

# FlexTech Industry Forum

Flexible Technology Integration Initiative

June 2019

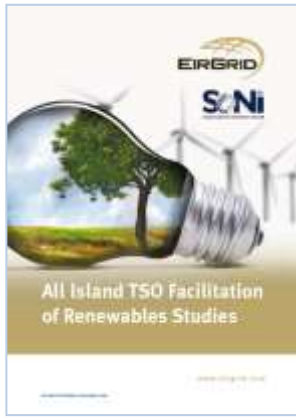


This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 773505.



# FlexTech – Genesis

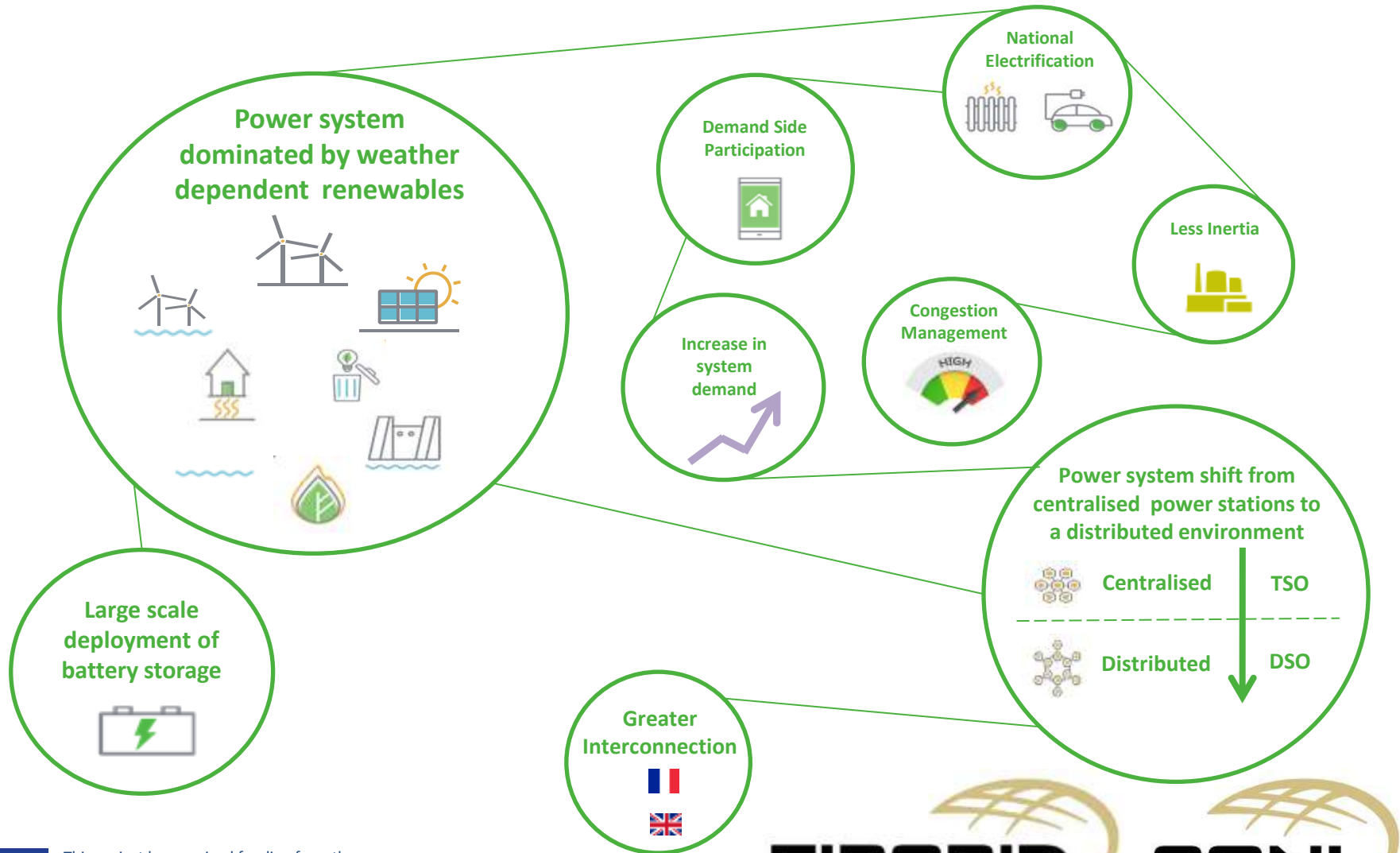
Flexible Technology Integration Initiative



This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 773505.



# 2030 Challenge – Future System Operation Complexity



# FlexTech Initiative

## Flexible Technology Integration Initiative

Time	Agenda
[10:30 to 10:50]	A 2030 View - Jon O'Sullivan, EirGrid
[10:50 to 11:10]	FlexTech Overview - John Lowry, EirGrid
[11:10 to 11:30]	Hybrid - Kate Hanley, EirGrid
[11:30 to 11:50]	Storage - Eoin Clifford, EirGrid
[11:50 to 12:10]	Demand Side Management - Mark Gormley, SONI
[12:10 to 12:30]	Large Energy Users - Jon O'Sullivan, EirGrid
[12:30 to 12:50]	Renewables/SSG – Eoin Clifford, EirGrid
[12:50 to 13:50]	Lunch
[13:50 to 14:20]	Tony Hearne, ESB Networks
[14:20 to 14:40]	David McDonald, NIE Networks
[14:40 to 16:00]	Facilitated Discussion – The Fish Bowl
[16:00 to 16:15]	Wrap up and Close



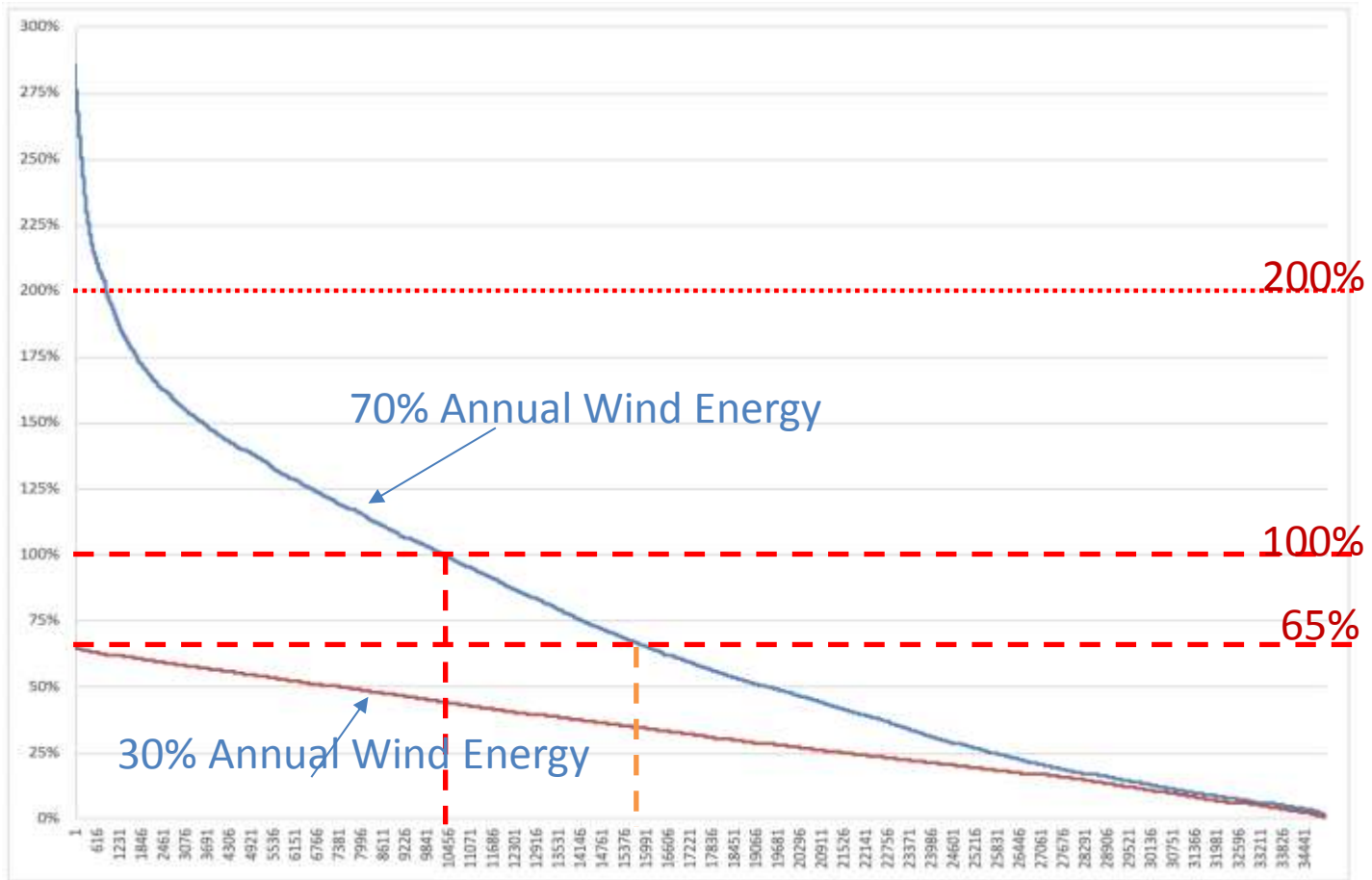
# A Vision of 2030

Jon O'Sullivan



# All-Island Wind Penetration Duration

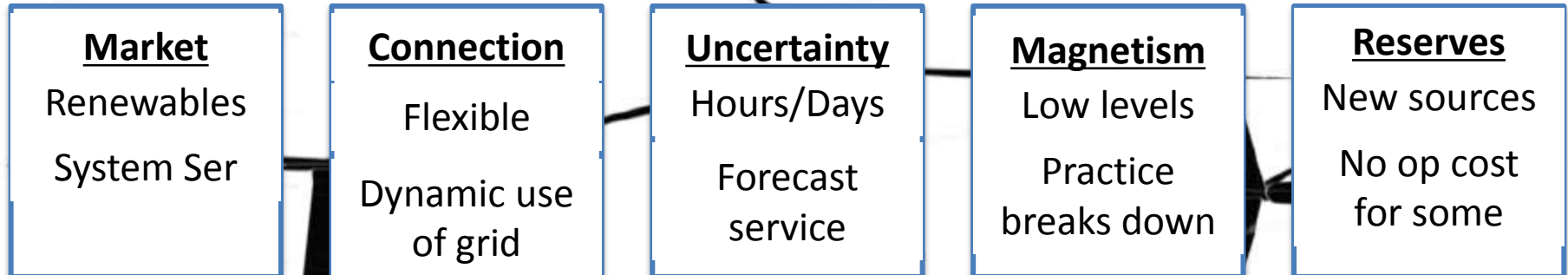
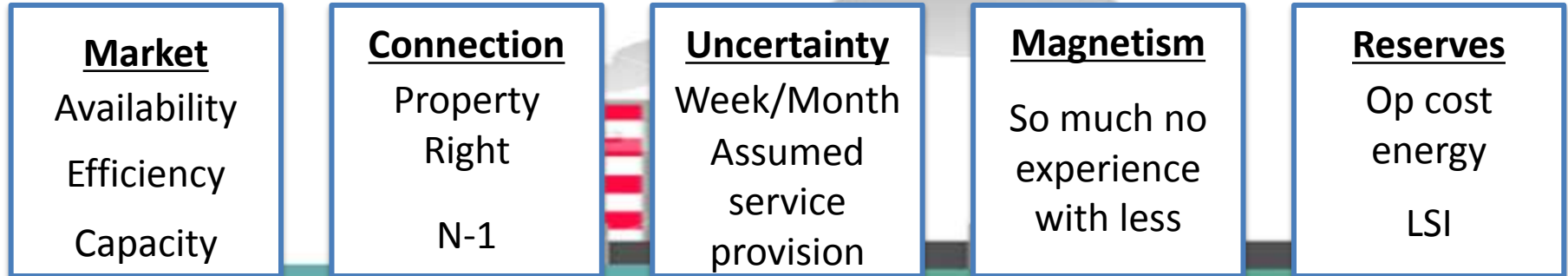
Wind Power/ Load (%)



2030 wind was estimated by multiplying 2018 wind availability by 2.1612 to achieve an energy balance of 70% wind.



