# Digital Spine

## Feasibility study

### Developing an energy system data sharing infrastructure

September 2023

Summary report

Developed for:

Department for Energy Security & Net Zero

# Contents



**Notice:**
This report summarises the findings and conclusions of the six-month feasibility study into an energy system digital spine, developed through a stakeholder-led, collaborative, and consultative approach with 100+ cross-sector engagements.

The findings are the view of the consortium and are not official government policy.

# Contents of the full report appendices

**Appendices of the full report provided for reference**

# Executive summary

## Developing an energy system data sharing infrastructure

Following the Energy Digitalisation Taskforce in early 2022 and its recommendations to develop a 'digital spine' for the sector, this feasibility study was commissioned by government to scope what precisely a digital spine is, and how it might be developed to benefit the energy sector.

The work presents the cumulative thinking of the consortium of Arup, Energy Systems Catapult and the University of Bath, along with the 100+ individuals and organisations that were consulted in the co-creation of what has now become the concept of a **data sharing infrastructure**.

An outcome of engagement activities conducted as part of this feasibility study was to move away from "***Digital Spine***" and "***Data Sharing Fabric***" terminologies, as they caused significant confusion and were unhelpful in communicating and articulating the overall purpose of an energy system data sharing infrastructure.

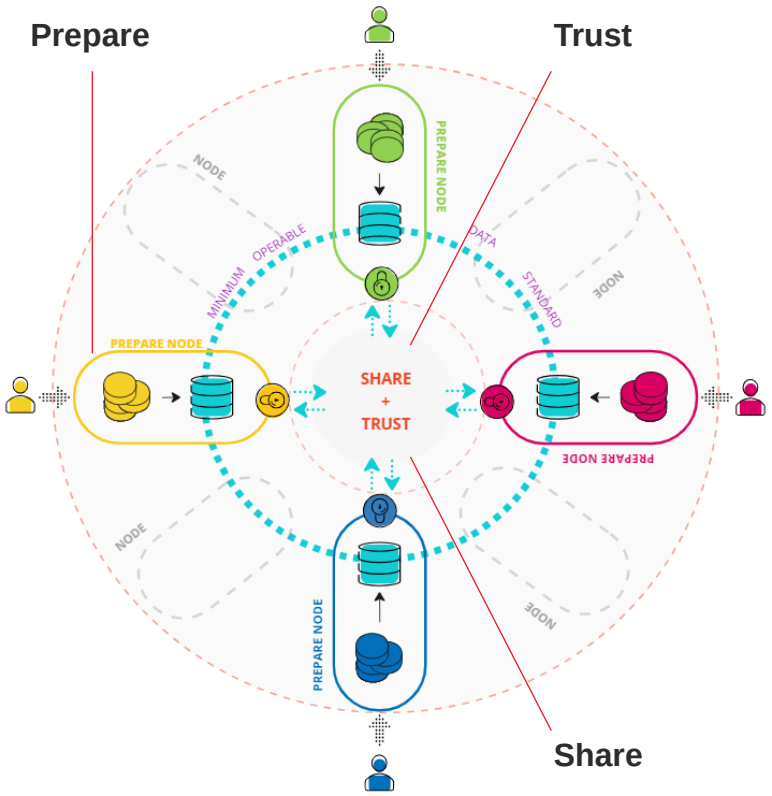
Instead, to promote broader audience understanding, it is described by the three functional components: **Prepare**, **Trust**, and **Share**, as shown in the adjacent diagram**.** Each component plays a vital role to ensure an ecosystem of data sharing is realised.

It is currently considered that government involvement will be crucial for implementing an MVP of the data sharing infrastructure due to the government's ability to prioritise public interest, provide security and trust, drive standardisation and interoperability, and ensure long-term stability.

A data sharing infrastructure is a modern public service for public good, and as such, a cost recovery route is proposed to pay for its implementation, and ongoing operation and maintenance.

This report is part of a suite of documents summarising the findings and conclusions of the feasibility study:

- **Full report** – 411 pages
- **Summary report** – 52 pages
- **Executive brief** – 16 pages




Proposed components of a data sharing infrastructure

# Approach

**Feasibility study to define, scope and assess the need and scope of a data sharing infrastructure**

## Overview

This feasibility study is a crucial step in determining the shape and delivery routes for implementing a sector-wide data sharing infrastructure.

Therefore, to ensure success, over 100+ engagement sessions were undertaken, guided by the principles of being stakeholder-led, collaborative, and consultative.

- **Stakeholder-led:** across every milestone and the various iterations of the data sharing infrastructure definition, those stakeholders who can be directly affected were actively engaged to help shape the definition.
- **Collaborative**: rather than stakeholders being solely recipients of information, they were encouraged to participate in the study. This mindset ensured the engagement sessions fostered a sense of ownership, responsibility, and commitment to the outcomes, leading to stakeholders wanting to be part of the study.
- **Consultative**: validated and extensively tested the definitions by seeking input and feedback. Stakeholders were given the opportunity to express their concerns, raise questions, and provide recommendations.

## Aims of the feasibility study

The overall aims of this feasibility study are to:

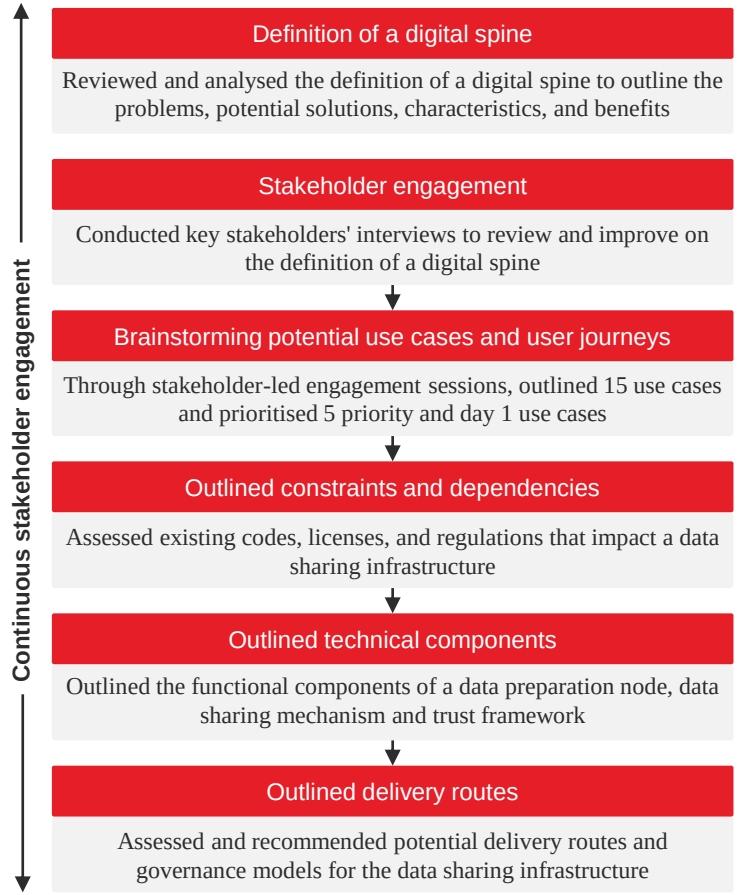
- Establish the needs case for an energy system 'digital spine' and its benefits to a smart, flexible, decarbonised energy system; and
- Understand the potential scope of an energy system 'digital spine', and the data infrastructure required to deliver it, and the costs of scope options.

The Energy Digitalisation Taskforce (2022) defined two concepts of "***Digital Spine***" and "***Data Sharing Fabric***".

Following stakeholder engagement activities conducted as part of this feasibility study, it was decided to move away from these inherited terminologies. They caused significant confusion and were unhelpful in articulating and communicating the overall purpose.

Instead, to promote broader audience understanding, the concepts are described through three functional steps: **Prepare**, **Trust**, and **Share.**

These concepts are collectively referred to as a **data sharing infrastructure**, and together enable a digital infrastructure that allows the exchange of energy data in a secure and interoperable manner.



# 1

# Why is a data sharing infrastructure needed?

# The contribution to UK Government's objectives

**Summary of how a data sharing infrastructure would support the strategic needs of the energy sector**

## Overview

The energy industry must undergo significant change to ensure the delivery of an affordable, resilient, net zero energy system.

The future system requires the integration of large volumes of low-carbon and renewable infrastructure with a significant increase of assets and interactions needed. The industry currently suffers from a lack of data sharing which present challenges in the ability to manage the increasing complexities of the future system.

The ability to ingest, standardise, and share data between different actors and customers will be critical in managing this and enabling:

- Lower overall system costs due to efficiencies
- The UK government meeting its strategic and legal objectives around net zero
- A flexible and stable system that can manage the increasing complexities of a net zero system
- An increased pace of innovation to support achieving all the above
- A resilient system with reduced risk of market failure.

### Greater value offerings for the customers

As the energy system moves towards net zero the way in which customers interact with the system is set to dramatically change. With current ways of operating this will incur significant costs to customers. Customers need an affordable, trusted, seamless energy experience with the necessary controls and protections that maintain customer experience. A data sharing infrastructure is critical to the robust delivery of these solutions, ensuring delivery of affordable energy to all.

### Meet policy objectives

The UK government have set out a net zero strategy and commitment to achieving net zero by 2050. To achieve this the UK must decarbonise its current energy system by 2035, integrating large volumes of low-carbon and renewable infrastructure without compromising energy security or resilience.

The complexity of the future system means that success can only be achieved through greater use of data and technology. Without this, the UK risks failing to meet its commitments.

### Flexible and stable system

To achieve an affordable, resilient net zero energy system, a whole systems view must be considered, with numerous actors working in tandem to deliver a flexible and secure network of assets.

To support the delivery of new markets assets owners and operators must be able to easily move their assets between different markets and service providers. All of this can only happen through greater use of data and technology. Without this there is a significant risk of market failure and likely inability to achieve resilience objectives.

### Increased pace of innovation

To achieve an affordable, resilient, net zero energy system significant innovation is needed. Innovative solutions that create new commercial structures or introduce more efficient ways to operate the network typically require data from multiple sources.

The current siloing of data and lack of sharing infrastructure means that barriers to entry for innovators are high and innovation cannot happen at the rate it is needed. A data sharing infrastructure would support access to the data needed to drive this

# Mitigating market failure

## Considerations of market failure for developing a data sharing infrastructure

### Overview

The Energy Digitalisation Taskforce recommended the need for a data sharing infrastructure. It considered that their absence would result in a loss of 'optionality' in how the future energy system is developed.

In the context of a data sharing infrastructure, the following types of market failures are considered:

- **Provision of information**
- **Absence of an interoperable way to share**
- **Lack of structural trust**
- **Data monopolies**
- **Increasing complexity of the energy markets**

Detailed descriptions of each market failure mechanism are given in **Appendix M** of the full report.

### Governance considerations

The energy market already is already familiar with the sharing of operational data related to system operation or financial flows within the energy retail market.

For example, organisations such as RECCo or ElectraLink facilitate data transfer with market participants to discharge their licence obligations. The codes are then governed by a strong framework that has iterated over time to deliver for the market needs.

The agreement of these types of frameworks is a core function of a governance mechanism that overcomes a common market failure, which is a lack of information.

The five prioritised use cases suggest that information provisions for each is lacking and may represent an information provision market failure. Therefore, the level of governance required for such a solution should reflect the technical maintenance and core functions of a data sharing infrastructure.

A decentralised and distributed approach to governance, reflecting the proposed distributed technological implementation will mitigate the described market failure risks (e.g., digital monopolies developing).

### Avoiding duplication across industry programmes

Another consideration for government is the efficient use of resources allocated to define, develop, and operate a data sharing infrastructure.

Coordinating multiple programmes, such as the National Digital Twin Programme (NDTP), Virtual Energy System, or Open Energy that receive funding from government should be priority of government to ensure effective uptake of policy outcomes, avoiding conflicting objectives, and ensure interoperability between programmes.

To mitigate risks from duplication of activities across programmes government should ensure coordination, collaboration, and careful resource allocation to optimise and maximise the impact of the publicly funded initiatives.

