

# DS3 Programme Status Update

Yvonne Coughlan

DS3 Industry Forum

5<sup>th</sup> November 2012



# The DS3 Programme

Shaping the power system of the future

- Programme established 2011
  - Meet the 2020 renewable targets on the electricity power system while maintaining system security levels
  - Engaging with all industry stakeholders e.g. Industry Advisory Council, working groups for a
  - Holistically considering technical, commercial and regulatory needs of the system



# First 12 months of DS3

## Grid Code

- Wind Farm modifications drafted and proposed in Ireland
- Consultation completed on Wind Farm Settings Schedule in NI

## System Services

- International Review of System Services
- Significant analysis carried out on requirements of system
- Published 2 consultation papers
- Draft of financial Consultation paper



# First 12 months of DS3

## RoCoF Workstream

Timeline	Tasks	
To Aug 2012	Worked with industry to discuss and propose a RoCoF standard	✓
Sep 2012	Publication of Joint Grid Code Working Group paper Publication of TSOs Opinion Paper	✓
Oct 2012	Modifications presented to Grid code Review Panels Modification published for consultation in NI	✓
Nov 2012	Modification consultation closes in NI	
Dec 2012	Modification for approval at Ireland Grid Code Panel Modifications sent to RAs for approval	
Q1 2013	Decision on RoCoF Modifications by RAs	
2013	Testing and Analysis of RoCoF Capability	



# First 12 months of DS3

## RoCoF Workstream

Timeline	Tasks
Mar – Sep 2012	Worked with industry to discuss and propose a RoCoF Standard ✓
S	Standard ✓
O	New Panels ✓
N	
D	New Panel ✓
Q1 2013	Decision on RoCoF Modifications by RAs
2013	Testing and Analysis of RoCoF Capability

**Objectives**

- All Island RoCoF Standard of 1 Hz/s**
- Temporary RoCoF Standard of 2 Hz/s  
(pending the system reinforcement in that region)**
- Capability to operate the system with higher instantaneous penetrations of renewable generation**



# First 12 months of DS3

## Renewable Data

- System curtailment levels
- Impact on system of high wind
- Review of forecasted 36 month renewable connections
- Analysis of High Wind Speed Shutdown

## Performance Monitoring & Testing

- All Island Generator Performance Reports developed
- Developing requirements specification for performance monitoring tool in line with system services workstream



# First 12 months of DS3

## Demand Side Management

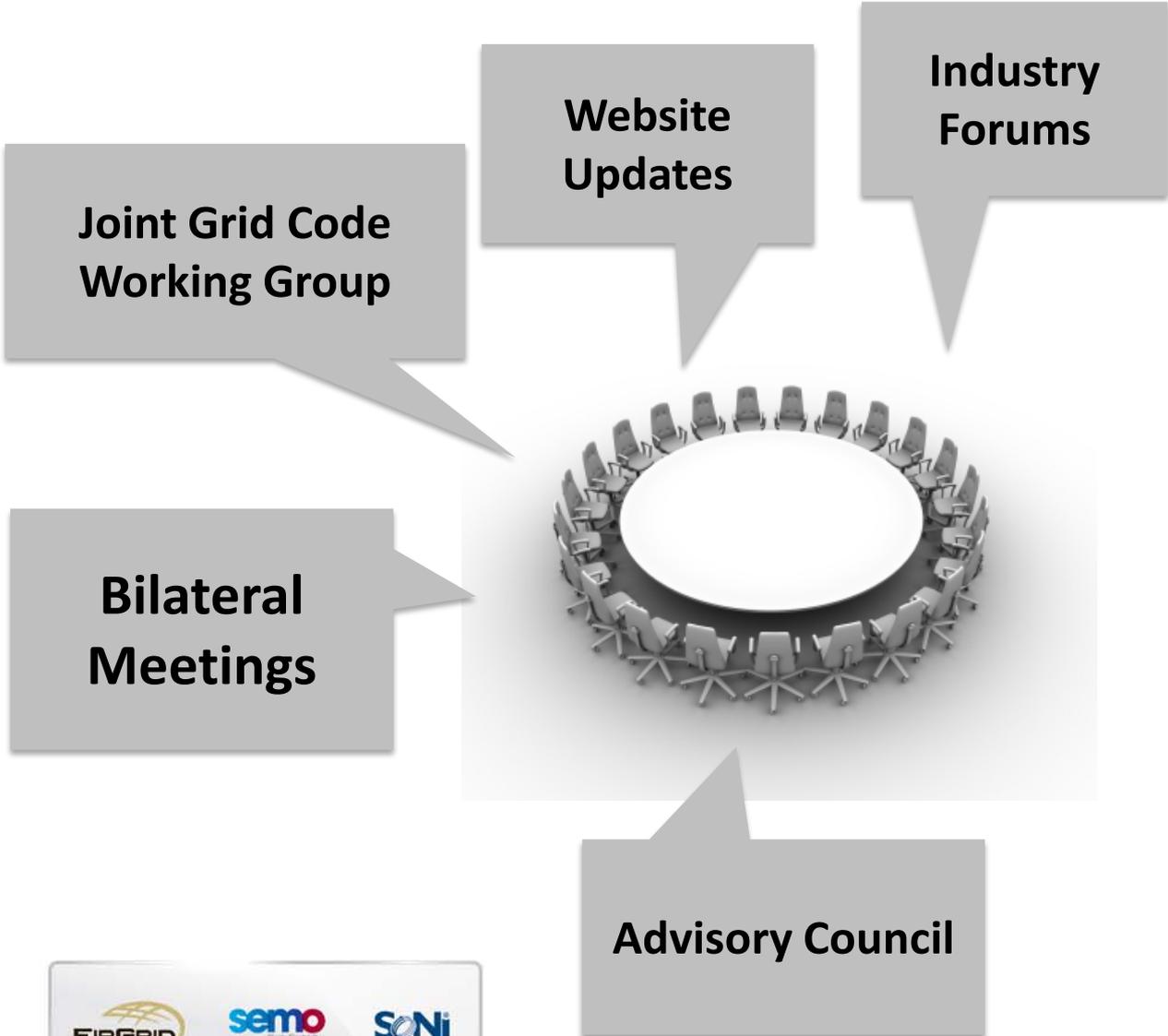
- 1 DSU operational
- Another DSU undergoing Grid Code testing
- Several workshops – Dublin, Belfast, Cork

## Model Development & Studies

- All Island Network Model
- Scoping studies and assumptions
- Loss of Largest In-Feed study complete
- Ramping analysis complete



# Industry Engagement DS3



# Key Milestones to 2015

- System Services evolution and implementation to meet needs of the system
- Long term operational policy development
- Advanced Real Time tools implementation



# Key Deliverables for 2013

## DS3 Programme - Transitioning toward System Policies and Tools

- Decision on RoCoF approach
  - Dependent on results of DSO studies
  - Dependent on Grid Code modification proposals
- System Services
  - TSOs Recommendations Paper on System Services
  - Regulatory Decision on System Services
  - Kick off Implementation project for System Services
- Technical Studies
  - Review of operational policies for frequency and voltage control



# High Wind Analysis of the All-Island System

David Cashman

DS3 Industry Forum

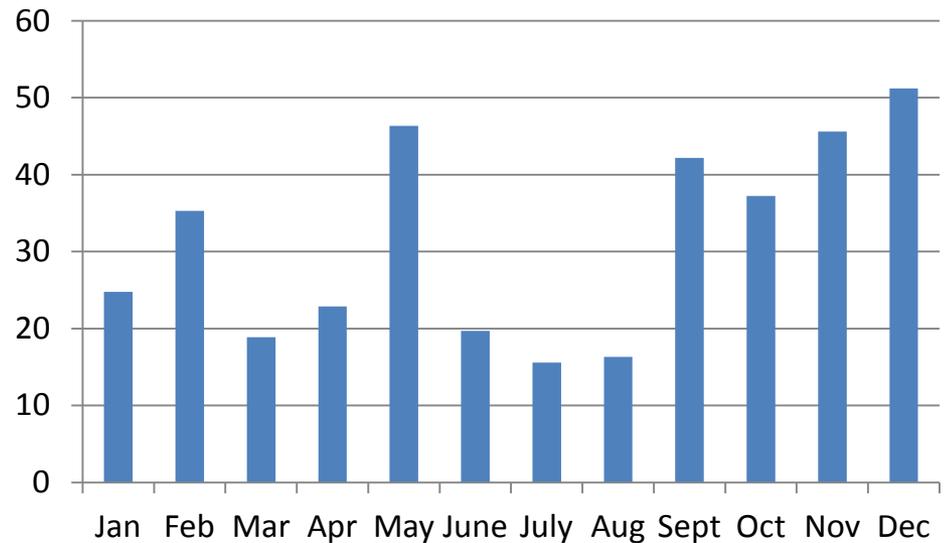
5<sup>th</sup> November 2012



# Wind Statistics

- Capacity Factor 2011: 31%
- All-Island Wind Generation record of 1838 MW on November 30<sup>th</sup> 2011
- On November 26<sup>th</sup> 38.4 GWhrs generated accounting for 38.8% of demand
- Maximum recorded SNSP: 50%
- 103 Days in 2011 where wind exceeded 40% of demand during one or more trading periods

2011 Monthly Wind Capacity Factors



# Analysis of High Wind Reports - 2011

- In 2011 42 high wind reports compiled.
- At the beginning of 2012 a summary document was compiled outlining the major findings and operational recommendations in relation to transient, voltage and frequency stability.
- To date results do not demonstrate any voltage or transient stability issues at current levels of SNSP.

Date	SNSP %	Voltage Stability	Transient Stability
27-11-11	49	✓	✓
02-11-11	46	✓	✓
24-11-11	42	✓	✓
26-05-11	40	✓	✓
29-05-11	40	✓	✓



# Analysis of High Wind Reports – 2011

- Simulate tripping of largest generating unit and determine ROCOF for the system.
- RoCoF originally measured at 100 ms intervals – results approached 0.5 Hz/s standard.
- EirGrid and SONI Grid Code modifications state units must withstand RoCoF of 1 Hz/s and 2 Hz/s in Ireland and Northern Ireland respectively.

Date	SNSP %	Fmin Hz	RoCoF Hz/s 100 ms	RoCoF Hz/s 500 ms
27-11-11	49	49.6	0.34	0.25
02-11-11	46	49.6	0.37	0.26
24-11-11	42	49.6	0.32	0.22
26-05-11	40	49.6	0.32	0.23
29-05-11	40	49.6	0.37	0.26

# Outcomes and Next Steps...

- Results from HWRs have reinforced and built on findings of the FOR study.
- The findings of the reports provide recommendations on operational policies.
- RoCoF analysis has helped to provide technical basis for the development of the revised Grid Code standard.
- Further analysis in 2012 is ongoing with improved methodology.
- Development of All-Island WSAT model to improve accuracy of results.





