Virtual Energy System

Powered by National Grid ESO

BUILDING THE VIRTUAL ENERGY SYSTEM


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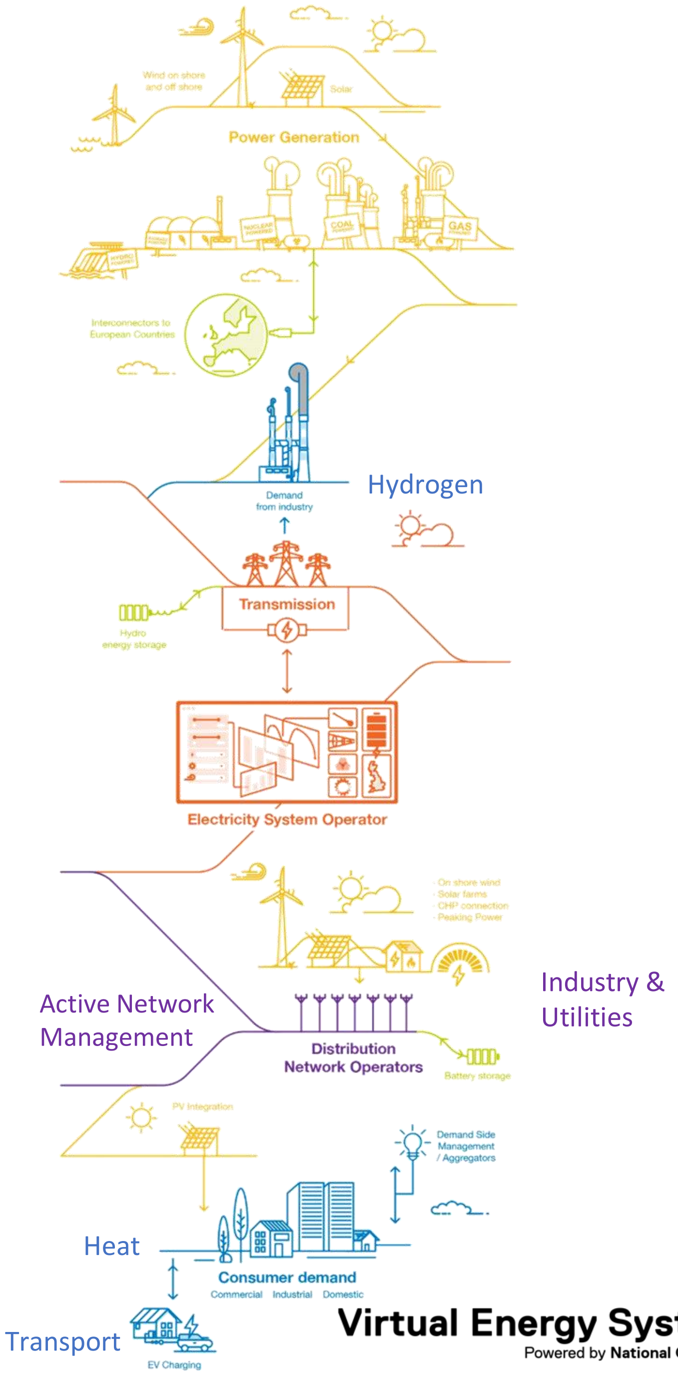
THE CHANGING ENERGY SYSTEM

40GW	18-30GW	120-230GW
Offshore Wind by 2030	Interconnection by 2041	Flexibility by 2050
FES - 2021	NOA - 2022	FES - 2021

“Increased data availability and digitalisation of systems is fundamental to enable markets and technology to manage peaks and troughs.”
Bridging the Gap 2021



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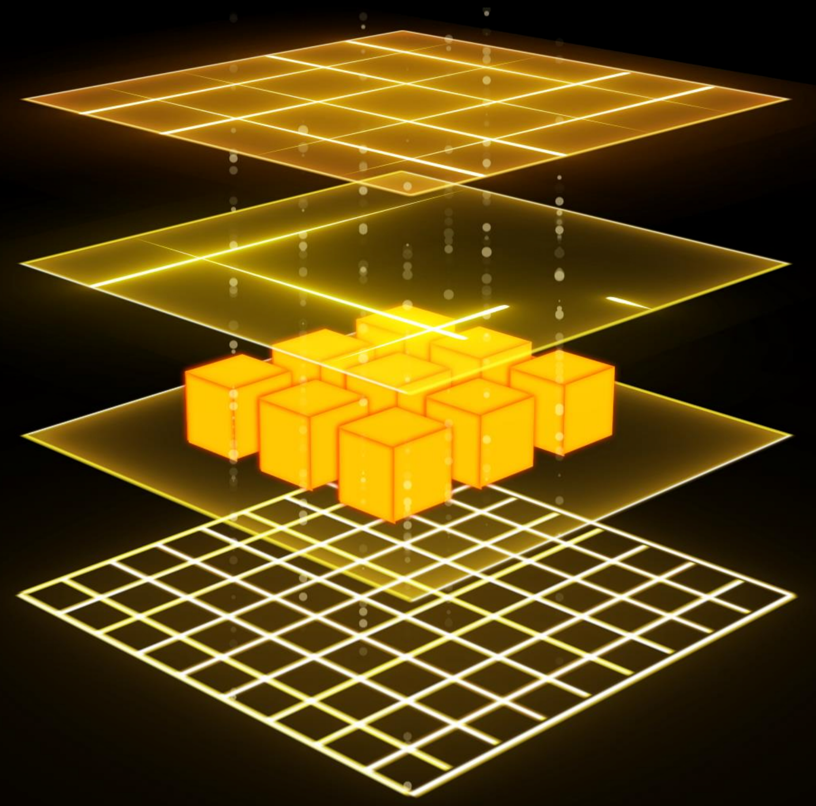
VIRTUAL ENERGY SYSTEM

