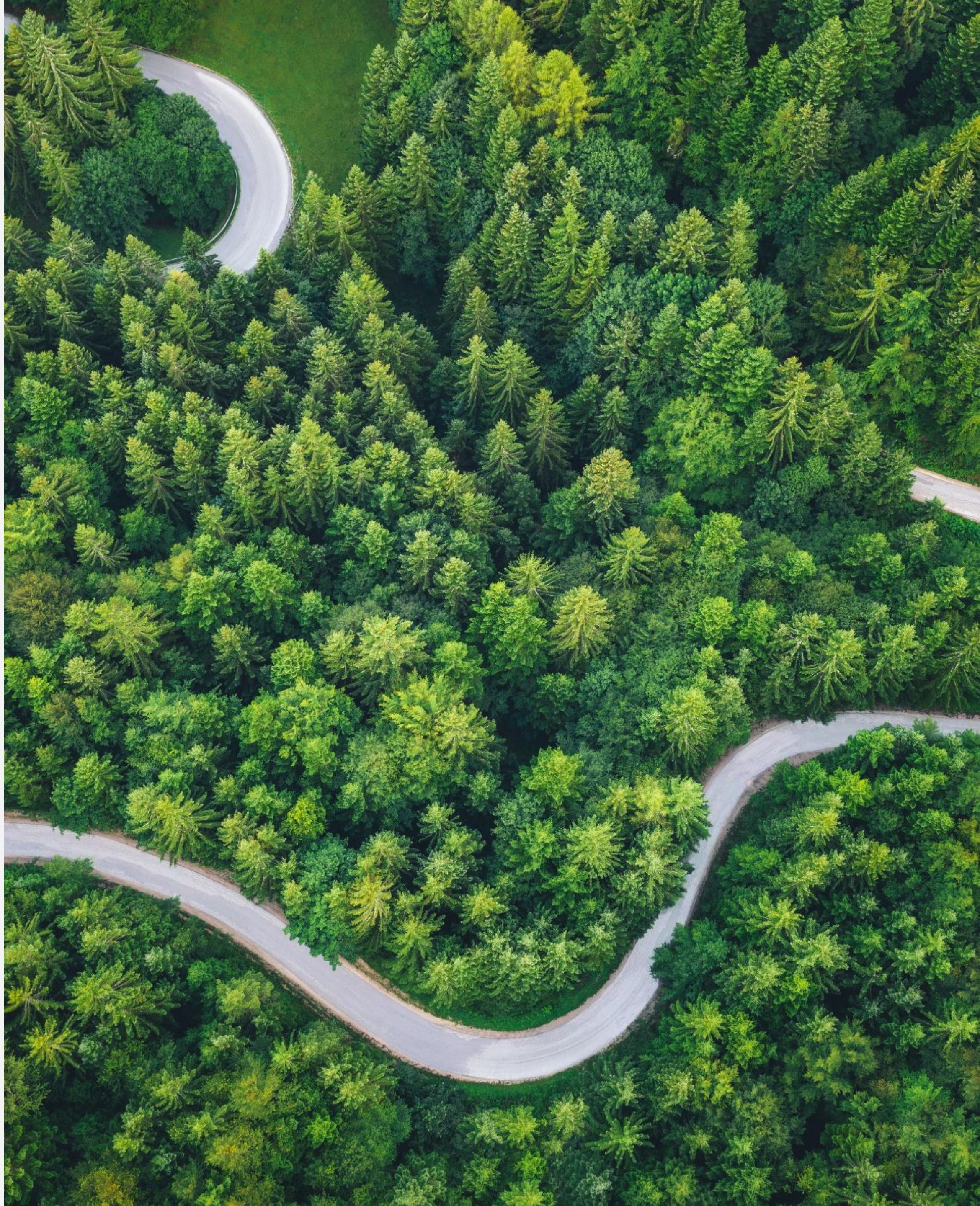
MAY 2026

Indus 2.0 NIA project

D6.2: Final NIA project report

outwit complexity™



Contents

1. Project overview

Project context | Industrial energy demand will evolve due to decarbonisation. Accounting for where, when, how, and how much will strengthen network planning.

Industrial energy demand makes up a **material share** of the **United Kingdom's (UK's) natural gas consumption** and **carbon emissions**, with about **50%** of this associated with **dispersed sites**, located away from the major industrial clusters.

The energy demand of dispersed sites is set to change significantly between now and 2050 driven by decarbonisation. At a local site level, there is **uncertainty** about **how**, **when** and **how much** across the sector for these **dispersed sites.**

Electricity and gas networks account for industrial decarbonisation in different ways, with **limited cross-vector visibility** and **differences in assumptions.**

A lack of coordination between electricity and gas networks, to plan for industrial decarbonisation, poses potential risks of **inefficient investment** and **stranded assets** which could lead to **increased costs for energy consumers in Great Britian (GB).**

Data sharing between energy networks and jointly developing granular spatial and temporal industrial decarbonisation pathways could resolve this.

