Electricity Distribution

Tyseley Environmental Enterprise District (TEED)

Ofgem/UKRI SIF Discovery Phase

Show & Tell Session
20th June 2023

nationalgrid

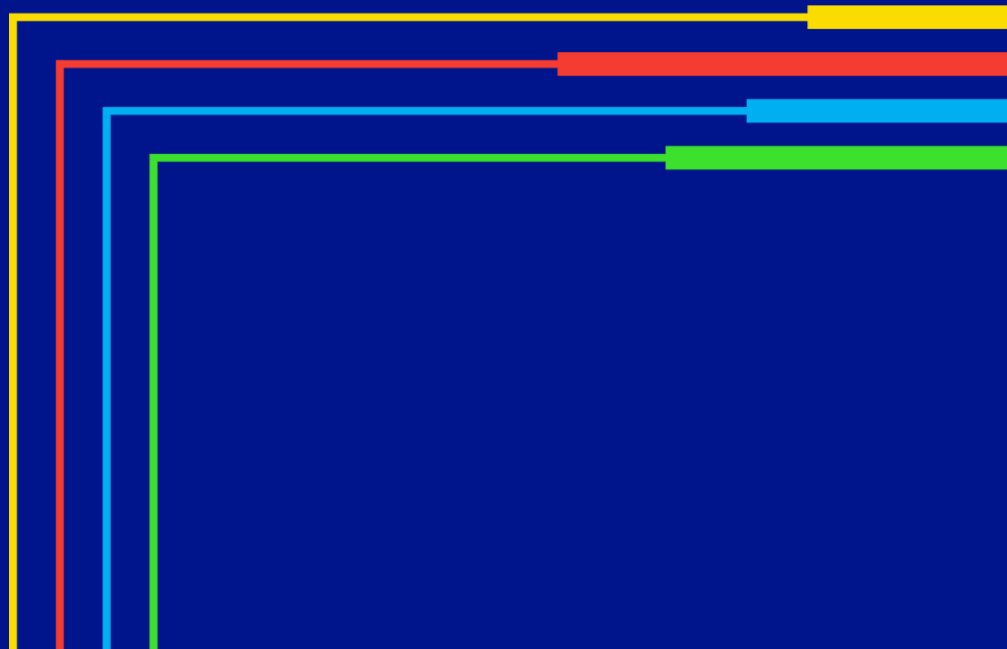
Agenda

01	Introducing the TEED Project
02	Problem Statement
03	Retrospective Review
04	Building the data model
05	Unlocking NetZero Delivery
06	Considerations for Alpha Phase
07	Questions

Electricity Distribution

01

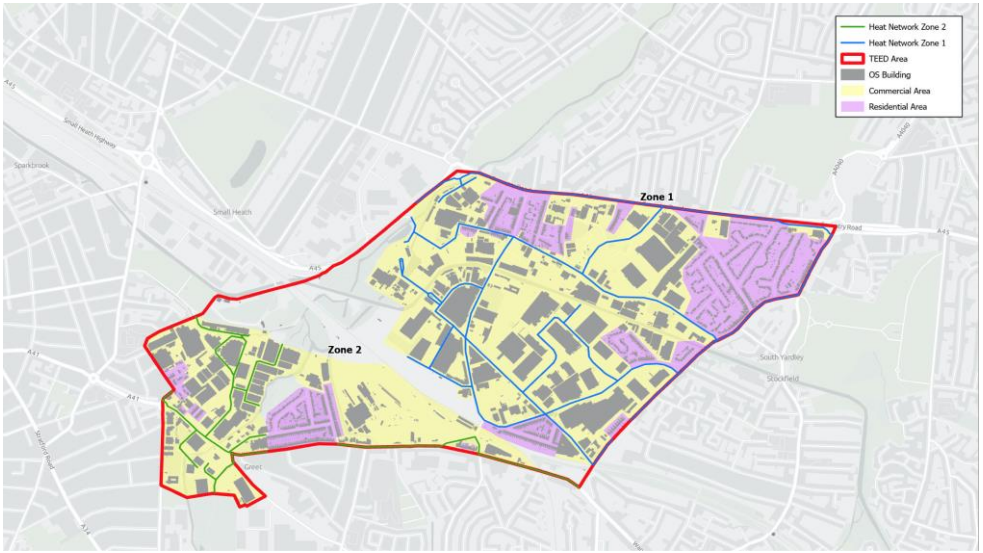
Introducing the TEED Project



nationalgrid

The Tyseley Environmental Enterprise District (TEED)

- The TEED zone is a 2.5 square km area of East Birmingham comprising of mixed industrial, commercial and residential housing (250 businesses and 2000+ homes)
- Identified in the Birmingham Development Plan as a principal location in Birmingham for CO2 reduction as part of a low carbon, low waste economy through recycling, energy production and renewables
- The TEED zone is also home to the Tyseley Energy Park (TEP) which hosts energy from waste, bio-generation, PV, hydrogen & clean fuel production
- There are a highly diverse range of energy assets and use cases, all contained within a small geographic area on the outskirts of the UK's second largest city



"Probably the best location for a NetZero 'Living Lab' in the UK!"

