Virtual Energy System

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ARUP CATAPULT Energy Systems IB1 Icebreaker One

Note to reader:

These slides are a snapshot of the work to date on the Virtual Energy System underpinning framework. The intent is to share the evolving knowledge and learnings with industry. For more information on the latest developments please contact VirtualES@nationalgrideso.com

VIRTUAL ENERGY SYSTEM

SHOW & TELL

MARCH 2023

Simon Evans
Global Digital Energy Leader, Arup

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AGENDA – THE NEXT 45 MINUTES

- **Introductions**
  2 mins: *Dial-in buffer, introductions, context and objective of Show & Tells*
- **The Virtual Energy System (VirtualES)**
  10 mins: *VirtualES, journey to date, and socio-technical factors*
- **Demonstrator use case**
  5 mins: *Use Case Definition (what)*
  5 mins: *Data needs & Gaps*
- **Demonstrator technology**
  5 mins: *Introduction and options assessed*
  5 mins: *Overview of the high level design and recommendations*
- **Next steps**
- **Questions & Answers**

All questions via Slido
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INTRODUCTIONS

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CATAPULT Energy Systems

IB1 Icebreaker One

Show & Tell objective

Share knowledge and learnings from the work to date with industry

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VIRTUAL ENERGY SYSTEM

WHAT IT IS, IT'S OBJECTIVES, AND THE SCOPE

Jonathan Barcroft

Workstream Lead – National Grid ESO

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THE CHANGING ENERGY SYSTEM

Our mission is to decarbonise the energy system and bridge the gap to net zero.

78GW

Offshore Wind by 2035

HND - 2022

18-30GW

Interconnection by 2031

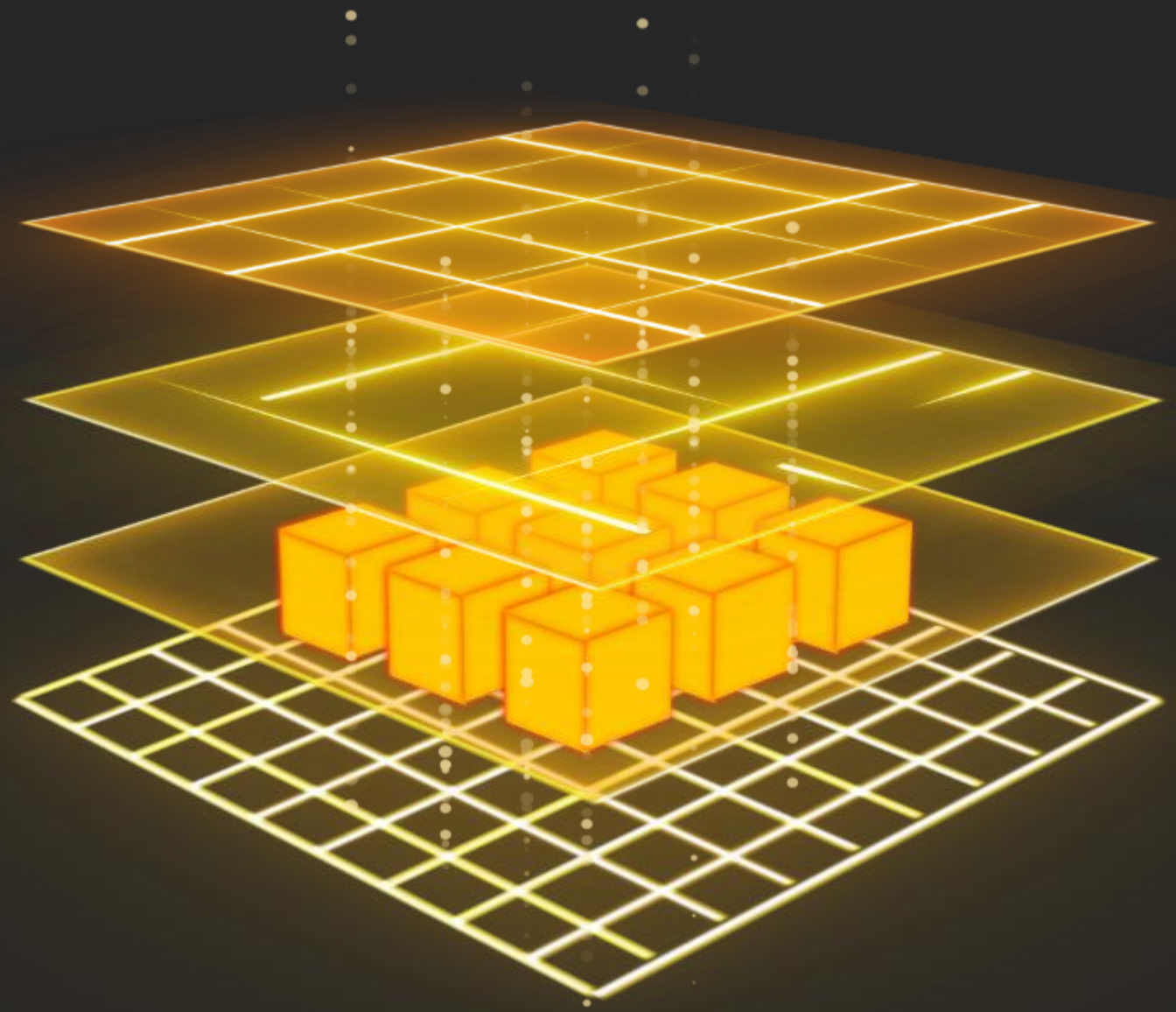
NOA - 2022

120-230GW

Flexibility by 2050

FES - 2021

Increased data availability and digitalisation of systems is fundamental to enable markets and technology to manage peaks and troughs.