Objective:

- enable the development of an ecosystem of digital twins for the GB energy system

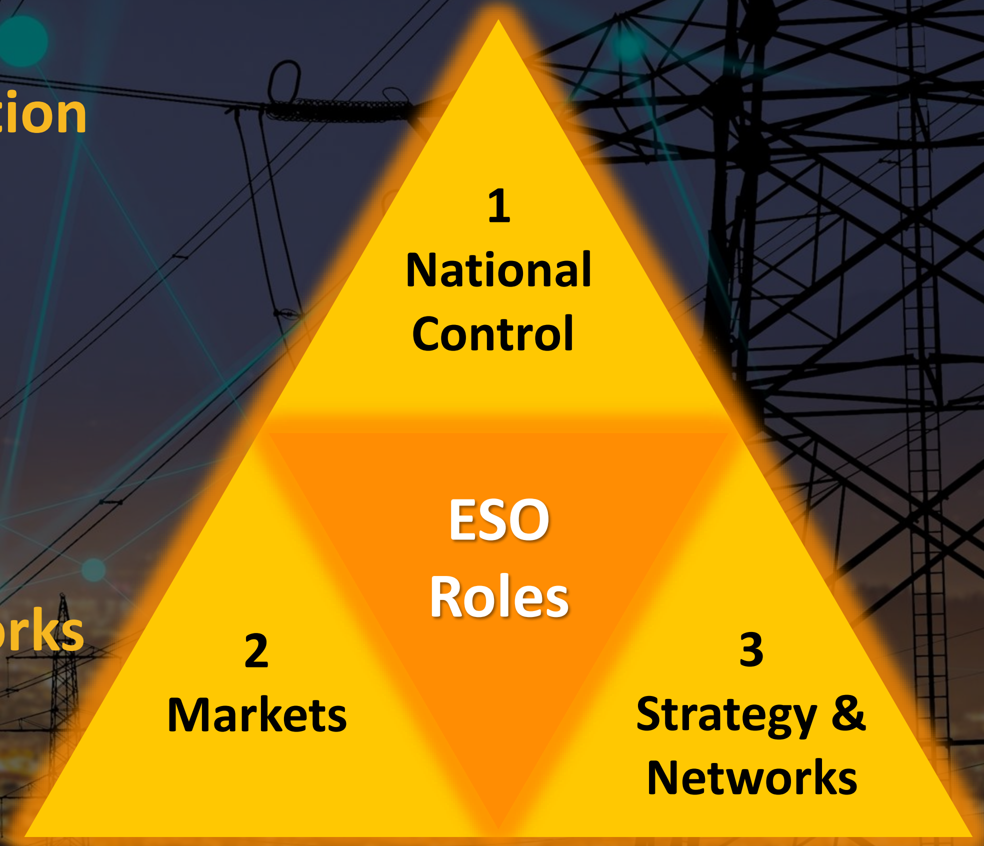
3 workstreams:

- Stakeholder engagement
- Common framework & principles
- Use cases



INITIAL USE CASES

1. **National Control**
   - enhancing **optimisation** and **data integration** capabilities to support **dispatch** decisions
2. **Markets**
   - understanding **consumer** and **technology** dynamics to simulate **flexible demand**
3. **Networks**
   - developing digital twins of **physical networks and assets** to support system **stability**



VIRTUAL ENERGY SYSTEM: COMMON FRAMEWORK

1. **Benchmarking:** Understanding the current cross-sector and global best practice for connecting assets, systems, and digital twins.

2. **Key socio-technical elements:** Determining the key socio-technical factors that need to be considered for the Virtual Energy System to succeed.

