All Island Generator Forum

7th March 2013

The Mount Conference Centre

Agenda (Morning)

10:15 Opening Remarks

10:30 Peter Baillie, Energia Renewables

10:45 Interconnectors:
- Moyle Update - Stephen Hemphill
- EWIC Update - Peter Lantry
- SO/SO Trading - Michael Carrington

11:30 DS3 Update - Yvonne Coughlan

12:00 Generation Capacity Statement (NI Perspective) - Adrian Henning

12:30 Network Codes RfG & Operational Network Codes - Mark Norton & Liam Ryan

13:00 Lunch

Agenda (Afternoon)

14:00 Commissioning and Testing Update - Karl O'Keeffe

14:30 DSUs - Alan Kennedy

14:45 Tea/Coffee

15:00 Phasor Monitoring - Ray Doyle

15:20 Closing remarks

Generator Forum

EirGrid Management Changes

Executive Changes

- Fintan Slye – Chief Executive
- Andrew Cooke – Operations
- Michael Walsh – Corporate Affairs, Planning & Strategy
- John Fitzgerald – Grid Development
- Ann Scully – European Affairs
- Rodney Doyle – Information Services

Management Changes

- Paul Killian – Operational Services & Performance
- Nick Fullerton – Commercial & Settlement
- European Market Integration - TBA
- EWIC - TBA


EIRGRID
semo
Single Electricity
Market Operator
SONI
System Operator for Northern Ireland

Energia Renewables
Generator connection forum
7th March 2013

Peter Baillie

RENEWABLES

Agenda

1) Tie Breaks decision & mitigation of curtailment

2) Interconnector Trading

3) DS3

Tie Breaks decision

- Pro rata allocation, with compensation to 31 December 2017
- A revised version of rule-set for distinguishing between constraint and curtailment has been approved.
- "The SEM Committee is of the view that based on the programme plans set out by the TSOs, *the DS3 programme will be substantially in place by 2018 which will ensure that levels of curtailment are lower than they might otherwise have been*. The SEM Committee will continue to over-see and support the work of the TSOs in this regard."

- Eirgrid curtailment projections in Tie Breaks response 2% -4%, ***assumes DS3 achieves 70% SNSP by 2020***
  - Where is step plan to achieve this?
  - Curtailment reporting needs substantially improved
    - Distinguish curtailment from constraints
    - Show impact of interconnectors on relief of curtailment
    - 2011 curtailment report: 7% curtailment on VPTs, 2% across all windfarms

energia RENEWABLES

Key mitigants of curtailment

- "If the measures under the DS3 programme are not delivered then the expected level of curtailment will be higher, and likely to be significantly so". "Interconnection is also beneficial in managing curtailment and will have an important role to play". Eirgrid response to SEM-12-028

- Key assumptions on mitigation of curtailment are:
  a) Export across interconnectors : maximum export assumption vs 250MW import in 2012, East west interconnector flows projected to be East to West (GB to Ireland)
  b) DS3 programme essential
     a) Non synchronous penetration levels assumed to increase from 50% to 70% "huge challenge"
     b) ROCOF improvements – significant challenges for older conventional plant and windfarms
     c) Controllability of windfarms
  c) Demand growth and off peak demand growth
  d) Reduced minimum generation level of conventional generation
     a) Fast start peaking plant to replace expensive running at mingen.
     b) Invest to achieve lower levels of mingen.

energia RENEWABLES

Interconnector Trading

- Evidence that EWIC and Moyle importing at times of high wind output, actually increasing SNSP
- Contrary to EWIC business case
- Potential for increased curtailment
- Immediate need for transparency
  - How SO-SO trades can be used to relieve curtailment.
  - Publication of available SO-SO price & volume whenever curtailment has occurred.
  - Publication of traded SO-SO price & volume alongside curtailment data.
- A market based solution involving market participants is required. SO–SO trades should be trades of last resort if the market doesn't deliver.

energia RENEWABLES

DS3

- Legacy link between ancillary services and capacity payment needs to be decoupled
- Insufficient information to enable investment decisions
  - System needs/preferences not clear
  - Locational requirements?
- Paper leans towards modification of existing fleet – may be limited in what can be achieved
- Contract proposals not financeable for new investment
  - Volume risk - needs to be capability approach, not dispatch dependent
  - Price risk – cannot re-set prices every 3-5 years
- Too much reliance on ROCOF – uncertainty of delivery and timing
- ROCOF: Retrospective changes to grid code need to be carefully managed and must be fairly compensated for RCOCF. Negative precedent of mandatory changes on future investments.
- Distribution connected generators need to be included

energia RENEWABLES

Stephen Hemphill

Mutual Energy

EirGrid Interconnector

Operational Update

Peter Lantry

EirGrid Interconnector Limited

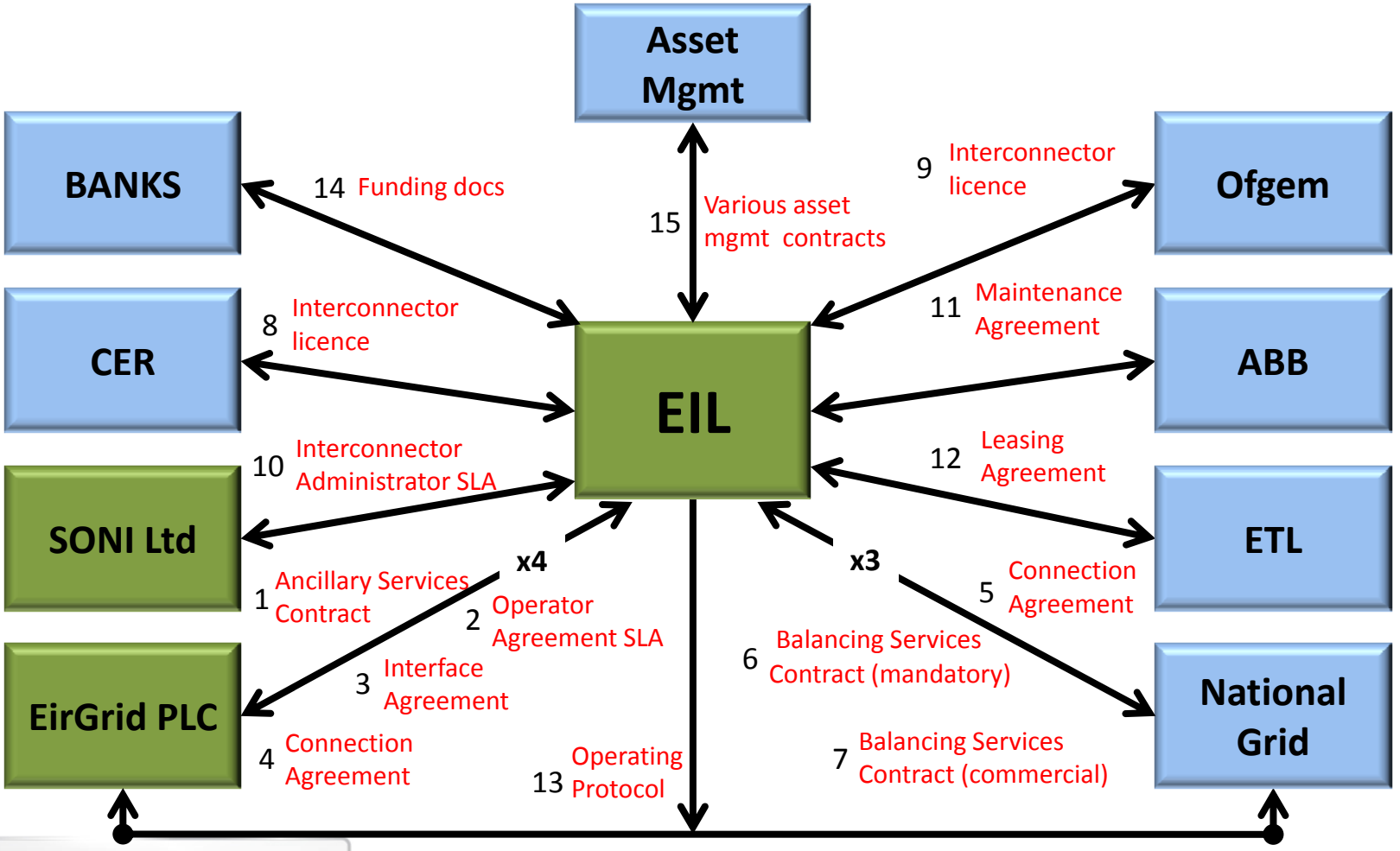
- EWIC is comprised of:
  - 2 x HVDC converter stations
  - 187km of submarine cables (2 x power & 1 x Fibre Optic)
  - 75km of land HVDC cables
  - 4km of HVAC cables
  - Storage facility in Liverpool Port.
- Flows are controlled from the NCC
- Maintenance & Repair contracted to ABB

EWIC Project Update

- The EWIC project has been delivered
  - Under the €601m budget
  - On time meeting the 2012 deadline
- Recently completed 187km offshore works on 20th Jan
  - ~500,000 marine man hours with no reportable Health, Safety or Environmental accidents or environmental harm
- Testing was completed between August and December
- Current outage is resolving the telecoms issue...

  ...and other minor outstanding items
- Unrestricted power flow after current outage
  - 530 MW import (GB→IE) and 500 MW export (IE→GB) measured at Deeside

Overall Contractual Matrix



- Traders sign-up to the access rules with EIL and are not shown – only asset establishment is dealt with here
- Other agreements such as those with Liverpool dock and Crown Estates are not shown
- SONI is registered with SEM and BETTA as IA and EIL is registered as interconnector owner

The Operation of EWIC

- Commercial since 21st Dec 2012, operating at 250/230 MW
- Power predominantly flowing as imports (GB→IE)
- Customers have acquired all available import capacity
  - New competitors in the SEM and BETTA markets
- Active SO-SO trading
  - E.g. helping to reduce wind curtailment (priority dispatch)

Our Customers

Bord Gáis Energy think beyond

energia Switched on

ElectroRoute

ESB International

RWE The energy to lead

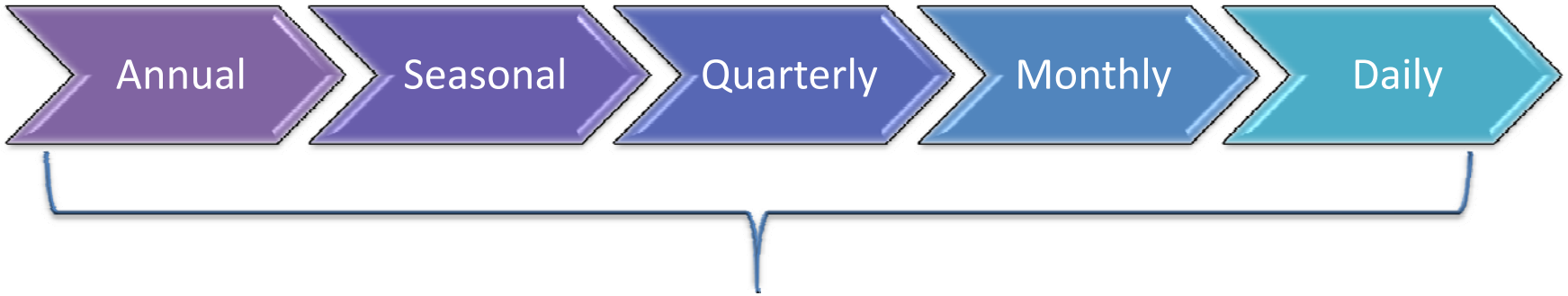
SSE

dc

New customer group…..buying capacity products

EirGrid semo SONI

Product Overview



Standard Timing: GB→IE (Import)

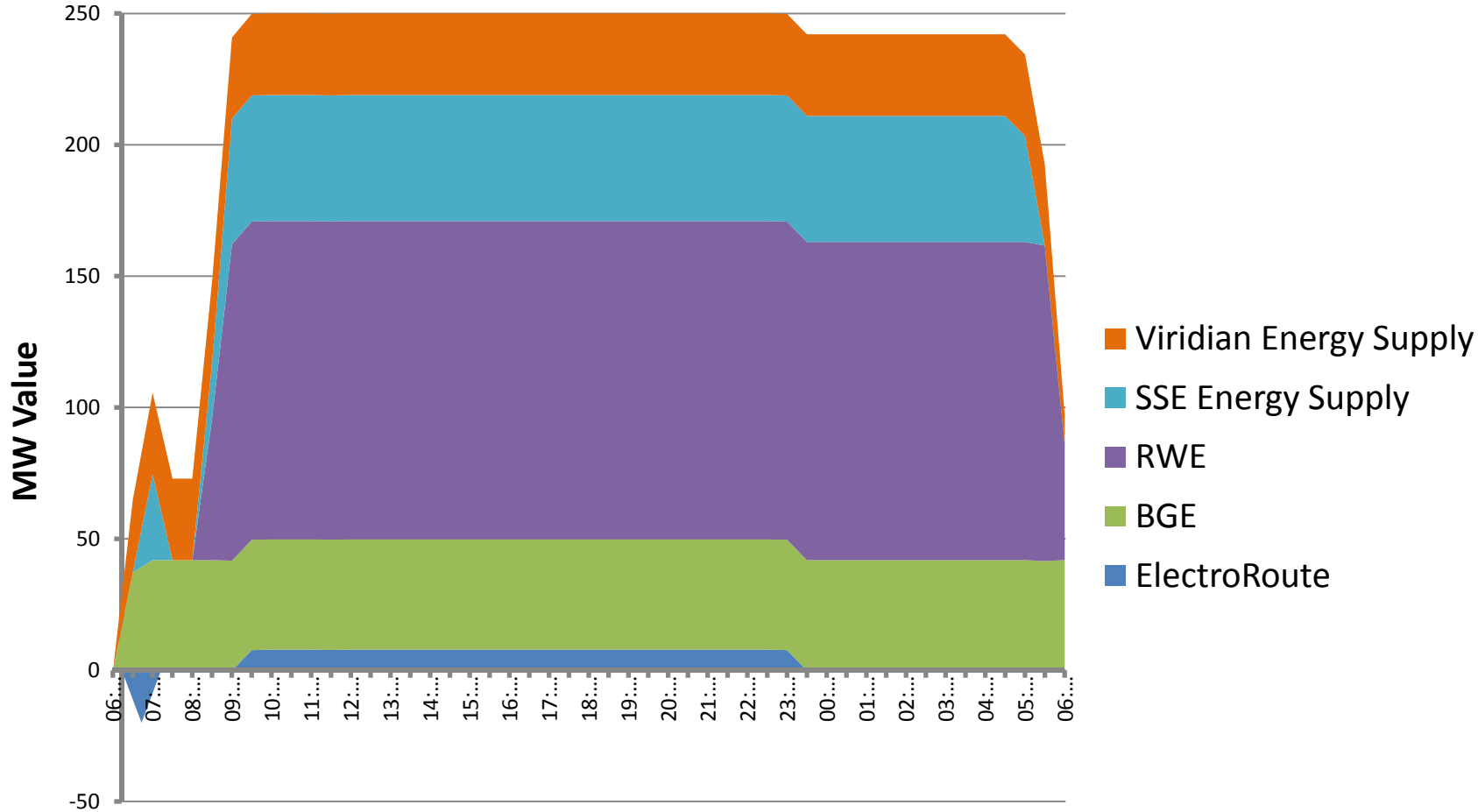
Auction Type	Import Amount	Auction Timing
SEM Annual (Oct to Sept)	150 MW	June (50) July (50) August (50)
Calendar Annual (Jan to Dec)		
Seasonal		
Quarterly		
Monthly		
Daily		
Total	530 MW	

Standard Timing: IE→GB (Export)

Auction Type	Import Amount	Auction Timing
SEM Annual (Oct to Sept)	50 MW	August (50)
Calendar Annual (Jan to Dec)	50 MW	November (50)
Seasonal	50 MW	2 months in advance e.g. August for Oct to Mar (50)
Quarterly	50 MW	2 months in advance e.g. August for Oct to Dec (50)
Monthly	150 MW	1 month in advance Week 1 (50) & Week 3 (100)
Daily	150 MW	Day ahead
Total	500 MW	

