# Fractal Flow – Webinar

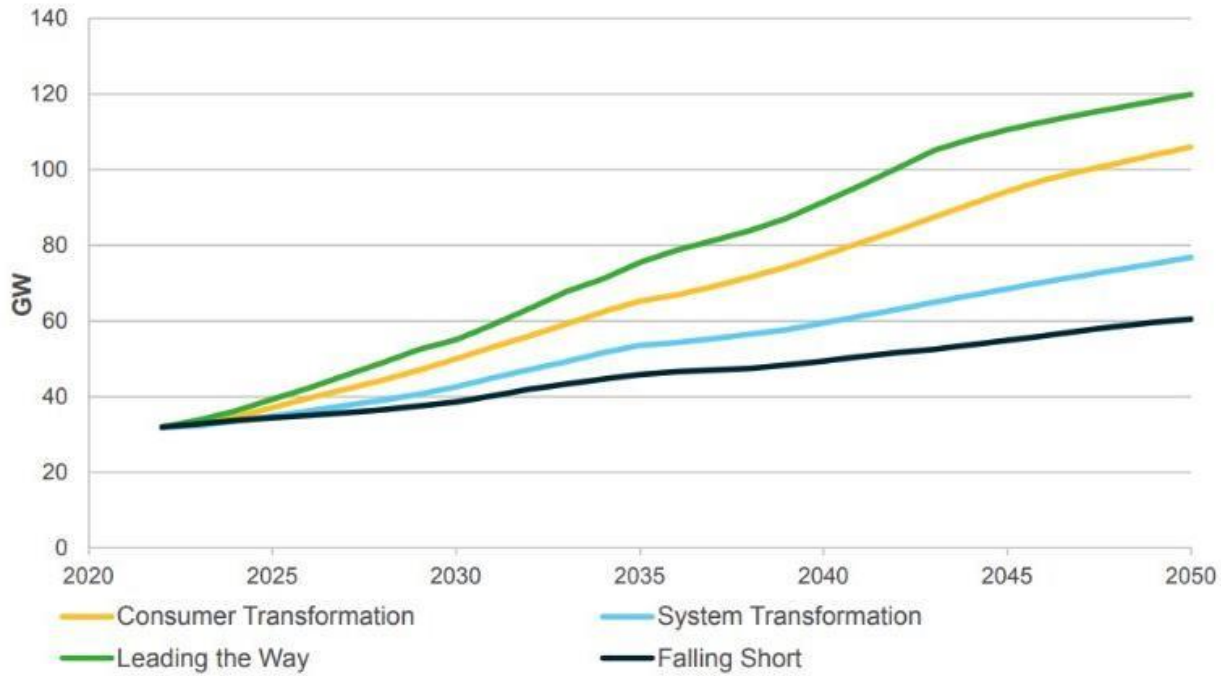
Frazer-Nash Consultancy

May 2024

# Future Energy Scenarios

- Achieving Net Zero by 2050 [1] requires integrating more Distributed Energy Resources (DERs) [2], challenging traditional grid operations.
- ESO and DNOs need better visibility of power flows to maintain stability and security.
- Increased DERs and active networks complicate this due to limited data visibility and sharing.
- Centralising data and creating a shared platform with analytics is essential for optimal DER management and informed investment decisions, supporting the transition to a Distribution System Operator (DSO).

Figure ES.22: Distribution connection generation [2]

