ESB Networks & EirGrid Joint System Operator Programme Virtual Briefing Webinar

Introductory Webinar

14 June 2024

Housekeeping

Please mute your microphone and turn off your camera during the webinar

Use MS Teams chat feature for comments/ reactions/ questions

This session will NOT be recorded. Voice/ Video/ Photo recordings are NOT permitted

Today's presentation will be shared after the session.

Registration for the next webinar will be issued to EirGrid and ESB Networks mailing lists today

Please note that by registering for this webinar, your name and email address are visible to relevant programme teams at EirGrid and ESB Networks and used solely to process your invitation to our webinar.
This session will not be recorded, however by joining this webinar on Teams, your name will be visible to other attendees on the call today.
The Q&A at the end of the session will be limited to the questions posted in the chat which relate directly to the content presented today. Any others will be addressed at our next webinar.

Agenda

1. General background and introduction
2. Future plans for engagement as part of this process
3. How the system currently works and drivers for change: Transmission system aspects
4. How the system currently works and drivers for change: Distribution system aspects

Speakers

Teresa Fallon
ESB Networks DMSO Design Lead

Eoin Kennedy
EirGrid, Head of Future Operations

Alan Keegan
ESB Networks JSOP and R&S Lead

Emma Fagan
EirGrid, TSO/DSO Programme Manager

Martin Hickey
ESB Networks DSO/TSO Technical Specialist

Martin Kerin
EirGrid, Senior Lead Engineer Future Operations

Background and Introduction

What is the purpose of this introductory webinar for EirGrid and ESB Networks Stakeholders?

1 | Provide and understanding of how the system currently works

Ensure stakeholders have a sufficient understanding of the current systems of operation of the TSO and DSO in Ireland to allow for better understanding of the changes that the Operating Model will implement

2 | Explain the drivers for change

Highlight the limitations of the current system and the opportunities posed by changes to this system

The TSO-DSO Joint System Operator Programme has four key pillars

A number of deliverables are defined under each of these workstreams each year, and published in the annual TSO-DSO Multi-Year Plan

Whole of System Approach

This workstream focuses on optimising the system as a whole rather than focusing on the transmission and distribution systems in isolation. Improved coordination between the DSO and TSO is important to deliver more efficient markets and a more resilient system.

Facilitating New Technology

Both system operators are looking to pilot new technologies and processes, and to facilitate the integration of new technologies. The system operators will work together to enable hybrid connections and supporting arrangements to optimise the use of existing infrastructure.

Reducing Dispatch Down

Renewable generation may be dispatched down to manage local transmission or distribution system constraints and/or curtailed at times to manage system wide limits. There will be a growing risk of oversupply of renewable generation, which will lead to a growing need to dispatch down. Minimising this dispatch down of renewable generation is important to ensuring the efficient use of renewable generation and achieving renewable energy targets in an economic manner.

Secure Future Power System

This workstream's objective is to address the long-term challenges and leverage the opportunities created by high renewables penetrations; high volumes of distributed energy resources (DER) and; widespread demand side flexibility.

The Operating Model will act as the backbone across all four pillars, with a number of tasks in each pillar contributing to or relying on its development

TSO-DSO Programme

TSO-DSO Future Operating Model

- Whole of System Approach
- Facilitating New Technology
- Reducing Dispatch Down
- Securing Future Power System

Why are we pursuing a future TSO-DSO Operating Model?

The TSO-DSO Operating Model aims to facilitate changes to electricity production and consumption by facilitating co-ordination between the system operators

Changes to Electricity Production & Consumption

There are significant changes to the scale and characteristics of electricity production and consumption on the distribution network.

These changes include:

- Non-firm generation connections;
- High penetration of roof-top solar;
- Electrification of heating and transport.

Facilitating Co-ordination

DSO and TSO co-ordination is important to facilitate these changes, providing benefits including maximising availability of distribution system flexibility, increasing efficiency, and ensuring certainty for system security.

Such co-ordination considers complex and fundamental aspects of operation of distribution system connected resources, including scheduling and dispatch.

Why are we pursuing a future TSO-DSO Operating Model?

The TSO-DSO Operating Model will also provide solutions to existing and potential challenges which are facing the system operators

Challenges

TSO Challenges

- Oversupply
- Curtailment
- Constraints
- Ramping
- System balance
- Security of supply
- System stability
- Service provision
- Decentralization of resources

DSO Challenges

- Network congestion
- Carbon abatement
- DER growth and co-ordination
- Cost and pace of capacity for electrification
- Customer participation
- Community energy

