Order issued
- No material changes since project kick-off – the plan has shifted out slightly since mid-point due to smart control testing challenges
- Deliverables finalised and Beta bid proposal is the remaining focus

Key achievements

- **Exceptional insights and opportunities identified**, providing a solid basis for a Beta bid including cumulative net discounted benefit of £165million and 150,000 tonnes of CO₂ avoided
- **High engagement and buy-in** from a wide range of target user groups who are keen to be involved and help shape the future of Heat Networks
- **Multiple publications** with good levels of reach and engagement across the news including the TV, articles and partner press releases **spanning the UK and Sweden**

Upcoming activities

- 18/04/2024 Additional smart control response events will delivered to support preparation for Beta
- 24/04/2024 Show and Tell presentation
- 22/05/2024 Beta submission deadline

Key risks & our mitigations

- Beta bid requires a large amount of dedicated time, especially no lead partners have Beta experience } Senior level discussion and support; workshops and ongoing discussions and support from Guidehouse as consultants

Work Package Updates

WP1 Project Management

What is it

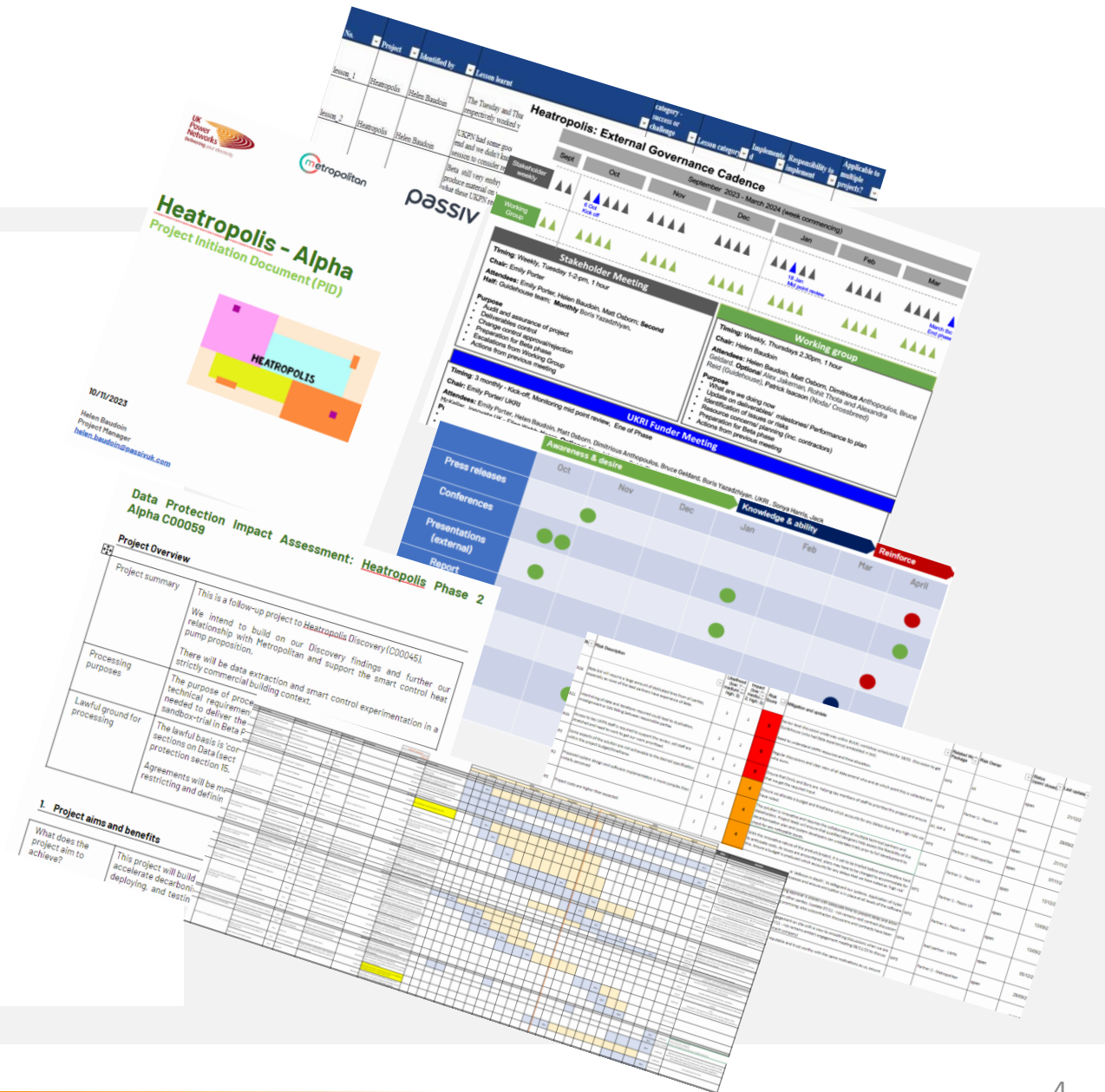
Project managed to time, cost and quality

Highlights

- SIF collaboration agreement signed by all parties and Purchase Orders received
- All partner contracts and POs issued and signed
- Project Governance and shared area set up
- Project initiation document, data protection impact assessments, risks, project plan, lessons learnt and comms plan signed-off and regularly updated

