DATA 2 INSIGHTS

Energy Innovation Summit 2025

Scottish & Southern Electricity Networks

IN PARTNERSHIP WITH:

CATAPULT Energy Systems

CGI

University of Strathclyde Glasgow

Roadnight Taylor
THE INDEPENDENT SPECIALIST GRID CONSULTANCY

PRESENTERS AND RUNNING ORDER

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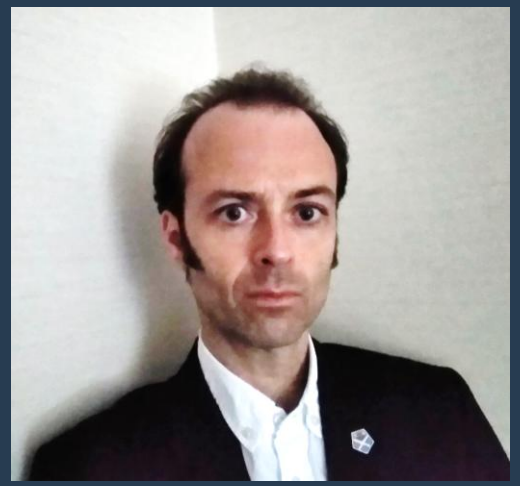


Bruce Stephen
Reader
University of
Strathclyde

1. Who we are
2. Problem and Barriers
3. Project Overview
4. User Journey
5. Data Needs
6. Identification of user need through Agentic AI
7. POC Demo

SSEN DISTRIBUTION

WHO WE ARE

We're Scottish and Southern Electricity Networks (SSEN) Distribution. We're the Distribution Network Operator (DNO) responsible for delivering power to almost 4 million homes and businesses across central southern England and the north of Scotland.

We serve some of the UK's most remote communities - and some of the most densely populated. Our two networks cover the greatest land mass of any UK DNO, covering 72 local authority areas and 75,000km² of extremely diverse terrain.

We're also at the forefront of delivering the decarbonised electricity system of the future, connecting new low-carbon technologies to the network. Through this, we're helping support sustainable economic growth for decades to come.