Solutions

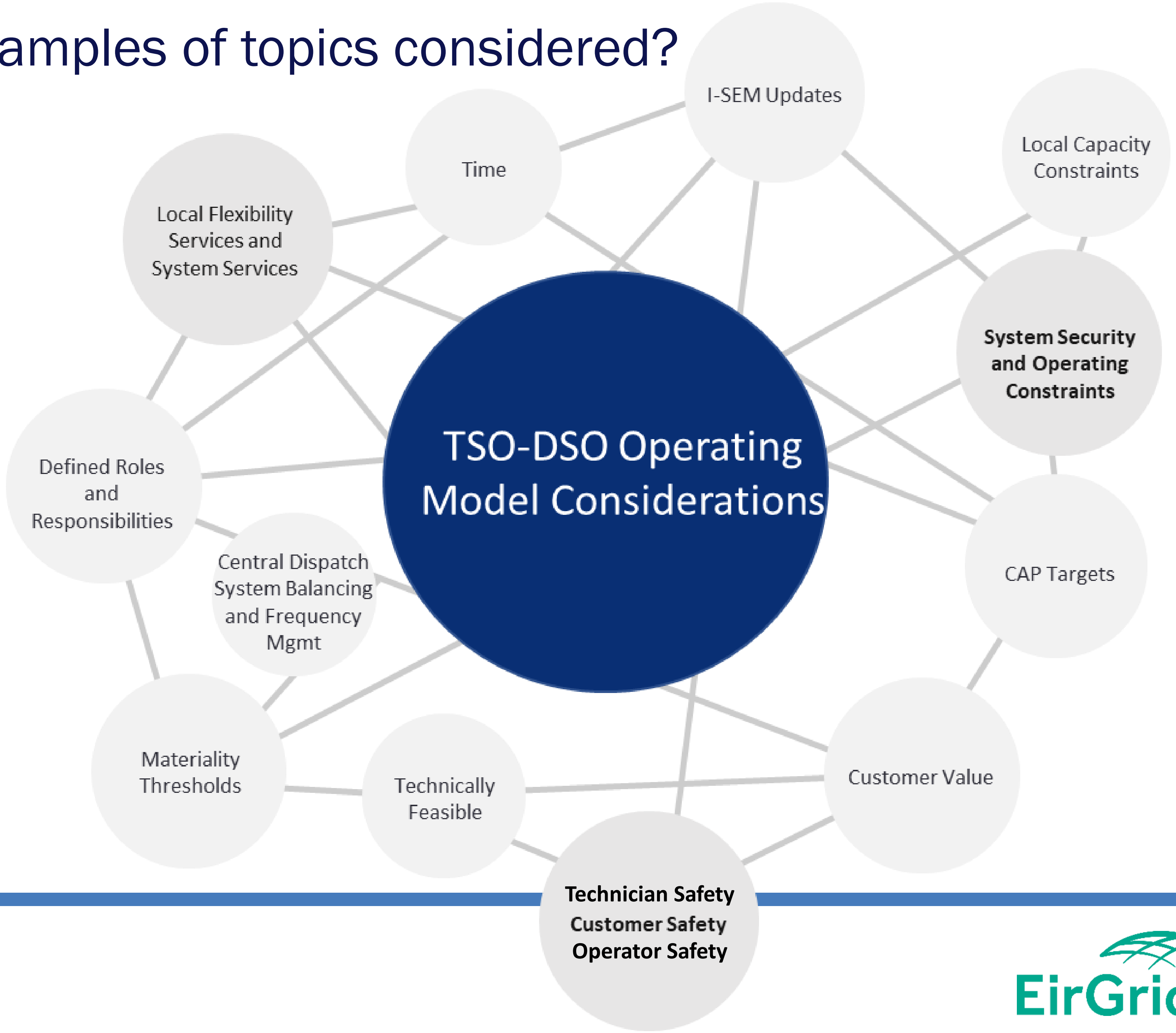
TSO Solutions

- Access to distribution system resources for energy
- Services
- Forecast information
- Distribution system visibility

DSO Solutions

- Flexible connections
- Flexibility markets
- Visibility
- Forecasting and optimisation

What are examples of topics considered?



Future plans for engagement

TSO/DSO Op Model Upcoming Engagement Overview

Stage 1 Industry Webinar	Stage 2 Industry Webinar
Today, Fri 14th June (11:30am-12:30pm)	**Thursday 27th June: Please watch your inbox for an invitation to register which will be issued today.**
Briefing webinar (60 mins) • General background and introduction • Future plans for engagement as part of this process • How the system currently works and drivers for change: Transmission & Distribution system aspects	Detailed webinar (90 mins) Detailed walk through of Vision and Principles of - Forecasting & Bid Management - Optimisation & Scheduling - Activation & Dispatch - Settlement - A day in the life worked example
This webinar being in response to feedback, purpose of this meeting being to bring people to the same level in terms of how the system currently works before we get into how it is proposed to change, etc.	Give participants an overview of vision and principles. Chance to articulate how this would impact them and ask questions.

EirGrid ESB NETWORKS

How the system currently works and drivers for change: Transmission system aspects

Drivers of change

Whole electricity system challenge

Supply

Offshore Wind
(+ 5 GW)

Onshore Wind
(+ 4.5 GW)

Solar
(+ 5.5 GW)

Small Scale
(+ 2.5 GW)

Conventional
(+2.2 GW)

Shaping Our Electricity Future

+ c. 350 Network Reinforcements

+ c. 25 Smart Network Devices

+ System Operation Transformation

+ Electricity Market Transformation

+ 3 HVDC Interconnectors

+ 2.4 GW Long Duration Storage

+ Over 20% demand flexibility

+ 10 GVAs Low Carbon Inertia Services

Demand (+50%)

Large Energy Users
(~1.6 GW)

Electric Vehicles
(~950 k)

Heat Pumps
(~600 k)

Social & Economic Growth

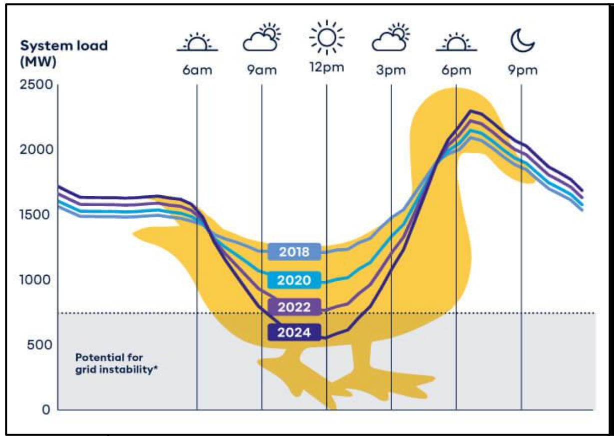
Drivers of change

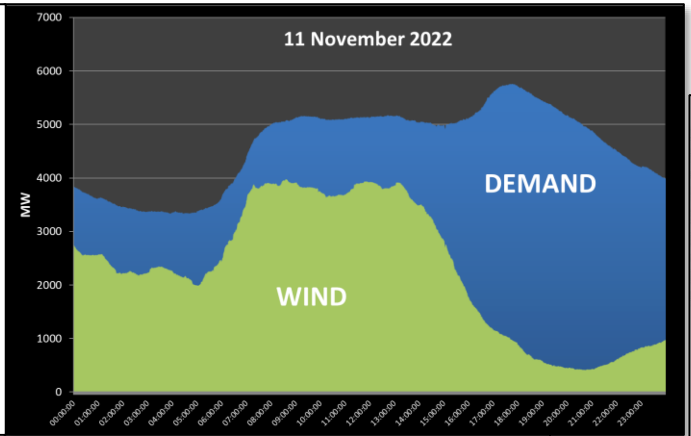
Integration of non-synchronous variable renewables

