

# SIF Discovery Close Down Report Document

## Date of Submission

Nov 2023

## Project Reference Number

10059404

## Project Progress

### Project Title

TEED (Tyseley Environmental Enterprise District)

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10059404

### Lead Funding Licensee

NGED - National Grid Electricity Distribution

### Project Start Date

April 2023

### Project Duration

3 Months

### Nominated Project Contact(s)

Laurence Hunter

## Project Summary

This project will explore how to deliver a mixed vector energy system with integrated energy storage across the TEED. It will use a Digital Twin to create plans that will decarbonise energy around Tyseley, provide local resilience and create replicable answers for similar communities across GB. It will also explore how to integrate the transition in transport systems (rail, trucks, lighter vehicles, city council fleets and logistics) can be integrated into the energy system.

This application fits with the following round-two Innovation Challenge (also several others):

- **Accelerating decarbonisation of major energy demands:** The decarbonisation of heating requires the integration of existing waste heat sources into the energy system in an optimal configuration. TEED currently has 2, but in the future 3, large scale generators of waste heat. At present, the simplest solution is to connect these sources into the city centre district heating system. However, this bypasses local residents and businesses. Exploring how to integrate a heat network into the development of the green energy system of the TEED will reduce energy losses through local exploitation of the heat. The project will also explore how a hydrogen grid can be integrated with a smart electricity and heat grid to produce an overarching energy system across an urban environment.

**The innovation** is to develop a local smart energy system with electricity, hydrogen, heat with energy storage which feeds a mixed community of business, industry and domestic consumers to accelerate a low carbon energy transition for local consumers, with good resilience and lower energy costs.

**Experience:** The project is led by NGED with experience of the management of the local grid, Tyseley Energy Park who have developed the 10 MW biomass plant and the 3 MW hydrogen electrolyser, Birmingham City Council who have oversight of the net zero transition of Birmingham and experience of developing the Birmingham District Energy Company and district heating, cooling and power system, University of Birmingham who have led innovation in energy systems including energy storage the digital twin of the TEED and the companies EQUANS, Pinnacle Power and SSE all who have considerable experience of developing energy systems at national and city scale.

**End users and match to need:** The end users are communities of fuel poor households and 250 local businesses. These both have challenges around the decarbonization of energy, energy resilience and cost. This project will examine how local energy assets can

support these communities.

## Problem Being Solved

This project is an investigation of how a complex, multi-vector energy system with significant local generation and storage can be developed to be optimally resilient and deliver best value to a mixed local community of industry and domestic consumers, alongside ongoing regeneration of the area.

## Summary Key Findings

Tyseley Environmental Enterprise District (TEED) in South-East Birmingham encompasses about 250 mixed-use businesses, 8,000 residents, and 2 large-scale power plants. The project aligns with the 'Decarbonising Major Energy Demands' SIF innovation challenge. It explores ambitious, innovative, and realistic solutions to optimise waste heat utilisation and decarbonise transport. The project consisted of five work packages: Project Management, TEED Data Compilation and Baselineing, Option Analysis, Development of Design / Options, Business Case Development.

### Project Management

During the Discovery phase, the project maintained robust management following NGED Innovation Governance. Weekly updates were made to the project's Risk, Learning, and Action Logs.

### TEED Data Compilation and Baselineing

The second package focused on data gathering and analytics, delving into current energy infrastructure, forecasted energy demand, and available waste heat. The study revealed an annual heating demand of approximately 130GWh. Analysis of potential heat extraction points from the Veolia and Hayhall Power Plants estimated a potential waste heat availability of up to 110 GWh in Tyseley.

### Options Analysis & Development of Options

Package three involved detailed development and analysis of options. Commercial partners contributed to the TEED solution:

- Hemiko (formerly Pinnacle Power) proposed a 42MW District Heat Network (DHN) to supply commercial and some residential buildings. The DHN was estimated to provide 94 GWh/year of heat, resulting in a 26% net CO<sub>2</sub> saving over 25 years compared to the Air Source Heat Pump option.
- SSE Energy Solutions focused on three energy centers supporting the DHN, emphasising the use of thermal energy storage to reduce grid import and avoid 132kV reinforcement.
- Equans, utilising Decisio™ software, recommended a blend of centralised and decentralised energy solutions tailored to specific areas. Heat Networks were suggested for higher heat demand density regions, while distributed air source heat pumps were preferred for residential areas.

### Business Case Development

Concluding the Discovery Phase, the University of Birmingham conducted a comprehensive Cost Benefit Analysis based on the Options Analysis results. The analysis showcased the economic, environmental, and social benefits of implementing a district heat network over the counterfactual distributed air source heat pump (ASHP) solution in TEED. The DHN construction and operation were projected to create 2,300 jobs (in job years, an equivalent number of jobs for a specific duration) and generate over £100m in gross value added, resulting in £12m savings for consumers compared to ASHP, and 6.1kT CO<sub>2</sub>e fewer emissions released.