Next steps

- Final invoices to be made and processed
- Preparation of Beta submission



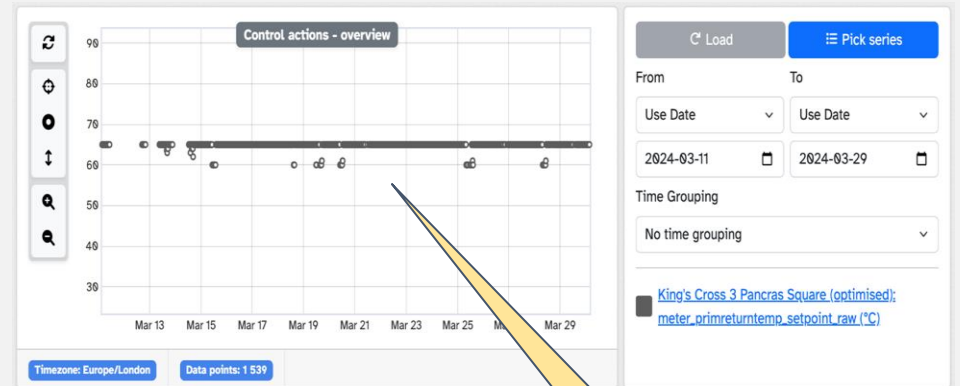
Work Package Updates

WP2 Smart Control Testing

Highlights

- Site selected, data feed options reviewed, smart control testing hypotheses and experimentation plan agreed
- Onboarding with multiple stakeholders in the building including - owners, Facilities Management providers, Occupants, Data services providers
- Completion of a three-stage integration process:
 - 1) Technical audit and data validation
 - 2) Set up of integration platform and provision to optimisation service
 - 3) Activation and launch of smart control service
- Initial data quality and communication errors overcome during initial end-to-end testing and configuration
- Six smart control response testing events delivered successfully
- Sequence of smart control actions used to learn the thermal response characteristics of the building
- No measurable impact on the indoor climate during test events recorded
- Performed automated impact evaluation as input for project reporting
- Final report on smart control testing submitted
- Flexibility data set for Metropolitan work collected and submitted

Smart Control Events:



Date	Duration
15/03/2024	2 hours
19/03/2024	1 hour
19/03/2024	2 hours
20/03/2024	3 hours
25/03/2024	4 hours
28/03/2024	3 hours

Normally HN building return temperatures are at 65°C. Any deviation from this is a sign that a smart control action is active

Work Package 2 - Deep Dive

Smart control of thermal systems

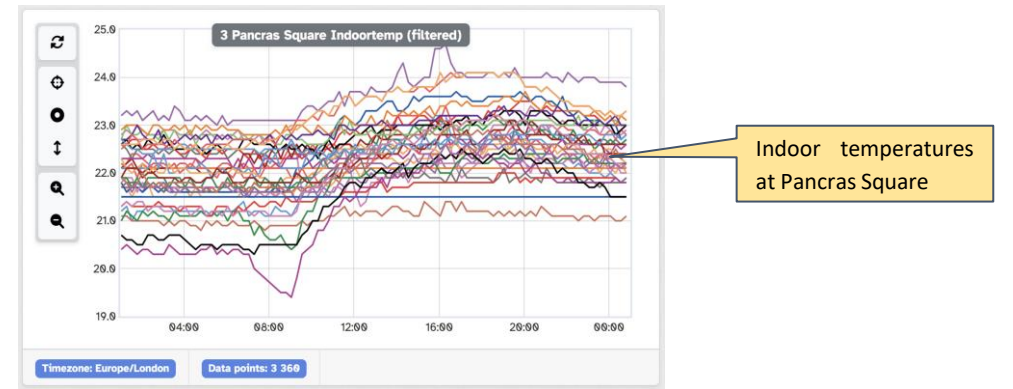
Response testing of thermal flexibility

- Electrical systems provide instantaneous responses.
- Thermal processes have a time delay - inertia
- Inertia is used to extract flexibility from heating systems
- The levels of available (long/short) flexibility are estimated through response testing
- Control actions delivered to study how buildings react – ML response model
- Analysis at St Pancras Square suggests a short-duration flexibility of up to 45 % while long-term reductions of up to 14.5 % over time are achievable



Data points - King's Cross 3 Pancras Square

- Multiple data points are provided through the control system integration:
 - Flow and return temperatures, volume flow, and setpoints
 - Over forty indoor temperature sensors



