DS3 Programme Status Update

28th January 2014

Robbie Aherne

DS3 – Change in Focus

System Services
Performance Monitoring
Grid Code
Demand Side Management

Frequency Control
Voltage Control
Renewable Data
RoCoF

Studies & Model Development
Control Centre Tools
Wind Security Assessment Tool

System Services & ROCOF

System Services:

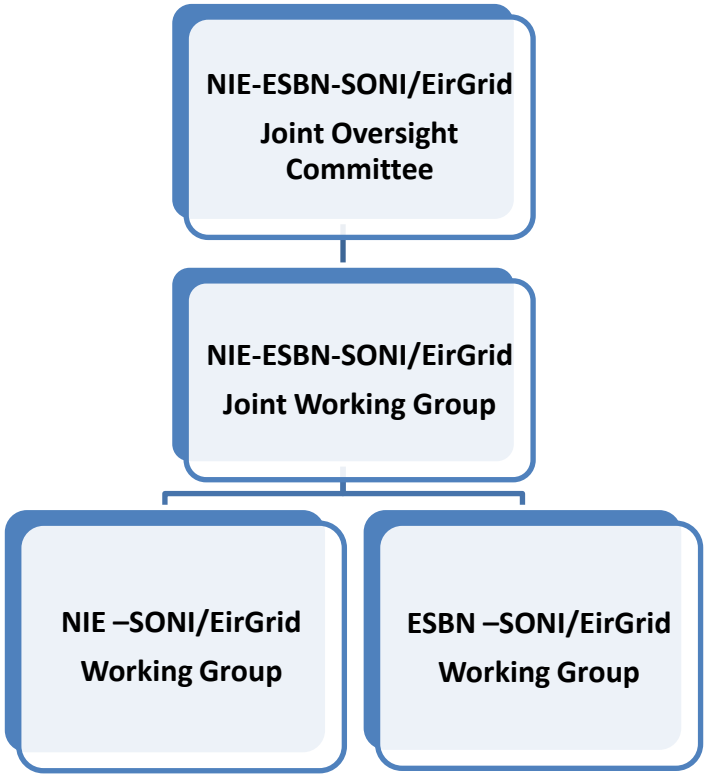
- TSOs currently carrying out further economic analysis
- TSOs met with SEM Committee on 19/12/2013 to discuss direction
- SEM Committee published a Decision Paper on System Services Product Definitions on 20/12/2013
- Substantial interest from different technology providers in SS

ROCOF:

- TSOs have engaged with RAs on proposed ROCOF implementation project

TSO-DSO Interaction

- DS3 TSO-DSO Engagement Plan
- Voltage Control, Frequency Control, Performance Monitoring, ROCOF and Demand Side Management
- Regular engagement



Grid Code & EPM

Grid Code

- Guidance notes for DS3 WFPS mods finalised and sent to Ireland GCRP on 04/12/2013

- Dynamic Model modifications presented to both GCRP on 04/12/2013
  - NI: consultation on modification opened
  - IE: Will be discussed again at next GCRP on 12/02/2014

EPM

- Focussed on Grid Code and AS Agreement requirements

- Internal workshop to scope out high level performance monitoring requirements for System Services

DSM

- 2 DSU operational (~ 75 MW)
  - 4 more at various stages of becoming operational
- Grid Code
  - Northern Ireland Grid Code DSU modifications awaiting decision
- DSU JGCRP Working Group
  - Meetings on 20/11/2013 and 23/01/2014
- Ireland National Smart Metering Programme
  - CER Smart Metering High Level Design Consultation

Renewable Data & CCTC

Renewable Data

- Annual Renewable Report launched on 28/11/2013
- All Island Renewable Connection Reports – 36 Month Forecast for Q3 and Q4 published shortly
- Constraint and Curtailment Report – with RAs for final approval

CCTC

- Initial validation of EMS short circuit tool have highlighted discrepancies
- Alstom provided a demonstration of Wind Dispatch Tool – no major issues

Operational Studies

- All island study on future levels of reactive compensation – Q3 2014
- Matrix of system security and stability metrics being compiled
- All island min generation analysis complete; outputs under review
- Over frequency generation shedding
- Secondary tripping study (related to RoCoF)

Actions from Last Advisory Council Meeting #1

DS3 Programme Update

- TSOs to consider how the developments of changes to the operational policies are communicated to industry as part of the DS3 programme. **[TSOs]**