# 2030 - Revisiting Unresolved Challenges



# What tech can we prudently manage...?

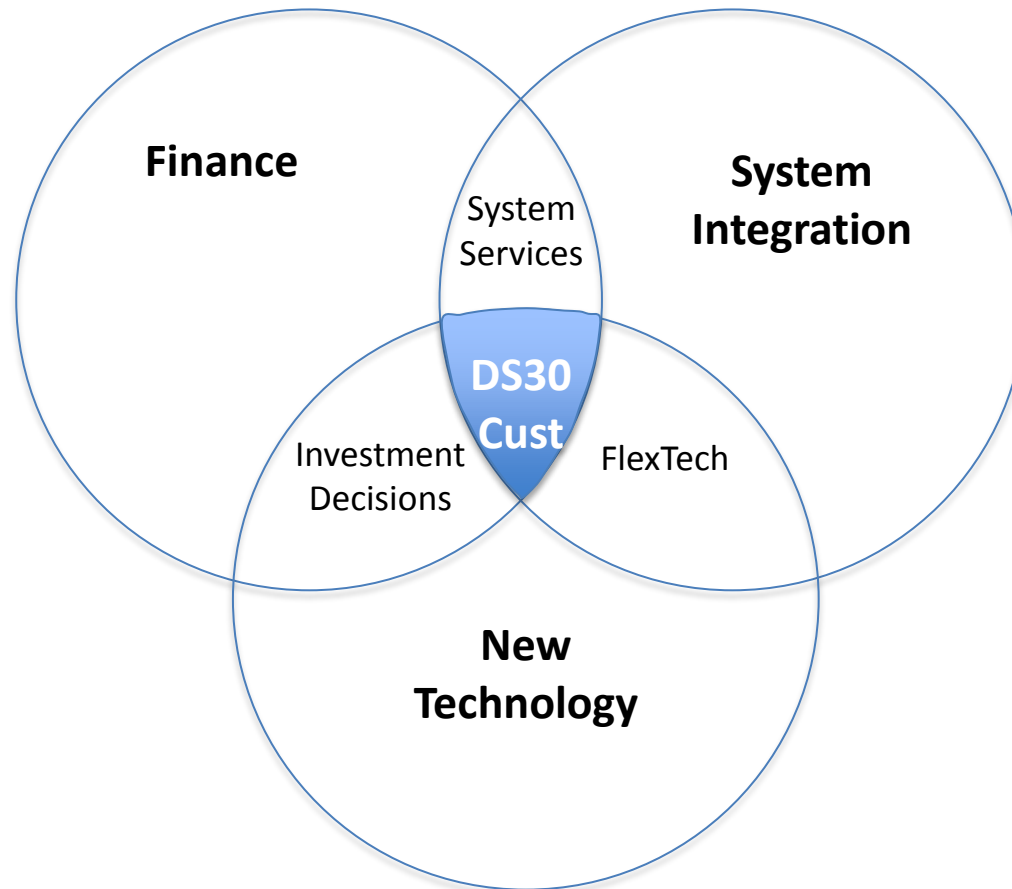
	Energy	Capacity	Trad Services	DS3 Slow Services	DS3 Fast Services	New DS30 Services	New DS30 Congestion
Conventional	●	●	●	●	●	●	●
Wind	●	●	●	●	●	●	●
Solar	●	●	●	●	●	●	●
Storage	●	●	●	●	●	●	●
DSM – Ind	●	●	●	●	●	●	●
DSM – Res	●	●	●	●	●	●	●
Large Energy	●	●	●	●	●	●	●
HVDC Interconns	●	●	●	●	●	●	●



This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 773505.



# RES Integration Philosophy



# FlexTech Overview

John Lowry



# FlexTech Initiative

Flexible Technology Integration Initiative

*A platform of engagement with industry with the objective of removing barriers to renewable integration*

A cross sectoral initiative which will bring together existing activity across a range of topics under a single banner.

It shall consist of external aspect

- EirGrid Group wide Working Groups – with SME Panel
- An industry forum - Addressing industry concerns!
- TSO/ DSO/ DNO Task Force - Working together!

It shall inform future policy, standards, QTP and system solution development



# FlexTech Forum

Flexible Technology Integration Initiative

Flex-Tech Initiative Industry forum is to act as a **consultative body** with respect to solving a broad range of challenges associated with the integration of technology.

- Industry forums shall take place bi-annually
- This will be followed by a consultation process with industry our SO partners and regulators
- First consultation commencing early July



# FlexTech Working Groups

Flexible Technology Integration Initiative



Renewable/SSG

DSM

Hybrid

Large Energy  
Users

Storage

Programme Management - Innovation

## SME Panel

MARKET DESIGN

CUSTOMER RELATIONS

COMMUNICATIONS

NEAR/ REALTIME

LEGAL

PLANNING – TNP/AP

SCENARIO PLANNING

MARKET REGISTRATION

REGULATION

SYSTEM SUPPORT

CONNECTIONS &  
CHARGING

IS/METERING

NEW CONNECTIONS

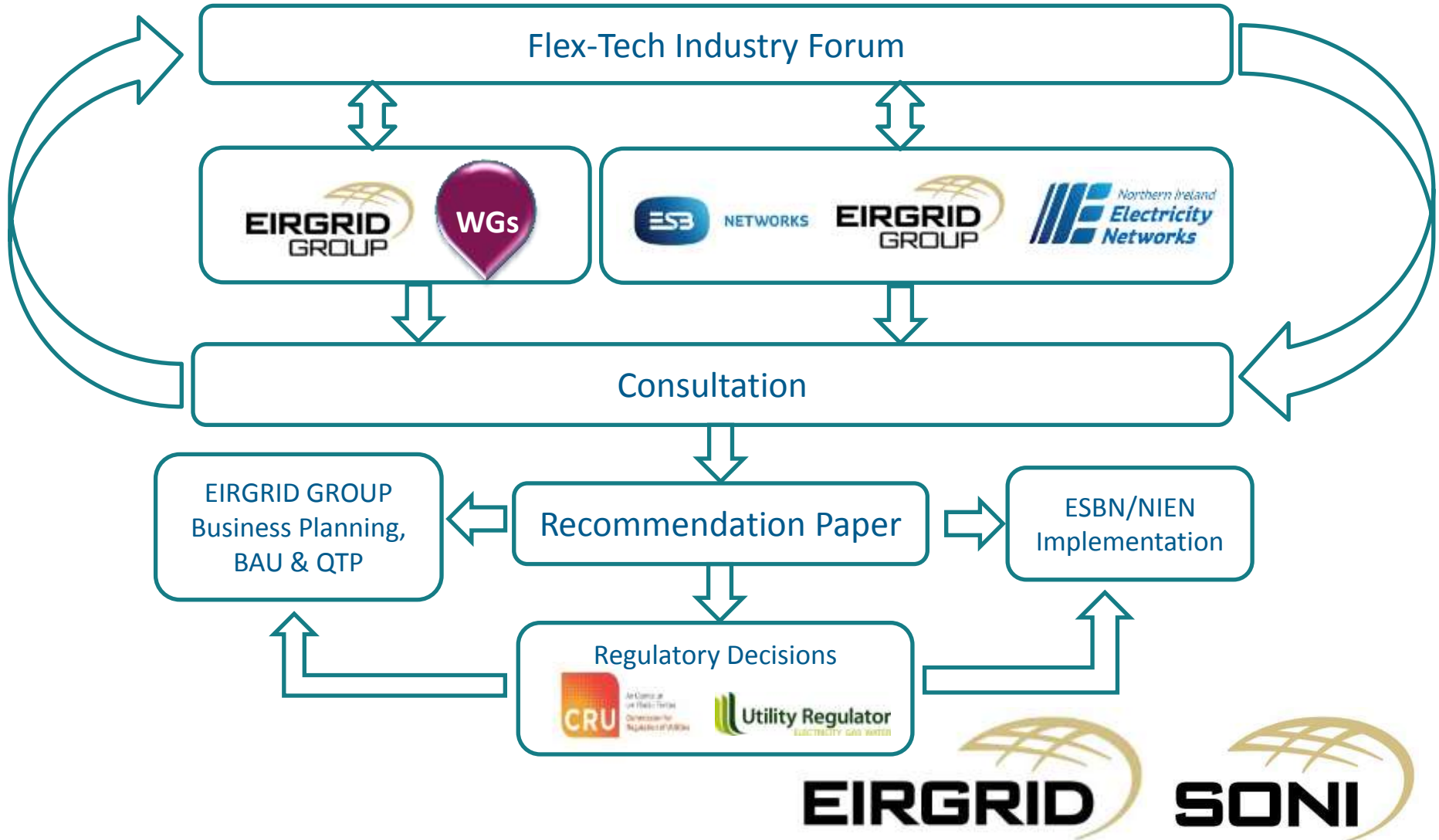
TRANSMISSION SYSTEM  
ENGINEER

INNOVATION



# FlexTech - Implementation

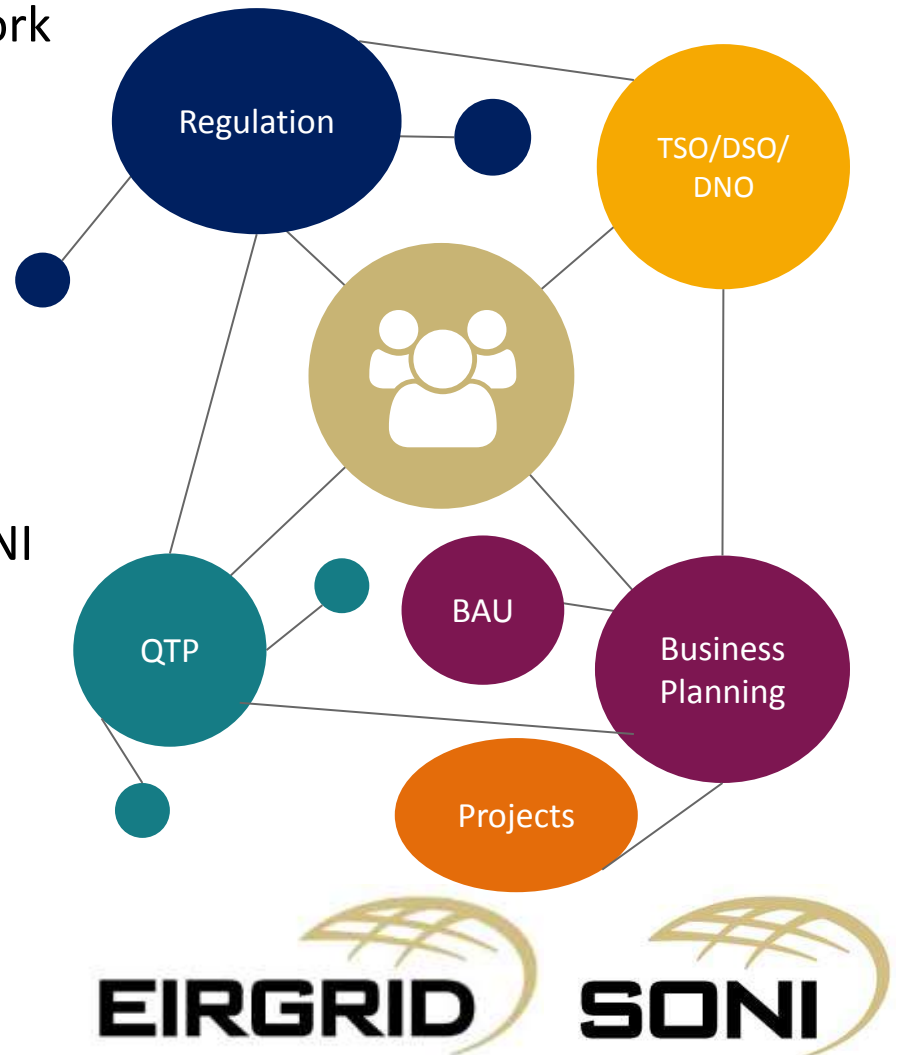
Flexible Technology Integration Initiative