4. DATA SHARING FACILITATES SYSTEM WIDE ACTIONABLE INSIGHT

3. EACH CONNECTED DIGITAL TWIN CAN SECURELY CONTRIBUTE TO THE SYSTEM

2. POPULATED BY CONNECTING EXISTING AND NEW DIGITAL TWINS

1. IT BEGINS WITH A COMMON SOCIAL-TECHNICAL FRAMEWORK

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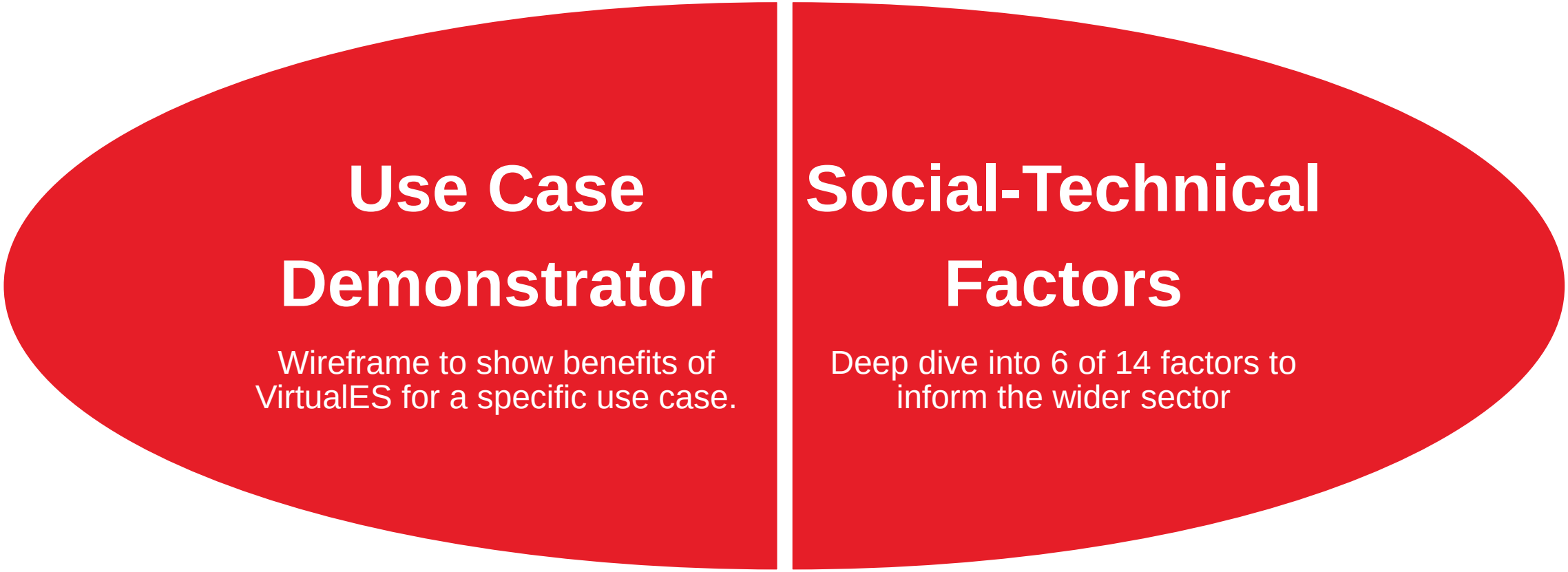
OUR APPROACH



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A SOCIAL-TECHNICAL FRAMEWORK

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DEMONSTRATOR USE CASE

DATA NEEDS & GAPS

Ed Rous Eyre

Senior Digital Consultant, Arup

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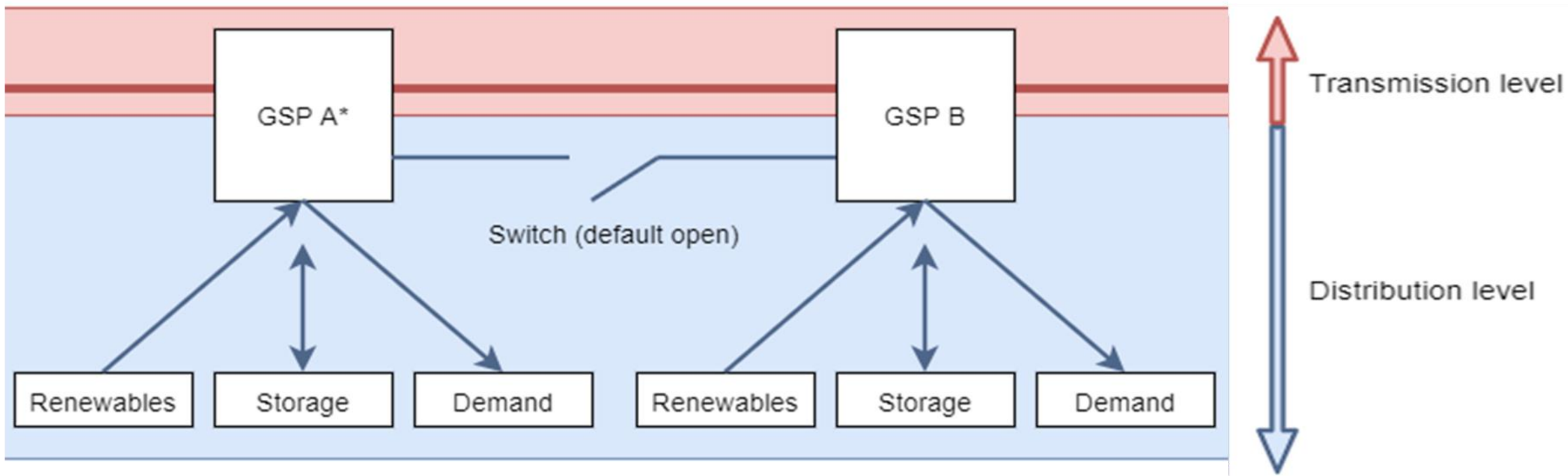
DEMONSTRATOR USE CASE

