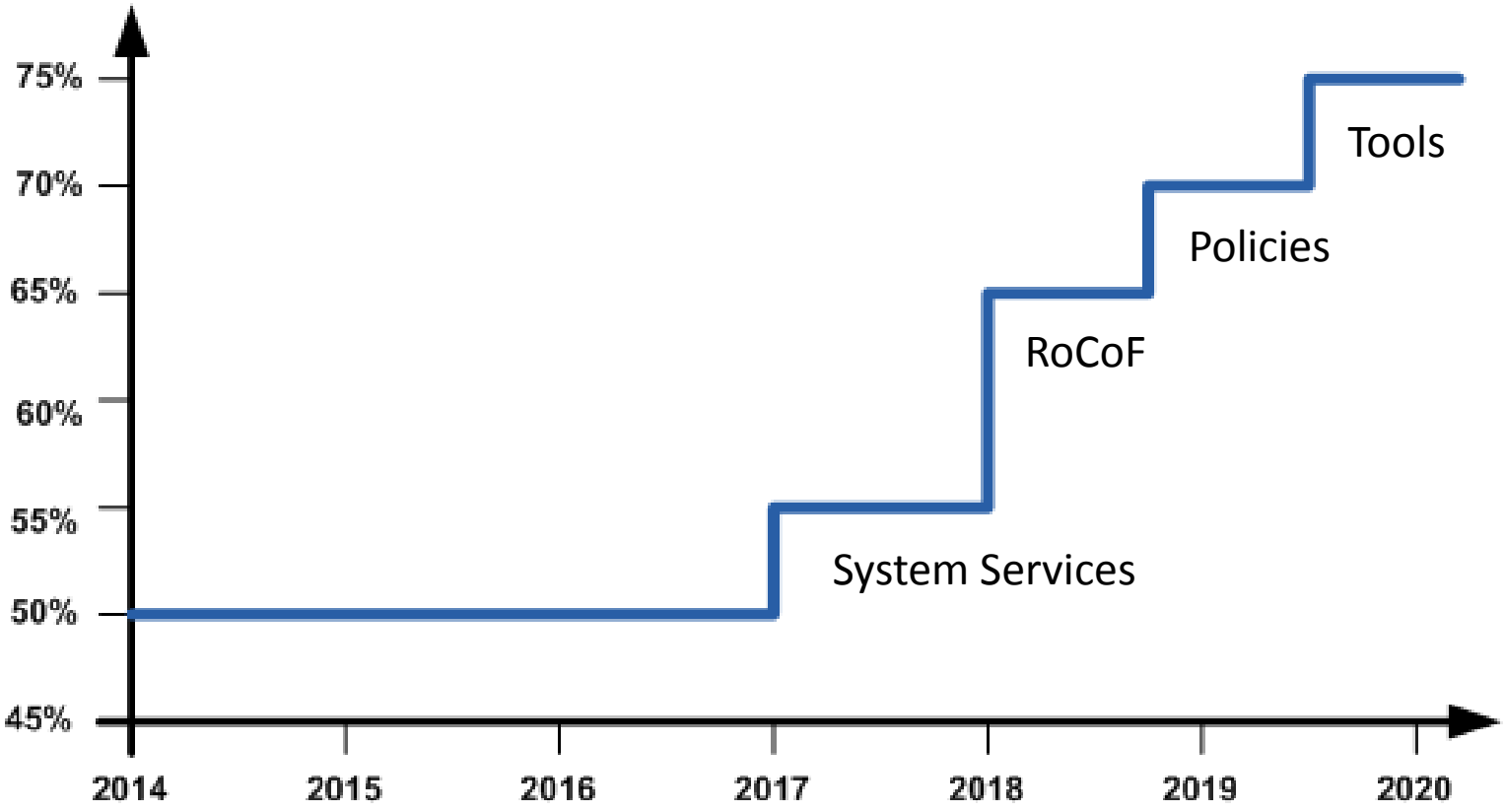
DS3 Programme Status Update

20th May 2014

Robbie Aherne

Operational Capability Outlook



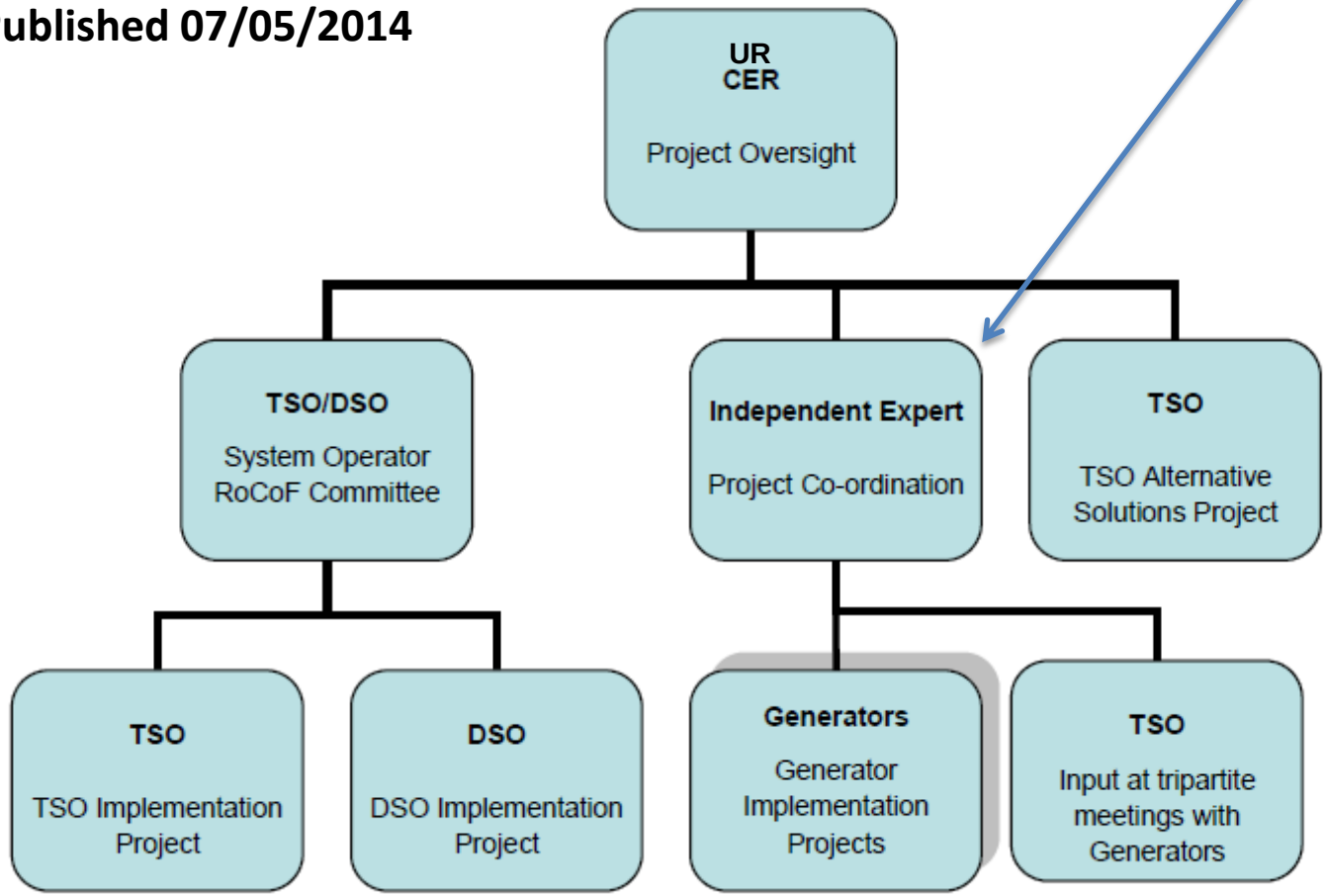
System Performance

- Grid Code
- Performance Monitoring
- DSM
- System Services
- ROCOF

RoCoF

UR Decision:
Carried out by SONI

CER: Published 04/04/2014
UR: Published 07/05/2014



System Services

TSOs

Plexos: System Service Valuation

- Updated inputs
  - Demand and wind
  - New counterfactual
  - Model refinements

Report delivered to RAs (7th Mar 2014)

RAs

Evaluation of "supply-side"

- Investigation of potential costs for system service provision
  - Industry call for evidence
  - Building on KEMA costs analysis

Consideration of Procurement Options

- RAs developing proposals for SEMC
- SEMC Consultation paper expected in Q2 2014
- SEMC Decision expected by end 2014

Grid Code, EPM&T and DSM

Grid Code

- Ireland DS3 WFPS D-Code mods brought into force

EPM

- EPM system: implementation of requirements underway
- Proposed workflow and reporting templates for EPM circulated to industry for comment on 26/03/2014
- Test procedures based on industry workshops published for comment

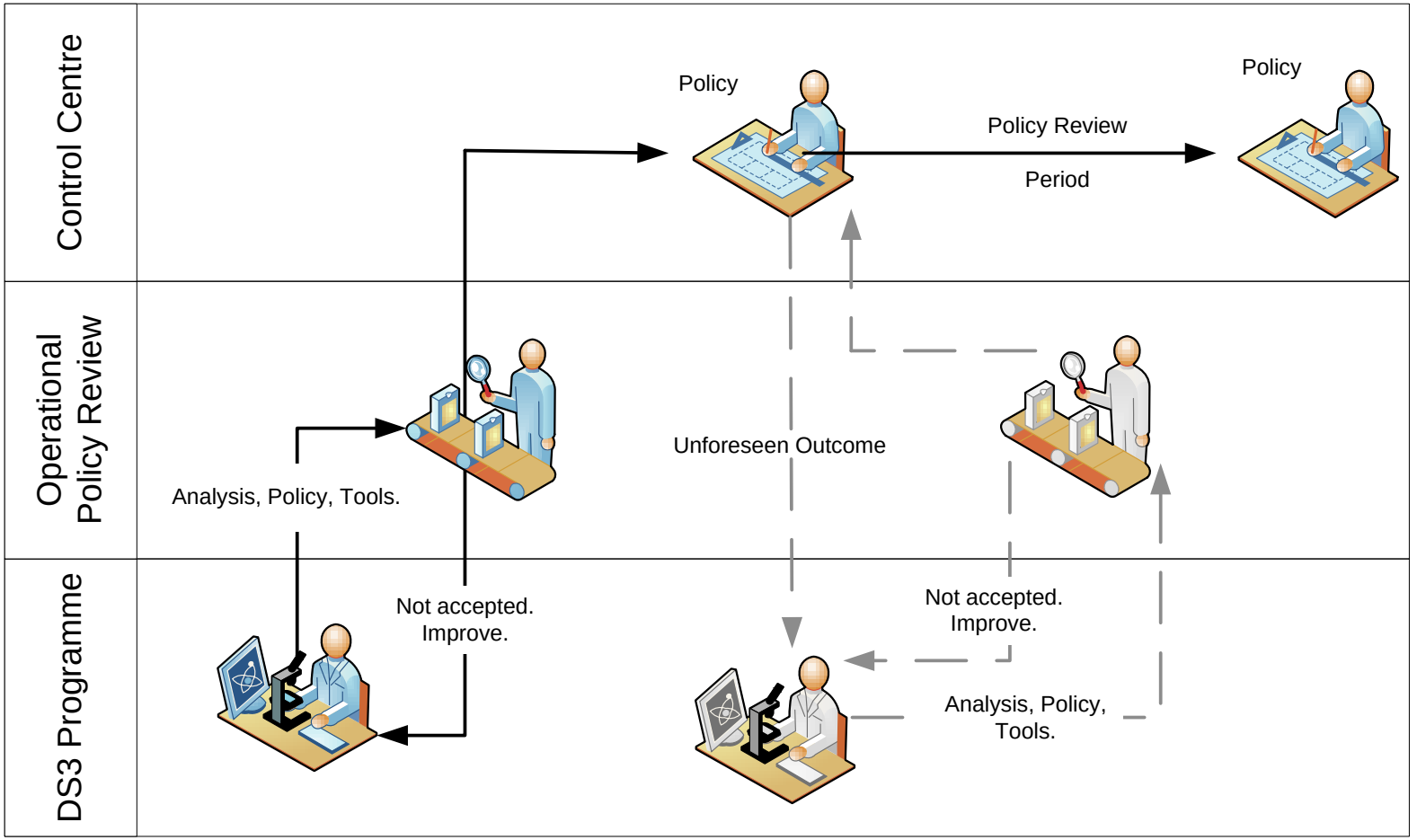
DSM

- Five DSU JGCRP WG meetings held since November
- Six Grid Code modifications will be discussed at June GCRP meetings
- On-going work on application, commissioning and testing