Digital scan created by MAADigital

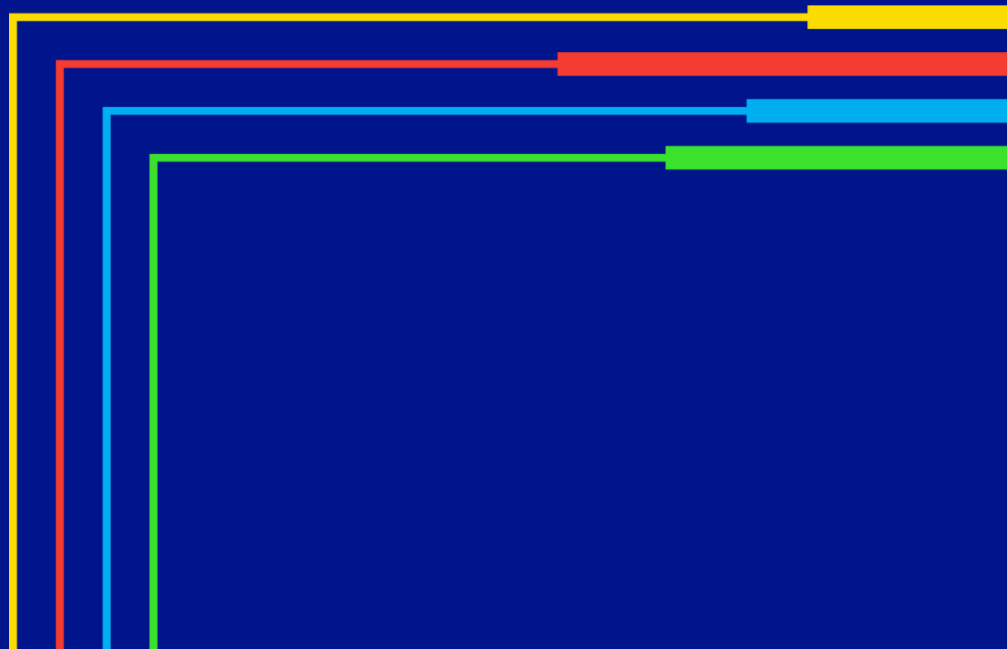
Project Partnership Structure

SIF Project Partners	Key Project Stakeholders
NGED	Birmingham City Council
University of Birmingham	Ofgem
Equans	UKRI
Pinnacle Power Ltd	
SSE plc	
Tyseley Energy Partnership	
NGESO	
Smart Grid Consultancy	

Electricity Distribution

02

Problem Statement



nationalgrid

The Project Challenge

The TEED project approach:

We seek to assess the compatibility of the existing and future energy vectors within Tyseley Environmental Energy District and propose an optimised roadmap to reduce net carbon emissions, minimise capital costs, maximise affordability and system resilience for the benefits of consumers and stakeholders

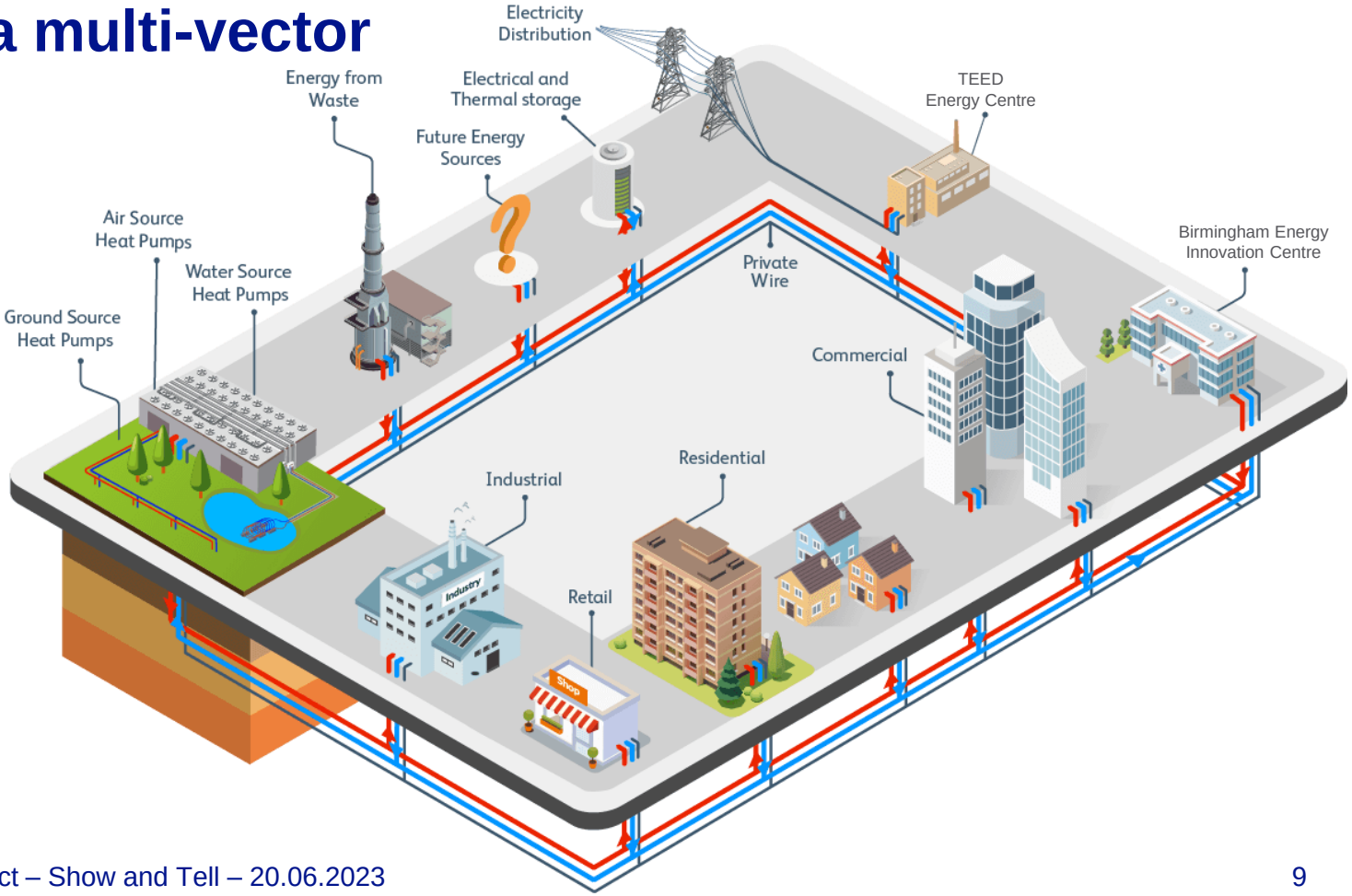
Discovery Problem Statement:

To use the development of an optimised local solution to create a transferrable model for use across the UK to accelerate heat decarbonisation and mitigate distribution reinforcement costs

"We aim to capture the city's low carbon, waste heat; and give it back to the local community"

Working in a multi-vector living lab!