Project objectives | Indus 2.0 pioneered a data-led whole systems, collaborative approach between electricity and gas networks to plan for industrial decarbonisation.

Project objectives

1) Develop **data sharing agreements** and **infrastructure** to facilitate **data sharing** between electrical Distribution Network Operators (DNOs) and Gas Distribution Networks (GDNs).

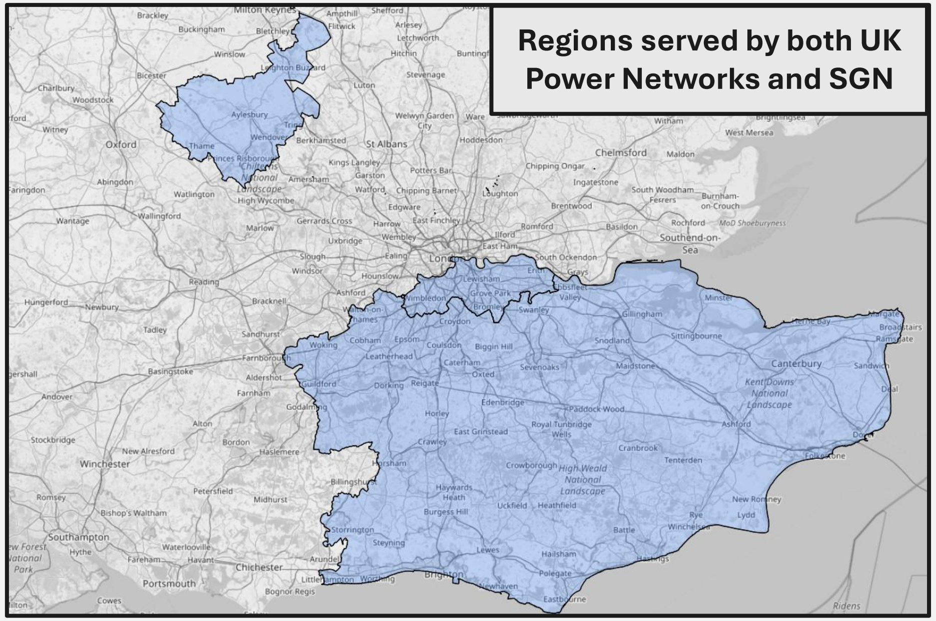
2) Develop **typical decarbonisation routes** for a range of industrial subsectors to **determine the future electricity and gas peak demand for specific sites.**

3) Identify approaches for **scaling data sharing and decarbonisation pathway designs across Great Britain.**

Sectors modelled

- Paper
- Bricks
- Bakeries
- Building materials
- Pharmaceuticals
- Non-ferrous metals
- Greenhouse
- Dairy
- Breweries

Geographic scope of Indus 2.0 (Southeast England)



Funded through Ofgem's Network Innovation Allowance (NIA)

In partnership with:

Key findings | Indus 2.0 enables data-led, whole system planning of industrial decarbonisation, unlocking targeted investment and system wide value.

What Indus 2.0 delivered

Data sharing between gas and electricity networks

Established a first of its kind, Data Sharing Agreement (DSA) enabling secure cross-network sharing of site-level electricity and gas data between DNOs, GDNs and NESO, creating a repeatable framework to scale data sharing across GB networks for whole-system planning.

Data modelling for future industrial energy demand

Developed nine sector playbooks to model four future energy scenarios and ~4.7 TWh of industrial demand across 65 sites, creating a scalable framework, linking sector pathways to site-level electricity and gas demand for scenario-based planning to 2050.

Impact of future energy demand on electricity and gas networks

Identified 130–771 MW of additional electrical load by 2050 and significant shifts in gas demand, with ~95–97% of impacts concentrated in 10–17 substations and ~80% of hydrogen demand clustered in three locations.

Potential next steps

1. **Establish Business-as-Usual (BaU) industrial data sharing**
   Progress the Indus 2.0 data sharing framework into a scalable BaU model across DNOs, GDNs and NESO, including alignment with NESO's Data Sharing Infrastructure (DSI) and strategic data partnerships.

2. **Scale and standardise the Indus 2.0 modelling framework**
   Expand sector playbooks and technology adoption pathways across GB and enable consistent whole-system industrial decarbonisation modelling across networks and scenarios.

3. **Enable GB-wide coordinated whole-system planning**
   Use Indus 2.0 insights to support coordinated electricity and gas network planning, targeted reinforcement strategies and integration into Regional Energy Strategic Plans (RESPs).

4. **Build cross-sector operational readiness and governance**
   Establish coordinated engagement across NESO, DNOs, GDNs, legal and planning teams to identify barriers, align governance and prepare organisations for scalable industrial data sharing.

2. Project insights

Project overview | We followed a five-phase work programme to develop the data foundations and analysis needed to assess network impacts.