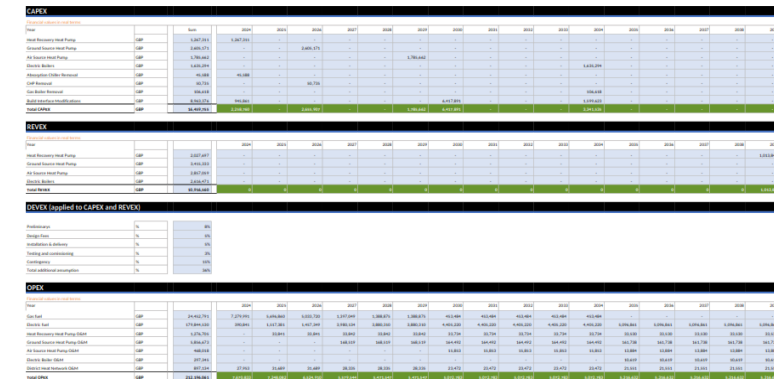
Work Package Updates

WP3 Technical Design

Highlights

- Further modelling has confirmed greater reduction in peak contributions than identified during Discovery where additional heat pumps can be installed alongside increased thermal storage and Smart building controls
- Now confirmed reductions of >70% for large sites already incorporating some thermal storage under business-as-usual
- Reductions of >85% possible for smaller sites – e.g. single block communal heating systems – which would typically not have any significant thermal storage under business-as-usual
- Options for more compact phase change material based thermal storage identified for a range of scales and operating temperatures
- Outline design undertaken for integration of modelled additional storage and Air Source Heat Pumps (ASHPs) at Kings Cross to achieve circa 6MVA reduction during electrical peak demand periods
- Data provided for Business Case development on capital, operating and replacement costs for revised design compared to business-as-usual
- This confirms that while operating costs are reduced against business-as-usual for the optimised load reduction design this is not sufficient to support the additional level of investment required
- The technical design WP has demonstrated significant potential for reductions in peak electrical loads with additional investments and has shown the revenue gap which needs to be closed to allow this investment to occur

Example of model interface sheet



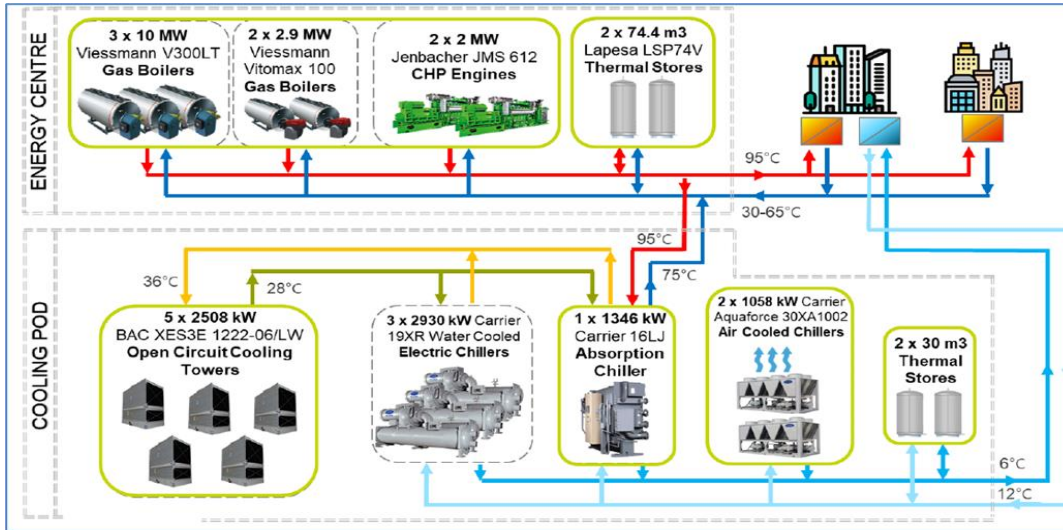
The image shows a spreadsheet interface with three main sections: CAPEX, REVENUE, and CAPEX (applied to CAPEX and REVENUE). Each section has a table with columns for years from 2020 to 2030. The CAPEX table lists items like 'Heat Recovery Heat Pump' and 'Air Source Heat Pump' with values in GBP. The REVENUE table lists similar items with values in GBP. The third section shows a summary table with values in GBP.



Example of phase change thermal store – Sunamp Central Bank (courtesy of Sunamp)