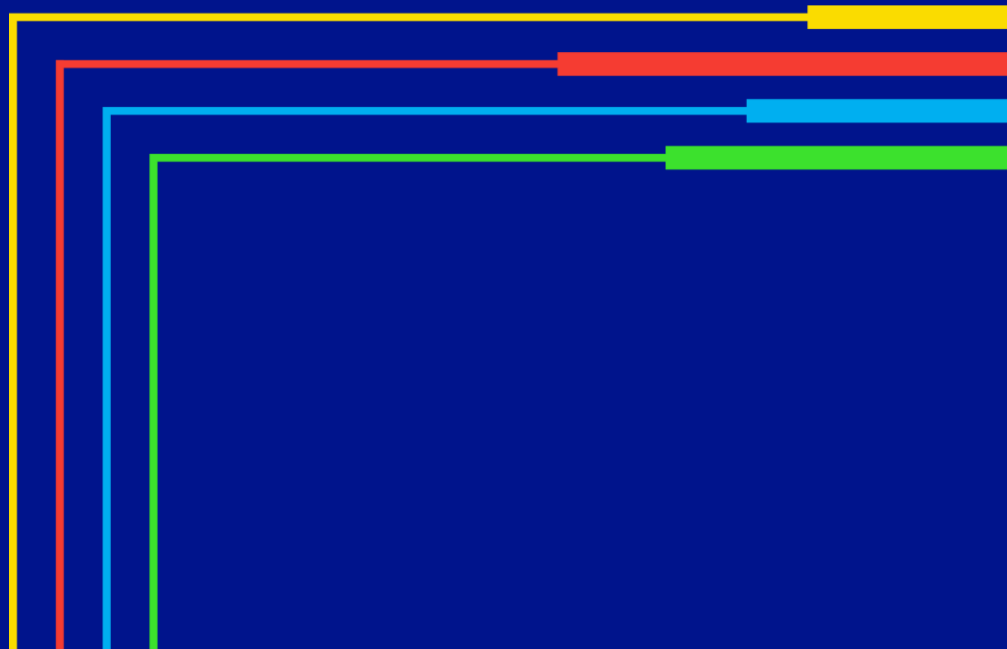
- Energy from waste
- Bio generation
- Clean fuels
- HV & LV ED grid
- Hydrogen production
- Electrical and thermal storage



Electricity Distribution

03

Retrospective Review



nationalgrid

Discovery work packages

1 Use case definition

- Management of project
- Defining scope and managing revisions
- Ensuring collaborative approach & data sharing
- Defining the use cases for the options

2 Data compilation & Baselining

- Compilation of existing available data on heat and electrical demand
- Establishing baseline CO2 emissions & years for review
- Consideration of neighbouring areas

3 Optioneering & the art of the possible

- Generation & appraisal of a range of options for development of heat, hydrogen electricity, storage
- Appraisal of demand need of TEED in terms of electrification of transport and heating and power
- Consideration of future waste and circular economy strategy

4 Development of options

- Builds on WP3 with each option subject to a design analysis led by company examining feasibility and high-level costs
- Each option would build options:

  i) do nothing,

  ii) net zero compliant,

  iii) do maximum

5 Reports & Alpha Application

- Document the approach and outputs from work packages
- Create 'green book' business case
- CBA for options
- Complete Alpha application

Exploring the art of the possible

Existing Infrastructure - Understanding the network constraints and opportunities of the existing infrastructure and how to make best use of them inside the existing market model, including the implications for specific and general reinforcement

Market & Regulatory structures - Examining the challenges to the regulatory governance that would improve the ability for utilities to collaborate and coordinate for improved outcomes – specifically around local storage and generation

