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ARUP CATAPULT Energy Systems IB1 Icebreaker One

VIRTUAL ENERGY SYSTEM

SEPTEMBER 2023

Simon Evans
Global Digital Energy Leader, Arup

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AGENDA – THE NEXT 45 MINUTES

- **Introductions**
  2 mins: *Dial-in buffer & context*
- **Recap of the programme**
  5 mins: *Challenge & Solution*
- **Demonstrator**
  5 mins: *Interaction of technology with the user journey*
  5 mins: *Wireframes of the demonstrator*
- **Governance model**
  5 mins: *Overview of the proposed roles & responsibilities*
- **Benefits framework**
  5 mins: *Ways to assess various use cases*
- **Next Steps**
- **Q&A**

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INTRODUCTIONS

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RECAP OF PROJECT

WHAT IT IS, ITS OBJECTIVES, AND THE SCOPE

Jonathan Barcroft
Workstream Lead, ESO

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CHALLENGE: ENERGY SYSTEM IS CHANGING

achieving **net zero**

requires an **integrated energy system**

operating an **integrated energy system**

requires modelling a wide **range of scenarios**

modelling a wide **range of scenarios**

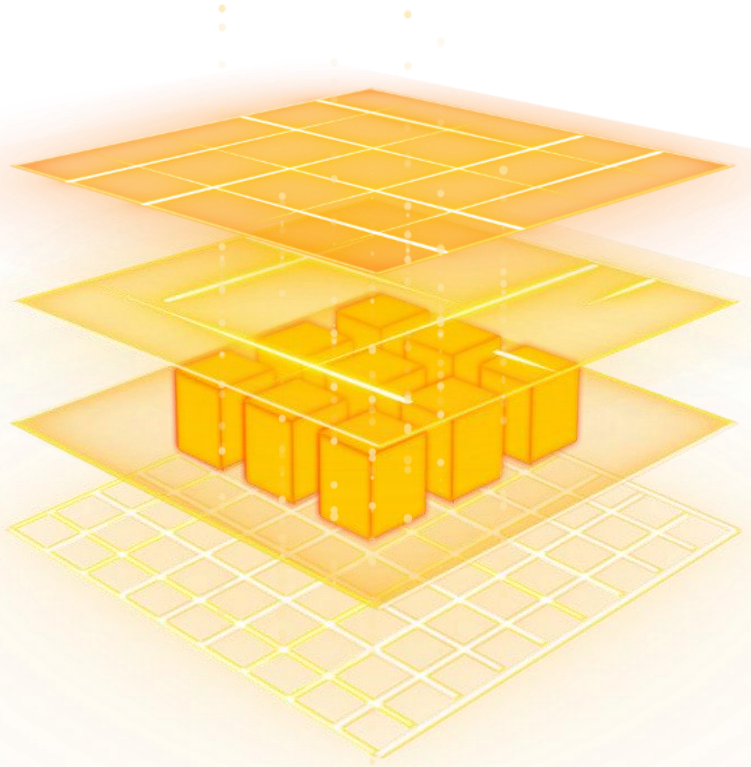
requires **visibility of system behaviour**

visibility of system behaviour of a dispersed system

requires **data sharing**

data sharing

requires a **common social-technical framework** to facilitate interoperability



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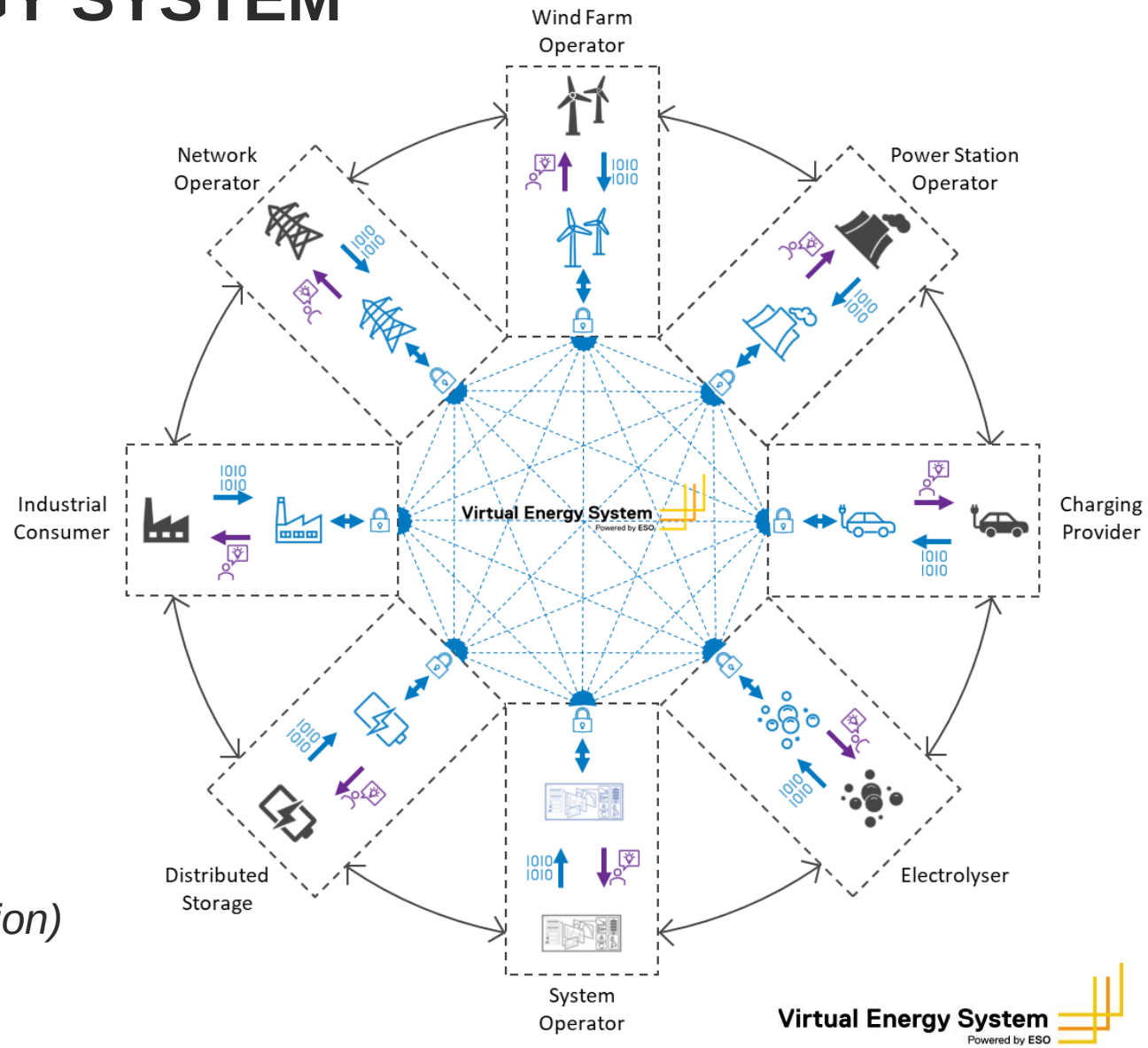
SOLUTION: VIRTUAL ENERGY SYSTEM

Ambitious objective:

Enable the development of an ecosystem of **connected digital twins**

For the **entire GB energy system** to solve wider system challenges

(e.g. energy optimisation, carbon reporting, investment planning, …net zero energy transition)



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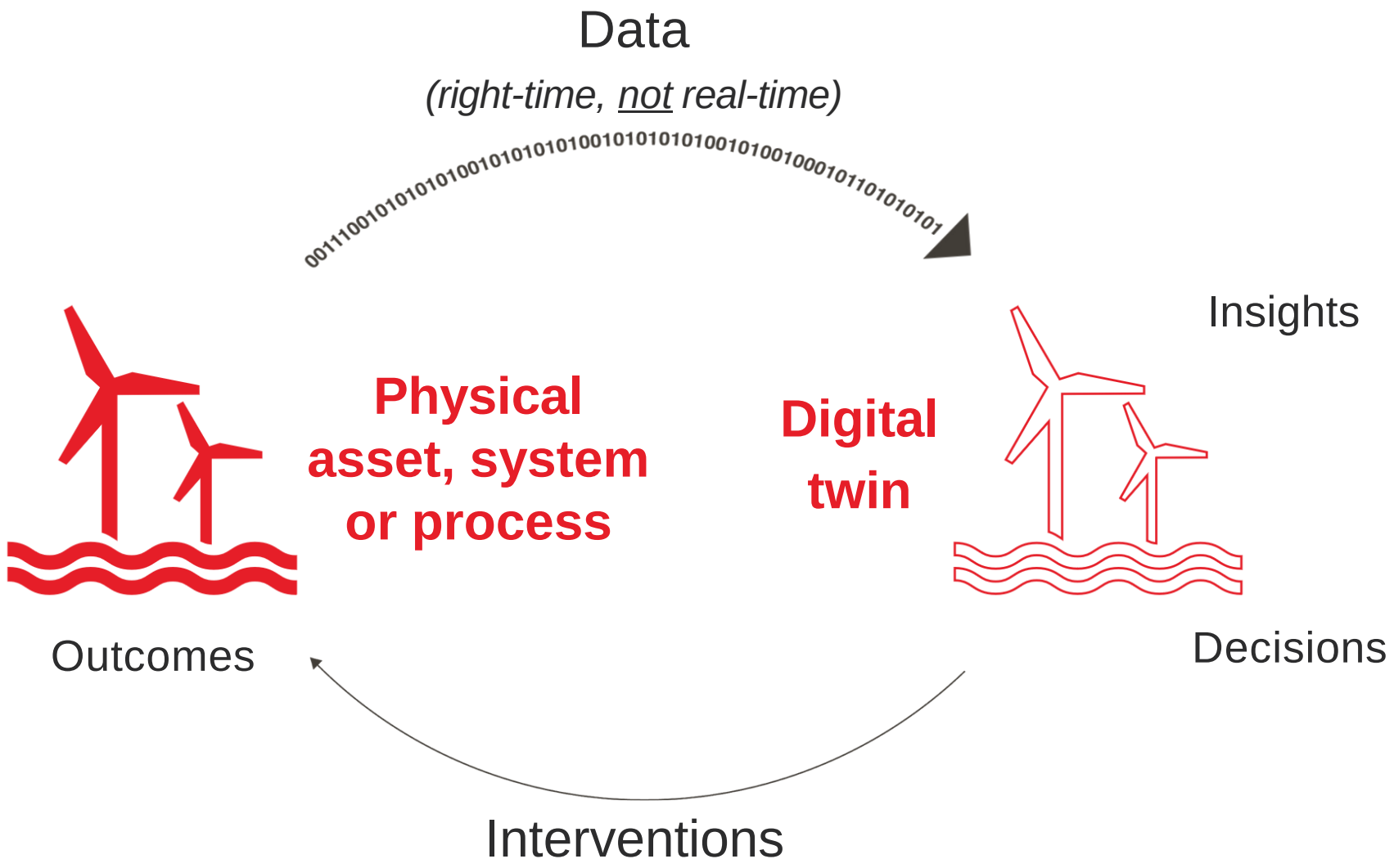
AN ECOSYSTEM OF CONNECTED DIGITAL TWINS