# All Island Renewable Connection Report - 36 Month Forecast

Jonathan O'Sullivan

DS3 Industry Forum

5<sup>th</sup> November 2012

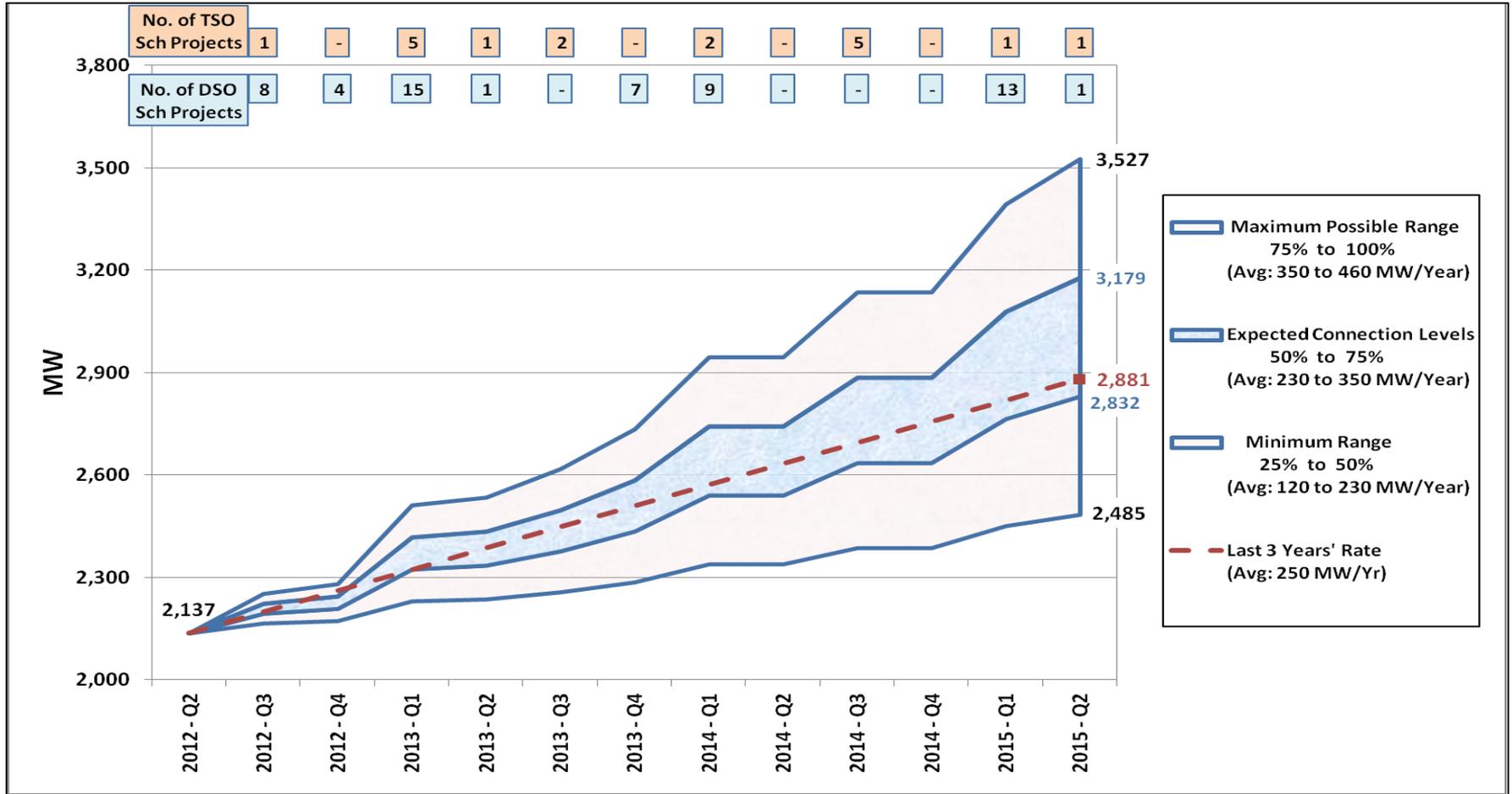


# Assumptions

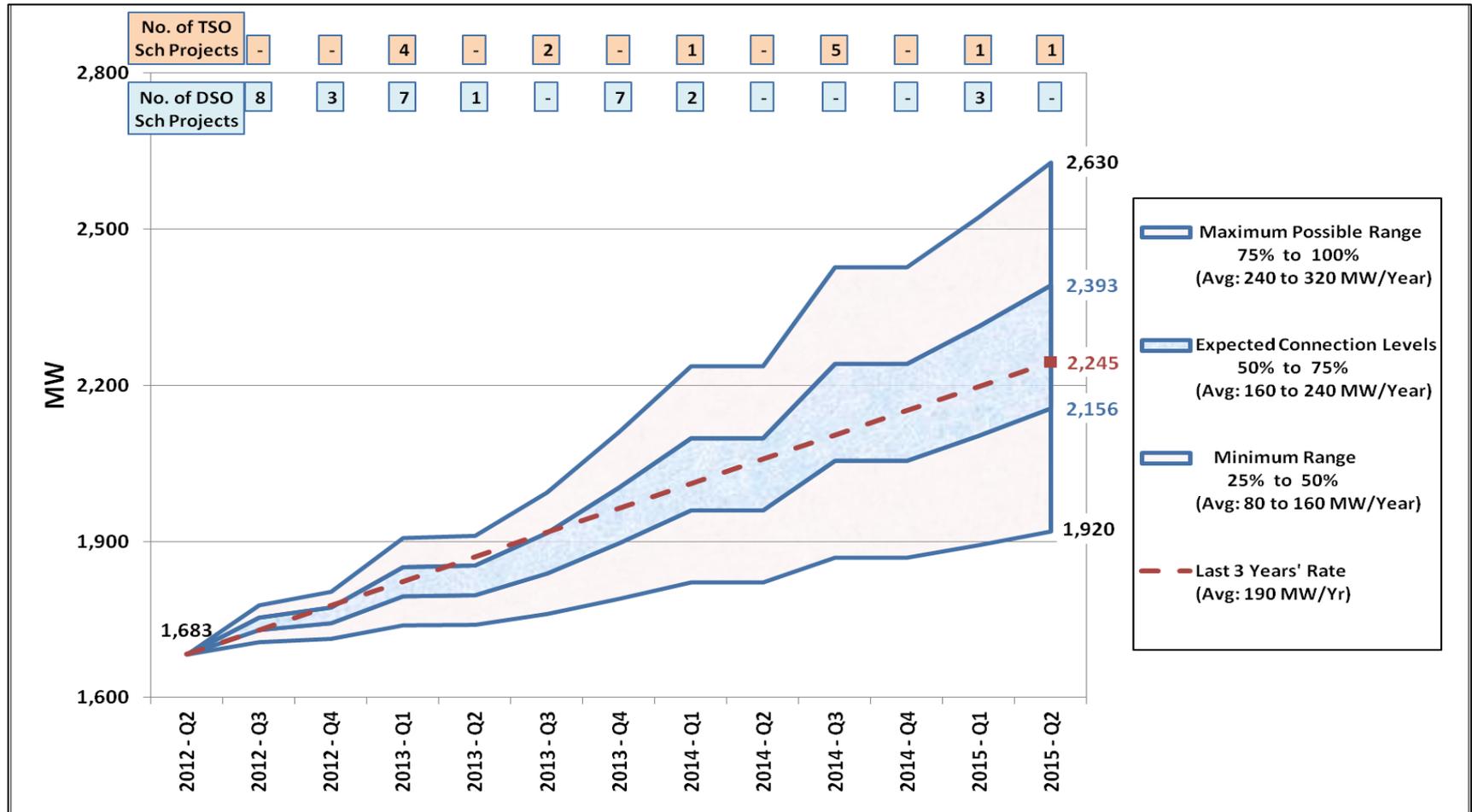
- Connection assessments are based on experience.
- The rate of these connections are contingent on a number of variables many of which are outside the control of the system operators, including:
  - Financing
  - Planning Permission
  - Commercial Decisions and
  - Construction of the wind farm itself
- No explicit link to these variables or to network rollout



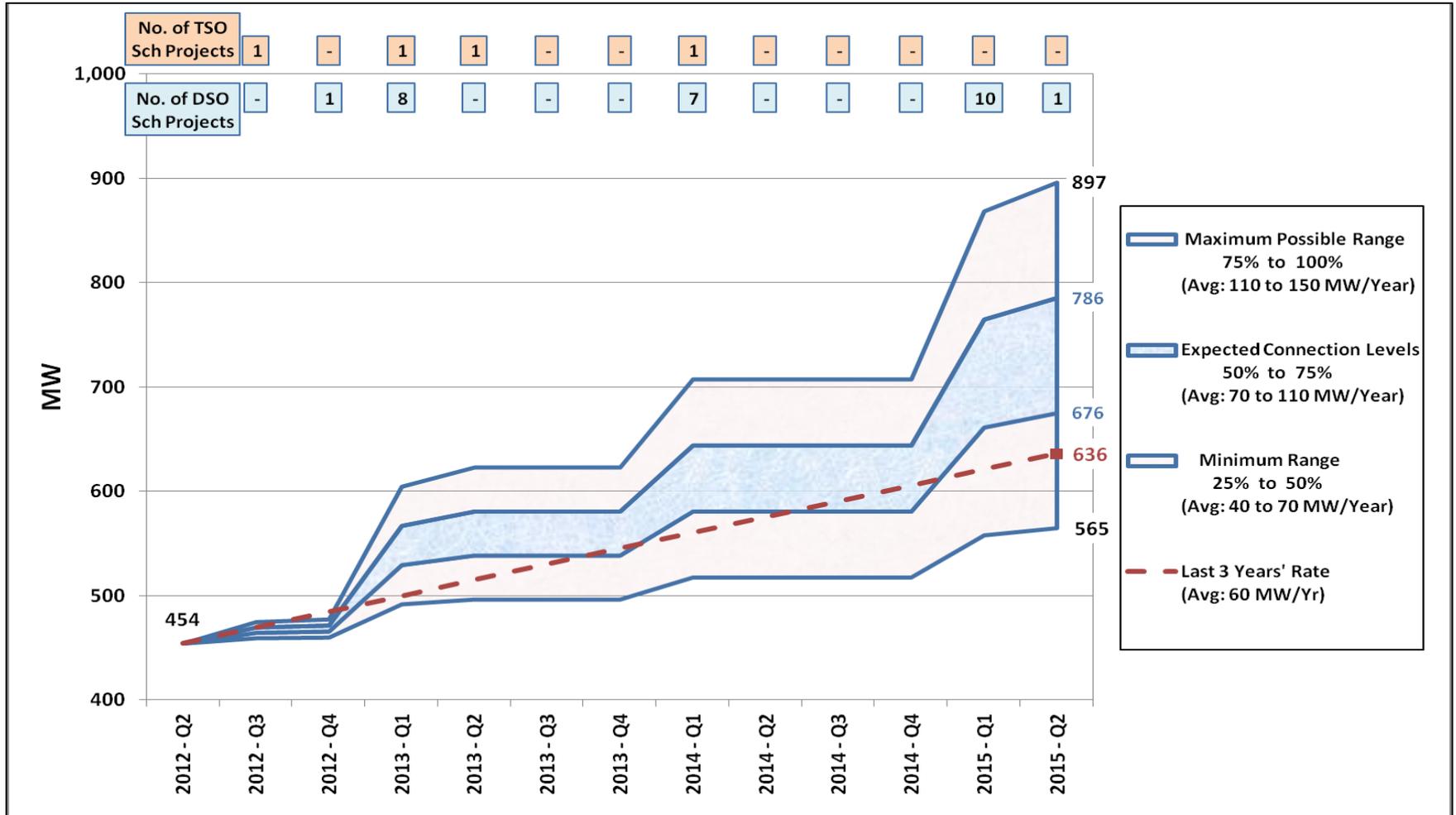
# All Island: 36 Month Forecast



# Ireland: 36 Month Forecast



# Northern Ireland: 36 Month Forecast





# All Island Curtailment Report

Jonathan O'Sullivan

DS3 Industry Forum

5<sup>th</sup> November 2012



# Results for 2011

- Report developed pre SEM 011-62
  - Hierarchy used based on VPTG
- Operational Issues of Note
  - Turlough Hill major overhaul
  - Moyle Interconnector outage
- Yearly wind profile
  - Latter 6 months windier than first 6 months