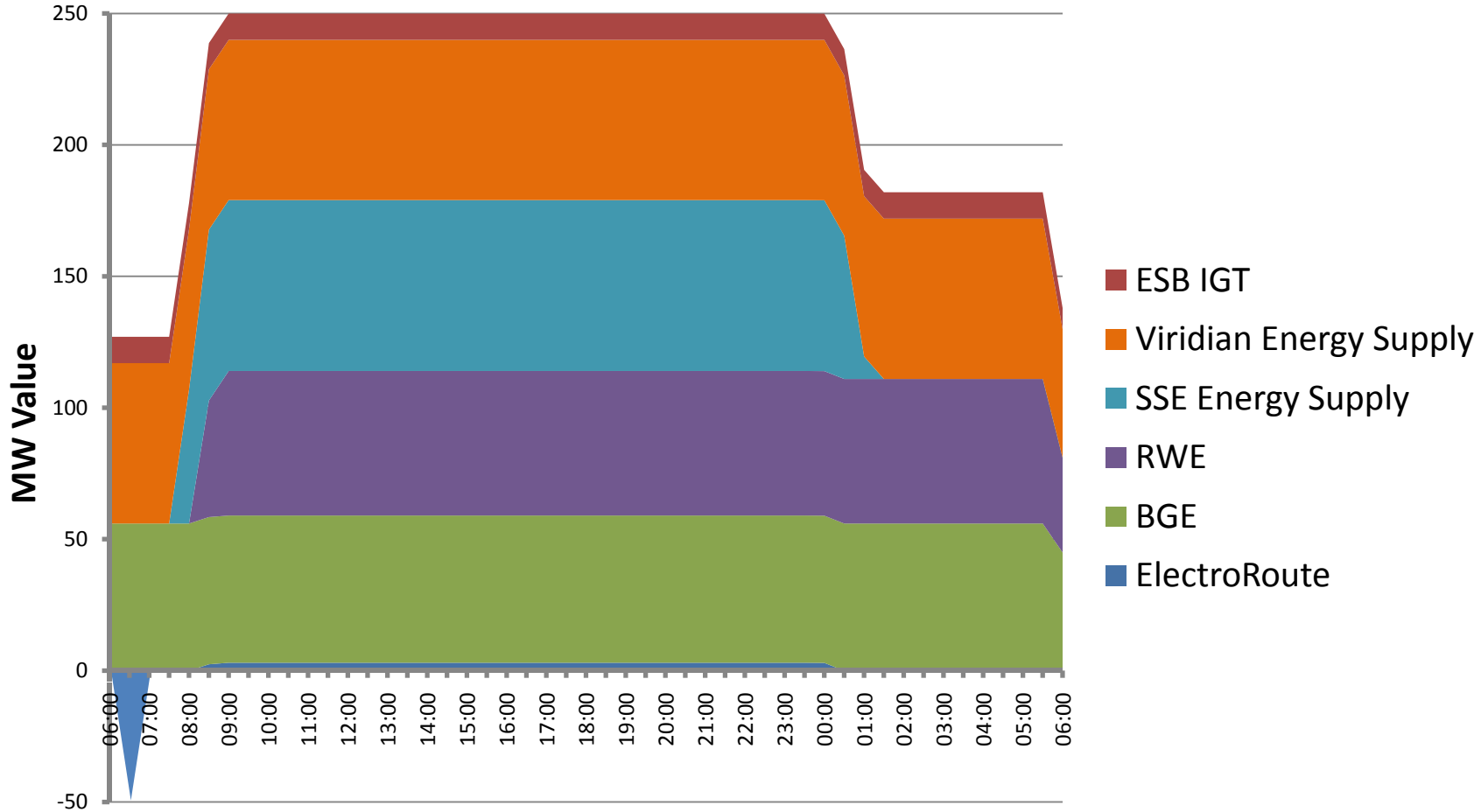
EIRGRID semo SONI

Customer MIUNs – in the SEM



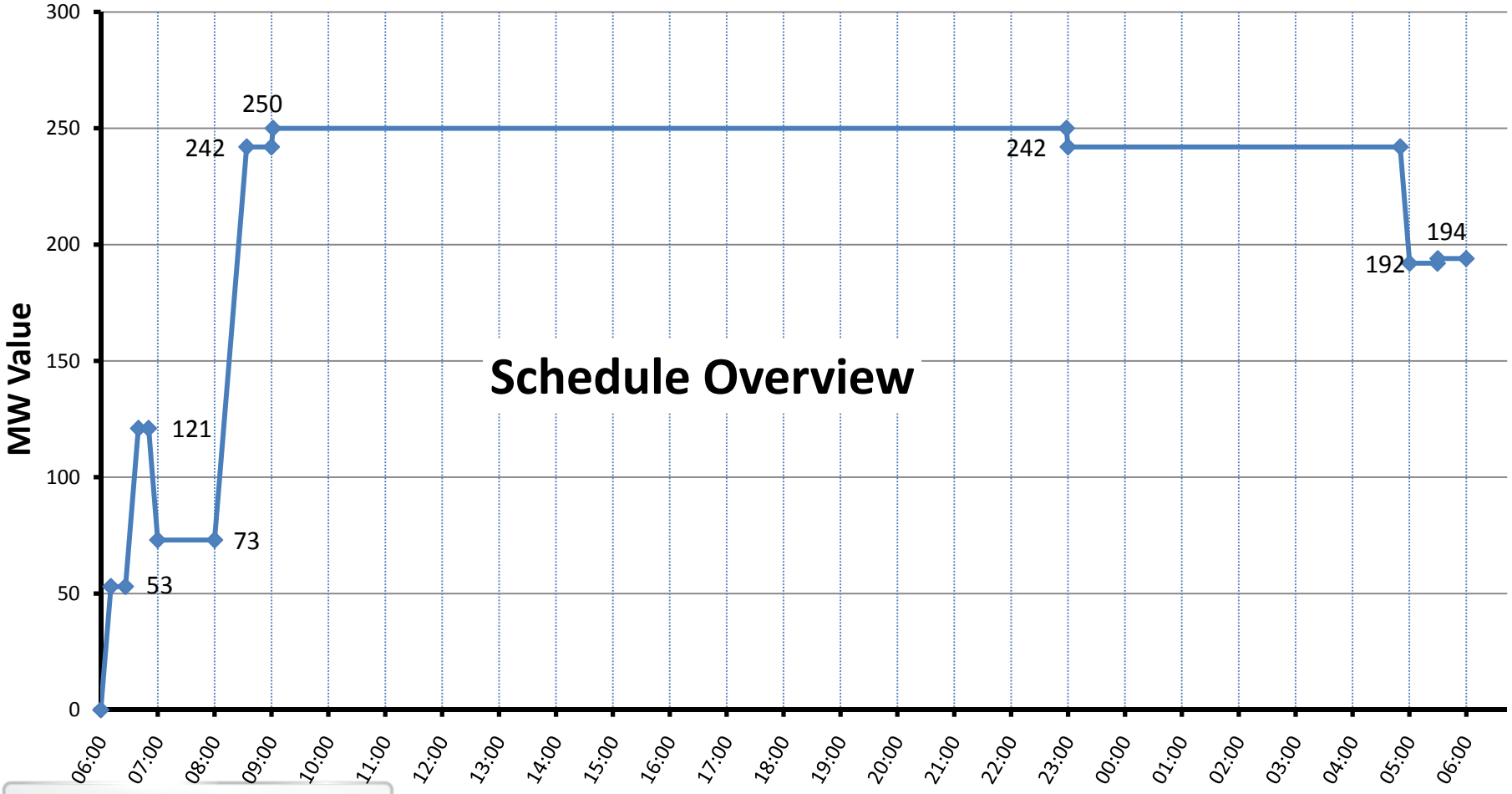
Trading Day 21st December 2012 - Day 1

Customer MIUNs – in the SEM



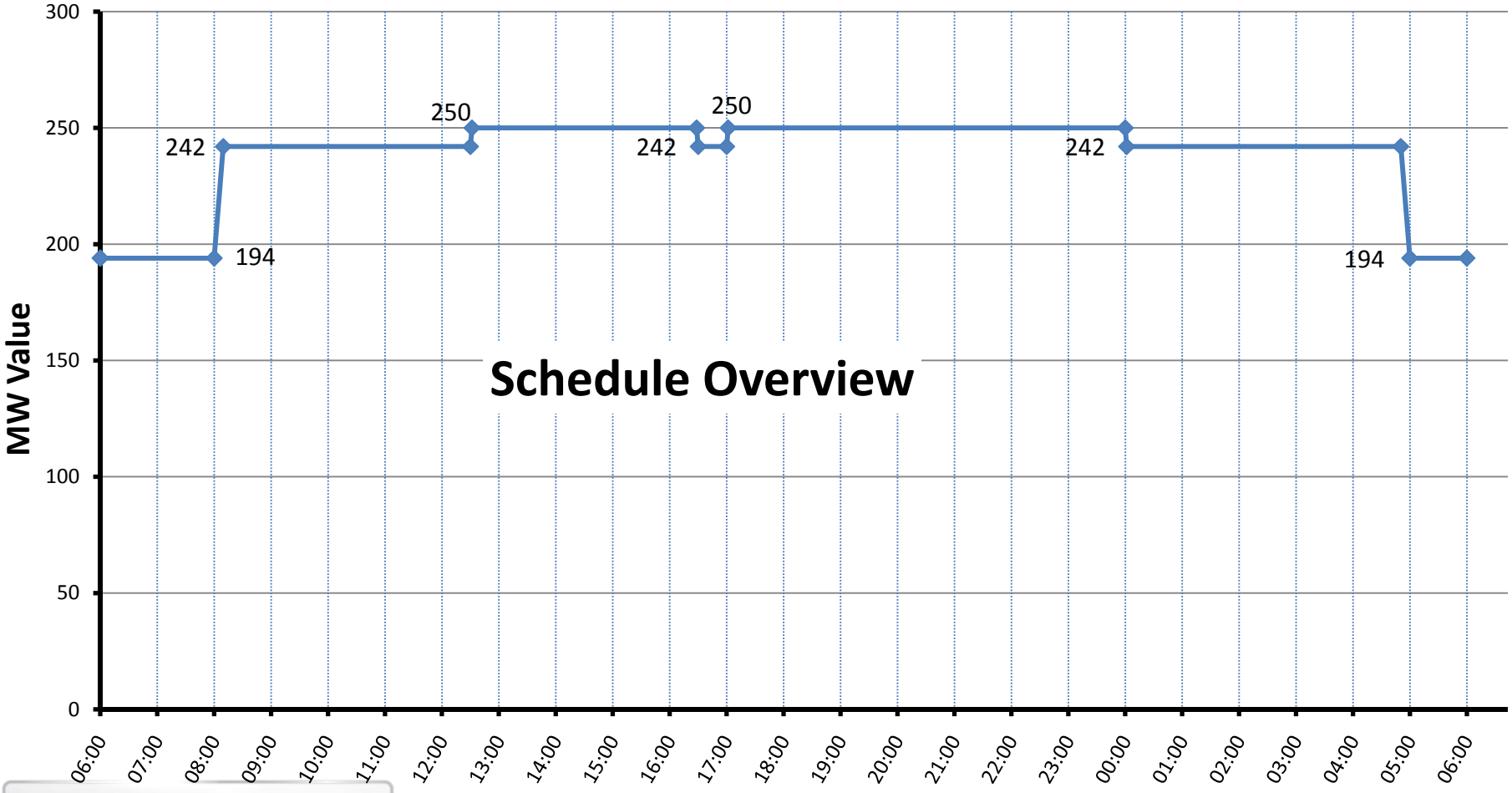
Trading Day 19th February 2013

Running Profile – Day 1



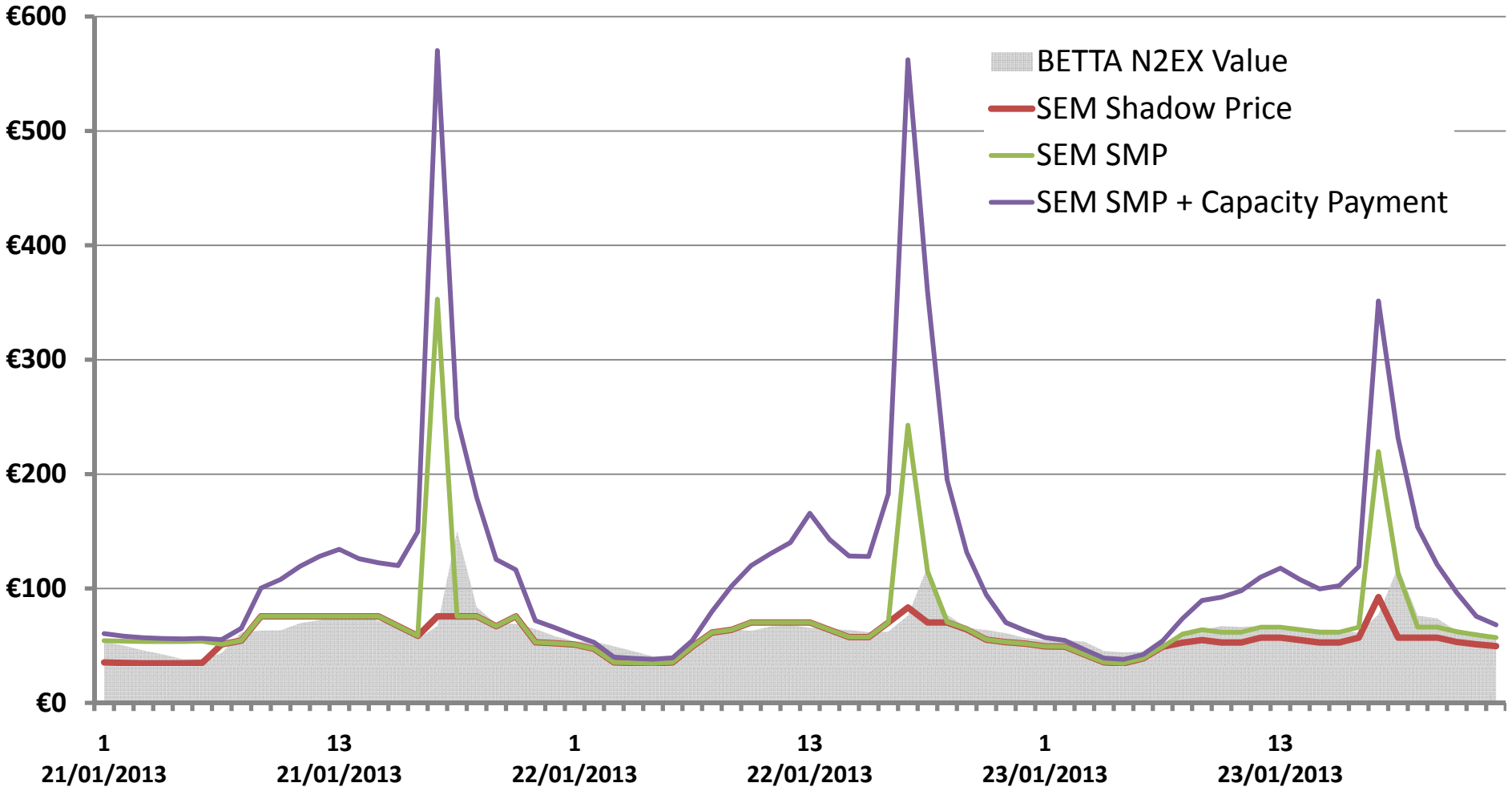
Trading Day: 21st December 2012

Running Profile – Day 2



Trading Day: 22nd December 2012

SEM .vs. BETTA Trading



SEM & BETTA Markets

SEM	BETTA
Gross Mandatory Pool	Bilateral Market
Ex Ante Complex Bidding	Exchanges: Simple Bidding
Ex Post Prices	Prices set at time of trades
• ½ hour Trading Periods • Single price only set on D+4	• Hourly Trading Periods • Price per contract
Capacity Payments	Balancing Payments (SBP, SSP)

EWIC Commercials

Revenue	Expenditure
Congestion rents – i.e. capacity • Explicit Auctions • Implicit Auctions	Compensation (NTC Δ)
	EWIC operating costs
Ancillary services	Subcontractors • NCC, IA, M&R, Security, Telecoms
Commercial fibre	The mortgage

Benefits of EWIC for SEM are wider ranging!

Ancillary Services

Revenue sources for EWIC

EirGrid

- Static Reserve (Frequency Response)
- Reactive Power
- Black Start

National Grid

- Static Reserve (Frequency Response)
- Reactive Power
- Use of Interconnector Fee

Benefits of the EWIC

- Vital Infrastructure for the island of Ireland
- Facilitating growth and prosperity
- Reducing dependency on imported fossil fuels
- Downward pressure on System Marginal Price
- Helping reach our renewable targets
- Introducing further competition

Delivering long-term economic benefits

Thank You

SO Interconnector Countertrading

All Island Generator Forum update
Belfast, 7th March 2013
Michael Carrington

Topics

- Current Situation
  - Arrangements in Place
  - Current Activity

- Project on SO Interconnector Countertrading

Current Arrangements

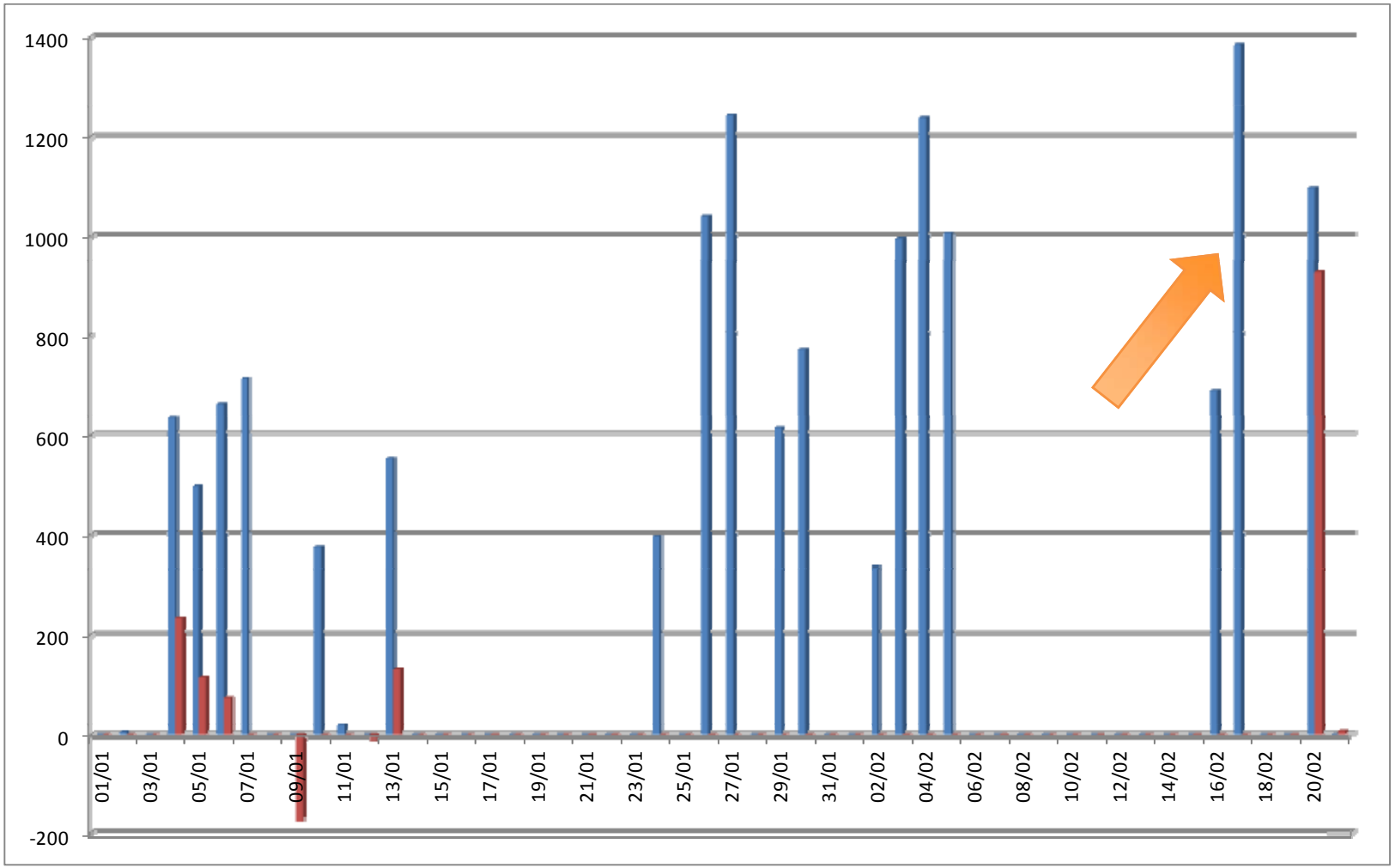
- SEM/BETTA market behaviour producing market schedules with interconnectors at full/high import (GB→NI, GB→IE)
- SO Interconnector Countertrading
  - Contractual Arrangements in place with National Grid
  - Reciprocal services between the System Operators
  - IT systems to exchange pricing information; exchange service requests; process requests; ex-post data to SEM/BETTA; Transparent data access

SO to SO Services

Cross Border Balancing	• System Security • Priority Dispatch • 200 MW on each IC • Regulated Price Floor
Emergency Assistance	• System Security – capacity shortfall or system security risk
Emergency Instruction	• NGET to EirGrid to ↓ power flow during system emergency
Static Frequency Response	• Low Frequency & High Frequency triggered power transfer change

EIRGRID semo SONI

Usage of SO-SO services in 2013



Source: SEM

EWIC schedule for TD 17th February

Current Project

- Key objective
  - Further alleviate curtailment of priority dispatch generation in the short-term

- Options under consideration
  1. SO Countertrading via a UK Power Exchange
  2. Procure a third party service
  3. Interconnector Trade exchange

Proposed Process Approach

Market Position established

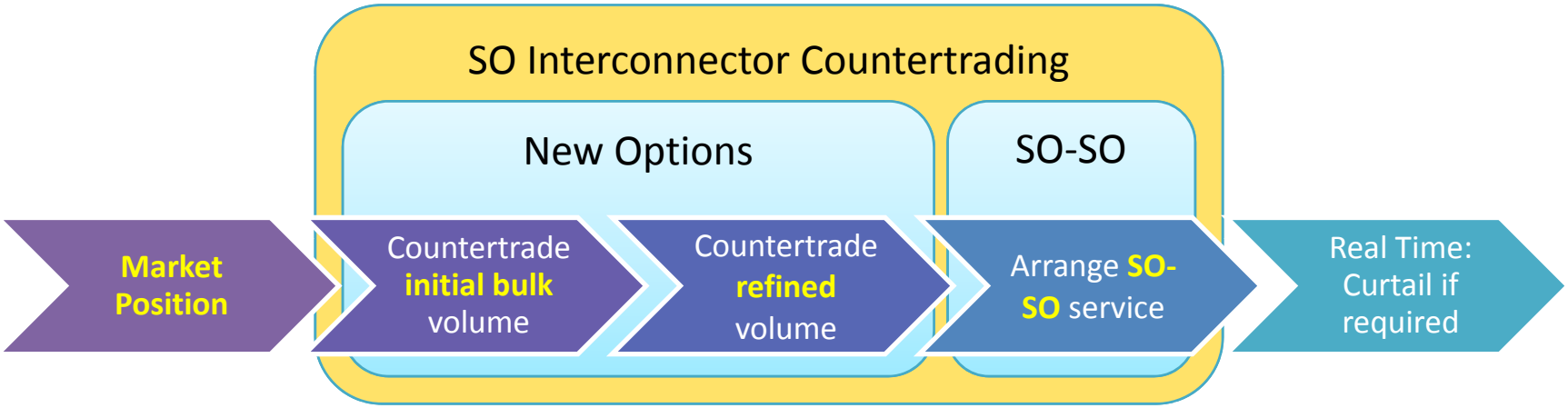
Countertrade **initial bulk** volume

Countertrade **refined** volume

Arrange **SO-SO** service

Real Time: Curtail if required

Process Terminology



Project Updates

- January: Note on options

  http://www.eirgrid.com/media/TheOperationoftheEastWestInterconnector.pdf
- March: Updates
  - National Grid arrangements
  - Additional information on public data on services