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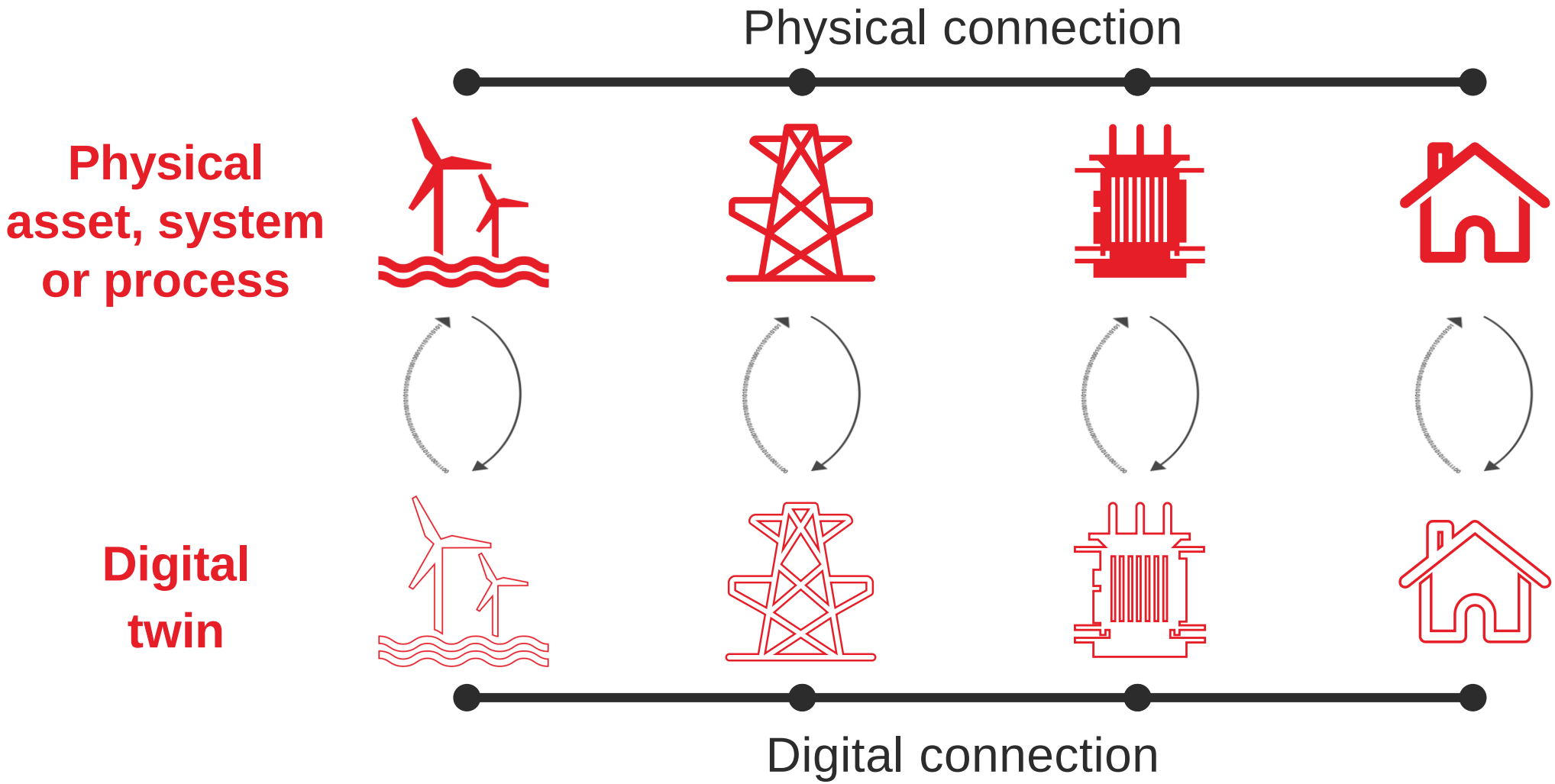

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WHAT IS NEEDED: COMMON FRAMEWORK

People	Defining roles & responsibilities	Raising awareness & fostering culture	Building capabilities & skills	PRIORITY FACTOR
Process	Aligning around industry codes & standards	Engaging stakeholders	Creating a governance framework	Determining the operating environment
Data	Aligning models & taxonomies	Establishing management & governance	Increasing visibility & enabling sharing	Managing security
Technology	Connecting physical infrastructure	Enhancing modelling and analysis	Creating an interoperable 'tech-stack'	

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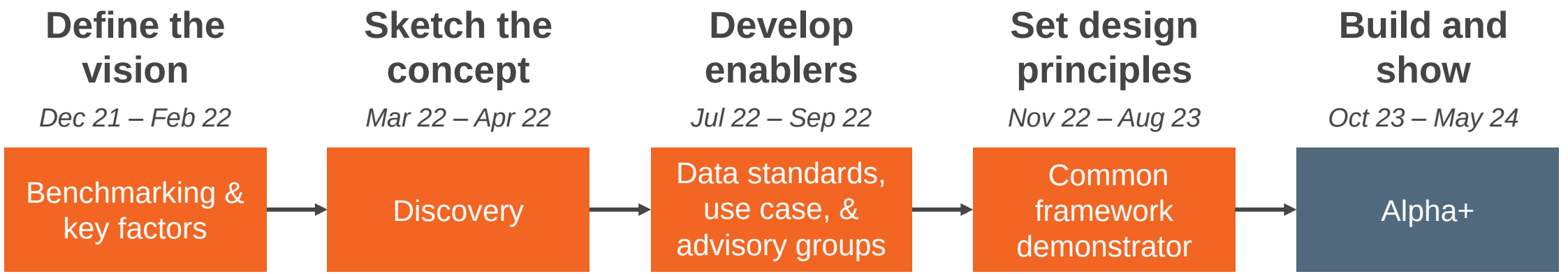
PROJECT TIMELINE



- Identified global best practices for connecting digital twins
- Refined learning of these into key factors required for interoperability

- Tested key factors with industry
- Recommendation to create tangible demonstrator of the framework in practice

- Reviewed industry maturity in data standards and data portals to set direction
- Refine use case
- Published strategy for advisory groups

- Developing industry-validated governance model and technology requirements.
- Creating wireframe of demonstrator

- Build, test, and showcase the demonstrator
- Develop the operating environment, and security model
- Track the benefits

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DEMONSTRATOR

USE CASE & TECHNOLOGY

Ed Rous-Eyre
Senior Consultant, Arup

John Bintu
Solutions Architect, Arup

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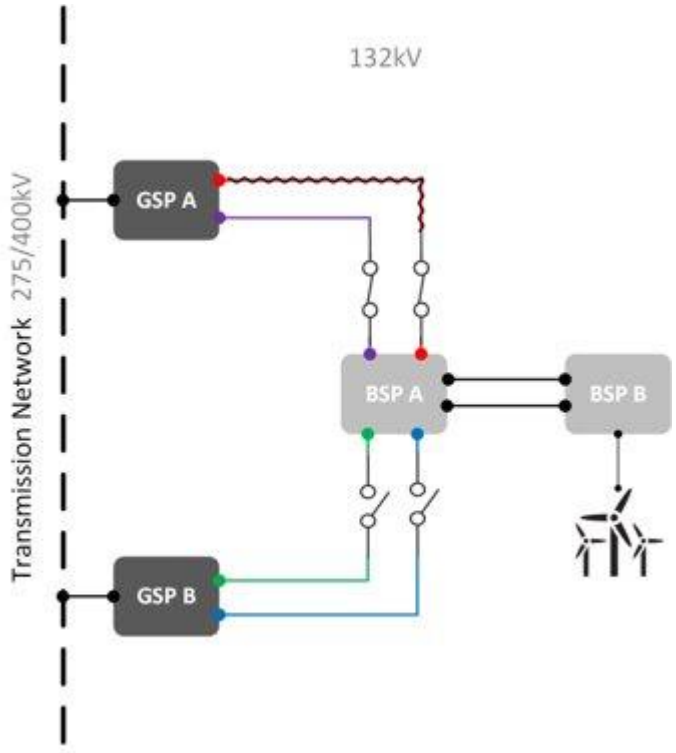
DEMONSTRATOR USE CASE

Exploring the opportunity to re-route electricity between grid supply points (GSPs)

To increase the network's resilience and eliminate BSP B's *Single Circuit Risk*, the coupling infrastructure between GSP A and GSP B can be employed.

Strategically changing the running arrangement within BSP A to allow BSP B to be fed by GSP B instead of GSP A would mean the substation is fed by two circuits (blue and green) rather than one, adding redundancy to the system and increasing network resilience.

Also, due to the risk of transmission power flowing through the distribution network causing overloads, only two of the circuits can remain open, meaning BSP A must be fed by one GSP, not both.