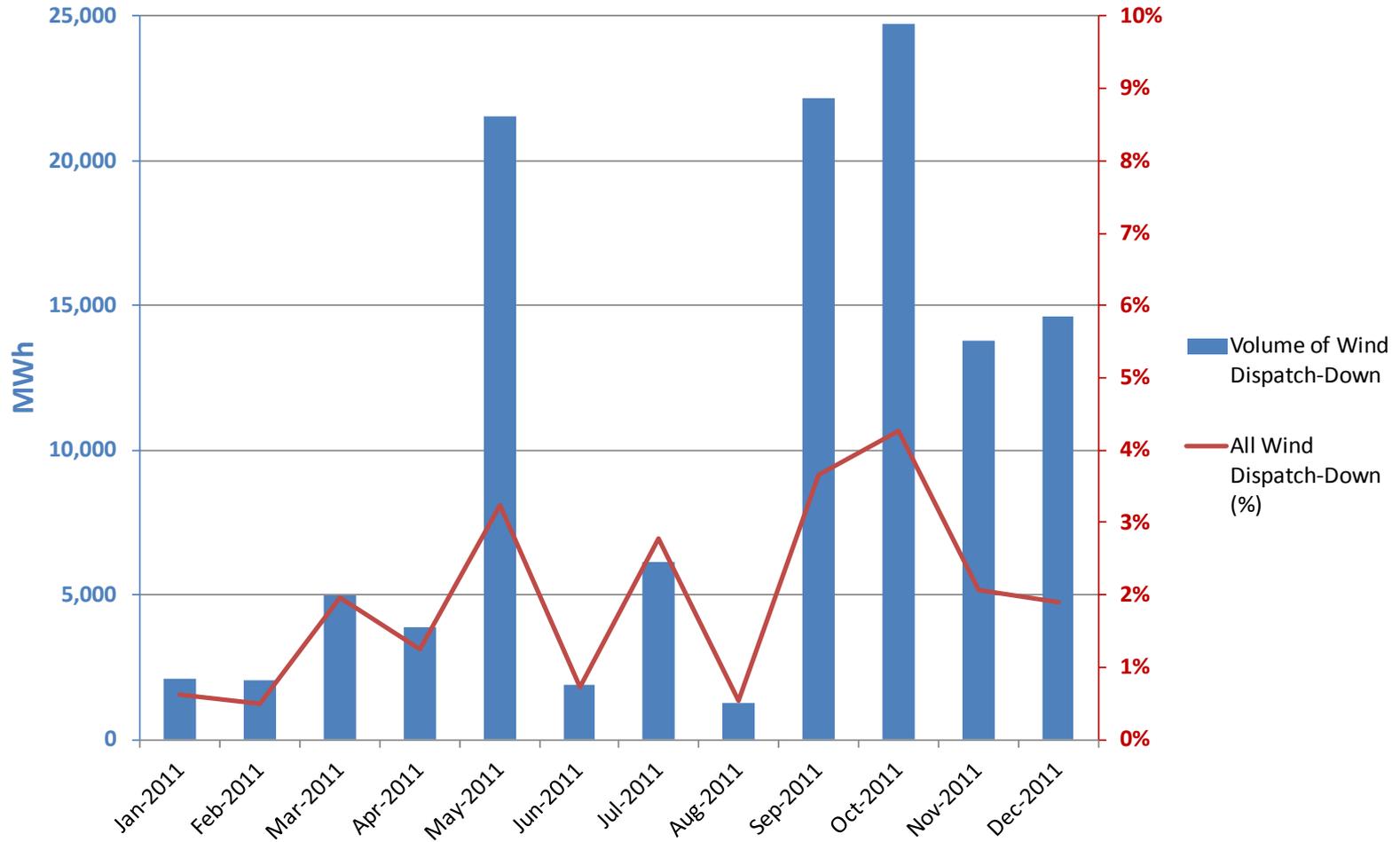


# Jurisdictional Breakdown 2011

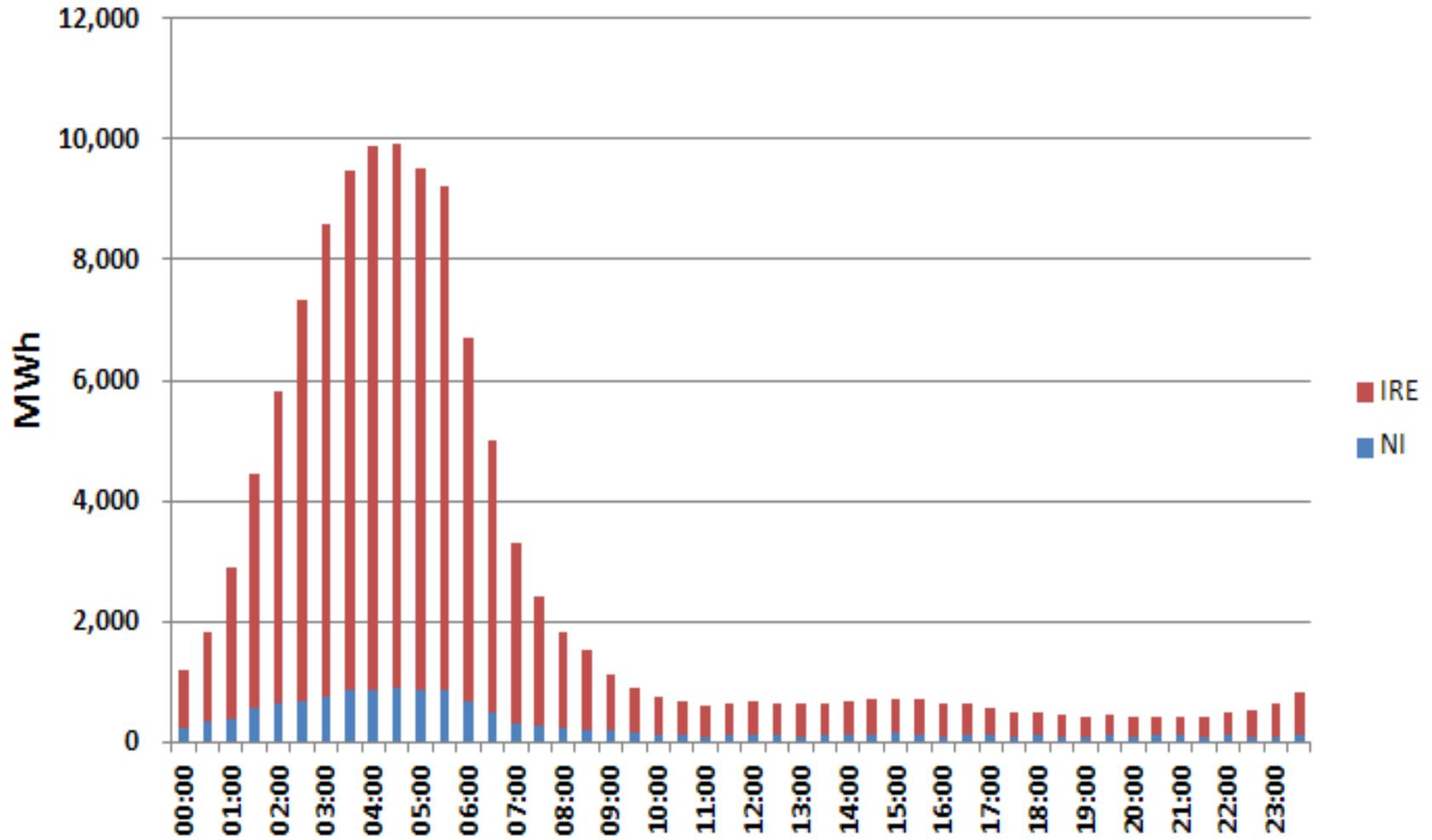
	IRE	NI	All Island
Total RES-E	18%	12%	17%
Total Dispatched Down (MWh)	105,741	13,415	119,156
Total Dispatched down RES-E	2.4%	1.3%	2.2%
Total Energy dispatched down on VPTG	7.5%	5.3%	7.2%



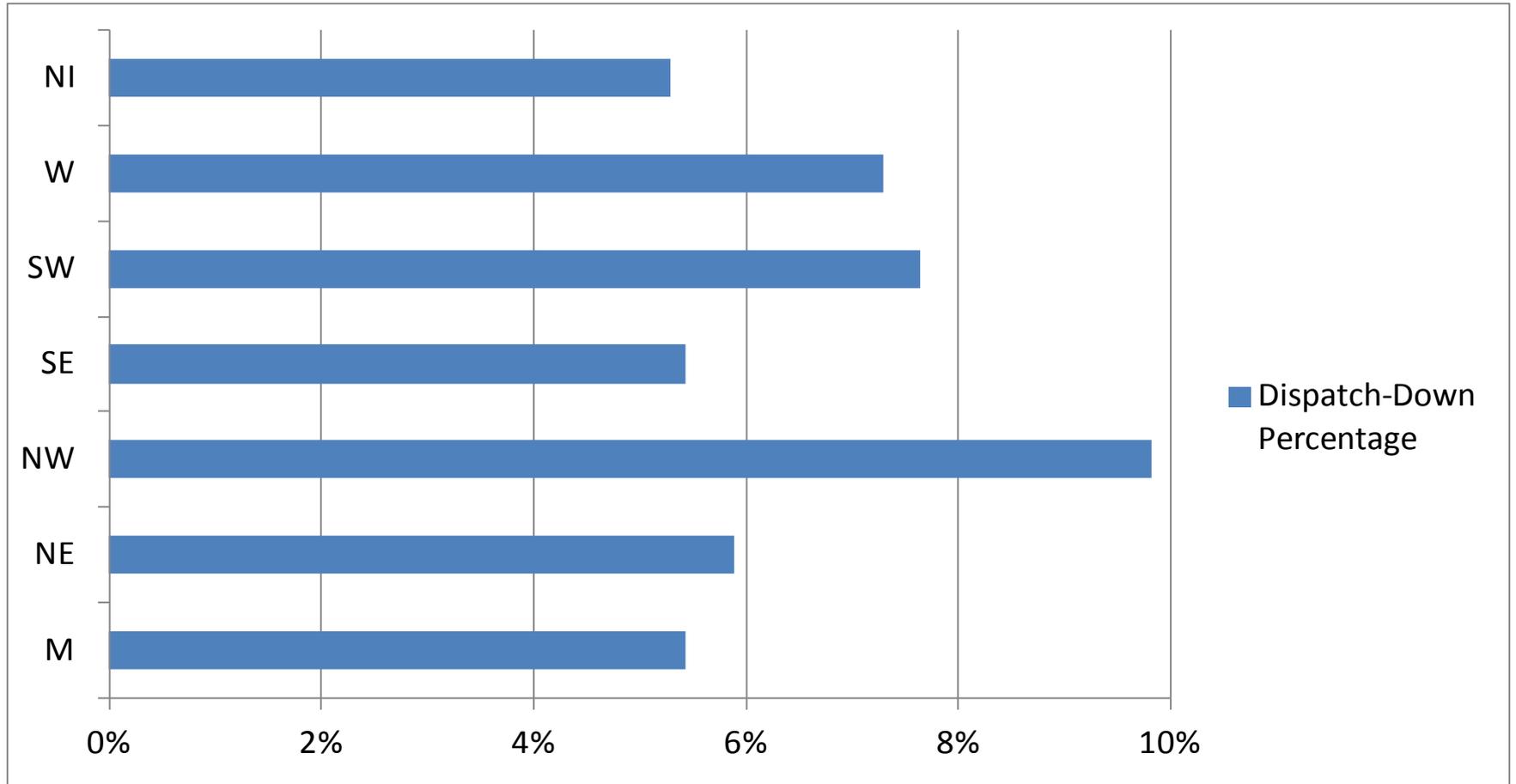
# All-island monthly totals



# 2011 - 24 hour aggregate dispatch down



# Regional Assessment



# DS3 Grid Code Windfarm Standards

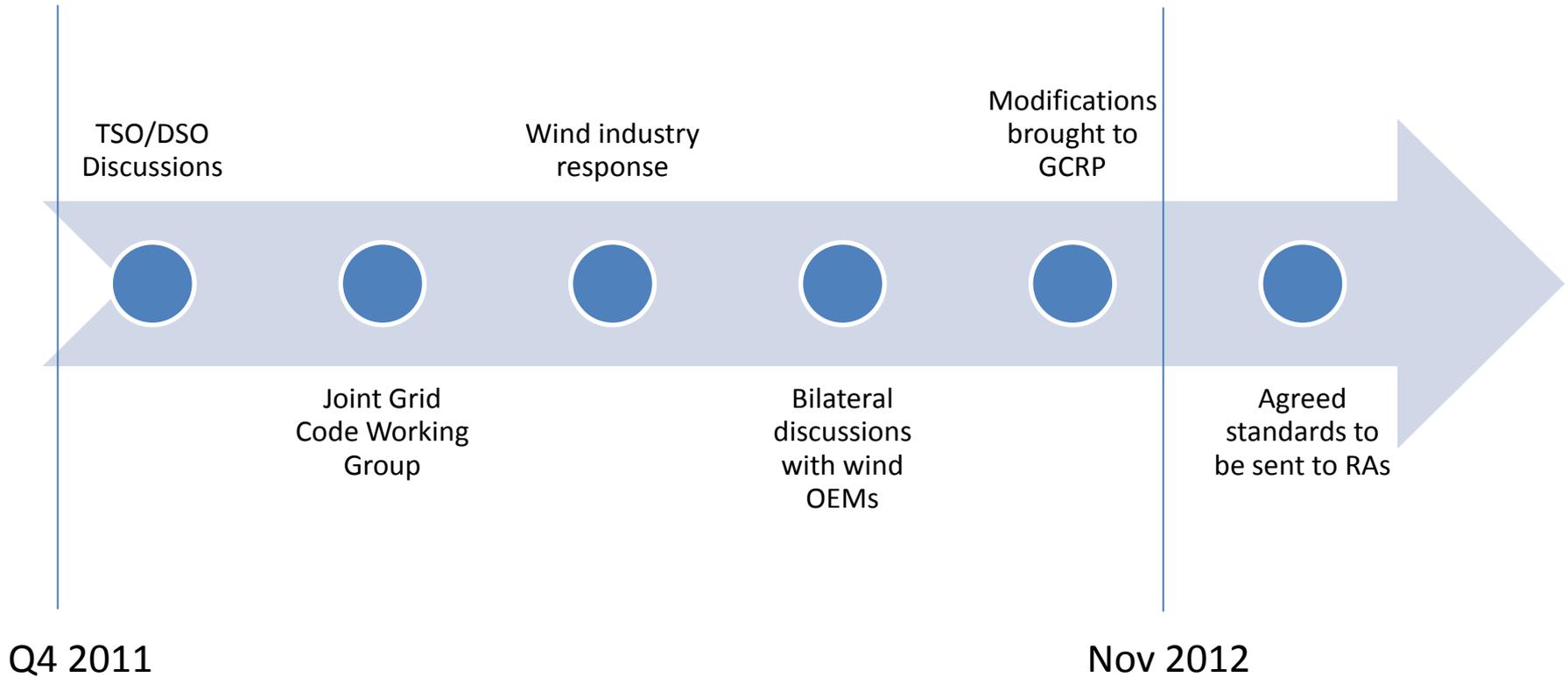
Alan Rogers

DS3 Industry Forum

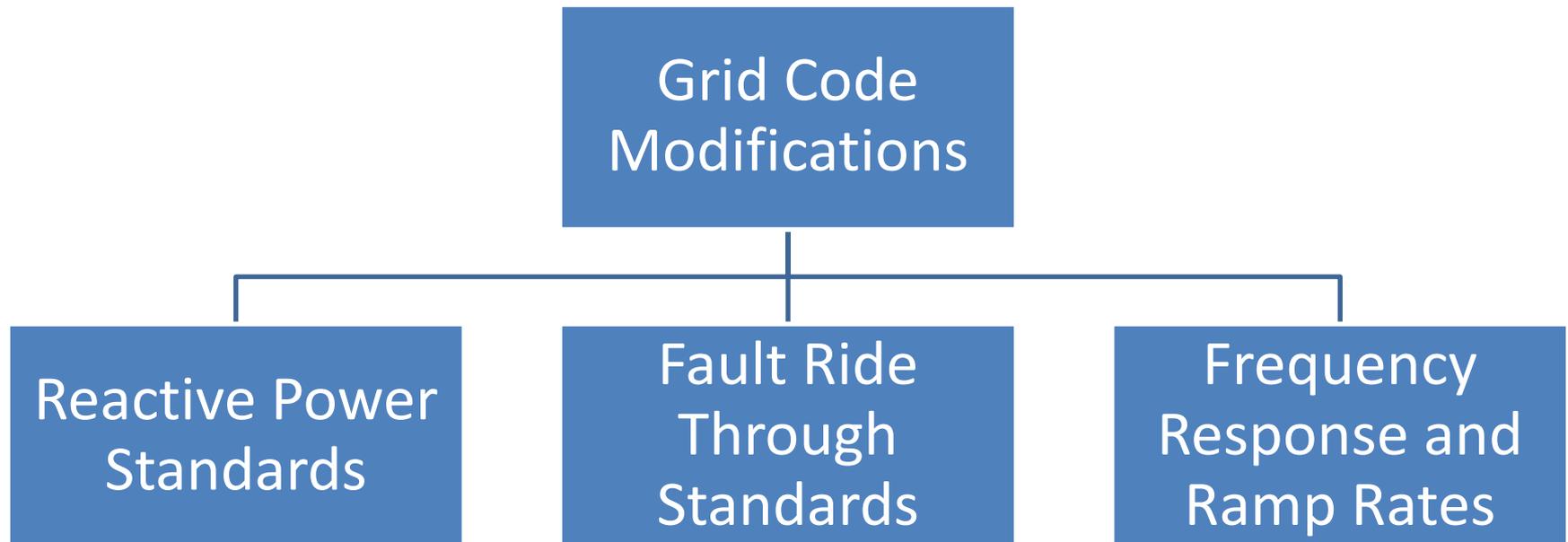
5<sup>th</sup> November 2012



# Ireland Grid Code Modifications



# Ireland Grid Code Modifications



# Northern Ireland Grid Code Modification Process

## Draft Windfarm Settings Schedule

- Supplementary document to NI Grid Code
- Incorporates standards as well as testing details

## TSO/DSO Discussion of Standards

- TSO/DSO joint view on WFPS standards necessary to operate at high wind

## Joint Grid Code Working Group

- Discussion with industry on proposed standards / wording refinement / broad agreement