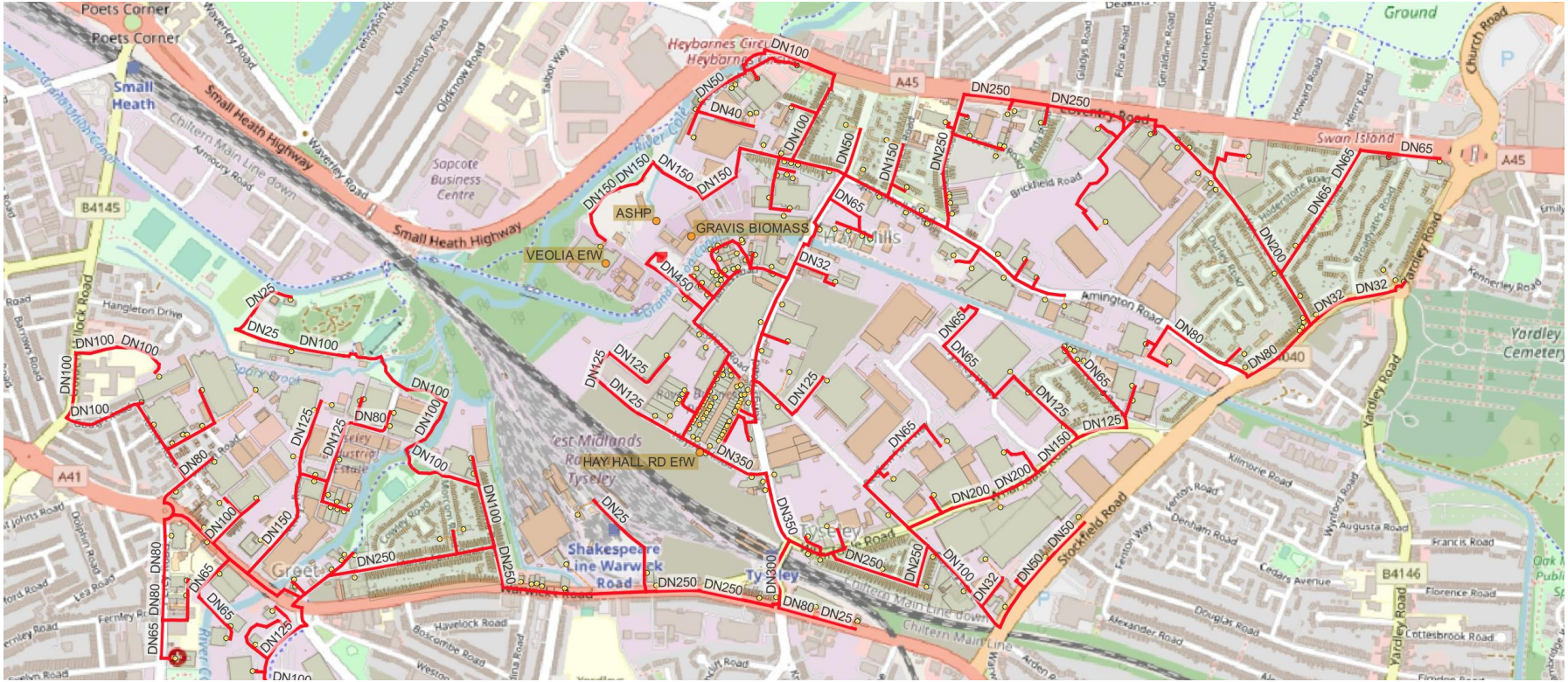
Using currently wasted energy - Examining the total waste heat availability and the characteristics and relative demand profiles for both high and low grade heat outputs together with their potential impacts upon electricity generation

Modelling the built environment – Volumetric and building thermal efficiency data is key to understanding the heat demand requirements and the retrofit potential.

Reducing emissions - Quantifying the potential carbon reduction opportunities in terms of both short term transitional support (10-15 yrs) and NetZero end state outcomes for 2050.

Breaking silos – The adoption of a 'whole systems approach' at a sub-local level requires supply solutions to be highly tuned to local demand profiles inverting traditional system thinking – moving from peak based infrastructure design to a dynamic flexibility architecture. The closer to local real time data we can achieve, the more accurate the flexibility response is in that area.

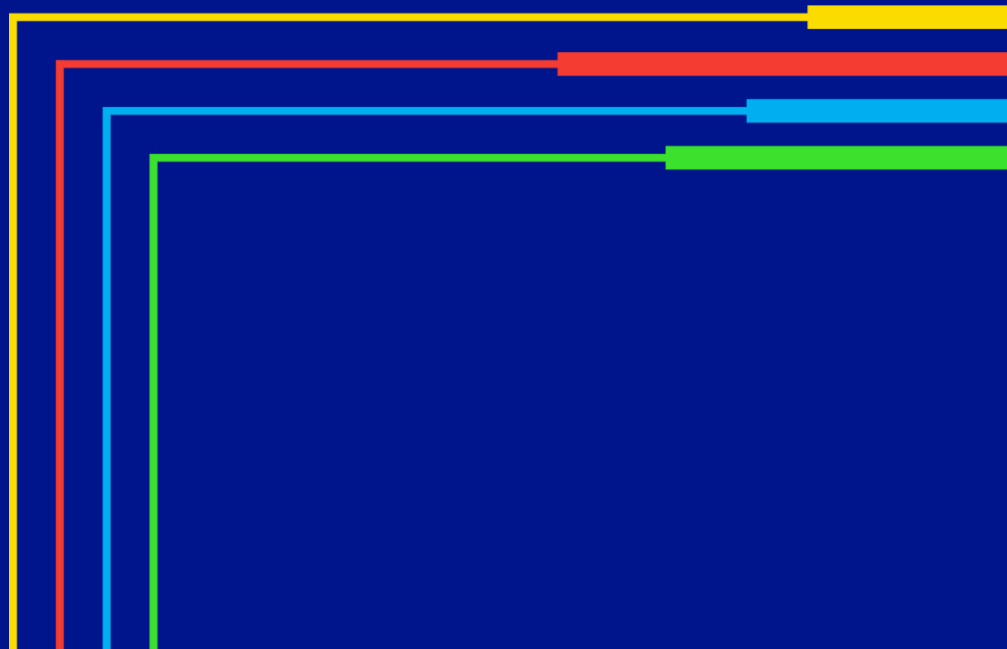
Preliminary view from project partners



Electricity Distribution

04

Building the Data Model

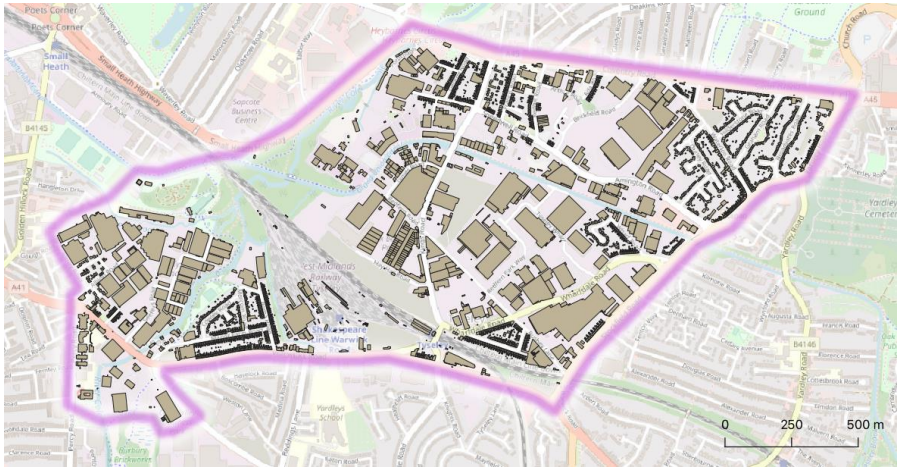


nationalgrid

Ongoing challenge of localised energy data availability

In many cases data is simply unavailable in a level of detail that is required

The project focussed on annual level energy data for the discovery phase



Heat Network Zoning pilot data was made available thanks to the Department of Energy, this had annual and peak heat demand for many of the 2000+ buildings located in TEED