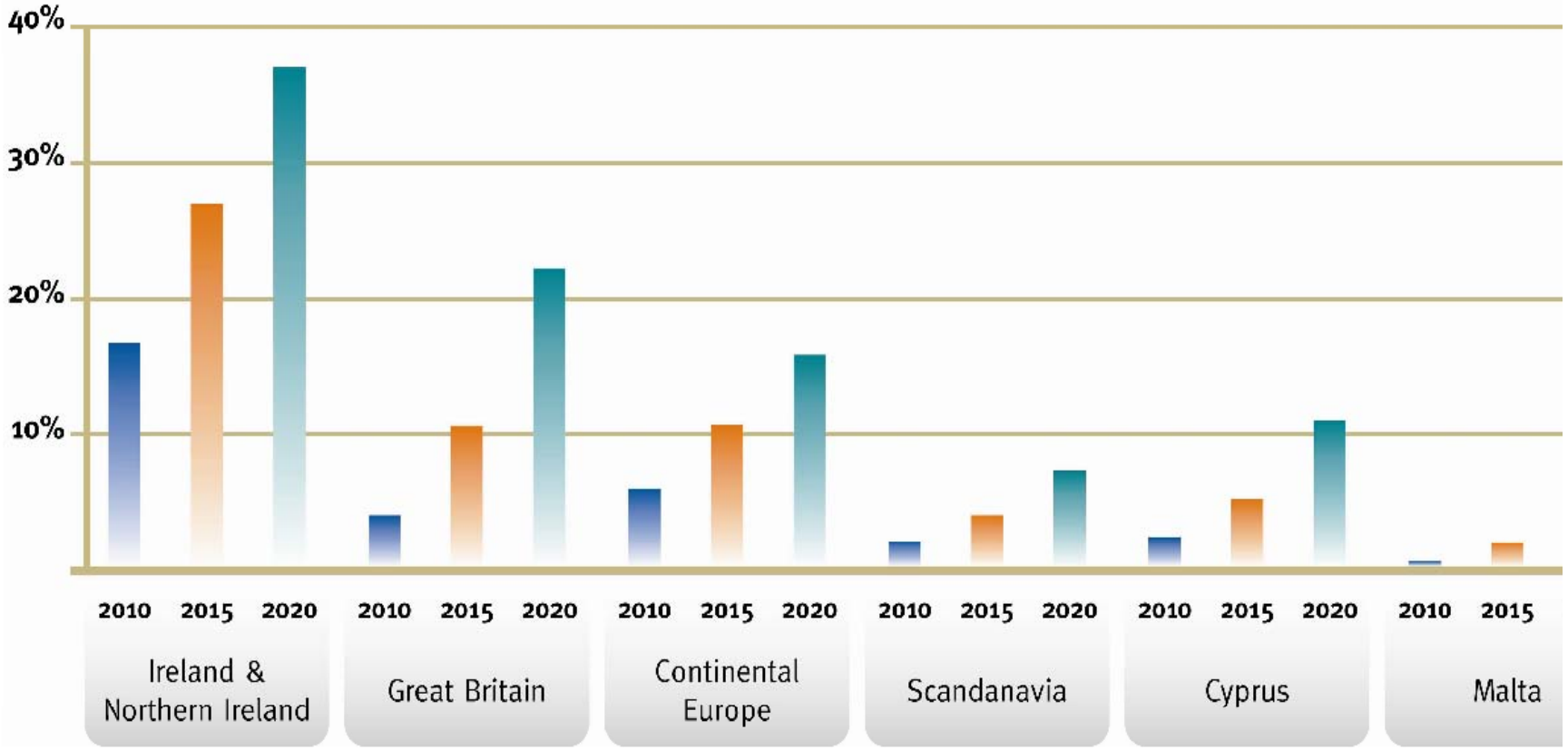
  http://www.eirgrid.com/media/InformationNoteOnSOInterconnectorCountertrading.pdf
- *April: Update on option(s) being pursued*
- *Project Progress is option(s) dependent*


EIRGRID
semo
Single Electricity
Market Operator
SONI
System Operator for Northern Ireland

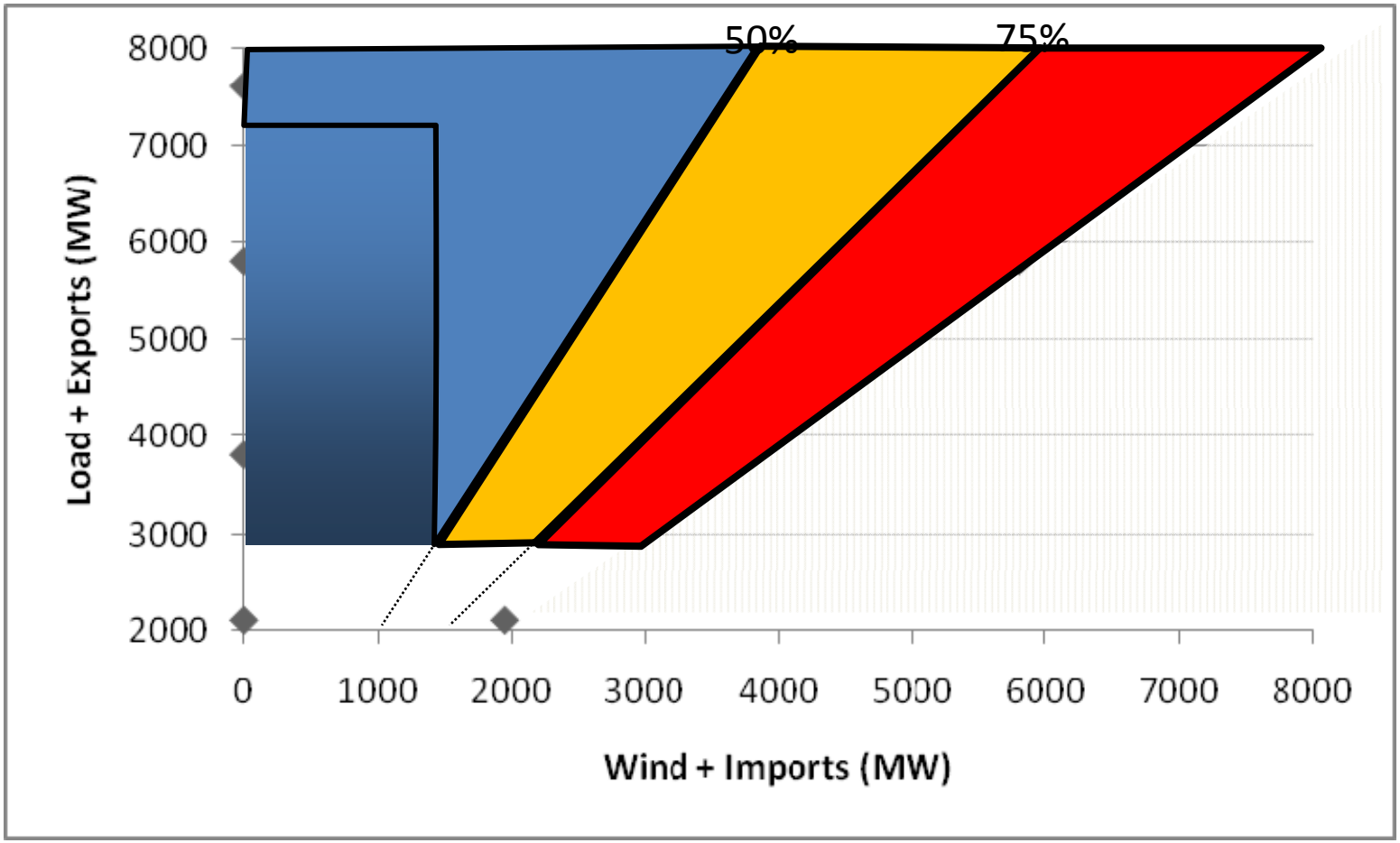
DS3 Programme Update

Generator Forum, Belfast
March 7th 2013

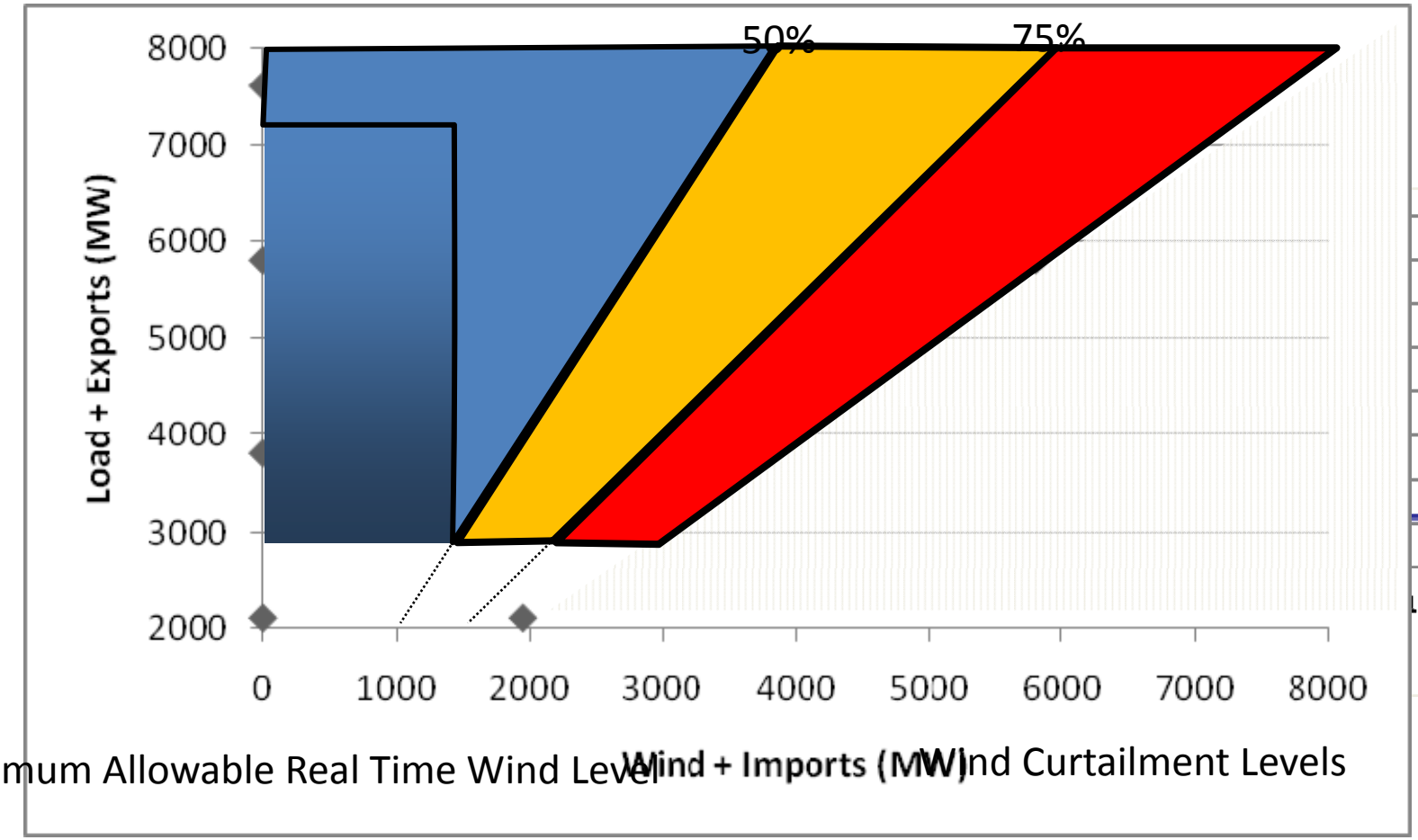
Context


40%
30%
20%
10%
2010 2015 2020
Ireland & Northern Ireland
2010 2015 2020
Great Britain
2010 2015 2020
Continental Europe
2010 2015 2020
Scandanavia
2010 2015 2020
Cyprus
2010 2015
Malta

Real Time Operational Limits and Impact on RES-E



Real Time Operational Limits and Impact on RES-E



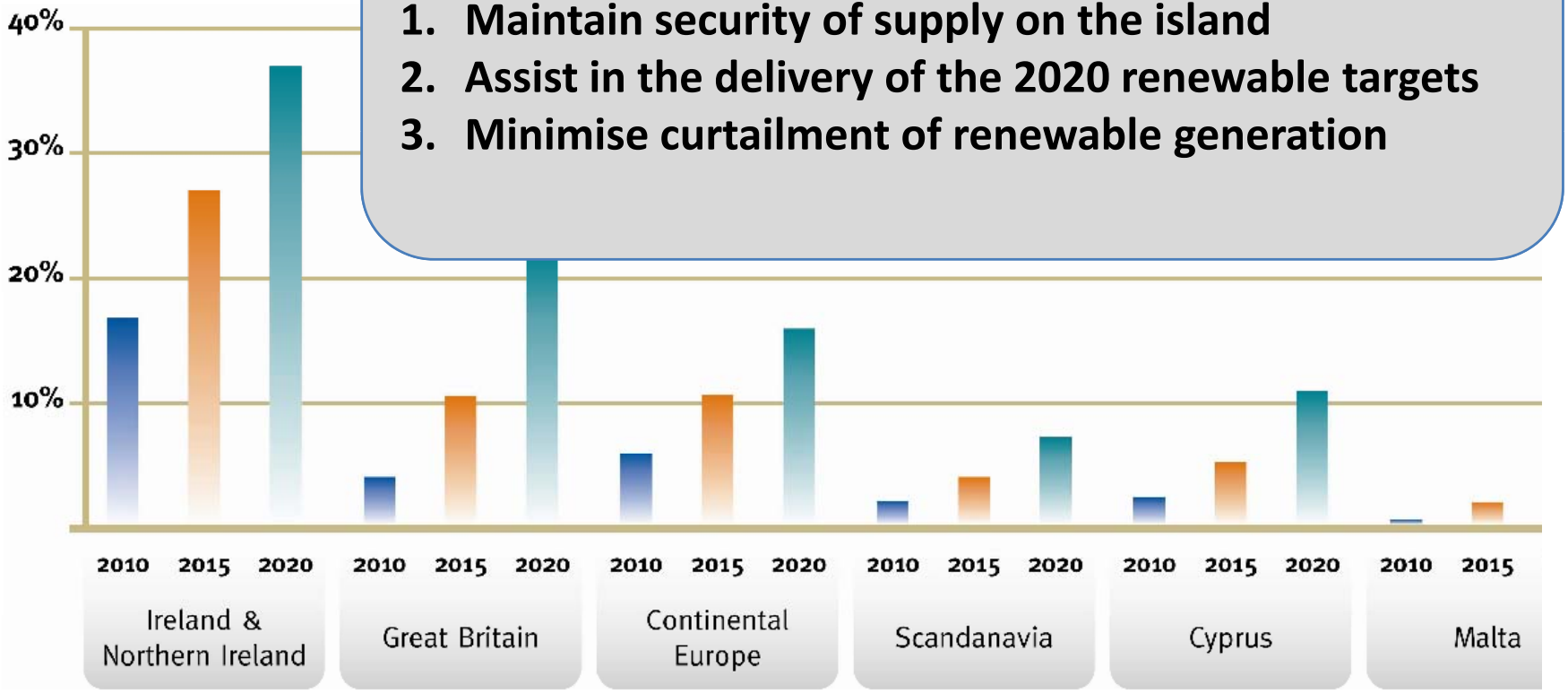
Maximum Allowable Real Time Wind Level

Wind Curtailment Levels

DS3 Programme Context

DS3 Programme Objectives:

1. **Maintain security of supply on the island**
2. **Assist in the delivery of the 2020 renewable targets**
3. **Minimise curtailment of renewable generation**



Background – DS3 Programme

Shaping the power system of the future

1. To provide greater certainty around **plant performance** capability

2. Developing and updating **system operational policies** to assist in securely managing the voltage and frequency

3. Design, development and implementation of enhanced **system tools**

Background – DS3 Programme

Shaping the power system of the future

System Services
Performance Monitoring
Grid Code
Demand Side Management

Frequency Control
Voltage Control
Renewable data
Rate of Change of Frequency

Studies & Model Development
Control Centre Tools
Wind Security Assessment Tool

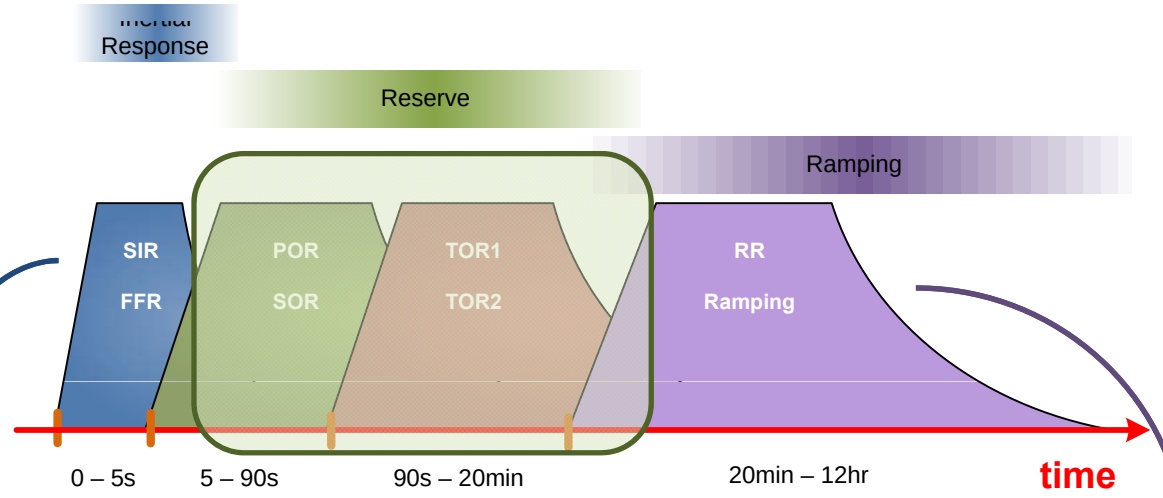
DS3 System Services Review

3 public consultations completed

1. Initial Information Gathering [COMPLETE]
2. Detailed New System Services product proposals [COMPLETE]
3. Financial Arrangements - remuneration, contractual arrangements [COMPLETE]
4. Recommendations Paper to RAs [UNDERWAY – Q1 2013]
5. Draft Decision by RAs [Q2 2013]
6. Full High Level Decision [Q3 2013]

System Services Workstream

Frequency Control

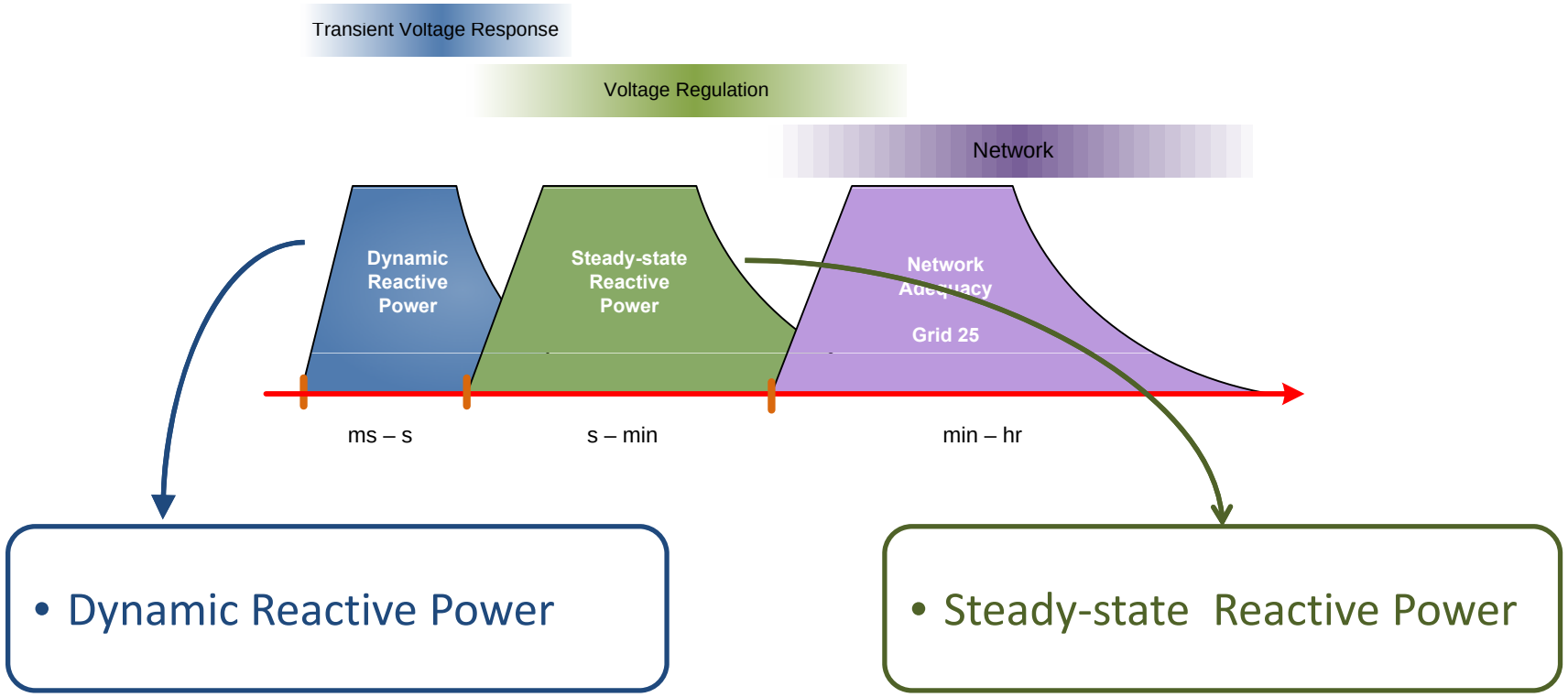


- Synchronous Inertial Response
- Fast Frequency Response
- Fast Post-Fault Active Power Recovery

- Ramping Margin

System Services Workstream

Voltage Control



Performance Monitoring

- Performance Monitoring is key to achieving our RES targets

- High Speed recording equipment will be required
  - To monitor the delivery of the new System Services defined
  - Validate generator dynamic models
  - Provide certainty for system operation