## Consultation on Settings Schedule

- Further opportunity for input from NI wind industry

## Review of Submissions

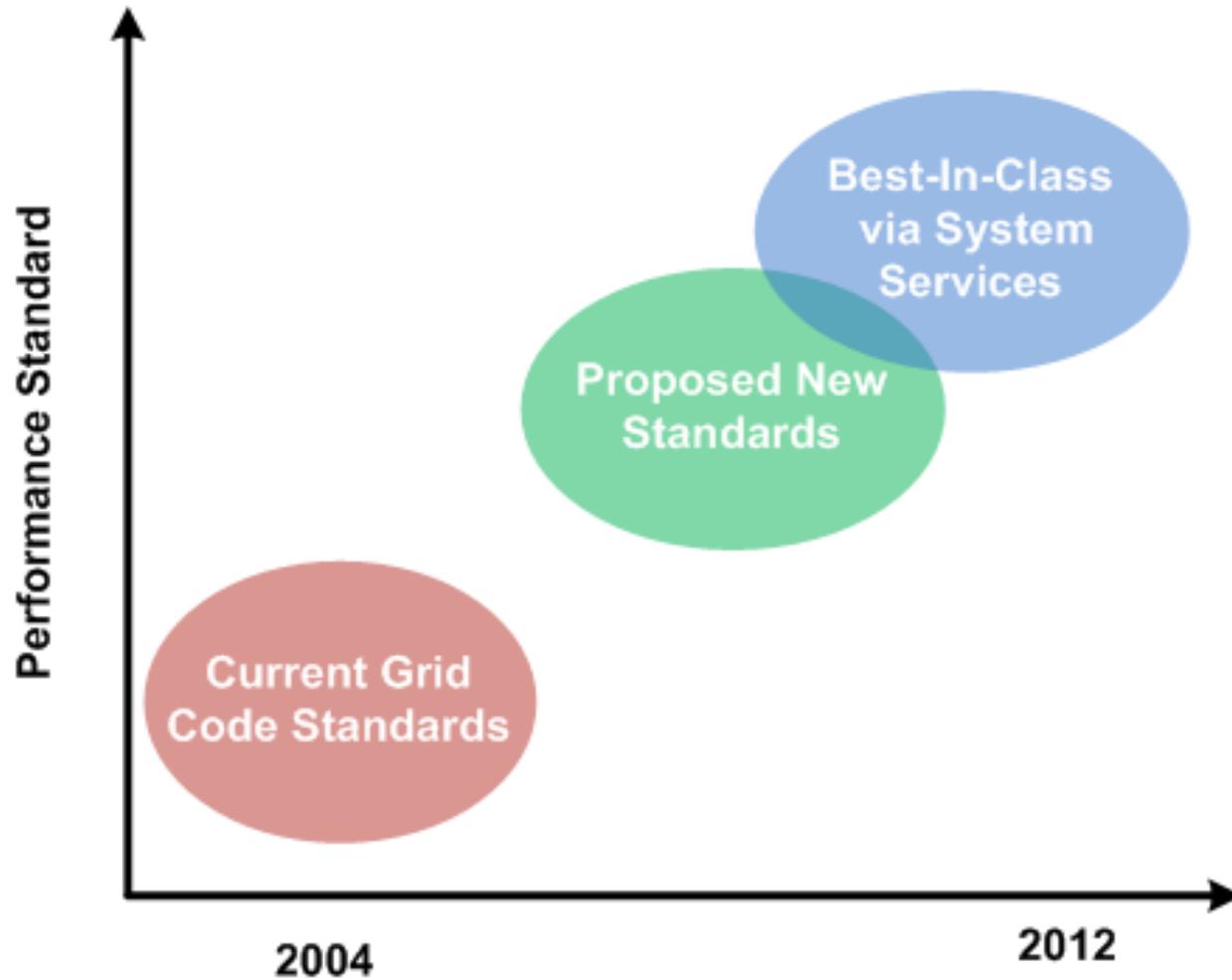
- Collation of responses, revision, and submission to RAs

# Summary of Differences

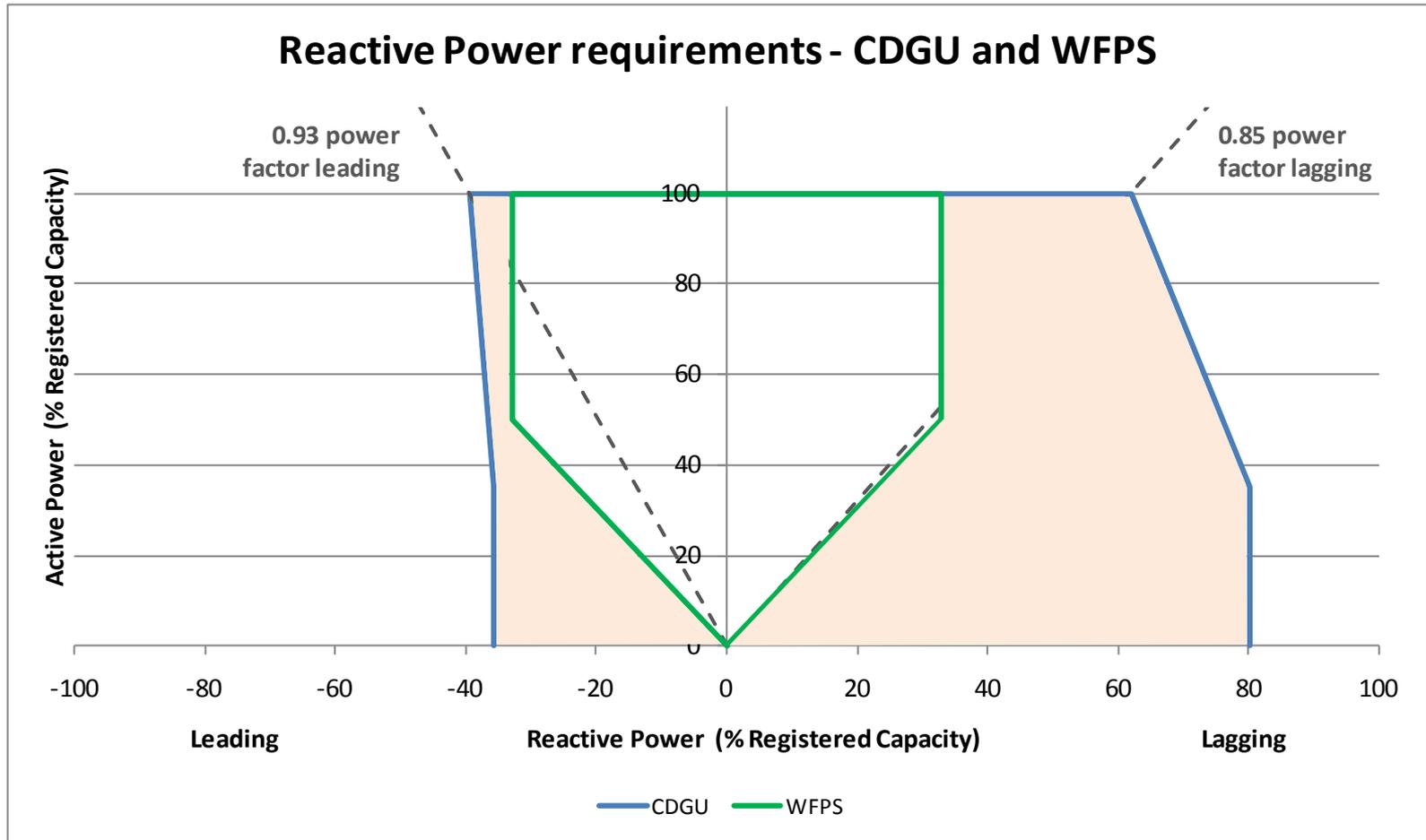
- No material differences in IE / NI standards on Reactive Power / Freq. Response / Ramp Rates
- Wording / approach may differ: GC vs Settings Schedule
- NI – Most wind is distribution-connected
  - Further studies required on FRT clauses before exact modification is decided