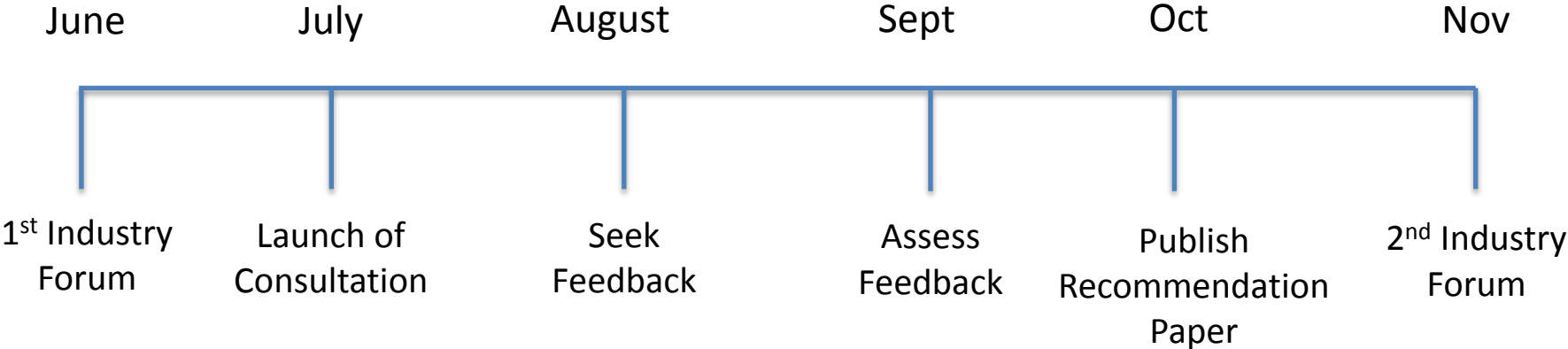
# FlexTech - Linking it all together

Flexible Technology Integration Initiative

- ✓ Engage Industry, Regulators and Network Operators to address technical, policy regulatory and commercial issues effecting integration of renewables.
- ✓ Inform scope development of future Qualification Trials
- ✓ Inform solution development and implementation within EirGrid and SONI
- ✓ Input to Business Planning Process & Business as usual
- ✓ Collaborate with ESNB/NIEN on cross sectoral challenges



# FlexTech – High Level Programme





# Hybrid

Kate Hanley





# FlexTech – Hybrid Working Group

## Introduction

### Why Hybrids?

- Maximising use of Transmission/Distribution Infrastructure
- Improved Diversity Factor
- Levelling of Generation Curve
- Options for Grid Code Compliance/Provision of System Services
- Reduced Lifecycle Cost for Plant



# FlexTech – Hybrid Working Group

## Issues Previously Identified

### Definition

- Hybrid Site vs Hybrid Units
- Renewable, Conventional, Storage, Mixed

### Connection

- Multiple Legal Entities Sharing a Connection Point
- Install over 120% of MEC
- Trading of Export Capacity

### Operation

- Grid Code Requirements
- Metering and Signal Requirements
- Market Integration
- Control Strategy



# FlexTech – Hybrid Working Group

## Consultation Process

### Recommendation Papers?

- Multiple Legal Entities Sharing a Connection Point

### Business Planning Considerations?

- Install over 120% of MEC
- Trading of Export Capacity

### Qualification Trial Process Considerations?

- Testing of Hybrid Power Plant Controller

### Proposed Changes to Business Processes?

- Grid Code Requirements
- Metering and Signal Requirements
- Market Integration
- Control Strategy

# Storage

Eoin Clifford





# FlexTech - Implementation

Flexible Technology Integration Initiative

## Introduction

- Focus on Batteries initially
- Rapidly expanding sector
- Innovation leading to lower costs
- EFR (NGUK)
- Hornsdale (Sth Australia)



## Identifying needs

- Batteries can potentially be of great service to the Power System, Market, consumer
- But work needs to be done to identify best uses
- Then we can design schemes to attract appropriate levels of investment



# FlexTech - Implementation

Flexible Technology Integration Initiative

- Experience to date

## Kilroot Battery

- 10 MW unit
- Primarily used for System Services

## DS3 System Services

- Volume Capped
- Volume Uncapped (?)

## Capacity Market T-4

- 179 MW of new batteries
- Mostly in Dublin





# FlexTech - Storage

Flexible Technology Integration Initiative

- Current Position - DS3 Volume Capped

## Service Provision

- FFR->TOR2, flat provision
- Over frequency response
- 300ms response
- We can dispatch outside frequency-event up to 10 times a year
- Penalised if not available 24/7

## Attracting new investment

- 2 years to deliver
- 6 year contracts
- Payment rates fixed





# FlexTech - Storage

Flexible Technology Integration Initiative

- Current Position - DS3 Volume Capped

## Auction-style tender

- We are contracting for 100 MW (91->140 MW)
- Max unit size of 50 MW
- Lowest bids win

## Connections

- Units need to be in connection process as of now
- Need accepted offer before they receive contract
- Performance bonding to ensure unit ready by Sept 2021

## Tech

- Must be on proven technology list
- High availability requirement and speed of response means suitable arrangements for batteries



# FlexTech - Storage

Flexible Technology Integration Initiative

- Examples of Issues we have seen

## Revenue Certainty

- Developers like to know their revenues in advance
- Volume Capped and T-4 give long-term investment signals
- Volume Uncapped, as presently designed, does not allow contract to be signed before testing

## TSOs' Technical Requirements

- Developers want to know in advance signalling requirements, testing, Grid Code etc.
- Hard to define due to limited experience with this tech
- What level of fast-acting services can the Tx and Dx Networks handle?



# FlexTech - Storage

Flexible Technology Integration Initiative

- Examples continued

## Connections

- Expected operation for planning studies? Unit may wish to operate in market
- MIC requirements
- Network Charges
- NI vs IE processes
- Prioritising: RES, Modifications, ECP

## Market

- Charging mechanism
- Treatment of de-minimis units

## Information

- DS3 info is spread across a range of documents
- Particularly challenging for Global players with no experience of Irish market



# FlexTech - Storage

Flexible Technology Integration Initiative

- Aim of today is to Identify the Problems

## Pre-application

- Opportunities
- Revenue streams
- Route to grid



## Integration

- Technical requirements
- Market rules
- Grid Access studies
- Charging regime



## Operation

- Recharging
- Dispatching
- Interactions between Capacity, Energy, DS3 markets



# Demand Side Management

Mark Gormley

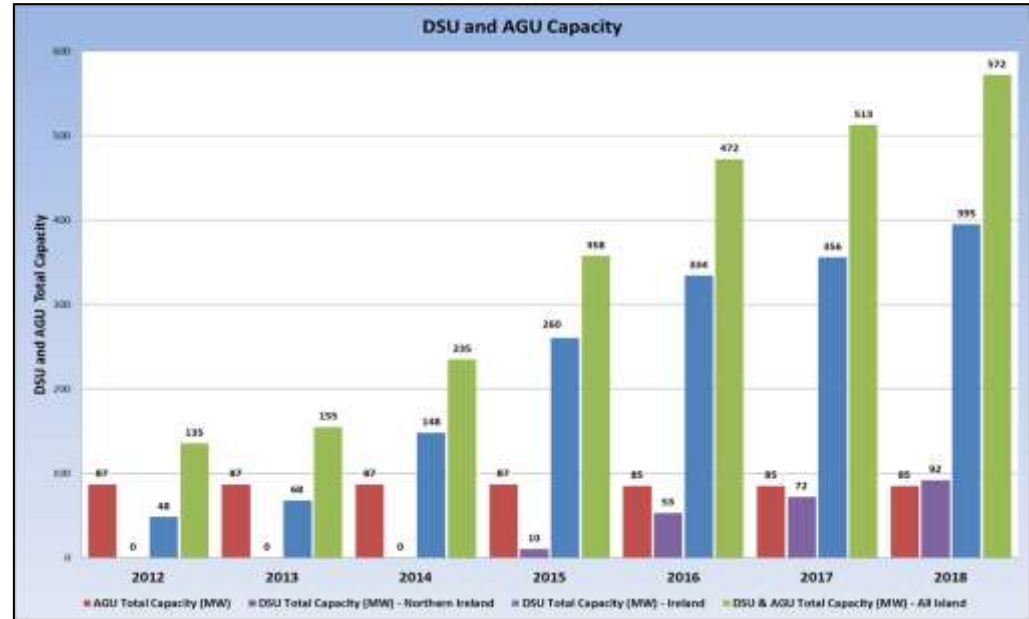




# FlexTech - DSM

## Flexible Technology Integration Initiative

- Demand Side is an inherently flexible resource with huge potential for providing system flexibility
- DSM has been around in various forms for many decades however is still in its infancy in terms of participation
- Historically DSM has been shoehorned into markets designed primarily for generator participation
- Coupled with a number of additional factors (i.e. comms, metering, cost, remuneration,) this has limited DSM from providing its full potential to date
- In SEM DSM Currently facilitated under DSU and AGU market models
- Currently DSU fall under 2 distinct categories:
  - **DSU: Out of merit:**  
Typically aggregating demand response and back up gen
  - **DSU: In merit:**  
Typically aggregating CHP
  - **AGU: Typically out of merit**  
Aggregating back up generation



Growth in DSM under current arrangements

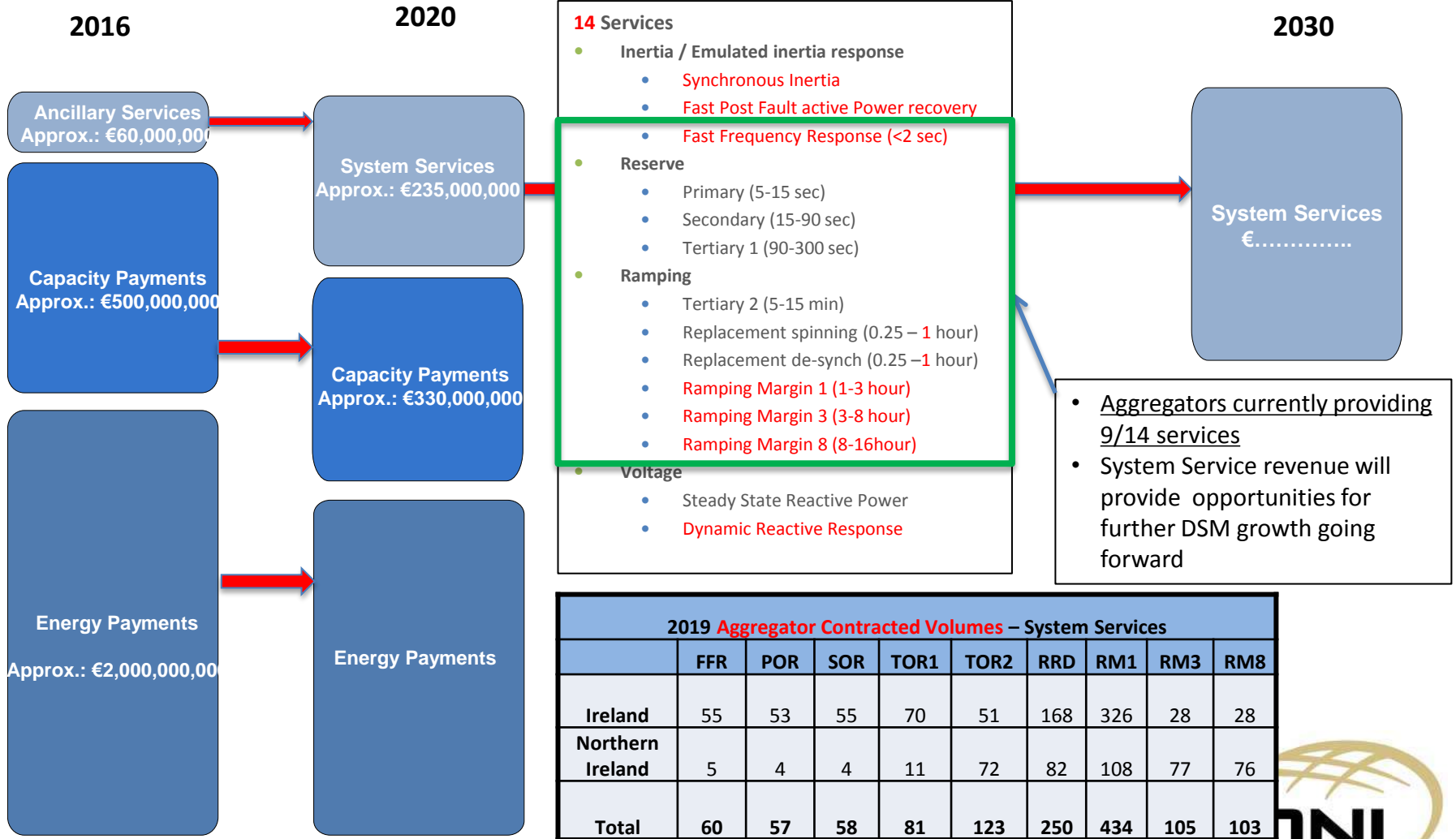
- Historically AGU and DSU remuneration was primarily focused on capacity revenue
- However models are currently evolving:
- Aggregators now participating in:
  - Capacity Market
  - System Services
  - Energy\*