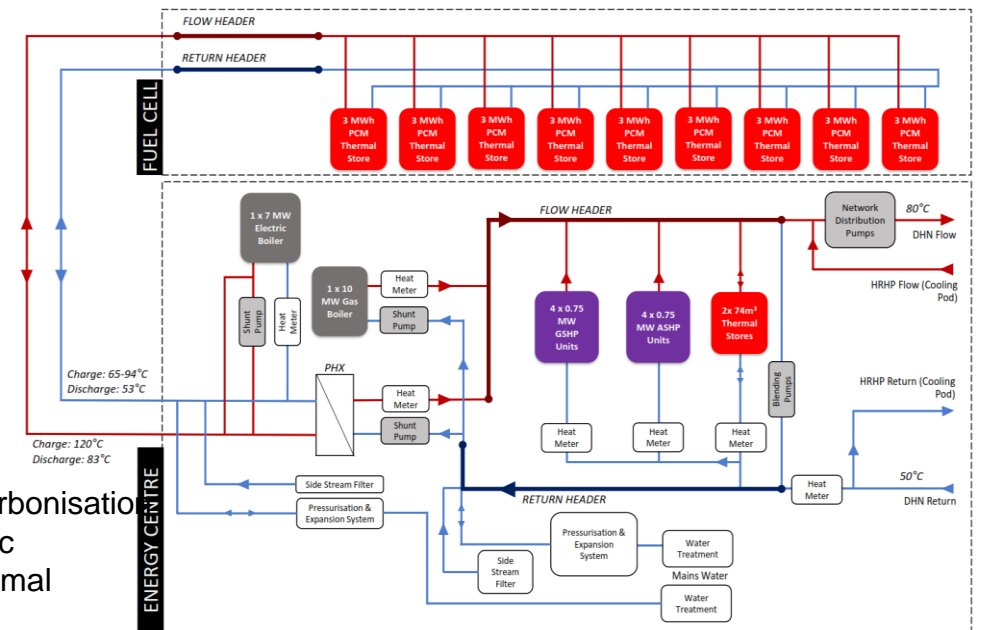
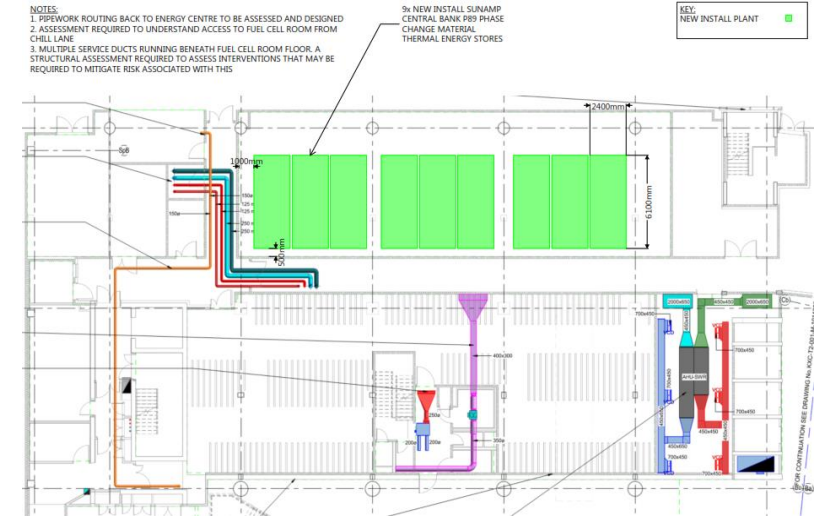
Work Package 3 - Deep Dive

Technical Design



Counterfactual decarbonisation solution for Kings Cross including existing 5MWh thermal storage

Electrical peak load optimised decarbonisation solution for Kings Cross – layout for additional thermal storage in existing plant room space



Electrical peak load optimised decarbonisation solution for Kings Cross – schematic incorporates additional 27MWh thermal storage and 1.5MWh ASHP

Work Package 4 Deep Dive

Business Models and CBA analysis

1

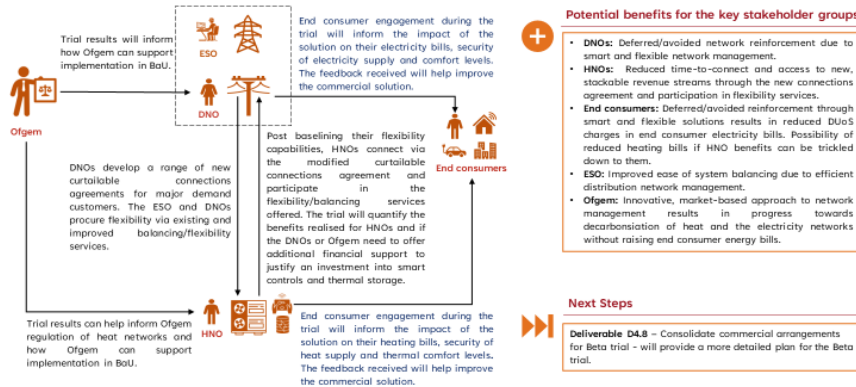
In the Alpha phase, the following 8 business models were ideated

#	Business model title	How does it work
BoU	Existing firm and non-firm connection agreements with DSO procured flexibility services	Heat networks connect via existing firm/non-firm connection agreements and can participate in the existing DSO-procured flexibility services.
1	Greater value, longer-term DSO demand flexibility services	DSOs offer longer-term contracts for flexibility services with increased availability/utilisation/service fees.
2	Curtailable connections agreement modified for electrified heat networks	DNOs implement a new, modified curtailable connections agreement mechanism that aligns with heat networks' flexibility design parameters.
3	Centralised flexibility procurement across electricity transmission and distribution networks	The National Energy System Operator (NESO) and the DSO jointly procure system balancing services and distribution level flexibility services respectively on a centralised platform from heat networks and other flexibility providers.
4	Upfront financial incentives from the DNOs to HNOs for flexible operation of heat networks	DNOs offer upfront financial incentives to support the adoption of smart building controls and thermal storage.
5	OfGEM incentivised flexible operation of heat networks	OfGEM offer upfront capital grants and/or payments-on-performance to support the adoption of smart building controls and thermal storage.
6	OfGEM mandated flexible operation of heat networks	OfGEM mandate that heat networks must adopt smart building controls and thermal storage and offer a certain degree of flexibility in their operation.
7	Clustered connection agreements with local capacity trading as a service	Heat networks submit a single connection capacity request in tandem with other flexible customers. When required, they trade capacity with each other.
8	Locational Marginal Pricing (LMP)	Locational price signals representing network congestion across the locations drive the adoption of smart building controls and thermal storage to manage electricity consumption.