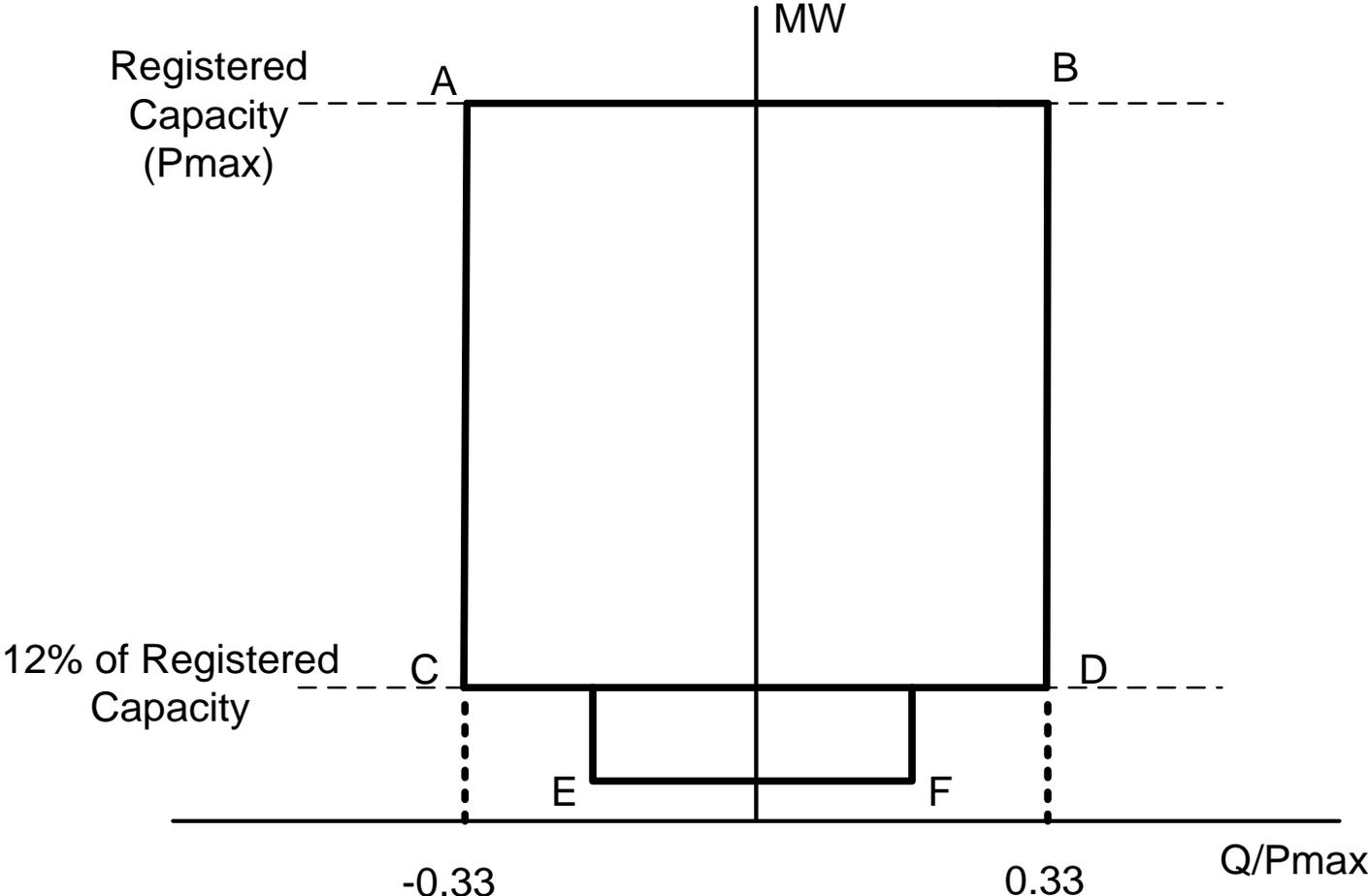
# Approach Taken



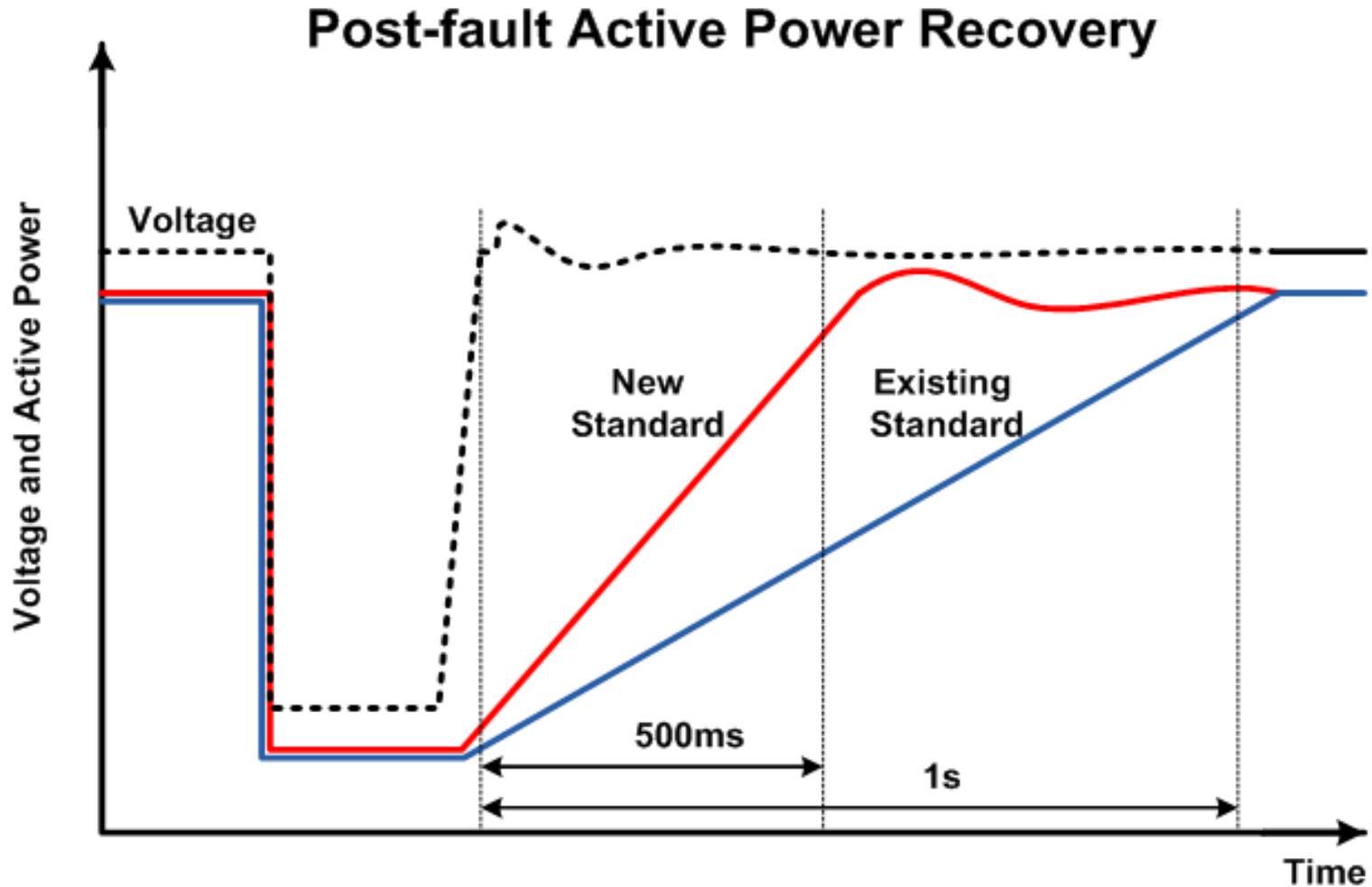
# Existing Reactive Power Standards



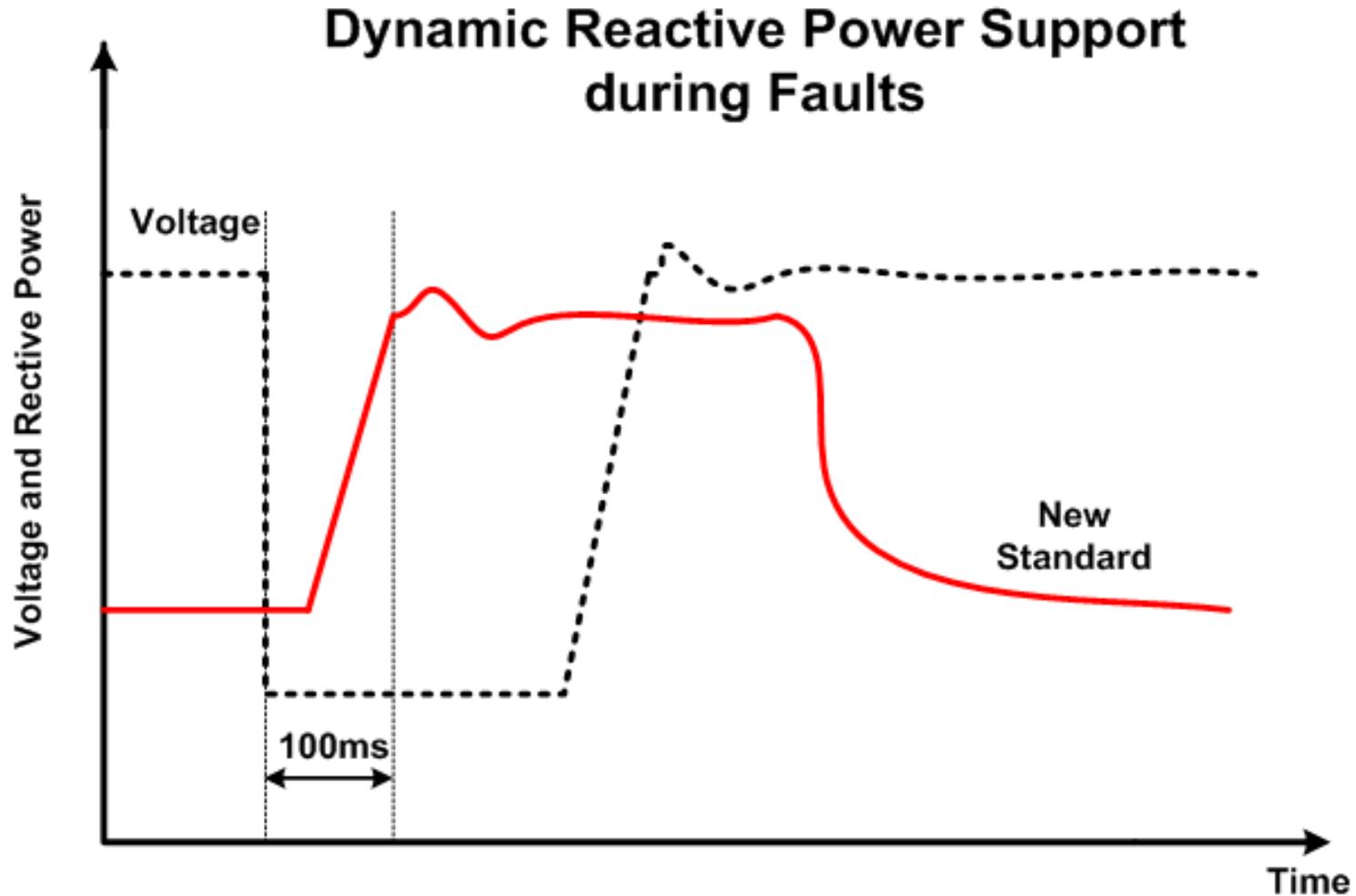
# Proposed WFPS Reactive Power Standard



# Fault Ride Through Standards



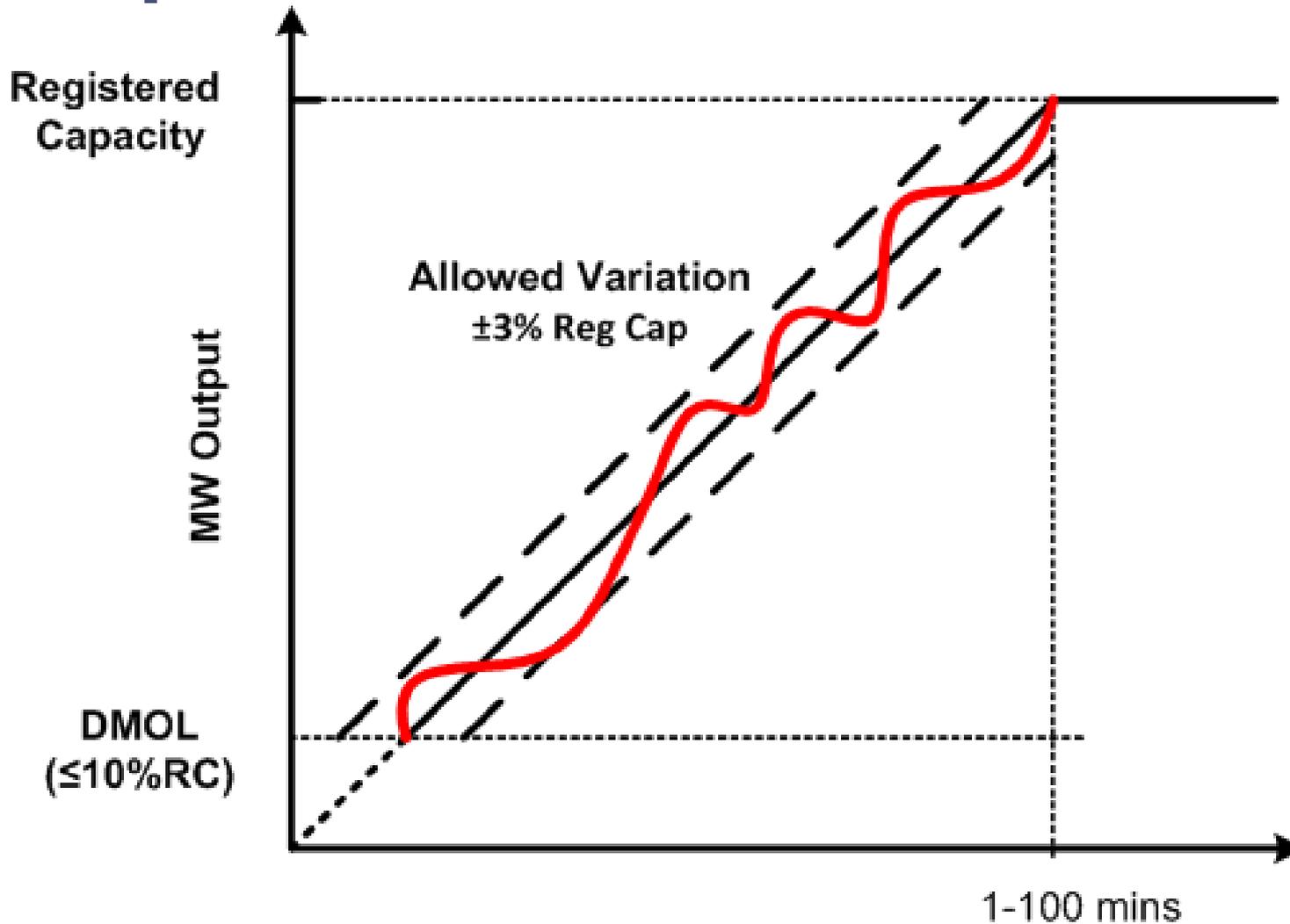
# Fault Ride Through Standards



# Frequency Response and Ramp Rates

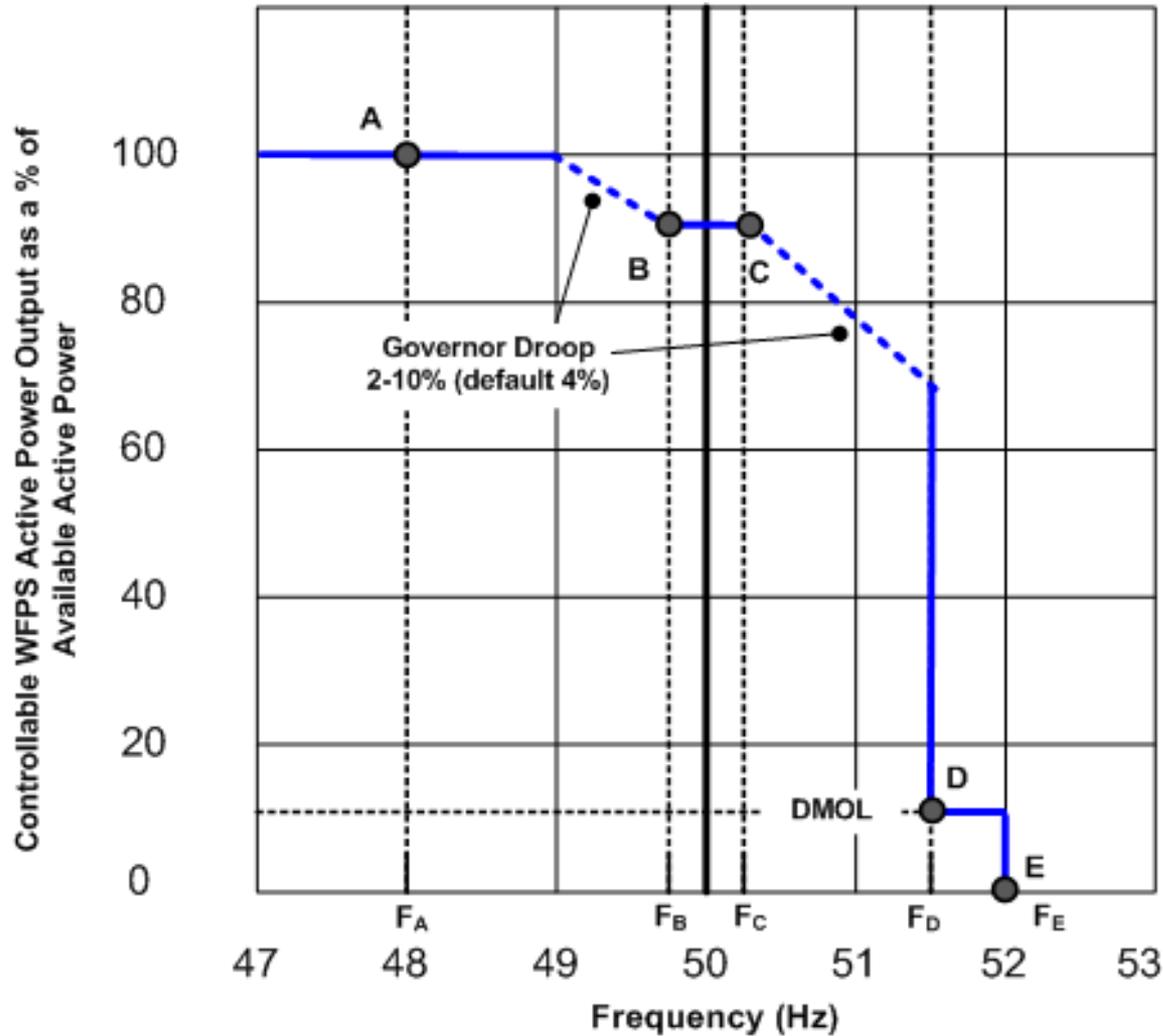
- Windfarms must help control frequency (Governor Droop) when curtailed down
  - i.e. when they have upwards and downwards regulation capability
- Speed of response defined and aligned with SONI standards
- Ramp Rates – simplification: Wind Following Rate, Dispatch Rate (Faster) and a Frequency Response Rate (Fastest)