## User needs

TEED focused on the Tyseley area of Birmingham, utilising it as a model for efficient waste heat utilisation through a heat network. This approach aimed to reduce peak electricity demand and maximise existing network capacity, fostering additional avenues for decarbonisation like electric transport. The project incorporated various 'User Stories' specific to Tyseley while considering the broader application of the project to other regions.

**Tyseley Energy Park:** As a pivotal participant in TEED, Tyseley Energy Park spearheaded several initiatives in the area, including the establishment of the UK's inaugural multi-fuel open access refueling station and the formulation of the TEED Vision. Their active involvement in setting the project's direction and providing feedback on deliverables was key to aligning the work to existing local ambitions.

**Birmingham City Council (BCC):** Responsible for waste management in Birmingham, BCC collaborate closely with the Veolia

waste disposal unit, a crucial potential heat extraction point in Tyseley. They play a key role in devising local energy plans for the area and were consulted with during the Discovery phase. The project team coordinated with the ongoing DHN-related work via the Advanced Heat Network Zoning pilot, in which BCC was a partner.

**Local Residents and Industry:** By consulting with Tyseley Energy Park, the project considered the needs of local residents and industries. Leveraging their established relationships with the community and industry groups, the team planned for a dedicated workstream in Alpha phase to document the heat demands, customer perception, and feedback of local residents and businesses.

**National Grid Electricity Distribution:** Serving as the Distribution Network Operator for Tyseley, our focus lay in understanding how the adoption of a district heat network could yield cross-vector benefits for the electricity grid. It was evident across all options that significant network reinforcement could be avoided by utilising a DHN compared to the ASHP comparator, offering further deferral through the DHN's flexible asset capabilities.

In consultation with these key stakeholders, the Discovery phase's scope was modified to primarily assess the feasibility of optimising existing energy assets to establish a DHN that caters to the specific needs of the Tyseley area.

## Impacts and benefits

The Discovery project conducted a desktop-based study to assess the feasibility of utilising existing energy infrastructure and waste heat opportunities for decarbonising substantial energy demands in the Tyseley area of Birmingham. It aimed to establish a framework applicable to similar regions.

As discussed in Section 2, the primary stakeholders of the TEED project include Tyseley Energy Park, Birmingham City Council, Local Residents and Industry, and National Grid Electricity Distribution. Each stakeholder sought improved visibility and confidence in the most effective holistic decarbonisation approach for the area. The Discovery phase laid a solid foundation for future work in the TEED area, including a comprehensive breakdown of energy demand and well-documented existing energy infrastructure.

During the Options assessment phase, three detailed options were proposed and assessed, providing valuable insights for stakeholders considering different decarbonisation strategies in industrial zones like TEED. Following the Discovery Phase, the focus was on developing methodologies and market mechanisms for seamlessly integrating the district heat network into the electrical grid and avoiding grid reinforcement through flexibility, an aspect not widely understood. This phase presented an opportunity to trial the optimal whole-system outcome, combining heat and electrical network sector coupling.

To evaluate the economic, environmental, and social benefits of implementing the TEED solution, Birmingham University conducted a comprehensive cost-benefit analysis as described in Section 1.

However, due to the project's unsuccessful Alpha application, the project will not be pursued further. The decision was based on the high commercial risk, which made it unfeasible for National Grid to fund the work via regular business-as-usual means. A review will be conducted to assess the possibility of incorporating certain aspects of the proposed work into a separate Network Innovation Allowance (NIA) project.

## Risks, Issues and Constraints

The primary risk identified was the accessibility of accurate half-hourly data for gas demand, which were not available at a building level. During the Discovery phase, this was addressed by making informed energy demand assessments based on floor area, utilising CIBSE's Energy Benchmarks and consortium-agreed benchmark figures amounting to an estimated 2021 annual heat demand of approximately 133GWh within TEED. To further mitigate this assumption's risk, we sought support from Smart DCC during the alpha phase. This collaboration would have helped validate the Discovery approach with aggregated smart meter data for customers in the TEED area.

Another risk involved gaining access to Ordnance Survey's building footprint data, which requires a license agreement. Importantly, this means that even analysis and summary information derived from this underlying data cannot be shared with organisations who do not have a valid license agreement in place. In the TEED project, access was granted through the establishment of a standard research data agreement signed by all parties with OS. While not a significant obstacle when planned and agreed upon in advance, it is suggested that future SIF rounds include research agreements as part of the funding, which we believe should be possible as the Department for Science Technology and Innovation wholly owns Ordnance Survey.