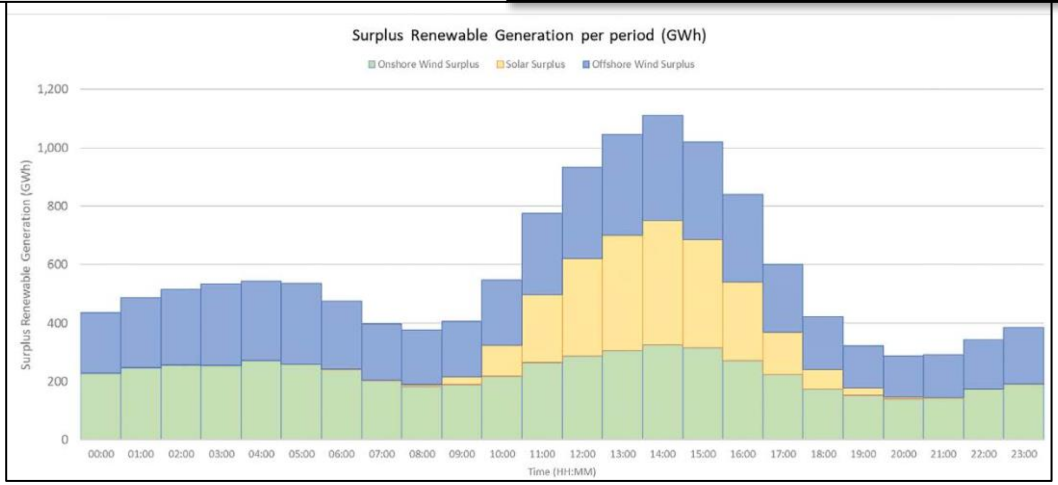
- System energy balance (frequency stability, surplus renewable energy)
- System Non-Synchronous Penetration limits (curtailment)
- Ramping (net demand, forecast errors)
- Generation adequacy

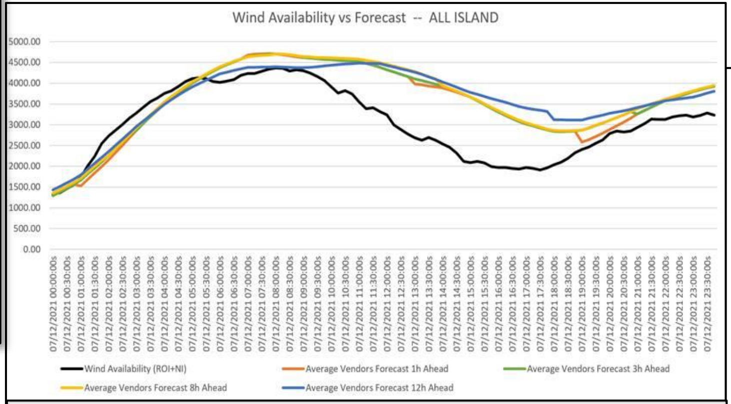
System challenges

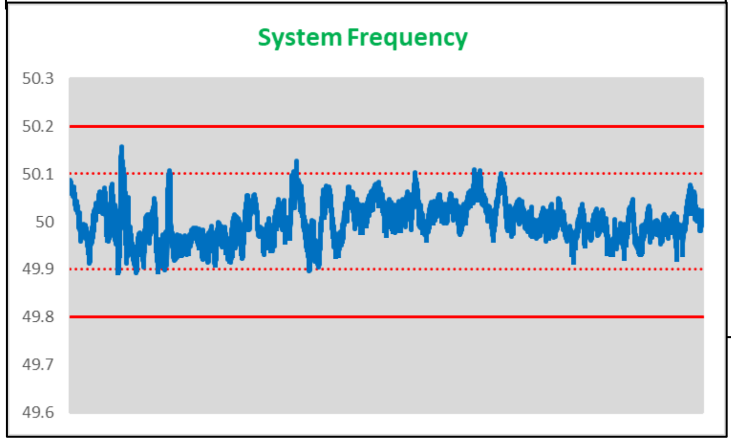
- System frequency stability and control (system balance, inertia, reserve, ramping, very low frequency oscillations)
- Transmission network capacity (constraint)
- Power quality (harmonics)
- Transient stability (synchronizing torque, damping torque)
- Voltage stability (Steady-State Voltage Control, Dynamic Voltage Control, Reduction in Available Fault Current)

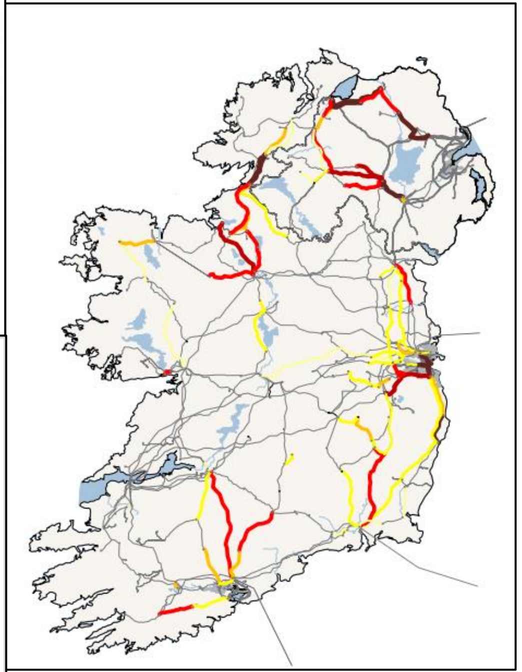












Solutions to challenges

Identification | Incentivisation | Arriving Capability

Developing Our Know How

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030

75% → 85% SNSP

85% → 95% SNSP

The changing landscape of system service suppliers

Renewables, DSM, Storage, LCIS, and others

Conventional Generation

ILLUSTRATIVE

Solutions to challenges

Operational Policy Roadmap

- System Non-Synchronous Penetration (SNSP) limit to increase from 75% to 95%
- Minimum number of conventional units' constraint to relax from 7 to 3 or less across the island
- Inertia floor requirement to decrease from 23GWs to ~20GWs and change from all-island to regional requirement
- New system strength policy
- To achieve these objectives, new services, operational tools and capability are required

Decision Making Ability

Improvements can be made to the decision-making ability through systems:

- Market Management System (MMS)
- Energy Management System (EMS)
- Electronic Dispatch Instruction Logger (EDIL)
- Look Ahead Security Assessment Tool (LSAT)
- Ramping Margin Tool (RMT)
- Voltage Trajectory Tool (VTT)