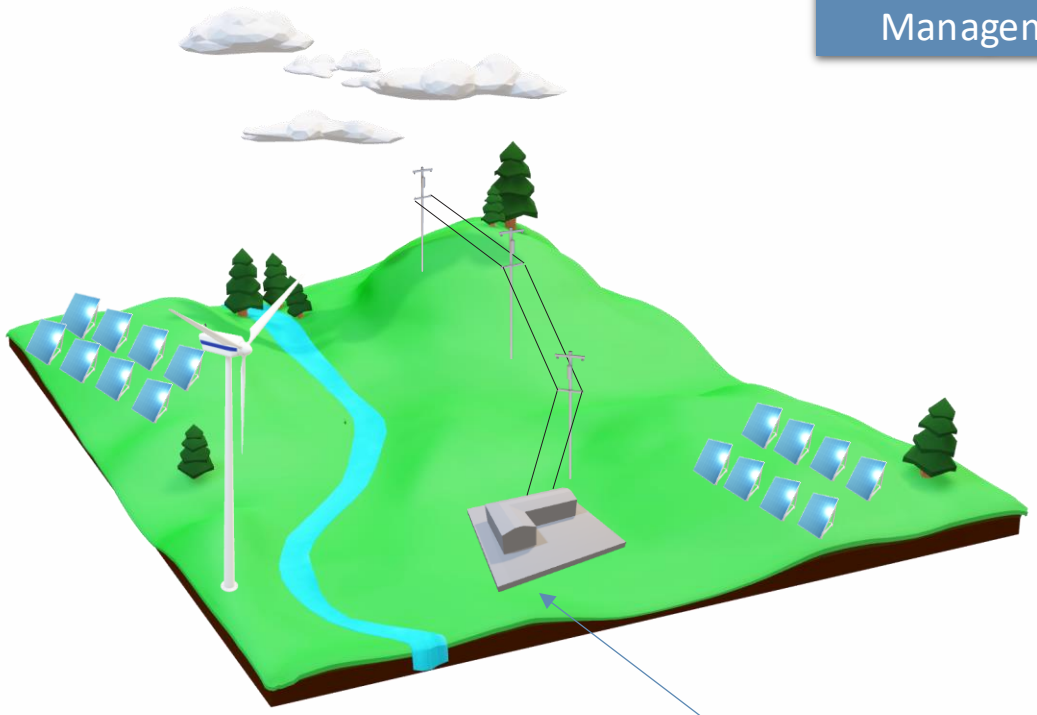



[1] Department for Energy Security and Net Zero and Department for Business Energy & Industrial Strategy, 'Net Zero Strategy: Build Back Greener', www.gov.uk/government/publications/net-zero-strategy

[2] NGESO, 2023, 'Future Energy Scenarios', https://www.nationalgrideso.com/document/283101/download, pg. 142