Data discovery

- Identified **what data** needs to be shared.
- Understood data **availability** and **quality.**

DSA development

- Assessed **barriers** to data sharing today.
- Engaged with **legal** and **planning** teams to develop a **data sharing agreement.**

Data sharing architecture

- Defined **minimum requirements** for data sharing.
- Identified **four potential approaches.**

Data quality assessment & data cleansing

- Selected **best-fit data sharing approach** for project and BaU.
- **Shared relevant datapoints** as per Data Sharing Agreement.

Network impact assessment & CBA

- Developed **sector decarbonisation playbooks.**
- **Estimated** future industrial energy **consumption.**
- Assessed **impacts on network infrastructure.**
- Conduct **cost-benefit analysis** (CBA).

Data discovery | A data gap exists in network planning for industrial decarbonisation and found that networks hold the data needed to bridge this gap.

Problem Statements

1. Do DNOs, GDNs and NESO currently account for industrial heat decarbonisation at the right spatial and temporal granularity to support cost-efficient network investment decision making?
2. Is there coordination of assumptions and inputs across the whole energy system?
3. What data is required to better estimate the how, when and how much future electricity and green gas demand will impact network assets?
4. Does the required data exist? If yes, where is it located within energy network IT systems and how can it be transferred?
5. Are there publicly available data sources that can be used to bridge any gaps?

Learnings and Outcomes

1. **Current network planning does not adequately capture industrial process heating decarbonisation** at the desired spatial and temporal granularity.
2. **Assumptions** on how industrial demand may change in the future are **not consistent** across the energy system.
3. **Site level total and profiled energy consumption**, as well as **locational information**, is **required** to estimate the impacts of industrial decarbonisation on network infrastructure accurately.
4. The **data required** to enable consistent, site level industrial process heating demand forecasting **exists**. However, this is **fragmented**.
5. **Public data sources** like National Atmospheric Emissions Inventory **lack information on peak and profiled demand** to support network planning.

Approach

1. Conducted a current state assessment workshop with UK Power Networks, SGN and NESO network planning teams.
2. Engaged with UK Power Networks Income management and Enterprise Data teams to understand UK Power Networks data availability on industrial customers.
3. Engaged with SGN LTS and <7barg network planning teams to understand what data SGN possess on industrial customers.
4. Summarised insights gathered and conclusions made in D1.1: Data Discovery.

DSA | Indus 2.0 established a project-specific DSA to enable data sharing across networks in an innovation setting.

Problem Statements

1. What legal and regulatory constraints apply to cross-network data sharing between DNOs, GDNs and NESO?
2. How can these legal and regulatory constraints be overcome to enable the sharing of the required datapoints identified in the Data discovery exercise?
3. Can the established Data Sharing Agreement be transferred outside of the innovation environment i.e. within BaU? If not, what next steps are needed to enable data sharing in BaU?

Learnings and Outcomes

1. **Section 105 of the Utilities Act** and **Clause 34 of the Distribution Connection and Usage Agreement (DCUSA)** were identified as the immediate blockers to data sharing between networks. There may be more barriers that were not identified in this project.
2. **NESO's role as the Independent System Operator**, and the **outputs of Indus 2.0 supporting strategic system planning**, provides a **legal exemption to the stated barriers**. Having NESO as a project partner, therefore, was the key to enabling data sharing.
3. The established Data Sharing Agreement is **viable in an innovation context** but **not directly transferable to BaU**. Further legal guidance is required to determine a path forward without NESO's continued involvement.

Approach

1. Engaged with legal representatives and network planning teams to identify current barriers to data sharing.
2. Conducted workshops with legal representatives to identify how the identified barriers can be overcome.
3. Engaged with IT teams to define data security and governance structures for data transfer.
4. Drafted and signed data sharing agreement between relevant project partners.

Data sharing architecture | Indus 2.0 identified four data sharing frameworks that enable secure, compliant data sharing while highlighting the need for a BaU solution.

Problem statements

1. What are the minimum requirements that constitute safe and secure data sharing between regulated entities?
2. How should data be transferred, stored and accessed to support modelling and analysis for the project duration?
3. Is this data sharing approach feasible and scalable in BaU? If not, what data framework should be adopted in BaU to unlock the benefits of Indus 2.0?

Learnings and outcomes

1. Safe and secure data sharing between regulated entities is achievable but **requires clearly defined minimum standards across governance, legal compliance and security** (e.g. DSA, access controls, encryption and auditability).
2. To support modelling, **data must be shared through a structured architecture with controlled transfer mechanisms and access-controlled environments** that enable storage, integration and analysis across networks.
3. BaU data sharing is **constrained by legal, operational and scalability challenges.** An enduring, standardised framework such as **NESO's DSI** is required to enable repeatable and scalable cross-network data sharing.

Approach

1. Defined minimum technical, security and governance requirements for data sharing.
2. Identified and assessed potential data sharing frameworks for project and BaU feasibility.
3. Selected the most suitable framework for the project duration. Identified the likely framework NESO's DSI – for BaU application.
4. Engaged with networks and NESO to develop a potential transition roadmap from Indus 2.0. to the rollout of the DSI.