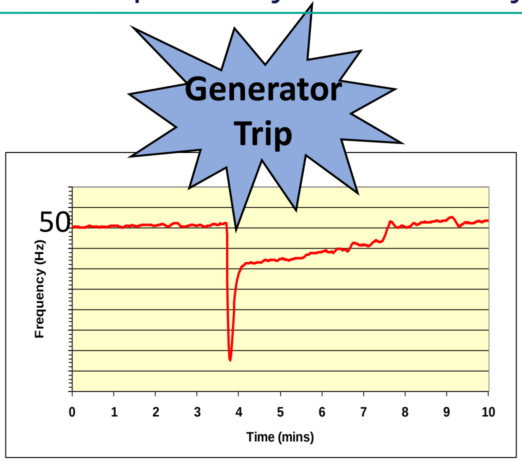
Projects

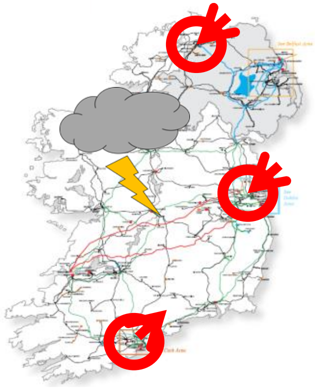
Examples of major projects which will provide solutions include:

- Scheduling and Dispatch Project (SDP)
- Long Duration Energy Storage (LDES) investment incentives
- Operational Tools and Capability Enhancement (OTCE) programme
- Strategic Markets Programme (SMP)
- Future Arrangements for System Services (FASS) programme

Scheduling and dispatch process – Four main aims

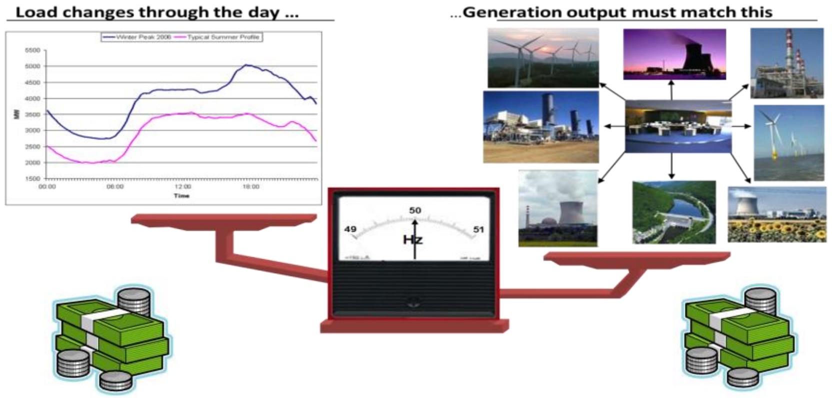
Maintain power system security



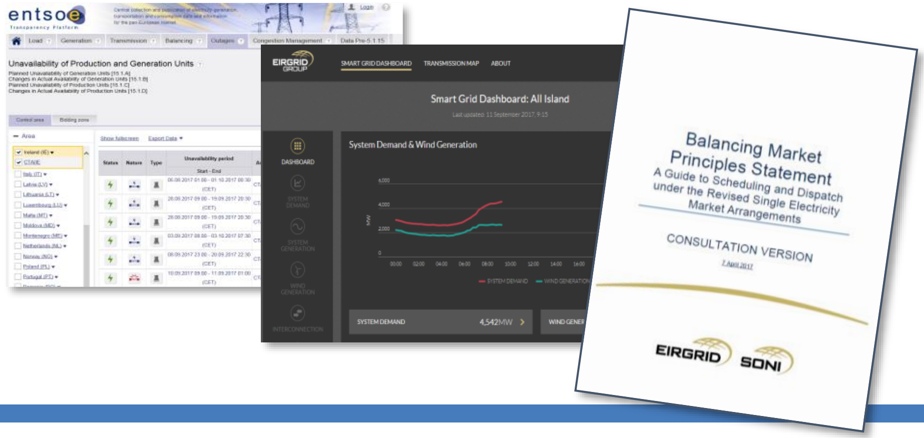


Maximise priority dispatch generation

Facilitate efficient operation of the market



Provide transparency



EirGrid ESB NETWORKS

Scheduling and dispatch process – Considerations and objectives

Europe
- Regulations
- Directives

National Legislation
- Northern Ireland Statutory Instruments
- Ireland Statutory Instruments

Regulatory Decisions
- SEM Committee decisions
- CRU / UR decisions

Licences
- EirGrid and SONI TSO licences
- EirGrid and SONI MO licences

Codes
- EirGrid and SONI Grid Codes
- Trading and Settlement Code

01
Maintain energy balance while minimizing cost of deviation

enacting the results of the ex-ante markets and keeping real-time energy balance

02
Transmission system congestion management

including thermal limits, and in some cases, distribution system aspects such as DSU instruction sets