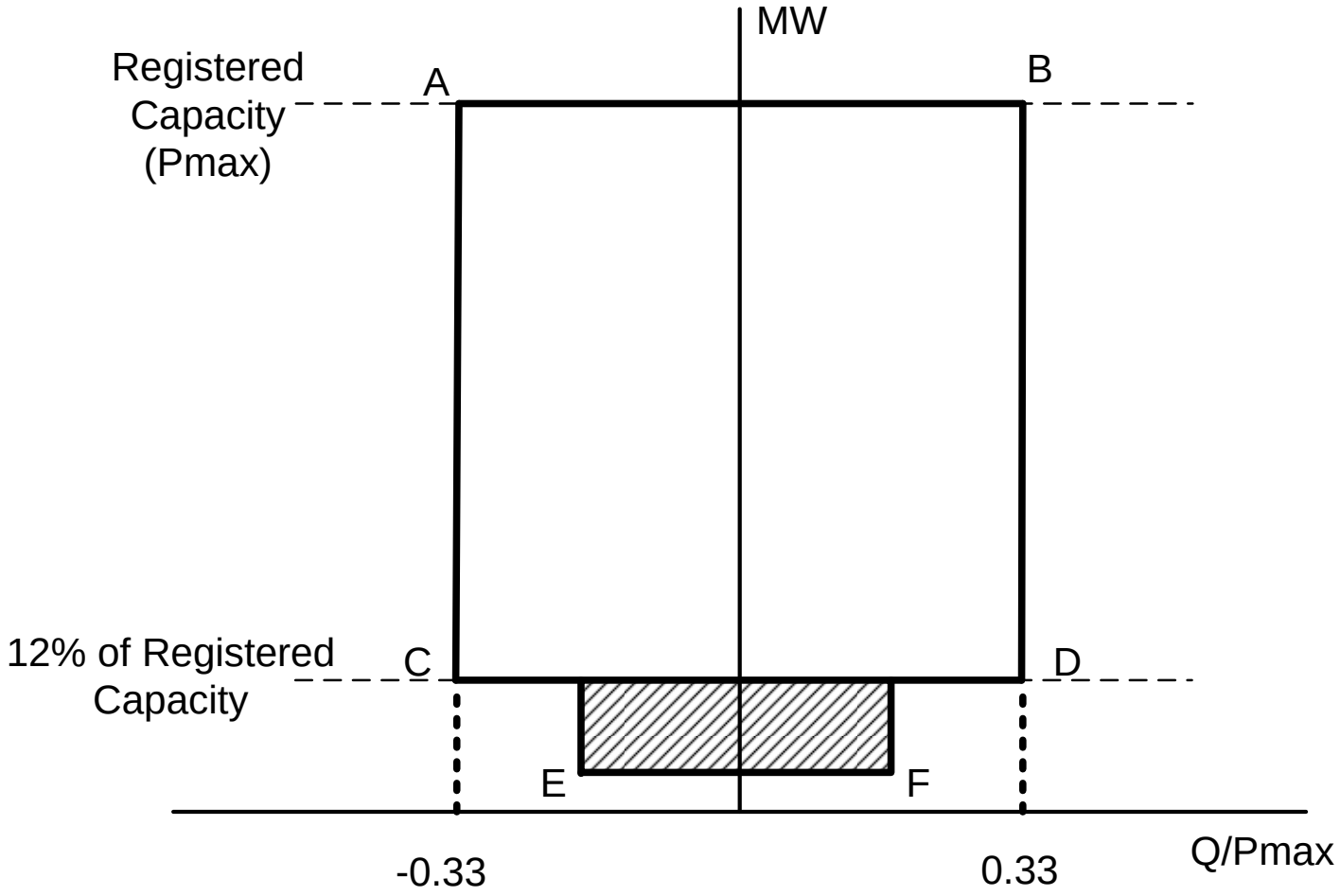
- Briefing session with industry in Q2 2013

Sample RoCoF – Loss of Largest Infeed

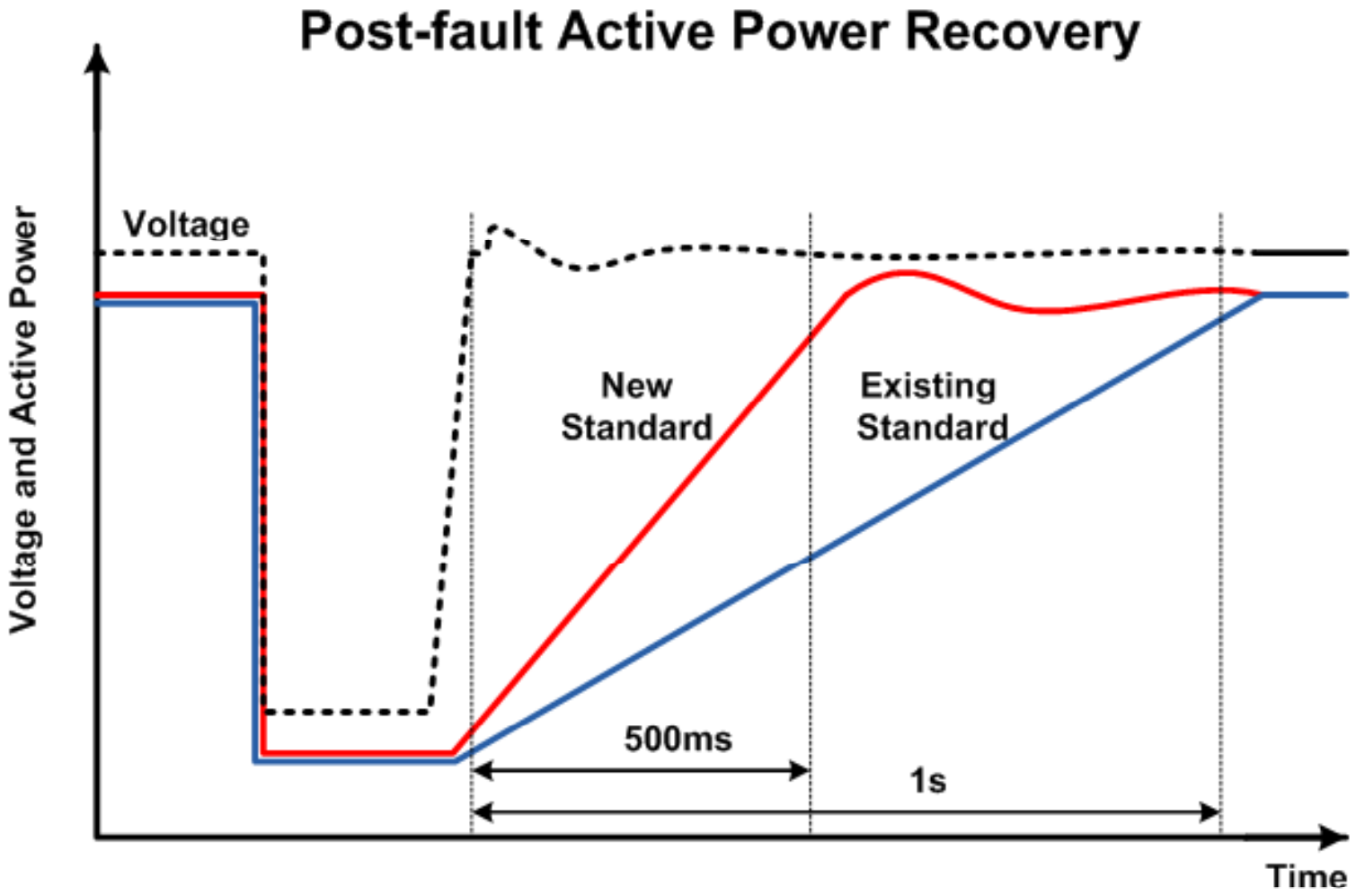
Grid Code

- All RoCoF Modifications submitted to RAs - Dec 2012
  - All island standard of 1 Hz/s averaged over 500 ms is proposed
- Ireland Wind Farm Modifications approved by CER – Feb 2013
- Northern Ireland Wind Farm Modifications – due to be submitted to UReg 08/03/13
- Testing Guidelines under development for wind farm modifications

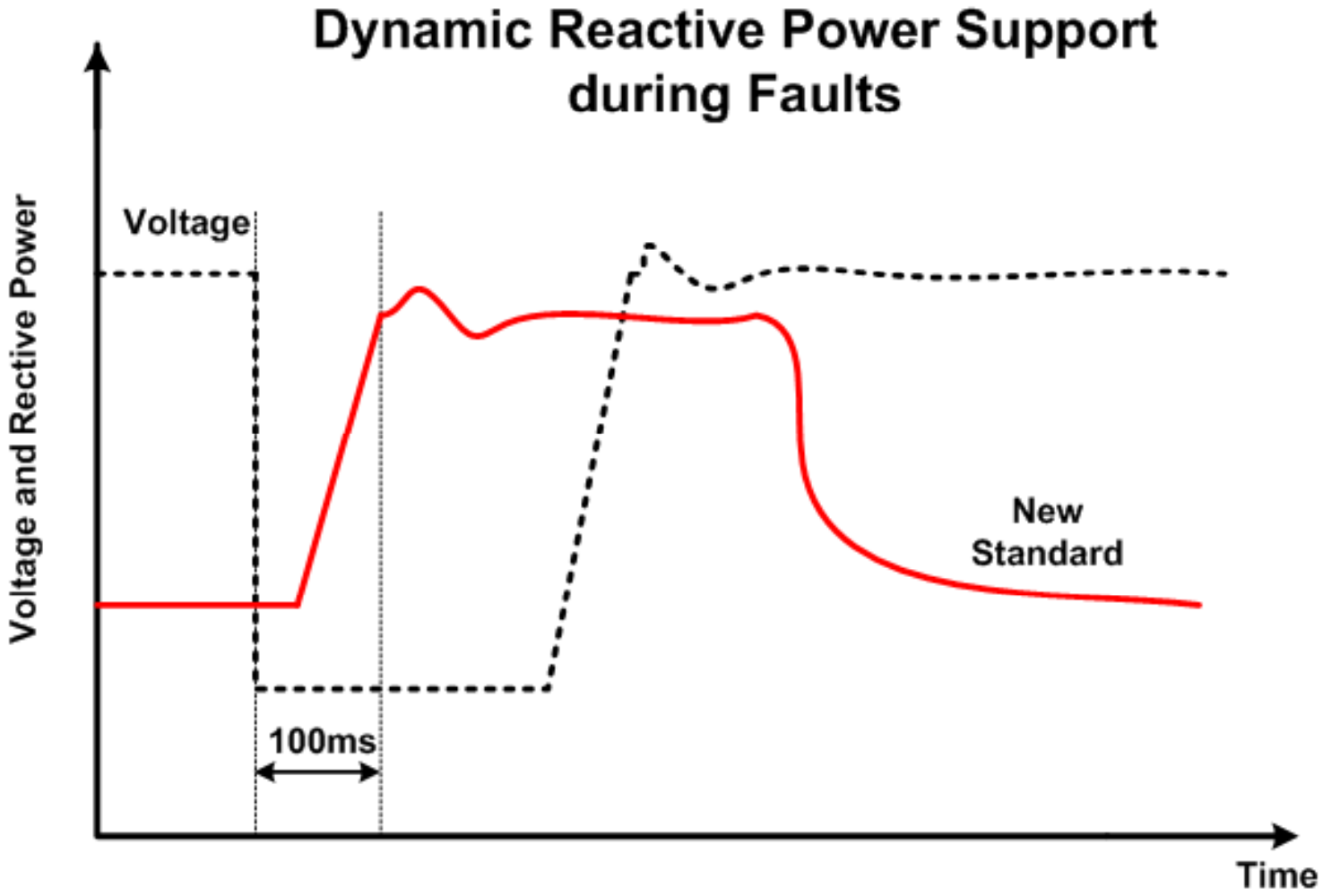
New Reactive Power Standard (Wind Farms)



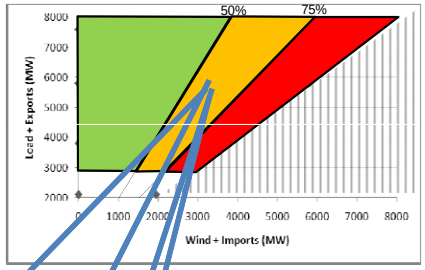
New Fault Ride Through Standards



New Fault Ride Through Standards



To achieve 75%.....



- RoCoF cascade failure
  - Loss of mains protection (G59)
  - Generator capability
- Ramping
  - Increased Variability and Uncertainty over hours
  - Require increased margin and performance to manage
- System Voltage Control (Reactive)
  - 25% reduction in Tx online reactive power by 2020
  - 50% of new windfarms in distribution including embedded generators
- Maintaining System Transient Stability
  - Increased electrical distance between remaining conventional gen
  - Require improved dynamic reactive response from

Focus over next 12 months

- Producing a recommendations paper on System Services for the RAs
- Developing operational procedures/policies
- Scoping performance monitoring systems to align with development of new System Services
- Carrying out further studies and analysis to determine the secure system operation levels e.g. at higher SNSP levels, new System Services capability, voltage control etc.
- Working with the DSOs on voltage control procedures, RoCoF relay settings

Questions?

All-Island Generation Capacity Statement 2013-2022

The Northern Ireland Perspective

Generator Forum (7th March 2013)

Adrian Henning – Grid Ops Planning, SONI

EIRGRID

semo
Single Electricity Market Operator

SONI
System Operator for Northern Ireland

OUTLINE

1. Introduction
2. Methodology
3. Demand Forecasts
4. Generation Assumptions
5. Adequacy Results
6. Key Messages from GCS
7. Implications for Future
8. Questions

INTRODUCTION

- Condition 35 of SONI Licence requires the production a Generation Capacity Statement (GCS). EirGrid TSO have a similar obligation through Section 38 of the Electricity Regulation Act 1999 and Part 10 of S.I. No. 60 of 2005 European Communities (Internal Market in Electricity) Regulations
- The last 3 GCS have been produced in partnership with the EirGrid TSO and covers a 10 year period
- Generation adequacy is a measure of the probability of Generation to meet the Demand.
- This Generation / Demand balance being assessed on both a regional and all-island basis and is measured against the regulatory approved generation adequacy standards
- Primary objective is to inform market participants, regulatory agencies, government policy makers, etc of the likely generation capacity shortfalls over the next 10 years

METHODOLOGY (1)

- Imbalance between Generation and Demand is measured against the Generation Adequacy Standards approved by Regulatory Authorities. This is a statistical indicator based on Loss of Load Expectation (LOLE).
- LOLE is the probability that the Generation available is less than the forecast Demand of all the half-hour periods over a period of a year.
- The Generation Adequacy Standard approved by Regulatory Authorities
  - Northern Ireland = 4.9 hours LOLE per year
  - Ireland = 8 hours LOLE per year
  - All-island = 8 hours LOLE per year
- The analysis uses AdCal which indicates the amount of generation required to meet the standard and is given in terms of a surplus (if above the standard) or a deficit (if below the standard)
- A 'capacity credit' is used for wind in the studies due to it's variability. This is based on forecasted capacity of wind connected modelled on the performance of historical records of actual wind output.

METHODOLOGY (2)

- Each jurisdiction has a formal capacity reliance on the other for the purposes of the regional generation adequacy studies. The additional NS tie-line allows analysis to an all-island basis.

- The modelling technique takes account of a number of combinations of generation and demand scenarios as well as other events that may happen on the system. This includes:

  - High and low generation plant availabilities (determined by Forced Outages Probabilities and scheduled maintenances)
  - High, median and low demand and peak forecasts (with the median being the most likely)
  - Sustained loss of a large CCGT in each jurisdiction
  - Sustained Loss of interconnection with GB

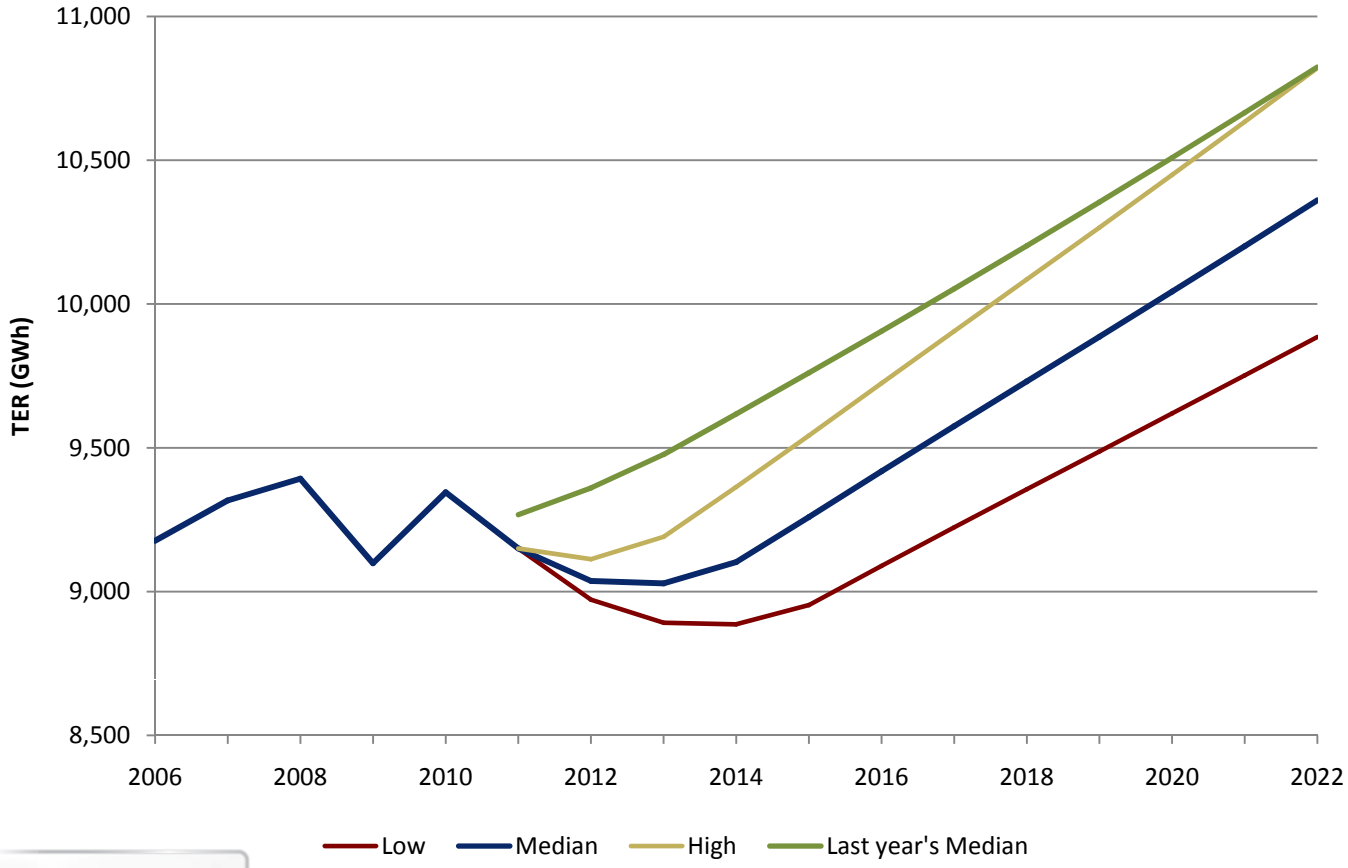
- **Meeting the generation adequacy standard is not a guarantee that there will not be load shedding particularly if surpluses are modest. It does mean that the probability is lower.**

DEMAND FORECASTS (1)

- Forecasting Demand now more complicated with the changing economic climate and varying extreme weather scenarios.
- Significant work required going forward to gain visibility of small scale generation and it's affects to feed into future forecasts
- For both jurisdictions, high, median and low demand scenarios have been created to allow for uncertainty in forecasting, with the median forecast seen as most likely.
- Forecasts are built separately for Ireland and Northern Ireland. These are then combined to produce the all-island forecast used in the all-island adequacy studies.
- Demand (MWh) and peak demand (MW) forecasts are modelled using historical trends and economic predictions and are temperature corrected.