Thanks also to Ordnance Survey for organising appropriate licences at short notice

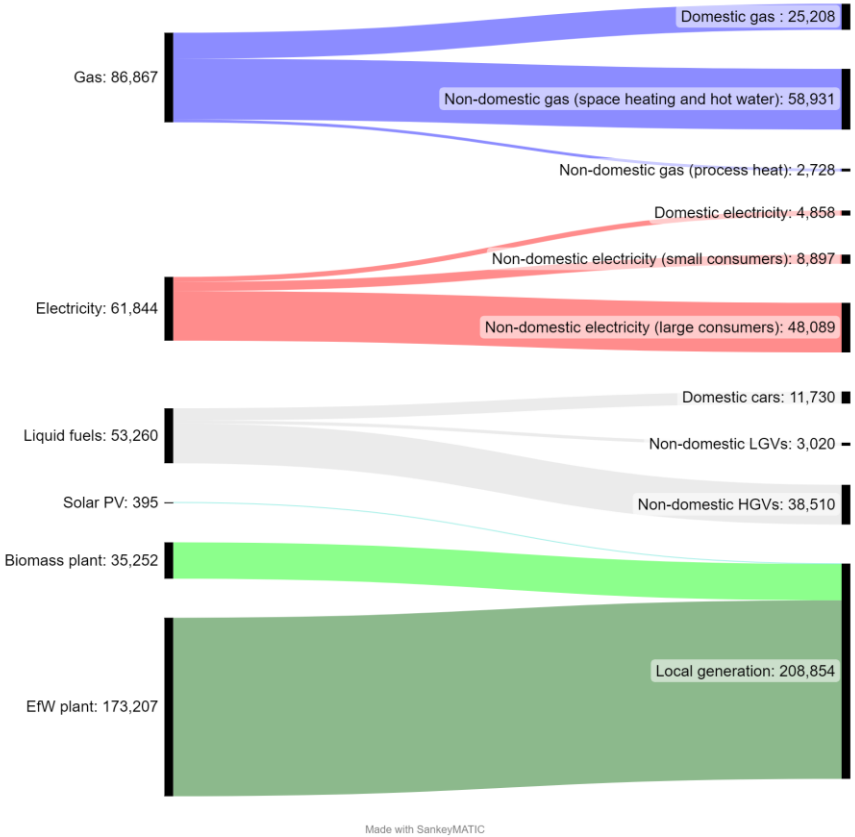
Alpha phase to focus on 30-minute synthetic datasets to be used for flexibility analysis in addition to peak and annual energy analysis

Annual data allows a high-level energy flows assessment

Annual data from various sources was used to build up a picture of the energy supply to the TEED area, and the energy demand of the TEED area and exports

This is a non-trivial task due to the boundary of TEED not matching with datasets, a lack of available data, or uncertainty in terms of approach.

e.g., different methods to allocate liquid fuel demand to the TEED area (in future, EV demand would be 'located' in the TEED area)