# What is Fractal Flow?

Centralised supplier-agnostic Data Management Tool



TRANSMISSION SYSTEM

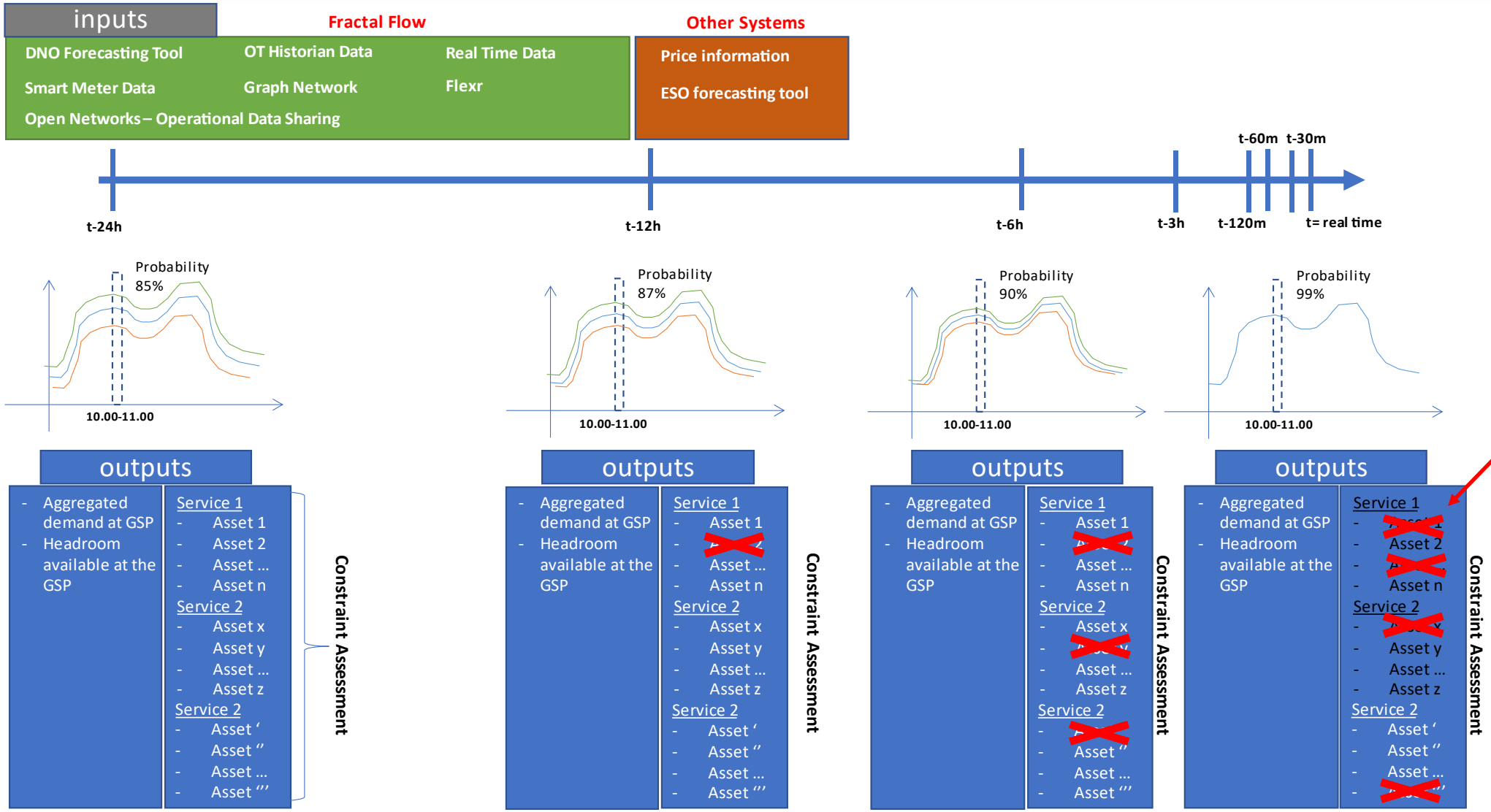
Grid Supply Point (GSP)