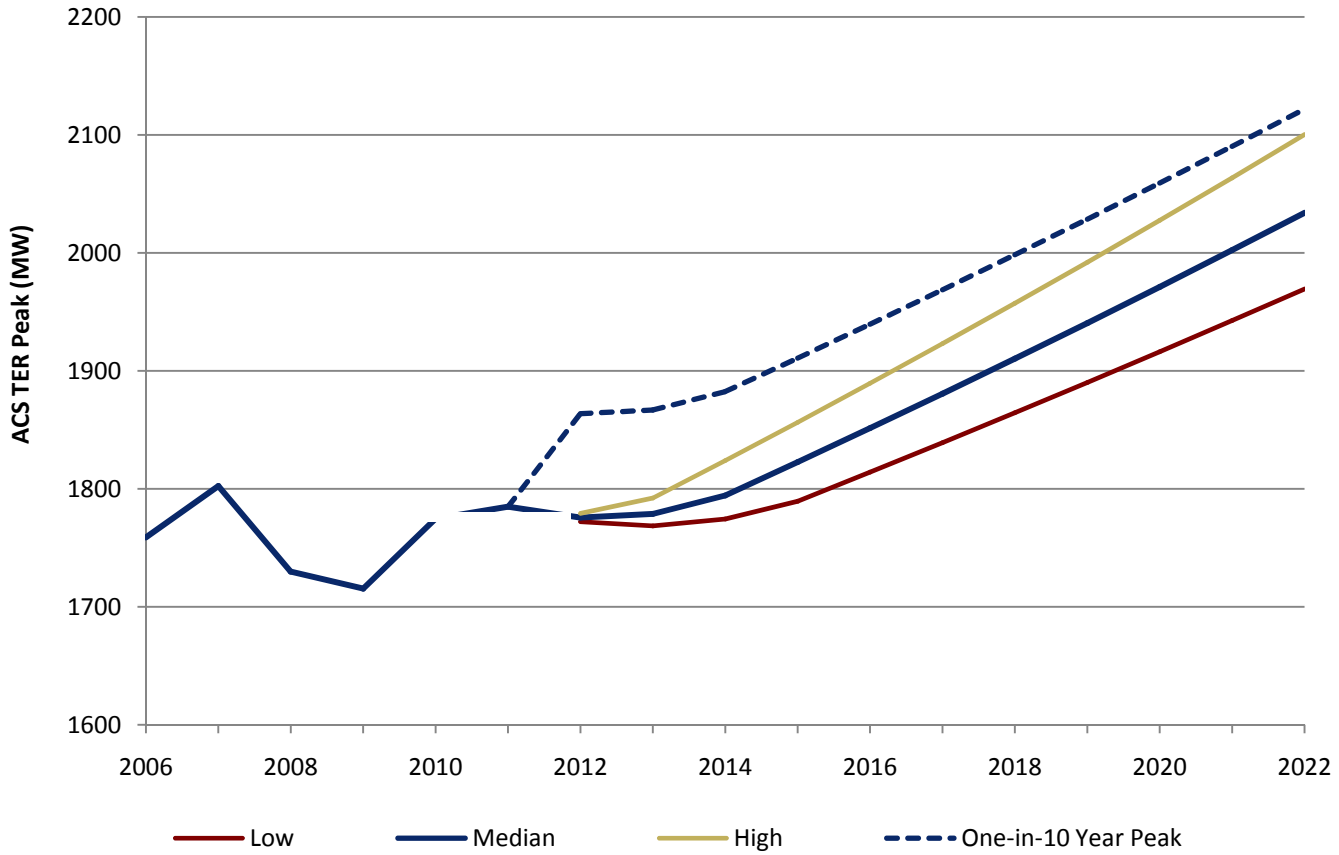
DEMAND FORECASTS (2)

Northern Ireland Demand Forecast (MWh)



DEMAND FORECASTS (3)

Northern Ireland Peak Demand Forecast (MW)



GENERATION ASSUMPTIONS (1)

Conventional Generation Portfolio

- At the data freeze date there was 2592 MW of Dispatchable plant in Northern Ireland

Conventional Plant Decommissionings

Plant	Capacity (MW)
Great Island 1,2,3	212
Tarbert 1, 2, 3, 4	592
Ballylumford 4, 5, 6	510

Conventional Plant Commissionings

Plant	Capacity (MW)
Great Island CCGT	431
Caulstown OCGT	55
Nore OCGT	98
Dublin Waste to Energy	62
Cuilleen OCGT	98
Suir OCGT	98

- Ballylumford 4, 5 & 6 are to be decommissioned due to LCPD at the end of 2015 resulting in a reduction of 510 MW in capacity

- **There is NO new conventional generation currently planned for Northern Ireland over the next 10 years**

GENERATION ASSUMPTIONS (2)

Issues with Other Northern Ireland Conventional Generation

- From 2016, KPS1 & KPS2 at Kilroot will have to comply with the Industrial Emissions Directive (IED) . This further tightens the Emission Limit Values (ELV) for Particulates (Dust), NO_X and SO_2 that were set in the Large Combustion Plant Directive (LCPD)

  IED Particulates (Dust) ELV
  Already compliant with IED Particulates ELV

  IED SO_2 ELV
  Compliant with SO_2 limits set in LPCD due to Flue Gas Desulphurisation (FGD) already installed in 2008. Some additional work & investment required to become fully compliant with IED

  IED No_x ELV
  Will not be compliant with IED No_x limits without major significant investment and work being carried out. Selective Catalytic Reduction (SCR) or similar technology will be required

- KPS1 & KPS2 likely to opt to enter UK Emissions 'National Bubble' under the IED. This will limit the MWh output each year from 2016-2020, followed by severely restricted running hours from 2021-2022.

- **The IED greatly affects KPS1 & KPS2 ability to contribute to system adequacy, particularly beyond 2020.**

GENERATION ASSUMPTIONS (3)

Renewable Generation

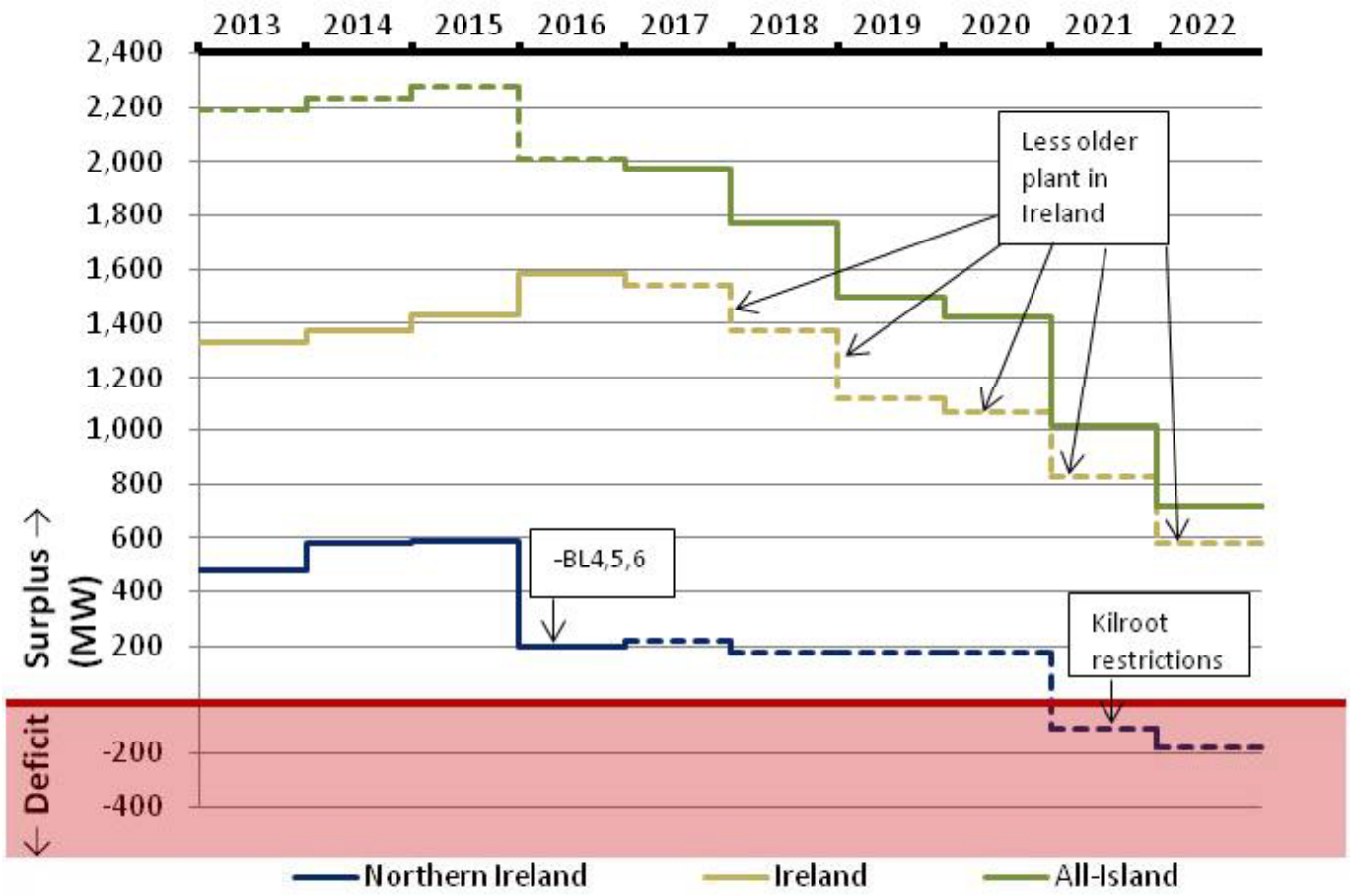
- At the data freeze date there was 497 MW of renewable generation connected, with the vast majority of this being wind generation (467 MW).
- SONI estimates that NI will need a total installed renewable capacity of circa 1570 MW in 2020 to meet the 40% renewables target.
- Wind power will be the main contributor with 968 MW of Large Scale Onshore and 191 MW of Offshore required to be installed. Other assumed renewables will include tidal (154 MW) and large scale biomass (45 MW).
- Most of the wind will be developed in the West of NI and transmission reinforcements will be required to transport it to the East.
- SONI have taken a conservative view of amount of renewables connected for the adequacy studies, but are confident that enough will connect to reach the 40% target.

GENERATION ASSUMPTIONS (5)

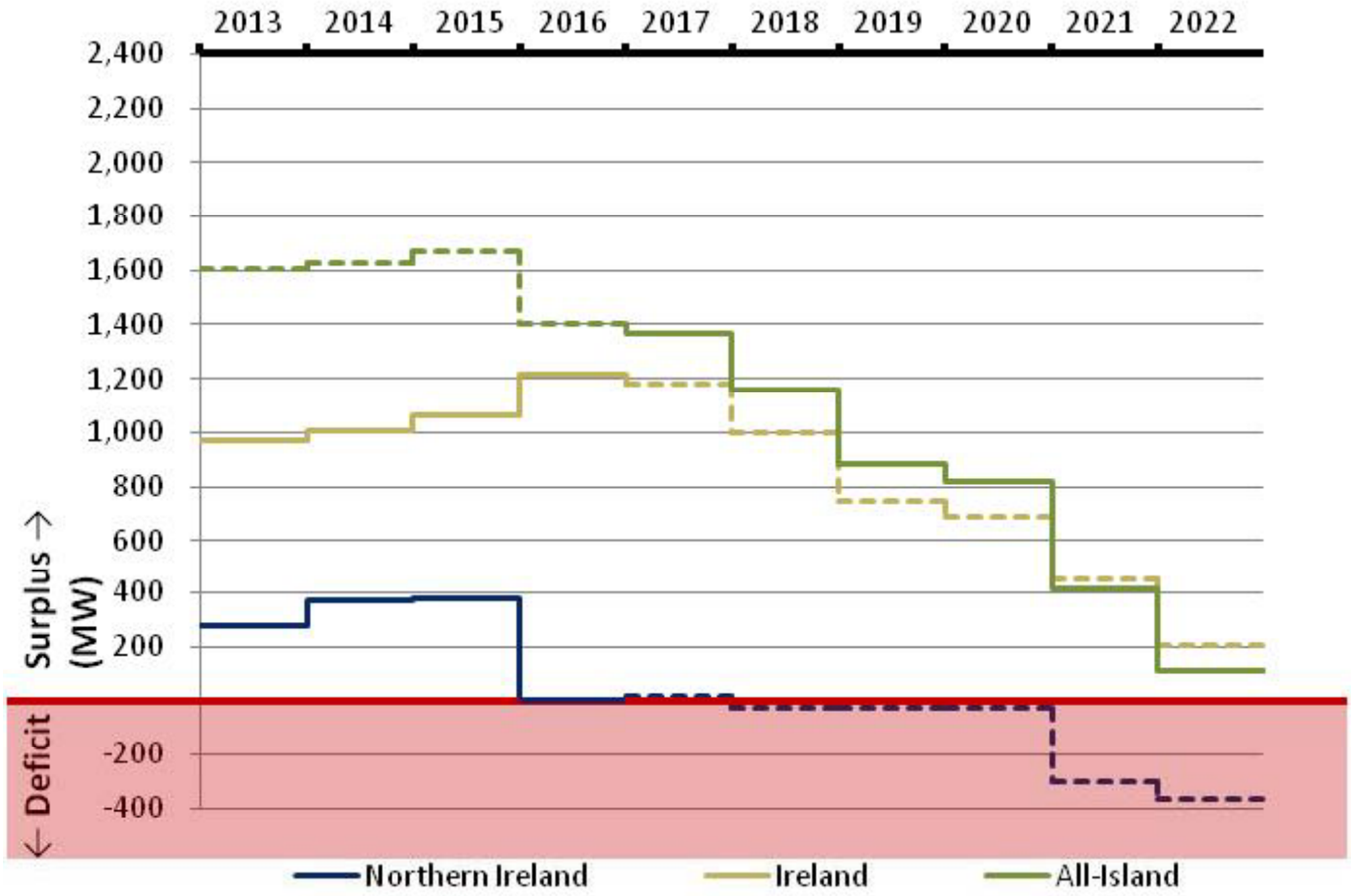
Interconnection

- **Existing North-South (IE – NI)**
  - Due to the current limited interconnection capacity each jurisdiction has a formal capacity reliance on the other for the purposes of these generation adequacy studies.
  - NI to IE = 100MW & IE to NI = 200MW
- **Additional Second North-South (IE – NI)**
  - Assumed to be in service from start of 2017
  - When the additional tie-line between the two jurisdictions is commissioned study moves to an all-island analysis as existing capacity limitation is removed.
- **Moyle (GB – NI)**
  - Treated as 250 MW capacity credit to NI due to ongoing fault.
  - Recent faults on Moyle have resulted in a substantially higher Forced Outage Probability being applied for the studies
- **EWIC (GB – IE)**
  - Assumed to be in service from start of 2013
  - Treated as 440 MW capacity credit to IE

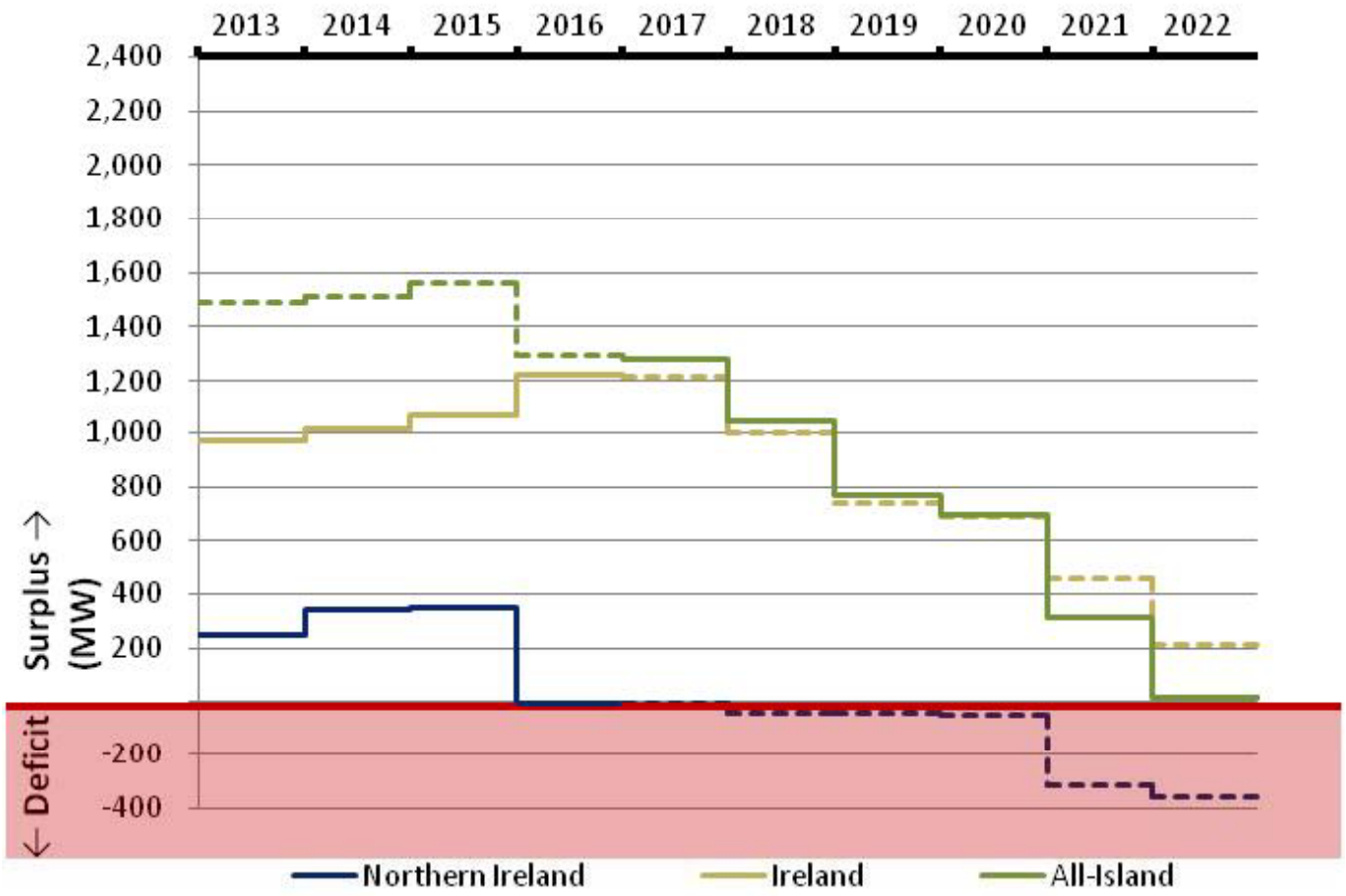
ADEQUACY RESULTS
(Base Case Scenario)



ADEQUACY RESULTS
(Sustained Loss of Interconnection with GB)



ADEQUACY RESULTS
(Sustained Loss of CCGTs)



KEY MESSAGES FROM GCS

- Demand remains subdued with growth dependent on economic recovery.
- No new generation is expected to connect in NI out to 2022 other than renewables.
- The Moyle Interconnector has been modelled at an import capacity of 250 MW due to uncertainty as to when the current ongoing fault on one cable will be repaired.
- 510 MW of conventional plant in Ballylumford will close by 2016. From 2021, the output from 476 MW of plant at Kilroot is projected to be severely restricted because of limited running hours due to the Industrial Emissions Directive (IED). The effect of this is that the Northern Ireland Generation Security Standard is not met in 2021 and 2022.
- In the base case scenario the Northern Ireland Generation Security Standard is met until 2020. Thereafter, Northern Ireland will be in deficit. With the additional North-South tie line in place, these deficits can be avoided.
- Northern Ireland is at risk of deficits from 2016 onwards in the event of a prolonged outage of a large generation plant or of the Moyle Interconnector.

IMPLICATIONS FOR FUTURE (1)

Main Issues & Risks for NI Going Forward

- 510 MW of capacity removed from NI system by 2016 (B4, B5, B6)
- No new conventional generation is planned to be added to system over the next 10 years
- Uncertainty with Moyle's reliability and if/when current cable fault will be repaired
- Implications of the IED on K1 & K2 (476 MW) – restricted output & limited running hours
- Uncertainty with additional N-S timescales
- Other unforeseen long term forced outages
- Carbon Price Floor Tax – "The Government intends to introduce an exemption for electricity generators in Northern Ireland from the carbon price floor, subject to discussion with the European Commission." Go ahead for this from EC not yet given, but likely?
- Very real possibility that Load Shedding may be inevitable?

IMPLICATIONS FOR FUTURE (2)

Next Steps

- SONI has licence obligation to highlight the potential problems ahead to policy makers (DETI), Regulator & other stakeholders
- While SONI alone cannot solve the problems highlighted, we are willing to assist the main stakeholders, policy makers and Regulator to ensure that sufficient generation on the system for SONI to operate
- Urgent action is **now** required to resolve the issues facing NI

?? QUESTIONS ??

Thank you for your attention

Any Questions?


EIRGRID
semo
Single Electricity
Market Operator
SONI
System Operator for Northern Ireland

Network Codes
Requirement for Generators (RfG)

Generator Forum

Mark Norton

7 March 2013

Topics

- What is a Network Code
- What Network Codes are there
- Significant Grid user
- Network Code structure overview
- Operational Notification Procedures
- Compatibility with existing standards
- Retroactive Application
- Next Steps to enforcement

What is a Network Code?

Becomes a European Regulation (law)

Regulation 714/2009 Article 8 (on cross-border electricity trade, part of the 3rd Internal Energy Market Package) Tasks of the ENTSO for Electricity to produce Network Codes for:

(a) network security and reliability rules including rules for technical transmission reserve capacity for operational network security;

(b) network connection rules;

(c) third-party access rules;

(d) data exchange and settlement rules;

(e) interoperability rules;

(f) operational procedures in an emergency;

(g) capacity-allocation and congestion-management rules;

(h) rules for trading related to technical and operational provision of network access services and system balancing;

(i) transparency rules;

(j) balancing rules including network-related reserve power rules;

(k) rules regarding harmonised transmission tariff structures including locational signals and inter-transmission system operator compensation rules; and

(l) energy efficiency regarding electricity networks.