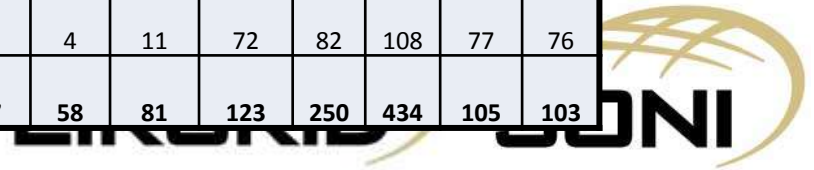


# FlexTech - DSM

## Flexible Technology Integration Initiative



2019 Aggregator Contracted Volumes – System Services									
	FFR	POR	SOR	TOR1	TOR2	RRD	RM1	RM3	RM8
Ireland	55	53	55	70	51	168	326	28	28
Northern Ireland	5	4	4	11	72	82	108	77	76
<b>Total</b>	<b>60</b>	<b>57</b>	<b>58</b>	<b>81</b>	<b>123</b>	<b>250</b>	<b>434</b>	<b>105</b>	<b>103</b>





# FlexTech - DSM

Flexible Technology Integration Initiative

## Approach:

Focus on enabling flexibility

Review of current arrangement

Review of current and future issues

Potentially a huge scope of work could be conducted in DSM space

Prioritisation is required to focus on areas which facilitate increased levels of DSM

In particular a focus on flexible DSM

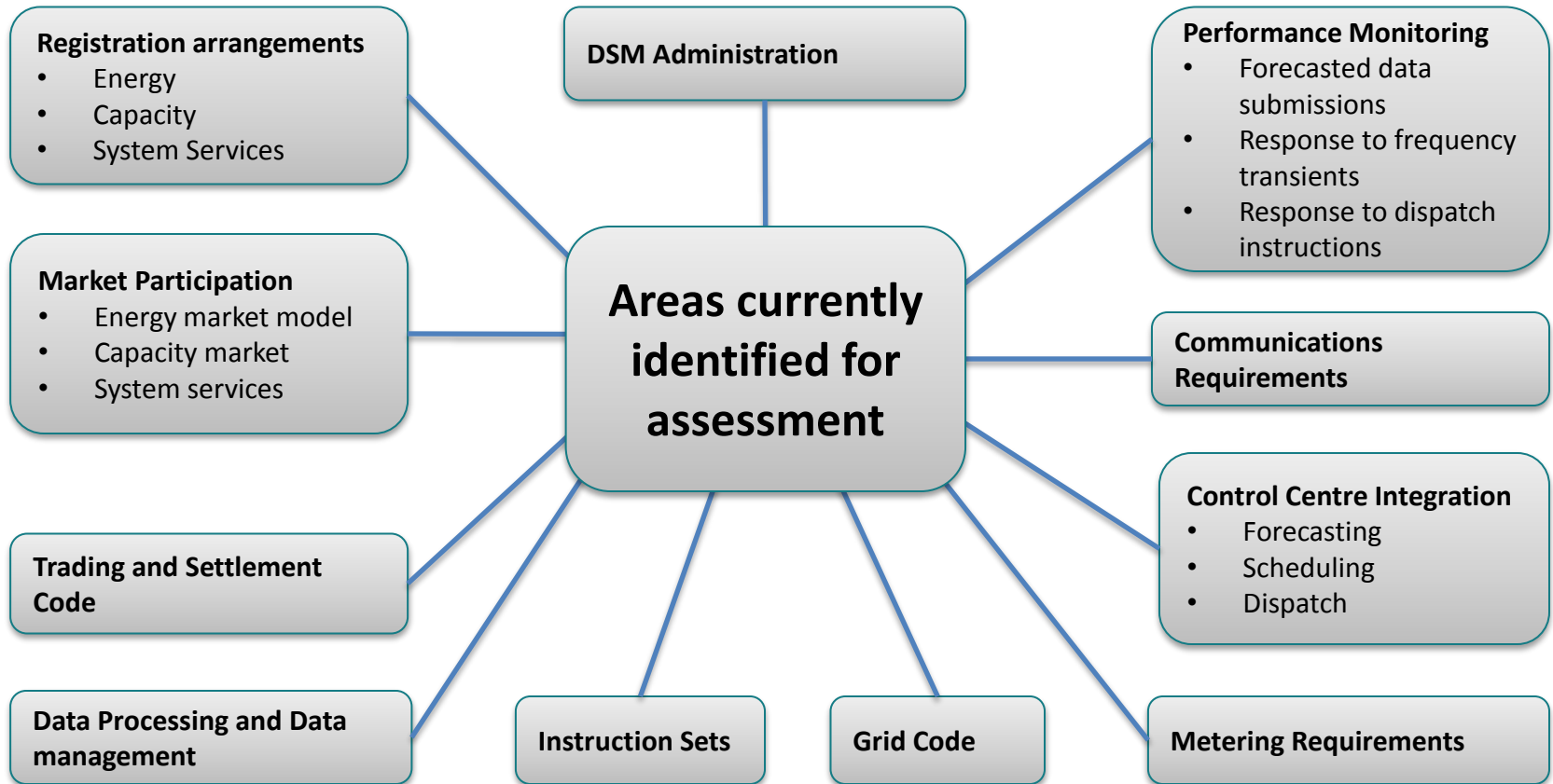






# FlexTech - DSM

Flexible Technology Integration Initiative





# FlexTech - DSM

## Flexible Technology Integration Initiative

- Increased System Service revenue
- Potential lowering of cost for communications and metering
- Growth in EV penetration
- Roll out of smart metering
- Internet of things – residential DSM
- DSU Compliance with State Aid decision (post October 2020)



- SEMC consultation on DSU Compliance with State Aid decision (post October 2020)
- Opportunities arise with additional revenue
- However this introduces added complexity for market, system operators, aggregators, demand sites
- Proposed interim solution relies heavily upon adequate performance monitoring being carried out
- Proposed Interim solution puts large onus on Performance Monitoring
- Review and evolution of current performance monitoring processes required



# Large Energy Users

Jon O'Sullivan





# FlexTech - Large Energy users

Flexible Technology Integration Initiative

## Scope & Objective/Overview of working Group

What does design flexibility really mean in the Large energy users world?

- The focus of the Large Energy User working Group is to identify the challenges and opportunities for the provision of Flexibility.
- Focusing on the Operational Aspects for Flexibility and the provision of System Services





# FlexTech - Large Energy users

Flexible Technology Integration Initiative

- Unprecedented scale of change
- Under the median forecast, by 2027:
  - Electricity demand will grow by 41%
  - 31% of all electricity demand will come from large energy users





# FlexTech – Large Energy users

Flexible Technology Integration Initiative

## Challenges

- Utility no longer linked to consumption;
- Automated response to Power Quality;
  - Coordinated actions not planned for...

## Opportunities

- Capability can support the system;
- Incentive and influence better outcomes

## Changing Obligations

- EU Network Code DCC



# Using the Grid More usage from the same site

Jon O'Sullivan





# FlexTech – More out of the Grid

Flexible Technology Integration Initiative

## Today:

Connection Limited to MIC/MEC  
Network planned to meet this  
Diversity assumed

## Tomorrow:

>MIC/MEC sought by multiple parties  
Operational policy and practice consistent with this  
Incentive and influence better outcomes

## Issues

- No operational mechanism to stop unapproved usage;
- No policy or procedures to manage;
- No decision support tools to implement in the control centers.

## Challenges

- Need confidence demand dispatch/controllable
- Need back up if overload occurs
- Need equitable treatment for all users of the network.







# FlexTech – More out of the Grid

Flexible Technology Integration Initiative

Precise

Unfair but  
efficient

Fair and  
efficient

**Distinct  
Connectee  
Control**

Crude

Unfair and  
Inefficient

Fair but  
inefficient

Crude

Precise

**Back Up Solution**



# Renewable & SSG

Colm MacManus





# FlexTech – RES/SSG

Flexible Technology Integration Initiative

## Small Scale Generation

- Units below 5 MW
- Mostly RES at present

## Controllability and Visibility

- Concern for TSO
- System Need Identified – visibility & control of units  $\geq 1$  MW

## European Network Codes – Requirements for Generators

- ‘Type B’ Generation units must be capable of being controlled
- Must have an input port to reduce MW
- Must provide Limited Frequency Sensitive Mode -O
- TSO-DSO engagement ongoing



# FlexTech – RES/SSG

Flexible Technology Integration Initiative

## Small Scale Generation – Sample Issues

### Visibility of units below 1MW

- Sustainable quantity of invisible MW?
- Opportunity for distributed tech?
- What can we learn from other countries?

### Aggregators

- How should they be defined?
- Does size or type of generation matter? When does an Aggregator become a Hybrid?
- What barriers do they face?





# FlexTech – RES/SSG

Flexible Technology Integration Initiative

## Small Scale Generation – Sample Issues

### Economy of scale

- Fixed costs hurt small guys more
- Application
- Market registration
- Metering
- Communications

### Services

- Should we be encouraging more System Services from SSG?
- Should we be looking for frequency control from SSG?
- Mandated or financial reward?



# FlexTech – RES/SSG

## Flexible Technology Integration Initiative

### Renewables

- Development is funded by Support Schemes
- Support Schemes are driven by Policy

### Climate Change Action

- 70% RES-E in Ireland by 2030
- Northern Irish ambitions also anticipated
- All of Government Climate Disruption Action Plan (support schemes & consenting regimes)

### How to meet goals?

- More Onshore wind
- Solar already in NI and expected in IE
- Offshore wind will have a significant role (but covered elsewhere)
- DS3 allowing high levels of RES penetration, but needs to do more



# FlexTech – RES/SSG

Flexible Technology Integration Initiative

## Renewables – Sample Issues

### Network Issues

- Cabling & Voltage issues e.g. South West
- Connection processes
- Offshore windfarm with onshore connection?

### Site Issues

- Over-installation (see Hybrids)
- Repowering with higher capacity factor turbines – should this impact grid access rights?

### Solar

- Limited experience

### Curtailement & Constraints

- DS3 post 2020
- Non-network solutions to constraints



# FlexTech – RES/SSG

Flexible Technology Integration Initiative

## Renewables – Sample Issues

### Public acceptance

- Should industry be collaborating more on this?
- Not just Windfarms, but grid also!
- Community Schemes – what are challenges?

### Support Schemes

- RESS auctions
- Beyond supports...

### Markets

- Balancing Market risk
- Forecasting
- Marginal cost pricing?



# DSO/DNO





NETWORKS

# Flex Tech Industry Forum

6<sup>th</sup> June 2019

ESBN Perspective

Tony Hearne

DSO-TSO Interface Manager

# FlexTech Working Groups

- ESNB hope to have mirror Leads for major themes



Hybrid



Storage



DSM



Large Energy  
Users



Renewable/SSG  
Tony Hearne



- Multiple Legal Entities behind a Connection Point
- Dynamic MEC
- Trading of Export Capacity

## Batteries

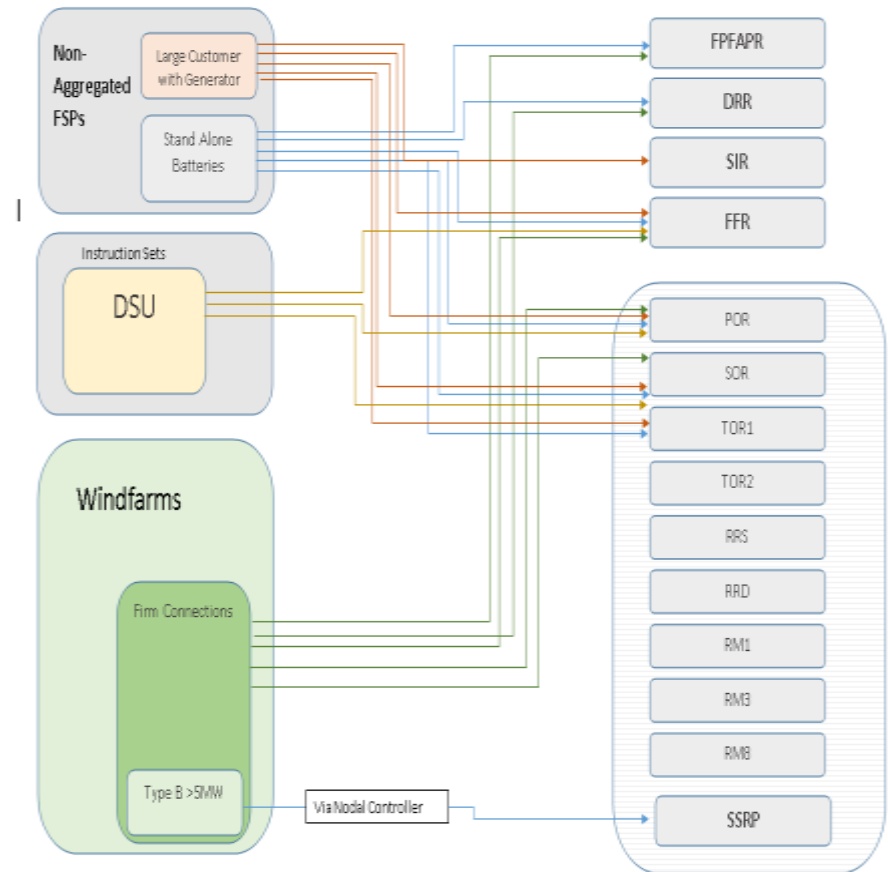


- Investor/build uncertainty chicken and egg?
- Limitations of Dx networks
- <300ms response times: Step Change magnitude, Flicker, Disturbing Load issues, Potential compromise of protection operation, simultaneous operation in response to global event
- Maximising use of MIC
- Plugging of D-Code gap – extension of PPM requirements
- Emerging public safety concerns