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# What is the proposed solution?

# Proposed components of a data sharing infrastructure

**Overview of the three key components that enable an ecosystem of data sharing**

The Energy Digitalisation Taskforce (2022) defined two concepts of "***Digital Spine***" and "***Data Sharing Fabric***".

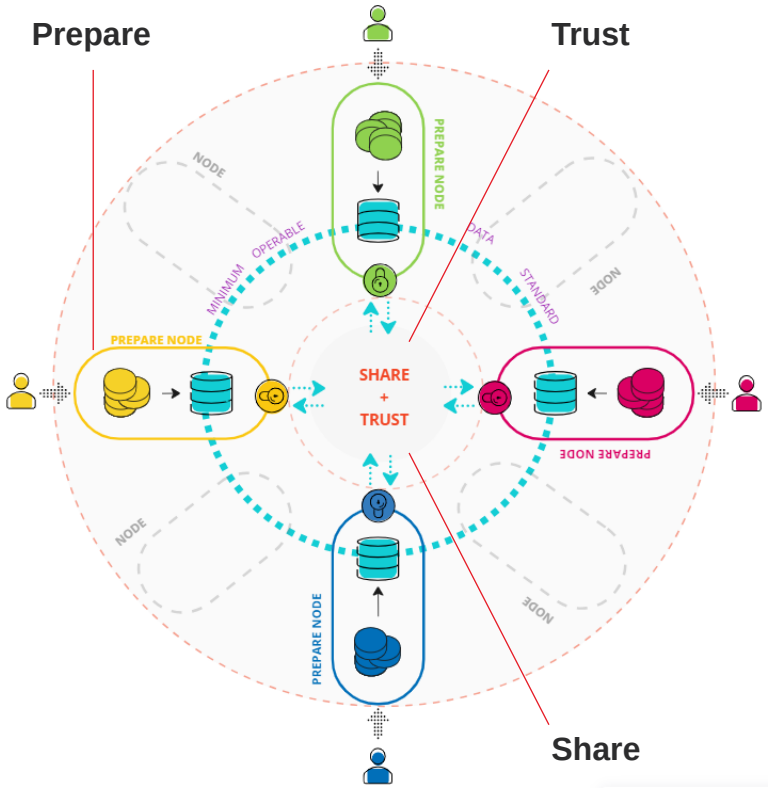
Following stakeholder engagement activities conducted as part of this feasibility study, it was decided to move away from these inherited terminologies. They caused significant confusion and were unhelpful in communicating and articulating the overall purpose of an energy system data sharing infrastructure.

Instead, to promote broader audience understanding, it is described by the three functional components: **Prepare**, **Trust**, and **Share**, as shown in the adjacent diagram**.**

These concepts are collectively referred to as a **data sharing infrastructure**, and together enable a digital infrastructure that allows the exchange of energy data in a secure and interoperable manner.

The data sharing infrastructure enables and fosters a culture of data sharing in the sector by empowering collaboration within the sector to co-define the rules, and through the enabling infrastructure facilitating the sector to compete on the game.

The **Prepare**, **Trust**, and **Share** functional components are detailed over the following pages.




### Prepare: a cross-sector data preparation node

A node on the organisation's own infrastructure that prepares data into a minimum operable data standard (specific to each data type and use case), and presents it through standard APIs, access and security controls.

There should be one consistent cross-sector version.

### Trust: a sector-wide trust framework

Provides the definition, implementation, and governance of the legal and identity frameworks. This establishes the user's confidence, right, and legality, where required, to share data between parties.

There can be more than one of these in the sector.

### Share: a sector-wide data sharing mechanism

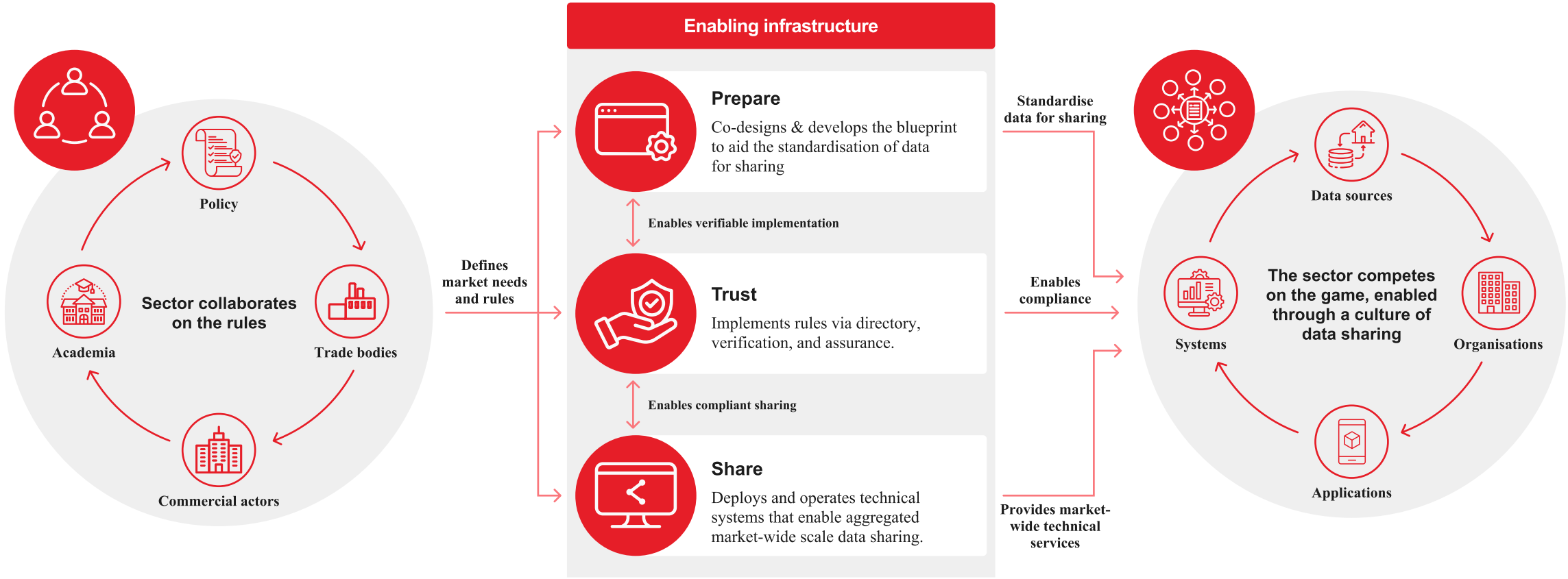
The connectivity layer and technology implementation for the governance of access controls to data.

There can be more than one of these in the sector.

# Ecosystem of a data sharing infrastructure

**A sector-led initiative with government support to develop and operate a data sharing infrastructure**

The diagram shows a data sharing infrastructure in the context of sector actors collaborating on defining data sharing rules; thereby, enabling a market that can compete on providing services to end customers, enabling faster innovation, and supporting the sector meet its net zero targets.



# Prepare: a cross-sector data preparation node

**Summary of the terminology used in defining the concepts**

## Cross-sector data preparation node

The **cross-sector data preparation node** allows each organisation across the energy sector to deploy a commonly structured component, referred to as a **data preparation node**, as part of their own IT infrastructure.

This component allows an organisation to:

1. Control and specify the data they wish to share
2. Align and prepare that data to a minimum operable data standard (specific to each data type)
3. Securely present the standardised data to the sector through standard APIs, access controls, and security procedures

These deployed nodes would be able to form a network with organisations across the energy sector, and ultimately across all sectors, all using and presenting data to each other in a consistent approach.

It is considered that there should only be one consistent cross-sector data preparation node to reduce the friction and barriers to cross-sector data sharing.

## Addressing a need

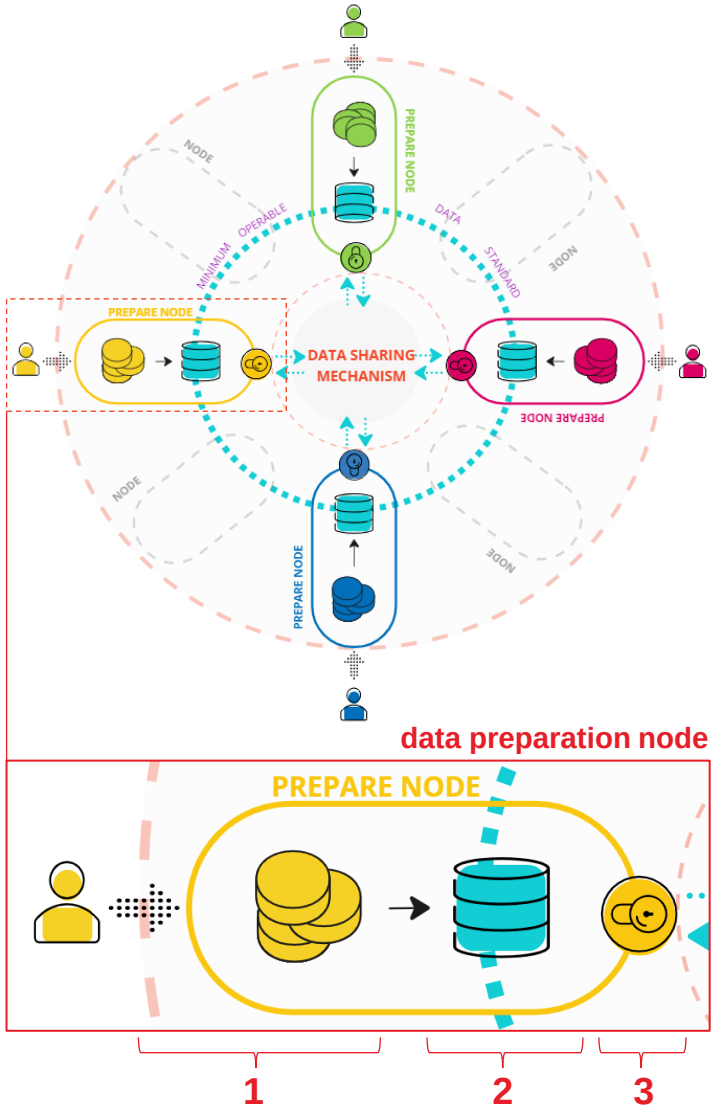
To enable a data sharing infrastructure, the data that is transmitted between two or more actors needs to be prepared and standardised against a set of rules.

These rules can be common standards, ontologies, and taxonomies, or at a basic level common metadata.

In the current operating environment, despite the vast amount of available data, joining and blending datasets remains a manual, inefficient process that requires extensive, domain-specific knowledge.

This challenge can be mitigated by fostering a culture of sharing standardised data. When data is standardised:

- It allows for better collaboration, by enhancing the trustworthiness of the data.
- It helps maintain the integrity of data as it is shared, through common quality standards.
- It can support interoperability which can also reduce overall system optimisation costs. Interoperable data requires fewer translations, lower processing requirements, and is less susceptible to errors, ultimately leading to minimised operational costs.



# Trust: a sector-wide trust framework

**Summary of the terminology used in defining the concepts**

## Trust framework

A **sector-wide trust framework** defines, implements and governs the legal and identity rules that ensure reliable data sharing. Users can set the data licensing and legal conditions for data, enabling user's confidence, right, and legality, where required, to share. It includes:

- The process of agreeing to rules for data sharing in the data sharing mechanism,
- An integration of process for enabling organisations to participate through a data sharing mechanism that can implement those rules.
- The technical components required to codify the rules

The development of trust framework is use-case driven, but one trust framework can be applied to multiple use case once implemented if the use cases allow for similar contractual framework and identity management.

Also, It is considered that there can be more than one of these in the sector. For example, a ‘network’ instance, a ‘regulation’ instance, and a ‘privately’ owned and operated instance. These would be designed from the same blueprint, so would be architecturally identical.

This will offer participants the flexibility to define a trust framework that is best suited for their use cases and associated commercial, legal and licensing policies.