- Members of the Advisory Council to consider methods of further engagement outside of the Advisory Council meetings, e.g. review of technical documents, hosting workshops on specific issues, and send recommendations to the DS3 project team. **[Advisory Council Members]**

RoCoF

- TSOs to investigate whether the technical detail and assumptions behind the RoCoF analysis completed by KEMA may be circulated. **[TSOs]**

- TSOs to consider the feasibility, specification and publication of further frequency / RoCoF traces to aid generator RoCoF studies. **[TSOs]**

Actions from Last Advisory Council Meeting #2

System Services

- RAs to consider if Pöyry review on the TSOs' System Services Recommendations Paper can be circulated. **[RAs]**

TSO/DSO Engagement

- TSOs/DSOs to provide information on the approach to reactive compensation studies. **[TSOs/DSOs]**

Grid Code

- TSOs to circulate version 5 of the Grid Code when published. **[TSOs]**

Wind Constraint & Curtailment Template Report

- TSOs to circulate confirmation on whether the wind dispatch tool in the development of records can provide a reason for constraint or curtailment. **[TSOs]**

Actions from Last Advisory Council Meeting #3

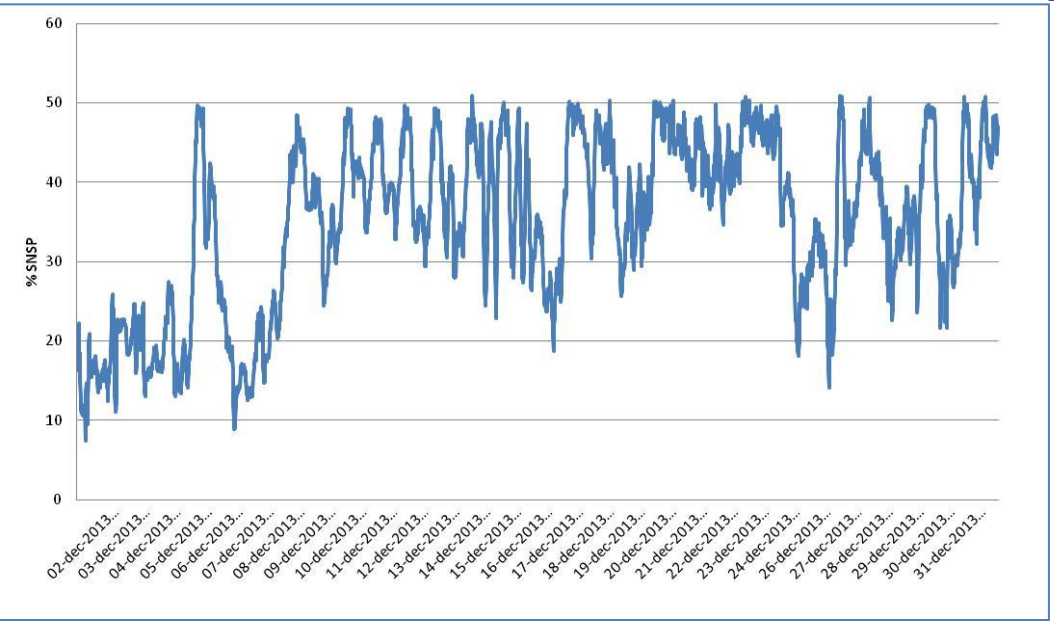
DS3 Advisory Council Review

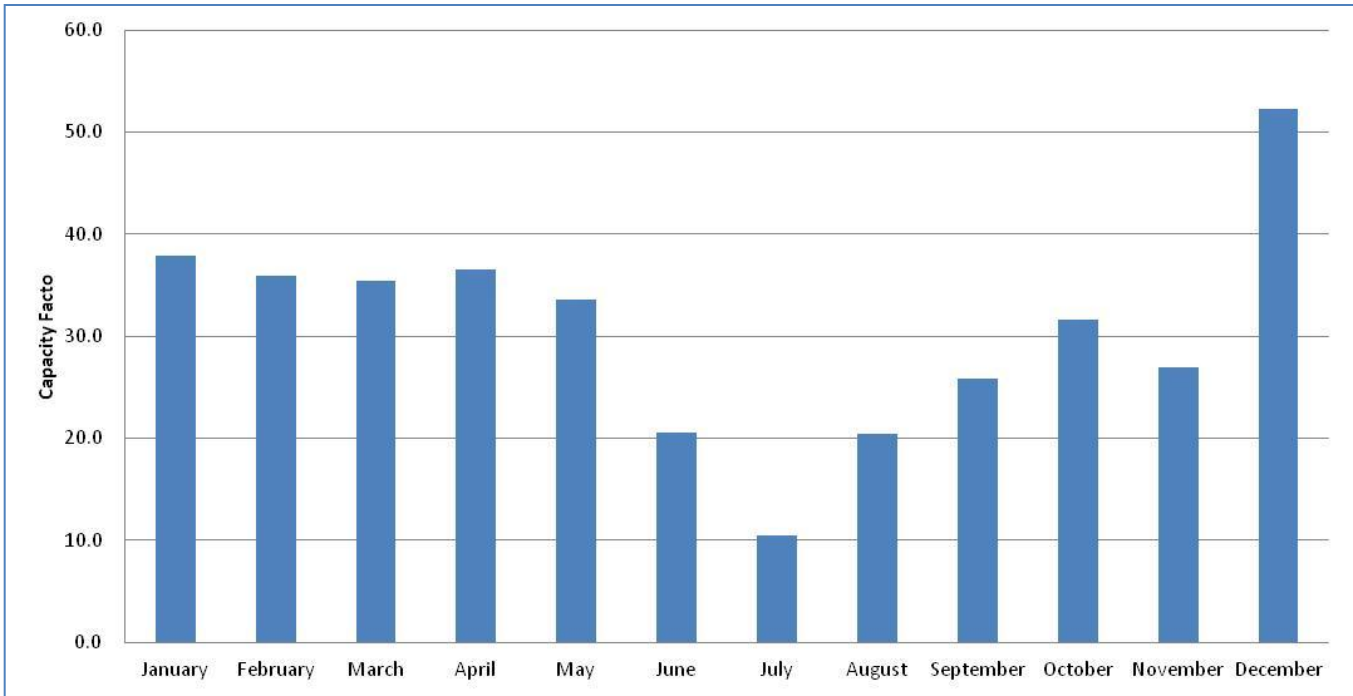
- The TSOs to consider circulating an Advisory Council Review questionnaire to the Council members requesting feedback in relation to format, content, timing, and location of the meetings. **[TSOs]**

- TSOs to request input from Advisory Council into November DS3 Industry Forum. **[TSOs]**