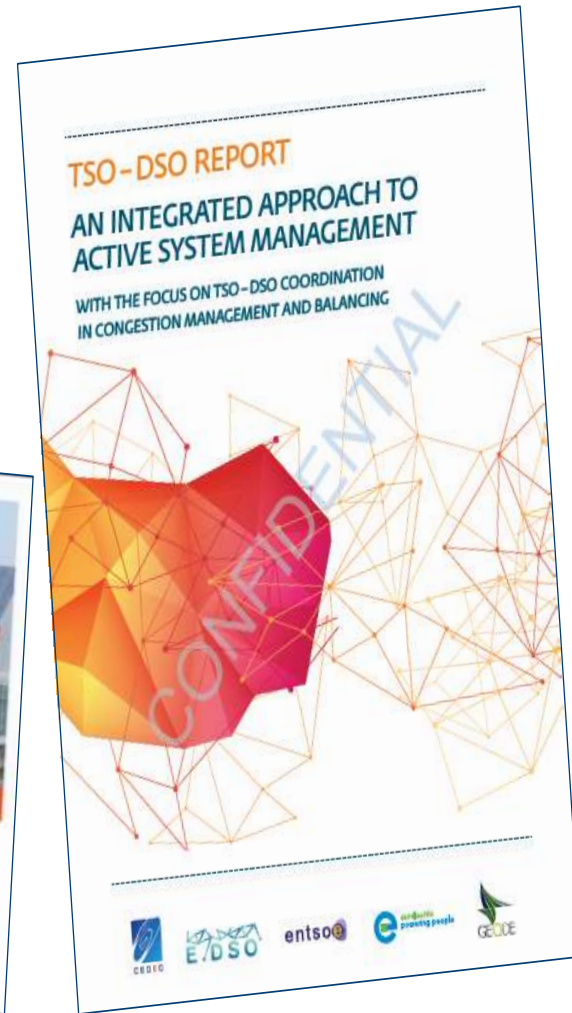
## /Flexibility



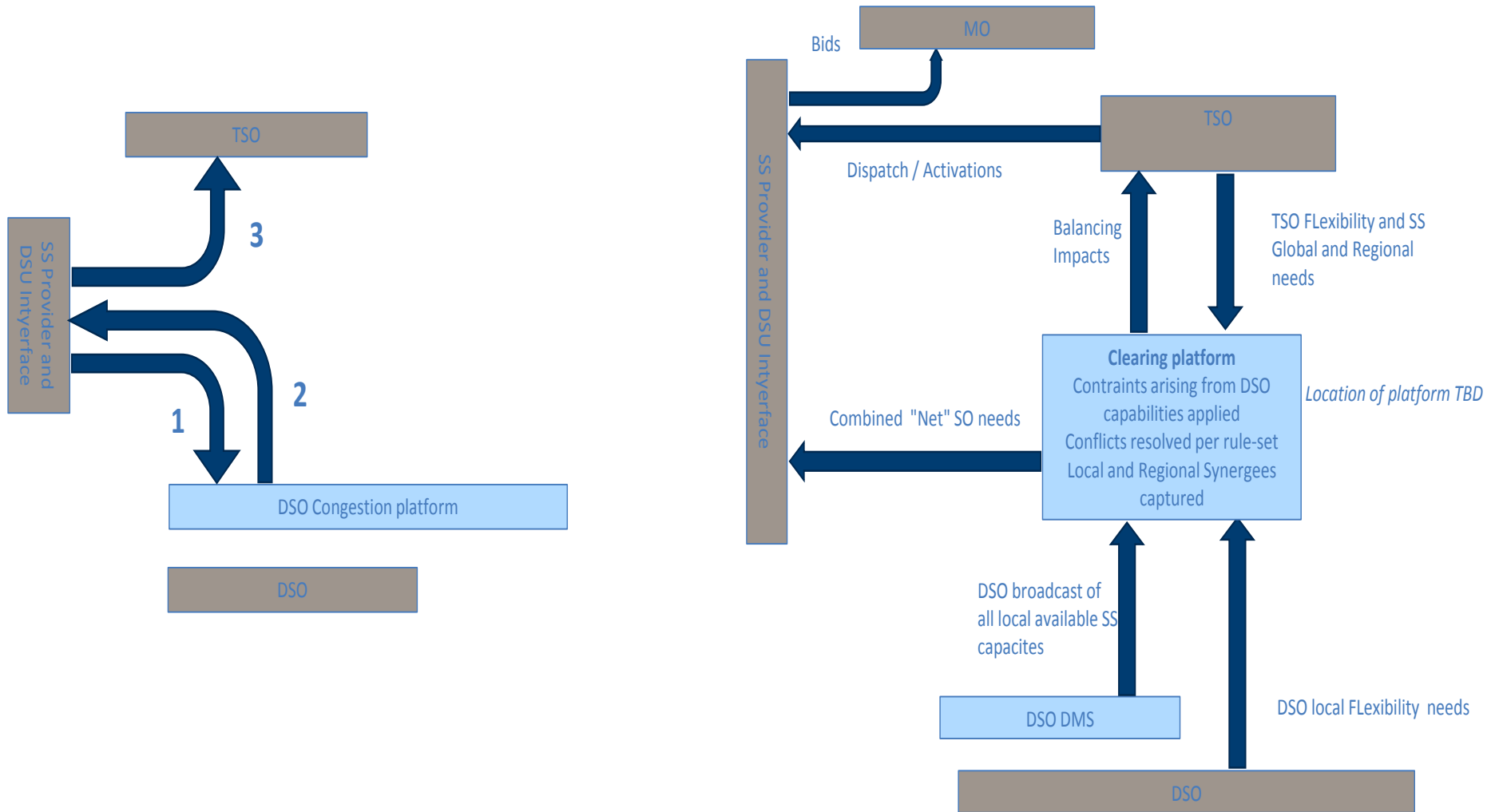
- Granularity of DSU Instruction Sets
- A genuinely integrated System Service Procurement / DSO pre-screening process
- A clear understanding of the contribution of each TSO system service to distribution network congestion
- A possible re-definition of Distribution Network Capacity for different classes of product/service
- Rule-sets or mechanisms for allocation of such capacities



# Network Visibility – Platforms - 1



# Network Visibility – Platforms - 2





## Renewables / SSG - 1



- 1 MW controllability for >1MW PPM's in hand through Distribution Code Mod #36
- TSO-DSO MOU on application of SOGL KORRR data transfer requirements
- Delay in visibility of RfG requirements in D-Code
- Potential for confusion; Types – Topologies, Network Code vs Normal process driven changes
- RfG requirements for generation in 110kV connected demand plants
- New Operational Notification process for Distribution Connected Generators

## Renewables / SSG - 2



- Need for clarity to Industry on implementation of Reactive Power requirements / Nodal Controller roll-out
- Testing process for Mandatory layer well established but not well communicated
- Clarity needed on Nodal Controller roll-out beyond Cauteen trial



Layer 3: Steady State Reactive Power [SSRP] Procurement

Layer 2: Nodal Controller

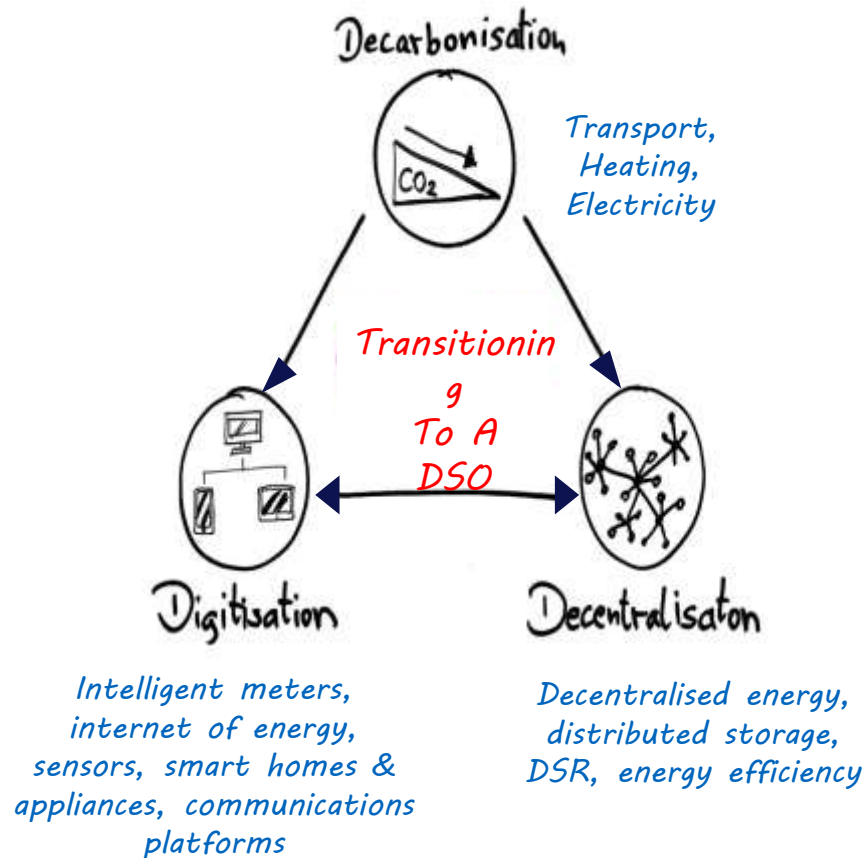
Layer 1: Distribution Code compliance / Testing

# Greater Access to the Distribution Network in Northern Ireland FlexTech Forum

6<sup>th</sup> June 2019

David McDonald  
Network Connections Design  
Manager

# NIE Networks' Role in the Decarbonisation Agenda



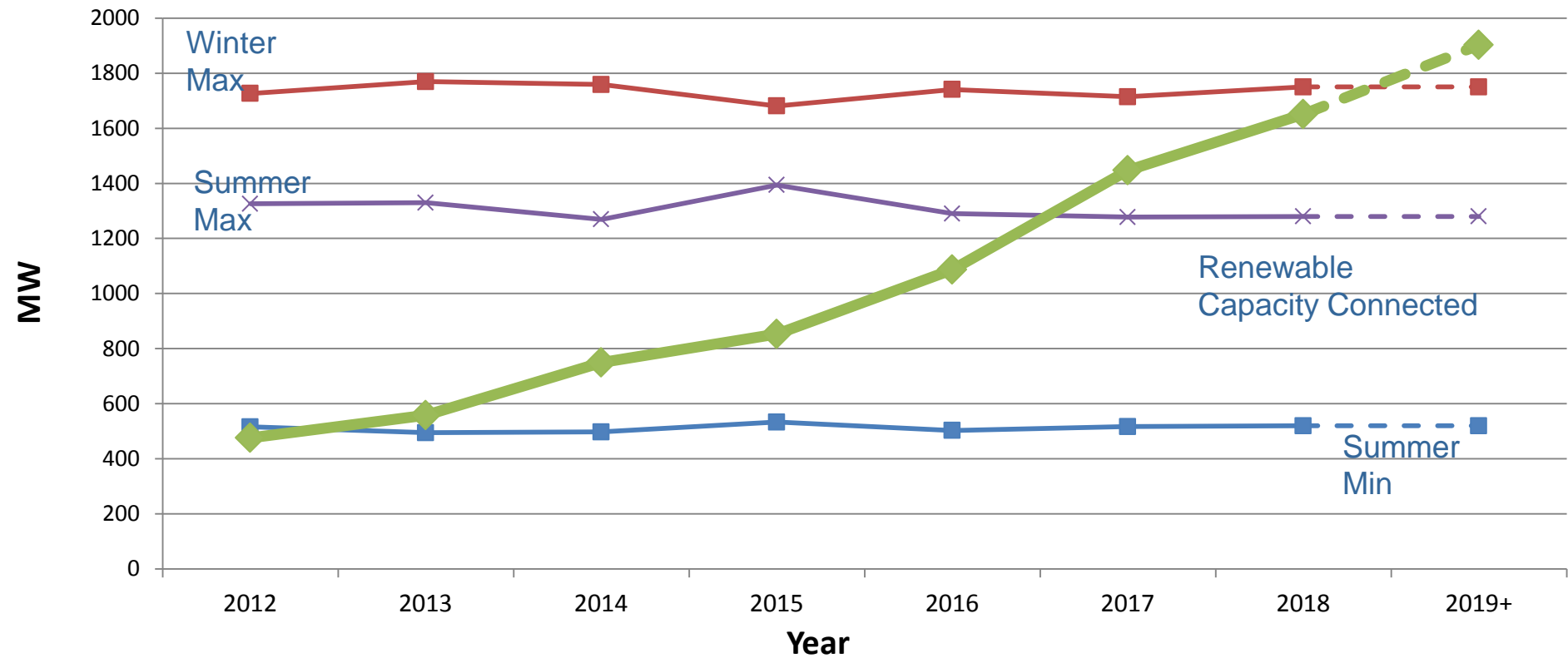
## NIE Networks DSO role involves

- Connection of increased levels of decentralised energy resources
- Accommodating Low Carbon Technologies to enable the decarbonisation of heat and transport
- More active management of the network through increased monitoring and control