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



Example GSP configuration (GSPs can be owned by the TNO or the DNO)

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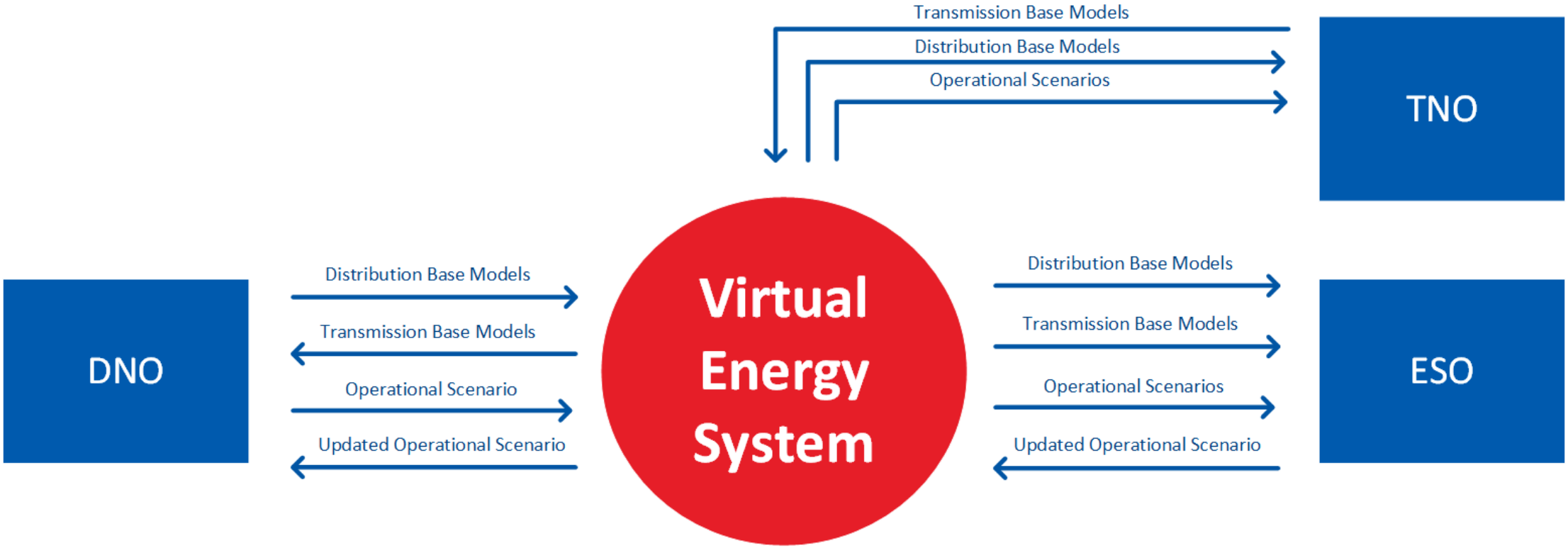
FUTURE OPERATING STATE – DATA FLOWS

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



ESO Key factors addressed: Engaging Stakeholders

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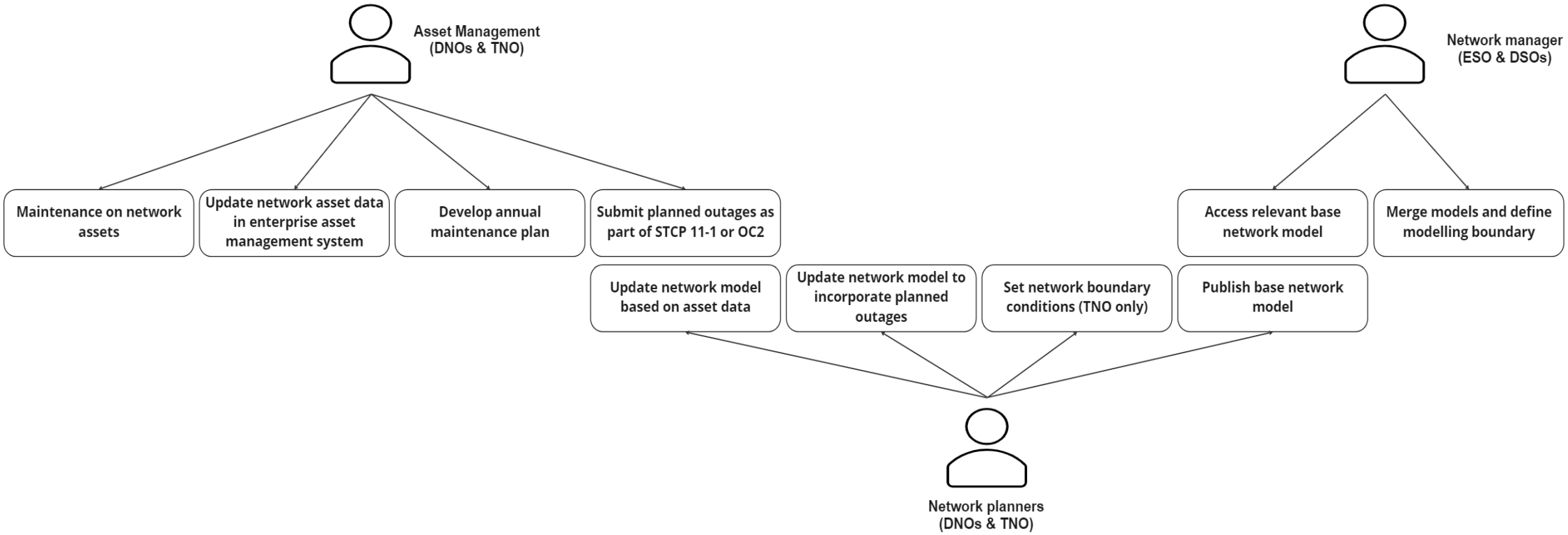
USE CASE DIAGRAM

Helping to describe the data and the key activities that would deliver the use case.