- TSOs to schedule 2014 Advisory Council meetings. Provisionally scheduled for January, May and September 2014. **[TSOs]**

December 2013 – SNSP & Capacity Factor





2014 Deliverables

- Continuation of operational studies
- Changes to Control Centre operational policy
- Delivery of Control Centre tools
- Continued TSO-DSO progress
- Clear path forward for RoCoF and System Services
- DSU JGCRP Working Group

DS3 – Change in Focus

System Services
Performance Monitoring
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RoCoF

Studies & Model Development
Control Centre Tools
Wind Security Assessment Tool

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DS3 Workstream Plans

28th January 2013

Robbie Aherne

Sample Format

HIGH-LEVEL PLAN

TASK NO.	TASK	RESPONSIBLE	ORIGINAL DUE DATE	DUE DATE
DSU Readiness				
DSM.1.1	Approval of Grid Code Modification for DSU (MOD_36_10)	CER	Q4 2011	Complete
DSM.1.2	Northern Ireland Grid Code Modification Consultation	TSOs & RAs	Q4 2011	Complete
DSM.1.3	Northern Ireland Approval of DSU Modification	UReg	Q1 2012	Complete
DSM.1.4	Delivering T&SC Modification	SEMC	Q1 2012	Complete
DSM.1.5	System Services Consultation #1	TSOs / RAs	Q4 2011	Complete
DSM.1.6	System Services Consultation #2	TSOs / RAs	Q3 2012	Complete
DSM.1.7	WPDRS phase out	EirGrid / CER	2012 – 2013	Complete
DSM.1.8	DSU Operation (Ireland Pilot)	TSOs / Industry	Q2 2012	Complete
DSM.1.9	Review of System Services arrangements for DSUs and AGUs	TSOs	Q3 2013	Q1 2014
DSM.1.10	DS3 TSO-DSO Engagement Strategy modified to take account of DSM	TSOs/DSOs	New Task	Q1 2014
DSM.1.11	Review of relevant Network Codes from perspective of DSM	TSOs	New Task	Q1 2014