ACER responsible for Framework Guidelines which drive most Network codes

EIRGRID semo SONI

EC / ACER / ENTSO-E high priority list *version 8 May 2012*

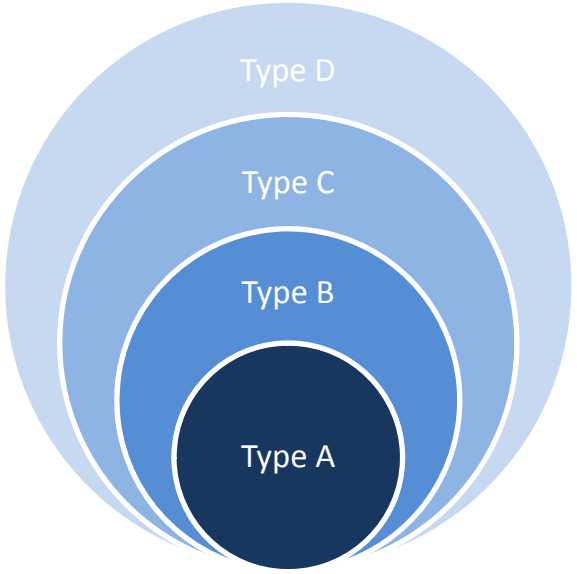
http://ec.europa.eu/energy/gas_electricity/codes/codes_en.htm

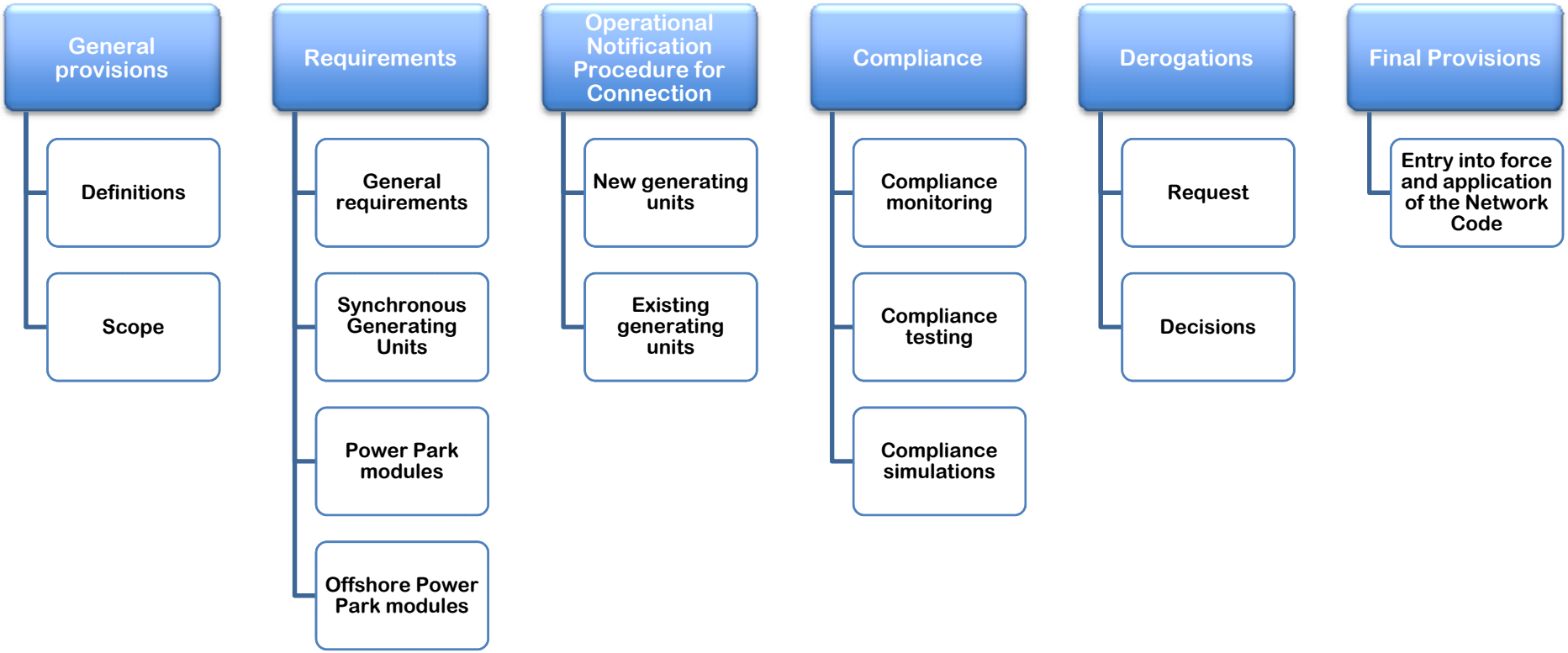
	Deliverable	Scoping Phase		ACER FG draft		ENTSO-E code drafting		ACER evaluation	Comitology
		Start	End	Start	End	Start	End		Start
Electricity									
	FG on capacity allocation and congestion management			Q1/11	Q2/11				
	NC on capacity allocation and congestion management [1]					Q3/11	Q3/12	Q4/12	Q1/13
	NC on forward markets					Q4/12	Q3/13	Q4/13	Q1/14
	Regional progress, setup and testing (incl. AESAG process and Regional Initiatives Work Program)								
	EC comitology guideline on governance								Q1/13
	FG on grid connection			Q2/11	Q2/11				
	NC on Requirements for Generators connection					**Q3/11**	**Q2/12**	**Q3/12**	**Q4/12**
	NC on DSO and industrial load connection					Q1/12	Q4/12	Q1/13	Q2/13
	NC on HVDC connection					Q1/13	Q1/13	Q1/14	Q1/14
	FG on system operation [2]			Q2/11	Q4/11				
	NC on operational security					Q1/12	Q1/13	Q2/13	Q3/13
	NC on operational planning and scheduling					Q2/12	Q1/13	Q2/13	Q3/13
	NC on load-frequency control and reserves					Q3/12	Q2/13	Q3/13	Q4/13
	NC on operational training								
	NC on requirements and operational procedures in emergency								
	FG on balancing	Q3/11	Q4/11	Q1/12	Q3/12				
	NC on balancing [3]					Q4/12	Q3/13	Q4/13	Q1/14
	EC comitology guideline on transparency								Q3/12
	FG on Third Party Access								
	NC on third party access								
	NC on data exchange and settlement								
	Possible Guidelines/FG on incentives to TSOs to increase cross-border	Q3/12	Q4/12						
	Possible Guidelines on investment incentives to TSOs	Q3/12	Q4/12						
	EC Comitology Guideline on tariffs	Q3/12	Q4/12						

Significant users

- Generator capabilities are formulated from a system performance perspective, independent from technology
- Need to be able to cope with evolutions in generation mix
- Significance is regarded per requirement

Wide-scale network operation and stability including European-wide balancing services	110kV+/ 10MW+
Stable and controllable dynamic response capabilities covering all operational network states	5MW+
Automated dynamic response and resilience to operational events including system operator control	0.1MW+
Basic capabilities to withstand wide-scale critical events; limited automated response/operator control	800W+



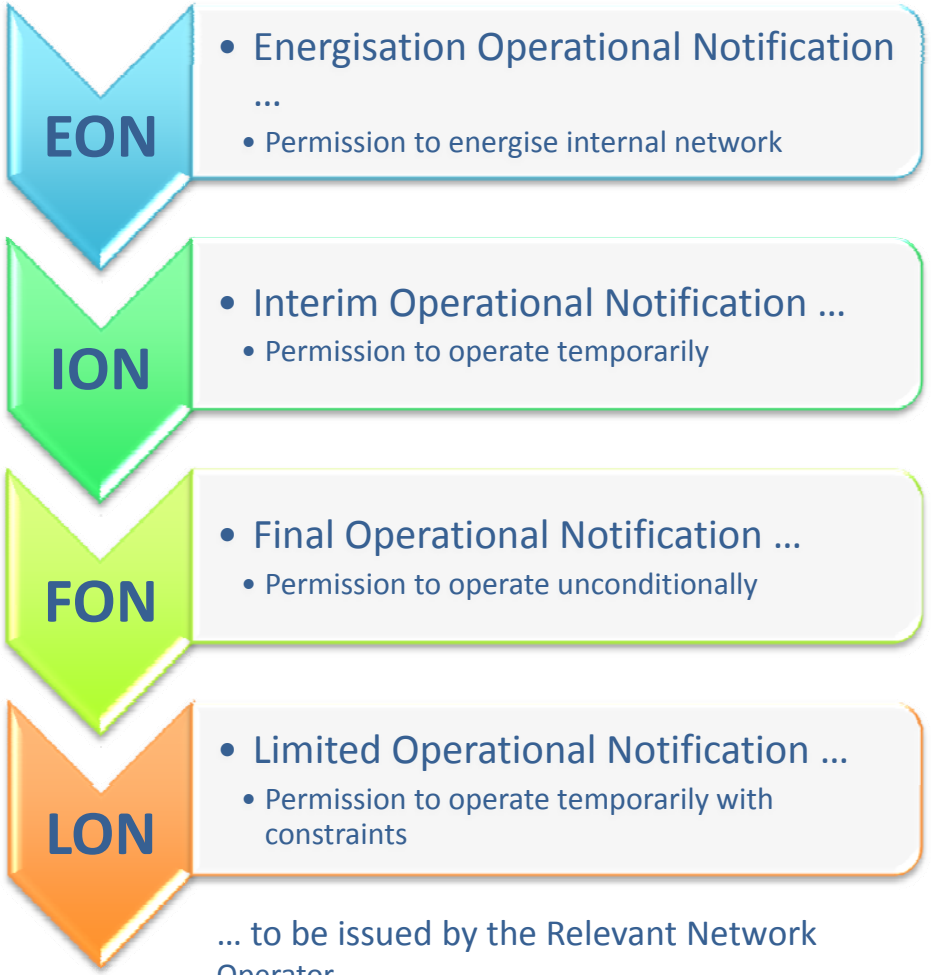

General provisions
Definitions
Scope
Requirements
General requirements
Synchronous Generating Units
Power Park modules
Offshore Power Park modules
Operational Notification Procedure for Connection
New generating units
Existing generating units
Compliance
Compliance monitoring
Compliance testing
Compliance simulations
Derogations
Request
Decisions
Final Provisions
Entry into force and application of the Network Code

Operational Notification Procedure

Type A: (800W-0.1MW)
Installation document

Type B/C 0.1-10MW [or 110kV]
Power Generating Module Doc
Must provide same info as type D
Can be single stage process

Type D 10MW+ [or 110kV]
Three stage process to right



… to be issued by the Relevant Network Operator

Existing Grid Code Requirements

Requirements in Title 2 of RfG

- Many type D requirements in line with existing Grid
- Most new requirements already being considered in DS3
- No automatic retrospective application to existing generators

Compliance testing

- Test requirements set out in code
- Alternatives can be agreed with Relevant Network Operator (DSO/TSO)
- EirGrid opinion consistent with existing tests

Operational Notification Procedure

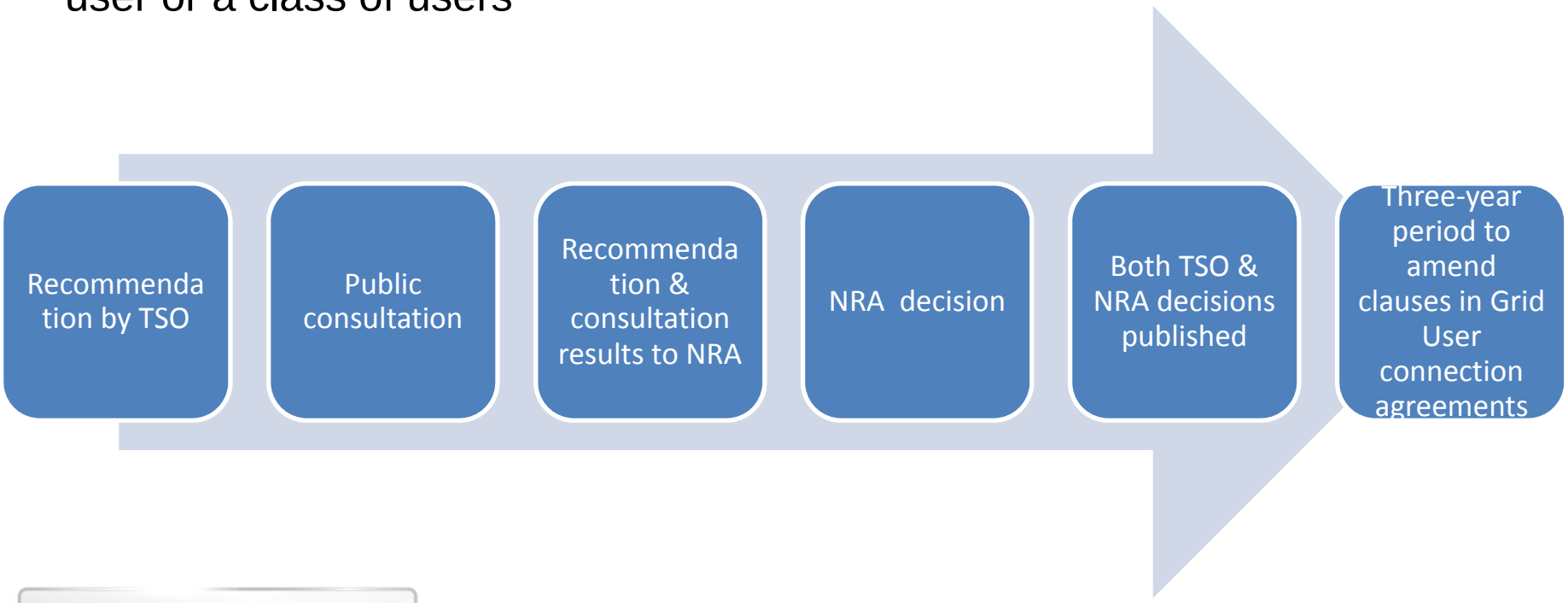
- EirGrid opinion that 3 stage process in line with existing process
- Flexibility in type B, and C allows consistency also

EIRGRID semo SONI

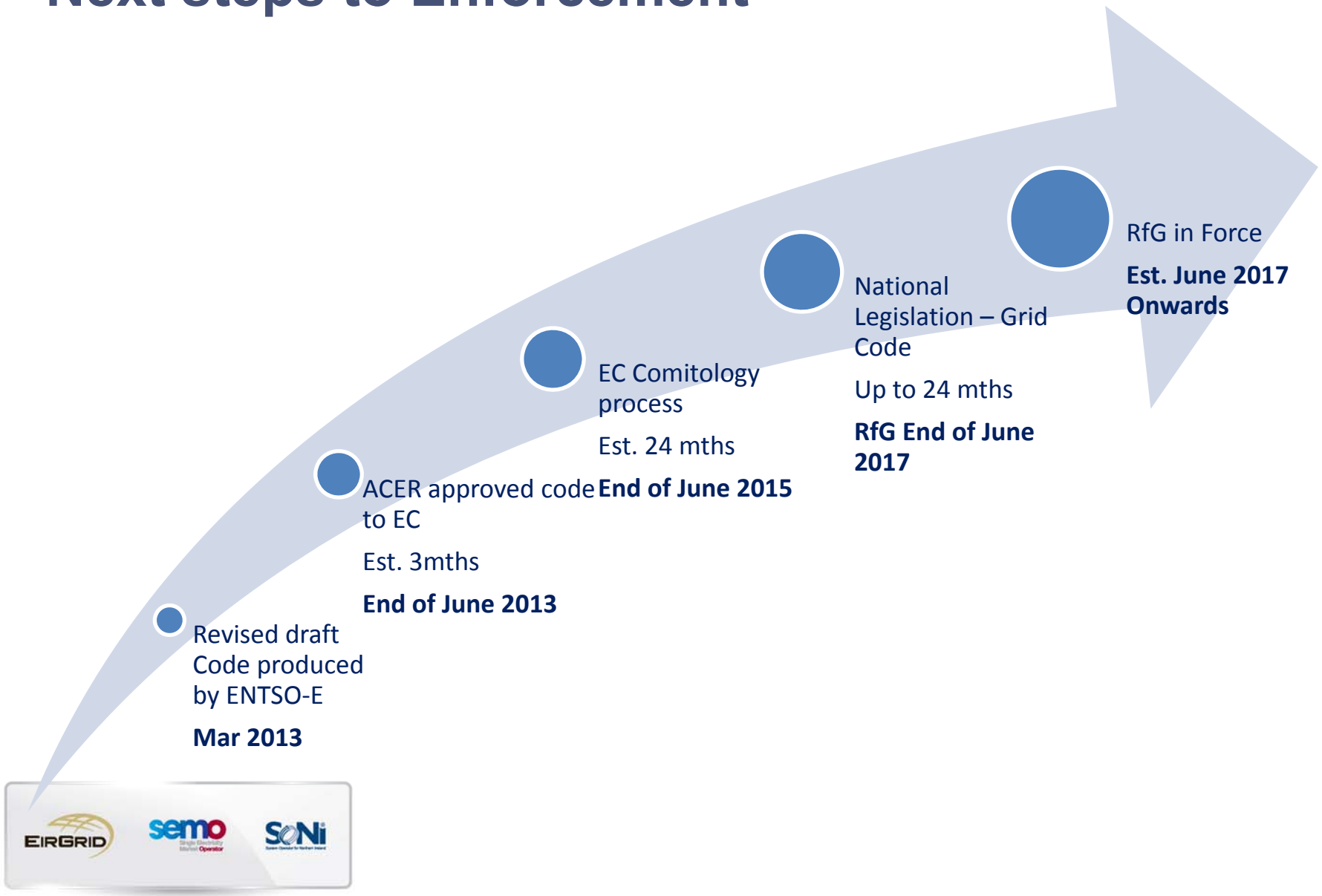
Retroactive application

Modernisation/replacement of existing generators move to new standards otherwise...

If TSO considers necessary and CBA justifies retroactive application for a user or a class of users



Next steps to Enforcement



Thanks for your attention

Links to further information:

https://www.entsoe.eu/major-projects/network-code-development/requirements-for-generators/

http://www.eirgrid.com/testsections/customers/workshopsandconferences/


EIRGRID
semo
Single Electricity
Market Operator
SONI
System Operator for Northern Ireland

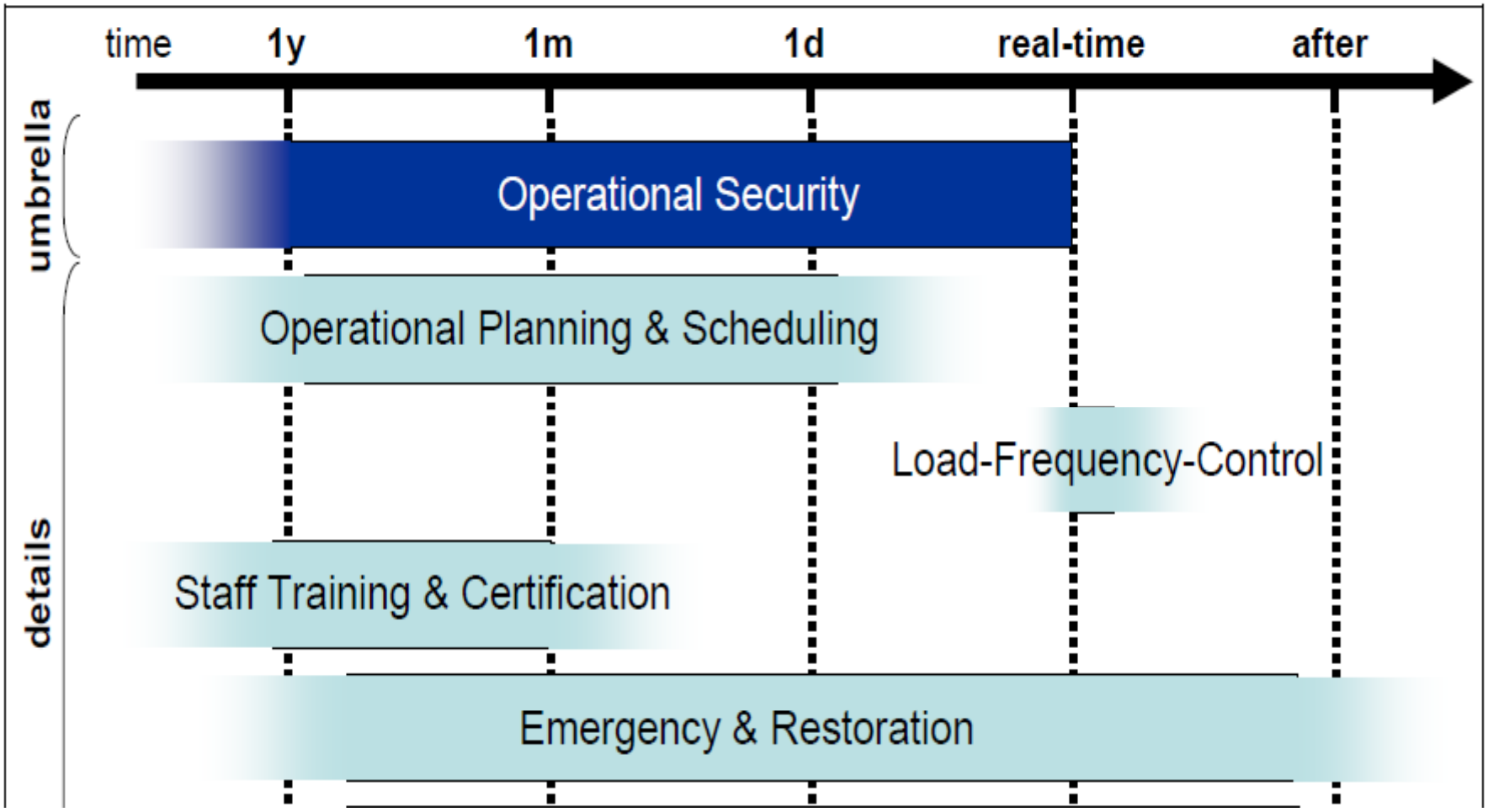
Operational Network Code Update

Generator Forum

Liam Ryan

7 March 2013

Overview of Operational Network Codes



Operational Codes

- Operational Security was first
- Closely followed by Operational Planning & Scheduling
- Next is Load Frequency Control & Reserves
- They will be followed later by Emergency Procedures and Staff Training

The Operational codes have strong links between themselves and to other codes;

- OS links to all connection codes
- LFCR is closely tied to BAL
- All the operational codes are linked
- OS and OPS are linked to the CC part of CACM (because of the Common Grid Model).