DS3 – Shaping the System of the Future

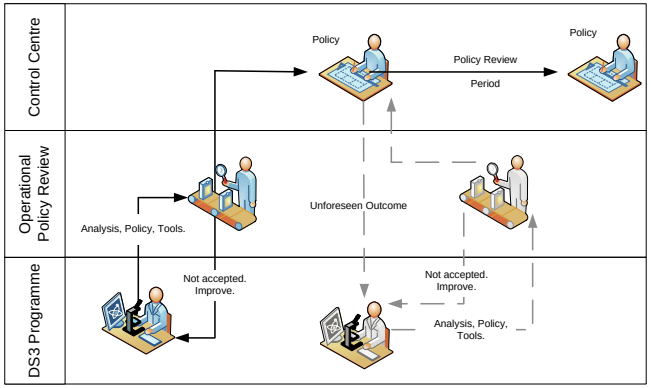
- Frequency
- Model Dev. & Studies
- Renewable Data
- Voltage

OPR Committee



Operational Studies

- High wind reports *
- Nodal voltage control *
- Minimum generation studies *
- Secondary tripping study *
- Over frequency generation shedding *
- SNSP metric review *
- Pilot version of automated large scale dynamic analysis using PLEXOS as input

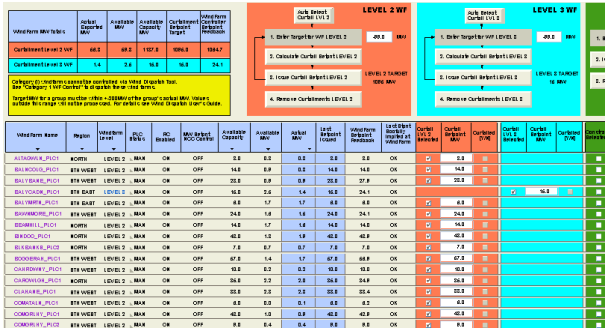


System Tools

WSAT

Control Centre Tools

CCT and WSAT



CCT

- Wind dispatch tool went live in Dublin on 08/05/2014
- Phasor monitoring display: launched on 23/04/2014
- Inclusion of RoCoF / inertia in RCUC: Q4 2014
- Factory acceptance testing of harmonised EMS took place in Feb

WSAT

- Roadmap detailing preferred functionality extensions complete

Actions from Last Advisory Council Meeting #1

DS3 Programme Update

- Circulate an update on the Operational Policy Review Committee and its role in the implementation of DS3 related policy changes **(TSOs)**

- Provide an update on the Minimum Generation Studies to Council members following the Operations Policy Review meeting **(TSOs)**

Actions From Last Meeting

- Suggest topics to be discussed at the next Advisory Council meeting in May **(All Members)**

- Suggest topics to be presented at the next DS3 Industry Forum **(All Members)**

Actions from Last Advisory Council Meeting #2

DS3 Workstream Plans

- Feedback and comments on revised DS3 Workstream plans to be sent to TSOs by February 4th **(All Members)**

- Collate responses from the Advisory Council on the revised DS3 Workstream plans **(TSOs)**

- Publish revised Workstream plans on February 10th **(TSOs)**

Industry Perspective

- Advisory Council members to make TSOs aware of any known inconsistencies between Grid Code, Guidance notes or MPID documentation or any areas where further clarification is required **(All Members)**

Actions from Last Advisory Council Meeting #3

Advisory Council Review

- Produce a draft list of the risks raised at the Advisory Council meeting and circulate to the Advisory Council members **(TSOs)**

- Advisory Council members to provide feedback on risks. **(All Members)**

Recent High Wind Generation

- Provide clarity as to the cause of the large wind forecasting errors seen on the 29th December in the 'Recent High Wind Generation' presentation and if this was as a result of high wind speed shut down **(TSOs)**

- Provide further clarity on whether capacity payments had effect on counter trading in the month of December **(TSOs)**

Advisory Council

- DS3 is a cross industry project – Advisory Council input important

- Refresh of membership?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DS3 Risk Update

20th May 2014

Robbie Aherne

Identified Risks

	Risk
1	Impact of Network Codes and other EU interventions on DS3
2	ROCOF and incapability of generators to move to 1 Hz/s
3	Non Grid Code compliance of older generators – analysis required to clarify this?
4	Timely decisions on System Services
5	Impact of network infrastructure construction on DS3
6	DS3 critical path not being clearly outlined
7	Future of REFIT contracts and economic analysis out to 2025


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Industry Perspective

20th May 2014

Rate of change of frequency (RoCoF) Modification

20th May 2014

Tom McCartan

Presentation overview

- RoCoF Consultation Timeline
- International Examples
  - National Grid
  - Tasmania
- Regulators decisions

RoCoF Timeline

June 2010	Facilitation of Renewables paper identifies RoCoF as a limiting factor to increasing non-synchronous penetration
September 2010	EirGrid group wrote to Generators requesting details of their protection settings
February - August 2012	DS3 Grid Code Working Group
December 2012	TSO RoCoF GC modification submitted
February 2013	DNV KEMA publish TSO commissioned RoCoF report
May 2013	PPA publish CER commissioned RoCoF report
June/August 2013	CER and UREGNI Consultation on RoCoF Modification to the Grid Code
April/May 2014	CER decision paper issued 4th April 2014. UREGNI decision issued 7th May 2014.

National Grid

Current Consultation

- Joint Distribution and Grid code working group established to determine the need for a change to the existing RoCoF standard of 0.125Hz/s

- RoCoF protection settings should be changed at new and existing distributed generators in stations of registered capacity of 5MW and above to 1Hz/s, using a delay setting of 500ms.

Tasmania

- Increasing amount of non-synchronous generation has resulted in the need to re-evaluate the Network security risks due to changes in system dynamic behaviour

- From analysis it was determined that a delayed RoCoF of less than 1.176Hz/s would limit the initial maximum RoCoF to less than 3Hz/s

Next Steps

- Publication of RoCoF plans
  - EirGrid still awaiting notification of start date from CER
- EirGrid to prioritise units into High, Medium and Low priority.
- CER to appoint Independent Expert


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Rate of Change of Frequency

DS3 Advisory Council

20th May 2014, Belfast

Robert O'Rourke

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Background

- RoCoF is a key work stream in the DS3 Programme
  - Required to increase SNSP to 75%
- Extensive industry engagement
  - Joint Grid Code Review Panel
  - JGCRP Working Group
- Regulatory Process
  - Separate CER and UR consultation processes
  - Bi lateral engagement with generators
- CER Decision 4th April 2014
- UR Decision 7th May 2014

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Considerations

- System security
- 2020 RES targets
- Changing nature of the system
- Technical capability of conventional fleet
- Cost and timeframe for implementation

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CER Proposed Decision

- Approve MPID 229 in principle
- Effective in Grid Code after TSO confirmation re system security
- 18 month lead-time assumed (studies etc.)
- Co-ordinated project led by TSO with RA oversight
- Public status reporting
- Generators responsible for project management of own studies
- Co-ordination where possible (i.e. similar units)

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Responses (1)

- Consultation closed on 9 August;
  - 12 responses received.
  - Subsequent representations from industry
- Wind generators broadly supportive:
  - ROCOF should be implemented as matter of urgency
  - A key part of delivering the 2020 targets and reducing curtailment levels
  - GPI generally supported
  - Project Governance: hard deadlines & public reporting critical

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Responses (2)

- Conventional generators highly critical:
  - Should not approve mod before completion of studies;
  - Alternative solutions project needs to be prioritised;
  - The 18 month period unrealistically short; several years needed;
  - OEMs don't have resource capacity to carry out studies on all plant within 18 months;
  - Certain plant should be exempted e.g. older plant, peaking plant;
  - Generators should be allowed cost recovery as ROCOF capability is a direct cost with no benefit for a conventional plant;
  - The GPI is penal and not an appropriate incentive;
  - Project Governance: Concern re the role of TSO. CER or a CER appointed consultant should be in this role;
  - Strong support for alternative solutions project, but some calls for it to be completed before generator ROCOF studies commence

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CER Decision

- Overall framework of the proposed decision retained
- Flexibility introduced for study deadlines
- GPI reduced and introduction phased over 36 months
- Co-ordination of generator studies by independent expert
- Remuneration mechanism to proposed

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ROCOF Implementation Framework

Modification

- Approved in principle
- Effective after confirmation from studies
- 18-36 Month timeline

Implementation

- Generator studies; Independent co-ordination
- TSO-DSO implementation project
- TSO led alternative solutions project

Financial Arrangements

- No Cost recovery for study
- GPI to be phased in after 18 months
- Payments (e.g. HAS) to be developed

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Next Steps

- CER engaging with EirGrid
  - Plans for alternative solutions project
  - Preliminary stages of Generator Studies Project
- Independent expert to be appointed
- Direct engagement, as required, with generators prior to initial trilateral meetings
- Formal notification of project commencement
- CER and UR will continue to liaise on RoCoF implementation

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Questions

System Services

20th May 2014

Jonathan O'Sullivan

Context and Progress

- Multi-stage consultation process (2011 – 2013)
- Recommendations Paper to RAs (April 2013)
  - Product definitions (5 new, 2 revised)
  - Remuneration framework
  - Valuation approach - €355m
- SEMC Consultation (Sep 2013) and Decision on product definitions (Dec 2013): SEM-13-060
- Further analysis on framework and financials
  - Request for TSOs to carry out revised financial analysis

DS3 System Services – Consultation process

First paper (Dec 2011)

- Scope & Principles
- Bilateral meetings (Feb 2012)
- DNV Kema International SS Review

Second paper (Jun 2012)

- Products & Technical aspects
- Workshop (July 2012)

Multi-stage Consultation

Third paper (Dec 2012)

- Financial aspects
- Bilateral meetings (Jan 2013)
- DNV Kema Capital Cost Paper

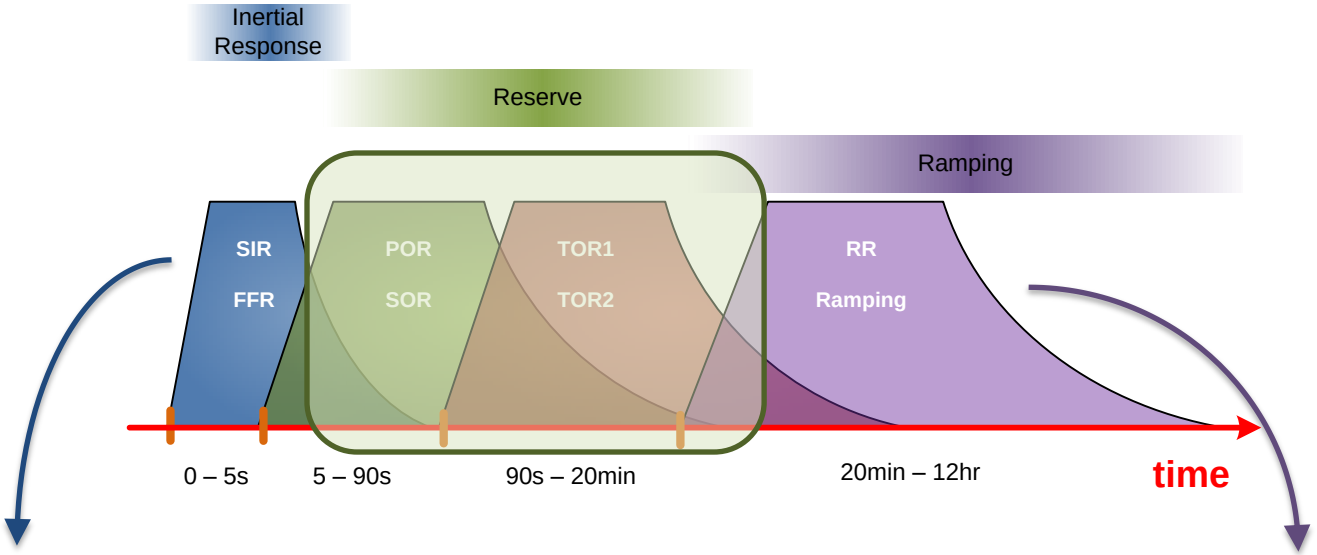
Recommendation (April 2013)

- Response to queries
- Price regulation with review
- Products/Rates/Next Steps

System Services: Proposed Approach

Increased revenue	• Currently 2% • Increase to ~ 10%
New services	• Fewer synchronous generators • Increase in variability
Focus on performance	• Efficient operation • Maintain security