03
System security

including operational constraints

04
System services

including reserves, ramping, inertia, voltage

05
Policy objectives

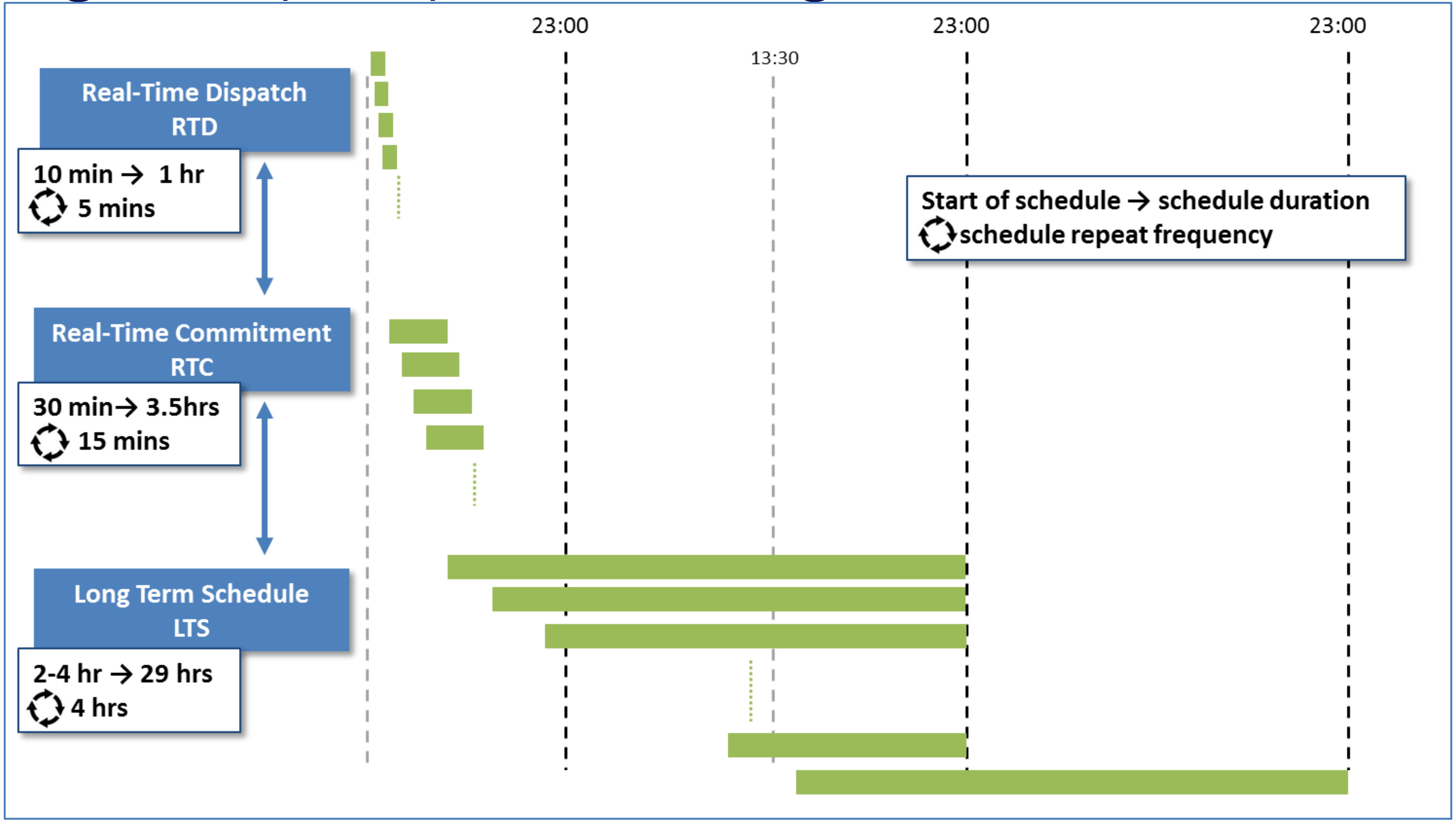
including maximise priority dispatch generation, curtailment and constraint of renewables

Objectives		Inputs		Outputs
Ensuring Operational Security		Policy Parameters		Indicative Operations Schedules
Maximising Priority Dispatch	+	Participant and Service Provider Data	→	Dispatch, Control & Cross-Zonal Actions
Efficient Operation of the SEM		System Operator Data		Data to Pricing and Settlement
Provision of Transparency		Interconnector Schedules		Data for Publications

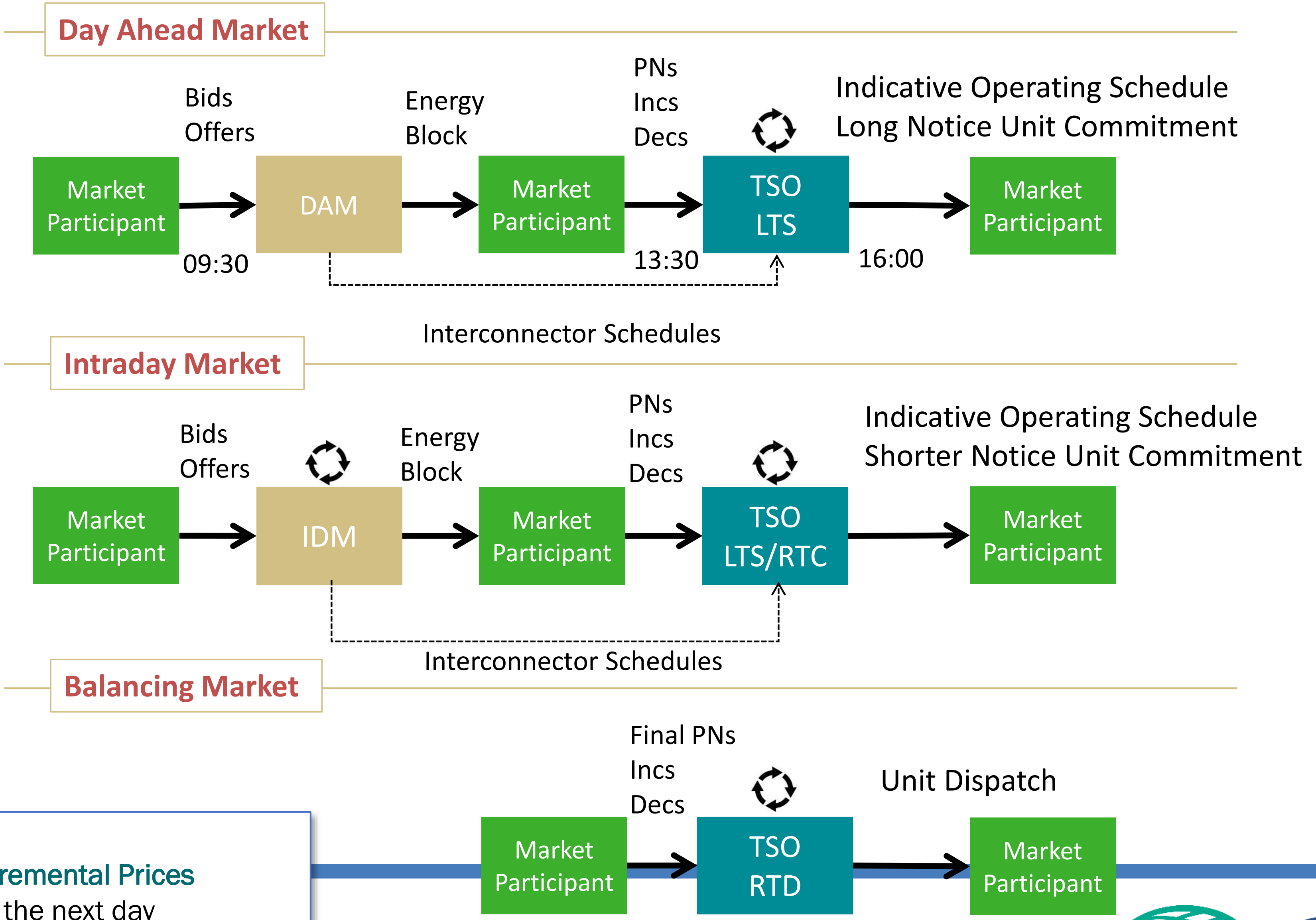
Scheduling and dispatch process – SEM / Ireland market characteristics