Increased LCTs

Substation A

Fractal Graph Network

# What is Fractal Flow?

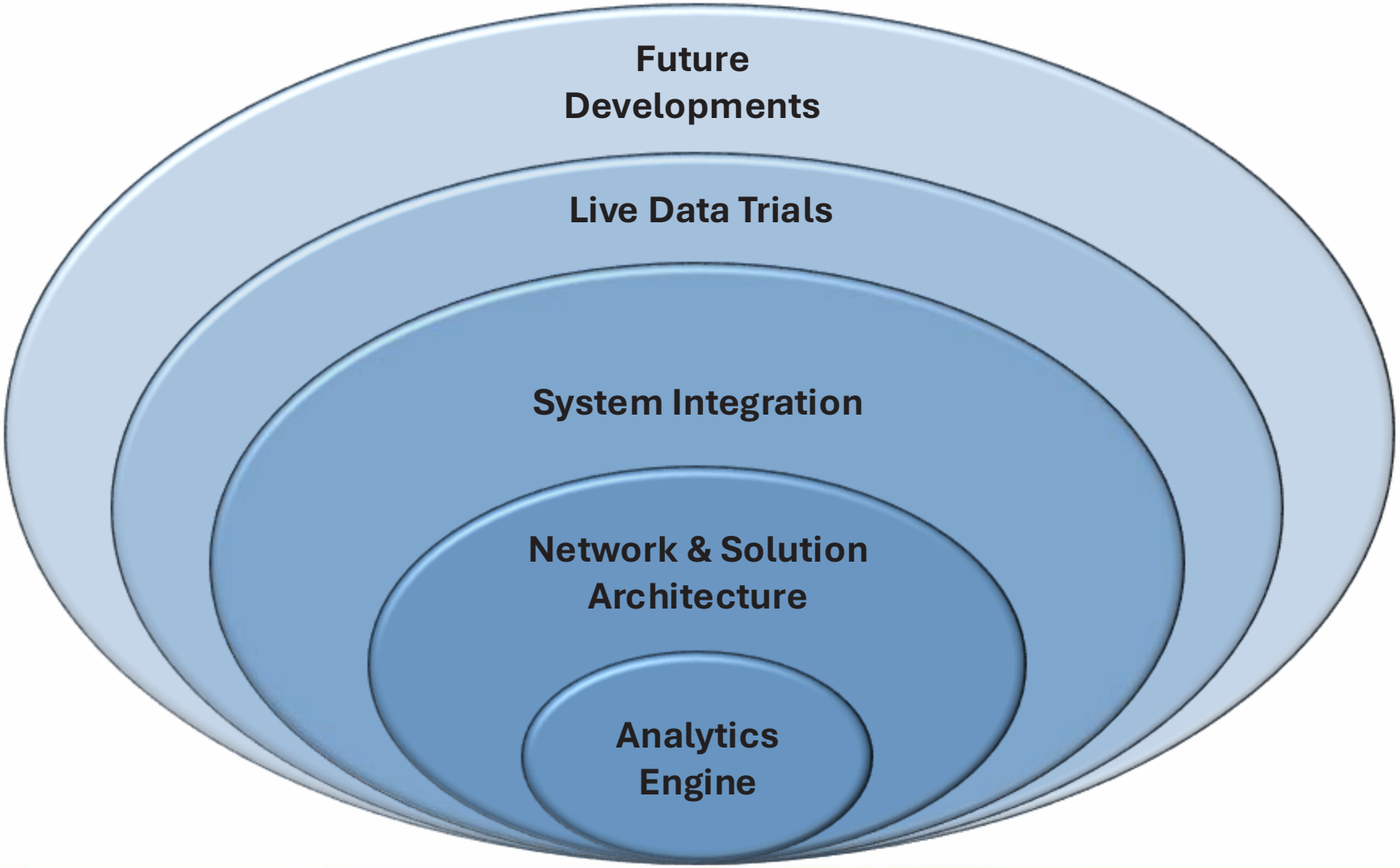



Identify assets as they become unavailable

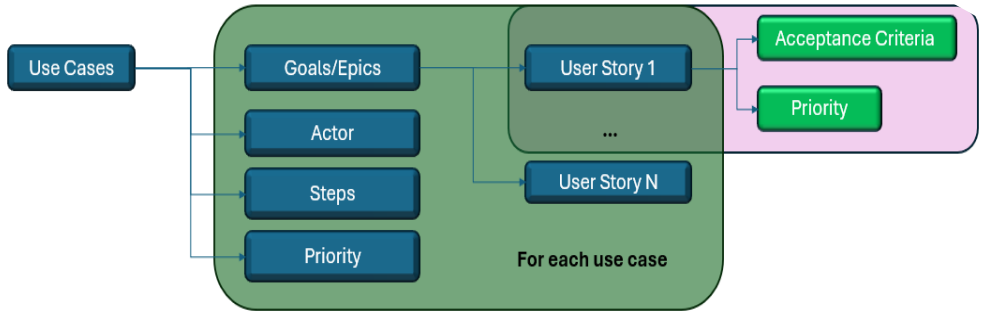
# Use Cases

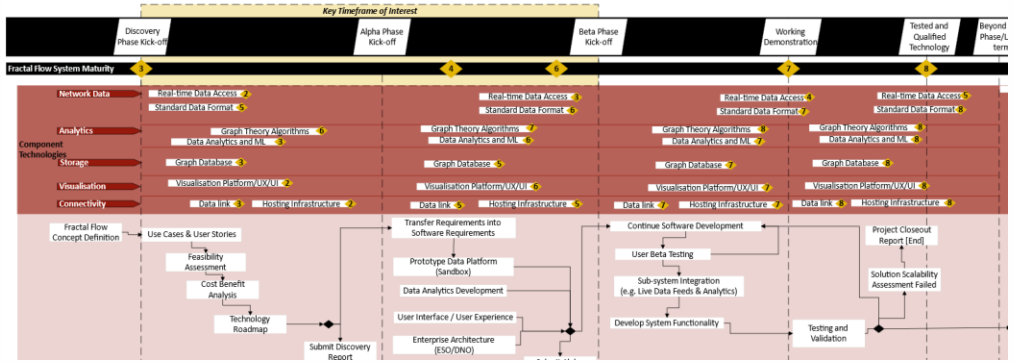
| | |
|---|---|
| **DNO Use Case 1: Network Visibility** | **EPIC: As a DNO Member, I want to be able to view the assets and connections on my network from the GSP-level down, so that I have a better understanding of supply and demand as well as constraints on my network.** |
| **DNO Use Case 2: Future Flexibility Services** | **EPIC: As a DNO Member, I want to have the infrastructure in place to support a system operator model and provide NGESO with the information they need for real-time control, so that I can optimise operations on my network and meet future grid requirements.** |
| **NGESO Use Case 1: Real-time Network Monitoring and Control** | **EPIC: As an NGESO Member, I want to have access to demand and availability of services at the GSP-level, so that I can make real-time control decisions within a specific region of the network.** |