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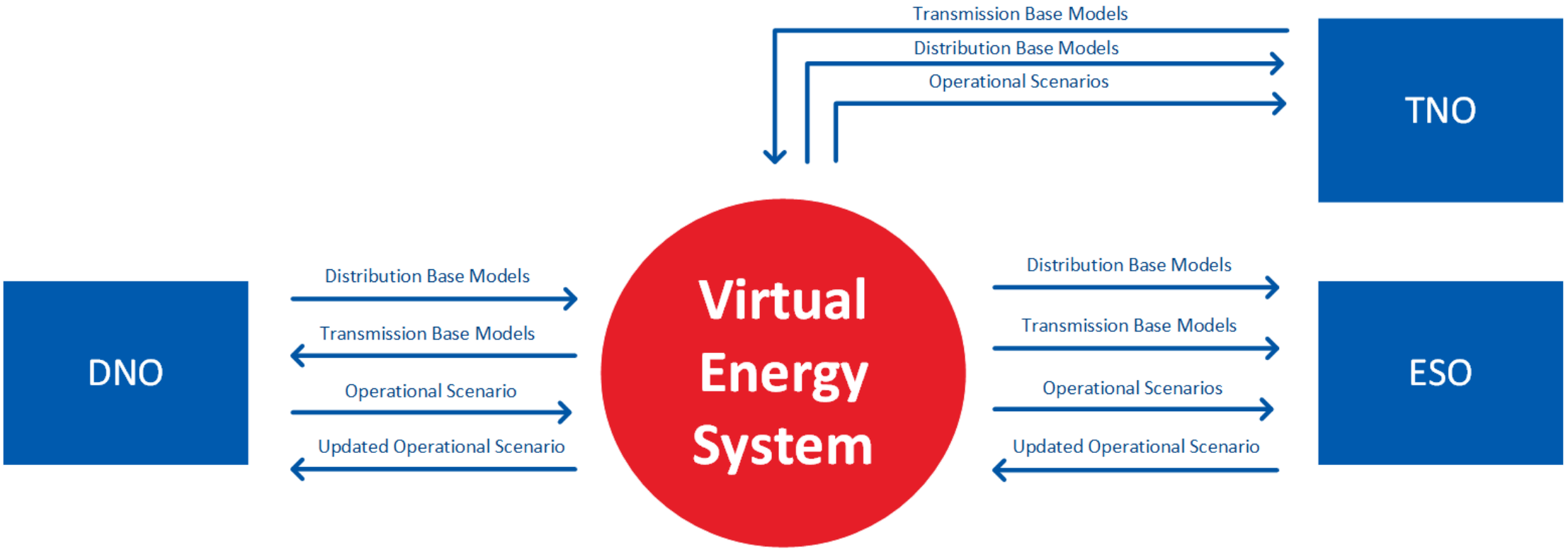
FUTURE OPERATING STATE – DATA FLOWS

Engaged stakeholders from across the sector to understand the future operating state and how the use case could be enabled



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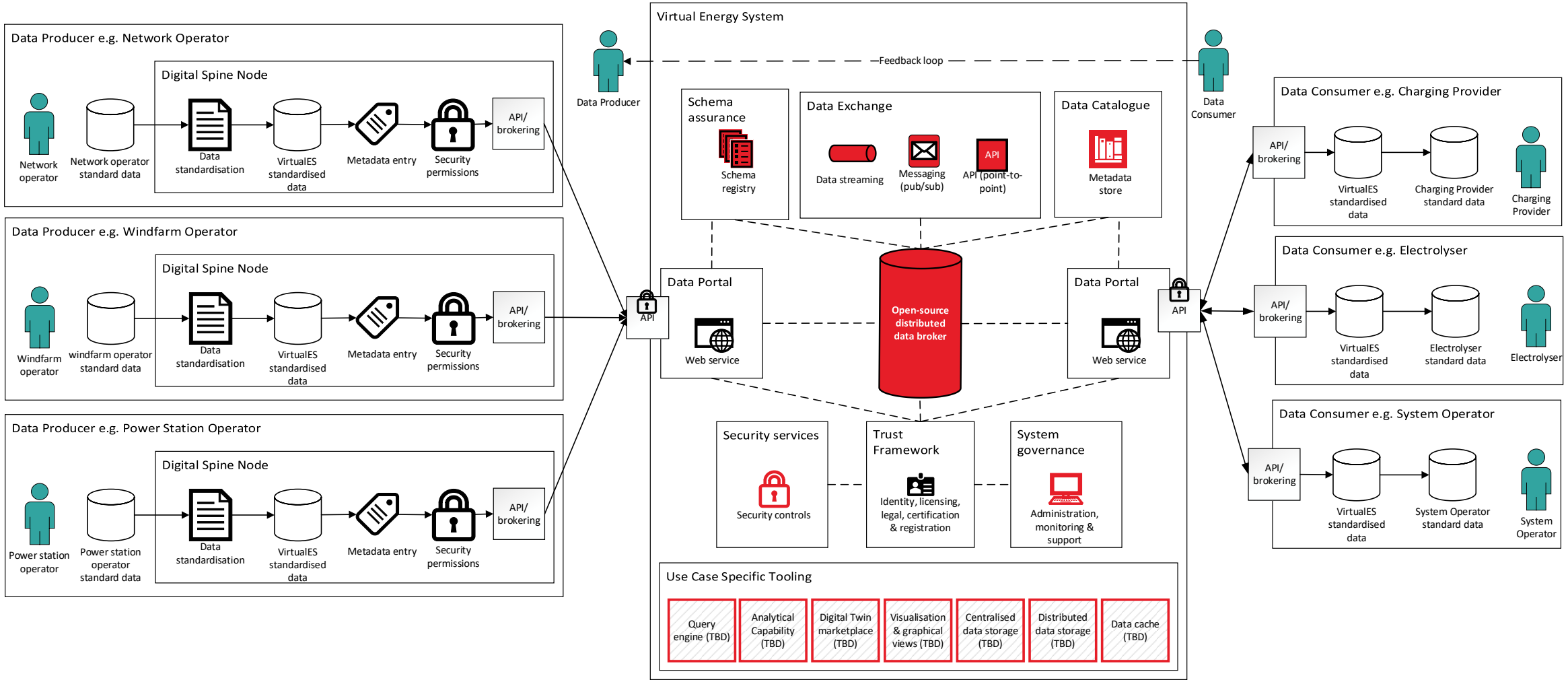
DEMONSTRATOR HIGH LEVEL DESIGN



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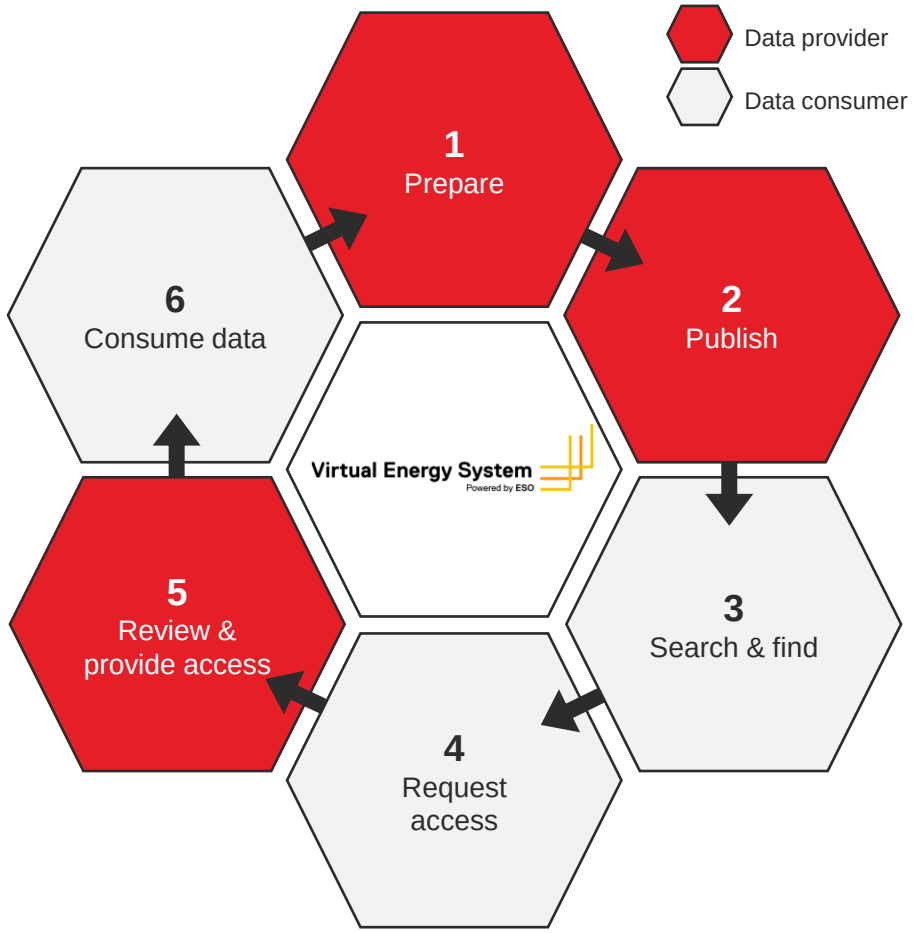
KEY STEPS FOR USING THE VIRTUAL ENERGY SYSTEM

Key steps:

1. Prepare
2. Publish
3. Search & find
4. Request access
5. Review & provide access
6. Consume data



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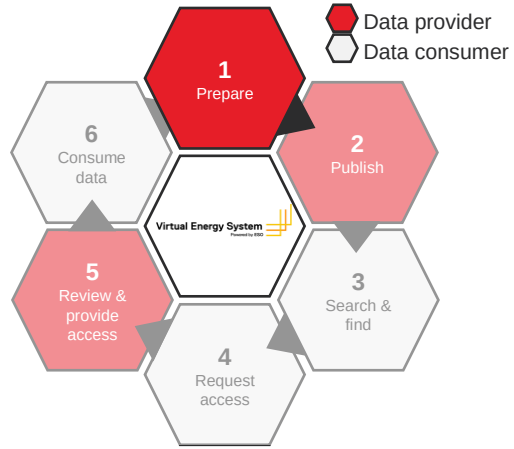
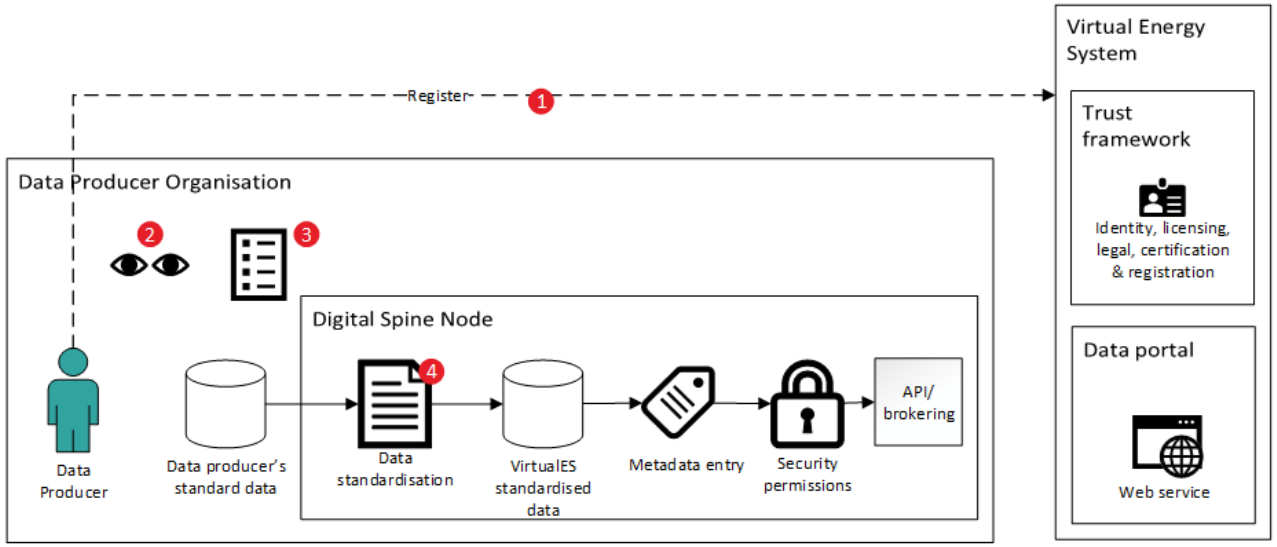
(1) PREPARE

Task Lead: Data Producer

#	Activity	Importance
1	Register with the VirtualES	Ensures verification and validation of participants
2	Identify data for sharing & establish endpoint	Ensures that the correct data is exchanged.
3	Identify data handling characteristics	Ensures appropriate controls can be placed on the data.
4	Data standardisation	Enables interoperability of data.