## Addressing a need

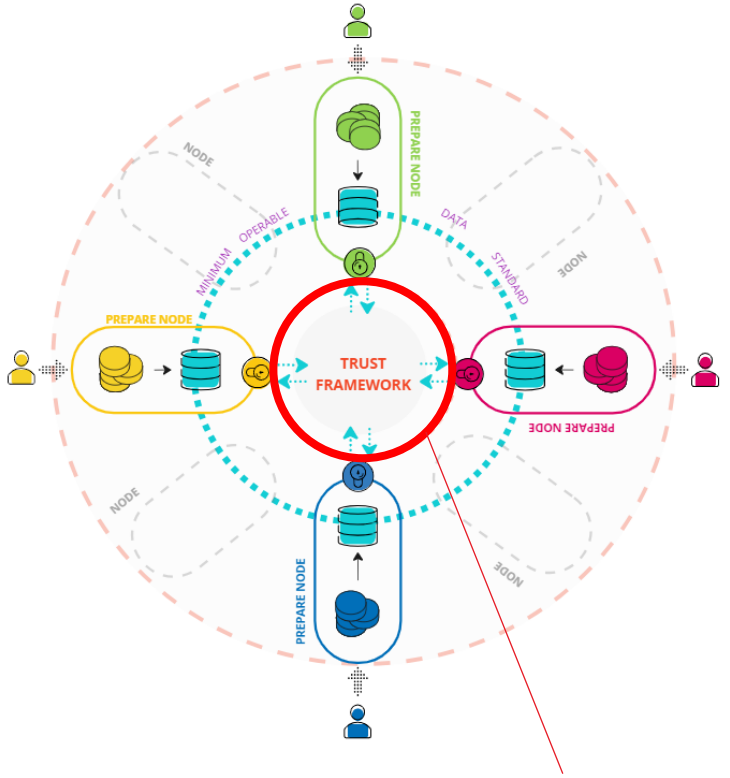
To enable a data sharing infrastructure, an appropriate framework for trust is crucial to facilitate the exchange of data between parties and stakeholders.

Currently, organisations use data sharing agreements. These agreements help reduce risks associated to data sharing by motivating the data producer to ensure the data is accurate, complete, and up-to-date.

They also establish guidelines for data privacy, security, and ownership - which are critical considerations when dealing with sensitive data.

Without appropriate data sharing agreements, there is a risk that parties share incorrect, incomplete, outdated data, which can result in inaccurate simulations and predictions, potentially leading to legal liability, financial penalties and reputational damage for the parties involved.

The trust framework aims to provide a scalable, and a robust solution by providing organisations accurate risk profiles, common user attributes, identity management, and pre-negotiated agreements based on use case needs.




Sector-wide trust framework

# Share: a sector-wide data sharing mechanism

**Summary of the terminology used in defining the concepts**

## Sector-wide data sharing mechanism

A **sector-wide data sharing mechanism** facilitates data sharing by providing the technology, security and governance means for exchanging data.

It enables the governance, security, and exchange of data between the organisations. This is delivered by a host of components related to security services, a trust framework, data catalogue, system governance and data exchange via message brokers and APIs.

It allows actors to:

1. Discover data shared by other actors
2. Securely request and pull the data of interest from other actors through their data preparation node
3. Provide governance, and licencing definition and brokerage

Once a request is granted then a stakeholder can securely connect to the data preparation node of the organisation from which they want data, then request and obtain that data, securely with appropriate assurances in place.

Like the trust framework, it is considered that there can be more than one of these in the sector.

## Addressing a need

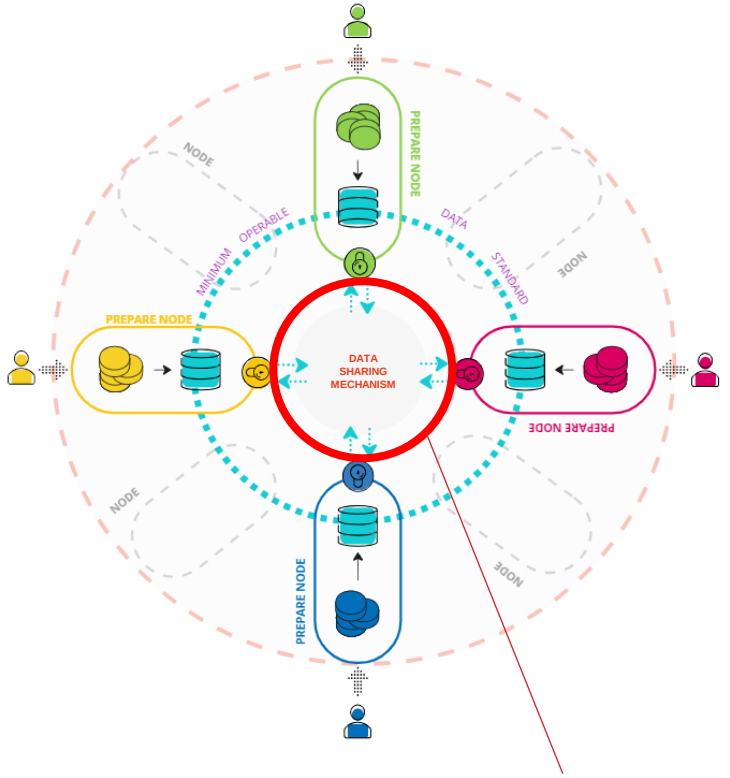
To enable a data sharing infrastructure, an appropriate mechanism is required to ensure secure, reliable, and scalable method for moving data from the producer to the consumer.

The current data pipelines in the energy sector have been developed in an uncoordinated manner. Regulated entities have typically tackled data sharing challenges by implementing vendor-specific solutions, resulting in a range of technologies and approaches being used.

This unstructured approach has led to significant variations in sharing and access to critical systems and data across different parts of the sector, creating high financial and technical barriers to entry for many data systems.

Therefore, establishing an appropriate technology framework, commercial model, and governance structure is crucial for the ongoing evolution of a data sharing infrastructure.

This will ensure that data sharing practices and interoperability initiatives are supported, and that organisations are incentivised to develop and implement supplementary functionality.




Sector-wide data sharing mechanism

3

# How to deliver a data sharing infrastructure

# 3.1
# Use cases and user journeys

# Summary of findings from over 100+ engagement sessions

**Main observations emerging from sector wide engagement**

## Meeting common objectives

A consistent theme observed through the stakeholder engagement activities was consensus around the ability of a data sharing infrastructure to effectively enable key policy objectives, such as:

- **Energy equity and affordability:** enabling energy that is affordable to consumers, keeping bills affordable, assisting vulnerable customers and reducing fuel poverty.
- **Energy security**: ensuring the UK is on a path to greater energy independence, ensure reliability of energy resources.
- **Support net zero**: supporting the economy through the net zero transition.
- **Economic security**: supporting growth, innovation and competition.

## Emerging themes

Through the exploration of the use cases and stakeholder engagement activities, several observations and themes have emerged:

- A data sharing infrastructure should be equally a technological and a governance initiative, so that it can respond to the complex challenges around sharing of data.
- A data sharing infrastructure that was confined to the energy sector only would significantly risk the creation of further siloes across sectors and future abortive work.
- A data sharing infrastructure as an ecosystem for data sharing across the energy sector should be as simple as possible. It should avoid creating a barrier to entry for data providers, particularly in the requirement alignment to standards, and for actors with lower digital capability and reporting.

## The value of a data sharing infrastructure

Through stakeholder interviews it was observed that the stakeholders found it difficult to clearly articulate the value of a minimal level data sharing infrastructure in relation to the problems they are trying to solve.

It was observed that stakeholders focused on the end functionality needed to solve a specific problem.

For this reason, it is considered challenging to achieve and understand the proof of the benefit of a data sharing infrastructure if it is measured at a single use case level, or on a use case by use case basis.

The value of a data sharing infrastructure is realised by solving common challenges faced across several use cases.

It is therefore recommended that a holistic approach for benefits is used, which considered whether it is better to solve each possible use case across the energy sector requiring data sharing in isolation or whether it is more effective to enable the missing foundational capability across the sector as a whole.

# Potential use cases and functional requirements

**Stakeholder-led approach to defining use cases, technical and delivery requirements**

## Stakeholder engagement

In total, 15 potential use cases were identified through stakeholder engagement, and market research.

They aimed at finding potential use cases that helped with the definition of a data sharing infrastructure and met the overarching policy objectives.

The 15 initial use cases were prioritised through three steps:

1. Eligibility criteria
2. Stakeholder preferences
3. Assessment against 'additional considerations'

See **Appendix C** of the full report for further details on the use cases, their prioritisation, and the detailed user journeys.

## Day 1 use cases

Five use cases were selected and prioritised for further research. These were divided into two categories:

- **Day 1 use cases** – those use cases for which a data sharing infrastructure could bring immediate value.
  - Use cases: *Vulnerable consumers identification, LAEP & coordination of local decarbonisation planning, and electricity flexibility.*
- **Strategic use cases** – those use cases that provide the future strategic potential of a data sharing infrastructure. Two use cases were identified in this category..
  - Use cases: *Electricity market reforms – nodal pricing, and sector coupling.*

The day 1 use cases were detailed further to understand the clear definition of how they would use a data sharing infrastructure to achieve a particular goal.

Each of these use cases are summarised on the next page.

## Functional requirements

In addition to identifying potential use cases, the stakeholder engagement also highlighted the functional requirements for a data sharing infrastructure.

The functionalities were broken down into three considerations:

- **MVP functionality**: common capability for users to carry out the data exchange across all use cases.
- **Extended functionality**: Potential capability, such as use case specific needs, that could be addressed to ensure better/effective sharing of data
- **Enablers**: Governance and process for users to exchange and access data effectively**.**

The user journey of the nine steps a user takes when interacting with the data sharing infrastructure are summarised on page 15.

**Appendix L** of the full report details worked examples of two use cases interacting with a data sharing infrastructure to outline the differences between the MVP and the extended functionality.

# Prioritised use cases

**Overview of the use cases explored and detailed**

| Type | Use case name | Use case goal | Core functionality | | | |
|---|---|---|---|---|---|---|
| **Day 1** | Vulnerable consumer identification | To provide a holistic and up to date view of vulnerability by facilitating the exchange and connectivity of data related to vulnerable consumers. To ensure this view is accessible for use at the right level of details needed to different parties to take appropriate actions. | Provide up to date access to vulnerability data owned across industries | Connect Vulnerability Information | Drive consistency and standardisation of information of vulnerability data | Streamline and leverage vulnerability self-disclosure |
| **Day 1** | LAEP & coordination of local decarbonisation planning | To use common input data and more granular level data to create better and more aligned decarbonisation plans.<br>To enable easier coordination of local decarbonisation planning and actions. | Drive standardisation and interoperability of planning data used | Connect decarbonisation planning input data | Enable wider planning coordination | Enable wider planning coordination |
| **Day 1** | Electricity flexibility | To improve the timely exchange of information to better understand, use and incentivise the reliance on and provision of flexible assets | Create a Register of Assets | Improve visibility of flexible assets connected to the network | Facilitate sharing of real time operational data | Improve forecasting capability |
| **Strategic** | Electricity market reforms - nodal pricing | To enable the exchange of data needed to test the potential working of a future nodal market structure. | Simulation of system behaviour under new market structure | | | |
| **Strategic** | Sector Coupling | To enable to better forecast the demand for flexibility over time so that it will be possible to define how to integrate different energy system and the role they can play in a whole system operation of the power network | Enable to better forecast the demand for flexibility over time to model integration | | | |

# Describing a data sharing infrastructure through a user journey

**Outline of nine steps a typical user will undertake when interacting with a data sharing infrastructure**

Interacting with the data sharing mechanism can be described through a nine-step user journey, which is based on the user needs identified in **Appendix C** of the full report.

The nine steps are summarised in the adjacent diagram.