| **NGESO Use Case 2: Dynamic Data Exchange for Balancing Services** | **EPIC: As an NGESO Real-Time Operator, I want to have a 30-minute resolution of demand and service availability information at the GSP-level, so that I can coordinate and maintain system stability.** |
| **NGESO Use Case 3: Anticipating Future Trends and Consumer Behaviour** | **EPIC: As an NGESO Real-Time Operator, I want to view future tariff trends and smart meter data, so that I can anticipate consumer behaviour and market dynamics and the corresponding implications on the network in real-time.** |

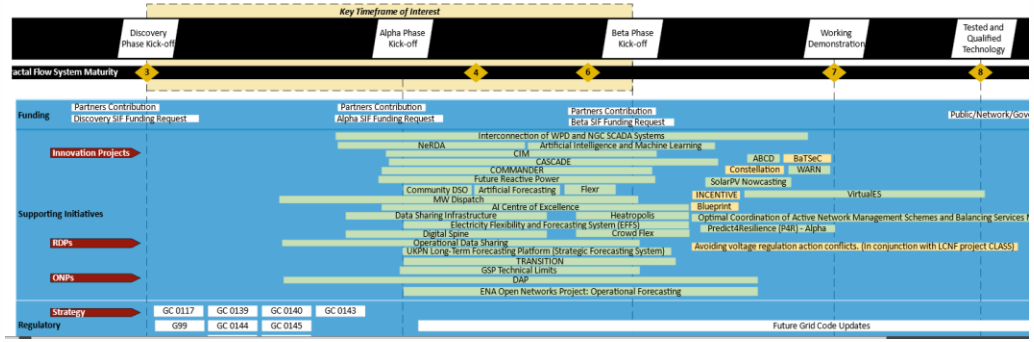
# How are we going to solve the problem?



# What did we do at Discovery?



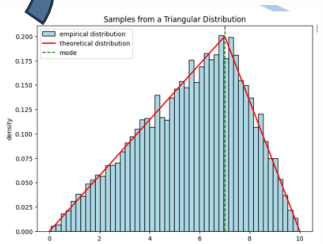




## DNO Use Case 1: Network Visibility – MUST (1)

EPIC: As a DNO Member, I want to be able to view the assets and connections on my network from the GSP-level down, so that I have a better understanding of supply and demand as well as constraints on my network.