SSEN DISTRIBUTION NETWORK AT A GLANCE

Nearly **4 million** homes and businesses

Over **128,000km** of overhead lines and underground cables

Over **460km** of subsea cables powering our island communities

Over **4,400** employees across the country

PROBLEMS AND BARRIERS

The Current Situation

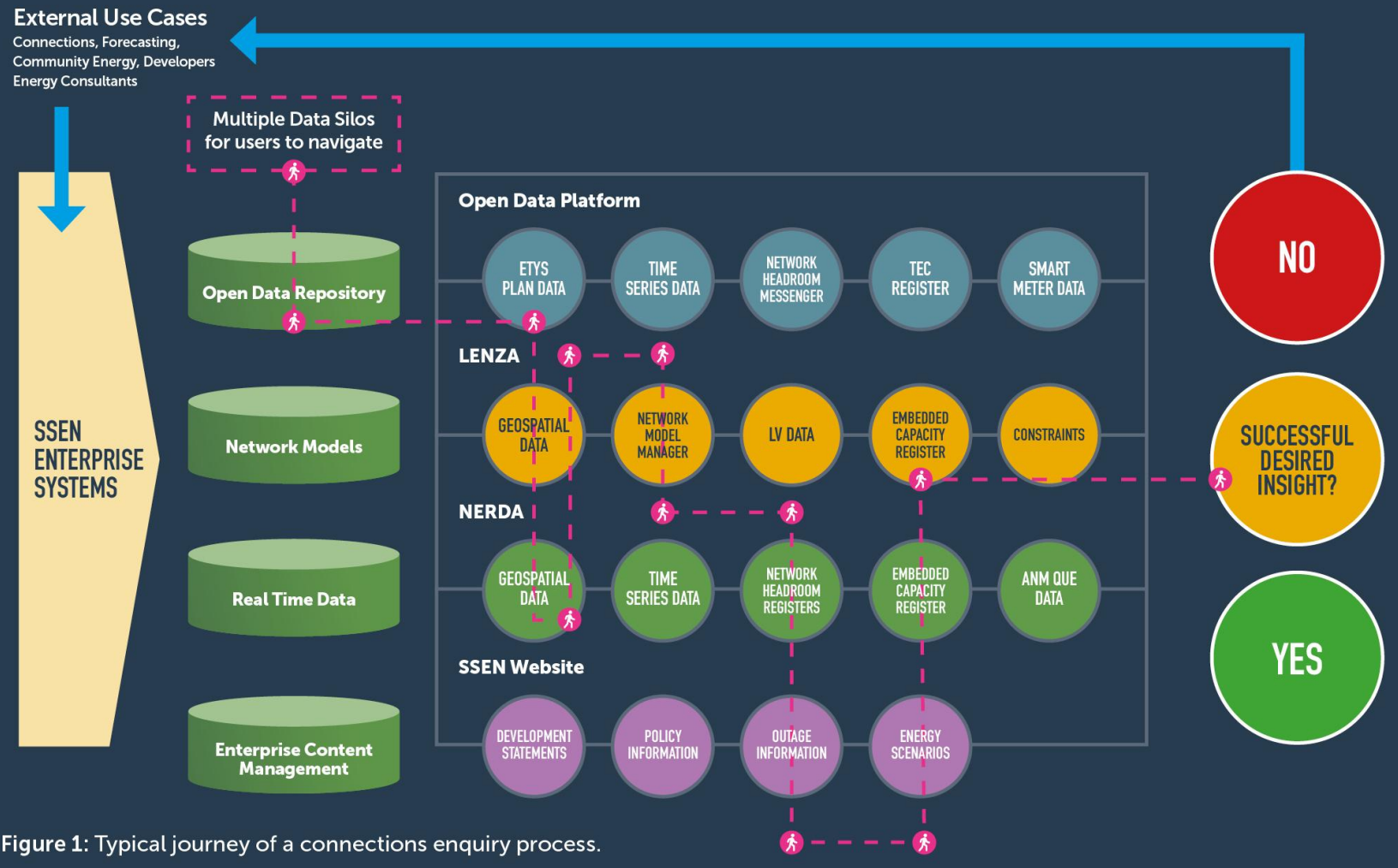


Figure 1: Typical journey of a connections enquiry process.

Barriers

- Complex and varied stakeholder needs
- Wide range of stakeholder expertise
- Large number of siloed and fragmented data sets
- Data is inconsistent
- Real-time data is incomplete by nature
- Volume: NeRDA looks at 1 million data tags and consumes 9.6M data points every 24 hours

PROJECT OVERVIEW

Straight to Alpha

WP1
Project management

Scottish & Southern Electricity Networks

WP2
Regulatory framework

Scottish & Southern Electricity Networks
CGI

WP3
User journeys

CATAPULT Energy Systems
Roadnight Taylor

WP4
Data needs

University of Strathclyde Glasgow
CGI

WP5
Solution implementation

University of Strathclyde Glasgow
Scottish & Southern Electricity Networks
CGI

WP6
Dissemination and CBA

Scottish & Southern Electricity Networks
CATAPULT Energy Systems

WP3: USER JOURNEY

SSEN are publishing **vast quantities of data** through their open data portals. It is unknown if users are gaining the most value from this data? The user journey work package looked to **understand user motivations** for engaging with SSEN. This will **enable D2I** to develop a **user centric tool** to **support users gain more** value from SSEN's open data.

Who are the users engaging with SSEN?

Input

- Specialist consultancies
- Local Authorities
- Developers
- Flexibility service providers

Why are users engaging with SSEN?

Analysis and engagement

- Stakeholder engagement and insights from previous enquires
- Stakeholder user group workshop

What insights do the users require?

Identifying

- Identifying areas with available capacity
- Inputs into the LAEPs and other planning activities
- Identifying opportunities for local capacity trading

User journey work package output

Reporting

- Map and document user journeys
- Rank and prioritise research questions
- Create use cases for D2I

A user journey is a path a user may take to reach their goal when using a particular application. User journeys are used in designing applications to identify the different ways to enable the user to achieve their goal as quickly and easily as possible.

WP3: USER JOURNEY

DATA 2 INSIGHTS

Method

The research happened in **3 phases**:

1. Documents reviewed were:
    - **227** SSEN data requests over **2 years**
    - **76** responses from a user feedback survey
    - **4** open data personas
    - Slido survey results from a SSEN Data Surgery

2. Conducted **9 x 1-to-1** interviews with a range of different stakeholders

3. Tested with the **AI Proof of Concept** with stakeholders

Key Findings

The primary users of the **NeRDA** portal look to use the data to facilitate grid connections: **50%** of SSEN data queries received are related to grid connections.