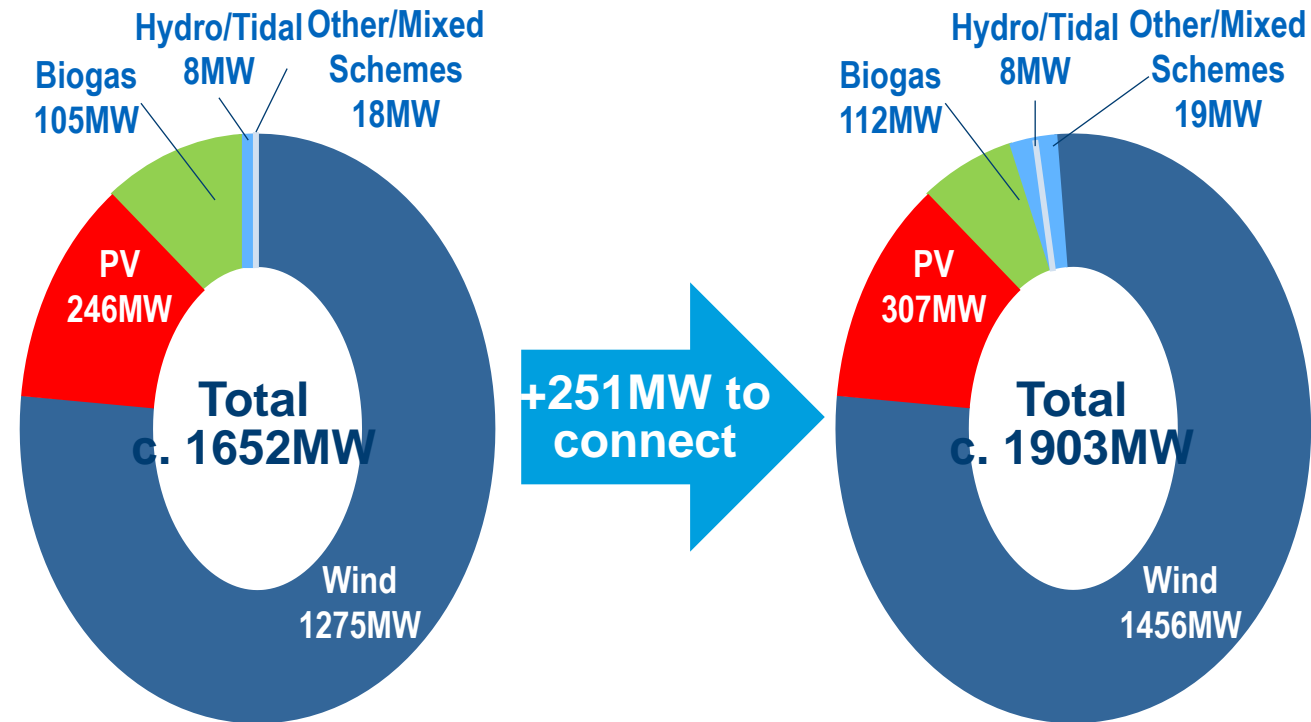
**The electricity network is a key enabler to the energy transition**

# The story so far....

## Renewables connected since 2012



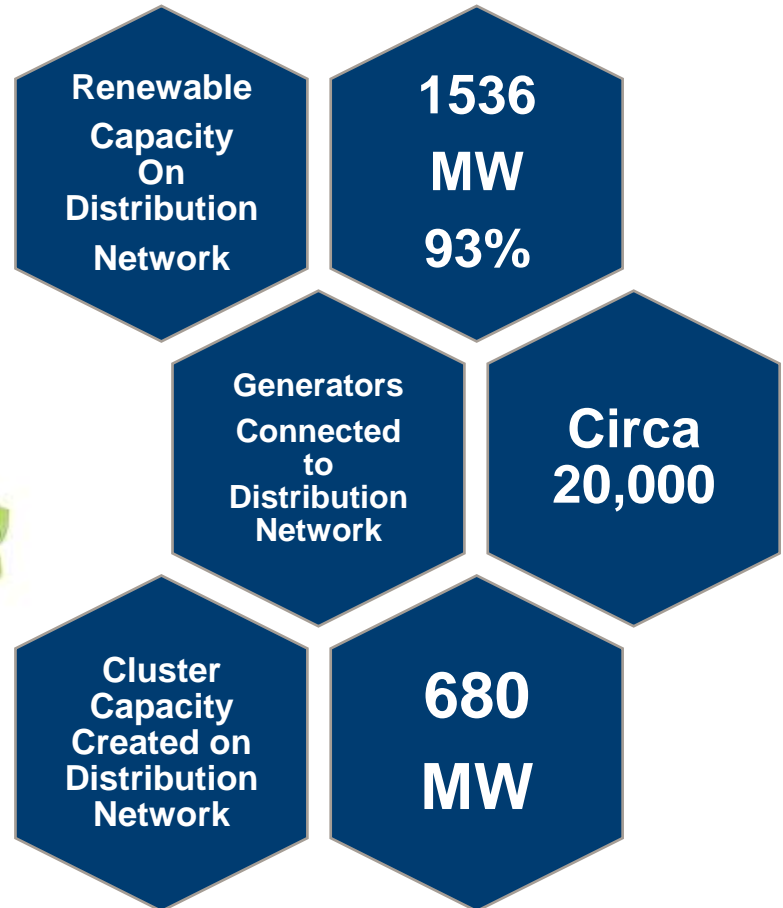
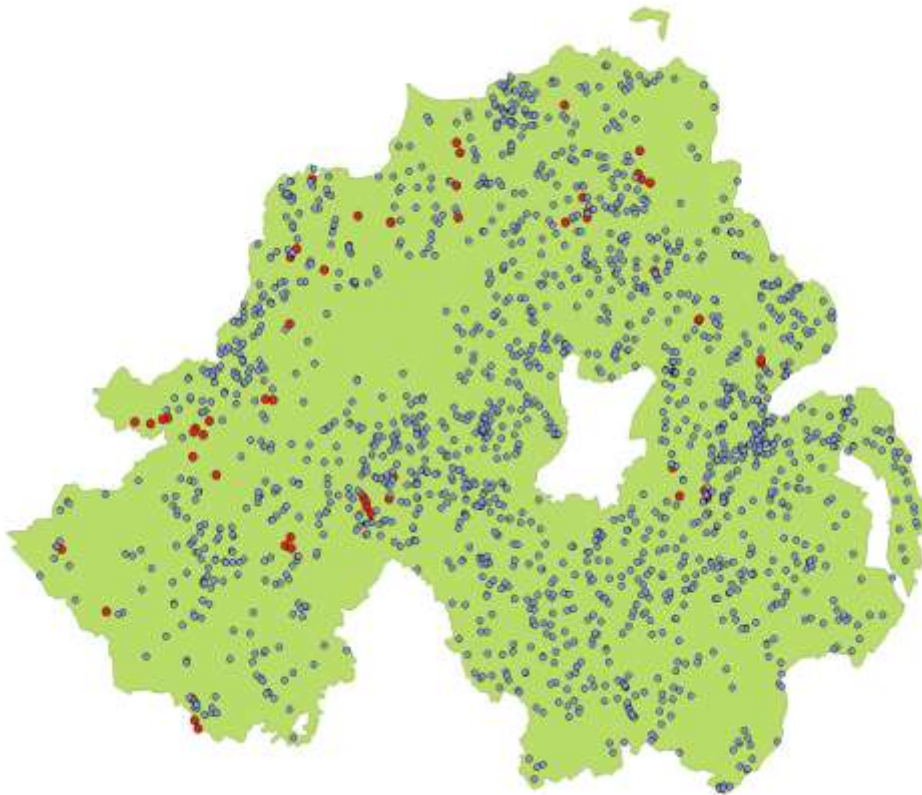
# Increasing Distributed Energy Resources (DER)



NI Connected Renewable Generation Technology Mix

NI Connected & Committed Renewable Generation Technology Mix

# Decentralisation of DER in Northern Ireland



## Current System Service Participants connected to the Distribution

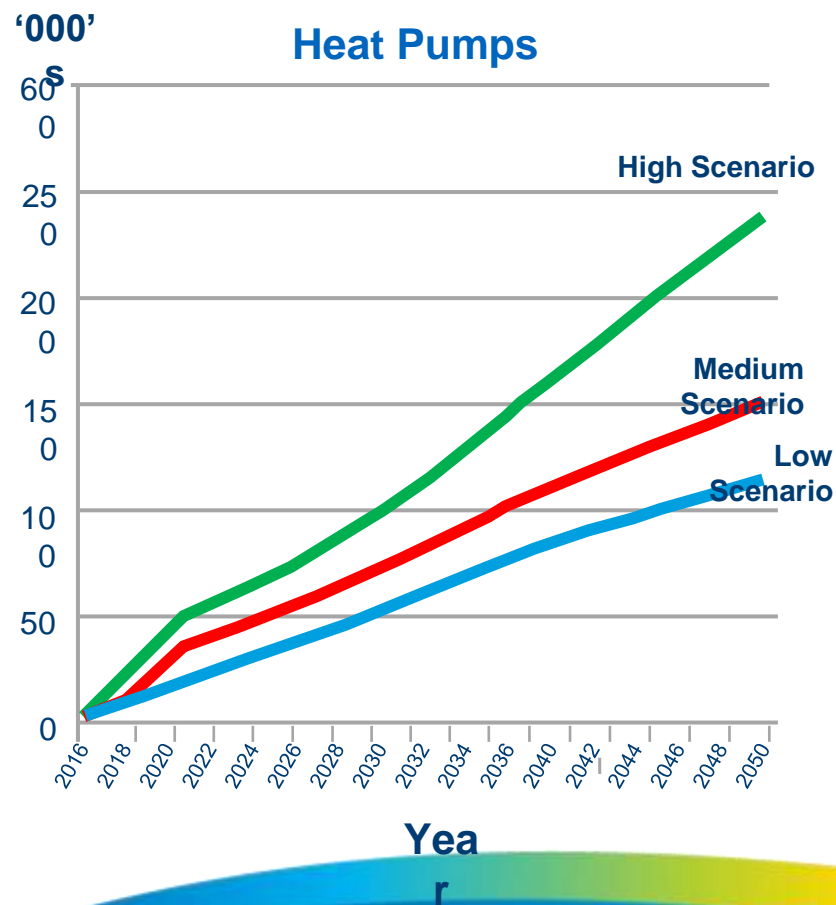
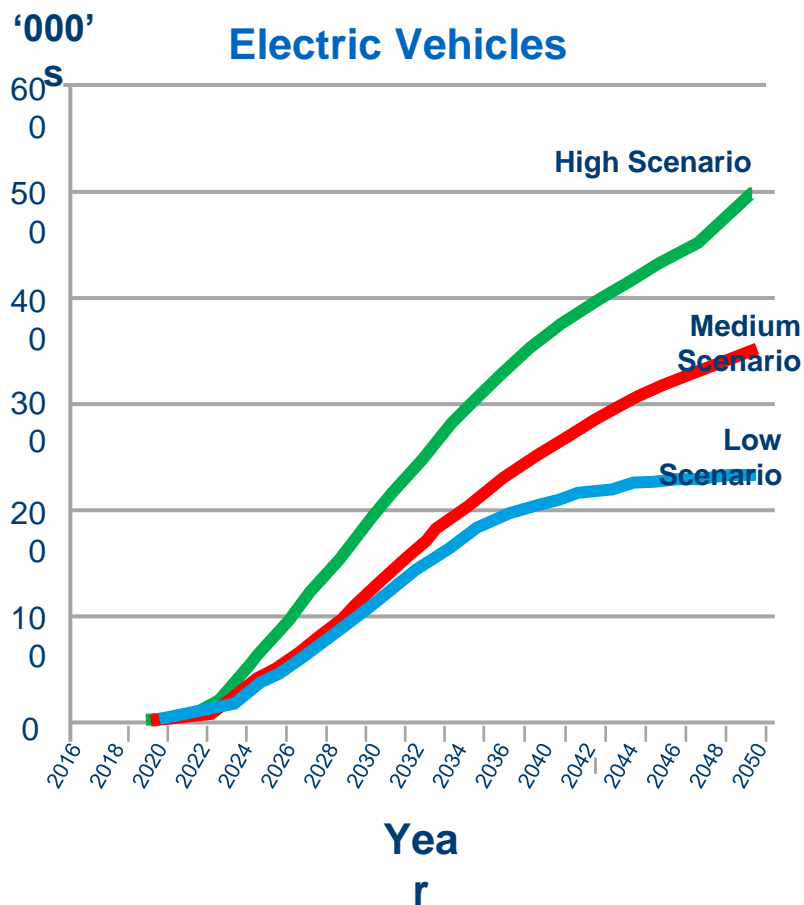
Provider Capacity (MW)	Network in Northern Ireland											
	NI Lots awarded											
	POR	SOR	TOR1	TOR2	RRD	RRS	SSRP	SIR	RM1	RM2	RM3	FFR
6									✓	✓	✓	
9					✓				✓			
63				✓	✓				✓	✓	✓	
7	✓	✓										
9.2	✓	✓										1.3 MW
16.1	✓	✓										
21	✓	✓	✓	✓	✓				✓			4 MW
7			✓	✓	✓				✓	✓	✓	
5	✓	✓	✓	✓	✓							5 MW
7.5	✓	✓										1.5 MW
13.8	✓	✓										1 MW
15					✓				✓			
<b>179.6</b>	<b>79.6</b>	<b>79.6</b>	<b>33</b>	<b>96</b>	<b>120</b>				<b>121</b>	<b>76</b>	<b>76</b>	<b>12.8</b>