Determined that current commercial mechanisms on their own do not provide sufficient incentive to unlock flexibility and ideated eight revised possible business models.

2

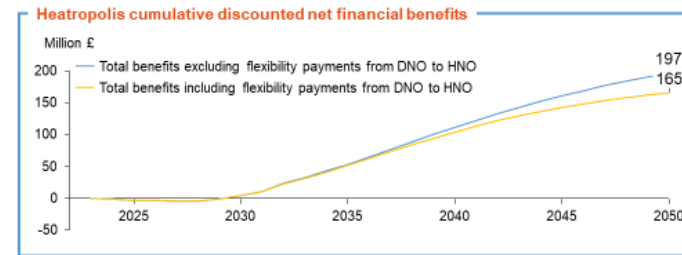
We recommend exploring a range of more dynamic curtailable connections agreements and flexibility services in the Beta phase



3

EXECUTIVE SUMMARY PART 1: DNO CBA PART 2: HNO CBA APPENDIX

The cumulative net discounted benefit including flexibility payments is £165million and 150,000 tonnes of CO₂ avoided



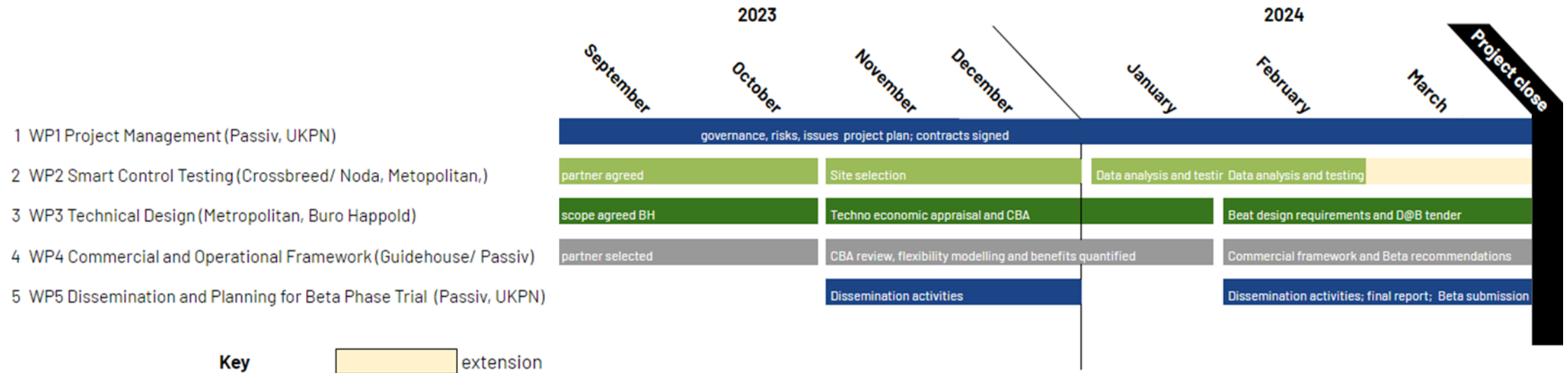
- £165m** of cumulative discounted net financial benefit across GB by 2050
- 9208 tCO₂e** of GHG emissions from avoided reinforcement by 2050
- 1.3 GW** of reinforcement avoided across distribution networks in GB by 2050
- 140 ktCO₂e** of GHG emissions from avoided electricity fuel used by 2050

- Key Takeaways:**
- Total benefits are dominated by avoided reinforcement at DNO level, with contributions from carbon benefits. Total costs are dominated by the ongoing flexibility payments to the Heat Network Operator.
 - The proposed solution offers additional benefits that have not been quantified as part of this business case.
 - Reduced time-to-connect and improved access to new low carbon heating technologies will accelerate the decarbonisation of heating in the UK.
 - Improved system balancing, due to greater access to flexible resources, unlocks financial benefits for the ESO.
 - Introducing new flexible assets onto the market will drive down the cost of flexibility improving the certainty and options from which flexibility can be procured
 - Reduced need for generation (e.g. wind farms and solar farms) reducing the need for large infrastructure projects designed to increase generation capacity.
 - Further analysis in the Beta phase is required to validate:
 - The actual amount of flexibility that can be achieved and the cost to unlock this.
 - Market price modelling to forecast how this will change over time.
 - Quantify the qualitative benefits identified, not yet quantified as part of this business case, through collaboration with the electricity system operator.

Developed a DNO network impact model which calculates the benefits of avoided reinforcement by deploying the smart solutions, which directly reduce the peak demand across heat networks. The cumulative net discounted benefit including flexibility payments is ~£165million and 150,000 tonnes of CO₂ avoided. The proposed solution identified additional qualitative benefits: 1) reduced time to connect, improved system balancing, introducing new flexible assets and reduced need for generation.

The project concluded that exploring a range of new curtailable connection agreements and flexibility services would be beneficial in the Beta phase.