Data sharing architecture | Four architecture options were evaluated with the use of a shared data pool between partners selected as preferred solution for Indus 2.0.

Framework selected to be used in Indus 2.0

Frameworks evaluated

#	Data Sharing Framework	Data Sharing Solution	Feasibility for Indus 2.0	BaU feasibility	Cost-effectiveness
1	**Enduring data pool between network partners**	Data stored in UK Power Network's secure cloud environment (Databricks); SGN and Guidehouse have access.	**Yes,** assuming compatibility of IT infrastructure between organisations.	**Yes,** subject to a signed DSA between the networks sharing the data.	**High** The costs associated were found to be minimal.
2	**Federated Matching via a Trusted Third Party (TTP)**	Data stored in NESO's temporary environment; Guidehouse accesses for modelling.	**No.** NESO's Enterprise Architecture team confirmed that they would not be able to build a data sharing platform within the project's timelines.	**No.** NESO remains committed to enabling secure and scalable data exchange through its forthcoming DSI.	**Low.** The costs associated with NESO standing up a temporary data hosting platform for Indus 2.0 could not be covered under Indus 2.0's funding. In BaU, NESO remains committed to building the DSI (see option 4).
3		Data stored in Guidehouse's environment; Guidehouse manages modelling and sharing.	**Yes,** assuming compatibility of IT infrastructure between organisations.	**No.** Data will have to be deleted upon project completion, making it infeasible from a longer term BaU perspective.	**High.** The costs associated were found to be minimal.
4	**NESO's Data Sharing Infrastructure (DSI)**	Secure, standarised data sharing between UK Power Networks, SGN and Guidehouse via DSI MVP Note: This solution would not require a DSA between UK Power Networks and SGN.	**No.** The DSI's minimal viable product for trialling will only be ready by late 2026 - early 2027.	**Yes.** The DSI will represent a practical, scalable, and future-proof solution for data sharing.	**High.** NESO's DSI team shared that the costs to each participating network would be minimal.

Data quality assessment & cleansing | Targeted cleansing of high-impact sites and postcode-based alignment enabled cross-network data to be used for modelling.

Problem statements

1. Was the data received from UK Power Networks and SGN of the required quality to allow mapping and support Indus 2.0's modelling and generating [1]SFS-ready sector profiles for UK Power Networks?
2. What data quality issues exist within the shared datasets? Is this likely to be reflective across wider GDN and DNO datasets?
3. How can the identified data quality issues be rectified in an efficient manner?
4. What data field can be a common identifier to enable the mapping of the two datasets? Could this approach be replicated for other DNO and GDN datasets?

Learnings and outcomes

1. With targeted cleansing and some manual corrections, the data shared was fit-for-purpose for Indus 2.0's modelling. However, generating high-confidence sector profiles was hampered by the limited availability of profiled gas consumption data.
2. SIC code inaccuracies, limited availability of hourly gas consumption data and slight mismatches in postcodes between the two datasets were the key data quality issues identified.
3. Targeting large sites with an annual demand >8GWh for data cleansing and manual correction proved highly effective. These ~50 sites accounted for >85% of the total industrial gas consumption in scope of the project.
4. Postcodes information was used for cross-network data mapping and merging, with accuracy critical for ensuring maximum coverage.

Approach

1. Assessed datasets against **availability, quality and quantity criteria**, identifying gaps, inconsistencies and limitations.
2. Defined **data alignment approach**, establishing postcodes as the primary identifier for cross-network mapping.
3. Mapped and integrated **UK Power Networks and SGN datasets**, creating a combined dataset for shared industrial customers.
4. Undertook **targeted data cleansing and validation**, focusing on key issues and high-impact sites to prepare data for modelling.

Data quality assessment & cleansing | Gaps in SIC codes in UK Power Networks' data were addressed using SGN data.

	Data availability		Data quality			Data quantity	
Data field name	**Existence**	**Format usability**	**Accuracy**	**Consistency**	**Timeliness**	**Volume**	**Granularity**
Unique Property Reference Number (UPRN)							
Meter Point Administration Number (MPAN)							
Customer name							
Customer postcode							
Standard Industrial Classification (SIC) Code							
Substation name							
Substation reference number							
Voltage level							
Connection point ID							
Total annual electricity consumption							
Profiled electricity consumption							

Rating legend:

	Criteria met fully. Data suitable for analysis and/or mapping.		Criteria partially met. Data suitable for analysis purposes post minor cleansing / correction.		Criteria not met. Data requires major correction to be suitable for mapping and/or analysis.

Data quality assessment & cleansing | Inaccuracies in postcode and SIC code data in SGN's dataset require cleansing to support analysis and mapping.