# Ramp Rates

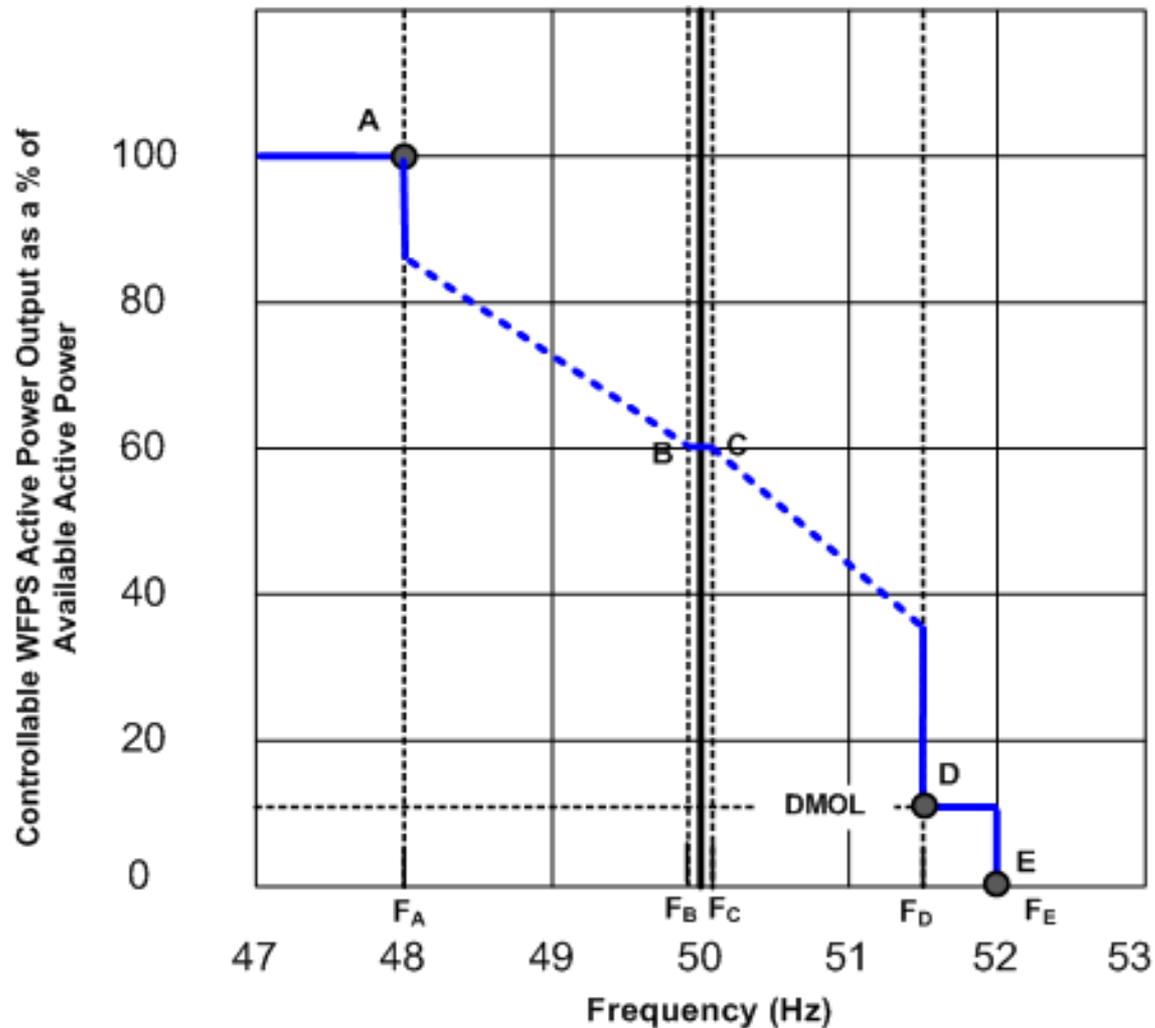


DMOL = Design Minimum Operating Level

# WFPS Power-Frequency Curve



# Active Power Dispatch Mode



# Enhanced Standards Through System Services

- ‘Best in Class’ standard were not sought
- Enhanced standards may form part of System Services
  - Full reactive power capability down to 0 MW
  - Very fast post-fault active power recovery (250 ms)
  - Very fast dynamic reactive power provision (40 ms)



# Next Steps – DS3 Grid Code Workstream

- Discussion with ESBN on appropriate D-Code modifications to WFPS standards
- RoCoF modifications to be brought forward to Grid Code Review Panels
- Dynamic Modelling modification in preparation
- SONI/NIE to carry out studies on FRT requirements for D-connected WFPS
- Maintain watching brief on new technologies



# DS3 RoCoF Workstream

Tom McCartan

DS3 Industry Forum

5<sup>th</sup> November 2012



# Background

- Generator Capability – CC7.3.1.1(d) – remain synchronised during rate of change of frequency up to and including 0.5Hz/s
- ROCOF is not currently a defined term in the Irish Grid Code and ROCOF generator capability is not mentioned in SONI Grid Code
- Need to specify how ROCOF is calculated
  - Definition will affect ultimate ROCOF capability sought from generators
- Current RoCoF level is a contributory factor to the SNSP level of 50%



# Challenges Facing Generators/DSOs

- Joint Grid Code Working Group facilitated different concerns to be discussed
- Concerns over effect of higher RoCoF on plant life
- Potential of catastrophic plant failure
- Significant costs associated with studying impact of RoCoF on generators
- Maintaining secure distribution systems
  - Detection of islanded generation
  - Discrimination between real electrical islands and other electrical transients
  - Ensuring public safety



# Proposed RoCoF Modifications

## All Island RoCoF Modification

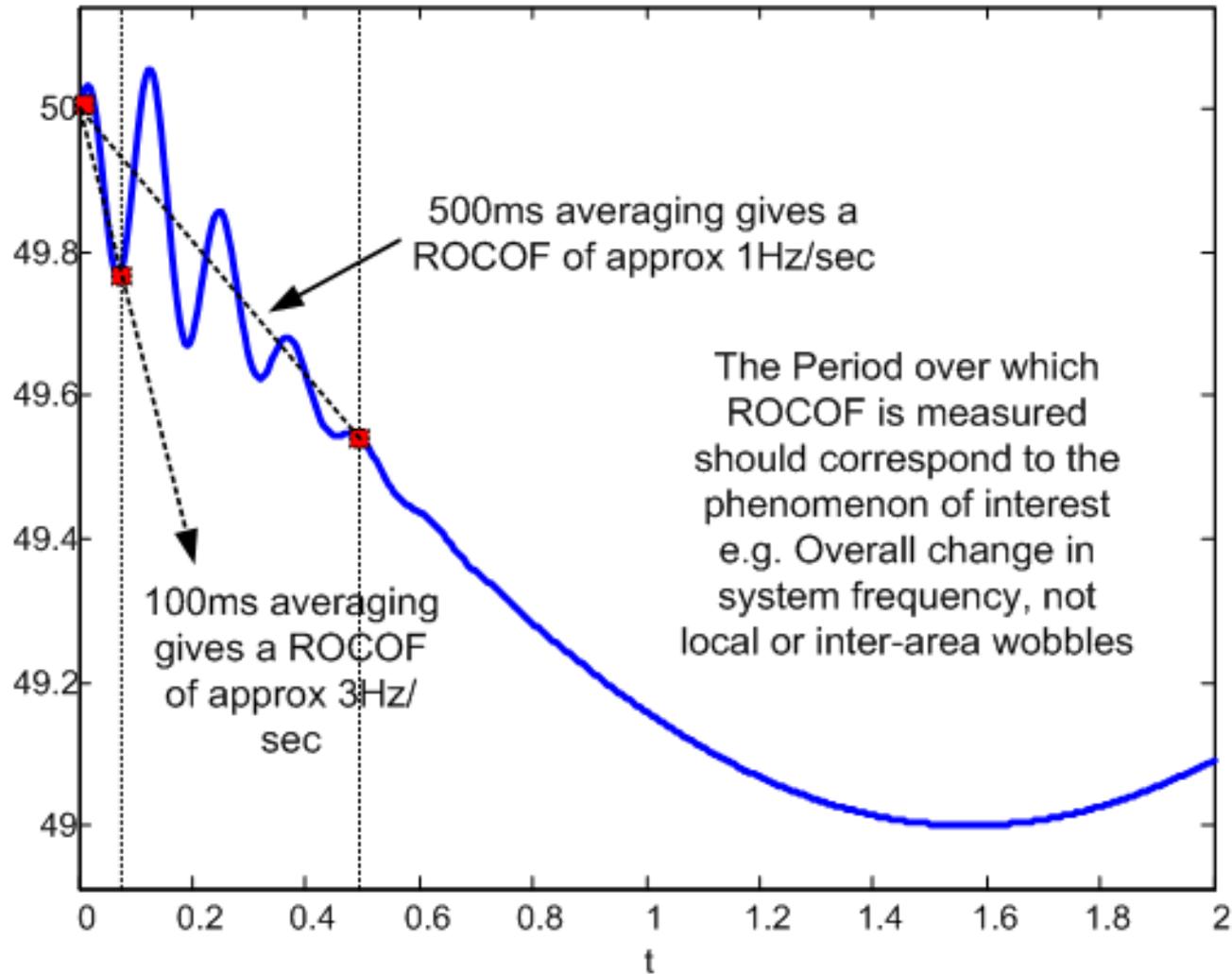
- RoCoF Standard of 1 Hz/s measured over 500 ms

## Northern Ireland RoCoF Modification

- Further system reinforcement is required between Ireland and Northern Ireland
- Results from System Separation Studies show RoCoF > 1 Hz/s
- Northern Ireland standard of 2 Hz/s is required as a temporary standard pending the system reinforcement



# Illustration – Averaging Concept



# Rationale for RoCoF Proposal

- Generators should not trip for very high ROCOF values seen during transient faults
  - Fault ride through clauses must apply here
  - There has never been a problem historically
- ROCOF value / Calculation Window should be chosen such that fast electrical transient effects are excluded
  - But should be high enough to capture loss of largest infeed / system separation type events



# Progress to Date

## Industry Interactions

- Significant discussions as part of the Joint Grid Code working group
- Joint Grid Code Working Group paper developed - position of all parties

## TSOs

- Have developed and published a TSOs' Opinion paper

## DSOs

- Both DSOs are undertaking separate studies to assess the impact of increased RoCoF standards

## Regulatory Authorities

- Conventional generators have been asked to give an indication of the cost associated with the impact assessments they believe are required on their plant and equipment in order to meet the RoCoF requirements.



# RoCoF Timeline

October	<p>RoCoF modifications presented to Grid code Review Panels</p> <p>RoCoF modification published for consultation in Northern Ireland</p>
November	<p>RoCoF modification consultation closes in Northern Ireland</p>
December	<p>RoCoF Modification for approval at Ireland Grid Code Review Panel</p> <p>RoCoF Modifications will then be sent to regulators for approval</p>
Q1 2013	<p>Decision on RoCoF Modifications by Regulatory Authorities</p>
2013	<p>Testing and Analysis of RoCoF Capability</p>



# Outstanding Issues

- Date for finalisation of DSO reports
  - Will require further discussions with the TSOs
- Regulatory decision will be required on Grid Code proposals
- TSO cannot move from present 50% SNSP level until resolution of the outstanding RoCoF issues





# DS3 System Services Review

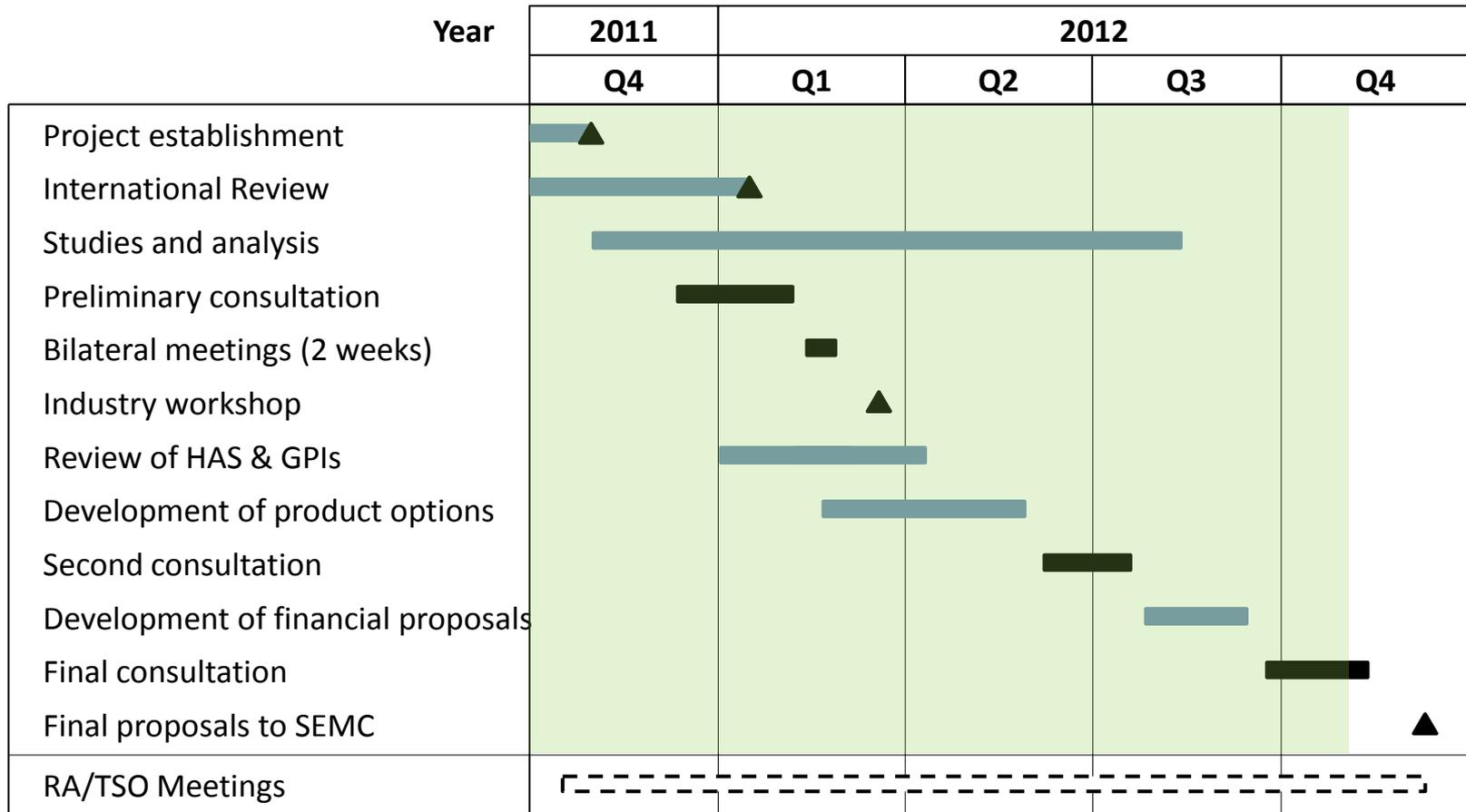
Jonathan O'Sullivan & Séamus Power

DS3 Industry Forum

5<sup>th</sup> November 2012



# Progress to date



# Second Consultation

- Focus on technical aspects
  - Identifying operational challenges
  - New services proposed to address issues identified
  - Proposed approach to remuneration and contractual arrangements
  - Enhanced focus on reliability
- Consultation paper published in June 2012
- Industry forum held in July 2012
- 26 responses received
  - Most responses were from Generators or Generator affiliations. The remainder were from demand affiliations and academia.
  - Comments incorporated into proposals in next consultation paper