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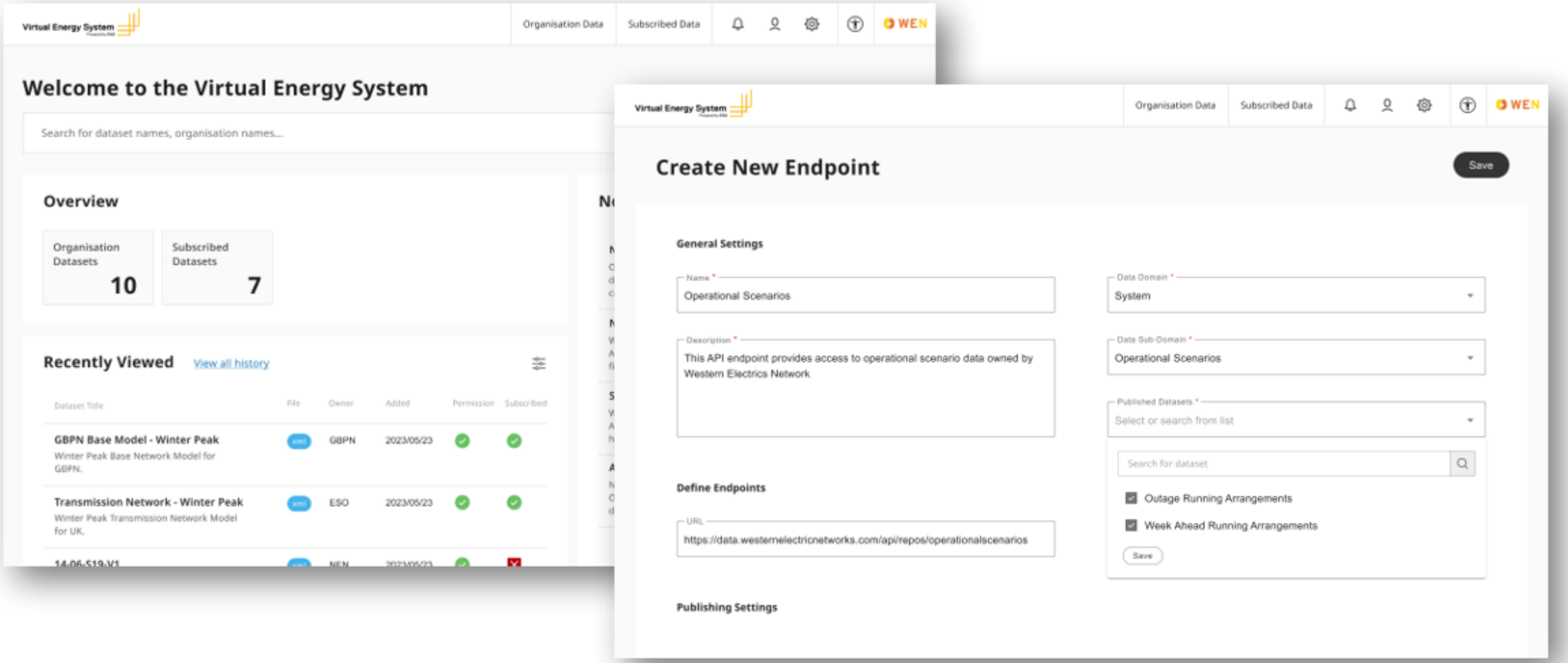
WIREFRAMES - PREPARE



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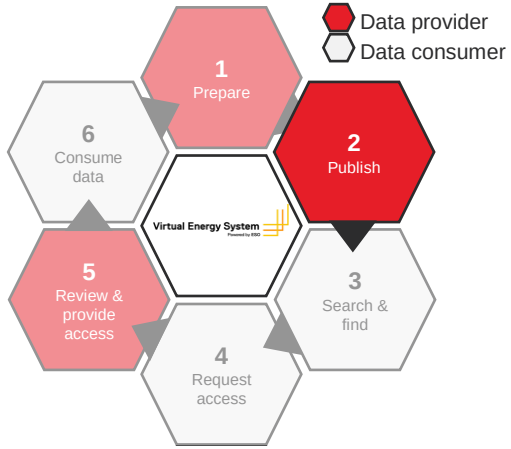
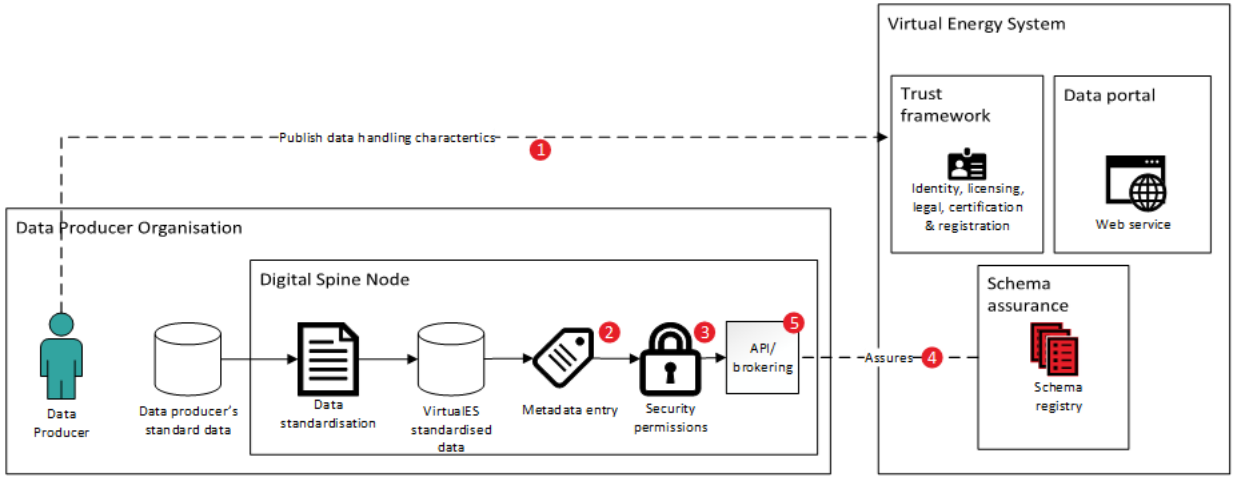
(2) PUBLISH

Task Lead: Data Producer

#	Activity	Importance
1	Publish data handling characteristics	Ensures that data has the correct licensing conditions.
2	Publish metadata to the data catalogue	Enables data to be indexed for search and find.
3	Apply security controls	Ensures that the date is secure and compliant.
4	Validate schema	Ensures that only approved schemas are used.
5	Publish via API & message brokers	Ensures that data is shared effectively and securely through approved endpoints and protocols.





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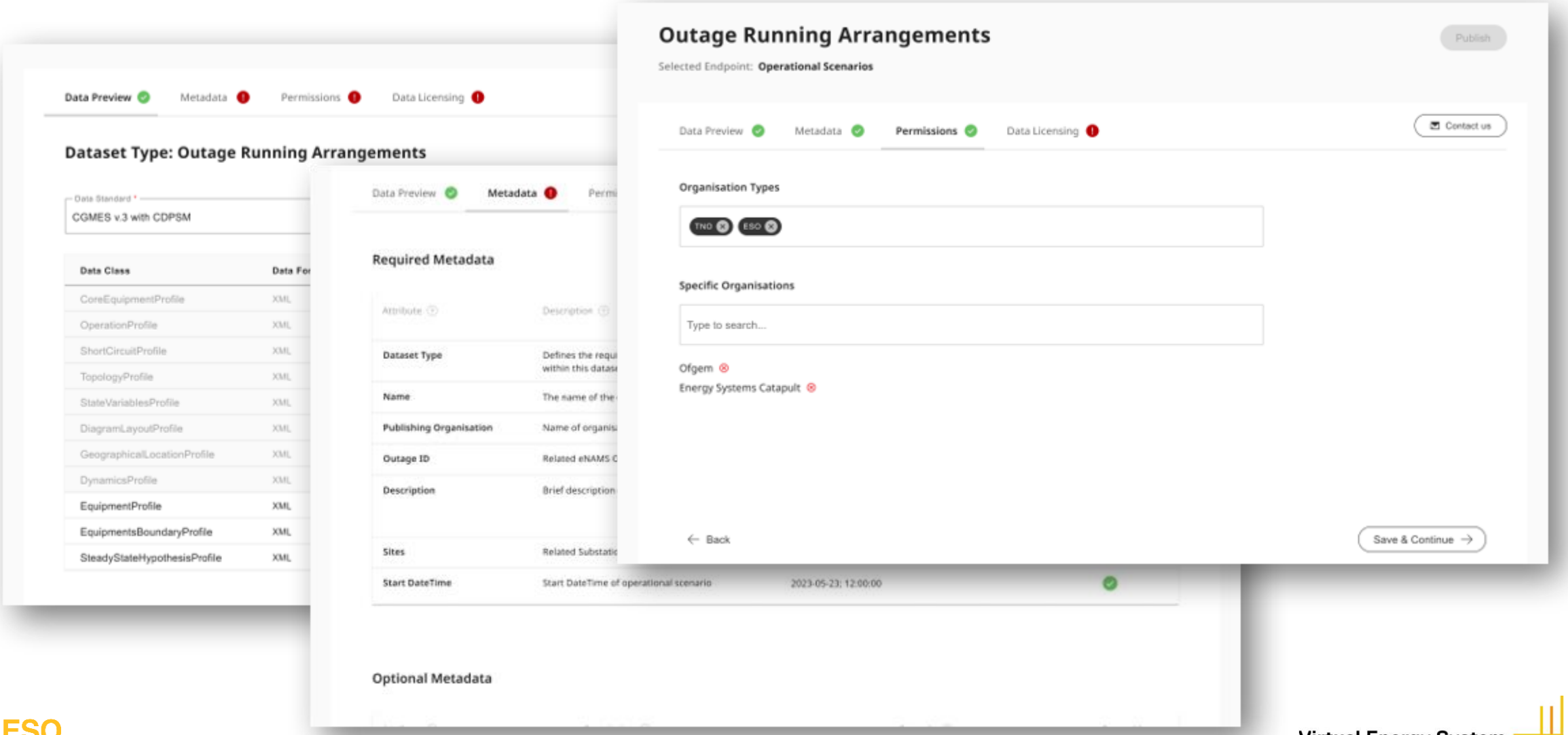
WIREFRAMES - PUBLISH