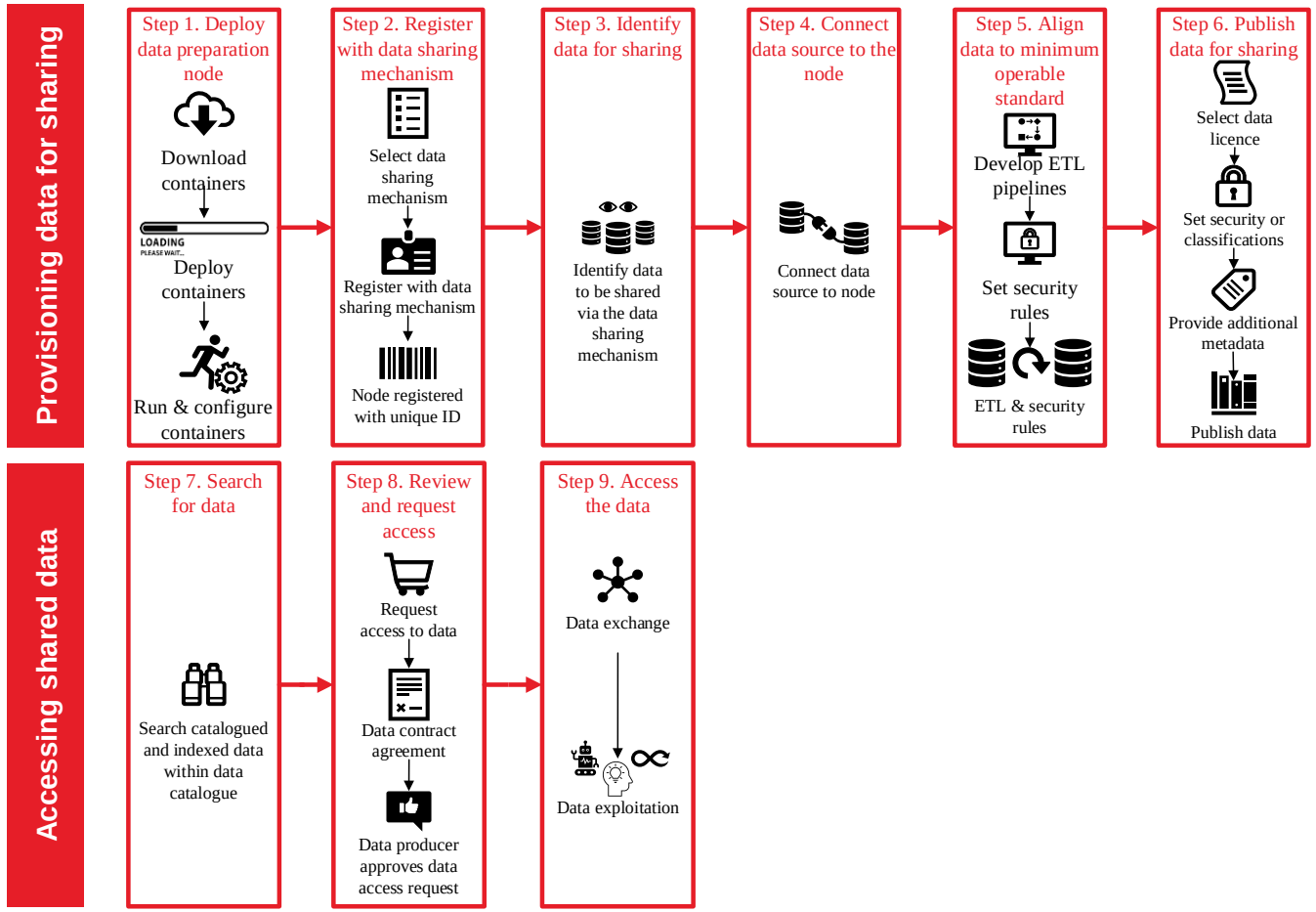
1. **Deploy data preparation node**
2. **Register with data sharing mechanism**
3. **Identify data for sharing**
4. **Connect data source to node**
5. **Align data to minimum operable standard**
6. **Publish data for sharing**

Activities pertaining to provisioning data for sharing. These are the activities an organisation will perform to prepare and publish their data for sharing

7. **Search for data**
8. **Review and request access**
9. **Access the data**

Activities pertaining to a data consumer accessing the data provisioned by a data producer in step 1-6

Detailed descriptions of the steps are in **Appendix G** of the full report.



# 3.2

# Worked example of day 1 use case: Electricity system flexibility

# Worked example of day 1 use case - Electricity system flexibility

**Typical journey of a user as they share data between ESO and DSOs**

## Problem

Current costs of balancing the UK electricity grid are dramatically increasing. Enabling a flexibility mechanism is key to reduce the overall cost to the system. While different flexibility options are available to address variability at different timescales, higher flexibility is now becoming essential particularly as power systems integrate higher shares of renewables.

In order to plan, operate and run effective markets for a more flexible energy system vast amounts of data is needed.

Data availability, granularity and access is a core problem encountered when looking to understand the flexibility capacity available at a given point in time and how to best deploy it (visibility of relevant assets being a key blocker). Lack of data sharing also hinders the effectiveness of forecasting leading to less confidence in procuring flexible assets.

## Vision

To improve the timely exchange of information to better understand, use and incentivise the reliance on and provision of flexible assets.

## User journey overview

To improve the timely exchange of information to better understand, use and incentivise the reliance on and provision of flexible assets.

Phase one of this journey is to understand the amount of flexibility requirement via a supply vs demand forecasting. Phase two is engaging the market to procure the required flexibility to balance the system.

This use case journey focuses only on the phase 1 of the journey between DSOs & ESO to forecast balancing requirements.

**Personas:**

- **Data producer**: Joseph, Network Analyst, DSO
- **Data consumer**: Neha, Network Analyst, ESO

## Assumptions

Based on user research and stakeholder engagements, it is assumed that phase one of the journey will promote data sharing between organisations, which will improve the effectiveness of forecasting and lead to more confidence in procuring flexible assets.

It is also assumed data granularity, availability and access will be improved by the implementation of phase one and will increase the understanding of flexibility capacity at a given point in time and how to best deploy it.

# User journey - operational data publishing

**User journey for a network analyst forecasting balancing requirements**

**Joseph**
**DSO, network analyst**

*'I want to better operate my network based on ESO's forecasted balancing requirements.'*

### Organisations

**DSO** – Will adapt distribution based on forecasted balancing requirements

**ESO** – Will publish forecasted balancing requirements.

**FSP** – Will adapt distribution based on forecasted balancing requirements

### Dependencies

- Ontologies that support data standardisation
- Legal arrangements between the market actors
- Verifiable identity through the trust framework
- Resilient and scalable system to support the high volume of data transfers

Sequence of activities

| | User journey | Key considerations | Component interaction |
|---|---|---|---|
| **Deploy cross-sector data preparation node** | Other actors in Joseph's organisation (IT colleagues) look to deploy cross sector data preparation node and set relevant data pipelines. | IT skills of organisations allow for them to set up the node | • Blueprint<br>• Datastore |
| **Register** | Joseph checks if their organisation is registered as a data provider. If it isn't the case, other actors in the organisation (IT colleagues) will register them. | Standardisation of registration requirements, and of unique identifiers for asset identify | • Management node<br>• System governance<br>• Trust framework<br>• Security services |
| **Identify data for sharing** | Joseph identify what data their organisation own that needs to be made available to ESOs due to current data sharing agreement. | | |
| **Connect data source to the node** | No action required as the IT team has preconfigured the data source to the node | | • Trust framework<br>• Security services<br>• Untransformed data |
| **Align data to minimum operable standards** | Joseph monitor that IT colleagues receive the support needed to transform some of the datasets into the right standards and ensure metadata is provided consistently. | Provide a consistent way to access associated asset information. | • ETL<br>• Datastore<br>• Security controls |
| **Publishing the data for sharing** | Joseph review that access permission sets follow what has been agreed for a specific datasets, and publish the data for sharing | Legal teams to review and set up any data sharing agreements needed to support the sharing of information. | • Schema assurance<br>• Data catalogue<br>• Trust framework<br>• Security services |

# User journey - operational data consumption

**User journey for a network analyst forecasting balancing requirements**

**Neha**
**ESO, network analyst**

*'I want to access DSOs' data to better forecast balancing requirements.'*

### Organisations

**DSO** – Will require access to forecasted balancing requirements from ESO.

**ESO** – Will require access to demand data from DSOs and FSP.

**FSP** – Will require access to forecasted balancing requirements from ESO.

### Dependencies

- Ontologies that support data standardisation
- Legal arrangements between the market actors
- Verifiable identity through the trust framework
- Resilient and scalable system to support the high volume of data transfers

Sequence of activities

| | User journey | Key considerations | Component interaction |
|---|---|---|---|
| **Search for data** | Neha log in a search page. They use the search function to look for data for record on past deployment of demand flexibility services and DER over the last 4 quarters. | Provide a view of the registered asset and available data | • System governance<br>• Data catalogue<br>• Security systems |
| **Request and review access to data** | Neha identify they can request a certain view of substation demand level data for a series of DSO across the country for their research purpose thanks to sharing agreement between ESO and DSO. | Enable exchange of aggregated or anonymised view of dynamic data sources | • Management node<br>• System governance<br>• Data catalogue<br>• Security systems<br>• Trust framework |
| **Access the data** | Neha access the dispatch data, granular demand data for certain area of the country. | Enable sharing of real time operational data (e.g., asset status data) at required time intervals and granularity | • API/brokering<br>• Datastore<br>• Exploit data<br>• System governance<br>• Security services |

# 3.3 — Technical components of a data sharing infrastructure

# Technical requirements of a data sharing infrastructure

**The technical requirements and functionality of the data sharing infrastructure and the minimum viable product (MVP)**

A data sharing infrastructure is an approach to enable data sharing across a sector amongst several organisations or participants.

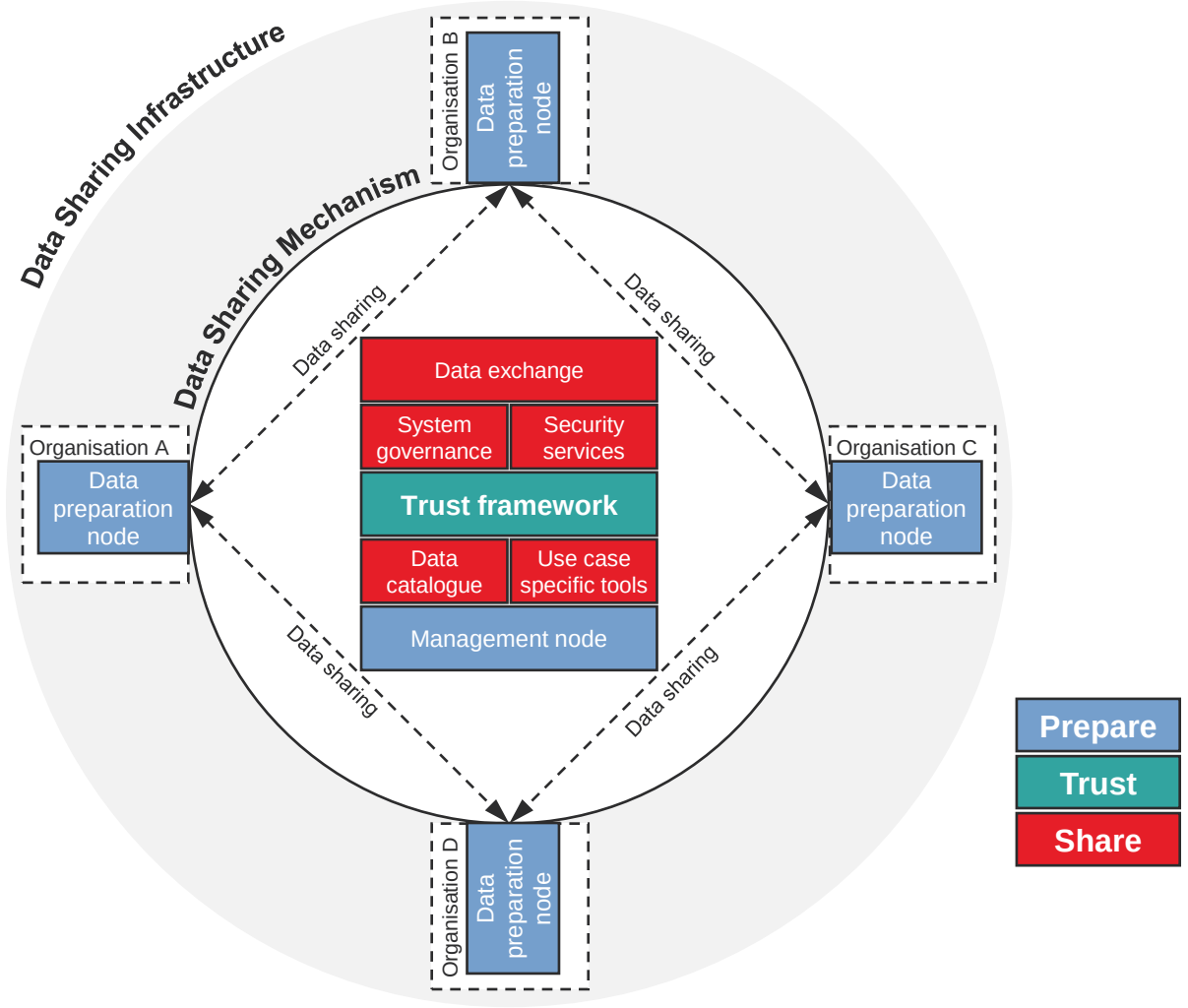
It consists of three components:

- **Prepare** - A cross-sector data preparation node
- **Trust** - A sector-wide trust framework
- **Share** - A sector-wide data sharing mechanism

To enable the secure, interoperable and effective sharing of data, these three components need to deliver a variety of functionalities and services.