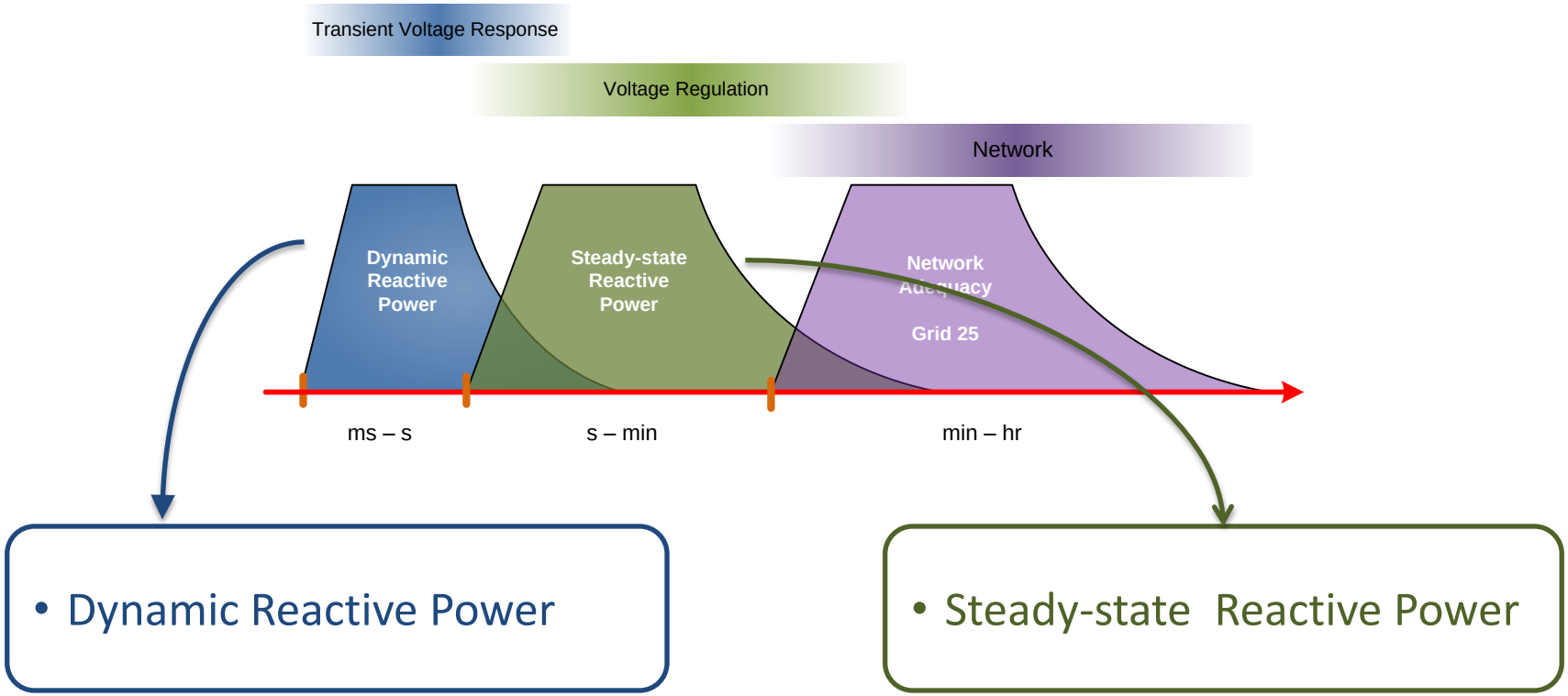
New Services: Frequency Control



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

- Ramping Margin

New Services: Voltage Control



Further Economic Analysis

TSOs

Plexos: System Service Valuation

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RAs

Evaluation of "supply-side"

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Enhanced Performance Monitoring and Testing

20th May 2014

Dave Carroll

Scope of Enhanced Monitoring Project

- Standardise and harmonise
- Existing Grid Code and HAS Agreements
- Automate monitoring
- Transparent for generators and improved comms
- Investigate use of improved data
- Use data to validate dynamic models

Phase 1

- Monitoring of new System Service products

Phase 2

Scope of Enhanced Testing

- Recommendations to improve procedures and report documentation
- Standardise these where possible
- Published on TSO websites

Progress to date

2012

- Improving existing Performance Monitoring (PM)
- Standardise PM reporting
- Industry workshops on Testing

Q 1 2013

- Recommendations for Testing published
- Initiating and planning for PM project
- High level requirements for PM developed by TSOs
- Updates at Joint Grid Code Review Panel

Progress to date

Q2 2013

- All Island Industry Workshop to get feedback on high level requirements for PM
- Findings/Action document published on TSO website
- Update at Joint Grid Code Review Panel

Q 3/4 2013

- Development of detailed design specification by TSOs for PM
- Review of report templates for PM with Industry
- Update at Joint Grid Code Review Panel

Progress to date

Q1 2014

- Report templates published for Industry feedback
- Comments incorporated into final design spec

Q 2 2014

- Development of business processes
- Test procedures being published on TSO website
  - http://www.eirgrid.com/operations/gridcode/compliancetesting/wfpstestprocedures
  - http://www.eirgrid.com/operations/gridcode/compliancetesting/cdgutestprocedures

Next Steps

Q2 2014

- Industry workshop in Belfast on 24th June to present proposed business processes
- TSOs to consider feedback and refine processes
- Development of IS systems
- Continue to publish Testing procedures on TSO website

Q 3 2014

- Industry workshop in Dublin to present final business processes
- Development of IS systems
- Continue to publish Testing procedures on TSO website

Industry Workshop

- 24th June in Belfast
- Invites to issue shortly
- Will focus on new process flow and discussion on tolerances, priorities, actions and times for EPM
- Kick off discussion on PM for proposed new System Services


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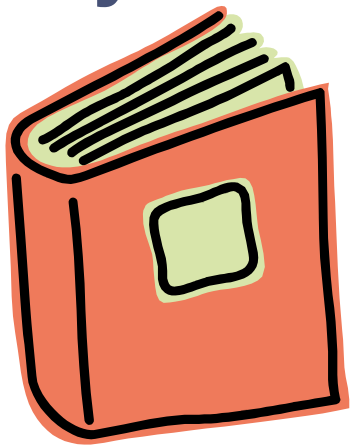
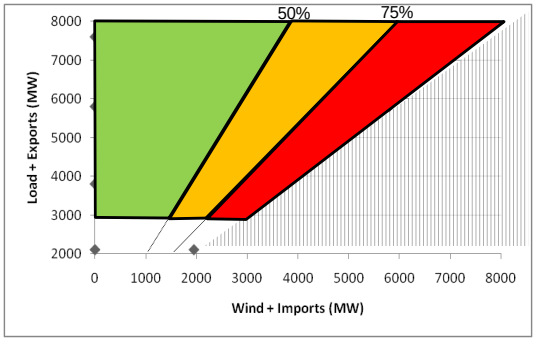
Control Centre Tools and Capability

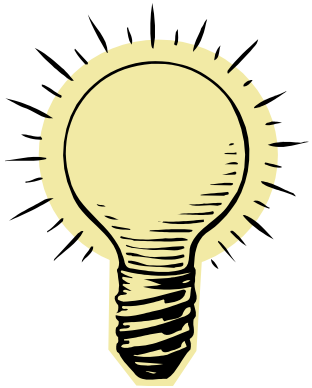
20th May 2014

Michael Burke

Tools and Capability







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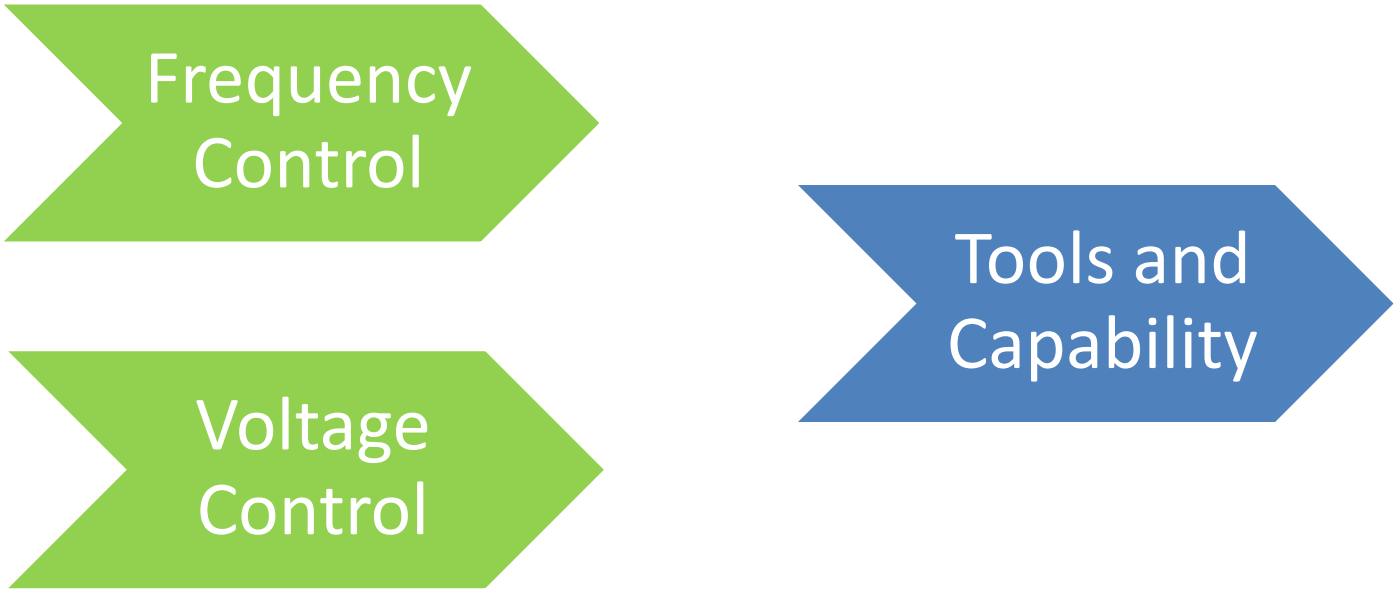
Key Driver: System Policies



Some Likely Tools and Policies

- Frequency Control
  - Frequency Regulation
  - Ramping
  - Reserve from wind
- Voltage Control
  - TSO/DSO Voltage Control Interaction
  - Voltage Trajectory Studies
- System Services
  - Schedule and Monitor

Developments to Date

- All Island WSAT
- All Island Generator Overview
- SNSP %: EMS and RCUC
- Inertia and ROCOF Monitoring
- EMS Windfarm Voltage Control
- New Wind Dispatch Tool
- Phasor Monitoring GUI

New EMS Wind Dispatch Tool

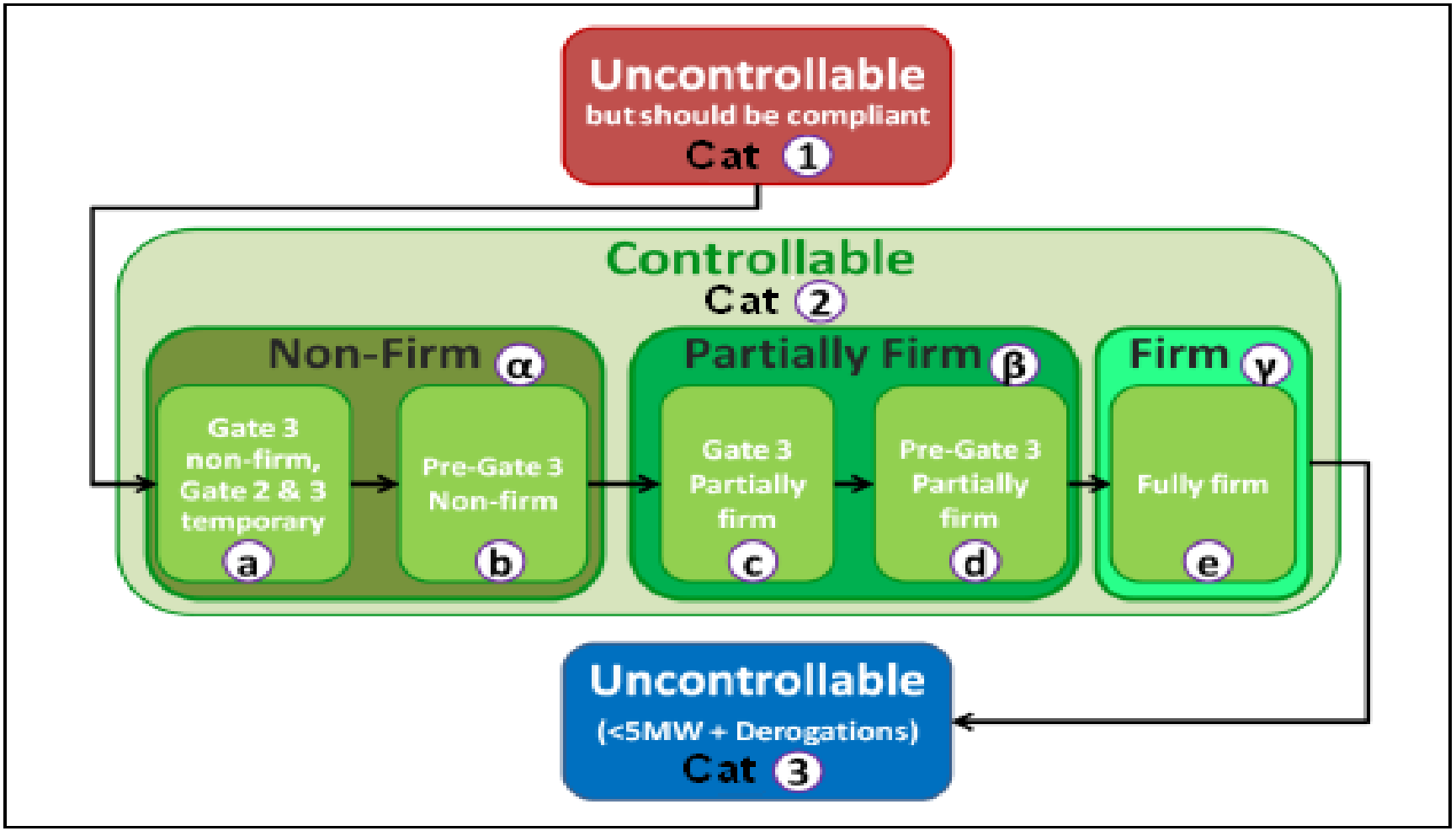
Dispatch Order

- More Complex within Constraint Groups
- Other Constraints and Curtailment Remain 1,2,3