	Data availability		Data quality			Data quantity	
Data field name	**Existence**	**Format usability**	**Accuracy**	**Consistency**	**Timeliness**	**Volume**	**Granularity**
Meter Point Reference Number (MPRN)							
Customer name							
Customer postcode							
Standard Industrial Classification (SIC) Code							
Supply point ID							
Total annual gas consumption (AQ)							
Peak 1 in 20 gas demand							
Profiled gas consumption							

Rating legend:

	Criteria met fully. Data suitable for analysis and/or mapping.
	Criteria partially met. Data suitable for analysis purposes post minor cleansing / correction.
	Criteria not met. Data requires major correction to be suitable for mapping and/or analysis.

Data quality assessment & cleansing | Targeted data cleansing of sites 2% of sites captured, accounted for >85% of industrial gas demand.

Approach & results of data cleansing

	Identify outcodes	Filter SGN data	Merge datasets
Approach	1. Extract postcode outcodes (the characters in the postcode that appear before the space) from UK Power Networks dataset. 2. Store as a new column or table.	1. Extract postcode outcodes from SGN dataset. 2. Filter sites matching UK Power Networks outcodes.	1. Join UK Power Networks data to SGN dataset using postcode matching. 2. Create merged dataset and remove irrelevant fields.
Result	Left with the outcodes of all the regions across UK Power Network's licence areas where an I&C customer exists.	Left with all I&C sites in SGN's licence areas that are served by UK Power Networks as well.	Left with a dataset of gas and electricity data for I&C customers served by both UK Power Networks and SGN.

Data mapping results

Cleansing conducted for 2% of all sites in the shared area

Which accounted for >85% of the total I&C gas consumption

- Total number of I&C sites in scope for cleansing = **54**
- Total number of I&C sites in the region = **~2,400**

- Total annual gas demand of sites in scope for cleansing = **~5,100 GWh/yr**
- Total annual gas demand of sites in the region = **~5,800 GWh/yr**

Sites cleansed Sites not cleansed

Network impact assessment | Indus 2.0 shows industrial decarbonisation could add up to 771 MW of electrical load alongside emerging H_2 and biomethane demand.

Problem statements

1. How might industrial energy demand in the Southeast of England change due to decarbonisation?
2. Which UK Power Networks primary substations and locations may be most affected by future industrial decarbonisation? How much reinforcement could these substations require, and by when?
3. Where may future clusters of hydrogen and biomethane demand emerge in the Southeast of England?
4. How can UK Power Networks, SGN and NESO use these outcomes in to support network planning and investment decisions in BaU?

Learnings and Outcomes

1. Industrial decarbonisation could drive **up to 771 MW of additional electrical load by 2050**, alongside up to **2,510 GWh of green gas** i.e. hydrogen and biomethane, in the **Southeast of England.**
2. This electricity load is likely to be **highly localised**, potentially **impacting up to 51 primary substations**.
3. **Hydrogen demand clusters may emerge around Gravesend and Maidstone**, while the **Canterbury** area, characterised by large **greenhouses**, could become a **future biomethane demand cluster.**
4. **UK Power Networks and SGN could streamline stakeholder engagement**, focusing on large sites with the potential to materially impact their networks, to **secure clarity on their decarbonisation intentions to inform timely network investment decisions**. **NESO could incorporate these insights into the RESP outcomes.**

Approach

1. Used decarbonisation pathways to **forecast site-level electricity and gas demand** across industrial customers, validating with industrial stakeholders.
2. Mapped demand to **network assets and primary substations**, assessing headroom and capacity constraints.
3. Identified **timing and scale of reinforcement requirements** across different scenarios.
4. Analysed results and conducted a **cost-benefit analysis to identify high-impact sites, demand clusters, and network planning implications**.

Network impact assessment | Overview of approach and results of technology adoption pathways across sectors and scenarios modelled.

Approach

	Demand data	Options identification	Option selection	Impact of decarb	Decarb timing
Purpose	Baseline gas demand for process heat	Potential process heat decarb options for each sector in scope	Select decarbonisation technology by scenario and sector	Understand the impact of decarb technology	Assign likely time of switch, based on stakeholder insights
Source	SGN customer data	Literature review, Guidehouse expertise and stakeholder validation	Total cost of ownership analysis, using price assumptions from FES and technoeconomic inputs from DESNZ COMIT model	Hourly profiles (for DNOs) and multipliers based on thermal efficiency of technology	Stakeholder interviews and Science Based target initiative (SBTi) targets