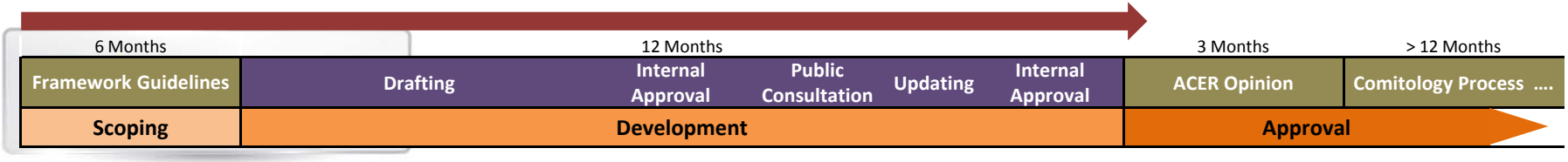
Operational Security

Purpose: To set common rules for ensuring the operational security of the pan European power system.

Contents:

- Operational Security Requirements
- Testing & investigation
- Data Exchange
- Training
- Compliance

Status: Submitted to ACER on the 1st March 2013



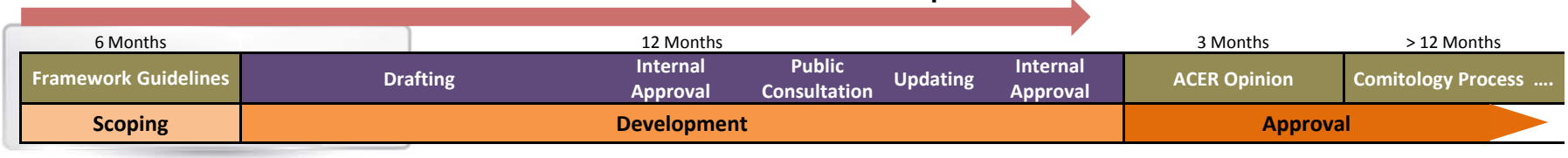
Operational Planning & Scheduling

Purpose: Sets requirements, for assessing the adequacy and operational security of the interconnected power system and for planning outages required by TSO's and grid users when they have cross borders impacts on power flows.

Contents:

- Data For Operational Security Analysis in Operational Planning
- Operational Security Analysis in Operational Planning
- Outage Planning
- Adequacy
- Ancillary Services
- Scheduling
- ENTSO-E Operational Planning Data Environment

Status: OP&S Network Code is being updated with comment received and is scheduled to be submitted to ACER on the 1st April



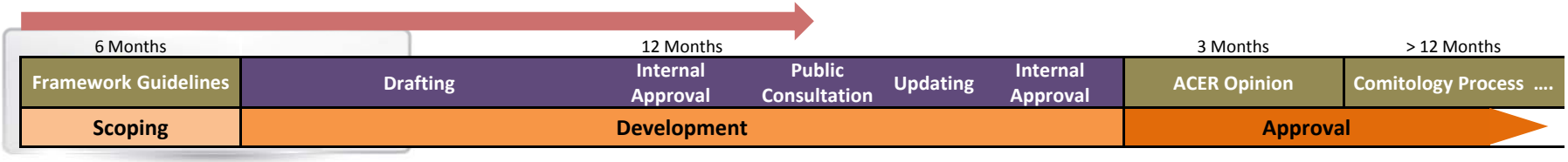
Load Frequency Control and Reserves

Purpose: To set out coordinated and clearly specified load frequency control processes and rules regarding the levels and location of reserves (back-up) which TSOs need to hold.

Contents:

- Frequency Quality
- Load Frequency Control Structure
- Frequency Containment Reserves
- Frequency Restoration Reserves
- Replacement Reserves
- Exchange & Sharing of Reserves
- Co-operation with DSOs
- Compliance

Status: Public Consultation



LFC&R - Key Areas for Participants

- Requirements on Reserve Providers
- Exchange of Reserves between Synchronous Areas
- Frequency Quality Evaluation

Key Dates for the LFC&R

- 3rd stakeholder forum in Brussels on 12th March
- EirGrid and SONI will be holding an addition Stakeholder forum at the end of March
- Consultation Closes on the 2nd April


EIRGRID
semo
Single Electricity
Market Operator
SONI
System Operator for Northern Ireland

Questions?

Agenda (Afternoon)

14:00 Commissioning and Testing Update - Karl O'Keeffe

14:30 DSUs - Alan Kennedy

14:45 Tea/Coffee

15:00 Phasor Monitoring - Ray Doyle

15:20 Closing remarks

Operational Services and Performance

Generator Forum, Belfast
7 March 2013

Agenda

1. SEM-11-062 - Controllability Updates.
2. Grid Code, Modifications and Testing.
3. DS3 Testing Review.
4. Demand Side Units (DSUs).

SEM-11-062

Background

(i) WFPS that do not comply with this requirement/ are not derogated from same; (circuit breaker used if active power controls are not working).

(ii) Controllable WFPS; (wind dispatch tool).

(iii) WFPS which are not required to be controllable/ are derogated from this requirement/ those in commissioning phase; (wind dispatch tool).

Categorisation Policy Document

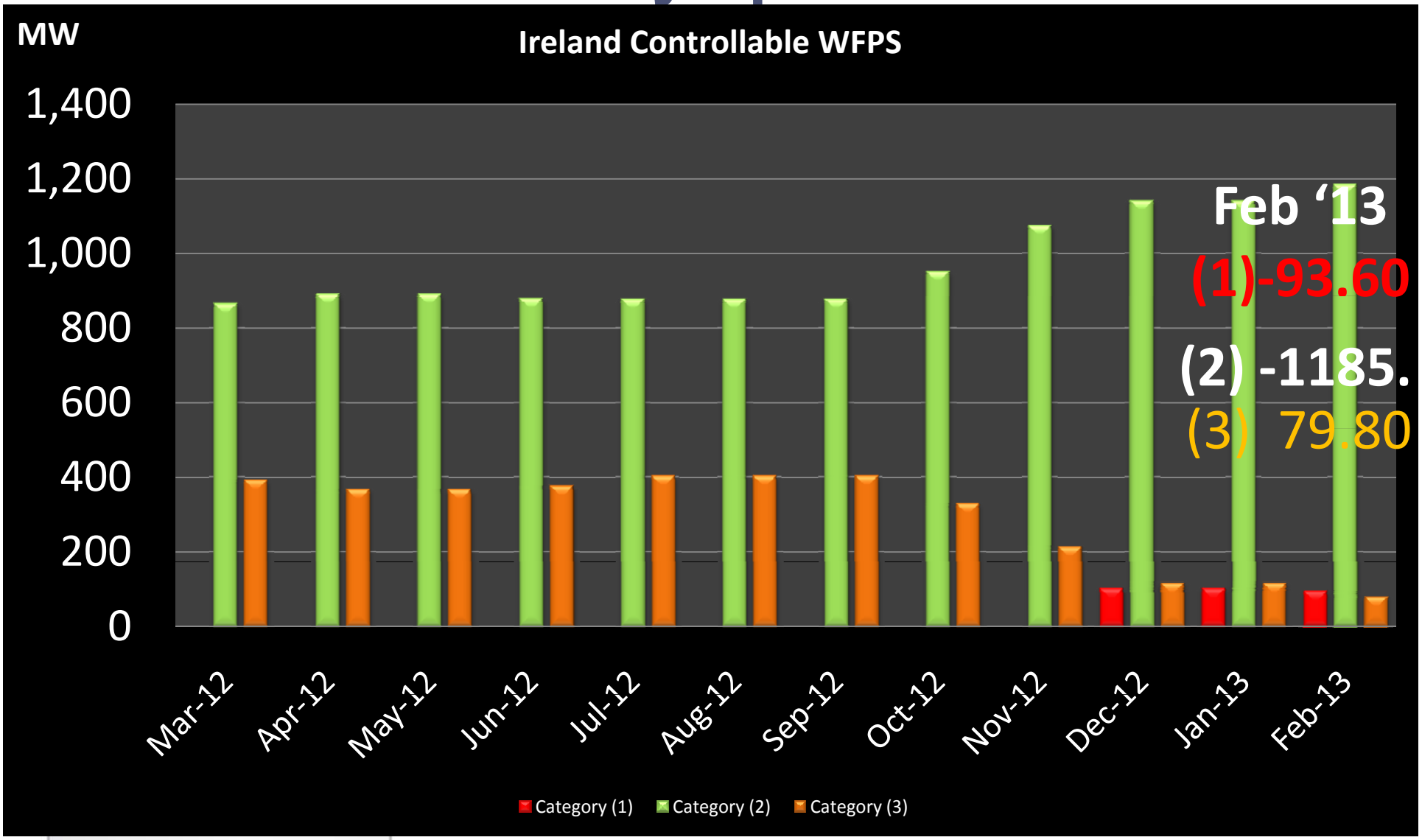
- 1 December 2012 – Controllable WFPS.
- 1 December 2013 – Operational Certificates (justification).

Performance Monitoring Process

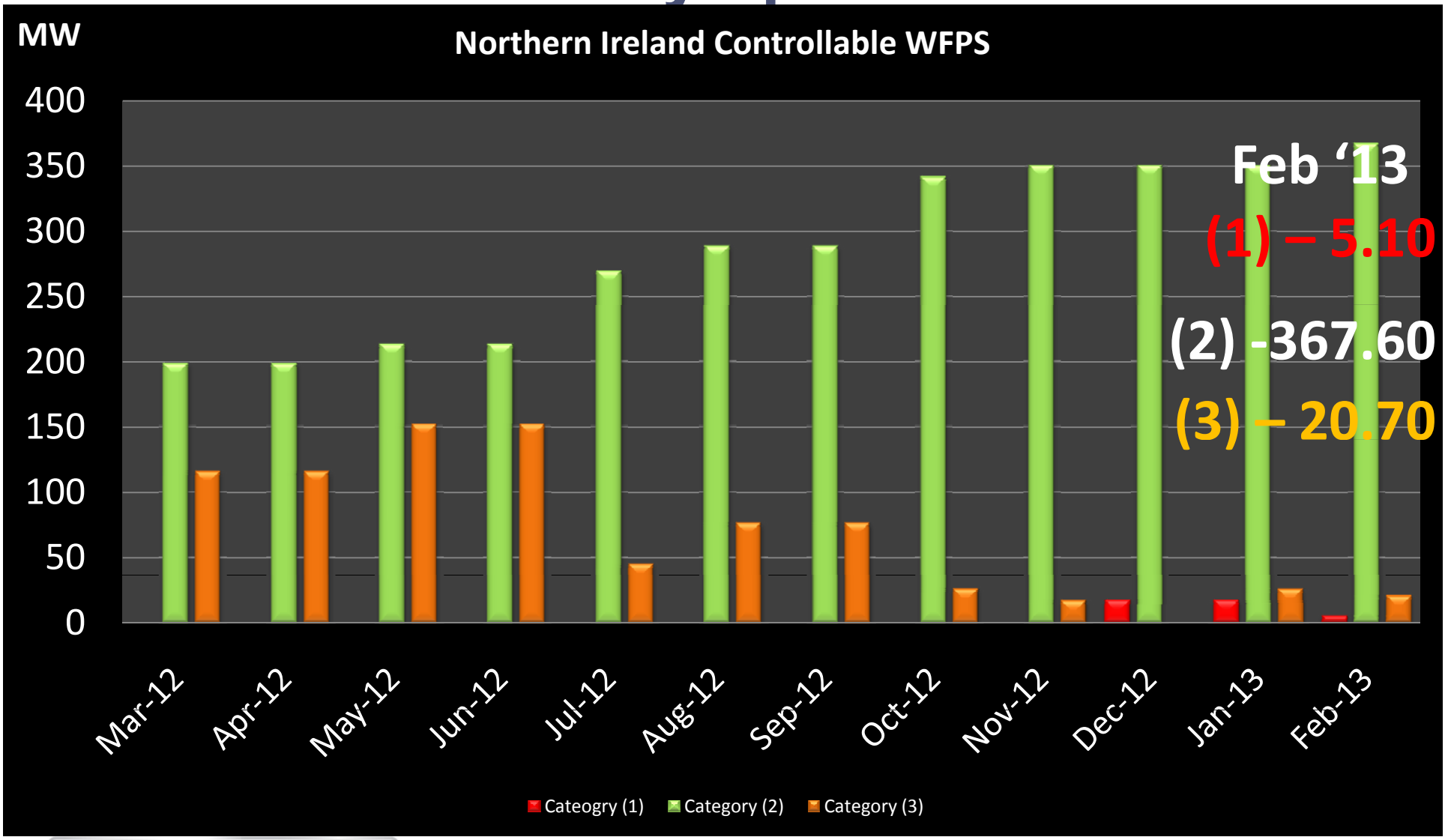
- 1 February 2013 – Moving Categories for non-controllable WFPS.

Further details published on www.eirgrid.com.

WFPS Controllability updates



WFPS Controllability updates



Grid Code
Modifications and Testing

Grid Code Ireland

- Modifications since Version 4.0 published. http://www.eirgrid.com/operations/gridcode/modifications/
- Grid Code Version 5.0 to be published in Q2 2013.
- Any User, the TSO or the CER can propose a modification.
- Modifications are proposed to the Grid Code Review Panel (GCRP), who recommends to the CER for approval.
- Modifications are effective from the date that they are approved by CER.
- Modifications are applied retrospectively.
- The GCRP Members and area of representation http://www.eirgrid.com/operations/gridcode/membersconstitution/

Grid Code Northern Ireland

- Existing Version – 20 July 2012.
- Next planned Revision to include WFPS Modifications.
- Modifications are proposed to the Grid Code Review Panel (GCRP).
- Consultation on the modifications have been completed.
- Final draft modifications and new WFPS Settings Schedule will be sent to UREGNI for approval by 8 March.
- Modifications are effective from the date that they are approved by UREGNI.

WFPS Grid Code Modifications

MPID	Description	Summary	CER Approved Effective Date
230	Fault Ride-Through	Active and Reactive Power responses redefined to offer a rapid response during and after a system event.	26/02/13
228	Reactive Power	New reactive power specifications.	26/02/13
227	Frequency Response & Ramp Rates	Clarify the requirements on Ramp Rates and frequency.	26/02/13

Further information from GridCode@eirgrid.com / Arlene Chawke – (01 2370129) or a GCRP representative

Next Steps

EirGrid TSO will:

1. Write to Wind Farm Power Stations (WFPS) seeking confirmation of compliance with Modifications; and
2. Publish and present guidance notes for JGCRP in May.

WFPS to Submit to gridcode@eirgrid.com:

1. Derogations as applicable;
2. Mitigation actions; and
3. Timelines for testing and implementation.

Compliance Testing:

1. Test procedure & Test Request Dates submitted by WFPS to generator_testing@eirgrid.com

Other Modifications

MPID	Description	Summary	Next Steps
229	RoCoF Definition Proposal	There are two proposals within the modification to change existing definition.	Awaiting CER Decision.
Northern Ireland Grid Code	Settings Schedule	Annex to the Grid Code for WFPS Technical Requirements.	To be submitted to UREGNI by 8 March.
239	Dynamic Models	Standard Models including source code to be provided by Generators.	GCRP members to submit comments on proposal to gridcode@eirgrid.com .
240	DSU Modifications	Changes to improve DSU response including Application Information, Signalling, Ramp Rates, initial time of response	Redraft modification and circulate based on comments at GCRP meeting.

DS3 Performance Monitoring and Testing Work stream

Testing Review

Testing Review

No.	Workshop	Date / Venue
1.	Centrally Dispatched Generator Units (CDGU) Review of Existing Process	EirGrid Offices 29/08/2012
2.	CDGU Recommendations	Ballymascanlon House, Dundalk 08/10/2012
3.	Wind Farm Power Stations (WFPS) Review of Existing Process	Crowne Plaza Hotel – Dundalk 19/11/2012
4.	WFPS Recommendations	EirGrid Offices 23/01/2013

Progress update on Recommendations to Joint GCRP – May 2013

Workshops and Recommendations published:
http://www.eirgrid.com/operations/gridcode/compliancetesting/

Demand Side Units

Demand Side Units

WPDRS Phased Out

- Winter Peak Demand Reduction Scheme (WPDRS) est. 2003 for security during evening peaks for periods of tight generation margins.
- Increased generation and interconnection has diminished the effectiveness of the scheme.
- WPDRS phased out since Friday 22/02/2013.
- All Customers have been notified.

Demand Side Units

- 2 Operational DSUs.
- DSU workshops planned for April.

Demand Side Units

- DSU application form
  http://www.eirgrid.com/media/DSU%20Application%20Form.pdf
- DSU Modifications to Joint Grid Code Review Panel
  http://www.eirgrid.com/media/MPID240DemandSideUnitProposalRevisedVersionGCRP34.pdf
- DSU Testing
  - Onsite Survey of Demand sites and Control Centre.
  - Signals Testing.
  - Individual Demand Response Testing.
  - Aggregate Demand Response Testing.
  - Performance Monitoring.

Contacts & Further information: dsu@eirgrid.com
http://www.eirgrid.com/operations/ancillaryservicesothersystemcharges/demandsidemanagementdsm/demandsideunits/

Contacts

Generator_testing@eirgrid.com

or

connections@soni.ltd.uk

DSU UPDATE

Alan Kennedy

SOME HISTORY

- In the 1990s we operated a scheme in NI whereby industrial customers could contract to reduce their demand in return for a rebate.
  - Bi-laterally contracted
  - 6 hours notice required
  - Limited number of reductions permitted each year
- Between 2007 and 2009 Energia had a DSU registered in NI, but this was only comprised of demand suppressing diesel gen sets
  - Effectively behaved like a generator in many important respects (eg ramp up/down smoothly)
  - Not actual demand blocks
  - Infrequently dispatched – effectively a peaking plant

Grid Code Mods 2011

- Permitted export from DSUs
- Certain consequential changes
- No material impact in NI to date since……..

CURRENT POSITION

- ….at present there are no DSUs registered in NI
- Current flexible demand response in NI is limited to Economy 7 space/water heating controlled via teleswitching
- So we have limited recent experience with industrial/ commercial scale demand response for day to day system operations

CURRENT POSITION

- SONI & EirGrid have a common vision for demand side measures
- We are aware that two DSUs are presently registered in Ireland
- Of particular concern would be the specific technical characteristics of DSUs.
  - Disconnection of significant load blocks
  - Timing of response

FUTURE CHANGES – GRID CODE

- SDC mods were tabled at the recent JGCRP
- We intend to table similar mods at the SONI GCRP

FURTHER DEVELOPMENTS

- Demand Side Management workstream within DS3
- DS3 demonstration project will show how Glen Dimplex Quantum space/water heating products installed in 1000 properties can be utilised as an aggregated demand side tool

Thank you for your attention


EIRGRID
semo
Single Electricity
Market Operator
SONI
System Operator for Northern Ireland

Questions?