The constituent functionalities and services are summarised on the following pages, alongside a technical user journey to describe a user's interaction with a data sharing infrastructure.

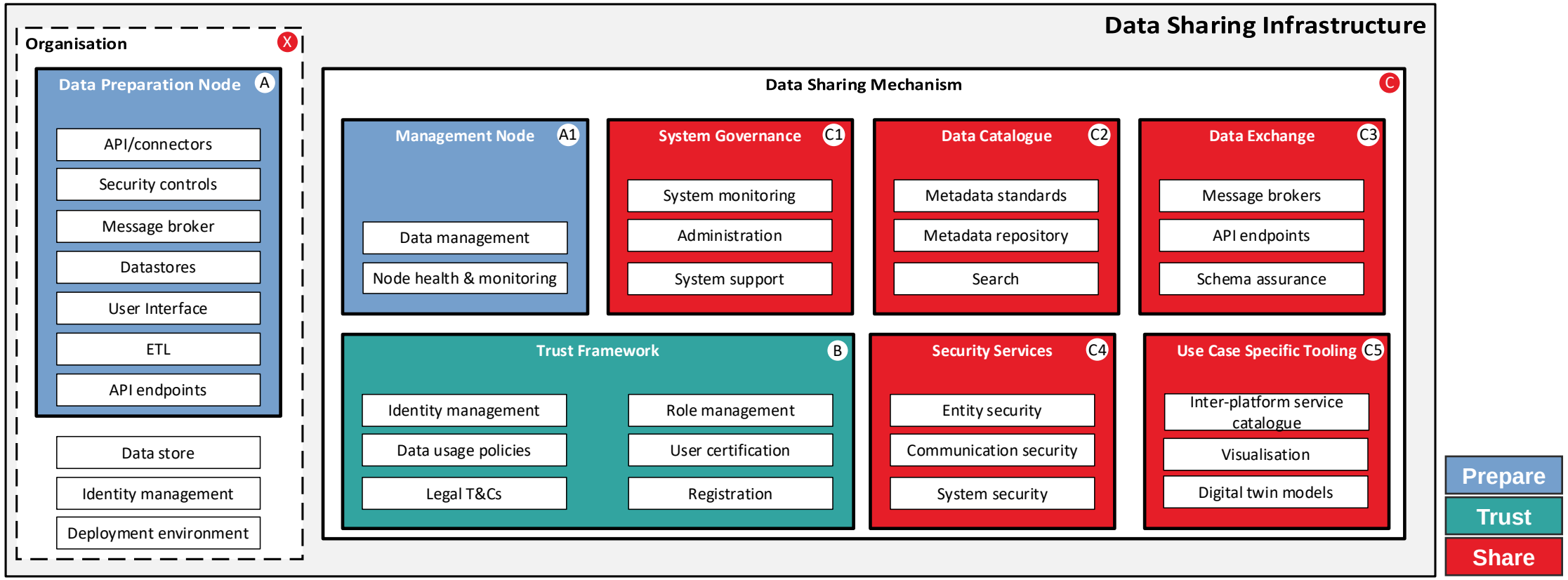
Further details on the technical requirements are given in **Appendix G** of the full report.



# Functional components of a data sharing infrastructure

**Diagram of the functional components of a data sharing infrastructure**

A data sharing infrastructure consists of several functional components. Each of these components are detailed on the next page using the numbers in the diagram below.



# Functional components of a data sharing infrastructure

**Description of the functional components of a data sharing infrastructure**

The following functional component descriptions correspond with the numbers on the diagram on the previous page. Further details on the technical requirements of the data sharing infrastructure are given in **Appendix G** of the full report.

**X. Organisation**: Organisations deploying a node will require a deployment environment (cloud, on-premise, hybrid) to deploy the node.

Their datastores will need to connect to the node for the transformation and publishing of data, and they will need identity management services for internal security authentication and authorisation for their users.

**A. Data preparation node**: The containerised application node with a set of components to enable the standardisation and publishing of data.

A high-level design is provided in **Appendix G** of the full report.

**A1. Management node:** Performs health & monitoring for data preparation nodes across a data sharing infrastructure and performs data management e.g., reference data management.

**B. Trust framework**: Provides the technology and legal functions to ensure assurance and compliance when exchanging data between nodes and actors.

This includes the technology elements such as identify management, role management, registration portal, and the legal elements such as data usage policies, legal conditions, and certifications.

**C. Data sharing mechanism:** provides a range of security, governance, cataloguing and data exchange services to enable sharing of data between nodes.

**C1. System governance**: Governance of the data sharing mechanism including administration, monitoring of data and system use, and system support.

**C2. Data catalogue**: Provides the metadata repository to host metadata in required standards to enable search by organisations.

**C3. Data exchange**: Provides the tools to facilitate the transmission of data between nodes. This includes API endpoints and message brokers i.e., data streaming and publish-subscribe sharing.

Schema assurance is also used to validate and check for schema conformity when data is published and consumed across the nodes.

**C4. Security services**: Security controls and techniques to facilitate the secure sharing of data across nodes. This includes entity security, communication security and system security.

**C5. Use case specific tooling:** tools and applications offered by the data sharing mechanism to deliver specific use-cases e.g. digital twin models marketplace to share digital twin models, and visualisation and analytical tools.

# 3.4
—
# Enabling a cross-sector data sharing ecosystem

# Blueprints: enabling a cross-sector data sharing ecosystem

**How a data sharing infrastructure can enable a cross-sector data sharing ecosystem**

## Approach

The development of data sharing infrastructure within the energy sector can be done in two complementary ways to enable a cross-sector infrastructure:

- **Blueprints:** The template or design pattern of the data sharing infrastructure components. These would include the architectural diagrams, specifications, processes, and standards that need to be adhered to for anyone to build any of the components of the data sharing infrastructure in a compliant way that is interoperable with other instances of the blueprints.
- **Development of components:** The technical implementation of those blueprints through the creation of components. It can represent demonstrating the technology readiness level of a data sharing infrastructure, provide the market with an 'early adopter' of the solution and in the long run represent the implementation of an ecosystem of interoperable components underpinned by the blueprints.

Setting the data sharing infrastructure up in this way ensures successful development of an energy sector data sharing ecosystem that can knowledge disseminate with future cross-sector data sharing ecosystems.

## Blueprints

Blueprints for a data sharing infrastructure will be broken down into its functional parts.

It is considered that, at a minimum, the blueprints will comprise of the data preparation node (prepare), trust framework (trust), and data sharing mechanism (share).

This feasibility study identified functional requirements for the data sharing infrastructure.

Whilst the functional requirements identified were underpinned by energy sector use cases and user requirements, they were developed with the intention of being sufficiently generalisable that they could be adopted by any sector looking to develop a data sharing infrastructure.

This was done with the intention of supporting cross sector collaboration, interoperability of data sharing, and delivery of maximum value from the effort expended.

## Development of components

Developing the components provides the implementation for a data sharing infrastructure by delivering the functional capabilities outlined in the blueprints. This represents the development of capability to build a data sharing infrastructure around a chosen use case, such as electricity flexibility, that can demonstrate usefulness for the sector.

The components could be developed as part of the organisation which is also delivering the blueprints. These components can then be iterated and validated against the design specification for a specific use case.

The development and implementation of the components may be different for each one; for example, the data preparation nodes will have an open-source delivery, but other components such as the trust framework may not.

The aim is to develop the components by using the blueprints. This will create the required capability for adoption. Coupled with this is the aim to accelerate the technology readiness level of the capability across the sector, and in the future, across other sectors.

# Cross-sector data sharing ecosystem

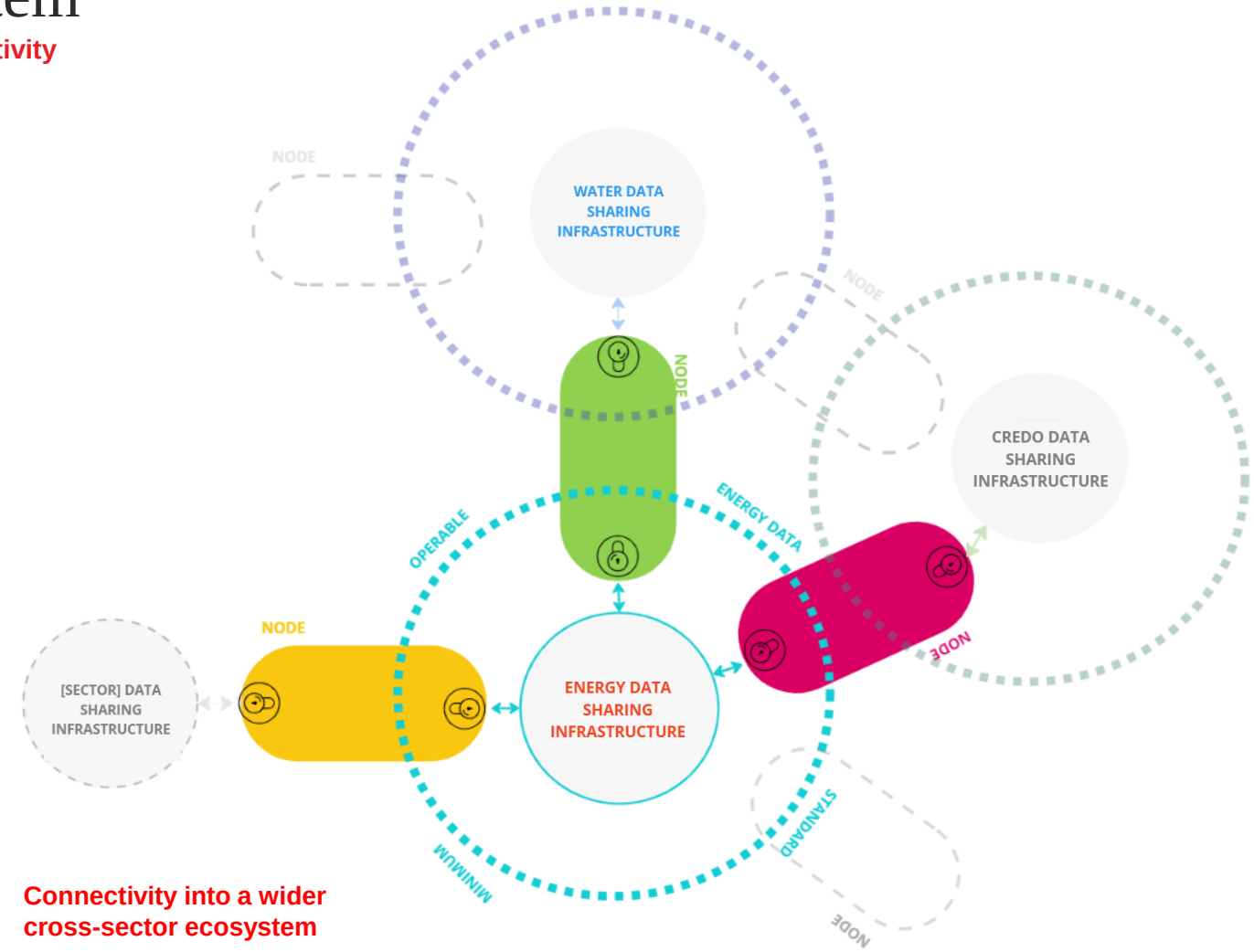
**A data sharing infrastructure could facilitate cross-sector connectivity**

As the data sharing infrastructure blueprints are developed and validated, the energy system data sharing infrastructure can grow to be part of a wider connectivity ecosystem spanning across multiple sectors (such as water) or other connected digital twin ecosystems (such as CReDo).