The feasibility work conducted during the Discovery phase did not encompass specific regulatory barriers to the mass adoption of the evaluated options within TEED. Although the presence of barriers was acknowledged, it was determined that a more detailed focus on these would occur during the alpha phase, with the Discovery phase primarily concentrating on technical feasibility. One of the key challenges to overcome was establishing the most suitable ownership and commercial structure of such a combined network that delivers whole system outcomes.

Furthermore, a key constraint was the necessity to draft and execute collaboration agreements with all project partners within a short period (<3 months total project duration), regardless of their contribution. The administrative effort related to contract management often outweighed partner involvement, consuming more partner time than anticipated. To address this, it is recommended that the approach be reconsidered in future SIF discovery phases. We recommend more time between notification and project kick off, or acceptance of a letter of support rather than full contract for partners who have limited involvement or no cost. Additionally, this constraint had implications for project delivery, including the management of commercial sensitivities between project partners.

## **Working in the open**

Openness and collaboration was at the heart of the delivery of TEED. Internally we worked together as one project team working towards a shared goal. Weekly Project Management meetings were held with all project partners to discuss progress against the plan, track actions and provide a chance for partners to raise any risks or issues. Additionally, all technical and PM material was held on a SharePoint site, allowing partners to access resources at any time. A defined 'Ways of Working' document was signed by all project partners, which detailed standalone 'Technical Operation Group (TOG)' meetings that were held separately from the weekly project management meetings to discuss the technical aspects.

Externally, we posted about our portfolio of SIF projects on the 'Innovation at National Grid' LinkedIn page and have published deliverables on the NGED Innovation website. In addition, the project was publicly presented at the TEED Show and Tell webinar on June 20th 2023. The slides from this presentation can be found on the TEED Smarter Network Portal Page. Furthermore, during the project delivery we worked closely with Birmingham City Council who may have been the eventual 'owner' of any solution developed. This engagement consisted of several update meetings to provide an update on work being completed, as well as briefings of deliverables produced. Following this engagement, we engaged with WSP who are conducting research as part of DESNZ's Advanced Zoning Pilot. The other 'product owner' was the Tyseley Energy Park, whose engagement was achieved throughout the project as a key project partner.

## **Costs and value for money**

During the Discovery Phase of TEED, deliverables were produced on a fixed cost basis. Project Partners delivered work to a fixed time and cost, and traded requirements where constraints arose. This approach resulted in no slippage between the forecasted budget and actual spend for all partners delivering work. For National Grid Project Management, additional costs were required in surplus to what was initially forecast. Higher than usual legal fees were not accounted for when budgeting the project. Furthermore, it was decided that National Grid Electricity Distribution were to subcontract the day-to-day project management to Smart Grid Consultancy. Although this is a slight deviation from the plan at the application stage the decision was made prior to kick off, during March 2023. The costs highlighted under National Grid Electricity Distribution contain subcontracting costs made to Smart Grid Consultancy in addition to the other internal costs. Over the three months of Discovery, significant work was produced by all project partners which has the opportunity to direct the vision for the Tyseley area.

### **SIF Funding Requested**

National Grid Electricity Distribution PLC: £11,923.00

National Grid Electricity System Operator Limited: £4,307.00

University of Birmingham: £23,549.00

Pinnacle Power Limited: £26,775.00

SSE Utilities Solutions Limited: £28,172.00

Tyseley Energy Park Limited: £18,360.00

Equans Services Limited: £32,130.00

### **Total Actual Project Spend**

National Grid Electricity Distribution PLC: £42,510.51

National Grid Electricity System Operator Limited: £4,785.00

University of Birmingham: £269,444.00

Pinnacle Power Limited: £29,750.00

SSE Utilities Solutions Limited: £31,302.00

Tyseley Energy Park Limited: £20,400.00

Equans Services Limited: £35,700.00

### Special conditions

**Condition 1:** The Funding Party must not spend any SIF Funding until contracts are signed with the Project Partners named in Table 1 for completing the Project.

**Response:** Our collaboration agreement was signed prior to any payments being made to project partners.

**Condition 2:** The Funding Party must report on the financial contributions made to the Project as set out in its Application. Any financial contributions made over and above that stated in its Application should also be reported and included within the Project costs template.

**Response:** As Funding Party, National Grid has reported on the financial contributions made to the project as set out in the application. This was submitted to the SIF team 6 weeks after project closure.

**Condition 3:** The Funding Party must participate in all meetings related to the Project that they are invited to by Ofgem, UKRI and BEIS during the Project Phase.

**Response:** All meetings were attended during Discovery Phase. This includes: kick-off meeting, midpoint review, show and tell, end of phase review, and alpha application interview.

### Documents uploaded where applicable

Yes