Base model publishing



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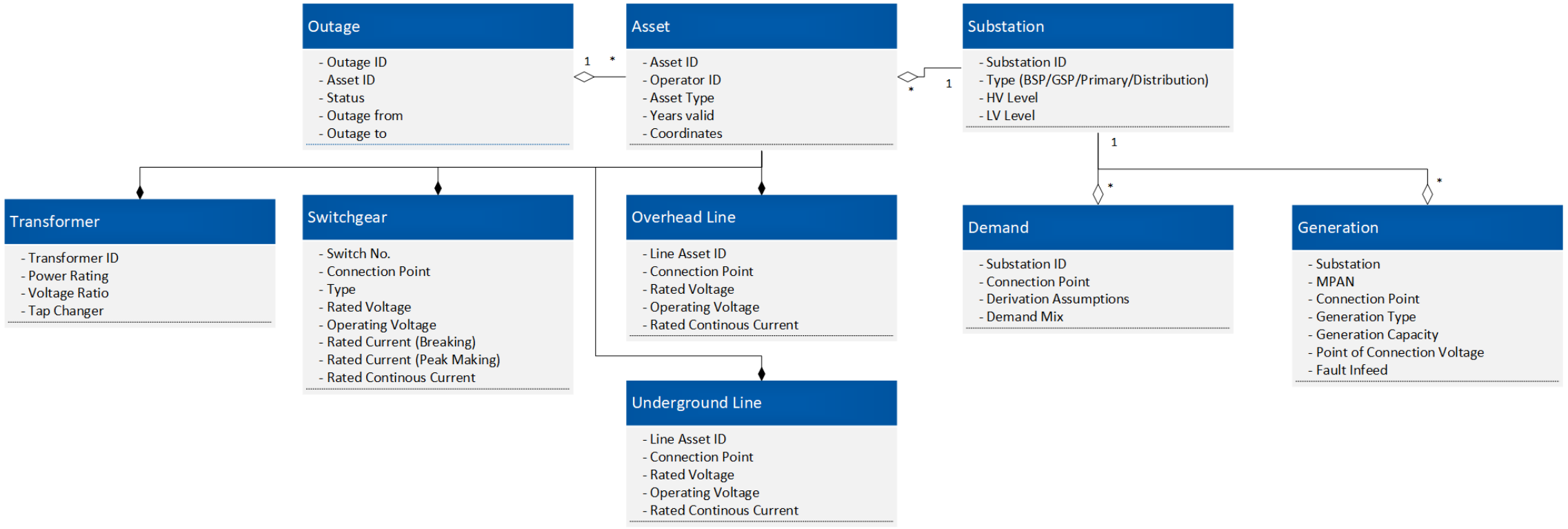
DATA PRODUCTS

Three data products identified that are critical to the implementation of the demonstrator. These are ***Networks, Assets & Operational Scenarios***



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Key factors addressed:

Aligning models & taxonomies

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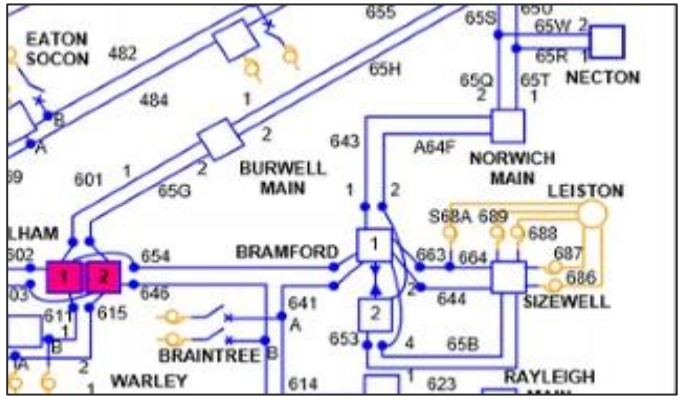
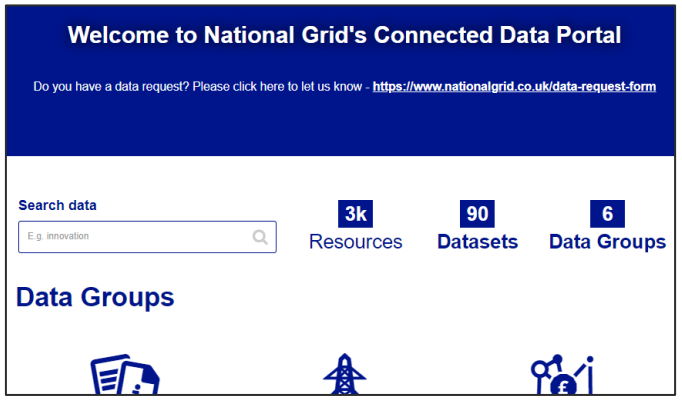
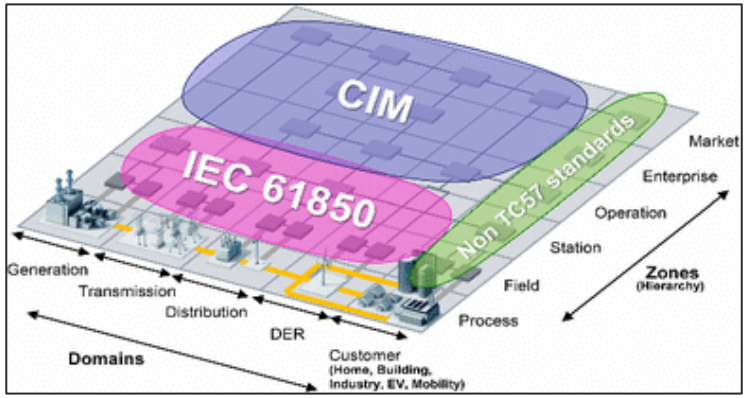
GAP ANALYSIS – EXISTING DATA LANDSCAPE