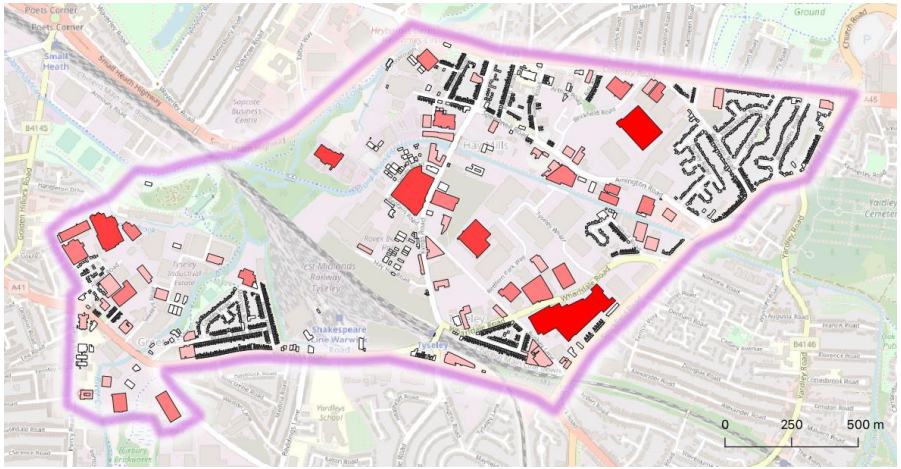


2021 TEED area energy supply and demand values in MWh

Stock model that is scalable across wider areas

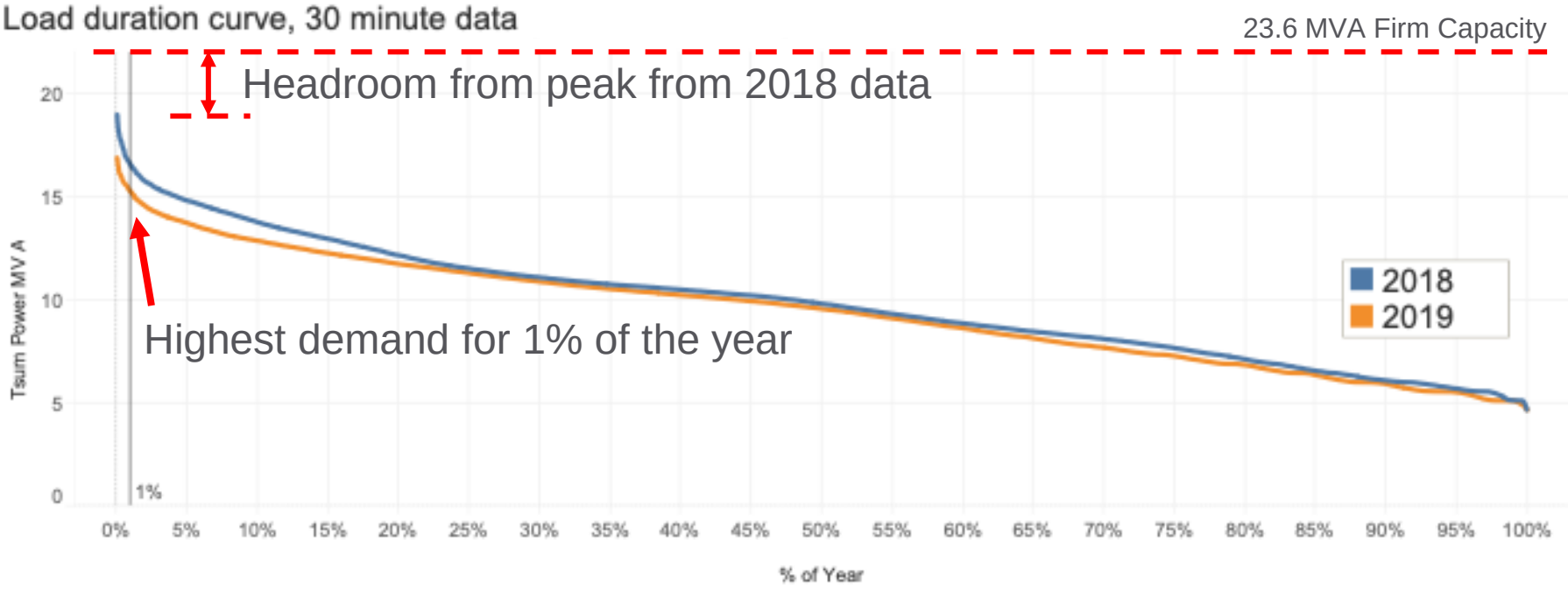
The discovery phase highlighted the need for a building stock model that is scalable across much wider areas than 2000+ buildings in TEED

This would help analysis across multi-vectors – not just for the demand for heat. The classification of building volumes is a challenge, particularly for multi-use buildings



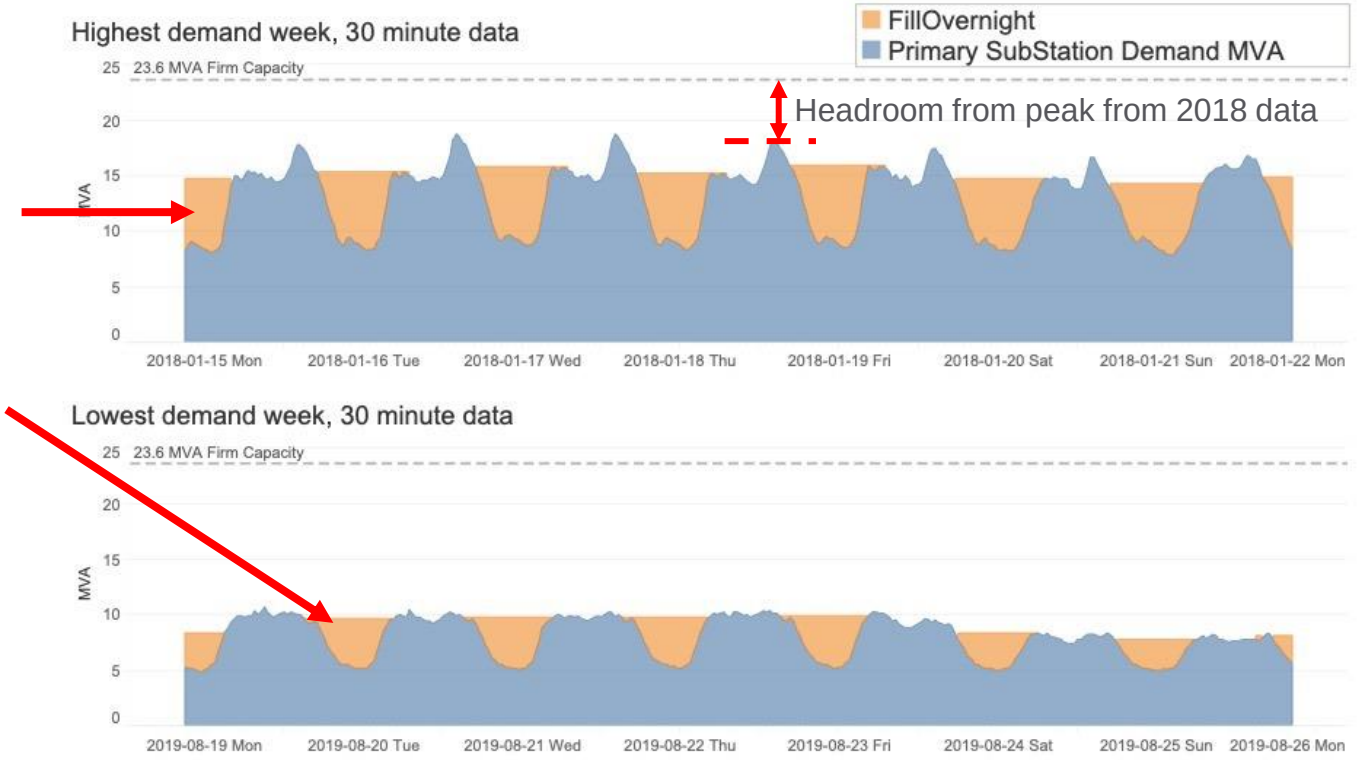
The blending of datasets showed some differences in the data, and incomplete data in others. Appropriate data of good quality for local energy systems analysis continues to be a challenge - common to many innovation projects