Heatropolis – High-level Project Plan (*minor changes*)



Minor delays were not material but were caused by:

- Access to key expertise was sometimes challenging due to clashes in other priorities, projects and changes to roles.
- There was additional complexity in identifying key stakeholders for building-level smart control trials.
- Staff sickness led to delays in starting smart control data analysis

Detailed Gantt with delays can be found in the [Appendix](#)

Heatropolis – Key risks



There was only one open risk which relates to the Beta phase which has been lowered from 'red' to 'amber':

Description:

Beta bid requires a large amount of dedicated time from all parties, especially as none of the lead partners have experience of Beta.

Impact:

Additional resources required, Senior stakeholder engagement.

Mitigation:

Senior level discussion and support; workshops and ongoing discussions and support from Guidehouse as consultants.

WP link:

All, WP5

Full Risk Register can be found in the [Appendix](#)

Heatropolis – Project specific conditions

Condition 1 - The Funding Party must not spend any SIF Funding until contracts are signed.



✓

Condition 2 - Any financial contributions made over and above that stated in its Application should also be reported and included within the Project costs template.



✓

Condition 3 - participate in all meetings related to the Project that they are invited to by Ofgem, UKRI and DESNZ.



✓

Held introductory session with DESNZ providing overview of Heatropolis project

Next steps with DESNZ – follow up meeting on conclusion of work – agree simple statement of benefits and any policy support required

Heatropolis – Lessons Learnt

The below lessons learnt have been incorporated into our Beta planning.

Process



- Collaboration agreements between multiple parties require months to be agreed
- Allow sufficient time for international partners to digest local policies
- It is essential for the partners to keep Beta Phase in mind while delivering Alpha Phase and keep a consistent focus on the innovation challenge



Scope

- Data insight has provided lots of interesting areas such as anti-legionella and static operation of HN to support operations
- Very useful to engage a third party who has knowledge of the SIF application/ bid process

Hardware



- UK control of buildings is inconsistent (controllers in network), additional analysis needed and to be built into future plans
- Data quality not initially optimum for control, in the future allow a longer time for data quality assurance
- Complex building ownership and responsibility means it's difficult to get agreement and sole control