The full **grid connection journey has been mapped,** revealing multiple opportunities where an AI tool could provide value.

These use cases span both the planning stages of connecting to the grid and tasks that involve querying or **manipulating grid-related data**.

Specific AI Findings

The AI tool could increase the efficiency of the grid connection process: Users see potential in AI to reduce response time.

But users also feel that AI could introduce risks: Users feel there is a risk of AI providing incorrect or misleading information.

Those with **less grid connection experience** would require support in knowing how to effectively interact with or query the AI.

AI needs to be able to **adapt to the variations** in the grid connection journey.

WP4 : DATA NEEDS AND ENRICHMENT

Barriers

- Complex and varied stakeholder needs
- Wide range of stakeholder expertise
- Large number of siloed and fragmented data sets
- Data is inconsistent
- Real-time data is incomplete by nature
- Volume: e.g. NeRDA looks at 1 million data tags and consumes 9.6m data points every 24 hours

Solution Functionality

Natural language interface that can accommodate domain terminology specific to Open Data sets

User profiling and recognition of use case archetypes through iterative dialog

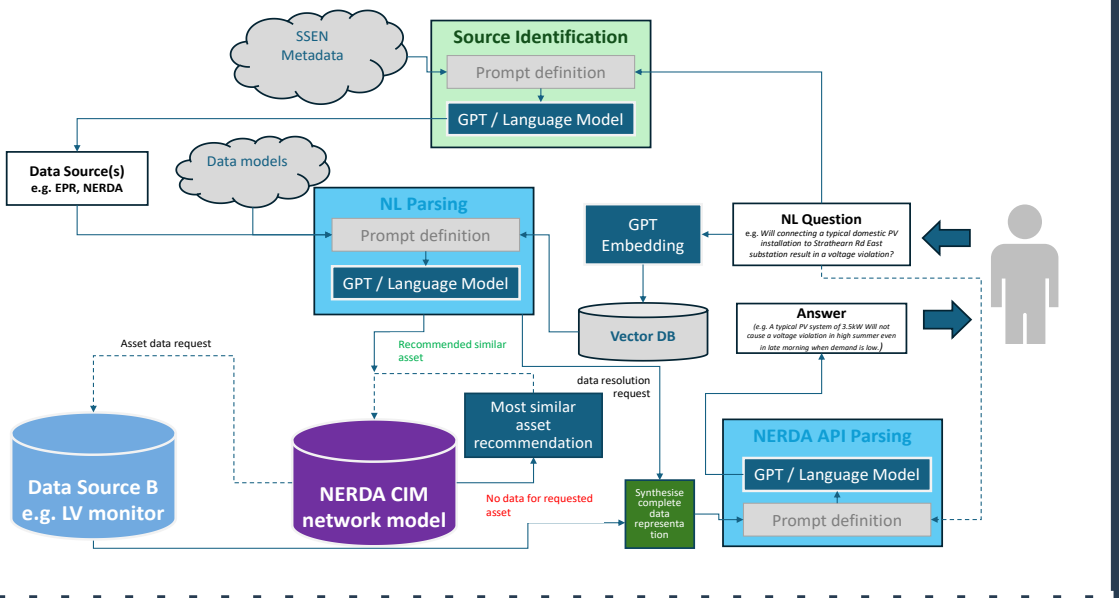
Data interfaces that are aware of their capabilities and past use cases

Means of corroborating returned queries across multiple data sources

Completion of returned query data using either closest similar or most plausible data points inferred from use case

Ability to divide queries into subtasks that can be executed across multiple nodes; refinement of queries through iterative user engagement to minimise search space.