Update on
Power System Low Frequency Oscillations

Raymond Doyle

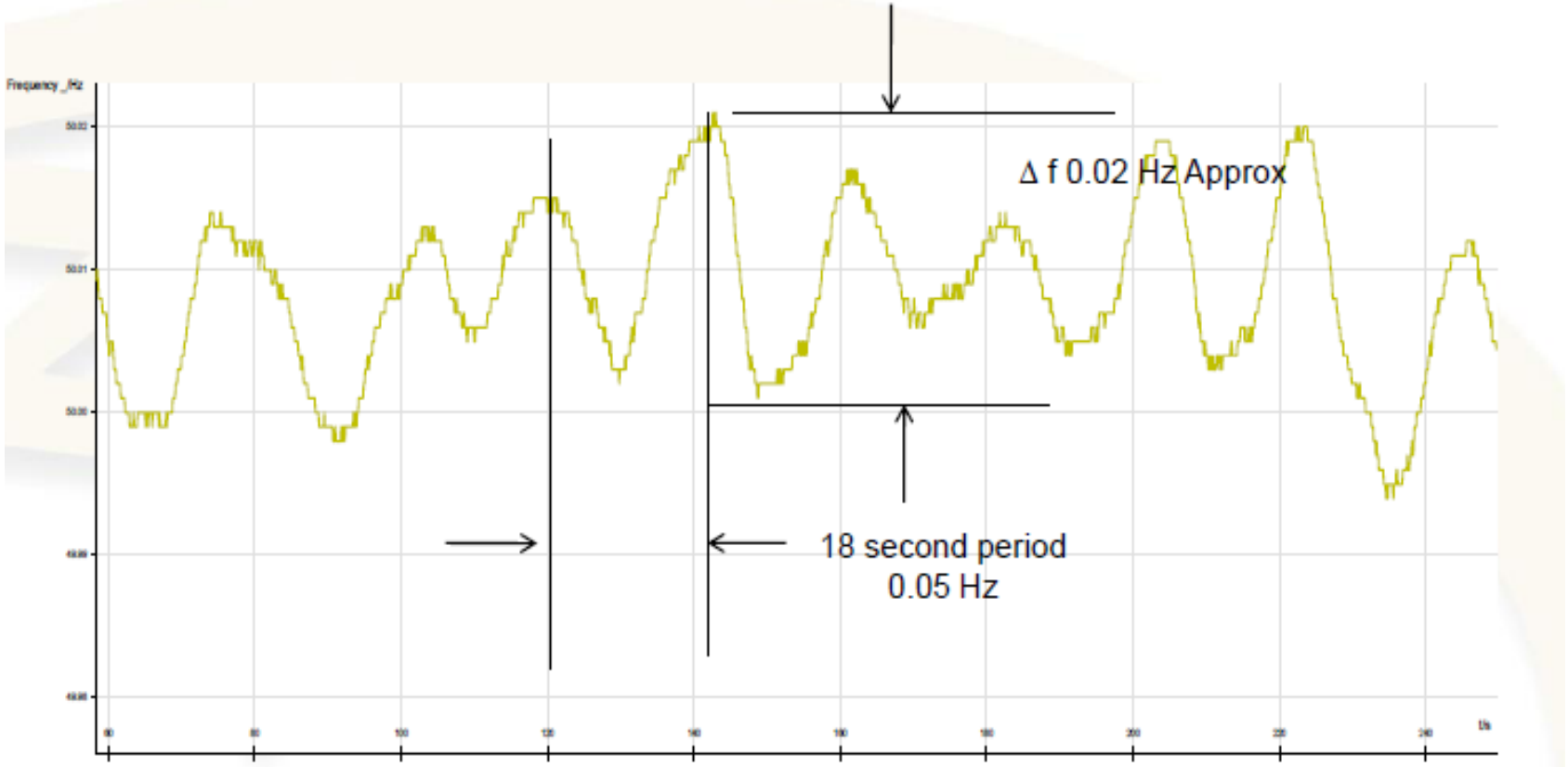
Belfast – 7th March 2013

Background

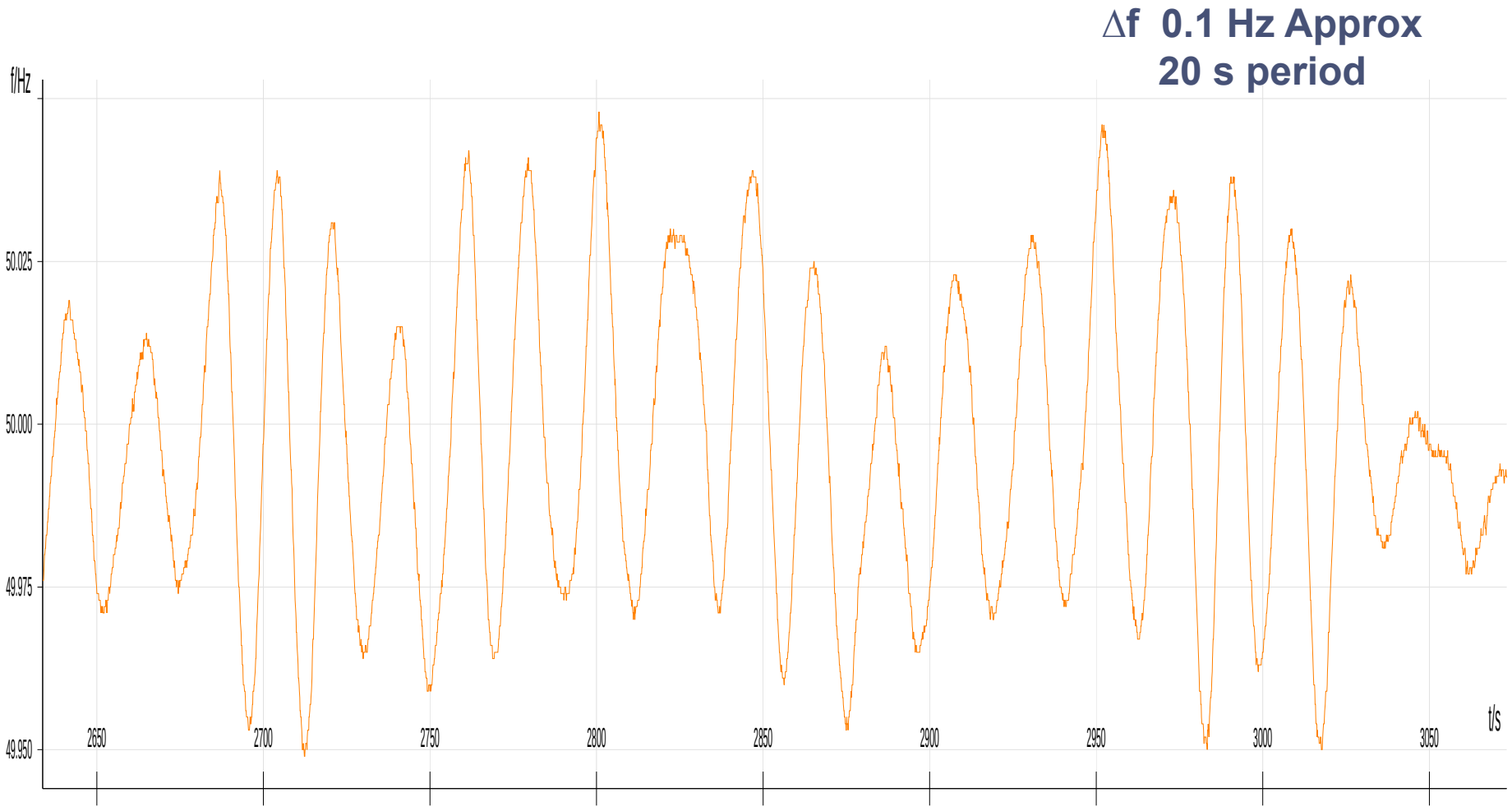
- In 2010/11 we began to observe LFO's on the system

- What had changed?:
  - A number of new units on the system
  - Increasing wind penetration
  - Turlough Hill not available
  - Increased Focus on units to deliver contracted MW reserve following u/f events
  - Changes to governor characteristics

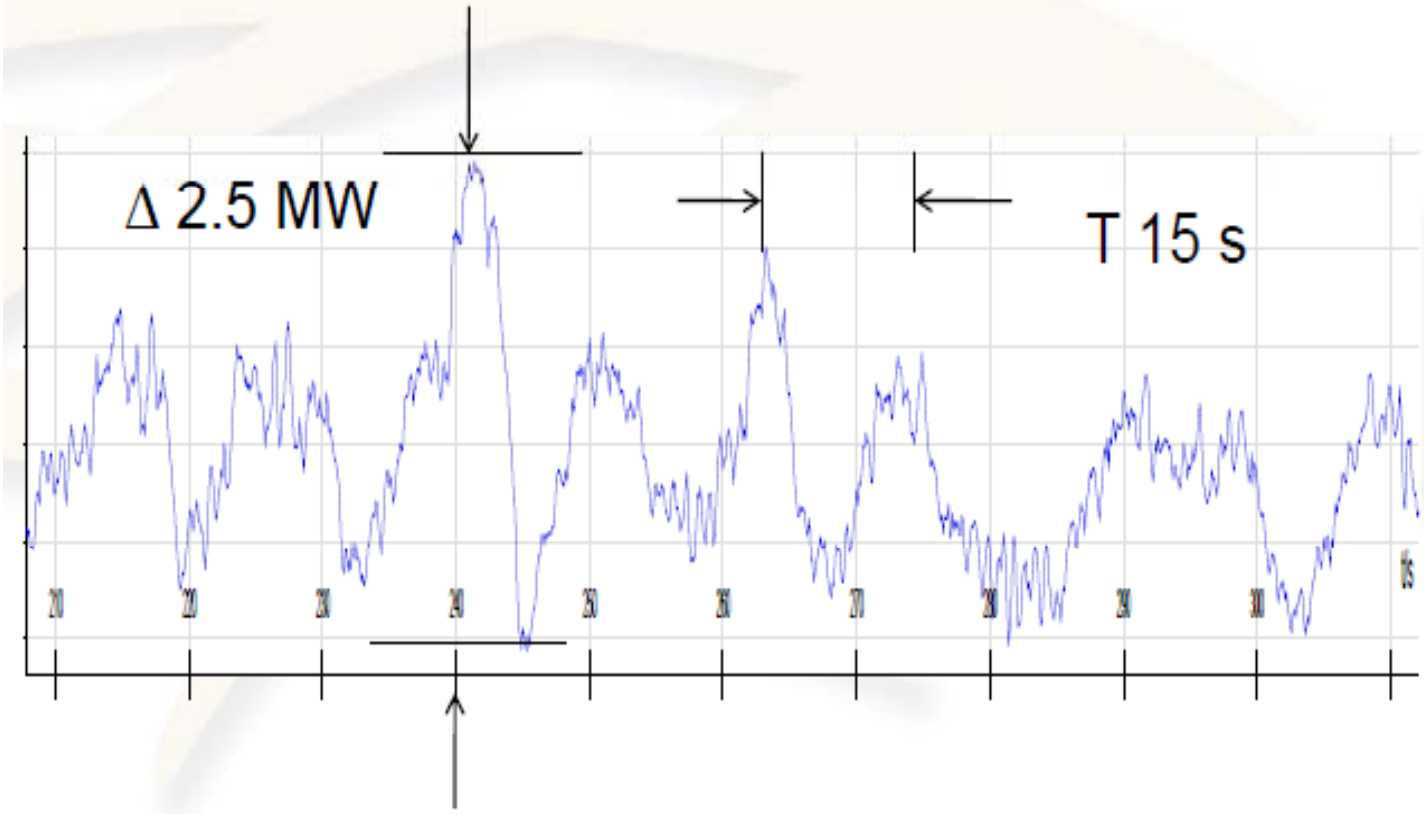
Slow Low Magnitude Oscillation in System Frequency



Higher Amplitude Frequency Oscillation

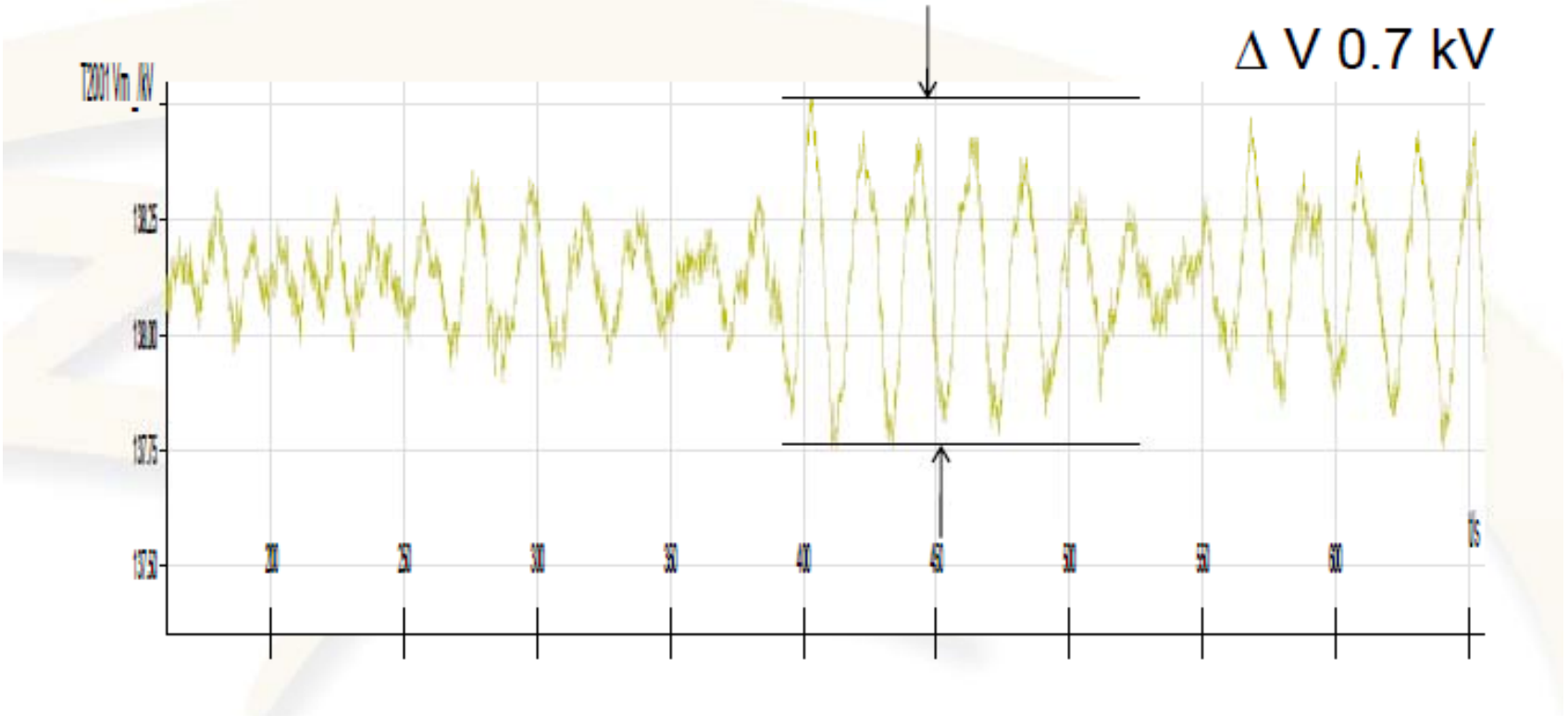


Actual Generator MW output



Impact on Power Quality

220 kV System Voltage RMS Variation



Difficulties identifying the cause

- Did not have sufficient generator monitoring facilities
- Available Data from various sites was not time synchronised
- No obvious triggers for many of oscillation events
- When oscillations began most generators north and south tended to participate
  - Thus very difficult to separate cause and effect with any degree of certainty

Getting To the Source of Problem

- Required installation of additional high speed recorders with GPS time stamping
- Involved months of time consuming collection of data and analysis of gen behaviour post each oscillation event
- Collection of information on governor models and settings
- Discussions and information exchange with a number of generators
- Generator discussions with OEMS

Getting To the Source of Problem

- A trial Synchro-Phasor monitoring system was setup in 2011
  - This facilitated the collection of time synchronised data from 5 sites on the system
  - Allowed cause and effect to be determined with a high degree of certainty
- The work eventually identified the machines initiating the oscillations and Generators/OEMS developed a solution
- This ultimately led to the modifications being made to governor control loops at two sites
- No events detected since September 2012
- Currently commissioning a permanent Synchro-Phasor Monitoring system which utilises existing recorder network

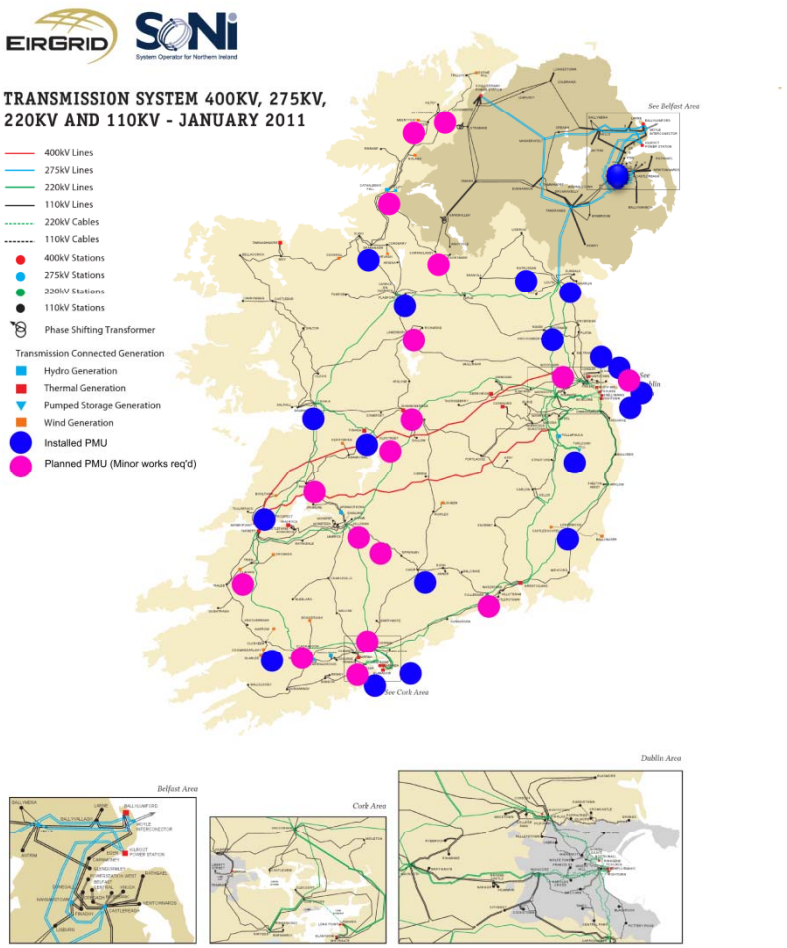
Overview of Synchor-phasor System

- GPS time stamped Current, Voltage & Frequency Data provided by Disturbance Recorders with PMU functionality
- Data is streamed by Comms network to Central server at the Oval
- This Data is held in a real time database
- Each measured quantity is available at a rate of 50 samples/second
- Active and Reactive Power is calculated from I & V measurements
- Information of the outputs of all monitored generators can easily be extracted and compared
- Plan is to hold a rolling 2 years of data

Applications of Synchro-Phasor Monitoring

- Automatic identification of system oscillation events
- Automatic calculation of Frequencies and amplitudes of oscillations
- Enables cause and effect of events to be determined with high degree of certainty
- Generator Performance Monitoring
    - Reserve, fault ride through, reactive power etc
- Enhanced System Awareness and Fault/incident Analysis
- Detection of islanded generator(s) or islanded network
- Assistance with Power System Restoration / re-synchronisation of island networks

PMU Locations



Future Aims for Synchro-Phasor Monitoring System

- Expand system to monitor all majors generators (conventional and renewable) in ROI

- Expand system to monitor all majors generators (conventional and renewable) in NI

What is required to avoid repetition of oscillation issue?

- Accurate Governor/AVR/PSS Models

- Timely notification of any proposed changes to governors/AVRs/PSS
  - For ROI: Information to be made available to EirGrid
    - Email: Registereddata@EirGrid.com
  - For NI : Information to be made available to SONI
    - Email: registrationdata@soni.ltd.uk

- Evaluation of any proposed changes to governors/control systems

- Testing and monitoring of generator performance following any changes to control systems

- Co-ordination of changes (one machine at the time)

- Possible Real time monitoring of governor modes

EirGrid Grid Code Requirements-Governors

Planning Code:

–Supply a Laplace domain control block diagram in accordance with IEEE standard prime mover models for thermal and hydro units (or as other wise agreed with the **TSO) completely specifying all time constants and gains to fully explain the transfer function for the governor in relation to frequency deviations and setpoint operation.**

Connection Conditions:

–**Users shall not change frequency or load related control settings of Unit governors without agreement with the TSO.**

–Each **Generation Unit must be fitted with a fast acting proportional turbine speed governor and unit load controller or equivalent control device to provide Frequency response under normal operating conditions.**

–The governor must be designed and operated to the appropriate

–(a) European Standards; or

–(b) In the absence of a relevant European Standards, such other standard which is in common use within the European Union

–As at the time when the installation of which it forms a part was designed. Normal governor regulation shall be between 3% and 5%.

EirGrid Grid Code Requirements-Governors

Operating Code:

REQUIREMENTS OF GENERATION UNIT GOVERNOR SYSTEMS

(a)Generation Units when Synchronised to the Transmission System shall operate at all times under the control of a Governor Control System, unless otherwise specified by the TSO, with characteristics within the appropriate ranges as specified in Connection Conditions;

(b) no time delays other than those necessarily inherent in the design of the Governor Control Systemshall be introduced;

(c) A Frequency Deadband of no greater than +/-15mHz may be applied to the operation of the Governor Control System. The design, implementation and operation of the Frequency Deadband shall be agreed with the TSO prior to the Commissioning.

SONI Grid Code Requirements

OC3.5 DATA REQUIREMENTS

The response capability data required for each **CDGU** (and in the case of a **CCGT Installation**, **CCGT Module(s)** therein), in connection with **Operating Reserve** and relating to circumstances when **NI System Frequency** falls to a level which fully opens the **CDGU's** governor valve, is listed in the **Appendix** to OC3 (in the case of an **Open Cycle Gas Turbine Unit**, only the data applicable to an **Open Cycle Gas Turbine Units** should be supplied). This data for all such units should be provided when required initially under the **Connection Agreement** and thereafter in Week 24 in each calendar year and shall be within the parameters set out in Schedule 1 to the CC**.** The provisions of SDC1.4.4.1(b) will apply, with necessary changes of terminology, to any changes to these parameters.

Questions?