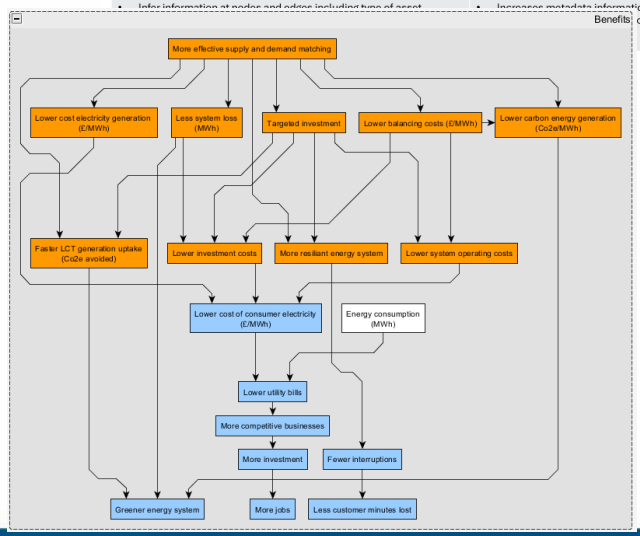
| ID | User Story | Acceptance Criteria | Priority |
|---|---|---|---|
| 4 | As a DNO Member, I want legacy assets to be included in Fractal Flow, so that I have a complete view of my network. | 1. A graph network that includes legacy assets as nodes and edges. | MUST |
| 5 | As a DNO Member, I want visibility of the assets and power flow data across the network, so that I can assess supply and demand across the network and identify constraints. | 1. Full network visibility OT data available within operation timescales. | MUST |
| 13 | As a DNO Member, I want Fractal Flow to be integrated into the current systems and processes that I use for effective BaU, so that it aligns with existing initiatives. | 1. The Fractal Flow tool is deployed and integrated into DNO's existing system and environment for the required users.<br>2. Fractal Flow can be used by the required users for BaU tasks. | MUST |
| 14 | As a DNO Member, I want to identify and fill gaps in the datasets, so that I can identify and resolve missing information and conflicts in the data. | 1. A tool that vis | |
| 16 | As a DNO Member, I want to know the power flow direction below the 'primary' level, so that I can improve network understanding, utilisation, and planning. | 1. Power flow di | |
| 20 | As a DNO Member, I want to be able to interrogate assets at each level of the network (GSP, BSP, primary, etc.), so that I can identify asset characteristics and view real-time and historic power flow data. | 1. Effective real<br>2. Effective hist | |




An example triangular distribution where the minimum = 0, maximum = 10, and mode = 7.

## Data Analytics and ML for DNO Use Case 1: Network Visibility

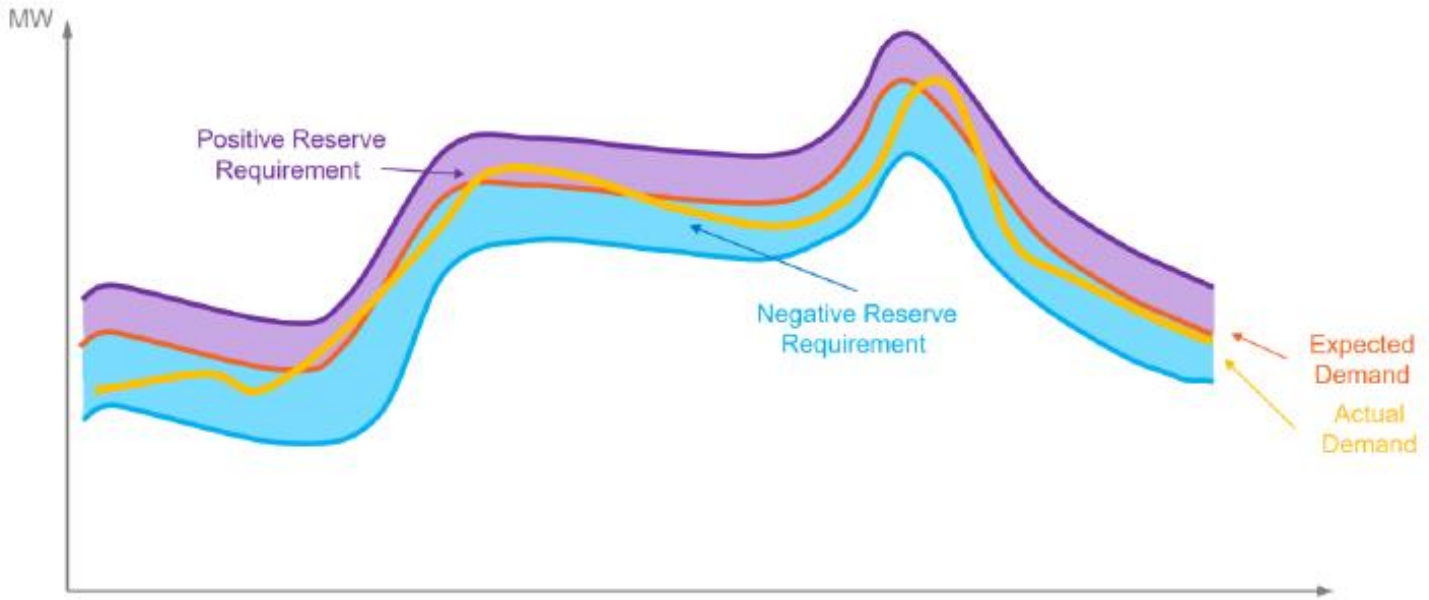
| Data Analytics and ML | Benefit |
|---|---|
| • Infer the direction of power flow at nodes below the primary substation network level. This will leverage the graph to solve local-neighbourhood power flow problems *[ML1, ML2, ML7, ML9]*. | • Improves network visibility for assets that have limited data or sensor availability, and speed of local calculation on a large network with real-time power flow data. |
| • Identify constrained edges in the graph and forecast constraint clusters *[ML1, ML2, ML7, ML9]*. | • Improves decision making and forecasting of supply and demand.<br>• Availability status would be metadata on a node allowing route finding problems to resolve outages or maintenance activities where a particular distribution or transmission asset is not available. |
| • Identify and fill gaps in the datasets.<br>• Identify bad data *[ML3]*. | • Addresses missing data, data conflicts, and bad data.<br>• Allows querying of nodes for real-time and historical statuses. |
| • Classify nodes to identify those which have generators attached *[ML4, ML8, ML9]*. | • Improves network visibility to understand sources of power flow error. |
| • Cluster nodes by characteristics *[ML4, ML9]*. | • Improves understanding of types of nodes and trends in node groups.<br>• Adds capability to forecast on expected behaviour of clustered nodes. |
| • Infer information at nodes and edges including type of asset | • Increases metadata information across all levels of nodes in the network.<br>ough network visibility by estimating missing data. |