USER NEED THROUGH AN AGENTIC AI INTERFACE

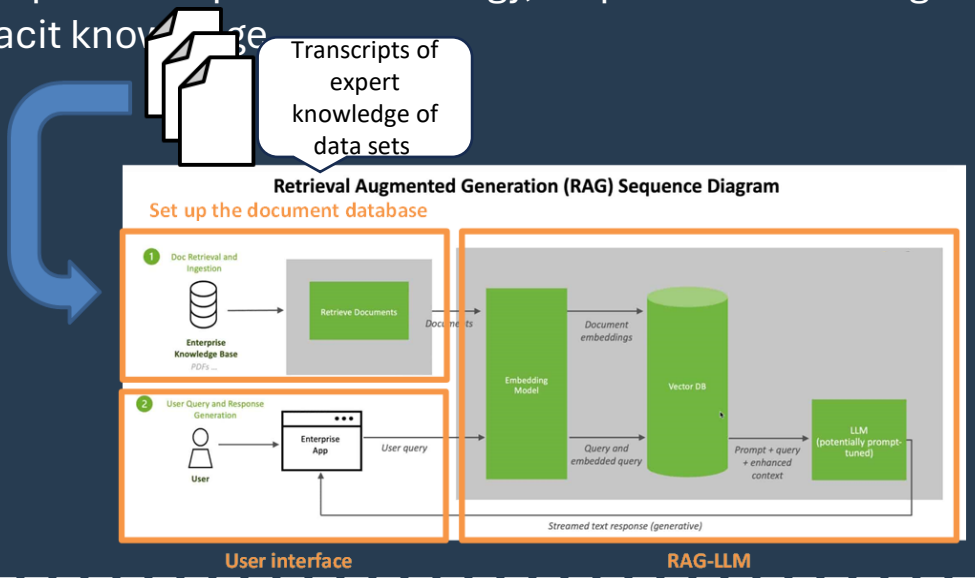


Natural language interface advances a user query to an insight:

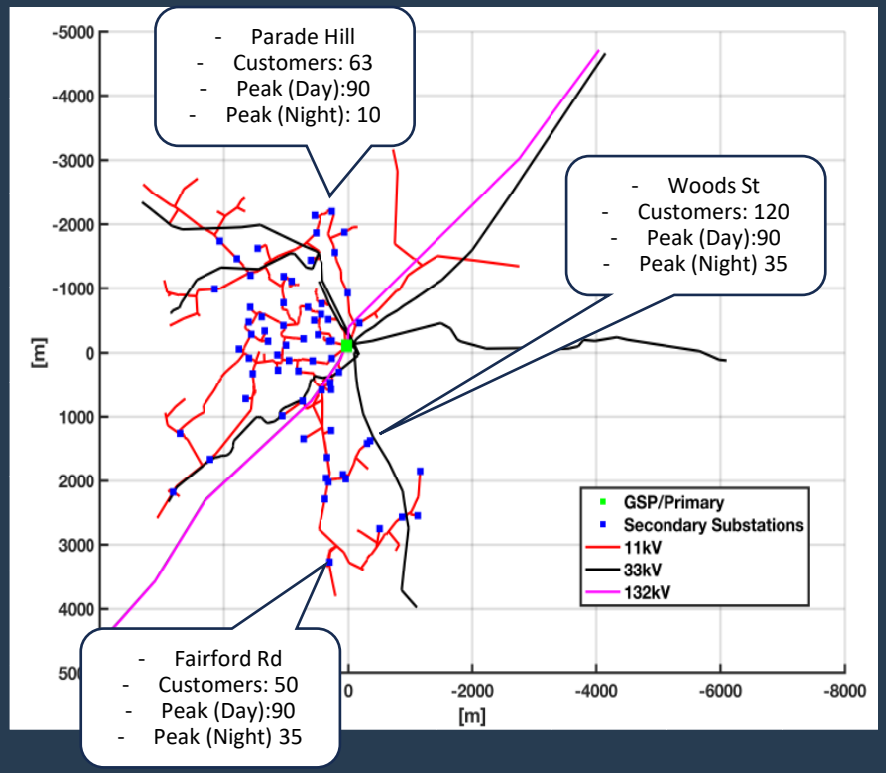
- Iterative completion of a use case template through two way dialog with the user
- Based around a RAG-LLM:
  - A Large Language Model (LLM) provides the ability to parse and generate coherent text
  - Retrieval Augmented Generation (RAG) specialises this to domain terminology and concepts.

Even within a DNO, Open Data sets are specialised and created in isolation. To open these up, D2I:

- Provides data sets with an RAG-LLM interface which makes them aware of their contents, potential use cases and limitations
- Open Data RAG-LLM trained on internal reports and transcripts of structured interviews with the data set owners
- Captures expert terminology, experience of usage and tacit kno[illegible]ge