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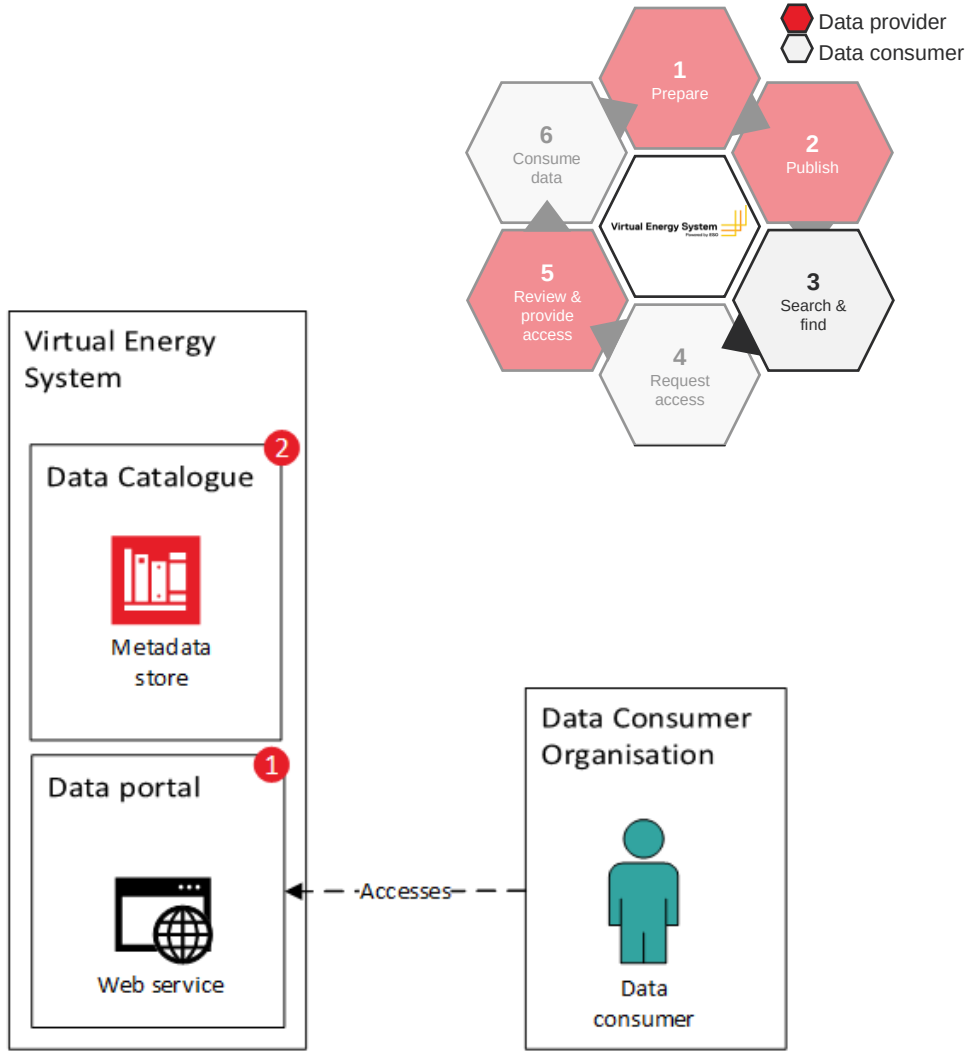
(3) SEARCH

Task Lead: Data Consumer

#	Activity	Importance
1	Access the data portal	Provides a browser-based interface to access the VirtualES.
2	Search using the data catalogue	Allows users to search, find and understand a range of datasets.



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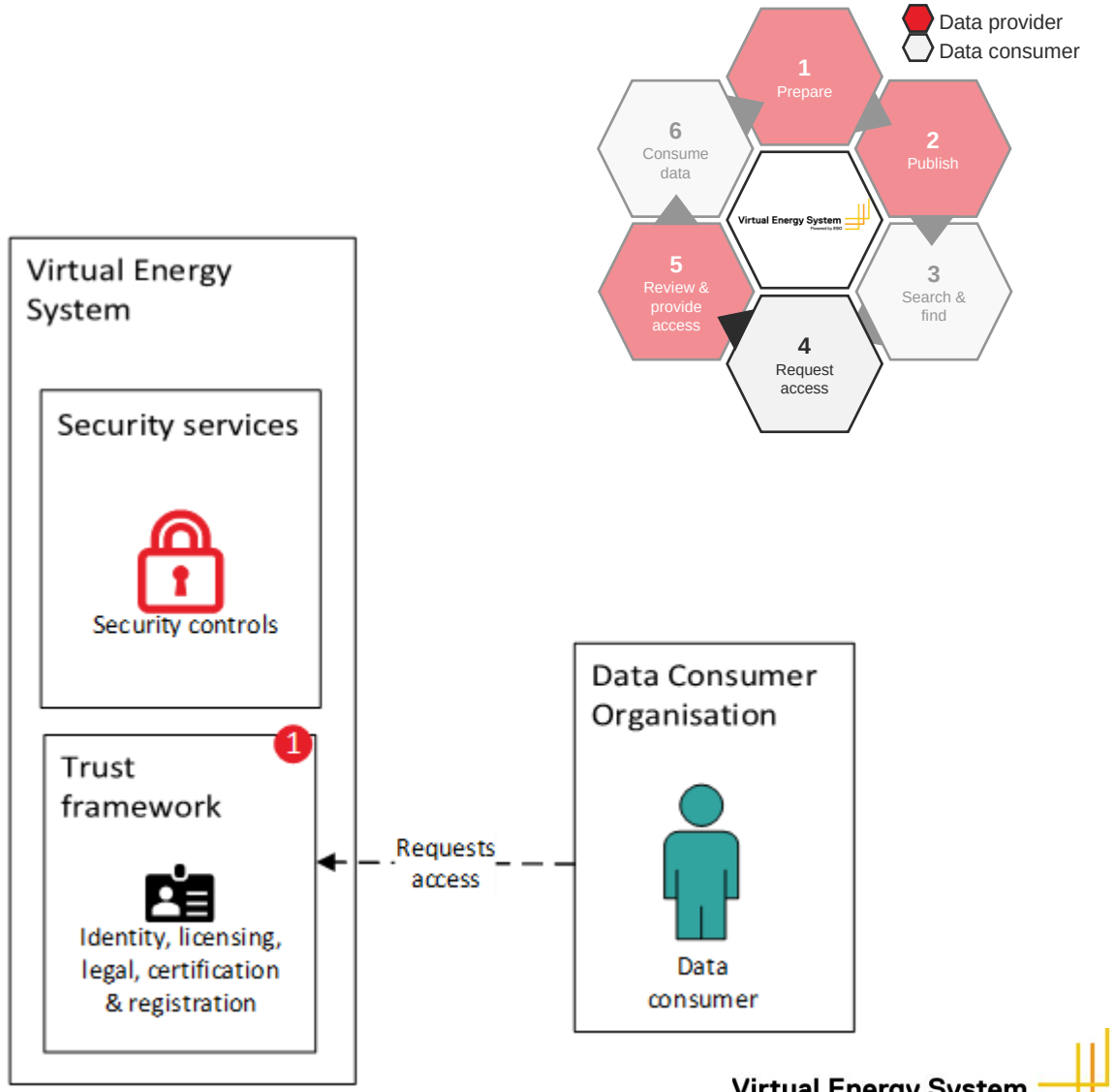
(4) REQUEST ACCESS

Task Lead: Data Consumer

#	Activity	Importance
1	Request access via the trust framework (a) Data consumer already has the correction permissions (b) Data consumer does not currently have the correct permissions and requests access	Checks if users have the correct policies and permissions to consume the data and allows them to request access.



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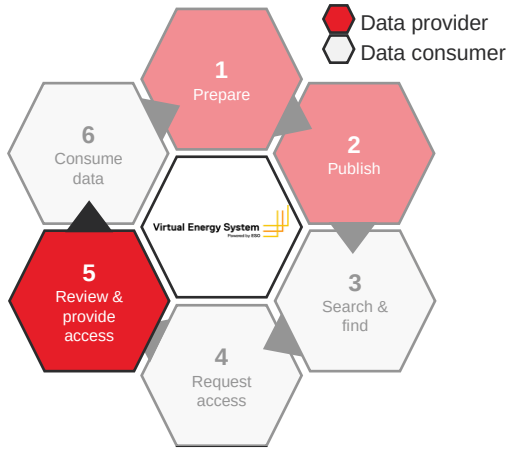
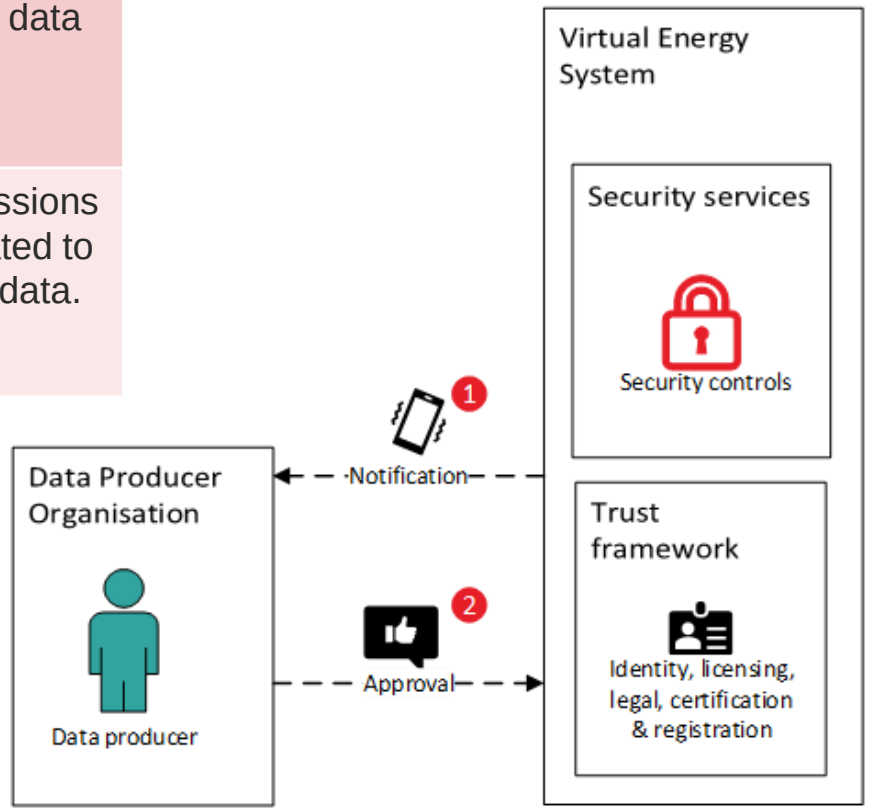
(5) REVIEW & PROVIDE ACCESS

Task Lead: Data Producer

#	Activity	Importance
1	Review access request	Enables producers to see who is requesting the data and why.
2	Provide access	Access control permissions and policies are updated to enable access to the data.