Annual and peak data is helpful for network analysis but 30-minute data is needed for flexibility analysis



Annual and peak data is helpful for network analysis but 30-minute data is needed for flexibility analysis

‘Valley filling’ demand overnight via storage or shifting demand can help to manage peak demand

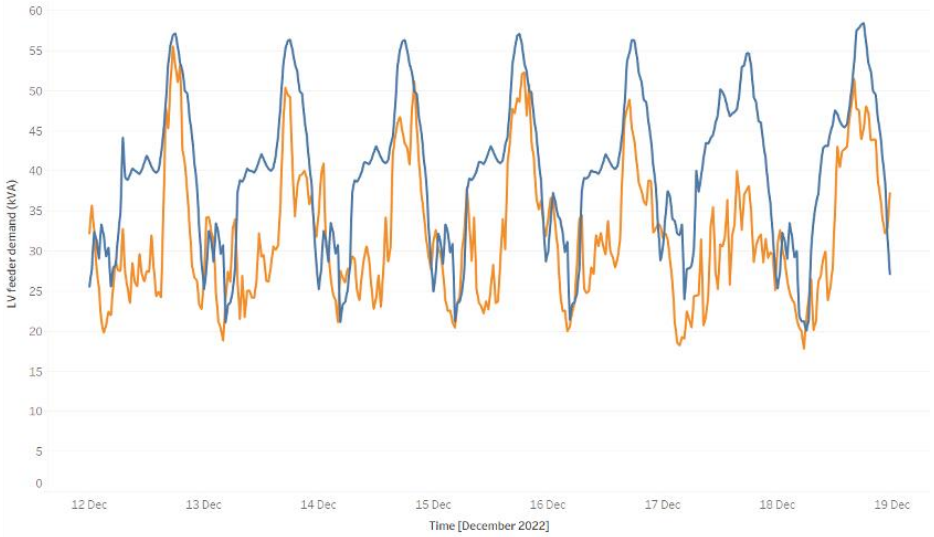


Alpha phase aims for 30-minute data

Using stock model and categorisation data, and the Faraday tool from the Centre for Net Zero, to create area based bottom up electrical demand profiles for domestic electricity

Similar approach for domestic gas using other datasets

Validate synthetic electrical and gas demand with measured data



However, for a highly industrial / commercial area such as TEED, there are major challenges of datasets for non-domestic energy demand and sub-daily profiles

Good data has a cost and therefore needs resourced

There is a cost to the increased digitalisation of the energy system and ongoing curation and production of good quality datasets that are trusted and of value

Open question on where data sources might be best resourced, but operational data seems a good place to start, i.e., with network companies to continue to build data science capacity within their organisations

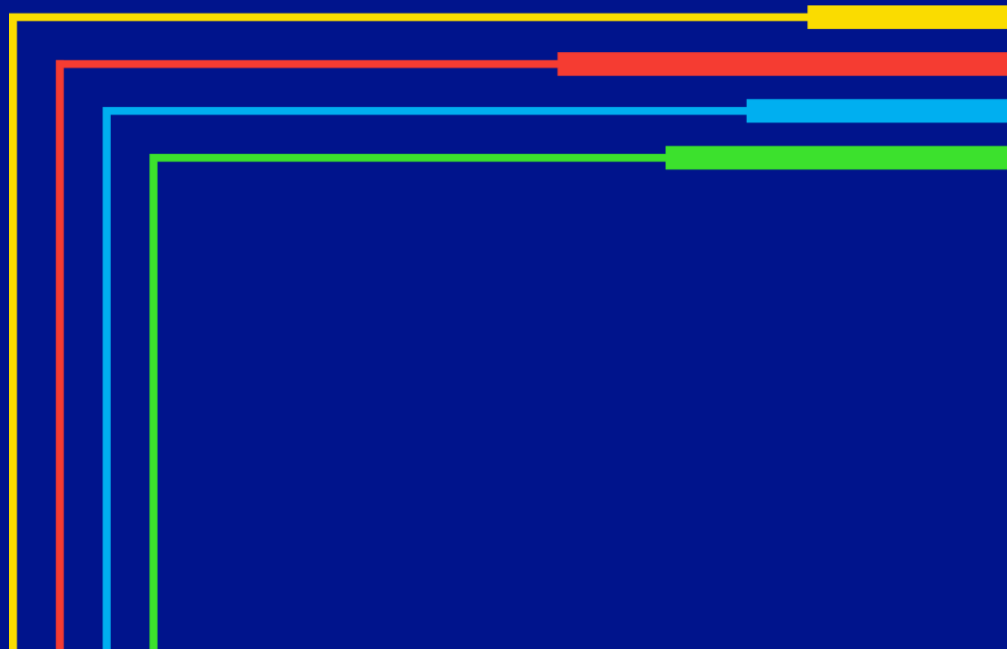
Data that has a significant purchase costs precludes many organisations from working with data to produce different insights, this is felt to be unhelpful for innovation in general and for generating insights of local approaches to Net Zero

There is therefore a tension between the resourcing of the creation and curation of high quality trusted data, but yet making this data available at low cost to a wider group of stakeholders. Data is key to evidencing different trade-offs in energy planning