Setpoint Calculation

- Dispatch down: pro-rata Actual Output
- Dispatch Up: pro-rata Uplift Capability

New Dispatch Rules from SEM Decisions



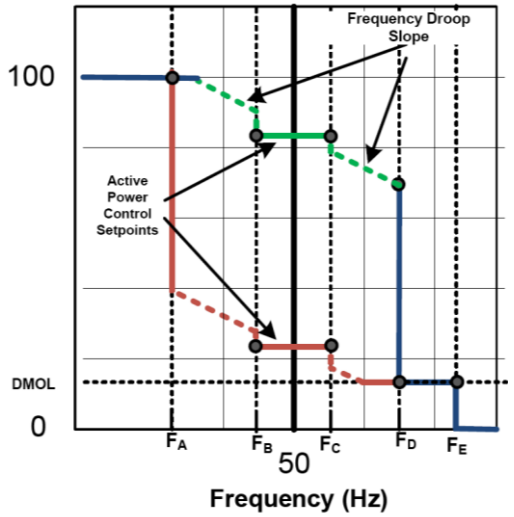
New Wind Dispatch Tool – Features

- Same functionality in Dublin and Belfast
- Integrated Category 1 dispatch
- Reason Codes for each dispatch
- DMOL – Design Minimum Operating Limit
- Frequency Control Settings
- Enhanced Achievement Tracking
- Windfarm Testing Functionality

New Wind Dispatch Tool – Features

- Frequency Control Settings
  - Grid Code Modification – 15mHz deadband
  - Global Control of Frequency Settings

- Design Minimum Operating Limit
  - Less Ramping and Frequency Response
  - Less Reactive Power Capability



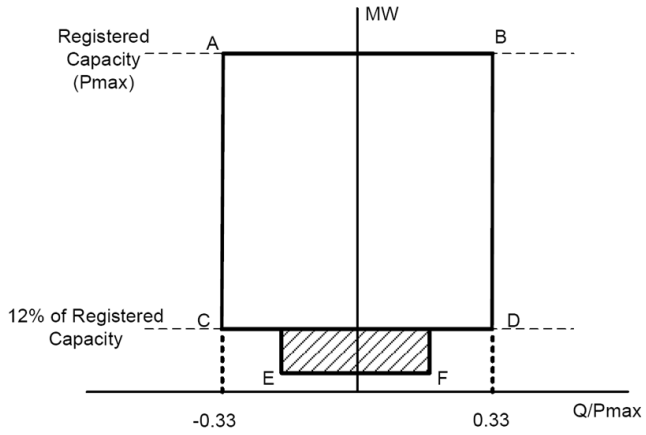
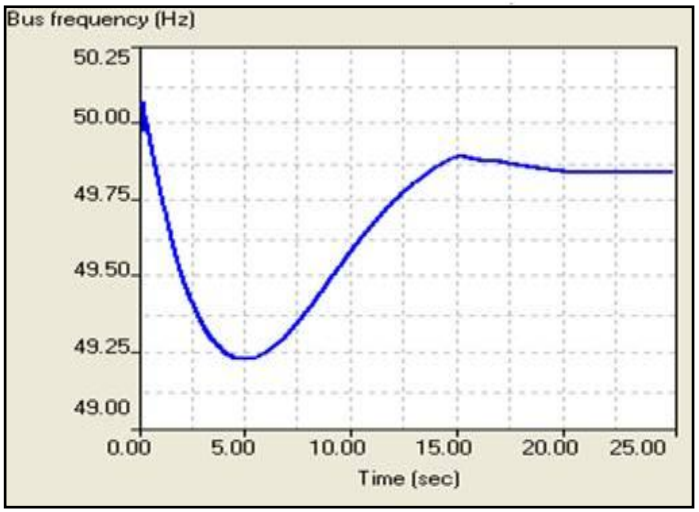


Figure WFPS1.4 – Minimum **Reactive Power** Capability of **Controllable WFPS**

WSAT Development

- Frequency Analysis
  - Predict frequency nadir/zenith
  - Benchmark against actual events



- Continuous Model Validation

- Prototype Overload Analysis
  - Predict amount of wind constraint necessary
  - Show margin to insecurity
  - Align with Constraint Groups e.g. Donegal

Wind Forecasting

- Enhancement project recently completed
- Increased data transfer to providers
- Accuracy incentives
- Improved User Interface
  - Regional Forecasts
  - All Island Forecasts
- Tender process underway for 2015 - 2017

Reserve Constrained Unit Commitment

- RCUC: Model Inertia Constraints by Q4 2014
- Future: New Services, Reserve from Wind
- I-SEM?

Real Time use of Phasor Monitoring

- General Overview of Transmission System
  - Data sampling every 20ms
  - Displays measured frequency and voltage at critical stations

- Oscillation Analysis
  - Spectrum analysis of measured frequency
  - Monitoring of individual generator oscillations

EMS Integration Project – EIP

- Will provide a fully integrated all island EMS
- Will facilitate all island power system operation
- Go Live Q3 2015

EIP – Facilitating DS3

- Easier modelling of wind in power flow studies
- SPS Schemes Integrated into Network Apps
- Dynamic Equipment Rating
- Busbar Rating Monitoring
- WSAT Alarms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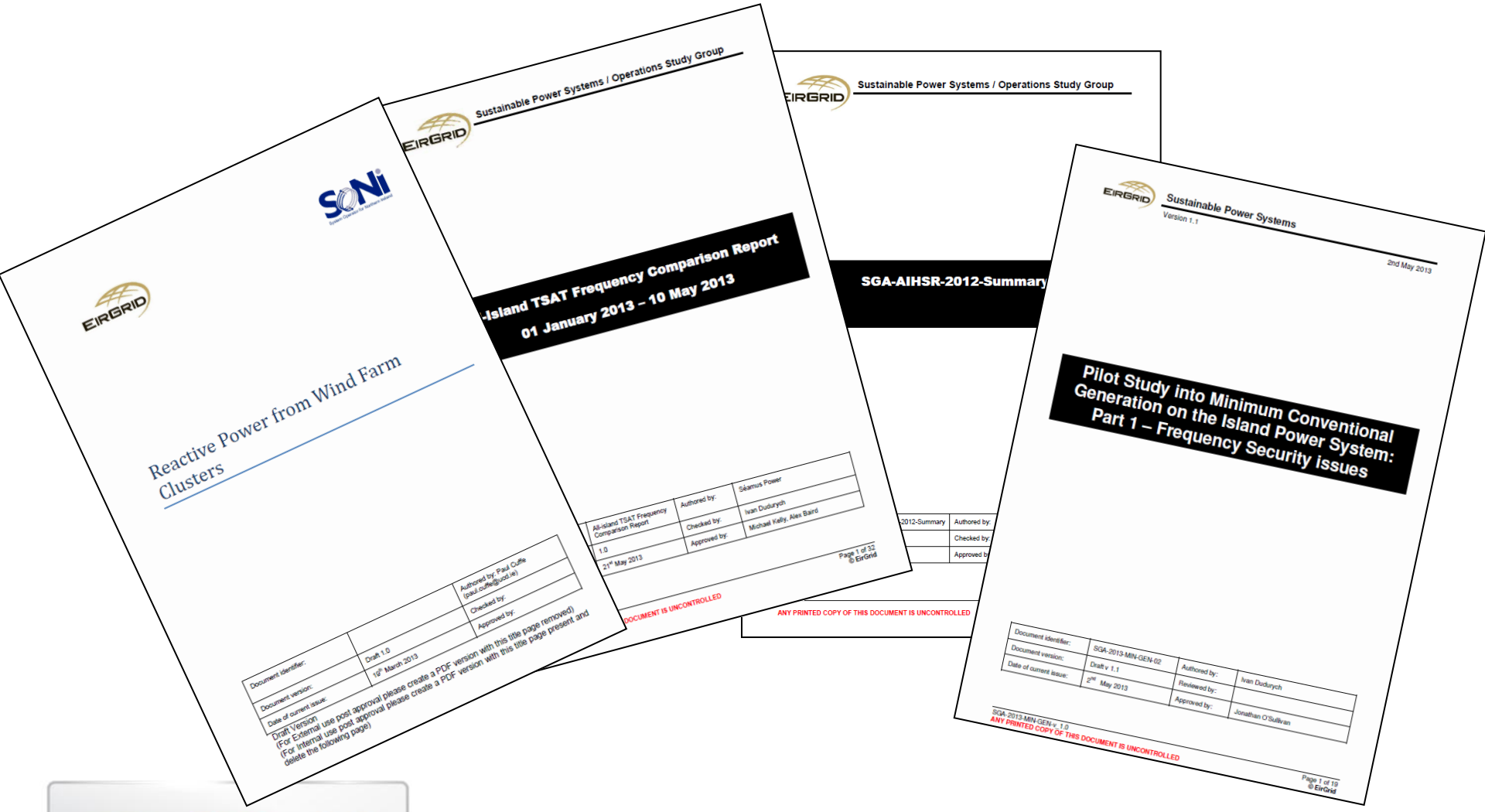
Voltage and Frequency Study Update