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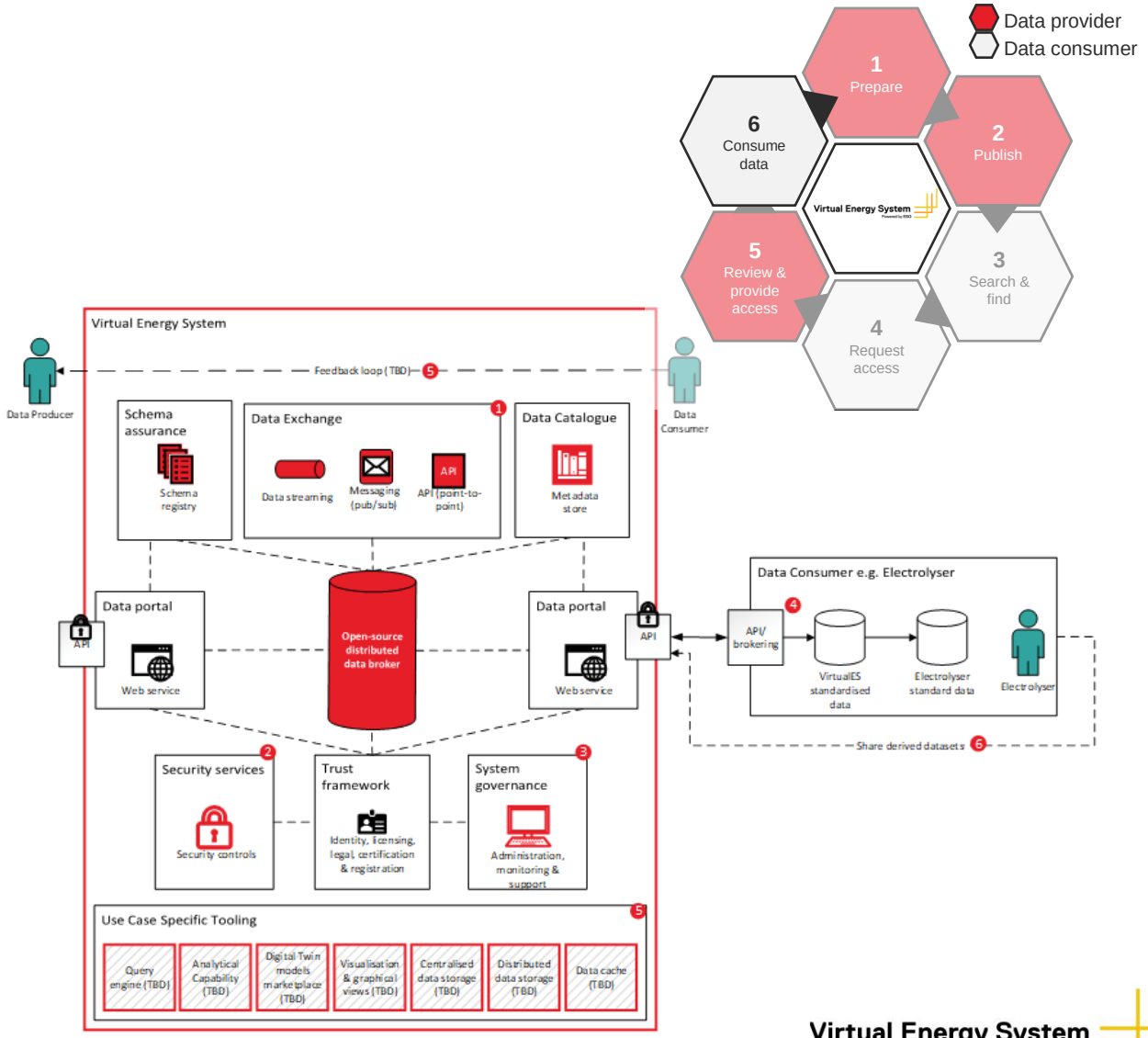
(6) CONSUME

Task Lead: Data Consumer

#	Activity	Importance
1	Data exchange	Data exchange patterns (pub/sub, streaming, API endpoints) are used according to use-cases.
2	Security services	Protects and secures the data by using the correct tools.
3	System governance	Provides the administration, monitoring and support for the VirtualES.
4	Data ingestion	Standardised and documented datasets are ingested for modelling & decision making
5	Use-case specific tooling	Provides users with tools to meet different requirements and use-cases
6	Share derived datasets	Derived data to inform digital twin models can be shared back via the VirtualES



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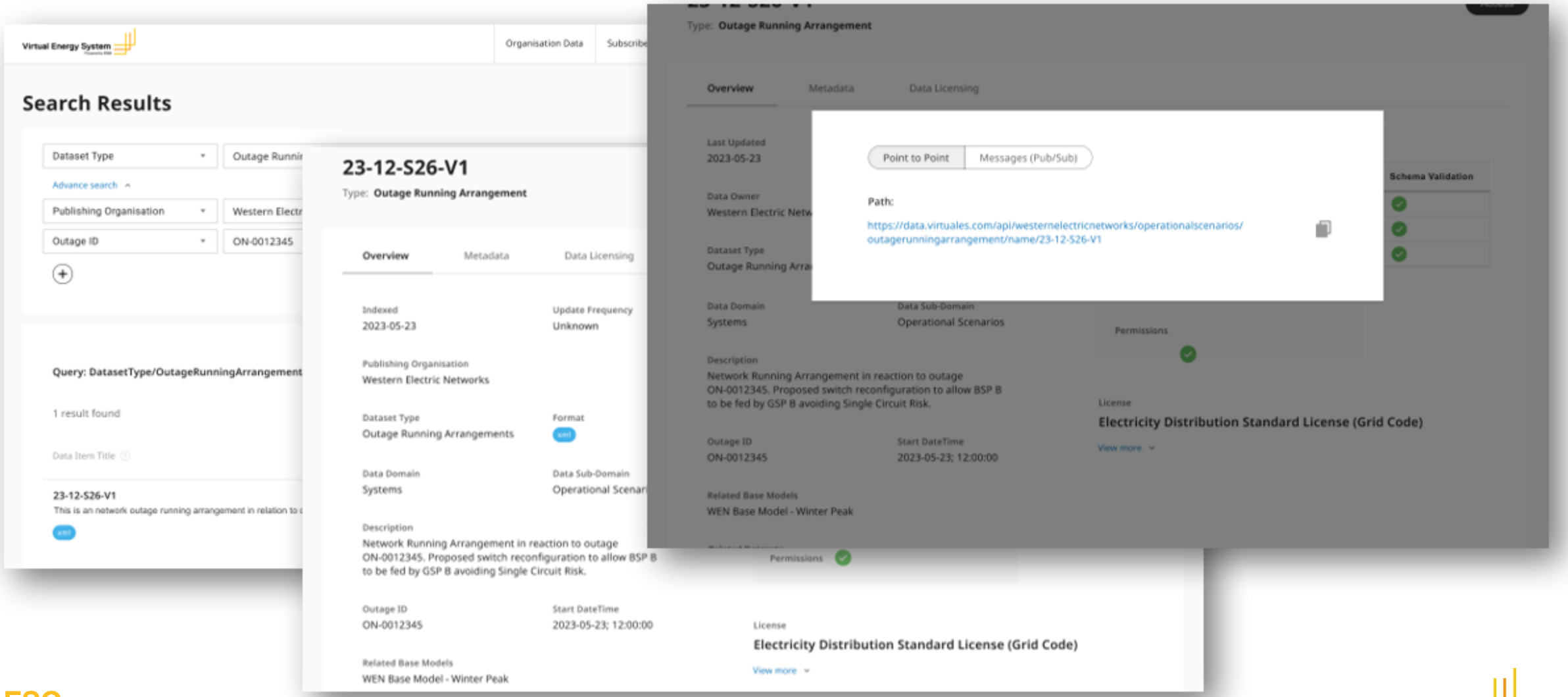
WIREFRAMES - SEARCH



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GOVERNANCE MODEL

Ankit Patel
Senior Consultant, Arup

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GOVERNANCE DESIGN PRINCIPLES

Set of principles use to evaluate different governance models

1. Transparent competition
2. Accountability
3. Stakeholder engagement
4. Responsiveness
5. Participation
6. Empowerment
7. Legitimacy