Its distributed implementation across each organisations enables the consistent cross-sector data preparation node to connect and share data through multiple data sharing mechanisms, enabling a wider system-of-system connectivity.

To achieve this, the blueprint of the **cross-sector data preparation node** should be managed and maintained by an appropriate national-level entity, and then consistently used by each sector to provide the blueprint of their sector-specific implementation.

This blueprint approach provides flexibility to accommodate sector-specific needs and requirements, on top of a common architecture design.




**Connectivity into a wider cross-sector ecosystem**

# 3.5
# Governance of a data sharing infrastructure

# Governance of a data sharing infrastructure

**Characteristics of the overall approach for data sharing infrastructure governance routes**

## Overview

Governance of a data sharing infrastructure needs to clearly define the overarching outcomes it wants to achieve by setting itself a specific remit and set of functions.

For a data sharing infrastructure to enable the exchange of energy data in a secure and interoperable manner through the provision of a minimum layer of digital infrastructure, it is considered that the best suited structure is one that brings:

- **Transparency and openness** – brings visibility to its operation to enable trust and adoption across different market's participants.
- **Accountability** – provides clear definition of responsibilities and party responsible for each governance function and avoid conflicts of interest.
- **Legitimacy** – assures the endorsement of a data sharing infrastructure as a sector wide common digital infrastructure.
- **Responsiveness** – enables adaptation to future challenges, opportunities and stakeholder needs.

Further details are given in **Appendix I** of the full report.

## Governance models

Several potential governance models were identified, and then evaluated and tested with cross-sector stakeholders.

Models were developed for the implementation and steady-state operation phases of a data sharing infrastructure, as it is considered that separate governance approaches are required for the two lifecycle phases because of their distinct requirements.

These lifecycle stages are outlined over three distinct time horizons, representing the necessary time required to establish capabilities and potentially enact primary legislation to create new sector wide entities:

- **Implementation (2024-2026)**
- **Interim-state (2026-2030)**
- **Steady-state (2030+)**

The implementation (2024-2026) time horizon is summarised on the next page

The interim-state (2026-2030) and steady-state (2030+) time horizons are detailed in **Appendix I** of the full report.

## Summary of implementation (2024-2026) governance

- Through the delivery of an implementation phase, a ***Data Sharing Infrastructure Task Group*** would be established. This would have the appropriate secretariat, terms of reference and funding mechanisms to develop the data sharing infrastructure blueprints, and technical MVP.
- During this period, the relevant roles and responsibilities of the ***Data Sharing Infrastructure Task Group*** can be handed over to the ***Energy Data Sharing Infrastructure Operator*** as and when that entity becomes technically capable to take on the responsibility.
- Concurrently Ofgem could, through the RIIO3 process, update the digitalisation licence condition (9.5) to compel licensees to engage with the data sharing infrastructure and create guidance around the use of the blueprints to develop capability (as done with Data Best Practice).

  This amendment to the licence condition could have a date from when it applies to align with ED3 licence conditions, so all networks have the same amount of time to be 'ready' for the requirements.

# Implementation phase governance (time horizon: 2024-2026)

**Governance of a data sharing infrastructure during implementation**

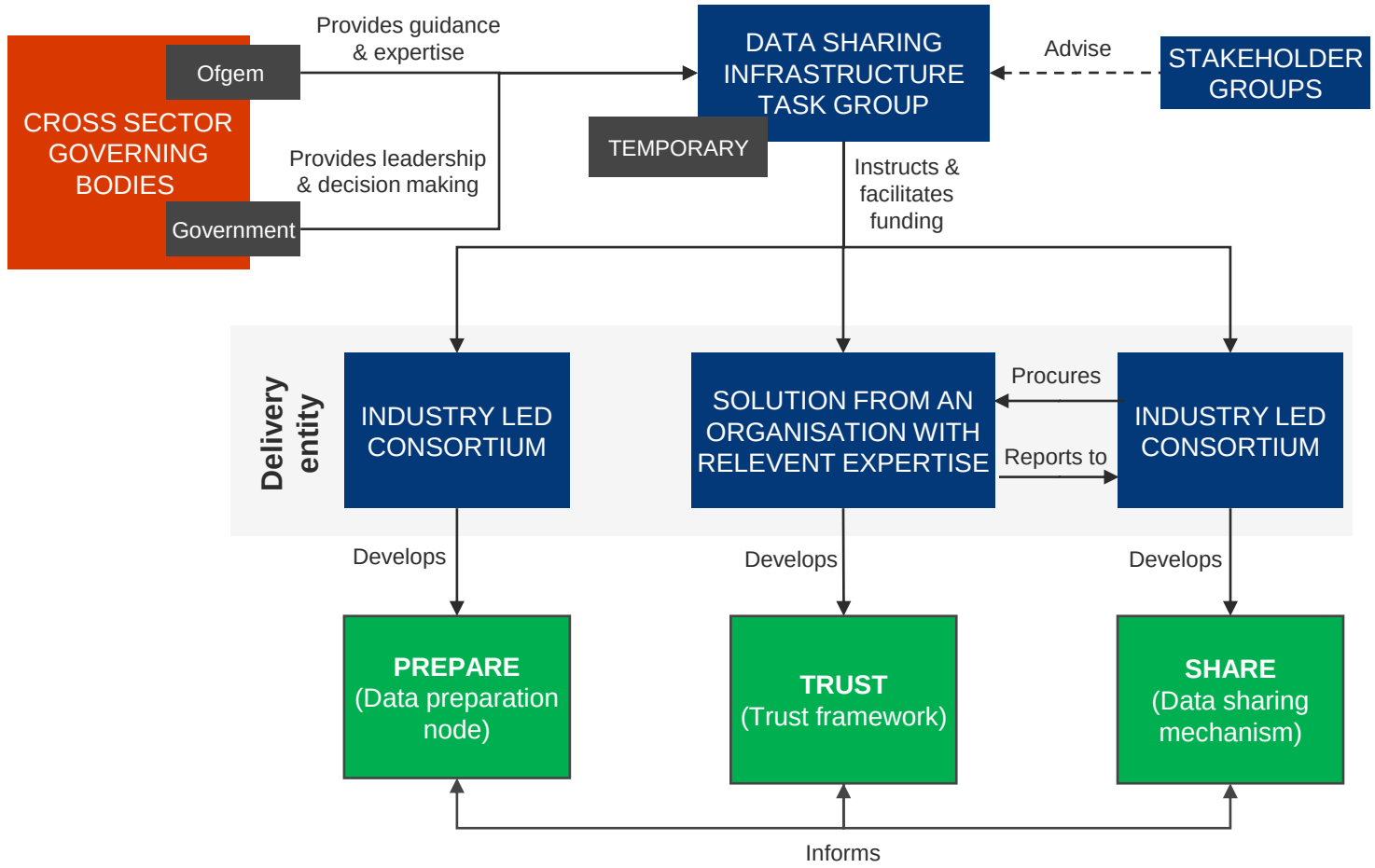
The diagram outlines the proposed governance of a data sharing infrastructure during the implementation phase.

The proposed approach is for a co-development of both the data preparation nodes and data sharing mechanism, and the direct procurement of a trust framework solution from an organisation with relevant experience.

This approach enables government and industry to select and deliver a high priority use case, either taken from those detailed in the use cases, or elsewhere. The governance shows two possible consortiums, one focussing on the development of a data preparation node, and the other on the development of the data sharing mechanism.

During implementation it is recommended that there is a ***Data Sharing Infrastructure Task Group*** established with the specific remit to fund and accelerate the development of the data sharing infrastructure on behalf of the energy sector.

This should be in support of the objectives of the National Digital Twin Programme, and to drive adoption.



# 3.6

# Pathways and routes to enabling a data sharing infrastructure

# Alignment with other data sharing infrastructure initiatives

**High-level review of existing digitalisation initiatives and their interaction with an energy system data sharing infrastructure**

## Complementary initiatives

A review of the existing energy sector and cross-sector digitalisation initiatives highlighted the close alignment to, and agreement with, the objectives of establishing an energy system data sharing infrastructure.

These initiatives including the following:

- Energy networks data sharing portals
- Ofgem's future of distributed flexibility
- OneNet
- CReDo (Climate Resilience Demonstrator, DT Hub)
- Market Wide Half Hourly settlement programme
- Smart Meter Data Repository
- Smart Meter Internet of Things
- Energy Data Visibility Project

It was concluded that four of the existing energy sector and cross-sector initiatives have very close alignment with the functional requirements of the proposed data sharing infrastructure. These are summarised in the adjacent boxes.

### National Digital Twin Programme (NDTP)

NDTP is directly run by the UK Government, in collaboration with industry and academia. Telicent were commissioned to deliver the technology aspects of the Isle of Wight demonstrator using their 'CORE' platform.

One feature of CORE is an open-source tool on an organisations own IT infrastructure to ingest raw data, cleanse and transform it to a specific standard. This is functionally like the data preparation node.

### Virtual Energy System

The Virtual Energy System aims to enable the creation of an ecosystem of connected digital twins of the entire energy system of Great Britain. This has functionality like a data sharing mechanism and has many common high-level components.

A data preparation node would provide the sector with the correct tooling to enable preparation and standardisation of data, which could then be shared through the Virtual Energy System.

### Open Energy

Open Energy provides a data catalogue, trust framework, and governance model to facilitate secure data sharing and access controls through a 'broker' model.

Open Energy could allow organisations to register their identities and connect to a data preparation node through the Open Energy Trust Framework, where specific actors may already have the correct permissions to enable them to consume data from a data owner's data preparation node.

### Automatic Asset Registration

The automatic asset registration programme (AAR), is a NZIP-funded feasibility study, aiming to support the development of an automated secure data exchange process for registering small-scale energy assets and collecting and accessing their data.

The data intended to be captured and sharable through AAR is of high value to the flexibility use case. The AAR would be a key data provider in an energy sector data sharing infrastructure

# Delivery pathways of a data sharing infrastructure

**An overview of the high-level delivery assessment undertaken to determine the recommended delivery routes**

*A pathway is defined as a selection of options for the implementation and steady-state phases for all three aspects of the data sharing infrastructure.*

Through stakeholder engagement, and subsequent prioritisation, four delivery options were identified for the implementation phase and five delivery options were identified for the steady-state operation phase. These delivery options are summarised to the right, with descriptions for each given in **Appendix H** of the full report.

Each of the functional components were evaluated against these potential delivery options, using various socio-technical criteria, to determine which pathways are most likely to be successful.

There are potentially many different pathways to deliver a data sharing infrastructure, each with its own benefits, disbenefits, and considerations. The consortium selected a set of plausible of candidate pathways for further analysis.

Additional work is required to assess the viability of a pathway and select a delivery route that aligns with sector policy requirements. Potential delivery routes, considering delivery pathways, and governance is outlined over the subsequent pages.

## Implementation phase

The delivery lifecycle encompasses the series of stages and processes involved in bringing the functional components from conception to implementation.

It typically begins with requirements gathering and analysis, followed by design and development, testing and quality assurance, and deployment.