20th May 2014

Simon Tweed

Study Reports



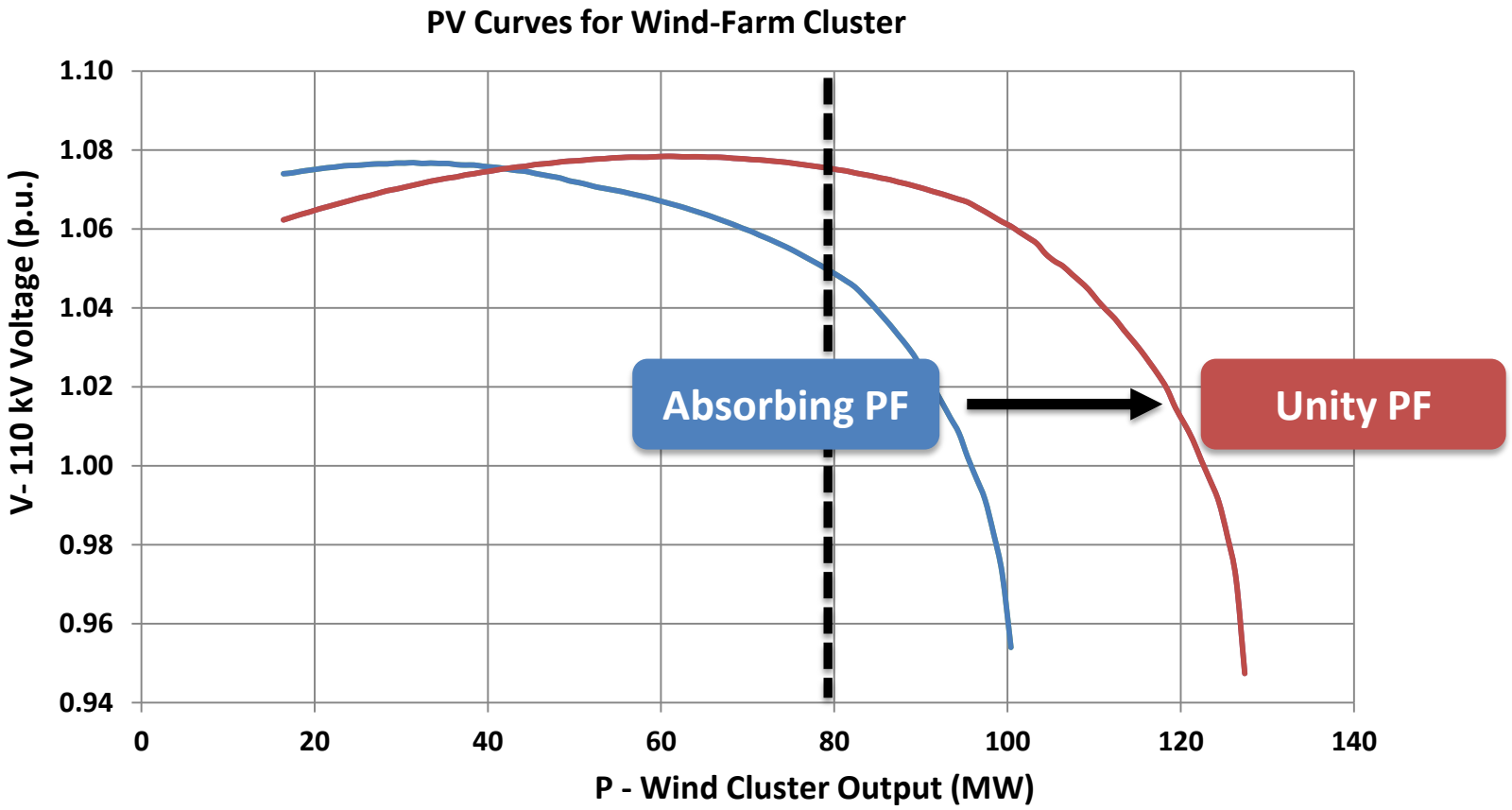
Voltage Studies

1. Short Term Issues

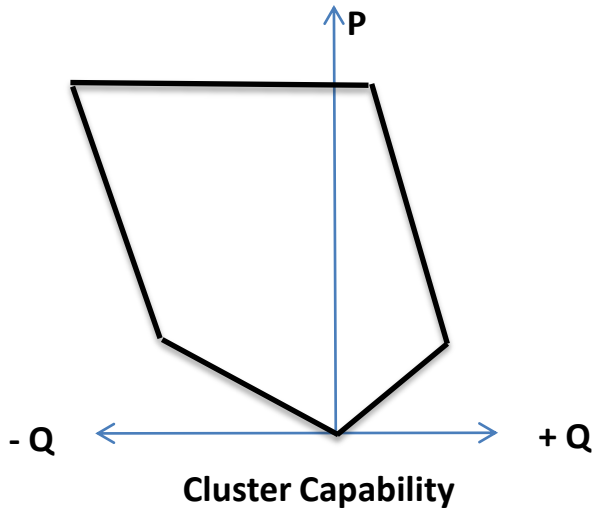
2. Distribution Connected Cluster Pilot Projects

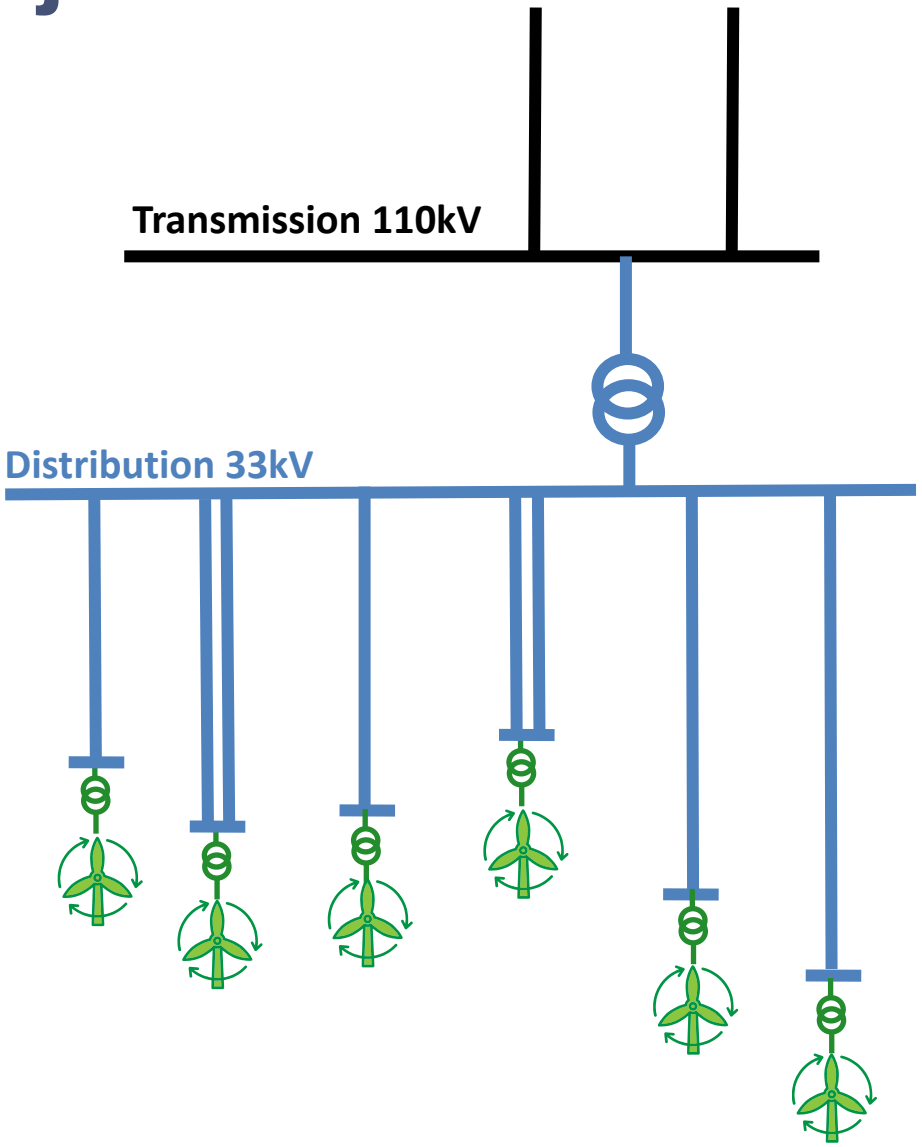
3. Reactive Power Planning Studies

Voltage Studies – Short Term



Cluster Pilot Projects





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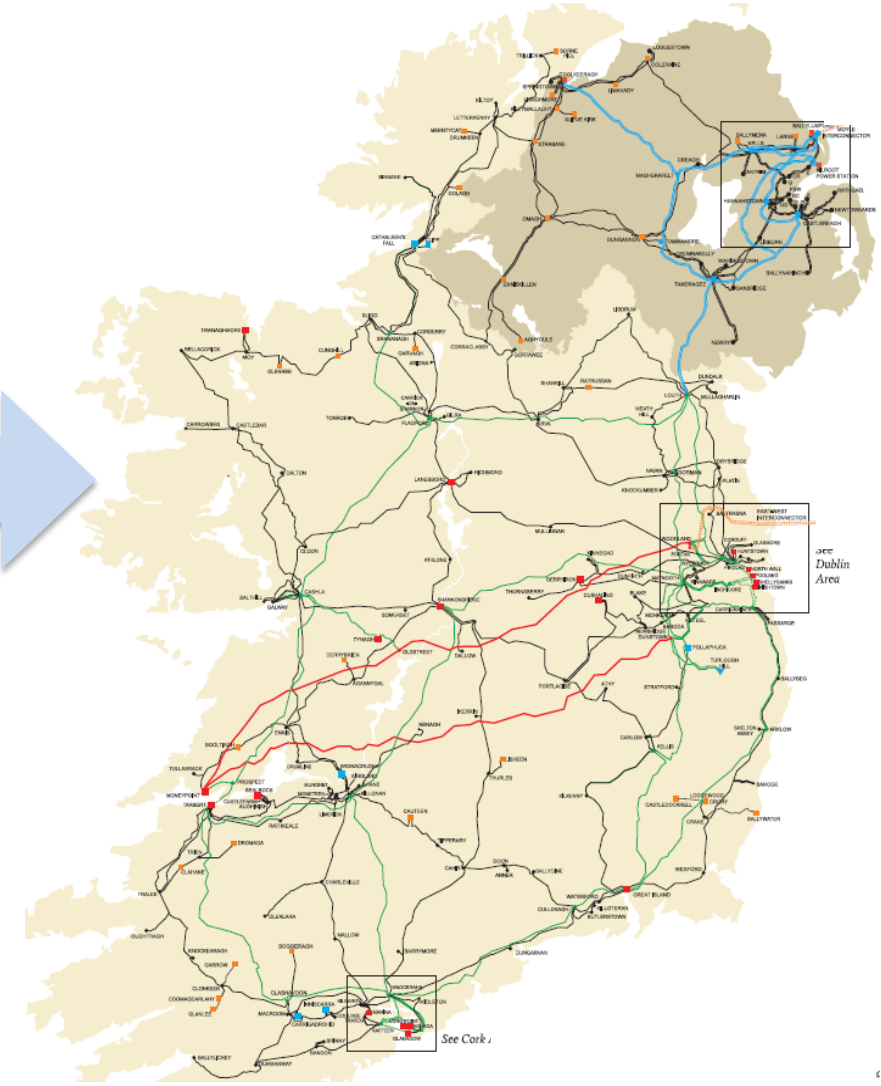
Reactive Power Planning Studies

Generation Sources + Network Devices

- Conventional
- Trans. Wind
- Dist. Wind
- Reactors
- Capacitors
- SVCs
- STATCOMs
- …others



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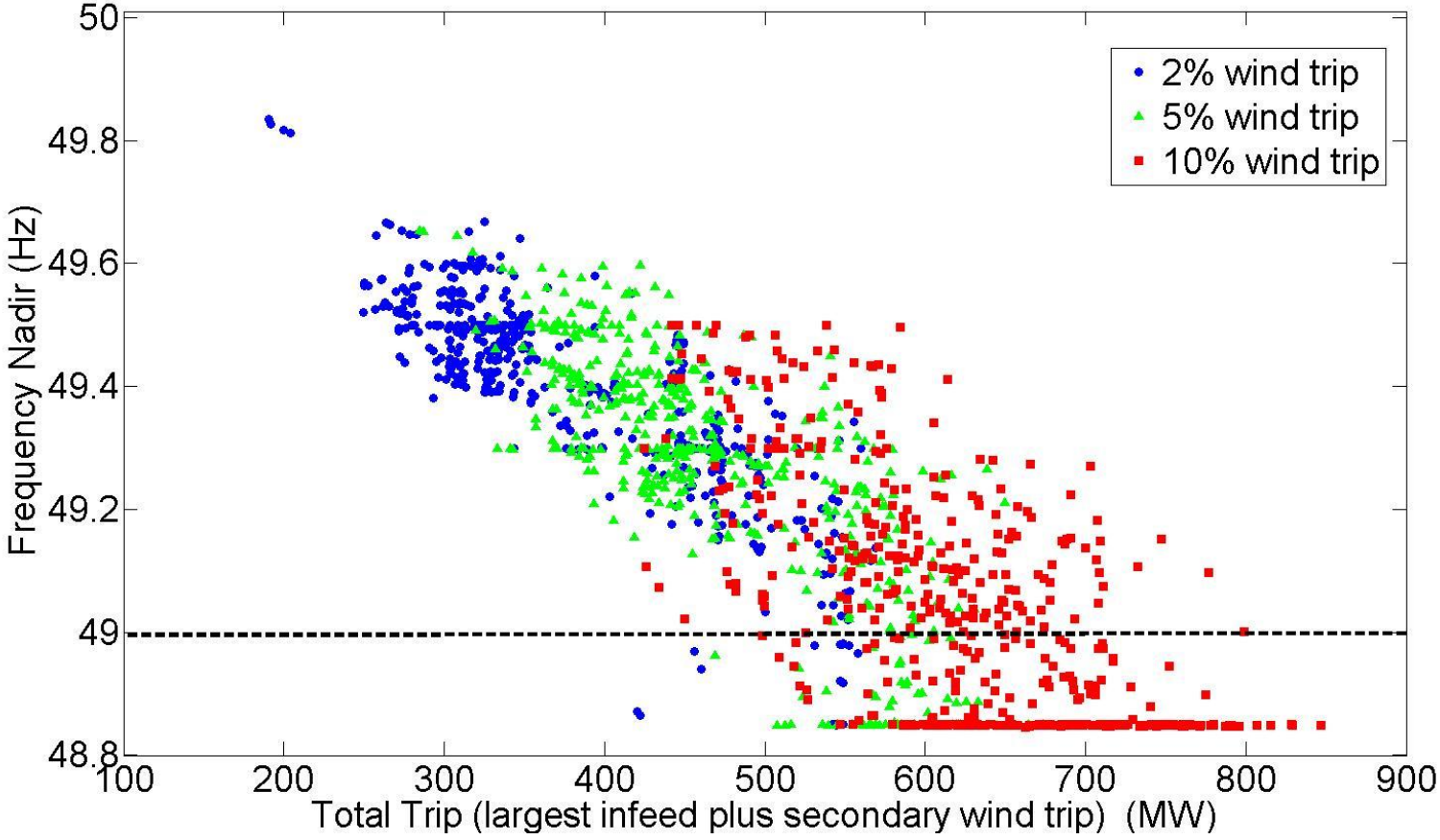
Frequency Studies