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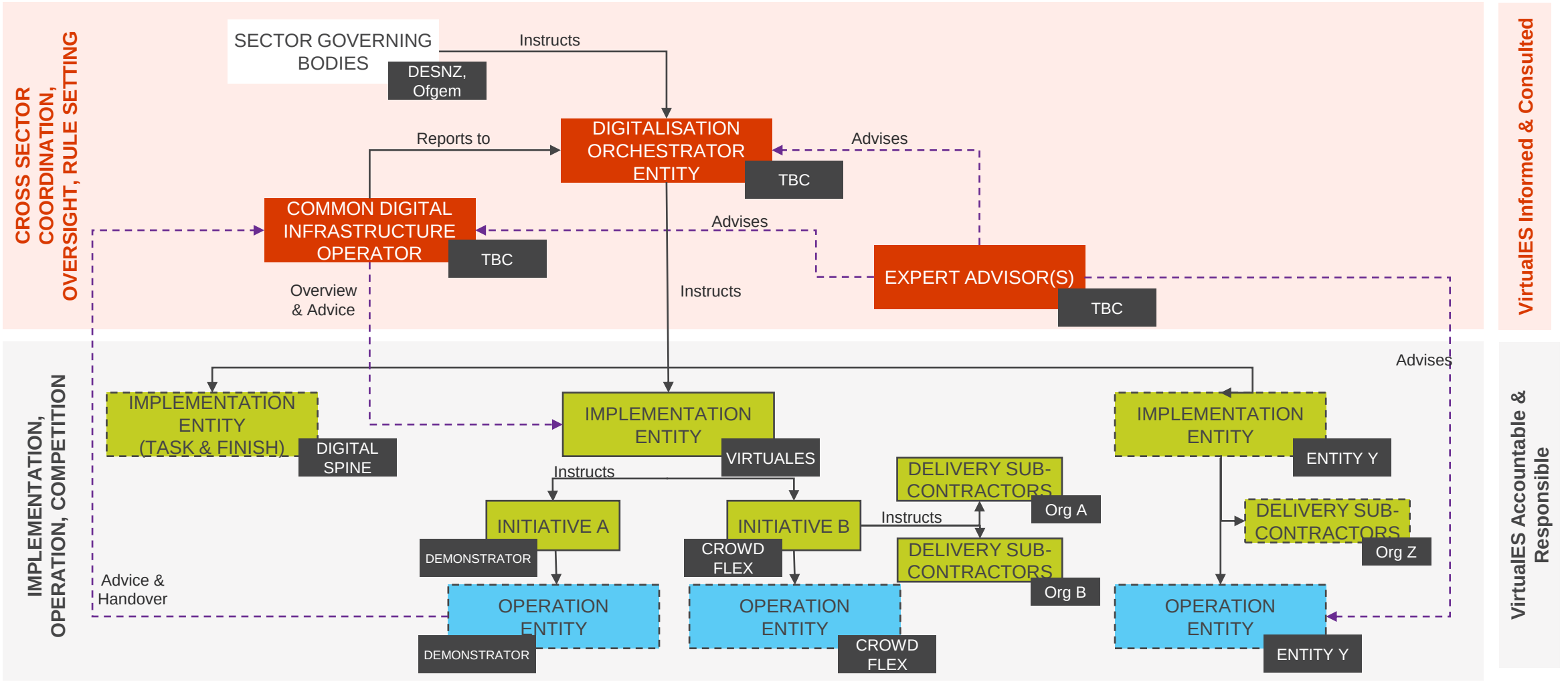
GOVERNANCE MODEL D – *CO-LEAD*



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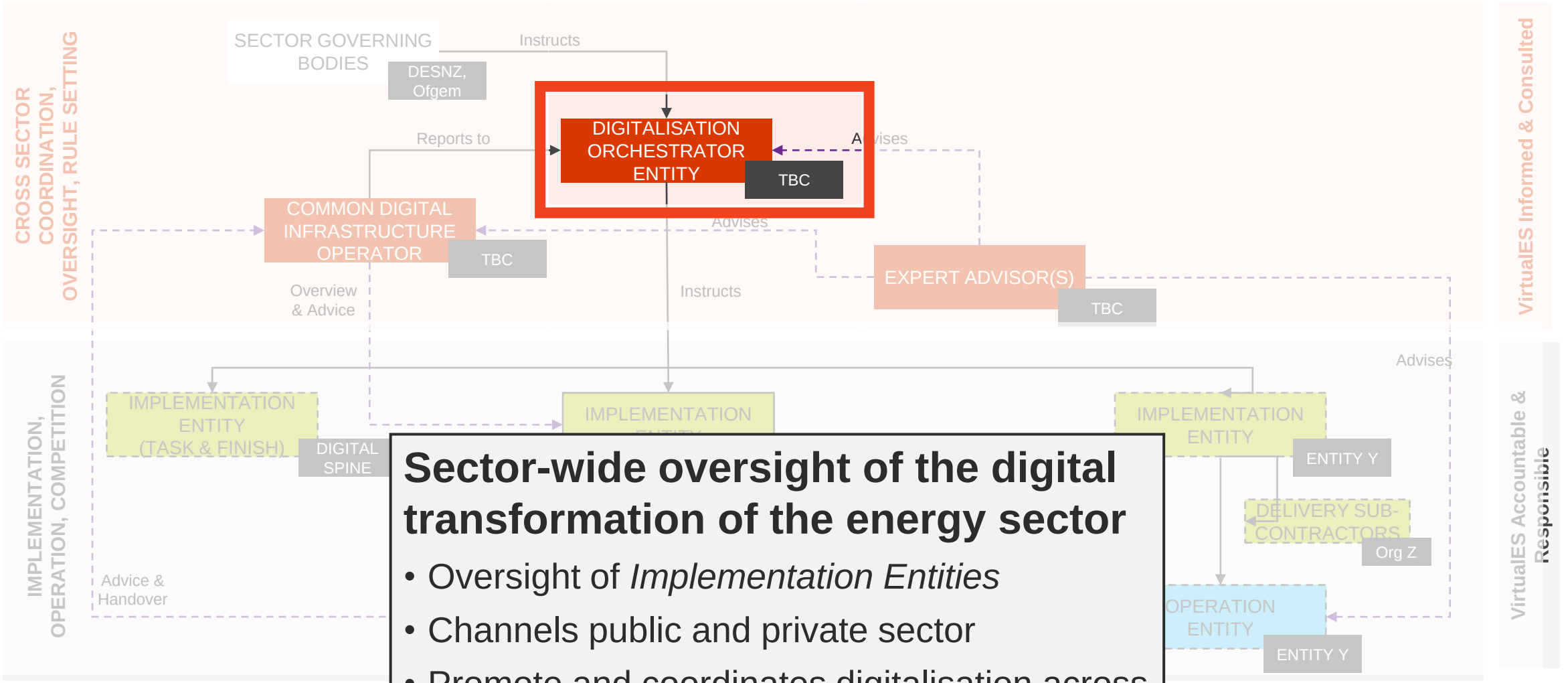
GOVERNANCE MODEL D – *CO-LEAD*



Sector-wide oversight of the digital transformation of the energy sector

- Oversight of *Implementation Entities*
- Channels public and private sector
- Promote and coordinates digitalisation across the sector and shares knowledge

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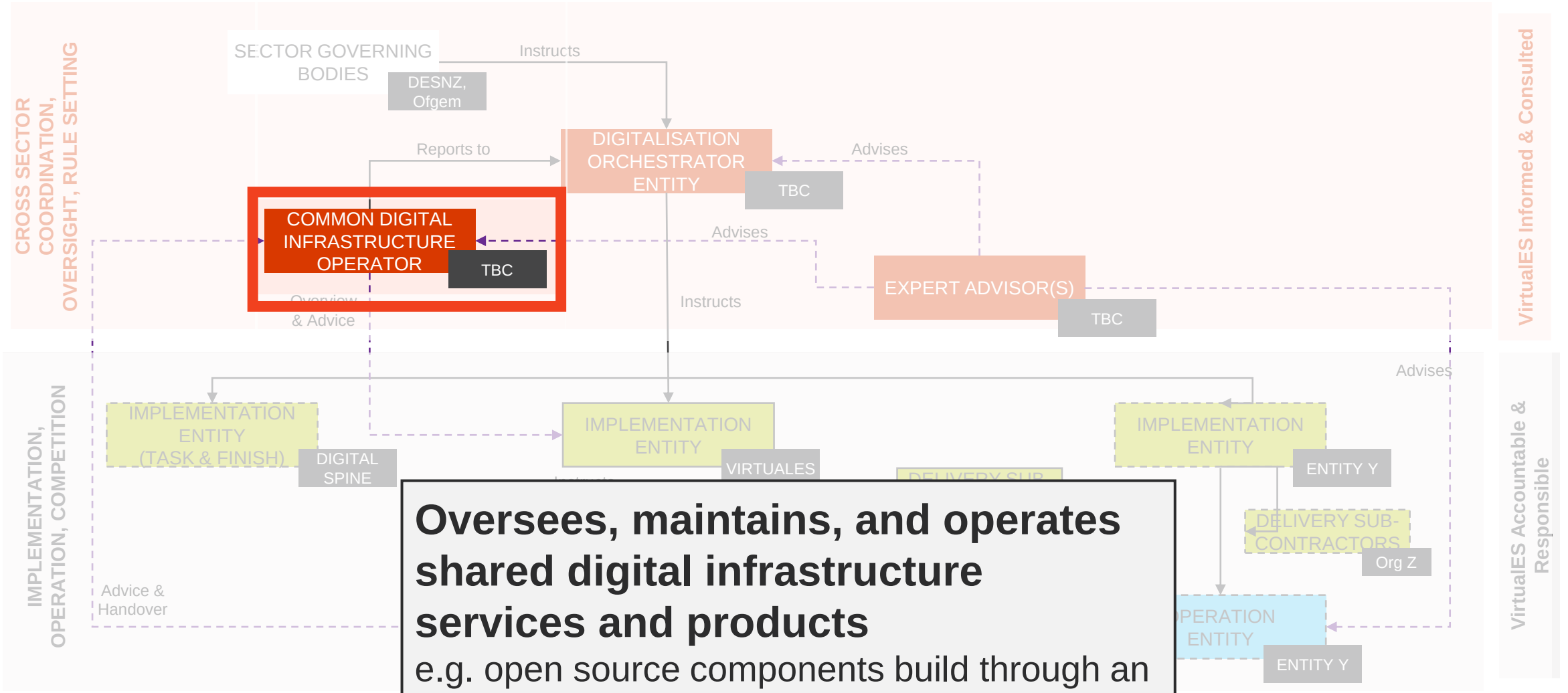
GOVERNANCE MODEL D – *CO-LEAD*



Oversees, maintains, and operates shared digital infrastructure services and products

e.g. open source components build through an Implementation Entity.