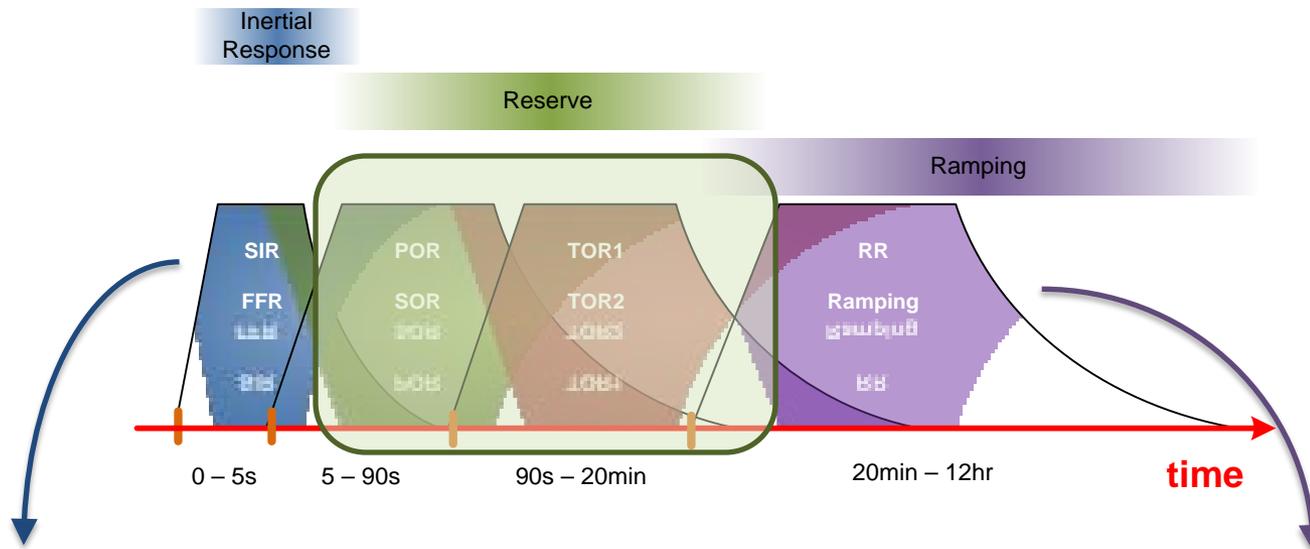


# Second Consultation Responses

- Product Design
  - Product descriptions were clear
  - Product refinements and definition revisions
  - Withhold final support until clarity regarding the financial arrangements
- Financial Certainty
  - Concern about funding arrangements in SEMC Cover Note
  - Agreement that bilateral contracts were the pragmatic option
  - Payments based on Capability were favoured
  - Contracts should be long-term and payment rates set
- Acceptance that payments should be performance-related



# Frequency Control



- Synchronous Inertial Response
- Fast Frequency Response
- Fast Post-Fault Active Power Recovery

- Ramping Margin

# Voltage Control

Transient Voltage Response

Voltage Regulation

Network

Dynamic  
Reactive  
Power

Steady-state  
Reactive  
Power

Network  
Agency  
Grid 25

ms – s

s – min

min – hr

- Dynamic Reactive Power

- Steady-state Reactive Power



# Third Consultation Paper - contents

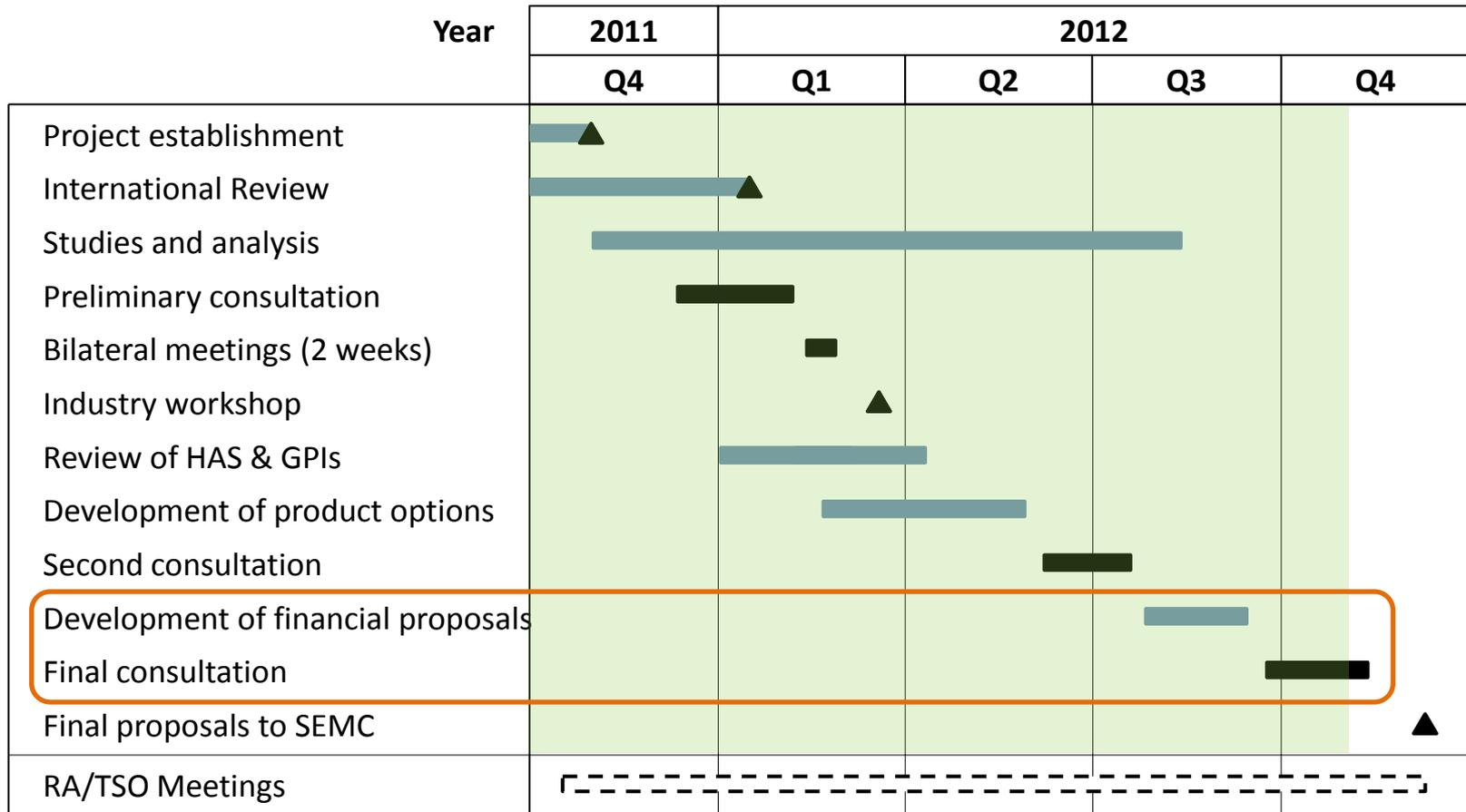
- Valuing System Services
- Financial modelling and analysis
- Revenue Allocation

- Remuneration approach
- Contractual Arrangements
- Proposed final product designs



**Based on  
responses to  
second  
consultation**

# Progress to date



# Next Steps

- Draft of financial consultation paper currently with RAs
- Aiming to issue 3<sup>rd</sup> Consultation paper as soon as possible
  - Four week consultation period planned
- Bilateral meetings will be offered to respondents during consultation window
- Recommendation paper to SEMC (based on three consultation phases)





# Performance Monitoring & Grid Code Testing

Dave Carroll

DS3 Industry Forum

5<sup>th</sup> November 2012



# Why?

- Under the Grid Codes, the TSOs have an obligation to monitor, test and investigate the performance of all connected plant
- Ensure ongoing compliance of the users with Grid Code requirements
- Changing available plant portfolio to meet demand
- Manage Dispatch Balancing Costs



# DS3



1. Increase certainty of how system is performing
2. Use info to improve modelling => greater certainty
3. Facilitate appropriate regulation & incentivisation of necessary products to ensure aggregated portfolio performance is delivered

# Performance Monitoring Achievements

1. Monetary Incentives (Trips, SNDs, GPIs)  High Effect
2. Daily monitoring process  High Effect 
3. Quarterly Reports & Trend Analysis  Medium Effect 
4. Studies & Investigation  Medium Effect
5. Publishing statistics on websites  Increase transparency

# Grid Code Testing - Achieved to Date

- All-Island Industry Review of Grid Code Testing Process
  - Proposed at JGCRP in May 2012
  - Conventional Workshop held on 29th August 2012
  - Recommendations presented to Industry on 8th October 2012
  - Recommendations will be implemented by September 2013



# Performance Monitoring – In progress

## Enhanced All Island Performance Monitoring System:

- Currently developing requirements for this (Dec 12)
  - Improving data quality
  - Applying all Grid Code metrics
  - User friendly reporting/run own reports
- Industry workshop (Q1 2013)
- Expect a 2-year implementation including Consultation with industry



# Grid Code Testing – In progress

- All-Island Industry Review of WFPS Testing
  - Windfarm workshops being held on 19th November 2012
  - Recommendations workshop will be held in January 2013
- Recommendations from workshops will be implemented by Sep 2013





# Smart Grid: Demonstration Projects Smart Grid Innovation Hub

Ciara Corby

DS3 Industry Forum

5<sup>th</sup> November 2012



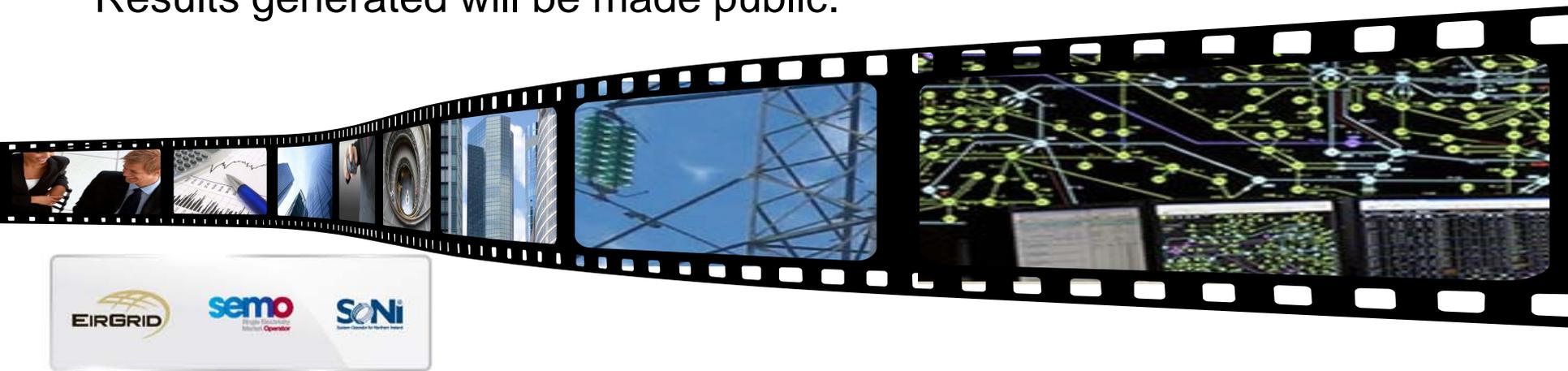
# Demonstration Projects

Issued invitation to demonstrate new Smart Grid concepts including:

- Demand side management
- System Operation – e.g., advanced voltage control
- System Services – e.g. reserve provision
- Transmission Technology types

2 Projects selected, healthy pipeline of additional projects

Results generated will be made public.



# Glen Dimplex Quantum – Greenway Project

- Demonstrate how the Glen Dimplex Quantum space and water heating system can be deployed as an aggregated demand side management tool
- Green Way will identify and make available up to 1,000 properties
- Demonstrate how a distributed population of energy stores can be switched on and off remotely in response to an operational command.
- EirGrid will facilitate grid level monitoring of the system's responsiveness



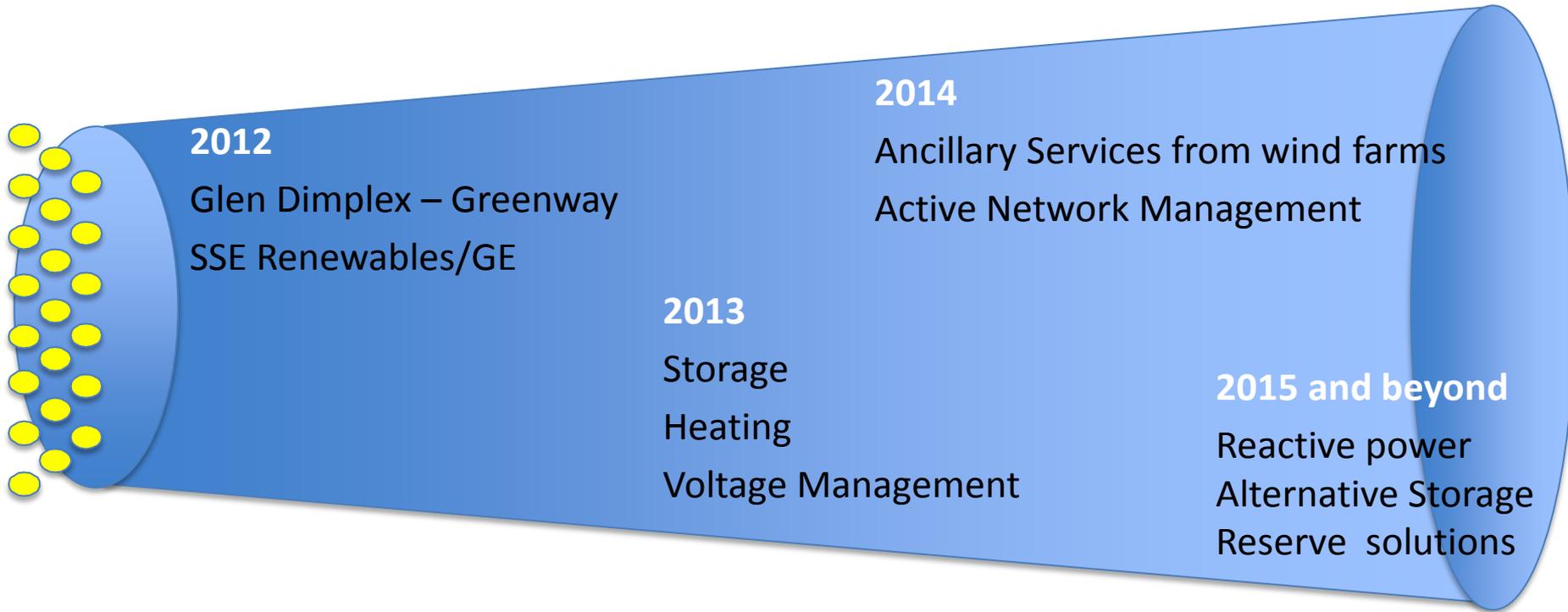
# Fast Frequency response (SSE Renewables/GE)

- Demonstrate fast frequency response from a Wind Farm Power Station using GE's WindINERTIA™ Control
- Demonstrate the automatic additional aggregate MW response from a WFPS during a frequency disturbance
  - Identify what is the minimum MW capability which can be provided at all MW output ranges in normal operation,
  - Determine what the time frames are where this MW injection can be achieved during the time period in advance of the POR (Primary Operating Reserve) timeframe.
  - Determine how can the performance be monitored.