Data exchanges



Data portals



Data standards

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Key factors addressed:

Aligning models & taxonomies

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SOCIAL-TECHNICAL RECOMMENDATIONS

People

- Continued engagement across the industry to promote VirtualES

Process

- Map the key user and data interactions and document process flows
- Certification process to validate network data quality
- Process to develop globally unique node IDs and to merge networks
- Consistent approach for implementing boundary conditions for reduced network modelling.

Data

- Greater alignment to a data standard
- Determine the appropriateness of CIM
- Assess interoperability and data loss challenges converting from proprietary standards to CIM.

Technology

- Engage with power flow modelling vendors to understand their roadmaps
- Test technology platforms to facilitate data sharing between parties.

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Key factors addressed:

Raising awareness & fostering culture

Creating a governance framework

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USE CASE

TECHNOLOGY ARCHITECTURE

Andy Kervell
Associate, Arup

John Bintu
Solutions Architect, Arup

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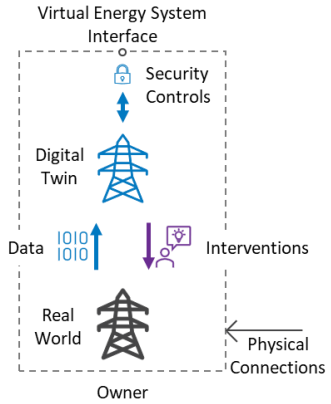
INTRODUCTION

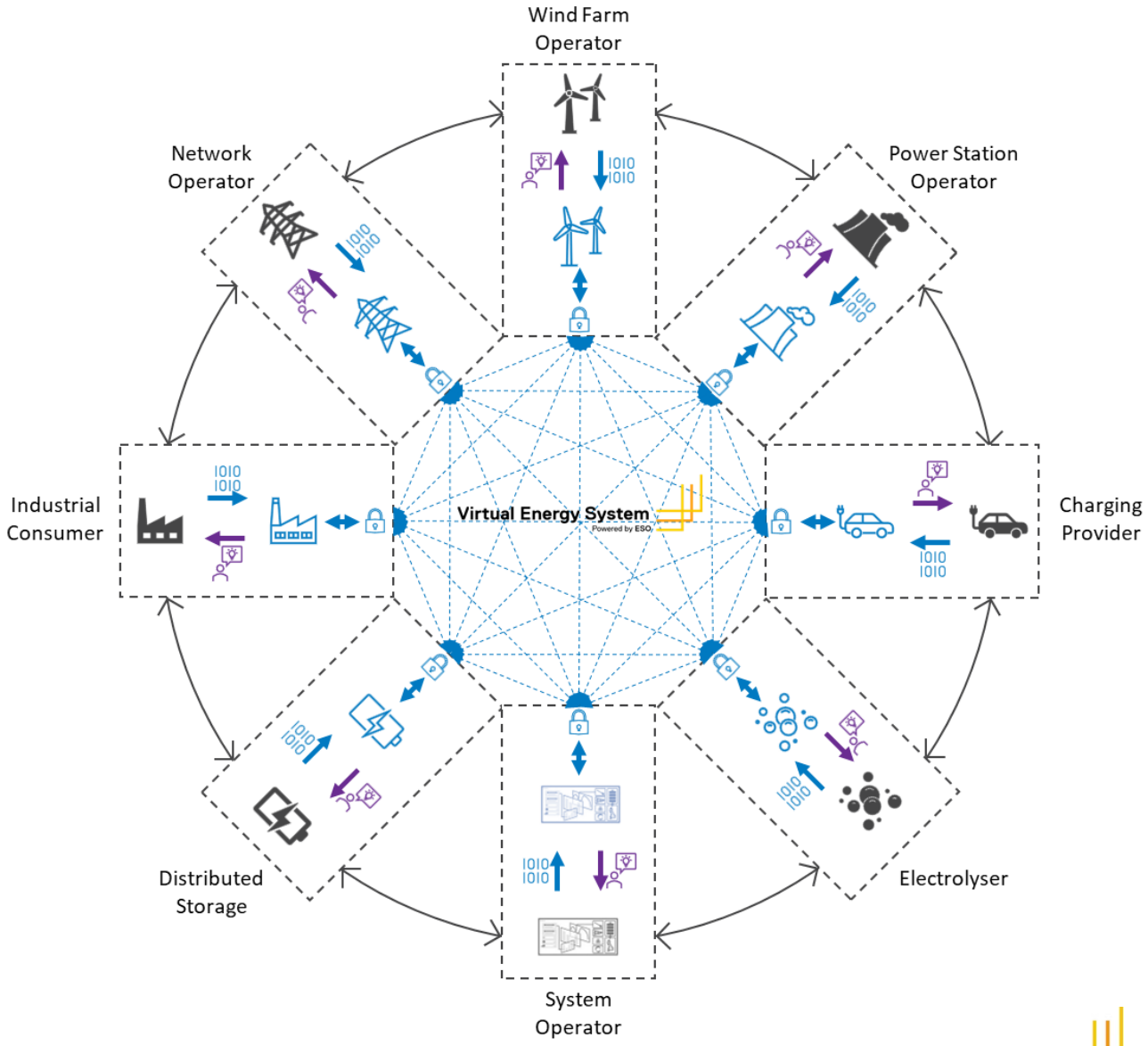
Overview

The success of the Virtual Energy System depends on the implementation of a suitable data sharing architecture.