SEM / Ireland Specifications	Topic	Other European Jurisdictions Specifications
One synchronous island system, HVDC non-synchronous interconnections, very high levels of non-synchronous generation	**Synchronous system**	Continent with multiple synchronised systems, AC synchronous interconnection, operating at less high levels of non-synchronous generation
Relatively small size at ~7GW, more dynamic with smaller changes	**Relative size**	Relatively large size at ~435GW, less dynamic with smaller changes
"Central dispatch" approach, single co-optimized process to meet energy balance and operational security requirements with complex bidding data	**Core dispatch approach**	"Self dispatch" approach, separate processes for managing different needs and with simpler bidding data
Centralized day-ahead and intraday markets only for physical trades	**Route to market for energy**	More opportunities for physical trading before day-ahead or bilateral trading
Mandatory unit-based	**Balancing market participation**	Mostly voluntary portfolio-based
Change output only in response to dispatch instruction	**Output position**	Change output of own accord-based energy market trading positions, including system operator markets
Manual real-time dispatch instructions, at any time on a last-time-to-call/order basis, and on "open" basis (instruction persists until next instruction)	**Balancing market processes**	Mix of manual instruction and automatic-response closed-loop processes, operating in more specific market timeframes, and on "closed" basis (instruction to deviate from and then return to original position)
Open at the same time as the intraday market primarily to be mechanism for redispatch	**Balancing market timing**	Mostly only open "in the last hour" with separate mechanisms for redispatch

Scheduling and dispatch process – Timings



Scheduling and dispatch process – Market interactions



PN – Physical Notification
Incs/Decs – Incremental / Decremental Prices
LTS - Long-Term Schedule – for the next day
RTC - Real-Time Commitment – for the next four hours
RTD - Real-Time Dispatch – for the next hour

How the system currently works and drivers for change:

Distribution system aspects

A new integrated energy ecosystem is emerging, that is interconnected in a multidirectional, customer-driven and digitally enabled network…

Increase of Distributed Energy Resources (DER)…

- Connection of ever more renewables to transmission & distribution
- Installation of utility scale storage for intermittent generation

Network of the Future

Bi-directional flow of energy and data…

- Effective, **interoperable communication** infrastructure to interact with everyone
- **Integrate DER, Storage** and build **flexibility** services

New loads and capacity…

- Managing **peak demand and grid planning**
- **Enable demand response, Electric Vehicle (EV), V2G services and electrification**

Rise of the "prosumers"…

- Active participation in the energy system through DER – Solar, Battery, V2G.
- Customer expectations
- Beyond kWh – product and service innovation

Increasing stress on the distribution network…

As a result of the energy transition, ESB Networks are facing a new set of challenges

EirGrid ESB NETWORKS

For Ireland and ESB Networks, the countdown to this new energy ecosystem is well under way…

Counting down to a new Irish energy system

2025-28
EV vs Combustion cost parity

2030
2.3GW
PV installations less than 200kW

2040
ESBN Net Zero Transition

Smart Meters
1.7 Million
Smart meters installed already, 2.4m targeted nationally

Renewable Targets
22GW
RES
CAP23 2030 9GW onshore wind + 5GW offshore + 8GW solar)

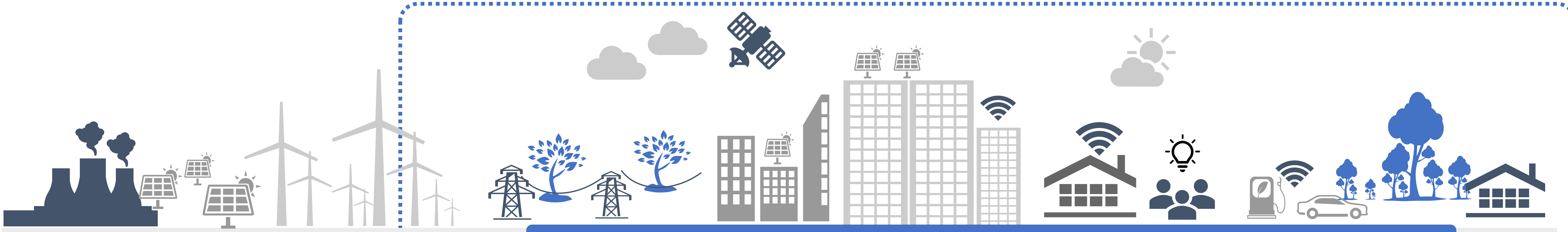
EV / PHEV
130000
EV's registered to date increasing market share each year

Network Demand
MW
Increase in load by 2030 due to extra 800,000 EV's, electrification of heat, transport and underlying growth

Omnisumers
%
Of consumers interested in energy engagement & renewables
–

EirGrid ESB NETWORKS

To tackle these challenges and build a resilient distribution network of the Future, ESBN must accelerate the digitalization of the network, harness data and build DSO capabilities



Journey towards Network of the Future:

Challenges and drivers

- **Proliferation of DERs (Solar)**
- **Rise of Battery Storage**
- **Electrification Transport & Heat**
- **More Proactive Customers**
- **Regulatory & Market Pressure**
- **DSO Constraints**

Network Visibility

- How and where are the new loads impacting the grid?
- How can the DSO complete topology mapping and keep up to date?
- ***How can we create visibility and linkage between generation, consumption and storage?***
- How will the DSO identify and respond to grid anomalies or disturbances caused by DERs?