Electricity Distribution

05

Unlocking NetZero delivery



nationalgrid

TEED Learning & NetZero contributions

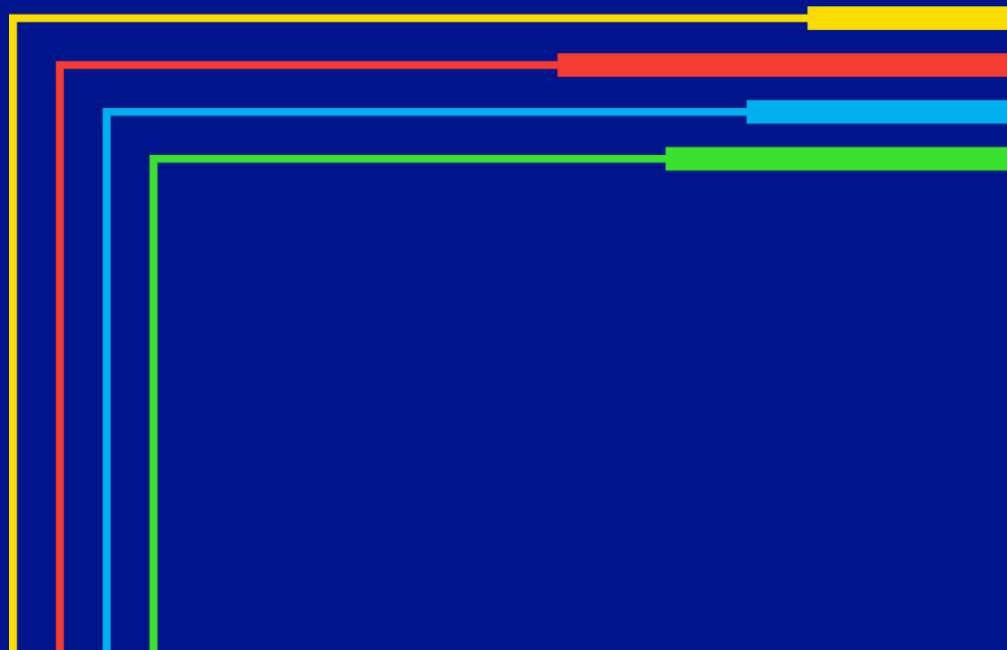
- **The energy from waste plant in the TEED area currently mitigates landfill GHG emissions by treating and burning waste.**
- **The heat generated from this process is currently vented to atmosphere, wasting between 80-110 GWh/year of useable heat.**
- **Channeled into a heat network this could provide water sourced heat and storage for the TEED area.**
- **Once built there are NetZero transition options to export heat more widely, install CCUS on a future waste plant or decarbonise the central heat source.**
- **The immediate benefit to the local electricity grid and BCC's NetZero strategy are significant.**
- **Using TEED to build a model to transfer learning and a consistent methodology across the UK.**

Electricity Distribution

06

Considerations for Alpha Phase

nationalgrid



Considerations for Alpha phase #1

- **TEED has an impressively diverse array of energy vectors, building types, use cases and heat decarbonisation opportunities within it:**
  - We need more accurate spatial data and more accurate time series demand data (half-hourly data) that is readily available to project partners and fully transparent
  - Build on existing engagement with the local community, stakeholders and consumers from the TEP strategy to test and develop options
  - Create detailed design and feasibility options for heat decarbonisation based on better data
  - Examine and propose local market design proposals to support DSF
  - Create a 'virtual DSO' local coordination model for the TEED area to provide more clarity on flexibility options

Considerations for Alpha phase #2

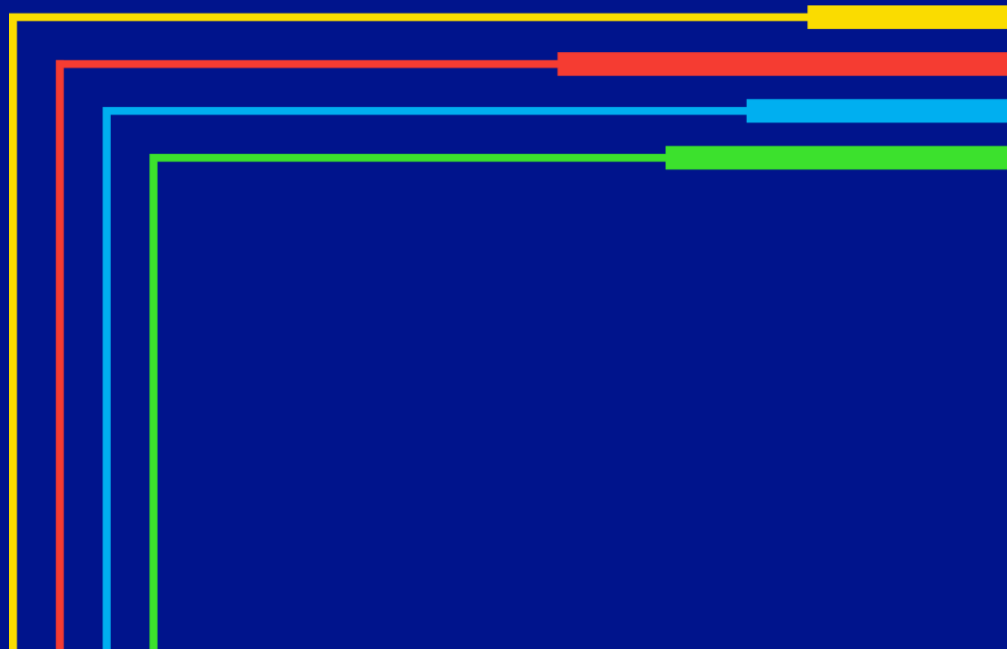
- **Modelling the infrastructure transition:**
  - Examining and demonstrating the value of network investments in this area and how they are maximised / mitigated through the adoption of local solutions to decarbonise heat
  - Quantifying reinforcement versus flex feasibility

- **Take forward the existing collaboration partners to develop single option and conceptual design**
  - Potentially to add Birmingham City Council, Cadent gas, Ordnance Survey and a buildings retrofit consultancy (currently in discussion) as formal partners

Electricity Distribution

07

Questions?



nationalgrid

nationalgrid