Workstream Plans

w.b. 6th Jan

Draft to RAs

w.b. 17th Jan

Draft to Advisory Council

TSO-DSO

Project Board

28th Jan

Advisory Council

w.b. 10th Feb

Publication

Comments to Robbie / Mark / Michael by COB Tuesday 4th February

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Industry Perspective

28th January 2014

Carsten Junge (GE)
Grainne O'Shea (ESB)

Energy for generations

DS3 Advisory Council
An Industry Perspective

Gráinne O'Shea

Involved in most types of Generation

Type	MW	Numbers
CCGT	2094	4 units
Peat	228	2 units
Coal	855	3 Units
Pumped Storage	292	1 plant (4 units)
OCGT	517MW	6 Units
Gas Plant	258MW	1 Unit
Hydro	206MW	17 units
Wind	263.8MW	14 Wind Farms 198 Turbines

DS3

View on the benefit of the DS3 Advisory Council

Expert Forum

Furthers understanding and moves issues forward

Onus on all members to participate.

Positive

RoCoF

- **Difficulty in getting information**
- **ESB commissioning studies - Building on the KEMA study commissioned by EirGrid**
  - Real parameters – Units; Duration; Loads
- **Real issues which will need to be overcome**
- **Mechanical stability – probes being installed**
- **Dynamic and further modelling required**
- **Solutions**
- **Project Management**

Grid Code Testing

- **Welcome the Grid Code Testing Workshops**
- **Governance**
- **Decisions can have significant commercial impact**
- **List of tests should be part of Grid Code.**

System Services

- **Potentially very significant impact**
- **Welcome further economic analysis being undertaken by CER**
- **Concerned about SEM to REM and roll out of DS3**
- **Look to have transparency re assumptions and scenarios.**
- **Investment / Closure decisions**

Questions?

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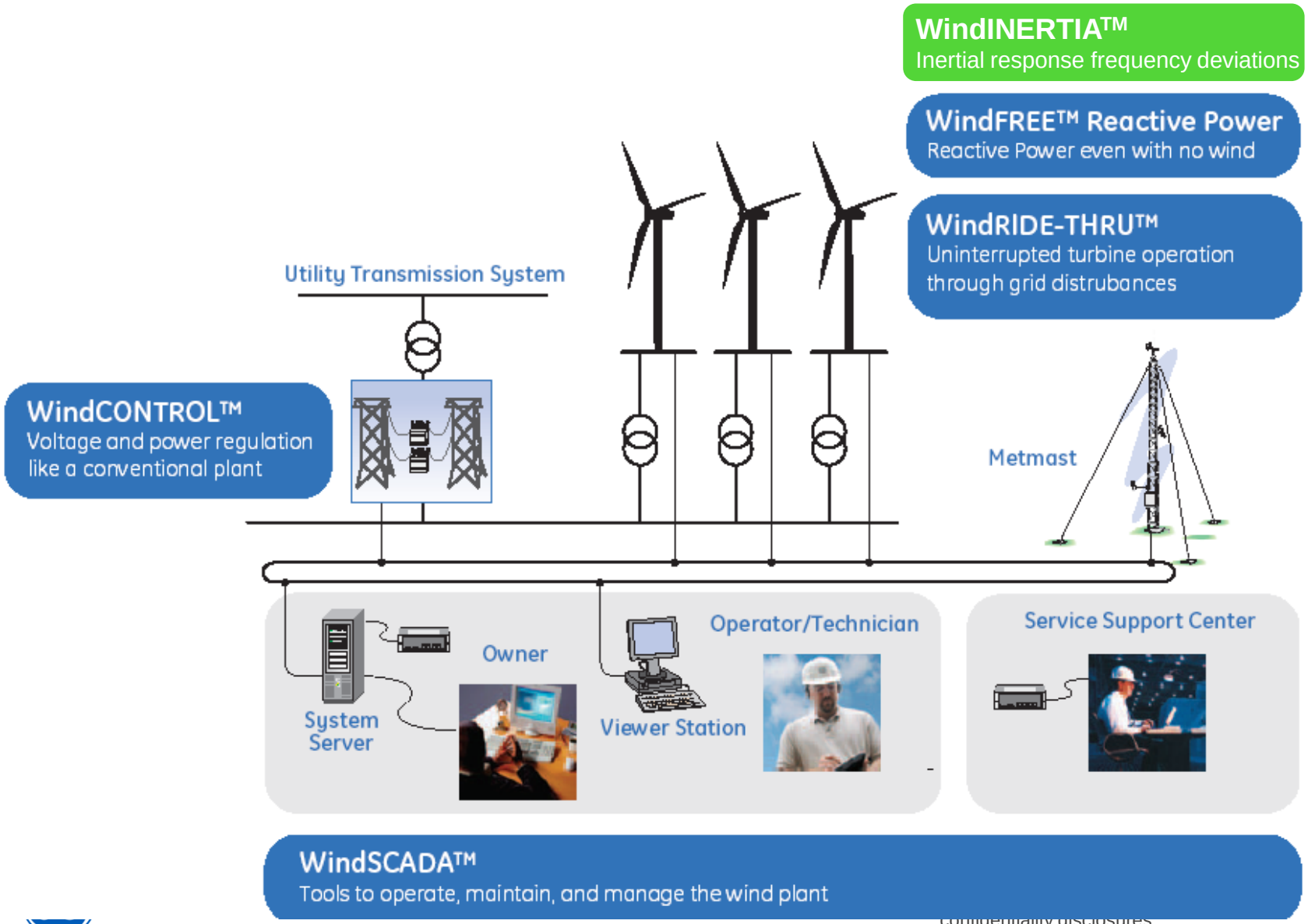
DS3
GE's Perspective