DATA RECONSTRUCTION, RECOMMENDATION AND SYNTHESIS

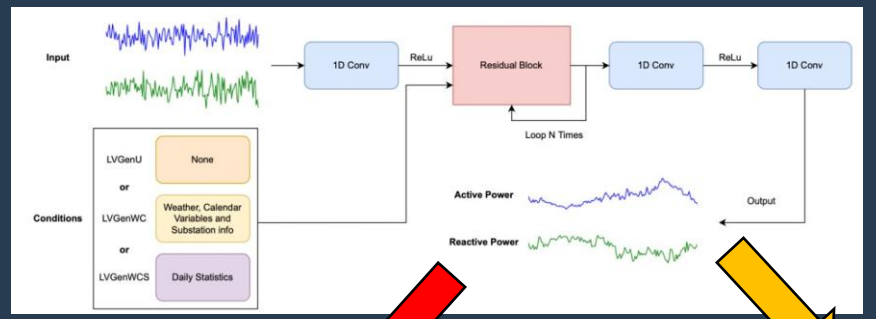


Not all assets are monitored; to generate an insight for a query D2I will use recommender system models to:

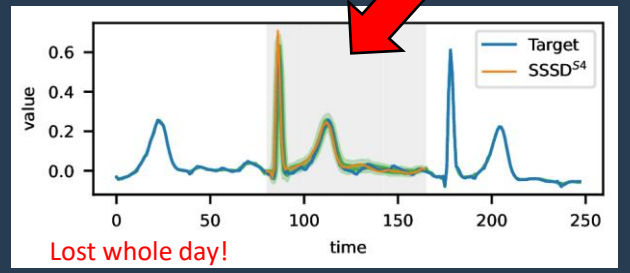
- Use most similar asset by meta data (e.g. customers connected, peak load)
- Use asset in closest spatial proximity
- Traverse a network connectivity (e.g. CIM) model to find asset peers with data

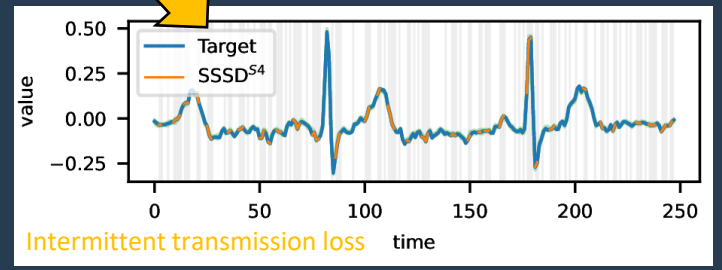
Not all assets carry the same level of monitoring; observations (e.g. LV monitors) may be low resolution, interrupted by communications failure, have limited history or be absent altogether. The D2I solution for this is to use GenerativeAI models on LV load measurements from the NeRDA platform to synthesise some or all of a time series to automatically:

- Recreate an entire missing day of load data
- Fill in random missing values from an interrupted monitor
- Create a plausible profile for an unmonitored asset
- Increase the resolution of the data if the insight requires it (superresolution)



Diffusion Neural Network solution permits reconstruction of missing substation load data with most plausible values prompted by weather, primary substation load, calendar variables and meta data.





POC DEMO

D2I DATA 2 INSIGHTS

http://127.0.0.1:7860

D2I Alpha PoC

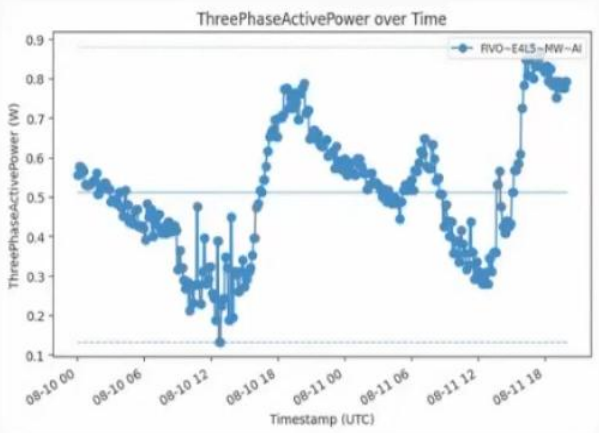
Let's try a different approach: Could you specify a shorter date range or a single date to see if that resolves the issue?

Select between 00:00 10/08/2025 and 20:00 11/08/2025

Here is the plot for the **Three Phase Active Power** measurement for the **E4L5** feeder at the **FIVE OAKS** substation, covering the date range from **00:00 10/08/2025** to **20:00 11/08/2025**:

Three Phase Active Power Plot

If you have any questions or need further information, feel free to ask!



What is the average line current at the Basingstoke substation?

Reset History

NEXT STEPS

- Visit the SSEN stand on M7 to receive a demo and interact with the D2I Proof of Concept.