**Significant increase in System Service applications from Participants connected to the Distribution Network in the 2019 Gate 1 Procurement window**

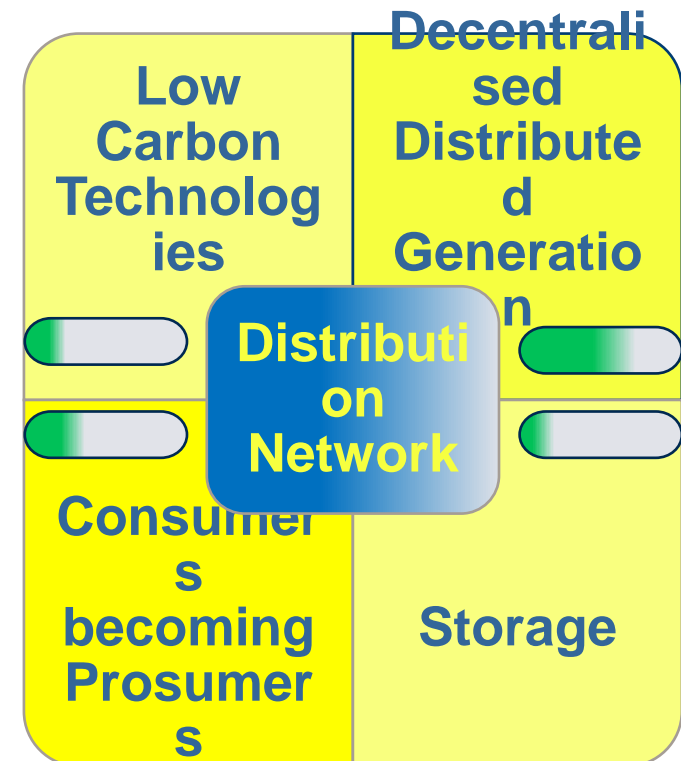
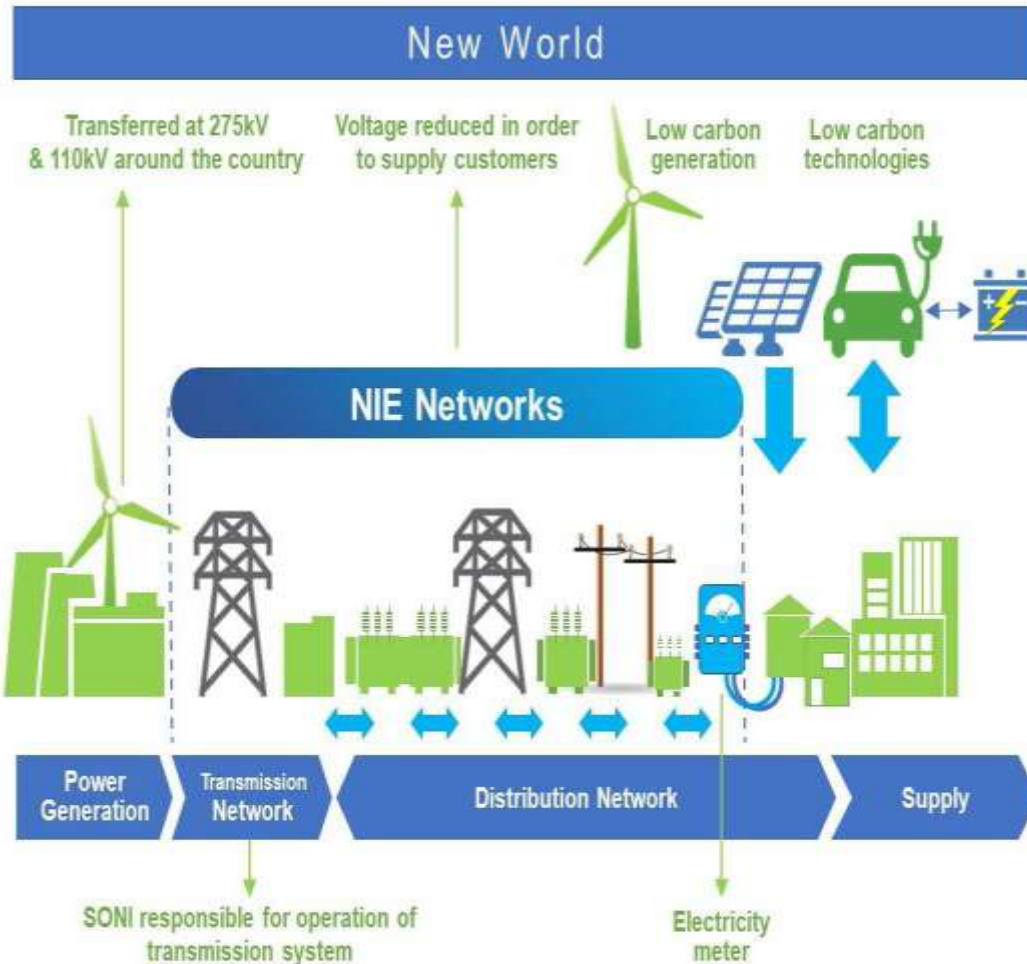


# Drivers for Change

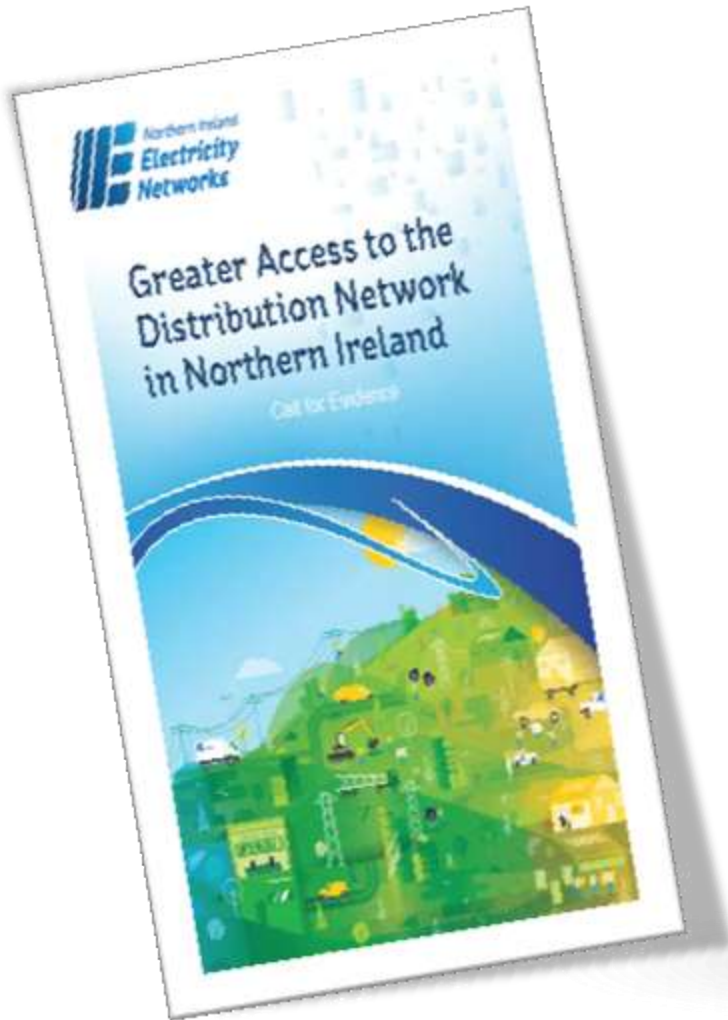
## Increasing Demand



# The Evolution of the DSO



# NIE Networks Future Policy Collaboration



# NIE Networks are not alone.

## What is the Open Networks Project?

In their Call for Evidence on “A Smart, Flexible Energy System”, BEIS and OFGEM referenced the existing Energy Network Association (ENA) work but also emphasised the need for electricity network operators to make greater progress around Transmission-Distribution interactions, with the energy industry best placed to address these requirements. On the back of this the ENA Open Networks Project was established.

### The project will:

- Help give households, businesses & networks the ability to take advantage of new energy technologies to take control of their energy and lower their costs
- Help underpin business growth, attract investment and deliver real economic benefits to the UK
- Take a whole energy system approach to designing solutions by consulting with a wide range of stakeholders



through the Advisory Group

NIE Networks are not alone.

## THE OPEN NETWORKS PROJECT

# DSO

A DSO enables customers to be both producers and consumers, enabling customer access to networks and markets, customer choice and great customer service.