Key considerations

- Data sharing
- Security
- Technology
- Architecture





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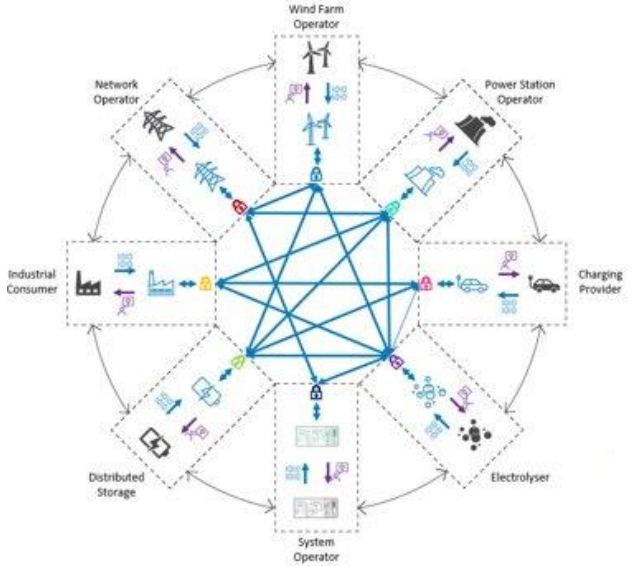
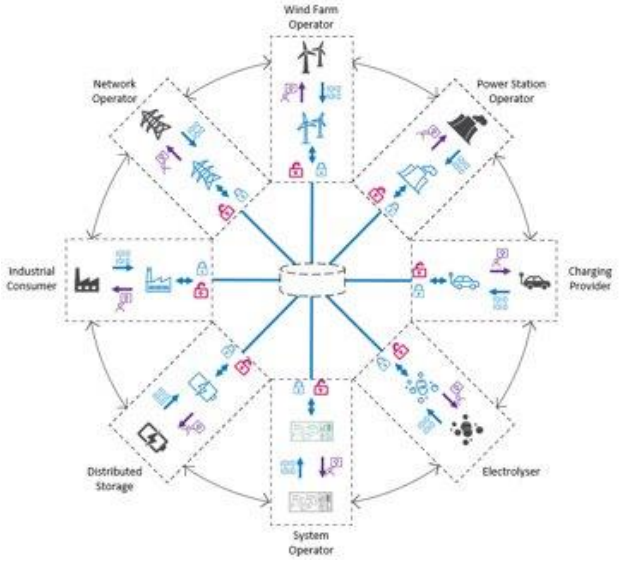
DATA SHARING OPTIONS

Data sharing options assessed

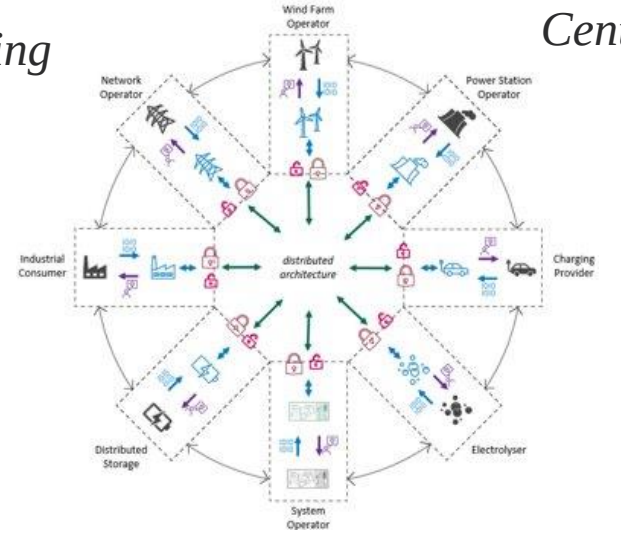
1. *Point-to-point sharing*
2. *Centralised datastore*
3. *Data portal*
4. *Distributed storage system*
5. *Distributed streaming platform*
6. *Data virtualisation*



Point-to-point sharing



Centralised datastore



Distributed streaming

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Key factors addressed:

Creating Interoperable tech-stack

Increasing visibility & enabling sharing

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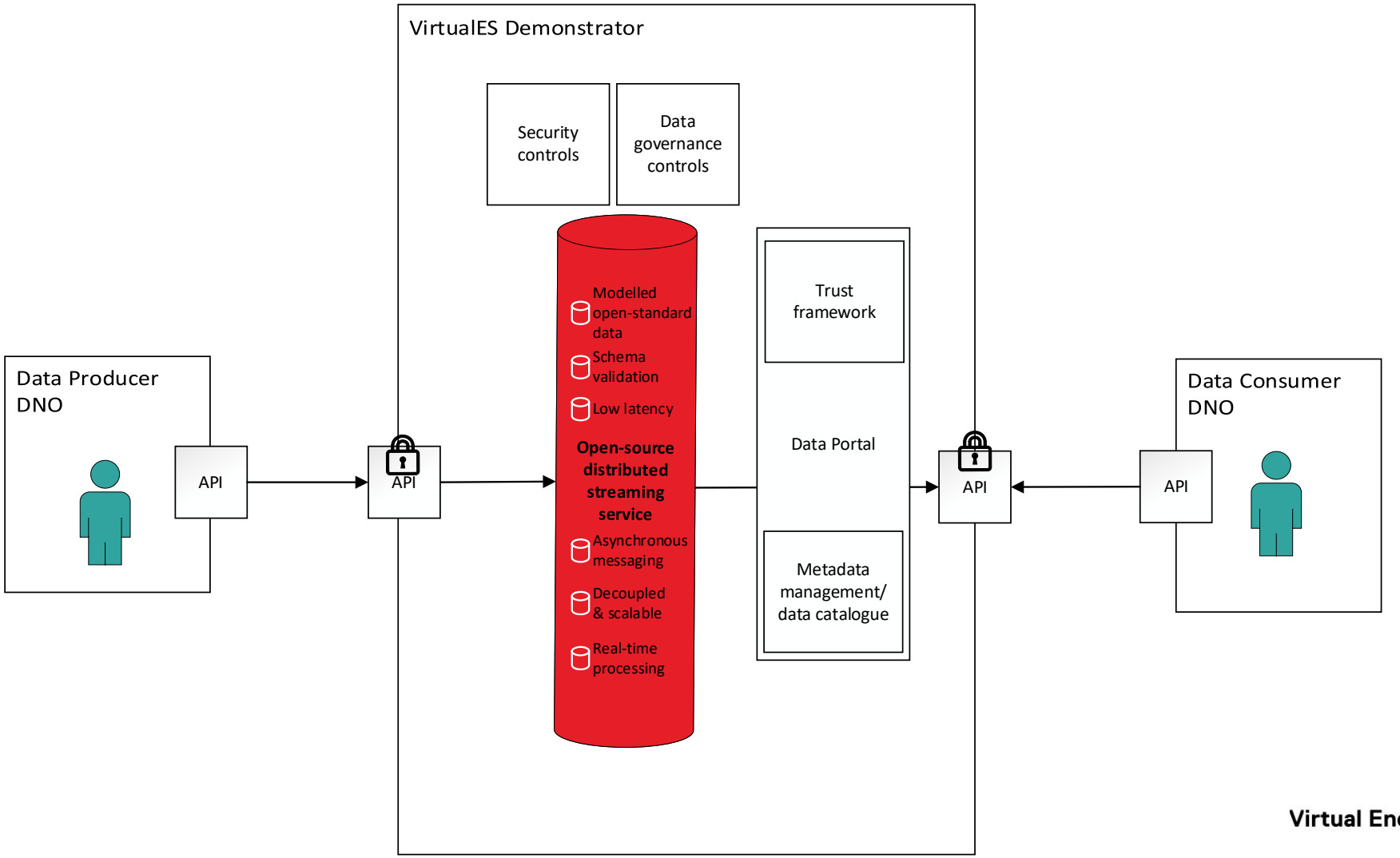
HIGH LEVEL DESIGN FOR THE DEMONSTRATOR



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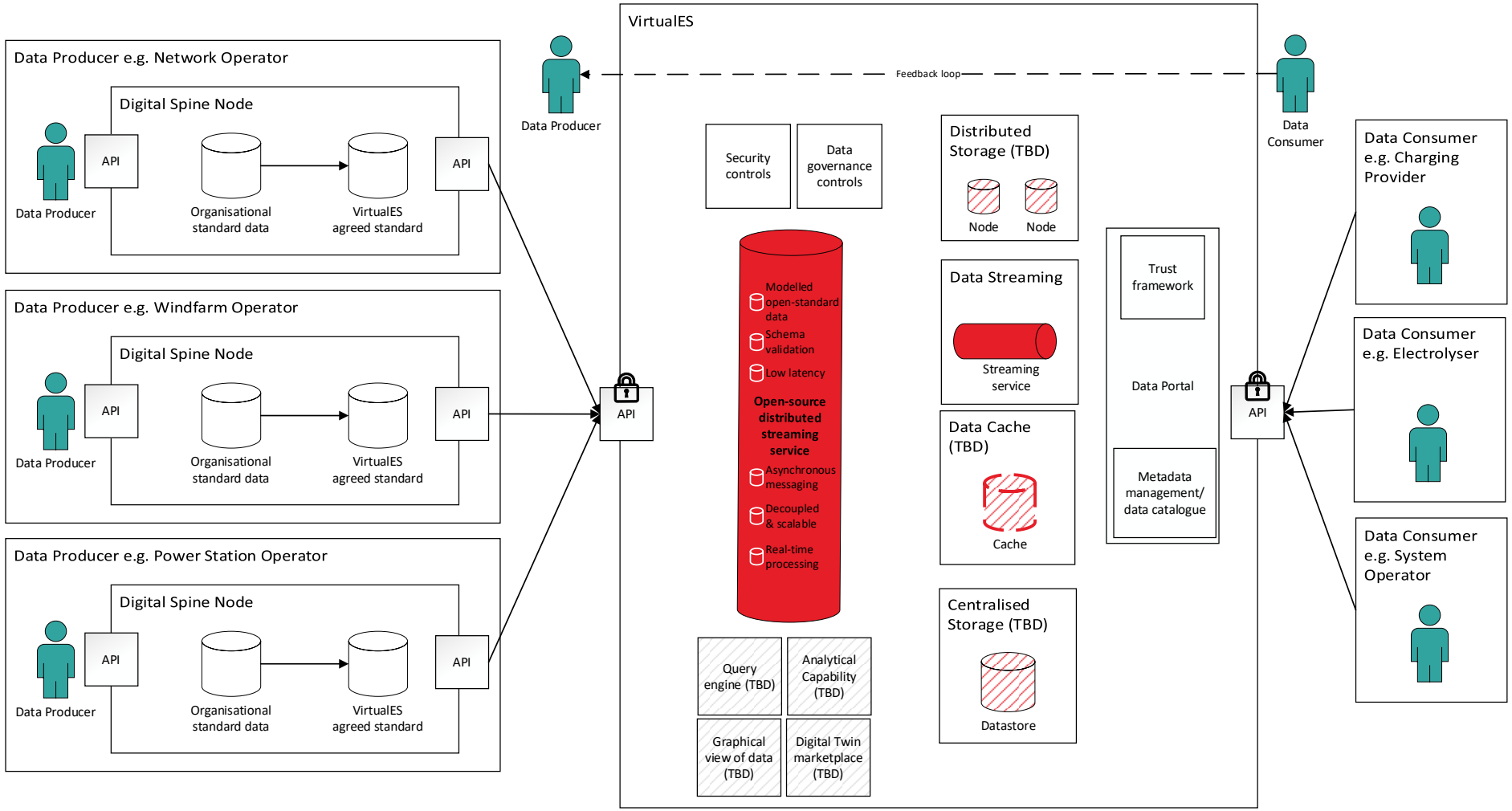
POTENTIAL HIGH LEVEL DESIGN FOR FUTURE VIRTUALES