# Benefits of Fractal Flow

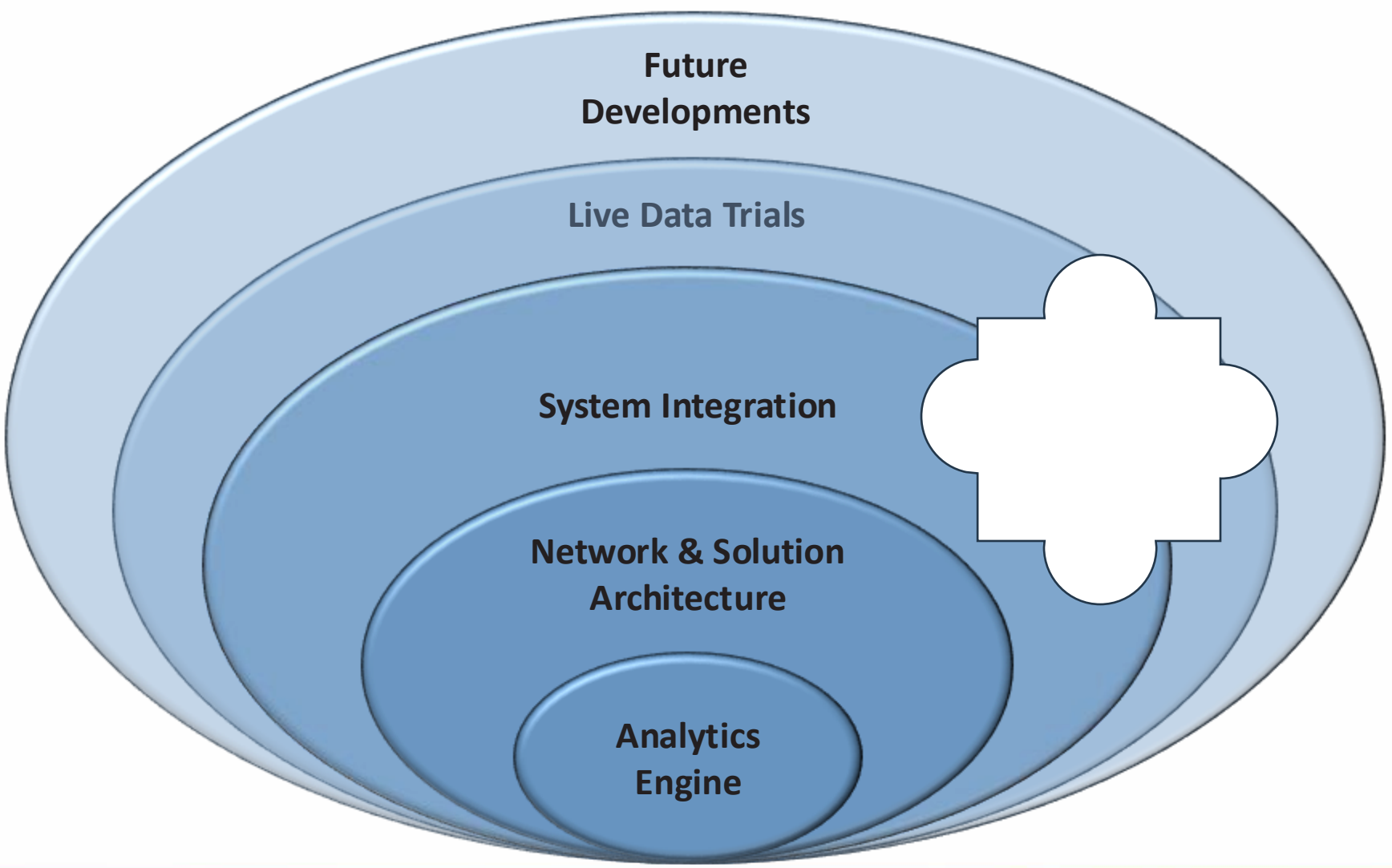
Fractal Flow provides a range of benefits, those that we have identified are:

1. Balancing mechanism cost saving: **£283m per annum** saving (1st percentile)
2. Decreased carbon dioxide emissions: **1.07 megatons per annum** saving (1st percentile)
3. Ancillary services cost saving
4. Increased system security
5. Improved DNO investment decisions
6. Reduction in conservatism in new connections




Ref: Cornwall Insight

# How has our thinking evolved and how this affects future activities




Data Links
Data Standards

Decision to change Challenge & Theme based on Discovery Outputs

# Future Plan

## Discovery

Feasibility Assessment

Core Requirements Capture

Cost Benefit Analysis

Technology Roadmap

Gap Analysis

Identify ML Approaches

## Alpha

Develop Graph Network

Develop and Demonstrate ML Analytics for BM Constraint Scenarios

Use Static Data

Investigate Network/Solution Architecture

Develop External Data Sharing Requirements

## Beta

Develop Network Solution Architecture

Integrate Analytics Engine & Data Streams

Trial Data Live Exchange

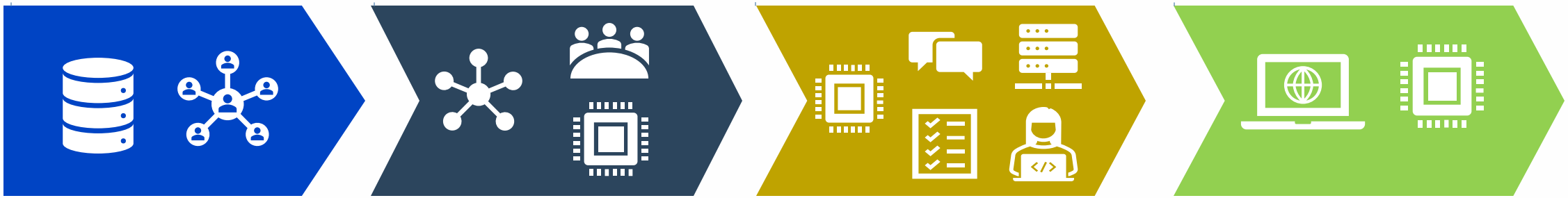
Trial ML Live Analytics

Develop Enhanced Analytics Capabilities

## BaU

Deploy Fractal Flow

Future Functionality Planning



# Thank you

Fraser Pearson

f.pearson@fnc.co.uk