### *Definition*

*“A Distribution System Operator (DSO) securely operates and develops an active distribution system comprising networks, demand, generation and other flexible Distributed Energy Resources (DER).*

*As a neutral facilitator of an open and accessible market it will enable competitive access to markets and the optimal use of DER on distribution networks to deliver security, sustainability and affordability in the support of whole system optimisation.*

*A DSO enables customers to be both producers and consumers; enabling customer access, customer choice and great customer service.”*

# The change will deliver...



# The need for an NI specific vision

## Generation

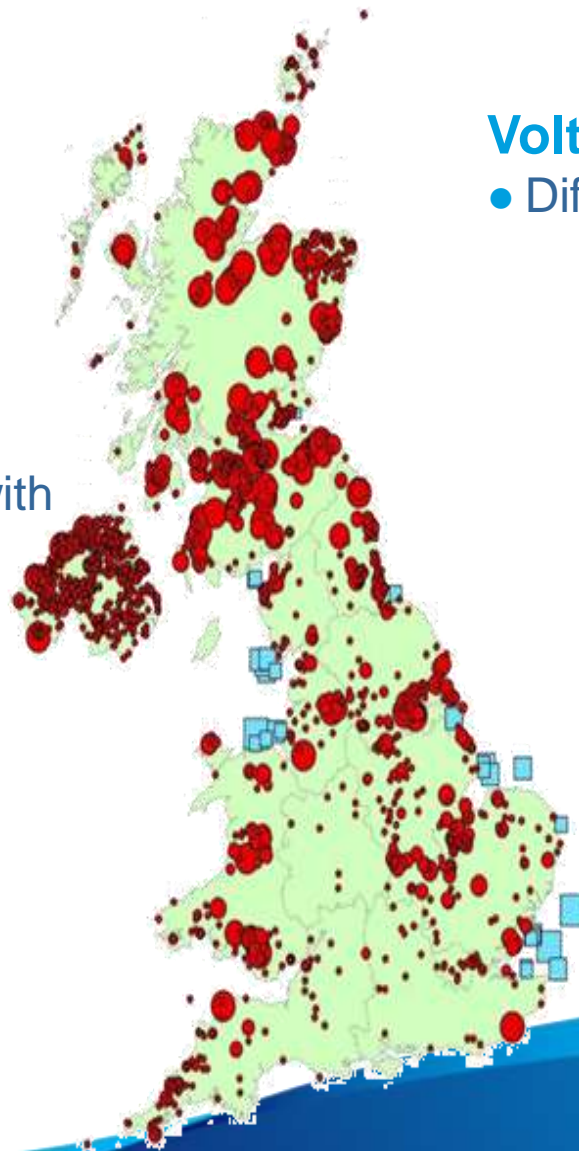
- More deeply embedded generation

## Customers

- Different customers with differing needs

## Market

- SEM
- DS3 System Services



## Voltage Levels

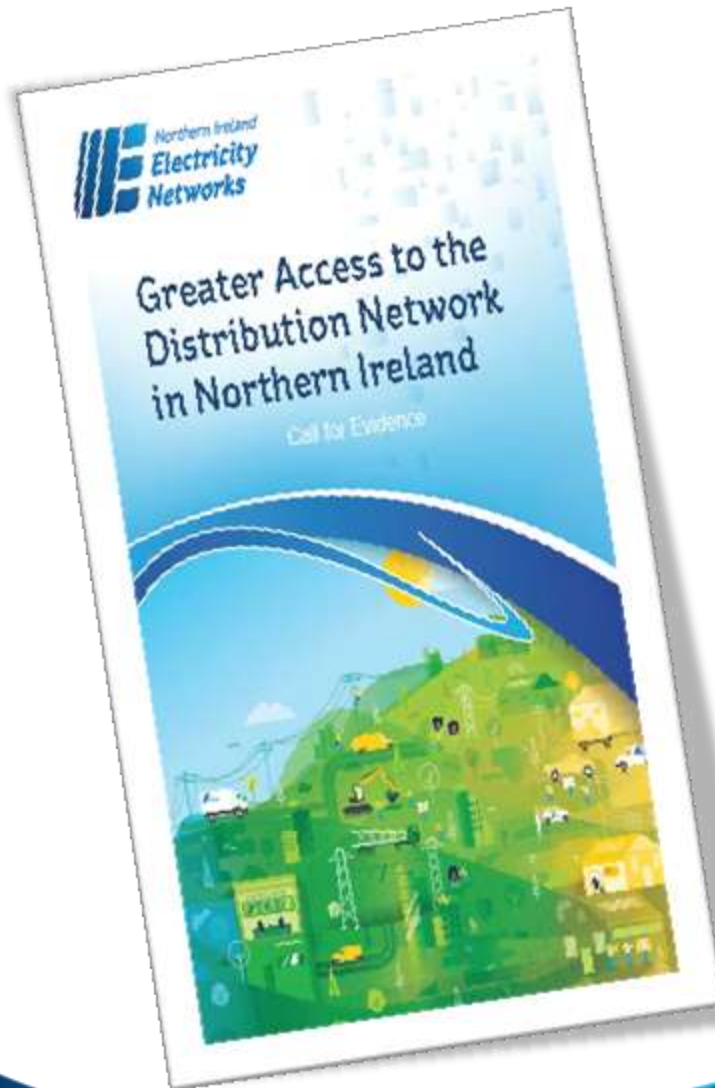
- Different voltage

## Energy Policy & Regulator

- Separately Regulated
- Devolved Energy Policy

## Transmission System Operator

- Different system operator and associated

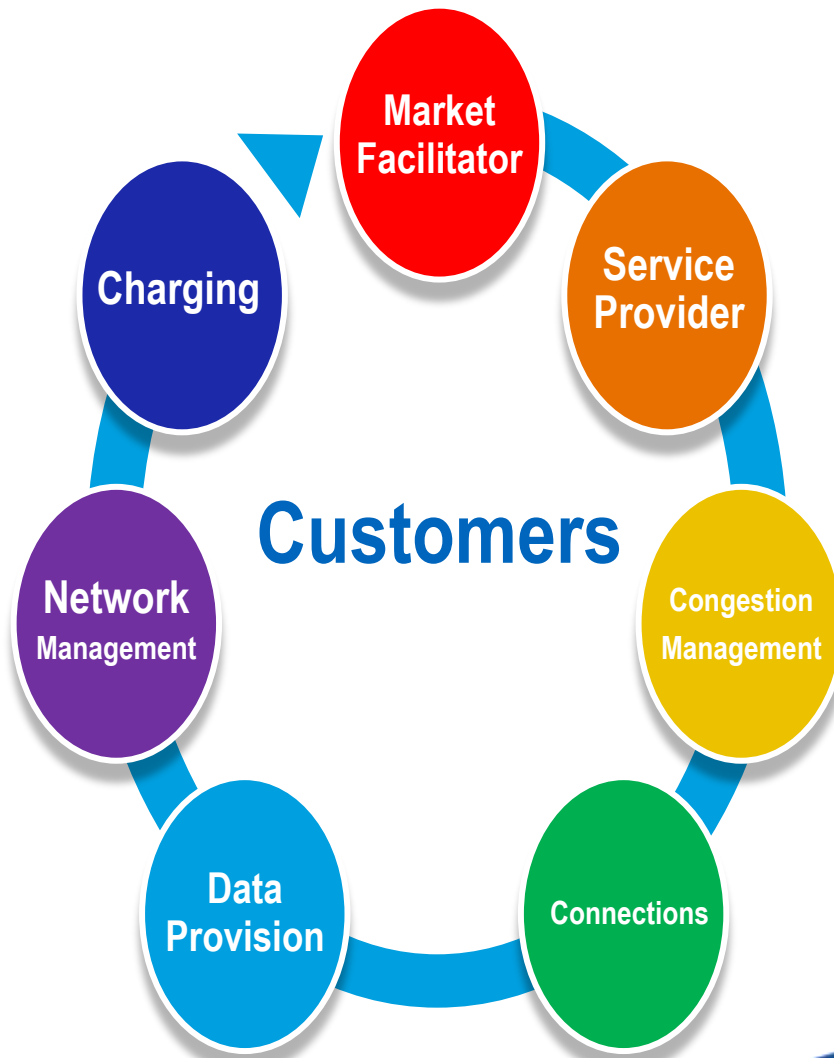


## Stakeholder Engagement

- **Call for Evidence – July 2018**
  - Industry workshop – September 2018
  - 20 responses received across all sectors
  - Key messages
    - Protection for passive consumers
    - Continued engagement throughout this process.
    - Increased data flows, IT systems and communications it is imperative
- **Consultation – closed 20<sup>th</sup> May 2019**
  - Currently reviewing responses
- **Recommendations to Utility Regulator**
- **Implementation – 2020 onwards**



## Long Term vision for DSO role

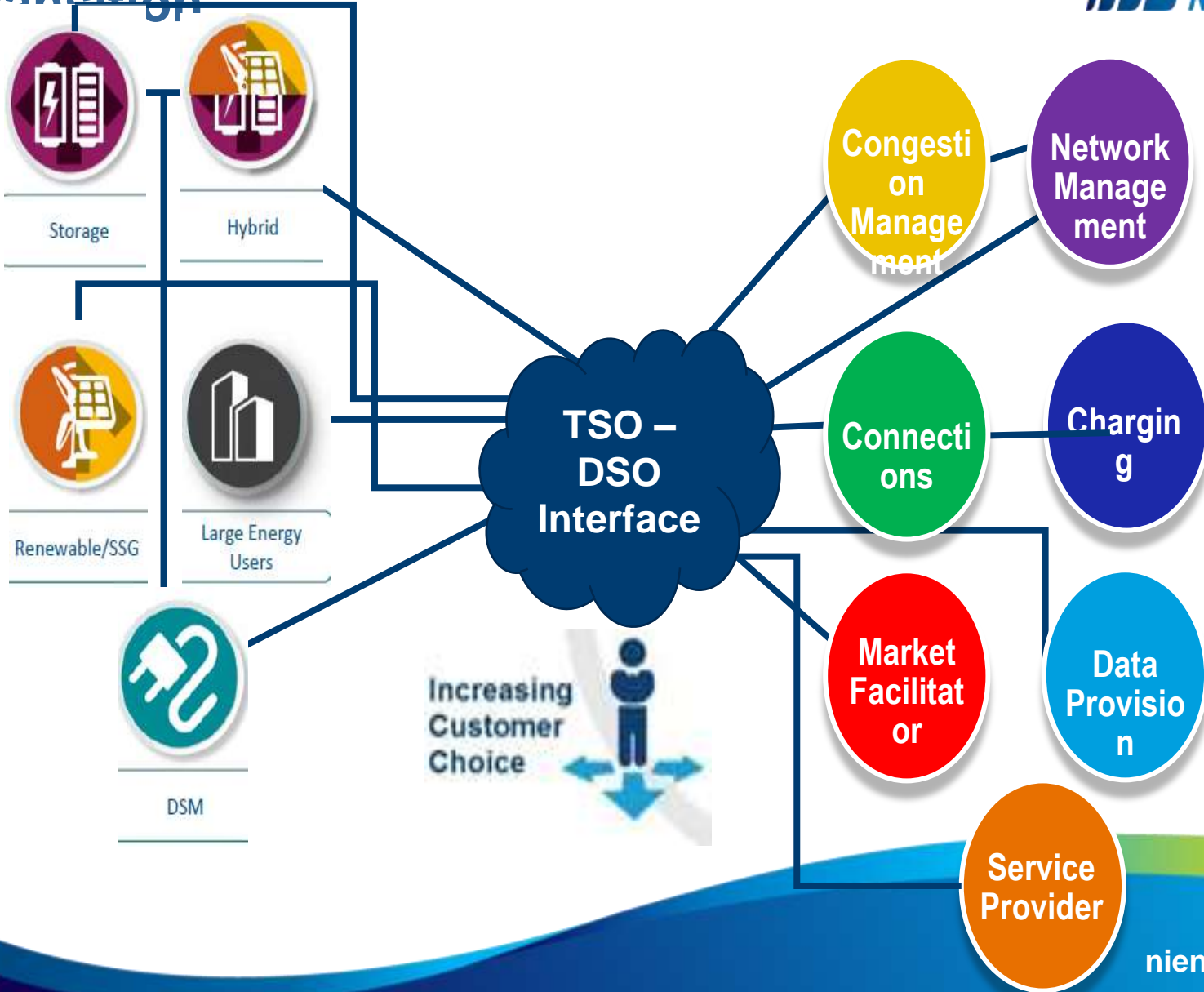


### Guiding Principles

- Customer centricity
- DSO will be a neutral market facilitator
- Whole system optimisation through increased cooperation between TSO and DSO
- Provide security, sustainability and affordability
- Provides protection to passive and vulnerable customers
- Will create DSO market for local congestion management
- Least regrets approach to the evolution

# Collaboration is central to the energy transition

FLEXTECH



DSO EVOLUTION

## Any questions?



[@NIElectricity](https://twitter.com/NIElectricity)



[linkedin.com/company/northern-ireland-electricity](https://www.linkedin.com/company/northern-ireland-electricity)



[facebook.com/nienetworks](https://www.facebook.com/nienetworks)



[nienetworks.co.uk](http://nienetworks.co.uk)

# FlexTech – Fish Bowl

Flexible Technology Integration Initiative



# Areas for Thought



## Technological Challenges

- Flexible capability
- Forecasting capability
- System Services capability
- Controllability
- Performance monitoring requirements
- Metering & Signalling requirements
- Standards



## Systems Challenges

- Control centre integration
- Control centre tools
- Controllability/dispatch arrangements/system requirements
- Metering & signalling system solutions
- Forecasting requirements and tools
- EMS
- Telecommunications
- Data management and exchange
- Digitalisation and the possibilities for the future power system



## Policy & Procedural Challenges

- Operational policies & procedures
- Grid Code and T&SC mods etc.
- Grid Code compliance
- Standardisation
- Communication protocols
- Modelling/technical studies



## Market & Regulatory Challenges

- System services
- Incentivising the right technology
- SEM/ I-SEM treatment, capacity market
- Connection Methods and arrangements
- European Network Codes

# Takeaways from Sessions

- Collaboration is key!
- The electricity sector is changing rapidly
- Preparing for and responding to this change and the uncertainty it brings is the big challenge for our sector
- We will embrace and respond to the challenge of transforming the grid for a low carbon future

CLOSE