The identified delivery routes include:

- **Option 1A:** Independently-led industry consortium
- **Option 1B:** Publicly-led development
- **Option 1C:** Technology provider builds it
- **Option 1D:** Directly procure an existing solution and/or services from an organisation with relevant experience

## Steady-state operation phase

Once the functional components has been deployed and all major development and implementation activities are completed, it enters the steady-state.

During this phase, the focus shifts from active development to maintenance and support activities to ensure the functional component operates smoothly, meets performance expectations, and remains reliable for its users. This phase involves activities such as monitoring, bug fixing, performance optimisation, security updates, and user support.

The identified delivery routes include:

- **Option 2A:** Solution given to an energy sector strategic entity
- **Option 2B:** Solution given to a national-level strategic entity
- **Option 2C:** Solution given to an energy sector operational entity
- **Option 2D:** Create a commercial agreement to support operation, maintenance, and further development of the solution
- **Option 2E:** Solution owned and operated by a private entity

# Highest scoring implementation pathway for each functional component

**A delivery pathway for the implementation of a data sharing infrastructure**

## Prepare: Data preparation node

An **independently-led industry consortium** (**Option 1A**) is the highest scoring option.

### Justification

An independently-led industry consortium has the benefit of selecting partners who are likely to share knowledge and bring their own skillsets to offset any gaps.

This option scored highly for the right skillset, social value (due to their ability to distribute learnings), adoption (by ensuring high stakeholder engagement to capture industry views), and mitigating monopoly risk (through their ability to design and set up tools to prevent vendor lock-in).

See **Appendix H.2.1** of the full report.

## Trust: Trust framework

An entity responsible for the data sharing mechanism **directly procures an existing solution** and/or services from an organisation with relevant experience (**Option 1D**) is the highest scoring option.

### Justification

This option scored highest in terms of timeline, cost, skillset, and governance because of the organisation's ability to leverage previous similar projects in the energy sector.

An existing framework will provide a common ground for stakeholder engagement to ensure high adoption for feature development, and high alignment for outlining the trust and assurance guidelines.

See **Appendix H.2.3** of the full report.

## Share: Data sharing mechanism

An **independently-led industry consortium** (**Option 1A**) is the highest scoring option.

### Justification

An independently-led industry consortium has the benefit of selecting partners who are likely to share knowledge and bring their own skillsets to offset any gaps.

The consortium can be flexible to adopt to changing regulatory landscape and government requirements; therefore, has scored highest when assessed against all four options.

However, a key risk associated with this option is the longer time required for the consortium to reach agreements for collaborative work, mitigating monopoly risks, and ensuring the incorporation of industry views.

See **Appendix H.2.2** of the full report.

# Highest scoring steady-state pathway for each functional component

**A delivery pathway for the steady-state operation of a data sharing infrastructure**

## Prepare: Data preparation node

**Solution given to a national-level strategic entity** (**Option 2B**), such as the NDTP, to be responsible for the blueprints for its cross-sector remit.

### Justification

The 'prepare' node has a cross-sector adoption requirement, Therefore a national entity is necessary for proper governance because of its ability to access relevant stakeholders and ensure broader cross-sector adoption. A sector-specific will not have the responsibility or mandate to engage other sectors; whereby, a national entity can have said responsibility.

See **Appendix H.3.1** of the full report.

## Trust: Trust framework

**Solution given to existing energy sector strategic entity** (**Option 2A**) because the trust framework is a specialised functional component which requires extensive sector-specific engagement.

### Justification

This option is assumed to be closely linked to the 'share' component; therefore, long-term operations should also align with the entity operating the data-sharing mechanism.

This component will not rely on vendor-specific technology, making it easier for the sector entity to manage long-term operations and maintenance.

See **Appendix H.3.3** of the full report.

## Share: Data sharing mechanism

**Solution given to existing energy sector strategic entity** (**Option 2A**).

### Justification

A sector-level organisation is necessary due to sector-specific needs and requirements. This includes sector-specific ontologies, CNI security, and use case specific tooling.

This component will require high stakeholder engagement for BAU activities to ensure high adoption across the sector.

Ensuring high adoption is a key need to realise major benefits the data sharing infrastructure can enable.

See **Appendix H.3.2** of the full report.

# Other considerations for evaluating potential pathways

## A delivery pathway for the data sharing infrastructure

### Overview

In addition to the proposed delivery pathway there are additional delivery reflections to be considered.

A decision on these will inform the requirements for procurement and underpin the implementation and steady-state operating model and future success of the data preparation node.

These reflections are:

- **Build or Buy:** The design and delivery of the data standardisation infrastructure from first principals or the use and customisation of existing solutions to act as the foundations.
- **Public or Private:** The provision of ownership of the data preparation node to a public or private organisation.
- **Open or Proprietary:** The data preparation node could either be open source and freely available in design or proprietary such that it is owned by one organisation only.

### Cost considerations

The cost ranges for the various functional components of a data sharing infrastructure are considered a class 5 estimate, with uncertainty range of +100% or -50%.

The cost ranges summarised are derived from and correlate with open data available from previous government-funded projects, and the consortium's experience from previous completed similar digital projects.

Therefore, the costs range contains uncertainty, and are a value judgement that is subject to change as new information becomes available. Further details assessments are needed to reach a class 1 or 2 estimate.

Such historical prices provide an initial estimate, but further detailed cost estimate are dependent on the following requirements:

- Delivery pathways
- Detailed outline of the MVP technology
- Scale of implementation
- Use cases

The MVP implementation of the **data preparation node**, encompassing the, sharing, or transformation of data, is expected to be **£1m-£3m**, depending on the complexity of design, procurement pathway, and future improvements. While the potential steady state costs can cost **£2m-£4m per year**.

The MVP implementation of the **trust framework**, to ensure security, and compliance, is anticipated to cost **£2m-£6m**, reflecting the complexity of enabling scalable, and codifying the various legal terms and conditions, identity management, and security controls. While the **steady-state costs** would be **minimum £2m per year.**

The MVP implementation of **data sharing mechanism**, the engine that facilitates seamless data sharing, is estimated to be **£10m-£20m**. While the **steady-state costs** would be **minimum £18m per year.**

Therefore, the overall investment for implementing an MVP of an energy sector data sharing infrastructure is projected to be **£13m-£29m.** While the **steady-state costs** would be **minimum £22m per year.**

These costs do not account the income generated from licensing, exporting technology, and other enabling innovation.

# Routes to enable a data sharing infrastructure

**Summary of routes available to the government for intervention**

*A route is defined as a selection of a pathway, a governance structure, and a review of existing related programmes nationally and in-sector.*

Establishing a data sharing infrastructure involves evaluating a spectrum of routes, each offering advantages and potential challenges. These routes are designed to address diverse sector and policy needs.

Importantly, they are not fixed choices. Government or sector can transition between these routes, although the costs of switching varies.

Deciding on the most suitable route involves a nuanced evaluation of factors like adoption, vendor lock-ins, scalability, integration complexity, and the potential switching costs associated with each route and when a switch takes place.

While there are many pathways for the delivery and governance of the data sharing infrastructure, the six options summarised in the adjacent box and detailed on the subsequent page were considered to account for the and represent the majority of the pathways.

## Two categories of possible routes

There are two categories of possible routes, each with three options:

1. **National and sector specific programme alignment driven by government**

   These routes focus on the delivery of the enabling infrastructure through a collaboration of national and sector programmes, enabling effective cross-sectoral knowledge dissemination, optimal use of government funds, and reduces the risk of duplication.

   These routes are focused on aligning existing initiatives.

2. **Sector specific procurement of relevant capabilities required to deliver a data sharing infrastructure MVP**

   These routes focus on the delivery of the enabling infrastructure through a sector-specific lens, enabling greater oversight by the sector entities, and industry partners.

   These routes are focused on selecting one of the pathways while evaluating the need to aligning existing initiatives.

**Route 1 - National and sector specific programme alignment driven by government**

- **Route 1A:** Government encourages alignment of on-going programmes
- **Route 1B:** Government assigns staff to ensure alignment of on-going programmes
- **Route 1C:** Government assigns staff to NDTP and assembles a “tiger-team” to roadmap the enablement of a mandated task group

**Route 2 - Sector specific procurement of relevant capabilities required to deliver an MVP**

- **Route 2A:** Government funded innovation of a data sharing infrastructure
- **Route 2B:** Government mandates a sector strategic entity to deliver a data sharing infrastructure
- **Route 2C:** Government assembles a “tiger team” to roadmap enablement of a mandated task group to oversee delivery of a data sharing infrastructure

# Potential funding mechanisms

**Summary of potential funding mechanisms available to the government for the development of a data sharing infrastructure**

There are several funding mechanisms that are available for the government to use to develop an MVP of a data sharing infrastructure.

These routes could include:

1. Innovation funded
2. Treasury funded
3. Price control re-opener funded
4. Industry funded (non-regulated entities)

Routes 1 and 2 are ultimately derived from government funding. Routes 3 and 4 are is borne by consumers and industry respectively.

Route 4 requires further sector engagement to understand the industry's willingness to fund or invest in the development of a data sharing infrastructure.

### Innovation funded (e.g., NZIP/SIF/NIA)

Innovation funding could be used to develop an MVP. Each fund has specific eligibility criteria, and varying timescales, oversight/governance requirements, and expectations.

Using innovation funding could result in the sector considering a data sharing infrastructure as “innovation”, rather than a key sector enabler.

### Industry funded (non-regulated entities)

Government and Ofgem could engage with industry partners to find a way of funding the development of a data sharing infrastructure as part of an organisation’s development or capital expenditure.

While this route reduces cost to the government, it also reduces the ability to provide coordination and oversight to the development of a data sharing infrastructure.

### Price control re-opener funded

'Reopeners exist to respond to changing needs of the energy system. If DESNZ and Ofgem collectively decide there is a new need and publish a policy decision stating as such, then a re-opener window could be triggered to provide funding to action this policy decision.

This mechanism likely presents the fastest route of funding that maintains government oversight and control.

### Treasury funded

Using the evidence of the feasibility study, government could develop a business case for the development of the MVP of a data sharing infrastructure.

This business case would be complimented by wider government priorities for net zero, data and digitalisation. It would also provide a sector specific implementation of the NDTP integration architecture.

This route is least certain of those highlighted and is likely the slower options to release funding.

# 4
# Next steps

# 4.1
# Need for government intervention

# Opportunity for government intervention

**Overview of the opportunity for government intervention and considerations required to assess its viability**

## Overview

The delivery of the resulting solution will require a combination of governmental, industrial, trade bodies, and academic collaborations.

While a collaborative approach emphasises participatory decision-making, co-creation, and collective ownership of the infrastructure, enabling diverse perspectives, innovation, and agility in implementation, it often involves establishing multi-stakeholder committees, or working groups to ensure effective coordination and representation of all stakeholders, which can be challenging for any one stakeholder to undertake.

Therefore, an initial push or encouragement from Government is required to align the dispersed actors.

It is currently considered that government involvement will be crucial, due to government's ability to prioritise public interest, to provide security and trust, to drive standardisation and interoperability, and to ensure long-term stability.

By taking a proactive role, government can support and fast track the creation of a robust data sharing infrastructure.

## Sector engagement feedback

Through the stakeholder engagements, two common themes have emerged of which one was a clear need for central intervention:

- **Scope boundaries:** The stakeholders engaged repeatedly asked about the extent of what should be in and out of scope indicating needing a common, centralised view of the solution.
- **Need for central intervention:** Most stakeholders stated a clear need of central intervention and direction in ensuring that a future data sharing infrastructure construct can become a sector wide tool/service and achieve the market cohesion and coordination needed to decarbonise the sector.

  Some stakeholders stated a clear need for a regulatory mandate of a data sharing infrastructure, or some parts of it. All stakeholders raised the need of clear policy intervention to ensure a data sharing infrastructure adoption and oversight.

## Avoiding duplication across industry programmes

Another consideration for government is the ineffective use of resources allocated to define, develop, and operate a data sharing infrastructure.

When multiple programmes, such as NDTP, VirtualES, or Open Energy, receive funding from government without coordination it can lead to inefficient resource utilisation, competition for market adoption, conflicting objectives, and potentially lack of interoperability.