Network Planning

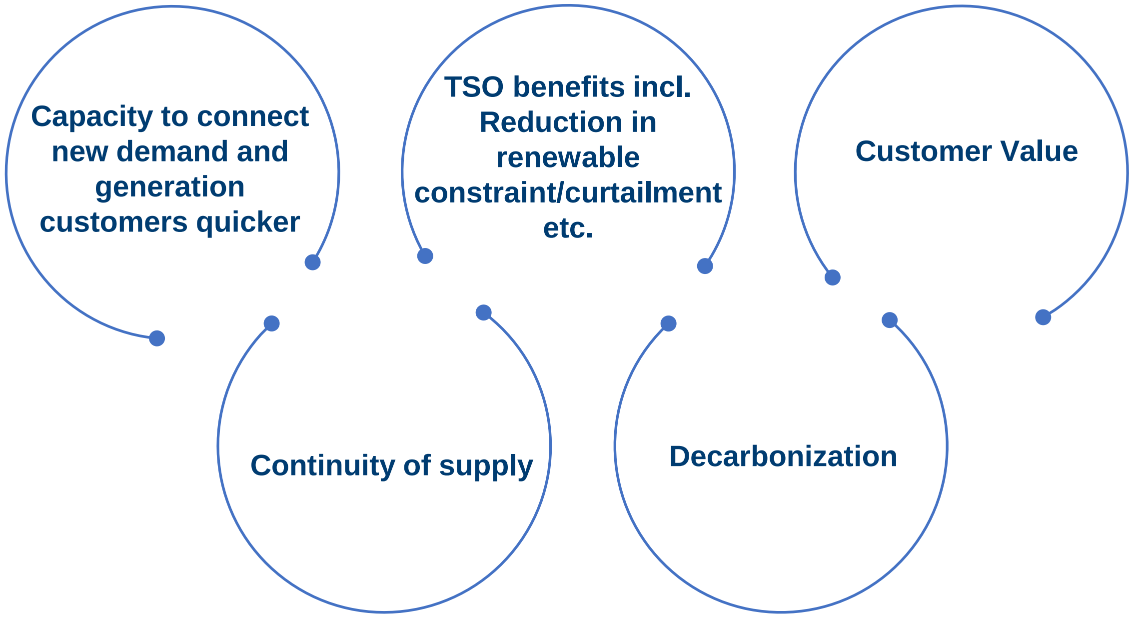
- Is it possible to accurately forecast future demand and supply given the increase of DERs and renewables?
- ***How will the DSO incorporate renewable energy sources, energy storage systems, and DERs into the grid planning process?***
- How can the DSO facilitate EV adoption and build a more resilient grid?
- Can the DSO provide insights to influence future policies? *(e.g. DER registration, metering of assets etc.)*

Network & Market Operations

- What tools and pilots should be run to prepare for the future?
- How can ESBN optimize the use of DERs and renewables to balance supply and demand?
- How to manage the variability and intermittency of RE generation to ensure network stability and reliability?
- What are the impacts of bidirectional power flow between EVs, DERs, and the grid?
- ***How to manage and leverage this two-way energy flow effectively?***