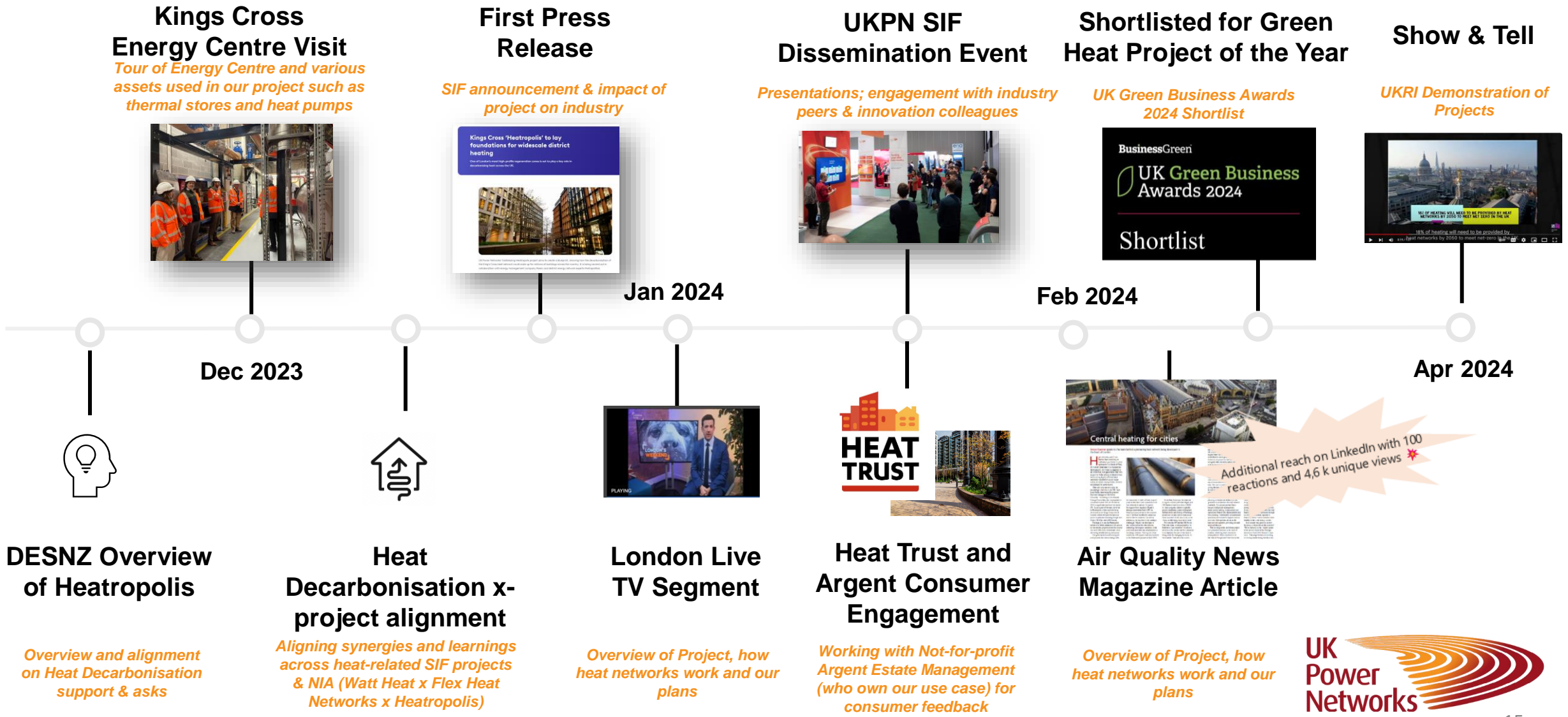


Stakeholders

- Agree time needed from stakeholders upfront
- Close contact with Innovation Manager was helpful to ensure progress (including scheduled monthly check-ins and ad-hoc sessions)
- Site management companies/ building owners may expect to be paid for their time to support data sharing

Full Lesson learnt can be found in the [Appendix](#)

Heatropolis – Comms & Engagement Activities



What's next....

Further analysis in the Beta phase is required to validate:

Smart Control Testing

Smart control Integration

- Extend the pre-integration tech audit to comprise configuration and validation of heating system controllers, and provide new routine to clarify system stakeholders/ ownership
- Implement a Data Requirement Specification and a Data Performance measurement tool for data accuracy, frequency and quality
- Improved interaction between the primary substation and the underlying building management system
- SCADA integration for network-level analysis and control

Smart control Operation

- Extended focus on system temperature optimisation
- Operational deployment of active energy services for consumer empowerment (end-point control)
- Demand response scheme in operation

Technical Design

Data access

- Refined data access process and integration platform integration between active solution components
- Extended supply-chain security-related policies and increased reporting-related commitment

Customer-side

- Knowledge transfer for end-user engagement through relevant communication channels

Sector coupling and heat network

- Ancillary services supporting business models for relevant demand response schemes
- Framework for flexibility aggregation and practical usage