Therefore, this duplication can hinder progress, limiting adoption and the potential benefits of these programmes.

To mitigate risks from duplication of activities across programmes government should ensure coordination, collaboration, and careful resource allocation to optimise and maximise the impact of the publicly funded initiatives.

# Challenges government intervention could address

**Overview of the opportunity for government intervention and challenges it could address**

## Overview

Government intervention has the opportunity to support enacting the changes required to the existing system to address critical challenges associated with data sharing in the energy industry.

Addressing these challenges is critical to ensuring the development of a resilient, net zero energy system. This includes mitigating risks of market failure posed by the current digital and data systems. More details on market failure mechanisms can be found in **Appendix M** of the full report.

At a minimum, it is considered that government intervention could address the following challenges to support trusted, interoperable data sharing across the industry:

- Insufficient data interoperability
- Lack of common data sharing practices
- Lack of open-source foundations
- Lack of flexible and scalable digital infrastructure
- Data monopolies
- Lack of skills and capabilities

### Insufficient data interoperability

Tackle insufficient data interoperability by facilitating establishment of standards, mechanisms, or enacting policy or regulatory changes.

### Lack of common data sharing practices

Tackle the lack of common data sharing practices by establishing best practices, encouraging collaboration and partnerships, and creating regulatory frameworks to determine minimum requirements for sharing data, security and privacy.

### Lack of open-source foundations

Tackle the lack of open-source foundations through instigating the development of open-source tools and owning the definition of requirements to do so.

### Lack of flexible and scalable digital infrastructure

Tackle the lack of flexible and scalable digital infrastructure by instigating a sector-wide governance framework and developing open-source tools to support the smaller players in the sector.

### Data monopolies

Tackle impact of data monopolies controlling markets and creating barriers to entry and innovation through enacting regulatory requirements and enabling safe secure sharing of data through supporting development of required infrastructure.

### Lack of skills and capabilities

Tackle the lack of skills and capabilities which are required as the sector continues the transition to being increasingly digitally enabled by engaging with, supporting and funding the academic community and other skills development programmes.

# 4.2
# Proposed next steps

# Emerging recommendation themes

**Themes of recommendations identified through the feasibility study**

Through the delivery of this feasibility study and the stakeholder engagement activities, several recommendation themes have emerged. These can be summarised in three categories, and directly translate to the recommendations detailed on the next page.

- Government to provide clarity to the sector
- Develop the technical capability
- Facilitate appropriate governance

## Government to providing clarity to the sector

To make use of the momentum gathered through this feasibility study, there are opportunities and no regrets actions that can be taken by government that will provide clarity to the sector on the direction of travel for the development of a data sharing infrastructure.

With existing initiatives already establishing and developing technical capabilities in this space, it is important for government to provide clarity on what it hopes to achieve. Providing a statement of what government's plans are, noting sequencing, rough timetable and expectations for engagement, would give the wider energy sector an opportunity to engage with the development. It would also establish where effort is, and is not, worth making for a wide range of market participants.

## Developing the technical solution

In order to test the concept of the data sharing infrastructure government should take forward a minimum viable product (MVP) to test the technical implementation.

This should consist of taking forward the technical architecture, which has identified strong alignment with the National Digital Twin Programme (NDTP).

This, alongside existing industry initiatives, provides a large opportunity to coordinate existing work and further government areas of focus set out in the Digitalisation Strategy 2021.

## Facilitating appropriate governance

The implementation of a data sharing infrastructure requires appropriate governance. In order to set that up the boundaries of what is expected of that governance regime should be tested and developed.

The creation of a task group, seeking to develop an appropriate governance mechanism for a data sharing infrastructure within the energy sector should be a priority of government when developing the MVP.

### Areas of further work

The work highlighted 11 areas for further work that have been identified through this feasibility study. These areas can be grouped into three categories:

- **Developing the technical solution**
  - Development of technical components
  - Security framework
- **Facilitating appropriate governance and skills**
  - Integration of existing initiatives
  - Data Sharing Infrastructure Task Group
  - Detailed analysis of delivery and governance
  - Foster a culture of data sharing
  - Trust framework
  - Knowledge dissemination activities
- **Developing standards and blueprints**
  - Data sharing infrastructure detailed blueprints
  - Management of standards
  - Detail review of licenses, codes, and legislation

# Accelerating the development of a data sharing infrastructure

**Recommendations to collaboratively enable the data sharing infrastructure**

## 1) Develop an MVP

***Develop the technical solution*** by DSIT/DfBT/DESNZ support a development project where the MVP of a data sharing infrastructure is developed, built, and tested.

Work with the existing initiatives that are functionally like the component parts of a data sharing infrastructure to accelerate the development of the MVP. These are the Integration Architecture (National Digital Twin Programme), Open Energy, and Virtual Energy System.

### No-regret actions (0-6 months)

- Host technical alignment meetings with existing initiatives (NDTP, VirtualES)
- Select a use case to develop the MVP

### Other actions (6-12 months)

- Select and implement a funding route for the development of the MVP
- Allocate staff to the coordination of the MVP

## 2) Establish a Task Group

***Facilitating appropriate governance*** by DESNZ & Ofgem to convene and provide a clear mandate and funding to a **Data Sharing Infrastructure Task Group**

The Task Group's objective is to support and accelerate the development of data sharing infrastructure.

### No-regret actions (3-12 months)

- Set up a "tiger team" of dedicated resources to determine the priorities of the task group
- Select and implement a funding route and priorities determined by the tiger team

### Other actions (6-18 months)

- Conduct the 11 areas of further work that support acceleration, articulated in **Appendix O** of the full report.
- Prepare a pathway to standing up a Task Group

## 3) Publish a decision

***Government to providing clarity to the sector*** by DESNZ and Ofgem publishing a statement of how a data sharing infrastructure will be developed and adopted by the sector.

Decision outlines the scope of the government, industry, and potential national programmes.

### No-regret actions (0-12 months)

- Create a plan that government can test with industry stakeholders.
- Publish a call for input on creating a data sharing infrastructure and associated governance.

### Other actions (18-24 months)

Update the digitalisation licence condition (9.5) to compel licensees to engage with the data sharing infrastructure.

# Consortium recommendations

**Recommendations to collaboratively enable the data sharing infrastructure**

## Developing the MVP

It is the position of the consortium that the most sensible path to developing the data sharing infrastructure is to combine the initiatives noted within the feasibility study:

- NDTP/Telicent's CORE solution is a match to the needs identified for the **Prepare** component.
- Virtual Energy System demonstrator has a significant alignment with the **Share** component.
- Open Energy has relevant expertise to implement the **Trust** component.

There is currently a critical window of opportunity to coalesce these programmes to enable a rapid MVP. While other initiatives may exist, they are less well developed and aligned, and their selection for an MVP would delay acceleration of delivery. Joining these programmes will not be without challenges. It is suggested that government funds a technical alignment study to avoid losing momentum gained to date. This study will evidence technical alignment between the programmes, and continue sector engagement, while a delivery pathway to an MVP is selected by government.

Once aligned, Ofgem/DESNZ mandates ESO to deliver a data sharing infrastructure by collaborating with NDTP. The MVP development can be funded through the RIIO ED2 reopener mechanism – which provides opportunities for appropriate government oversight.

## Governance

DESNZ/Ofgem can ensure appropriate oversight for the technical alignment study by contracting SMEs to represent public needs. For MVP development, an advisory team is assigned to collaborate with NDTP.

In addition to the development of the MVP, a concurrent workstream resolving issues of governance should be undertaken. Doing so supports the energy sector in building a sector-specific implementation of a data sharing infrastructure and resolve issues of who manages and operates any instances of it for public good. This workstream also helps map out the governance of the 'blueprints' of a data sharing infrastructure within the energy sector. We are of the opinion that this should take the form of a 'tiger team', who detail what the task group should undertake as its priorities and scopes.

The 'tiger team' can be wholly comprised of civil servants and is broadly defined as a short-term team that defines the scope of the task group. This can be funded as normal activity for DESNZ and/or Ofgem, or as an extension to this feasibility study. The funding model for the activities of the task group is less certain and is dependent on the work completed by the tiger team. It is likely also subject to a call for input or consultation on the expectations of the task group. A logic flow of this approach is set out on the next page.

## Resources consideration

The development of the data sharing infrastructure will require many resources with a board set of skill. Therefore, further work is required to determine the resources required to undertake the programme.

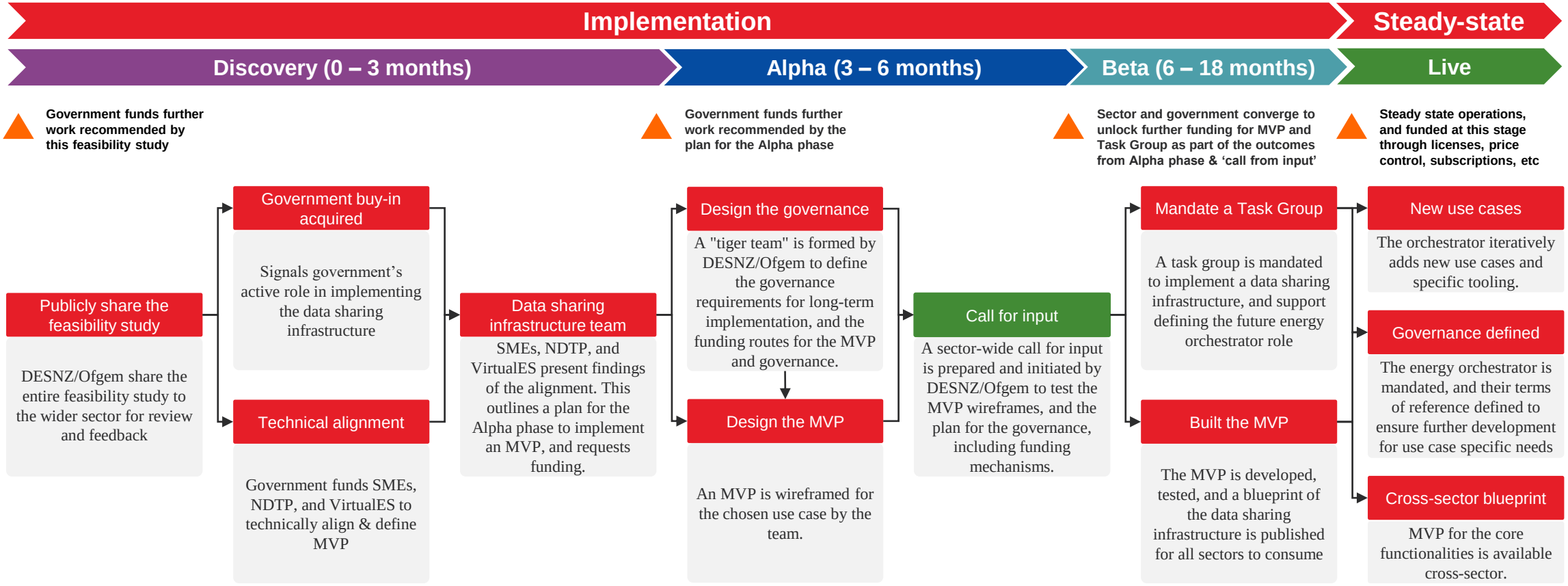
It is assumed that the government's input in the discovery phase will be to support the creation of a plan for alpha phase. This plan will outline, using agile principles and stage gate reviews, class 2 cost estimates, resource requirements, and terms of reference for the 'tiger team' to fulfil their remit. Additionally, it will provide an outline of the long-term governance and operating models.

The 'tiger team' will also serve as the PMO to support the integration of various programs. They will be responsible for submitting a terms of reference for the 'task group' to the government to unlock further funding for the development of the MVP and establishing the task group. Therefore, they will have the remit and the ability to request additional funds at various stage gate reviews, as defined in the alpha plan.

# Timelines of the consortium recommendations

**Recommendations to collaboratively enable the data sharing infrastructure**

It is proposed that the government funds the Discovery/Alpha phases through an appropriate mechanism. The exact funding routes for Beta/Live will be determined in Alpha.



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