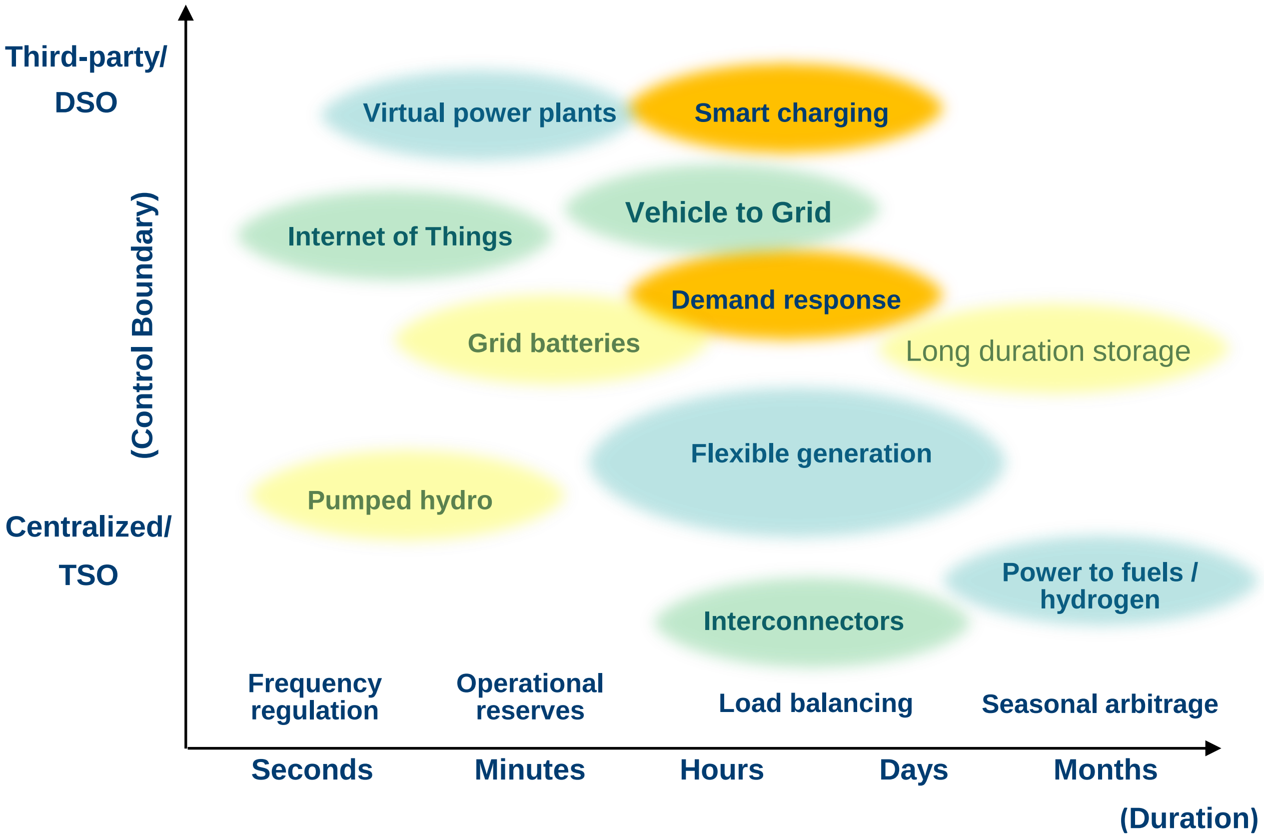
TSO/DSO Coordination & Flexibility

Benefits of flexibility services



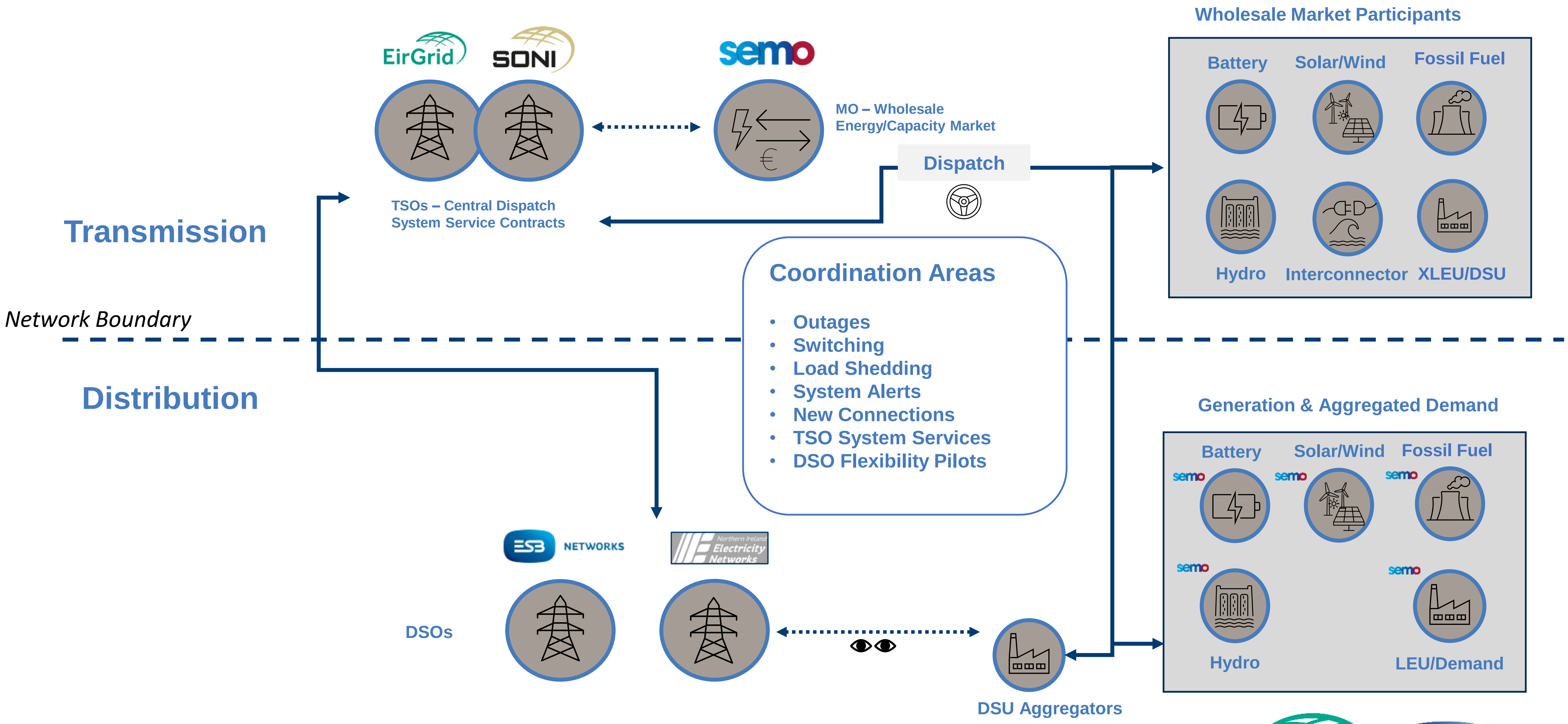
Storing energy
Improving grids
Flexible generation
Demand-side flexibility

Control and Visibility boundary will evolve between DSO and TSO as illustrated in the example below:



EirGrid ESB NETWORKS

Current TSO – DSO Coordination



Coordination that currently exists will need to evolve to operate the network of the Future

Flexibility Overview ESB Networks

2025 Targets

1 Demand Side Flexibility of 15 – 20%

2 Cumulative Carbon Abatement MtCO2eq. of 0.79

How we will deliver on our targets

Storage

Storage is a reliable means for providing flexibility. Advances in storage technologies and lower manufacturing costs have made energy storage more affordable.

Large Industrial

Large industrial customers have large electricity demand. High volumes of carbon can be abated if large industrials make the investments and/or operational decisions to **shift their demand**

Commercial

- Pilots are facilitating commercial participation in the provision of flexibility services
- Focus is scaling and diversifying participation in commercial sectors with greatest propensity to provide flexibility

Residential - PV

Opportunity to harness the inherent flexibility from the growth in domestic solar PV

Transport – EV's

Opportunity to harness the inherent flexibility of EV's through introducing the technical specifications and standards needed to enable flexibility-ready domestic EV chargers

Commercial-Scale e-Transport

Opportunity to harness the inherent flexibility of EV's through implementing standards that will enable flexibility-ready transport provider and commercial customer charge points

Transport – EV Charge Points

Opportunity to harness inherent flexibility of EV Charge Points through implementing standards

Residential – Social Housing

Opportunity to work with the CRU and the Department of Housing, Local Government and Heritage to amend existing policy with updates to Part L building requirements for social housing to deliver flexibility-ready homes

Collaboration through a number of pilots is crucial for understanding the future TSO/DSO Operating Model.

EirGrid ESB NETWORKS

Q&A

Please submit any questions on the current TSO-DSO Systems.

All operating model high level design queries will be answered at the second industry webinar.

Teresa Fallon
ESB Networks DMSO Design Lead

Eoin Kennedy
EirGrid, Head of Future Operations

Alan Keegan
ESB Networks JSOP and R&S Lead

Emma Fagan
EirGrid, TSO/DSO Programme Manager

Martin Hickey
ESB Networks DSO/TSO Technical Specialist

Martin Kerin
EirGrid, Senior Lead Engineer Future Operations

We'd love to hear your feedback!

Please use the QR code to submit your feedback or kindly go to chat box to click the survey link.

Thank You

Please register for our Stage 2 Webinar: TSO-DSO Operating Model High Level Design Session on 27th June using the registration form shared by email.