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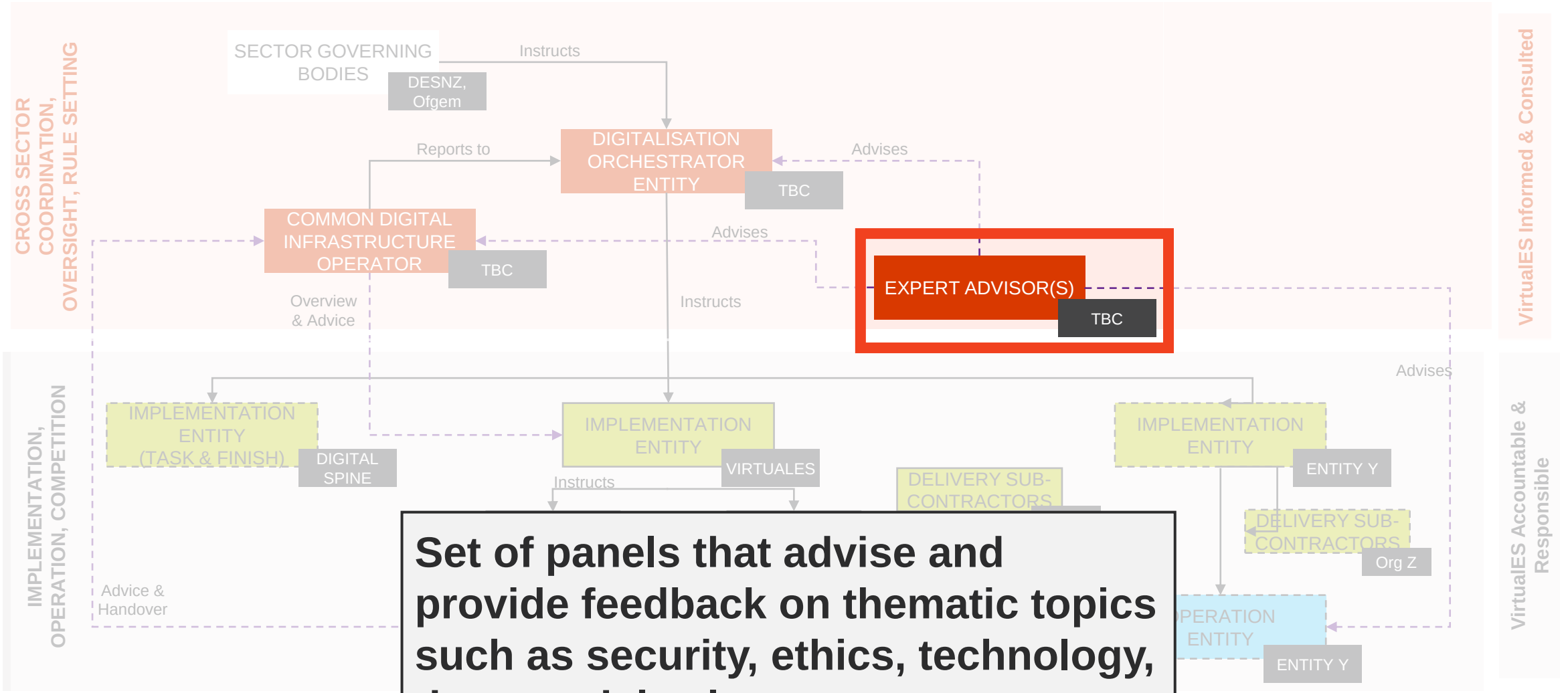
GOVERNANCE MODEL D – *CO-LEAD*



Set of panels that advise and provide feedback on thematic topics such as security, ethics, technology, data, social value, use cases, etc

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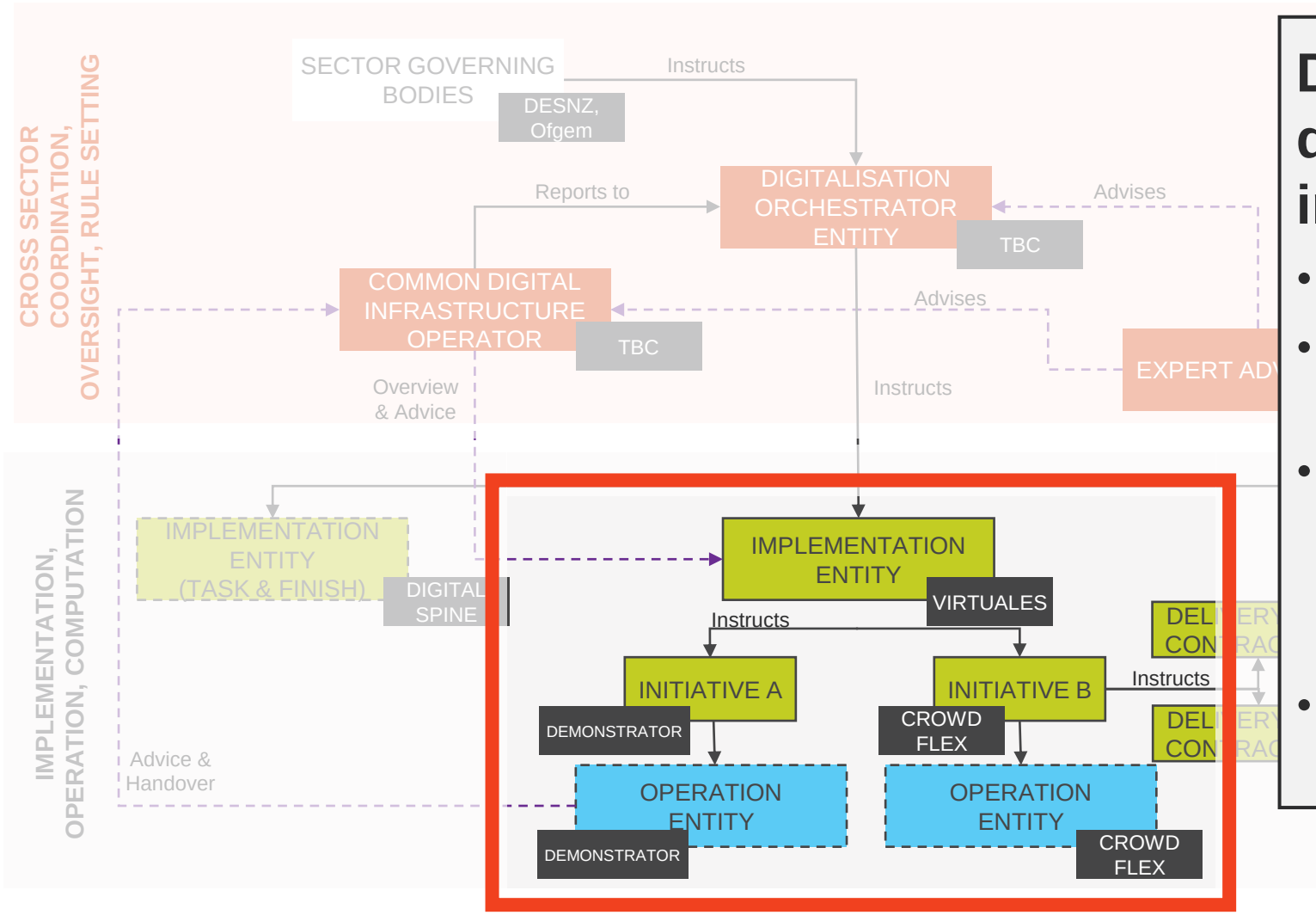
GOVERNANCE MODEL D – *CO-LEAD*



Delivers and accountable for digitalisation initiatives from initiation to operations.

- Carries out day-to-day management
- Enforces compliance to the principles, standards, and rules
- Identifies and applies to relevant funding routes, including engaging the Orchestrator Entity when public funds are requested
- Engage Expert Adviser(s) on initiatives, or emerging technologies

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BENEFITS FRAMEWORK

Hanna Lawrence
Senior Consultant, Arup

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BENEFITS FRAMEWORK

- Enables **multiple use cases**
- Use cases are individually and jointly delivering benefits;
- Therefore, it is important to have a **standardised approach**.

Benefit categories

1. Reduced consumer bills
2. Improved system operability and resilience
3. Reduced carbon emissions
4. Other wider benefits

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NEXT STEPS

Simon Evans
Global Digital Energy Leader, Arup

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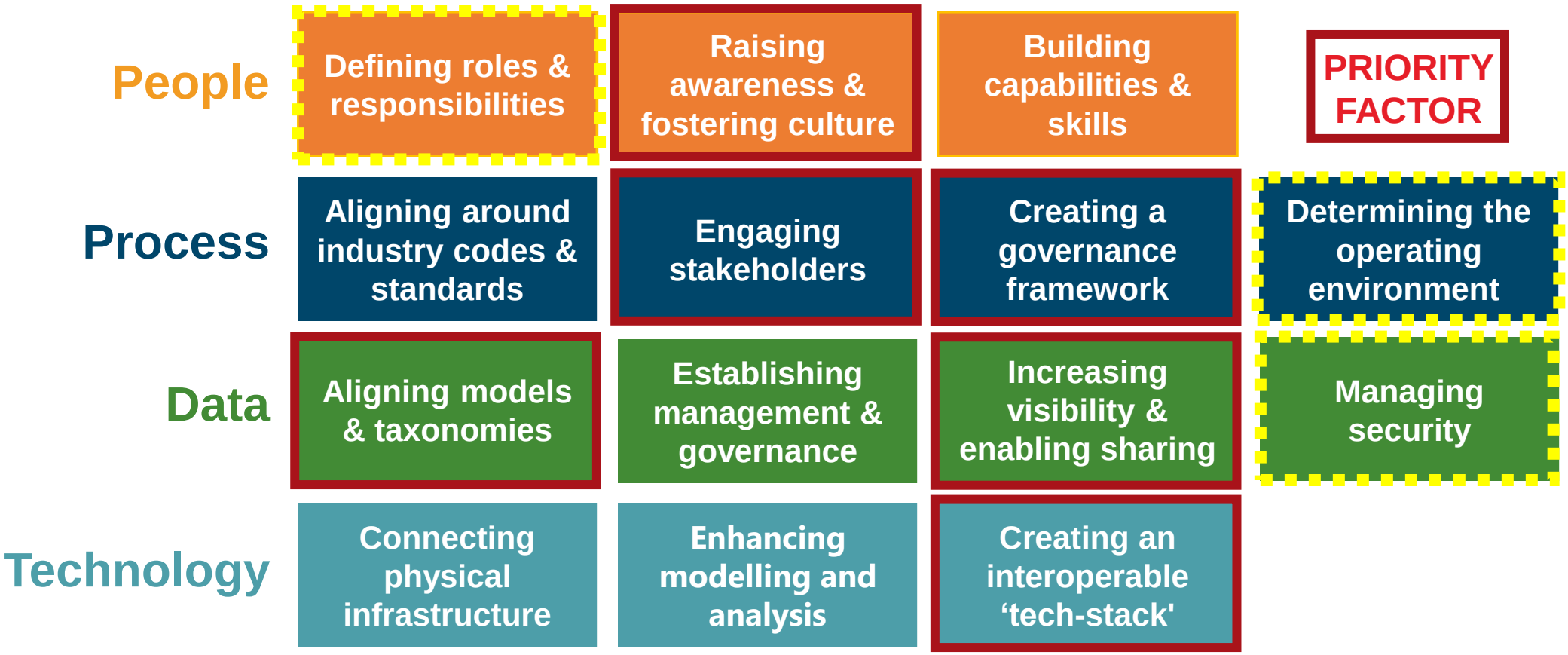
WHAT NEEDS TO HAPPEN NEXT:



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CALL TO ACTION

Aligning models & taxonomies

Increasing visibility & enabling sharing

Creating an interoperable ‘tech-stack'

Raising awareness & fostering culture

Engaging stakeholders

Creating a governance framework

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