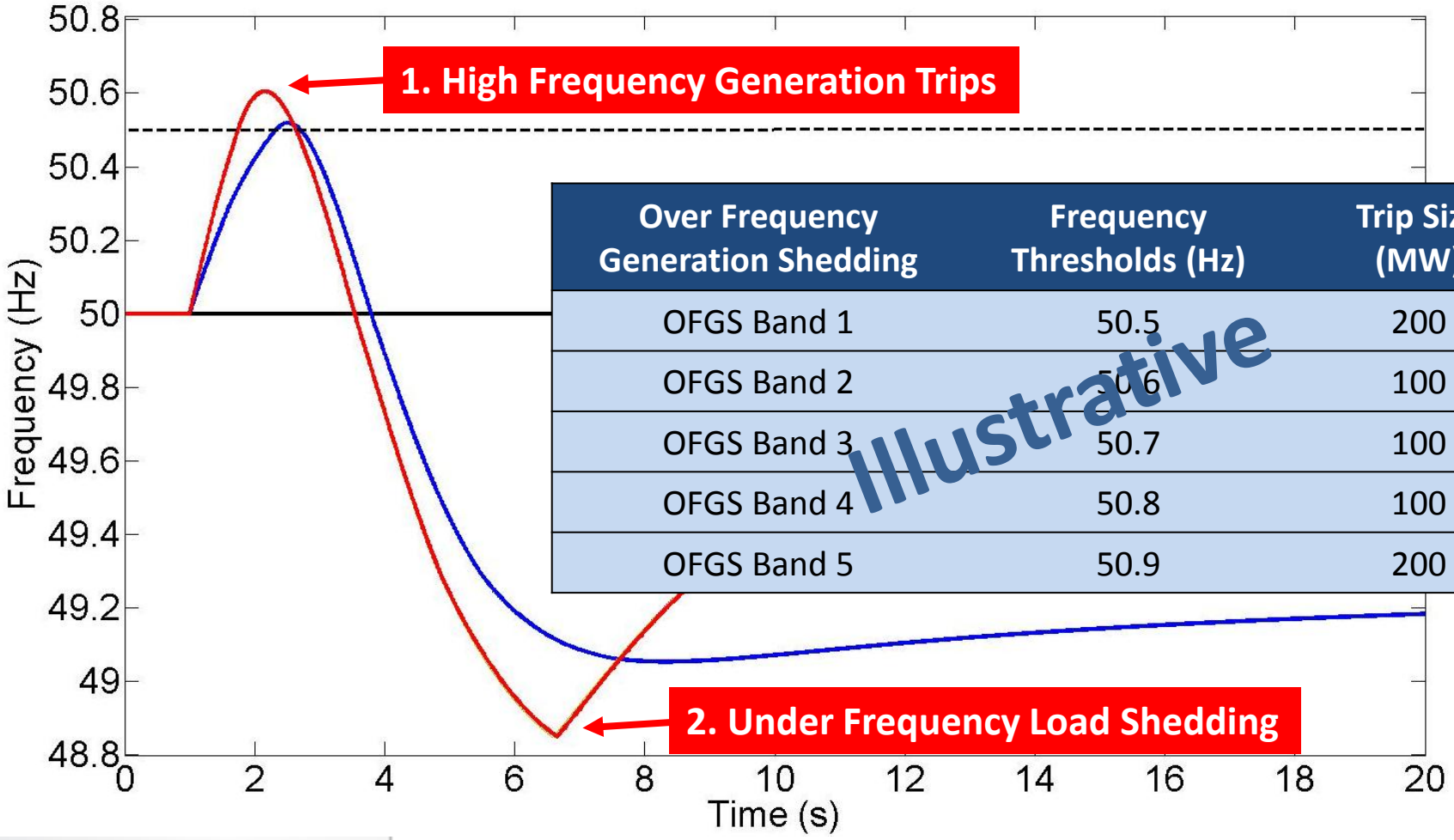
1. Impact of Embedded Generation LoM RoCoF Relays

2. Over Frequency Generation Shedding

Impact of LoM RoCoF



Over Frequency Generation Shedding



Over Frequency Generation Shedding	Frequency Thresholds (Hz)	Trip Size (MW)
OFGS Band 1	50.5	200
OFGS Band 2	50.6	100
OFGS Band 3	50.7	100
OFGS Band 4	50.8	100
OFGS Band 5	50.9	200

Illustrative

TSO–DSO Focus Areas

Voltage Control

- Pilot Voltage Control Projects

RoCoF / Frequency Control

- Compilation of Frequency Settings Database
- Understanding gaps in the application of new RoCoF requirement
  - to distribution ‘Loss of Mains’ protection
  - to distribution connected generation
- Implementation of RAs’ RoCoF decisions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Curtailment and Constraint Reporting

20th May 2014

Michael Kilty

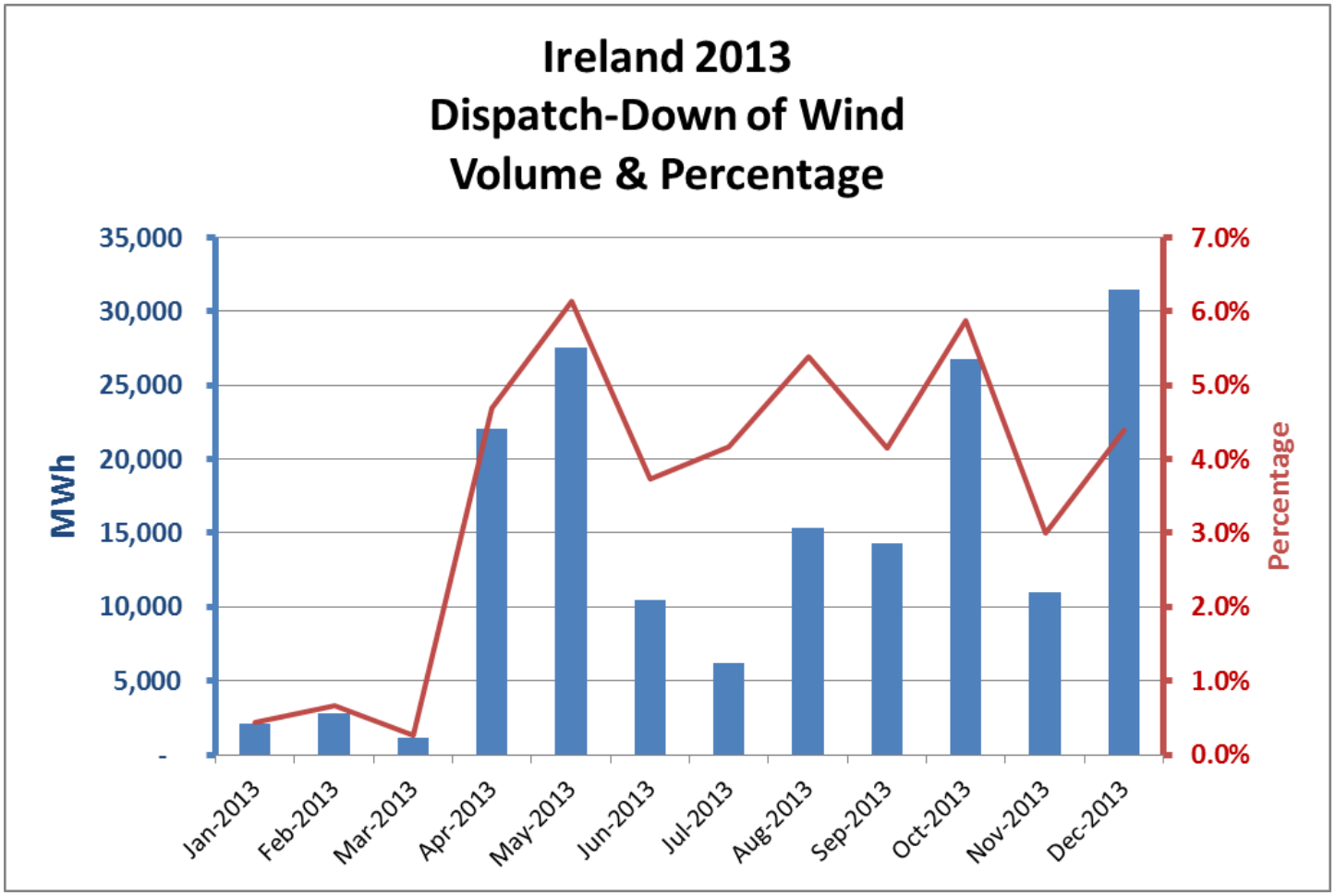
Annual Curtailment Report 2013

- EU legal obligation (Art 16 RES Directive)
- SEM 011-62
  - Hierarchy used based on Variable Price Taking Generation (VPTG)
- Operational Issues of Note
- EWIC - counter-trading from May 2013

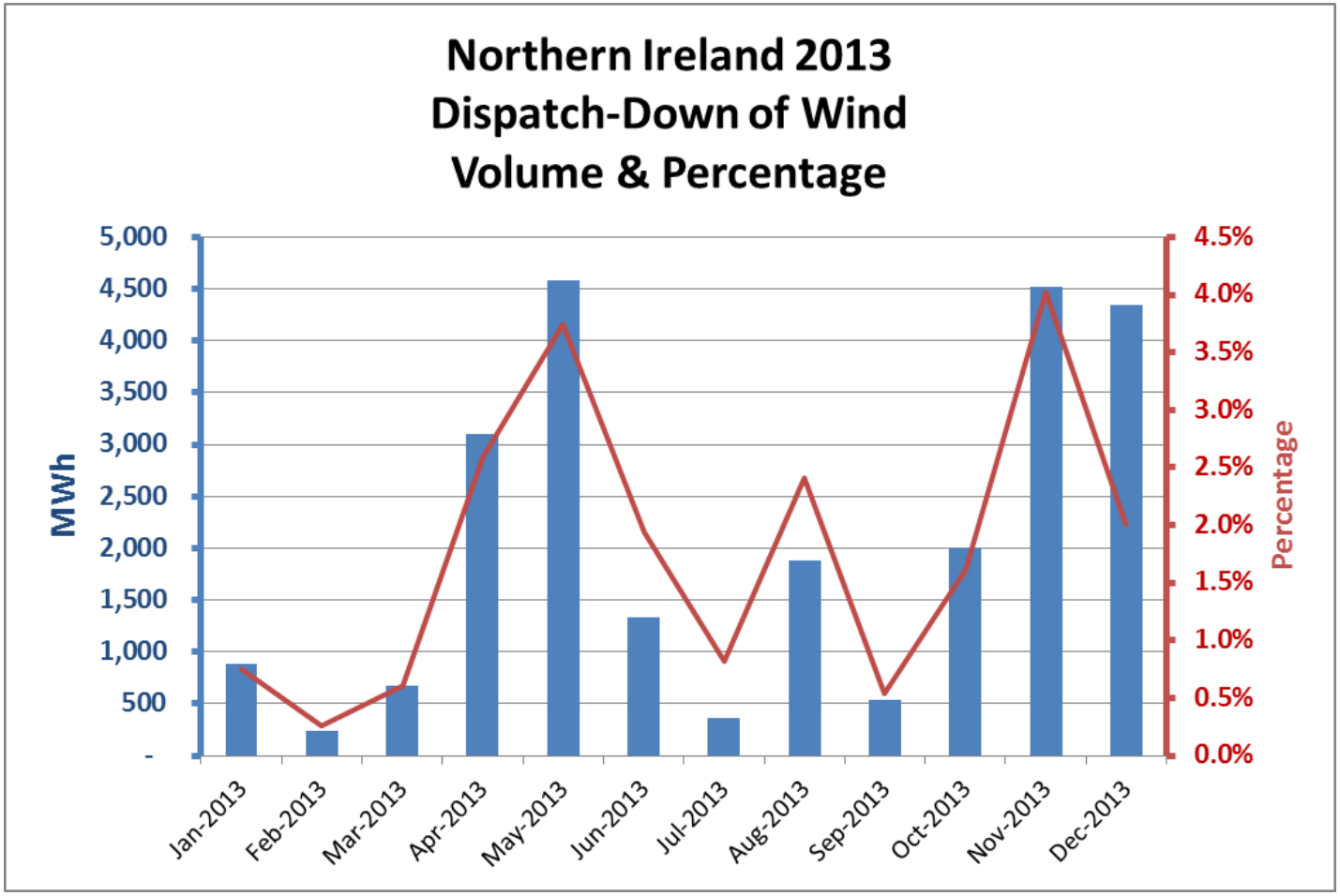
Jurisdictional Breakdown 2013

	IRE	NI	All Island
Total RES-E	20.2%	15.8%	19.1%
Dispatched Down Wind (GWh)	171.1	24.5	195.5
Dispatched Down Wind (%)	3.5%	1.9%	3.2%
Dispatched Down VPTG Wind (GWh)	118.1	12.4	130.5