Carsten Junge – GE Power & Water
January 28th, 2014

Imagination at work.

GE Unrestricted

Overview GE Grid Friendly Solutions



confidentiality disclosures.

History & Projects

Year	Project
2001	Corneen 2 x 1.5s
2003-2004	First WindCONTROL installed

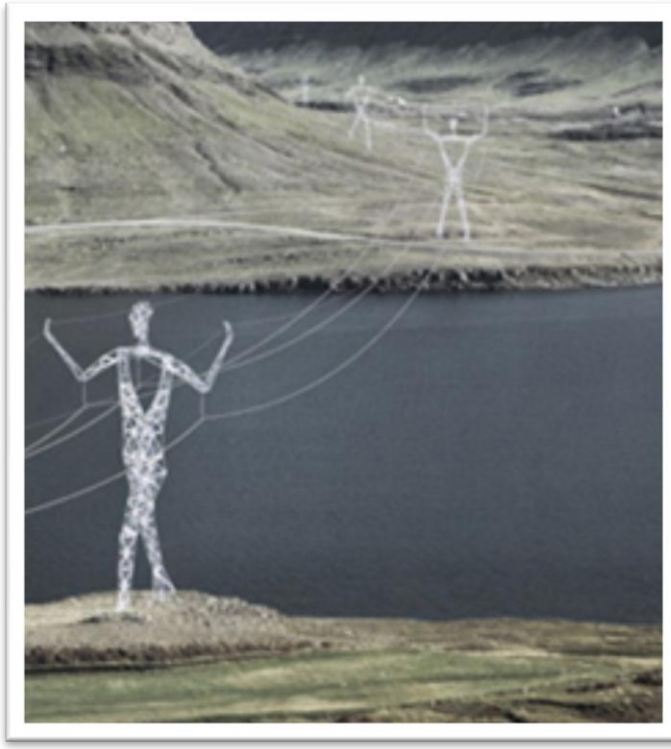
2003-2004	• Grid Code working group – Modern Grid Code:
	• WindRIDE-THRU
	• WindControl with control options:
	  • Dynamic Var
	  • Frequency Droop
	  • Ramp Rates
	  • Power Curtailment…..

2004-2009	1.5 fleet Ireland – various customers – 261 MW – 174 units
2009-2010	Rathcahill – 2.5 in Ireland
2013	Athea – 1.6 and 2.85

Ireland remains an important market for GE

Know your Grid

- Clear requirements that benefits the grid
- Limited number of documents
- Regular update cycle



„New functions can be expensive and time consuming to develop, so look what other utilities are asking for“