# Demonstration Project Pipeline

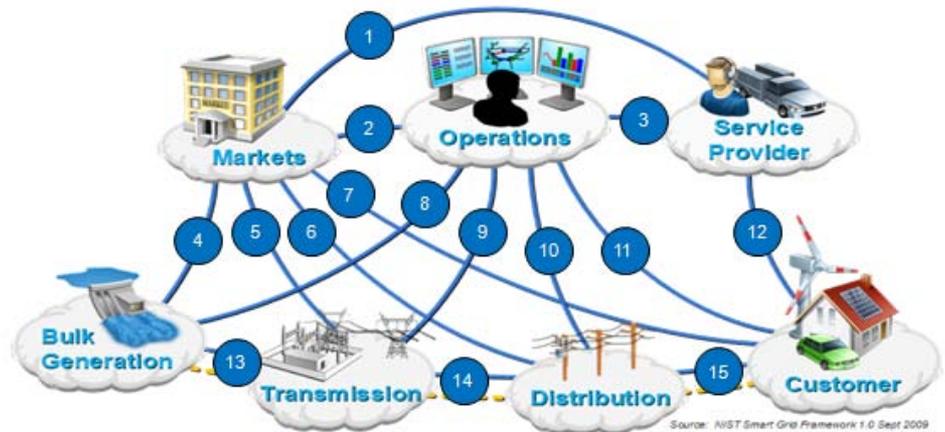
I  
D  
E  
A  
S



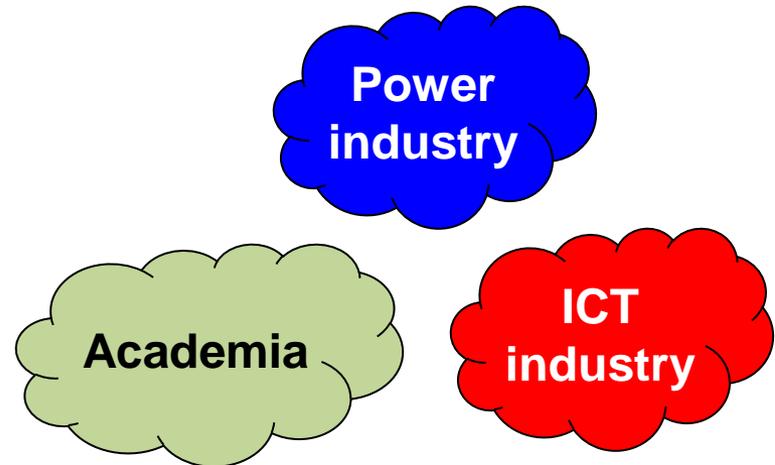
# Smart Grid Innovation Hub

## The Challenge

**Convergence of thinking of all actors within the power industry**



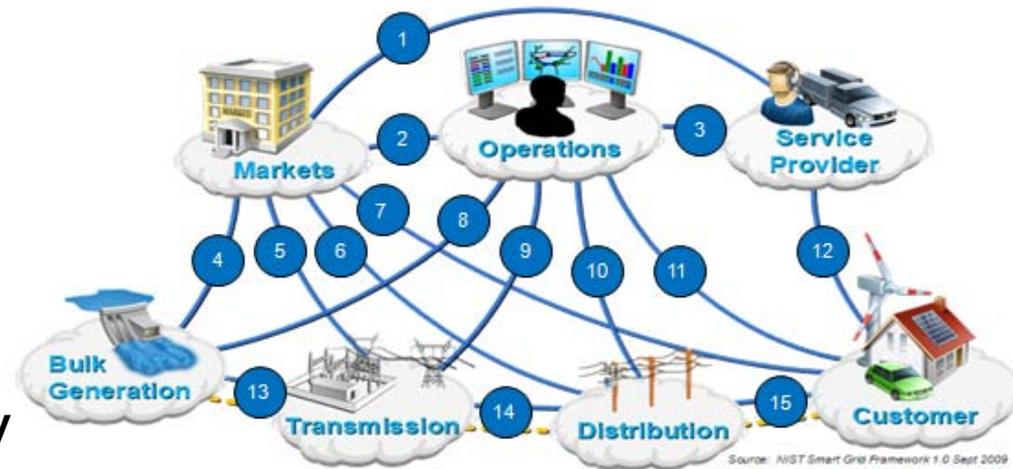
- **Power industry** who conceive & specify Smart Grid systems / applications
- **Academia** who offer advanced ICT technologies based on research
- **ICT industry** who build the systems / applications



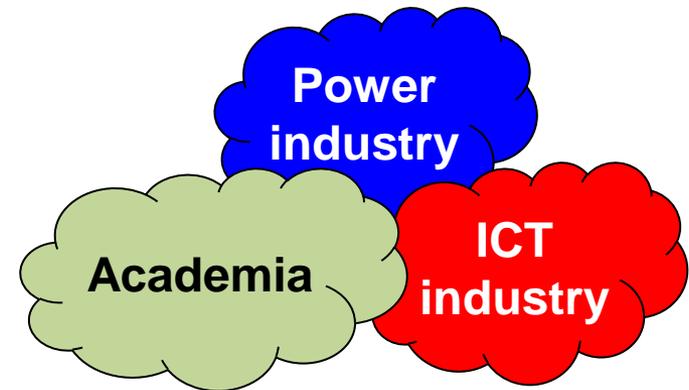
# Smart Grid Innovation Hub

## The Challenge

**Convergence of thinking of all actors within the power industry**



- **Power industry** who conceive & specify Smart Grid systems / applications
- **Academia** who offer advanced ICT technologies based on research
- **ICT industry** who build the systems / applications



Innovation

Job Creation

Enterprise



# What is the Smart Grid Innovation Hub?

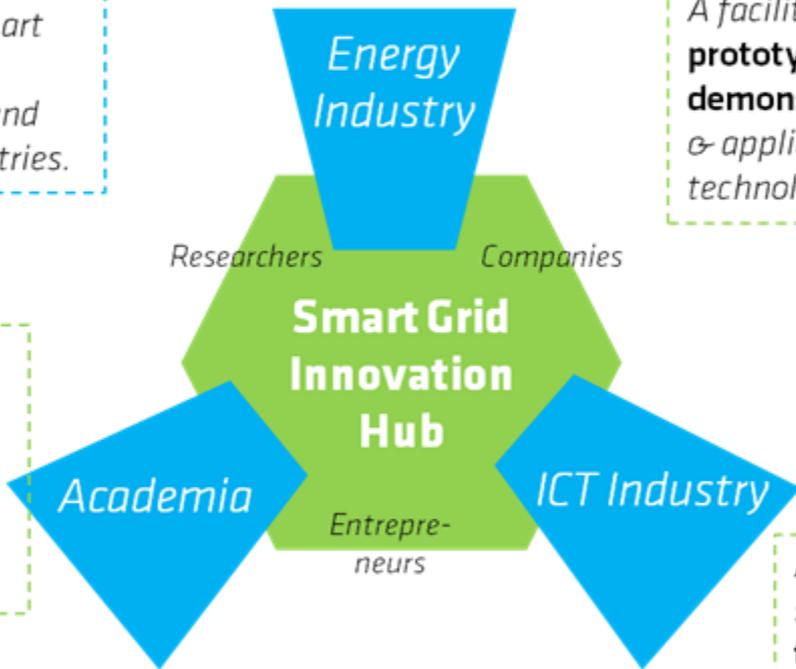
A collaborative initiative between EirGrid Group and NDRC to promote development of innovative SmartGrid solutions

Access to the Smart Grid community, energy industry and supporting industries.

A facility - 'the Sandbox' to enable **prototyping, testing, integration** and **demonstration** of Smart Grid systems & applications built on digital technologies.

Access to commercialisation support structures - **people, investment, customers, know-how.**

Access to a network of experts encompassing **technical & engineering domain** expertise in **electrical engineering, system operation and ICT.**



Access to data and systems with ability to **trial products and applications.**

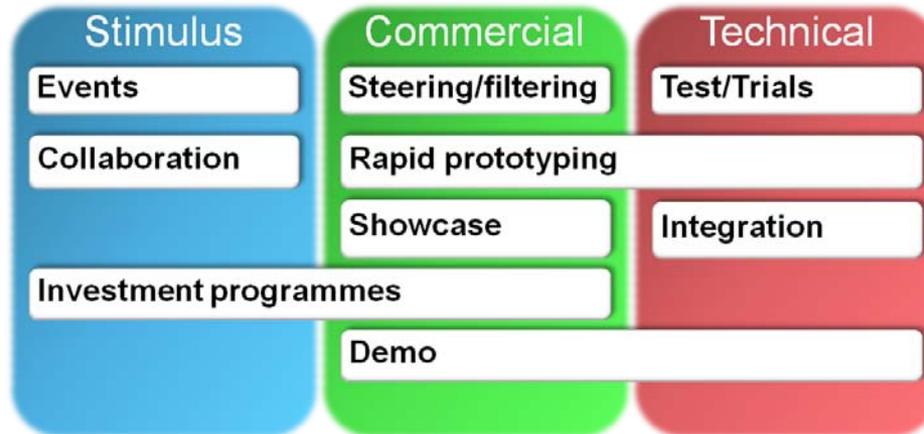
Project spaces: short term project facilities at NDRC/EirGrid.



Leading Innovation.  
Transforming Talent.  
Inspiring Results.

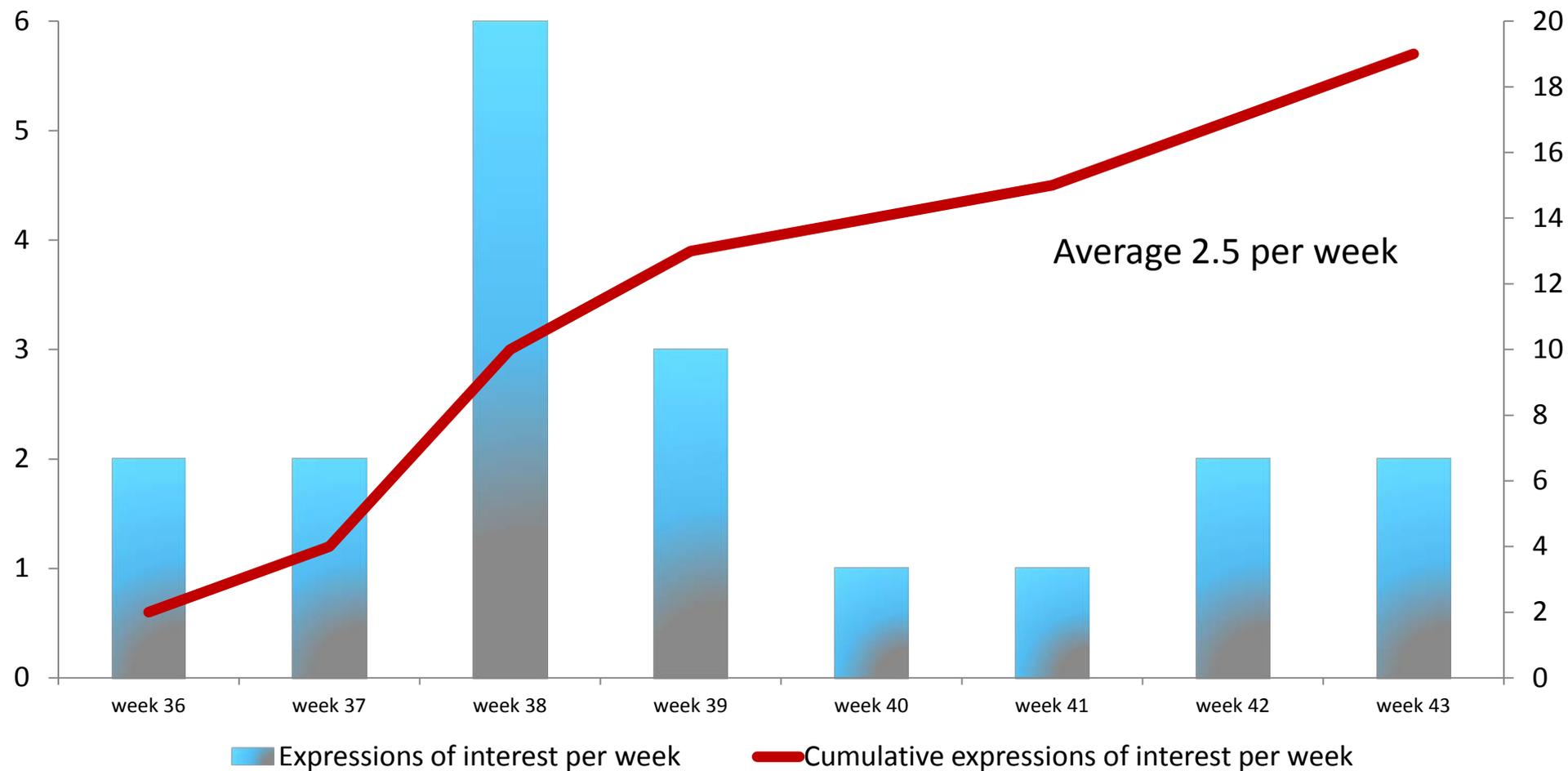


# Smart Grid Innovation Hub Programme



# Expressions of interest

## Number of expressions of interest per week



# Conclusions