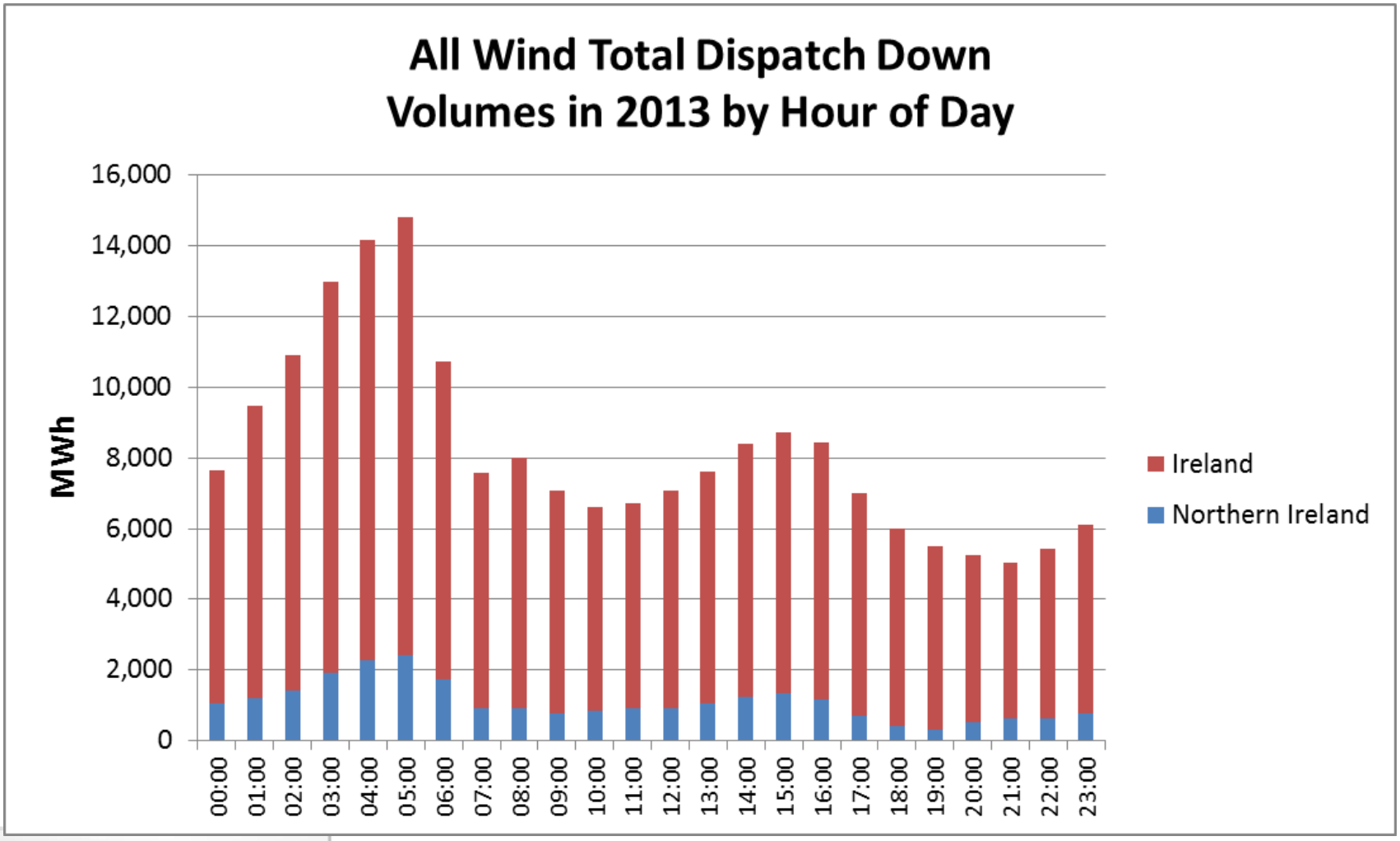
Ireland- Dispatch Down of Wind 2013



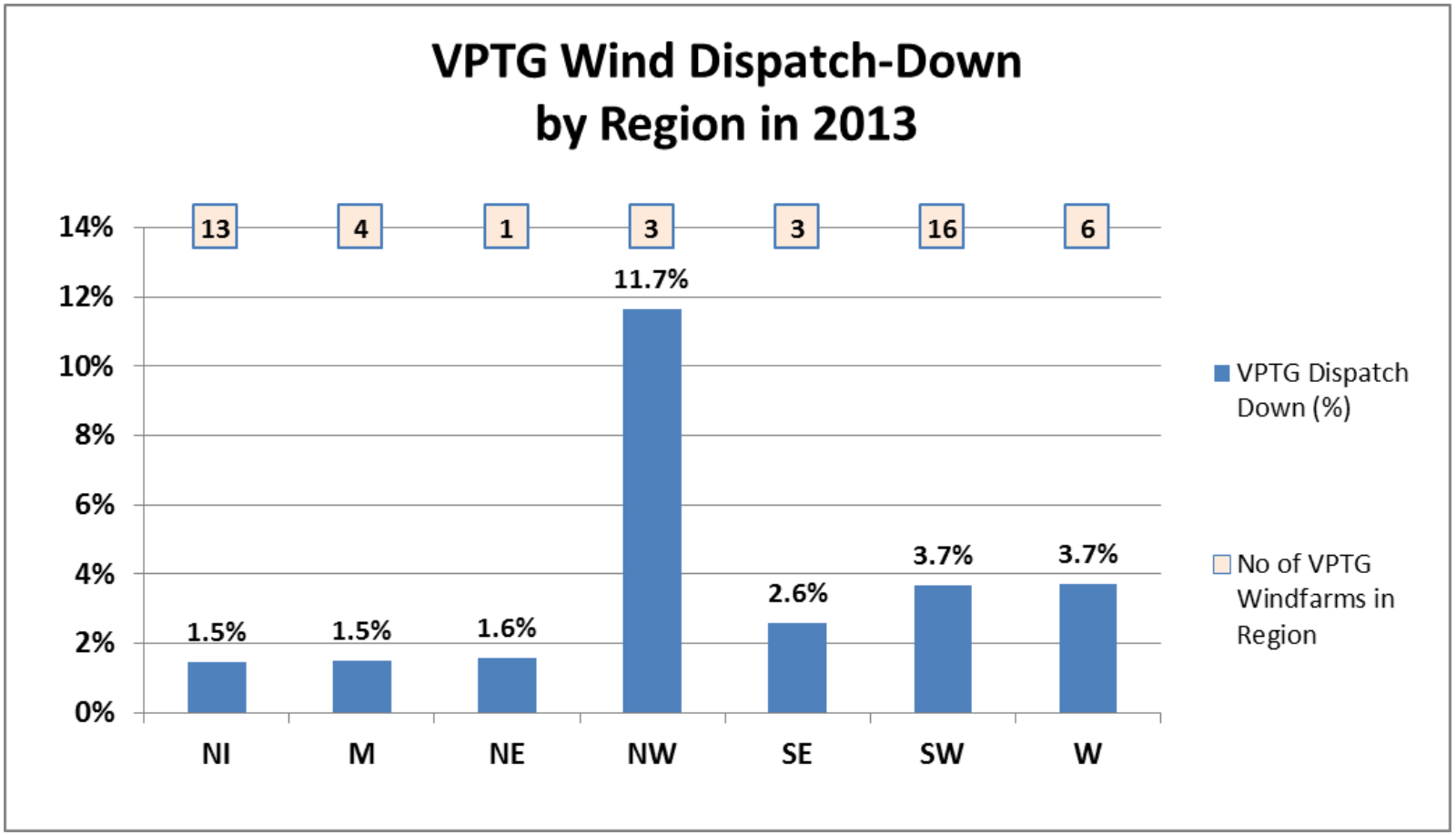
N. Ireland- Dispatch Down of Wind 2013



Dispatch Down by Hour of Day



VPTG Dispatch Down by Region

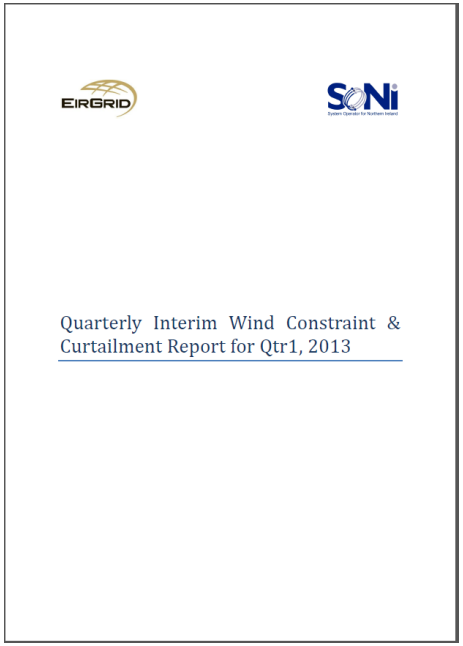


Quarterly Constraint and Curtailment Report

- **SEM Decision (SEM-13-012) on Constraint Groups arising from SEM-11-105**

- **Reports include (where data available):**

  - Constraint and Curtailment data for individual windfarms (hourly, daily, monthly).
  - Detailed breakdown of curtailment / constraint categories.
  - Equivalent data for same quarter in previous year (for comparison) and ;
  - Equivalent data for region and jurisdiction (for comparison).