Technology adoption pathway

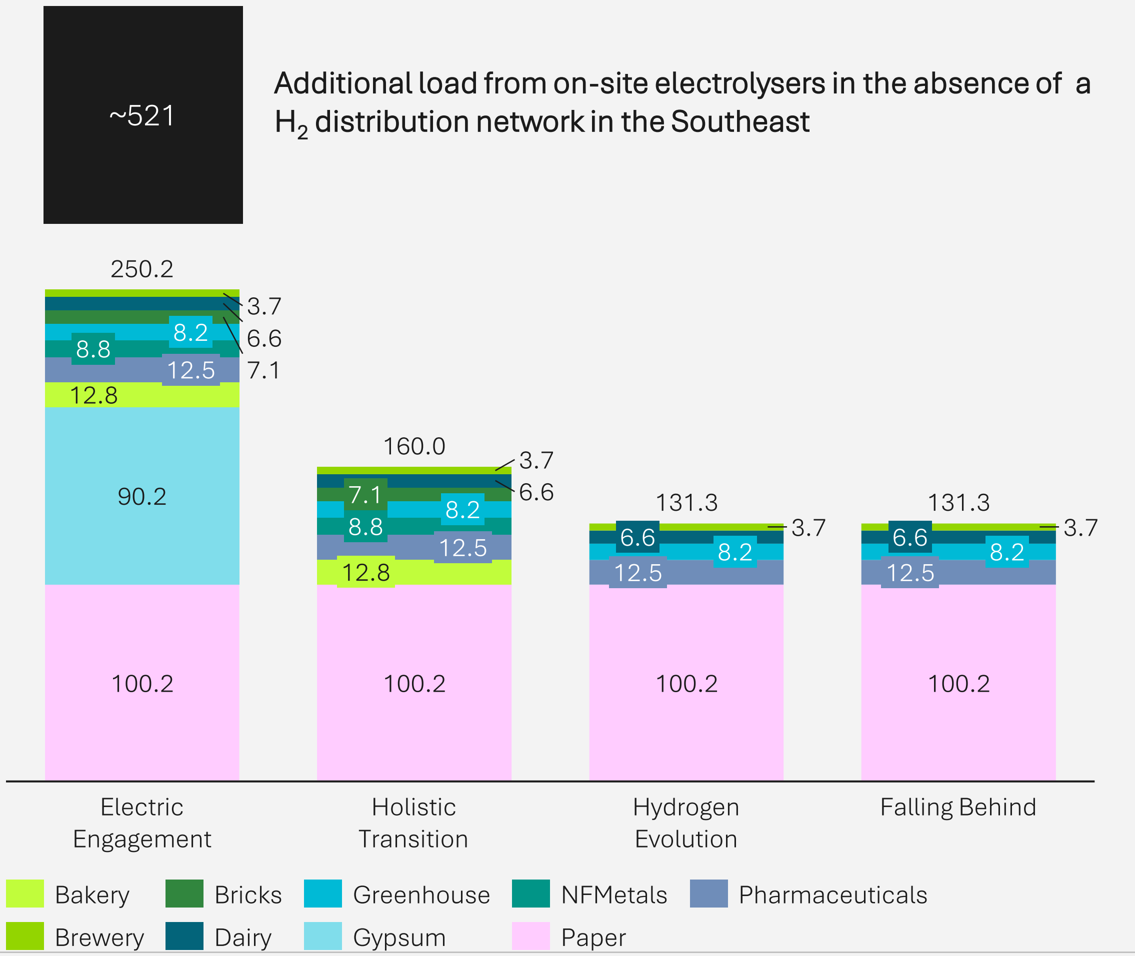
Sectors where biomethane would be the cheapest option

Sector	HT	EE	HE	FB
Paper	H_2 CHP + HP	H_2 CHP + HP	H_2 CHP + HP	H_2 CHP + HP
Greenhouse	Bio CHP + HP	Bio CHP + HP	Bio CHP + HP	Bio CHP + HP
Dairy	HP + storage boiler	HP + storage boiler	HP + storage boiler	HP + storage boiler
Brewery	HP + storage boiler	HP + storage boiler	HP + storage boiler	HP + storage boiler
Pharma	HP + storage boiler	HP + storage boiler	HP + storage boiler	HP + storage boiler
Bakeries	E-oven + HP	E-oven + HP	H_2 Oven + HP	NG oven + HP
NF metals	E-furnace	E-furnace	H_2 furnace	NG furnace
Building materials	H_2 kiln + drying	E-kiln + drying	H_2 kil + drying	NG kiln + drying
Bricks	H_2 kiln + E-drying	H_2 kiln + E-drying	H_2 kiln + drying	NG kiln + drying