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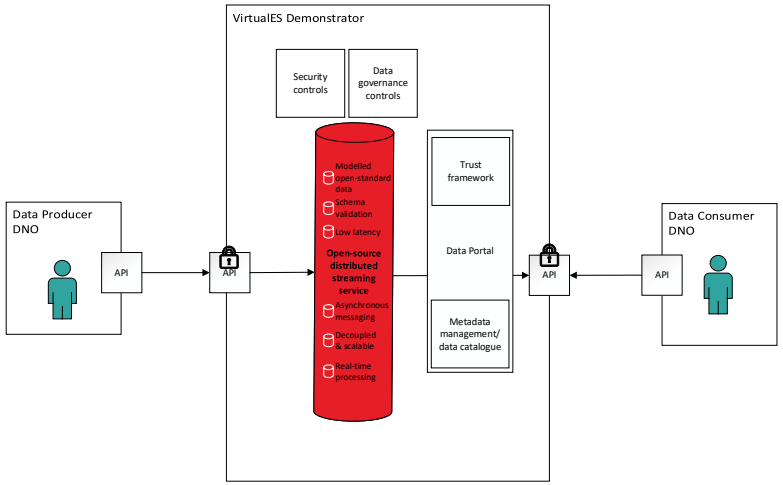
RECOMMENDATIONS

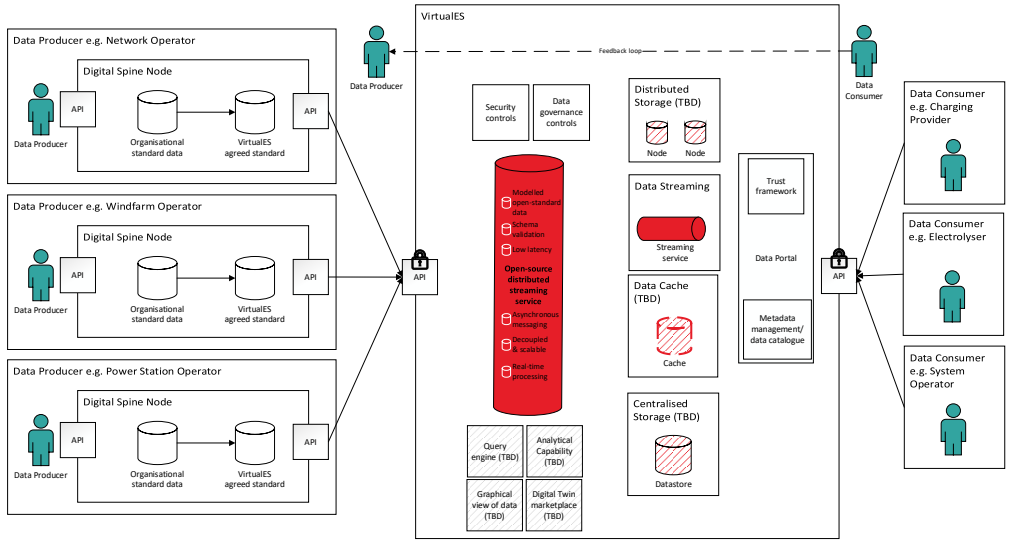
Key recommendations

1. *Fully distributed architecture*
2. *Demonstrator use-case to set the foundation for future iterations*



Demonstrator high level design

Further development



Future vision high level design

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NEXT STEP

Beatrice Nassi
Senior Business Analyst, Arup

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NEXT STEPS

Demonstrator

Field test elements of the VirtualES

Social Technical Factors

Define how social technical factors should be delivered to supports the VirtualES implementation and sector wide adoption

Gas Use Case

Evaluate a gas sector specific use case in relation to VirtualES

Cost Benefits Analysis

Evidence the value which could be enabled by the Demonstrator and the Common Framework

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QUESTIONS FOR THE AUDIENCE

Simon Evans

Global Digital Energy Leader, Arup

All questions via Slido

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QUESTIONS ASKED VIA SLIDEO

1. What are your thoughts on the demonstrator we just explained?

2. What are you thoughts on the high level design for the future VirtualES?

3. What are the core features you'd expect to see in the VirtualES?

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Q&A

Simon Evans

Global Digital Energy Leader, Arup

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