3. **Demonstrating the common framework:** Collaboratively prove and demonstrate, with industry, how the socio-technical principles work

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1) BENCHMARKING - APPROACH

Segments — Generation | Transmission | Distribution | Retail | Consumption

Use cases

1. Transition to net zero
2. Asset monitoring & predictive maintenance
3. Optimisation of energy production
4. Linking electricity & gas networks
5. Real time and predictive balancing
6. Flexibility modelling for increase renewable
7. Model energy storage needs
8. Demand response
9. Planning the future transmission network
10. Optimise connectivity capacity
11. Model stability of network
12. Visibility of transmission & distribution interface
13. Hazard event & threat impact simulation
14. Multi-pathway resilience modelling
15. Asset monitoring for improved modelling
16. Predict localised energy production
17. Real time distribution network optimisations
18. Optimise energy storage usage
19. Planning future distribution network
20. Improve demand forecasting
21. Better services to customers
22. Smart demand response
23. Prosumers
24. Planning of local LCT implementation

Sectors — Aviation | Banking | Energy | Rail | Maritime & Shipping | Telecoms | Water

Energy: Australia, Estonia, Singapore

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1) BENCHMARKING - LESSONS LEARNT

People
- Skills
- Capability
- Key roles

Process
- Government
- Regulatory involvement
- Political support
- Transparent Engagement
- Contractual relationships

Technology
- Cyber security
- Computing power
- Connectivity
- Security & privacy
- Trust in distribution
- Open software
- Ease of reliable interoperability
- Modelling
- Cost of technology

Data
- Data best practices
- Data completeness
- Harmonise existing data standards
- Interoperability
- Common taxonomies & ontologies
- Data visibility

ARUP

2) KEY SOCIO-TECHNICAL FACTORS

People	**Defining roles & responsibilities** Formalise R&R for the VirtualES with the intentions of consumer benefits	**Raising awareness & fostering culture** Share vision, belief & behaviours. Enabling practices to support VirtualES objectives	**Building capabilities & skills** Understand skills & competency needs & develop capacity building strategies	PRIORITY FACTOR
Process	**Aligning around industry codes & standards** Identify standardised practices in industry & align around them	**Engaging Stakeholders** Nurture industrial, governmental and political support	**Creating a governance framework** Set strategy and operational governance of the VirtualES	**Determining operating environment** Business models, cross organisational legal, policy, & contractual framework
Data	**Aligning models & taxonomies** Harmonise existing data standards, taxonomies and ontologies.	**Establishing management & governance** Data management & governance requirements	**Increasing visibility & enabling sharing** Nurture effective data sharing to support interoperability	**Managing security** Set the core rules needed to address security, privacy and risk implications surrounding VirtualES data
Technology	**Connecting physical infrastructure** Physical infrastructure, devices and their connectivity required to operate the VirtualES	**Enhancing modelling and analysis** Modelling / simulation & analysis software used for current & future modelling	**Creating interoperable tech-stack** Communication, cooperation & sharing across VirtualES & other in/cross sector projects	

3) DEMONSTRATING THE COMMON FRAMEWORK

"Collaboratively prove and demonstrate, with industry, how the socio-technical principles work"

- Testing of key factors
- Cross segment
- Wide appeal
- Leverages existing work
- Theoretically feasible

Project Supporters:

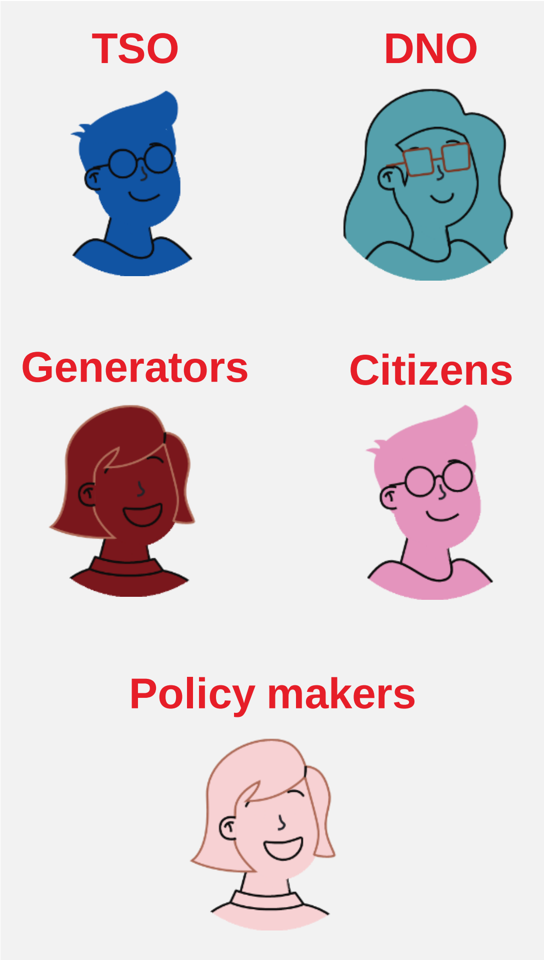
3) USE CASE: VISIBILITY FOR FLEXIBILITY

Context

- Net zero is a key goal of the industry
- Energy increasingly coming from renewable & distributed generation
- Significant impact on the flexibility of the energy system as a whole

Hypothesis

- Lack of end-to-end visibility of T&D assets, connectors, network capacities, and constraints
- This creates obstacles to accurately model, assess and control the whole system flexibility
- Enhance whole-system flexibility by making relevant information visible and accessible in machine readable formats, to all actors



HOW TO GET INVOLVED

- Show and tell – 7th April 2022

- Join our Mailing List

Contact Us: VirtualES@nationalgrideso.com

Find out more: https://www.nationalgrideso.com/virtual-energy-system