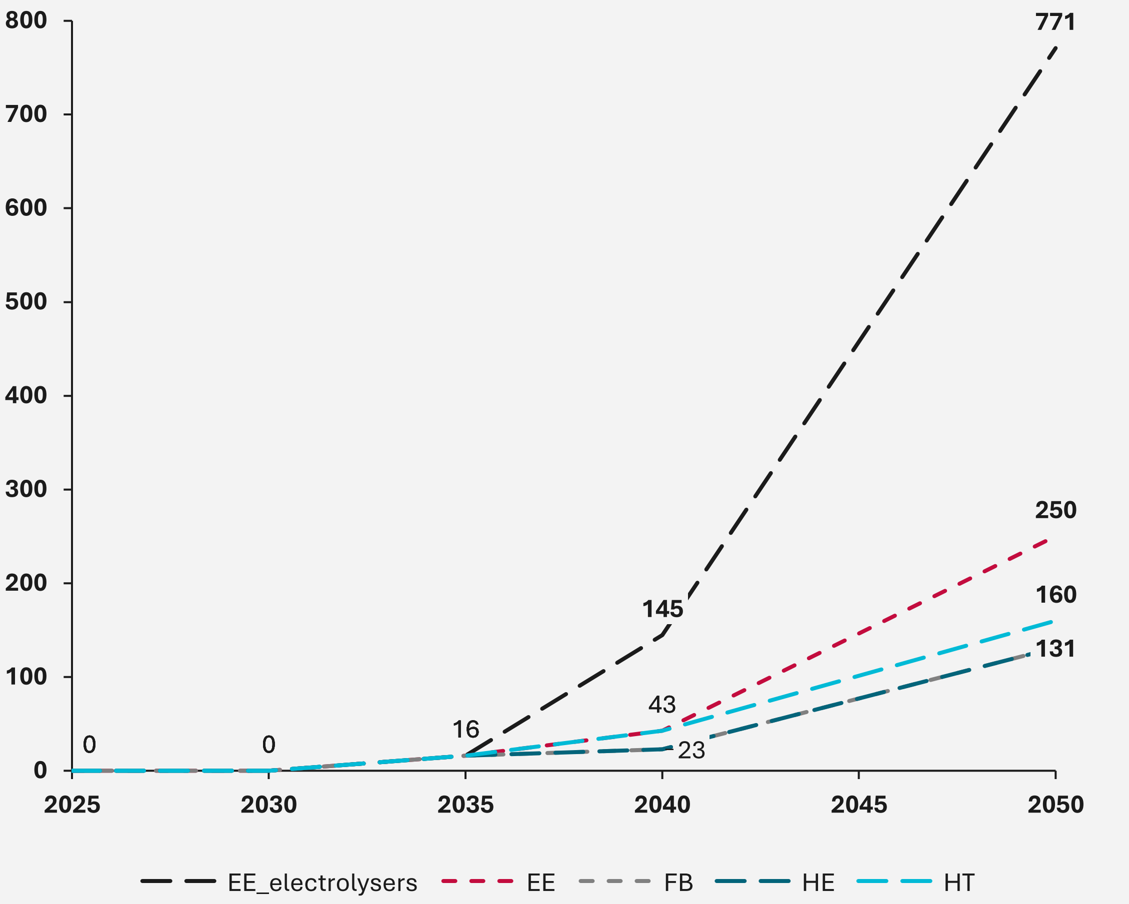
100% electric | 100% H_2 | Hybrid | No decarb

Network impact assessment | 131 – 771 MW of additional electrical load is expected from industrial decarbonisation in the shared licence area.

2050 Electric Load from process heat decarbonisation (in MW)



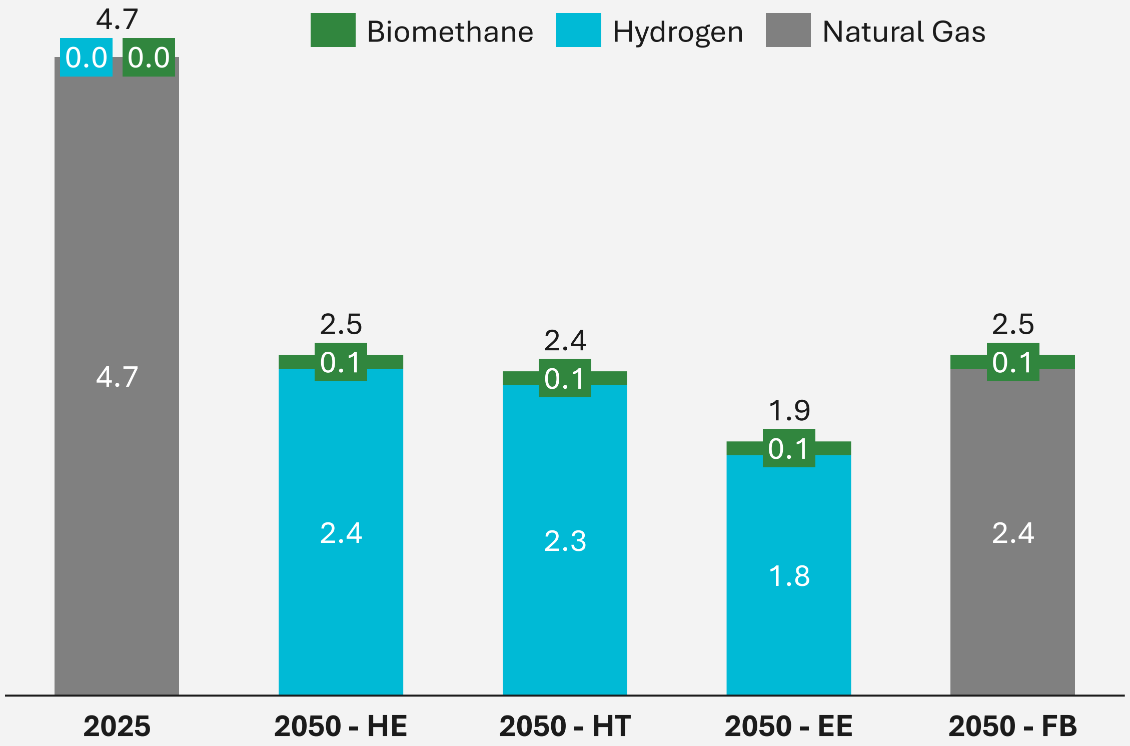
2050 Electric Load from process heat decarbonisation (in MW)