Commercial & Operational Framework

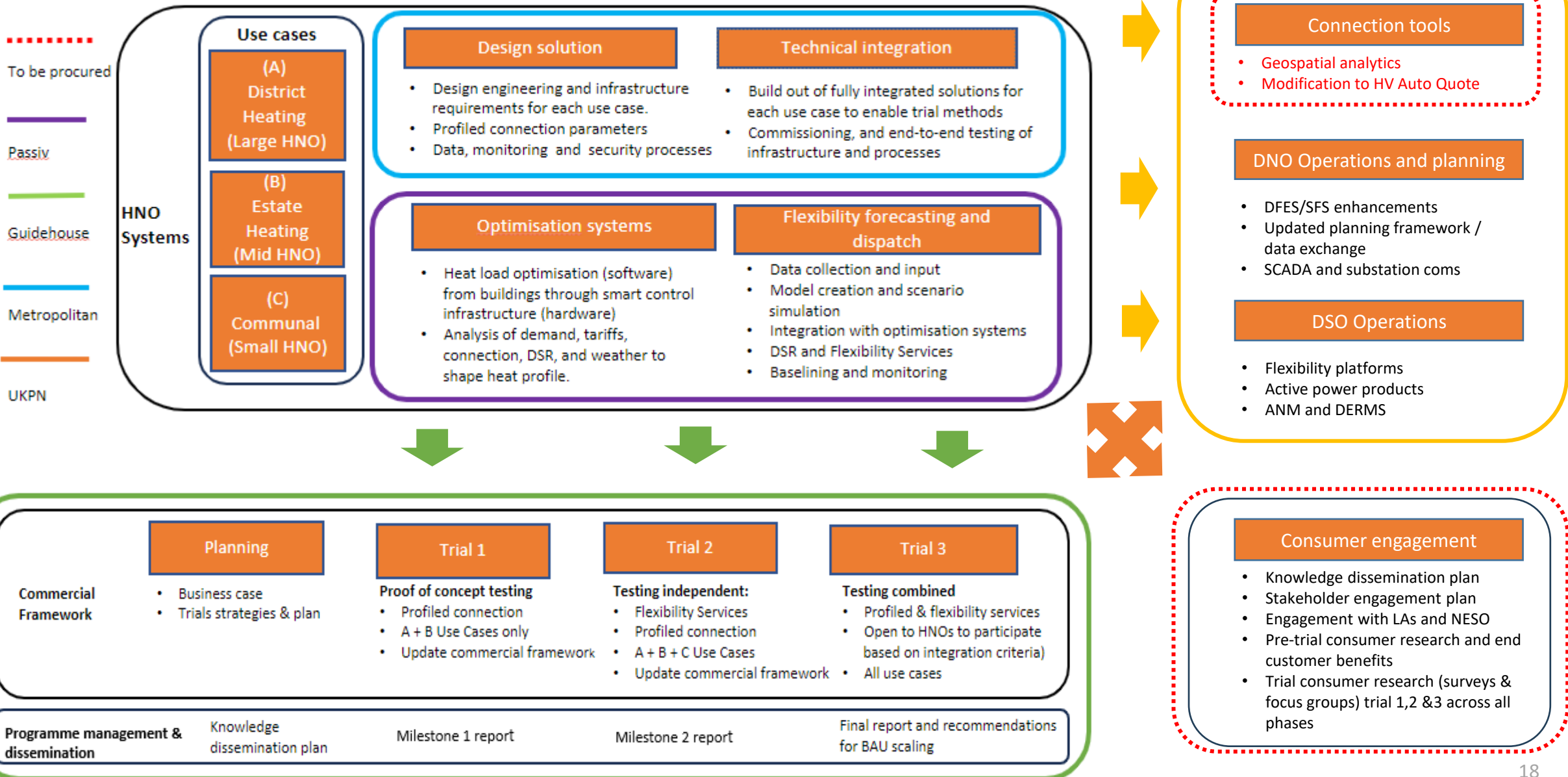
Business Models

- The amount and duration of demand flexibility the differing smart heat networks can offer at varying times
- Determine whether smart heat networks can successfully integrate with the DNO's DERMS system and participate in flexible connections
- Determine if smart heat networks can be available to provide flexibility and respond to utilisation instructions successfully when participating in flexibility services

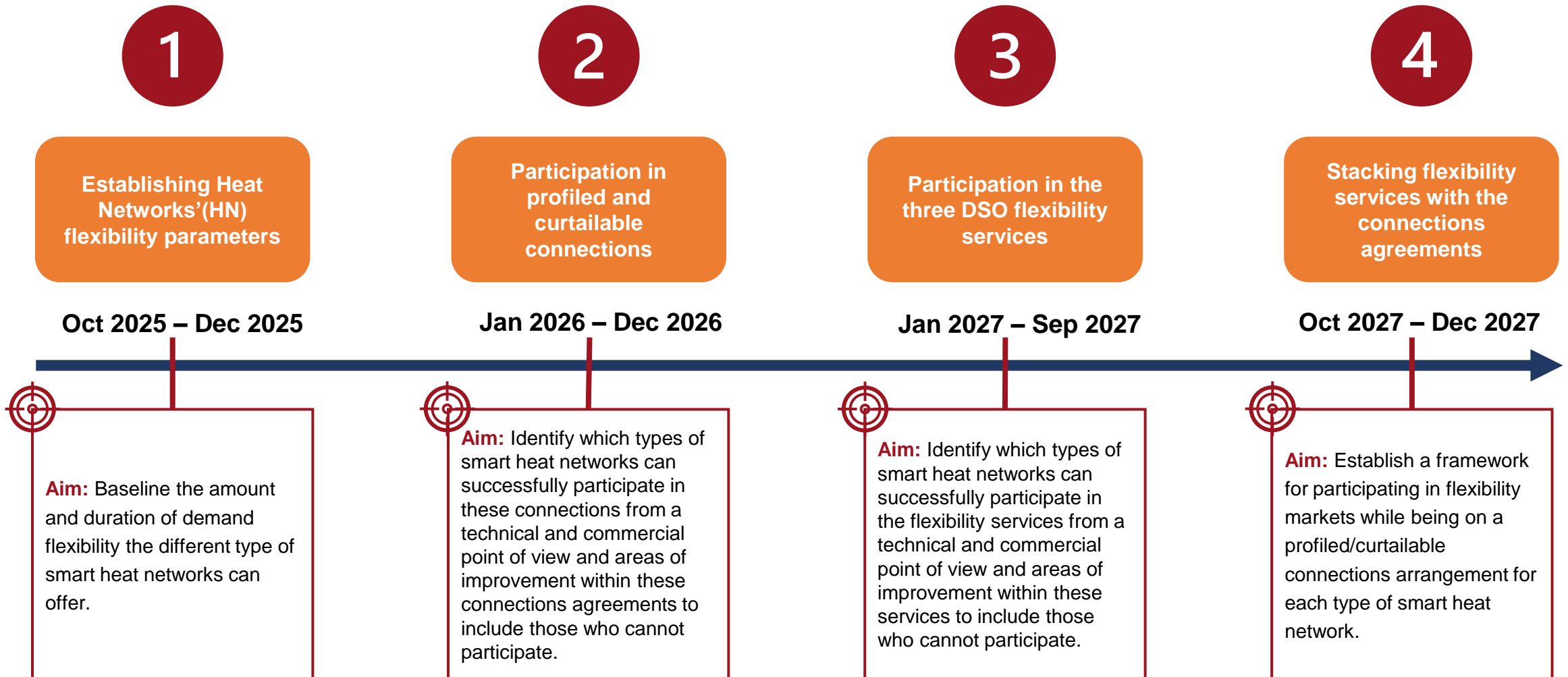
Cost benefit analysis

- The amount of flexibility that can be achieved as well as market price modelling to forecast how the price will change over time
- Quantify the qualitative benefits identified, not yet quantified as part of this business case, through collaboration with the electricity system operator
- Determining the costs for district heat network operators based on the end user use cases
- Understand the true technology saving over time for heat pumps, thermal storage & smart controls

Summary - Project on a Page



The Beta phase will be divided into the following 4 stages



Coming up...

- Show & Tell session: 24th April 2024 – 10:00 - 11:00
- Beta deadline: 22nd May 2024
- Successful project applicant start: September 2024

- AOB?





Appendix

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