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Power System Incidents

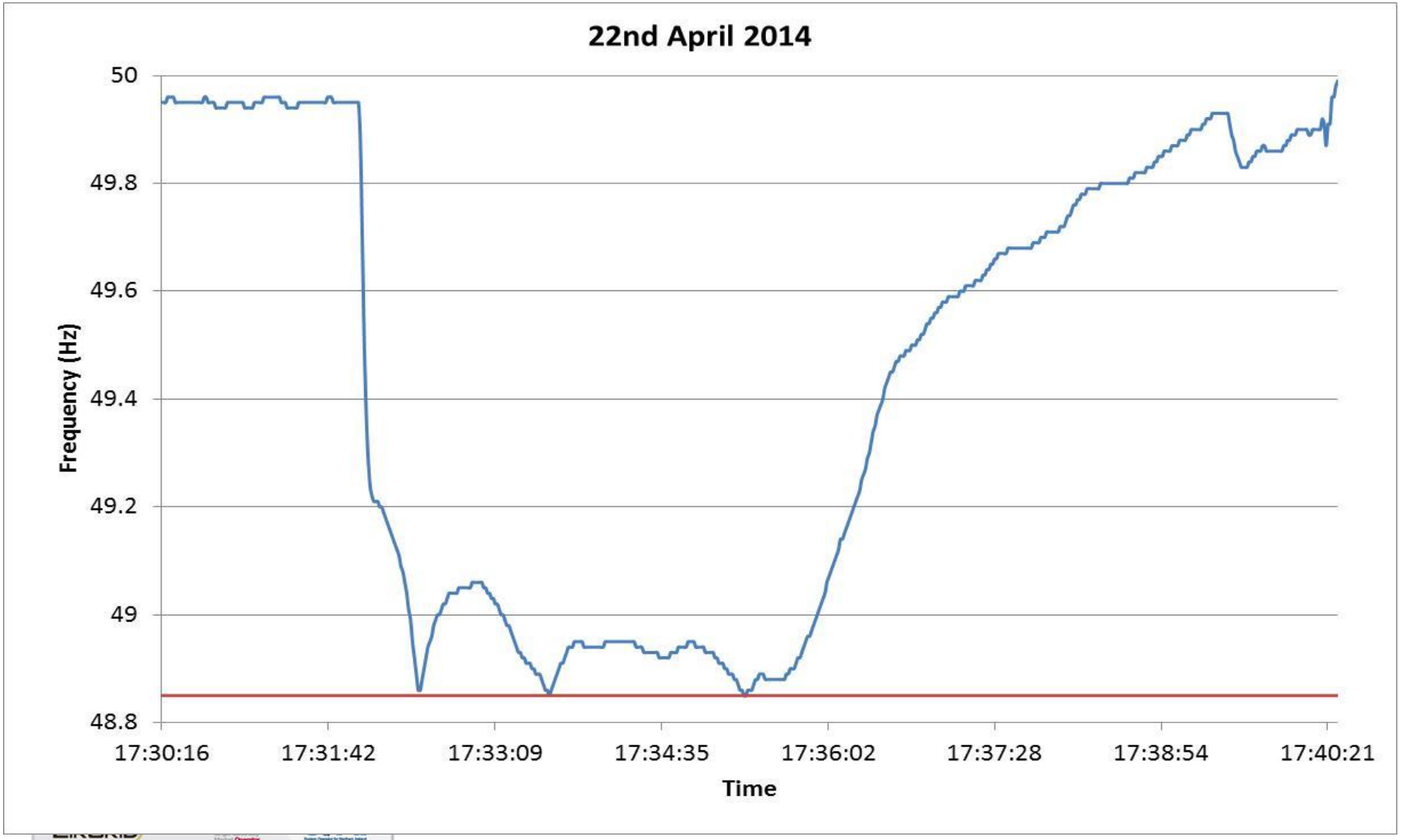
20th May 2014

Jon O'Sullivan

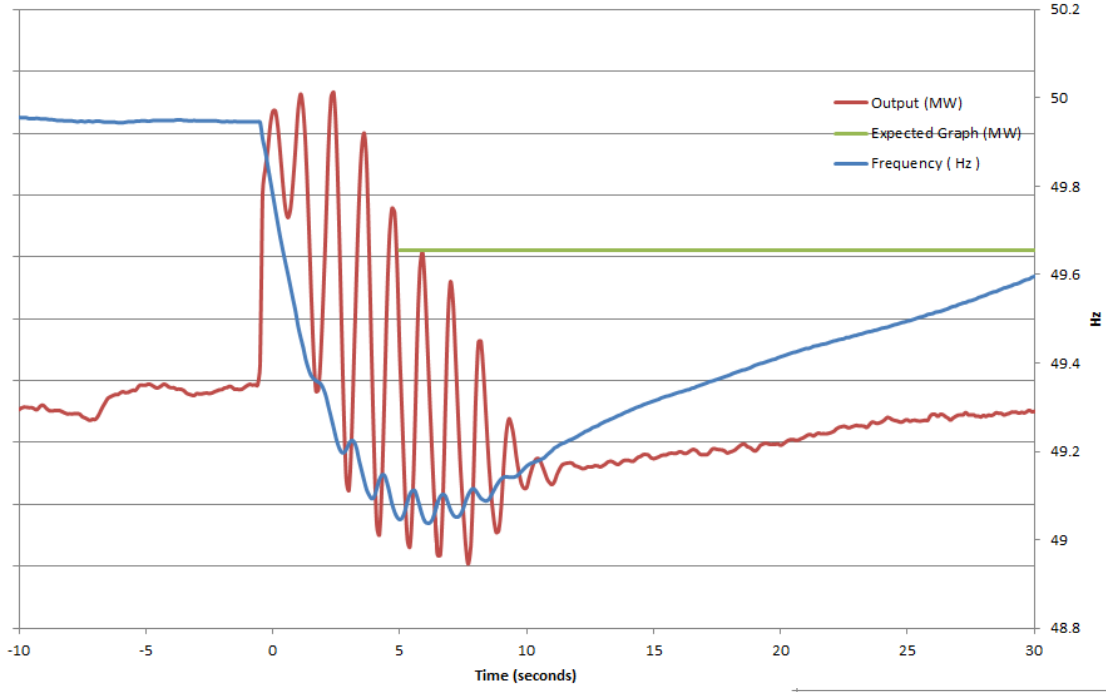
Recent System Incidents

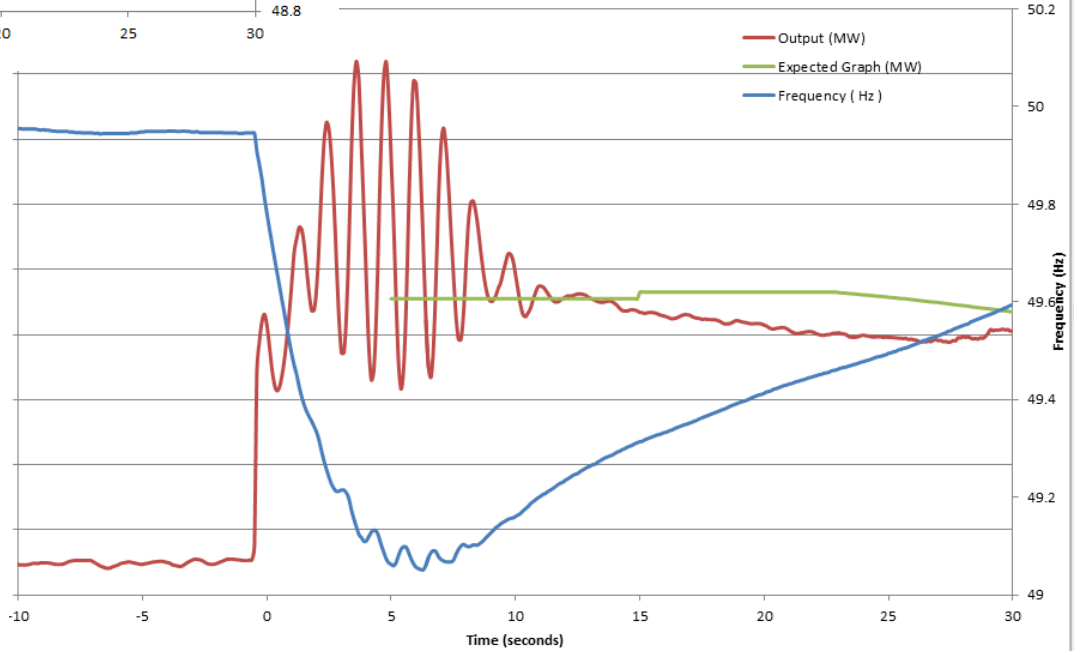
- Two Major Incidents currently under Investigation
  - 22nd April UFLS following generator trip
  - 27th April major oscillation following generator trip

22nd April 2014



27th April 2014



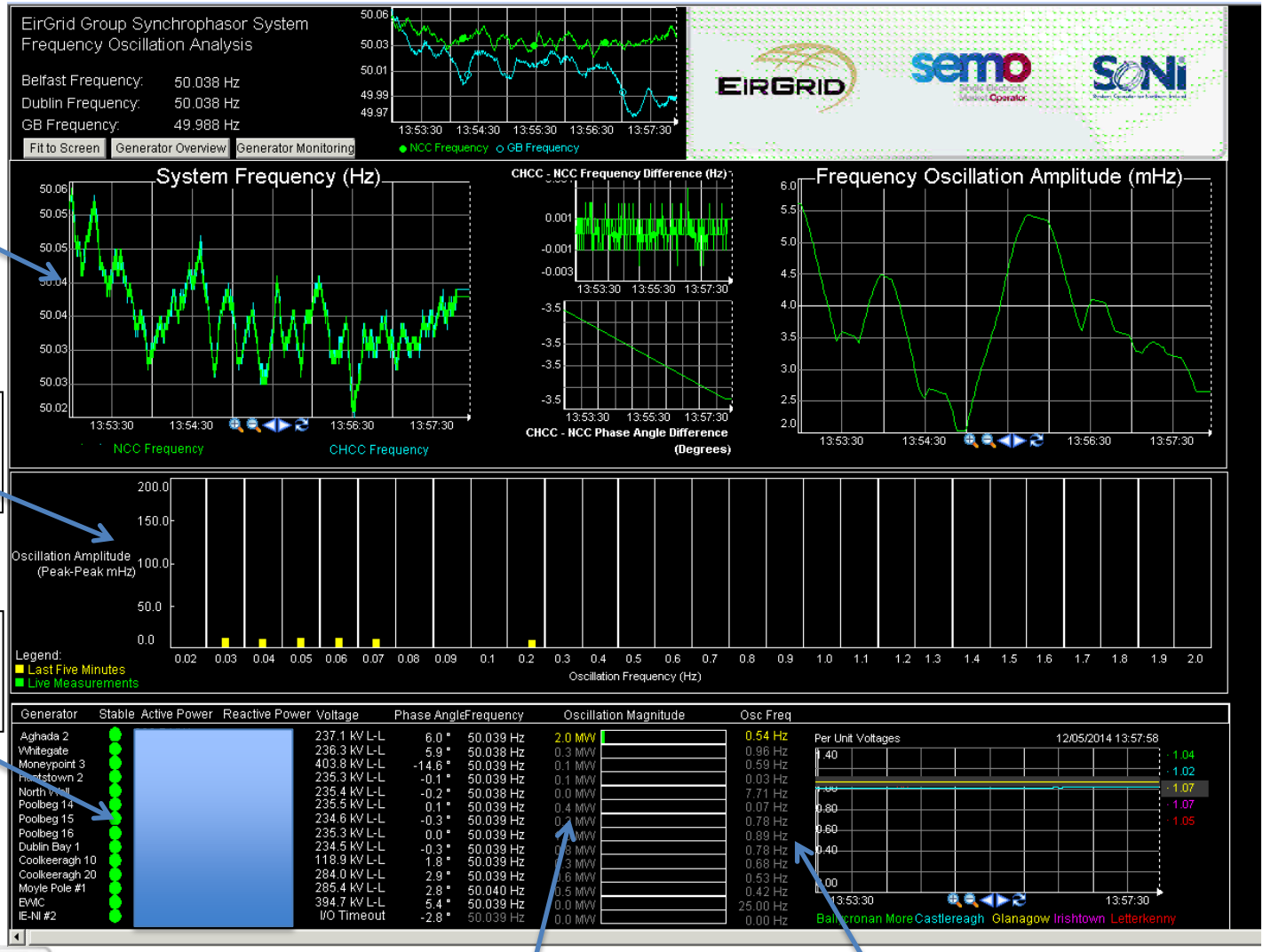


DS3: Synchrophasor System

System Frequency Measurements

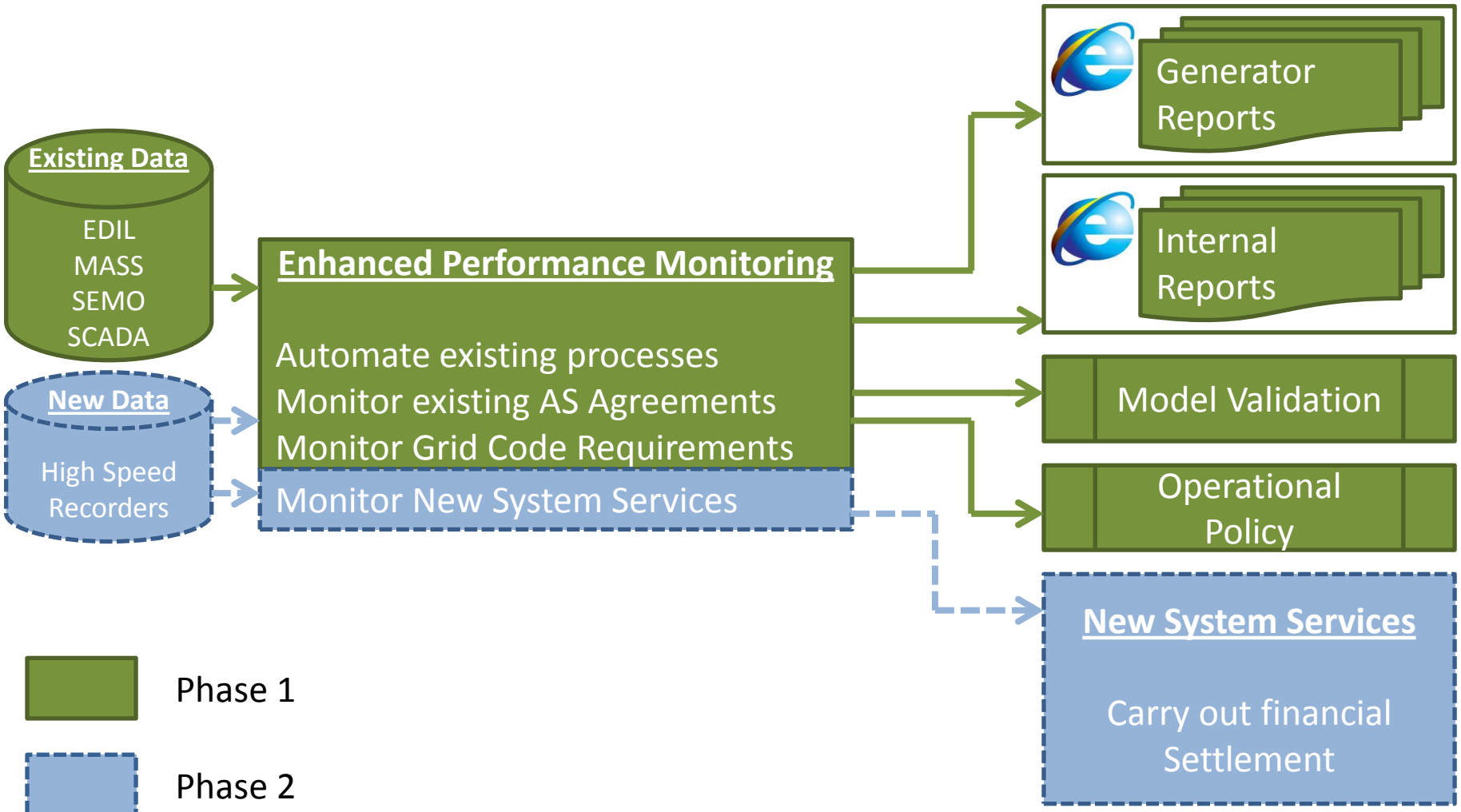
Frequency Spectrum Analyser

Generator Stability Status



Oscillation Magnitude (MW) and Frequency

DS3: EPM System

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