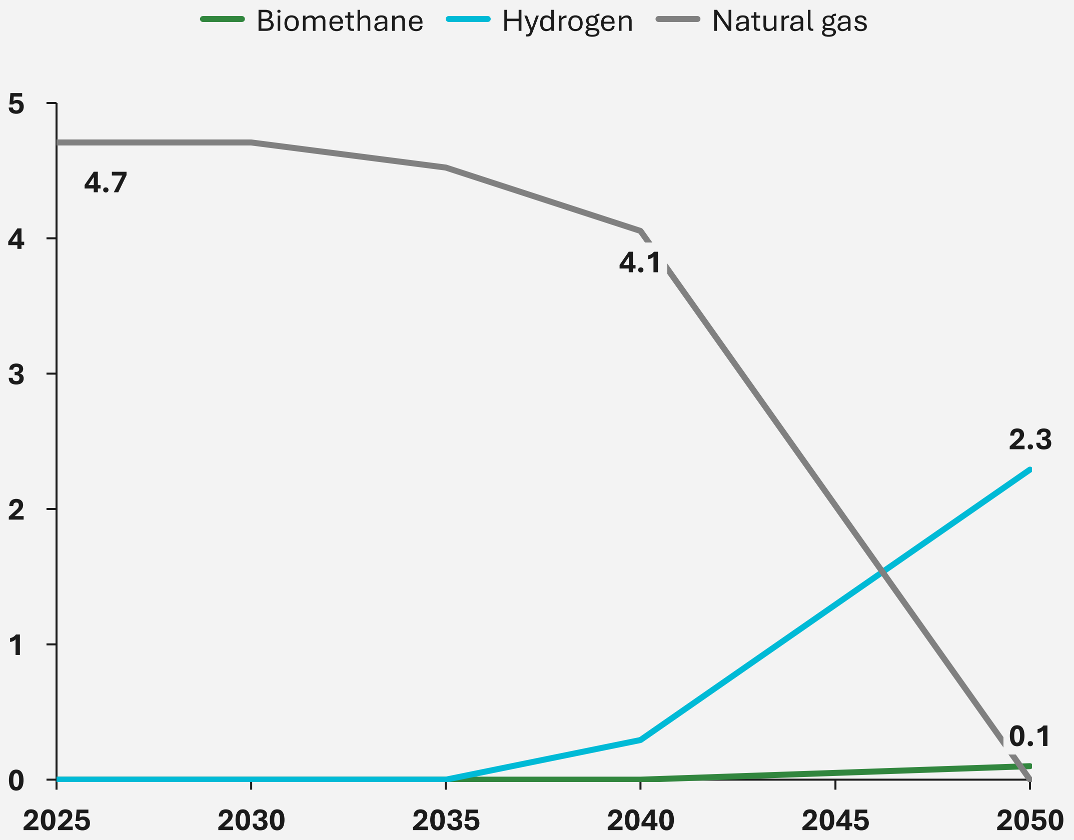
Network impact assessment | Hydrogen and biomethane demand is observed post 2040, with natural gas showing potential to have a role until then.

Gas demand in 2050 by FES pathways (in TWh per year)

- 90% of potential H_2 demand comes from 10 sites (mostly paper and bricks)
- **70% of potential H_2 demand by 2050** is expected from **two paper mills**



YoY evolution of gas demand in 2050 by in HT (in TWh per year)



3. Potential next steps

Potential next steps | Scaling Indus 2.0 requires unlocking BaU data sharing, expanding the sector playbooks and engaging with NESO's DSI team.

Potential next steps for scaling the benefits of Indus 2.0 GB wide could be:

After project closure, the project partners are exploring ways to integrate the insights into our business-as-usual forecasting. We have also identified the below two avenues for further expansion of the project.

Expansion of the modelling and methodology:

- **Explore avenues to expand the sector playbooks** and technology adoption pathways to **cover all industrial**, and potentially commercial, sectors **GB-wide.**
- Other **DNOs and GDNs** to **replicate Indus 2.0** across other regions in GB.
- Engage with and share modelling and insights with other DNOs/GDNs and NESO to support **Regional Energy Strategic Plans (RESPs).**

Expanding data sharing:

- Enable NESO to position industrial energy data sharing as a **DSI MVP/private beta use case** using existing legal frameworks. This will involve engagement to ensure **relevant functions within DNOs and GDNs are prepared to share data via the DSI when operational.**

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