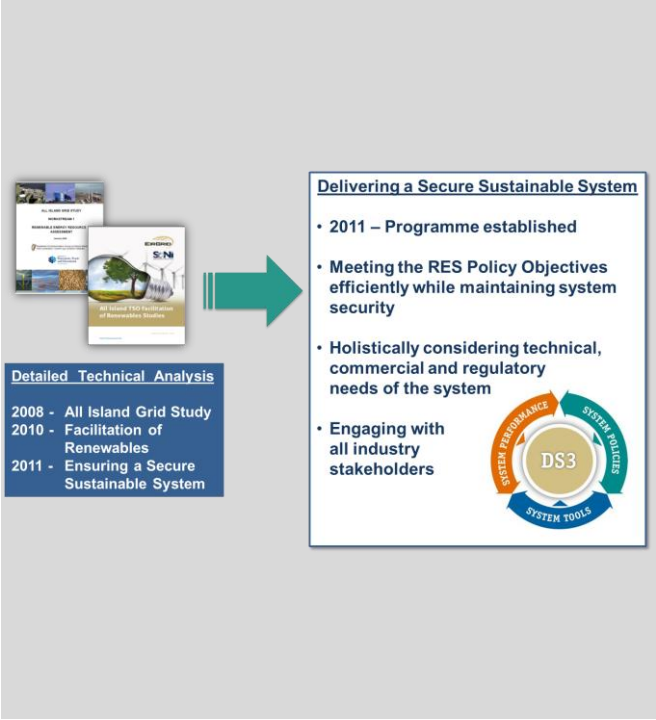
Know your generators

- Wind can do more, but…..
- Generators can have different roles and different requirements
- Play to the strength of the equipment

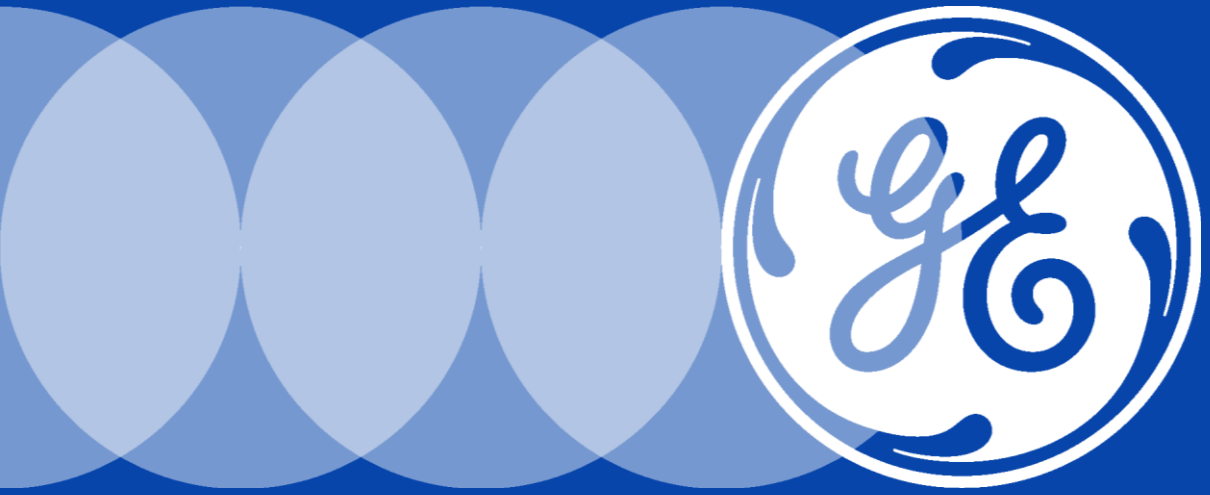
„All generators are not created equal“

View & Commitment

- We will continue to play an active role in Ireland
- We hope to demonstate our technology in Ireland



„Probably the only way to reach 75 % wind penetration“



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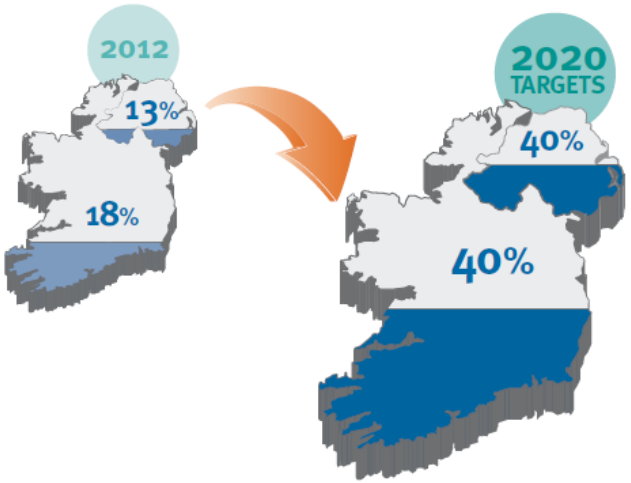
Annual Renewable Report 2013
Energy Policy Developments

28th January 2014

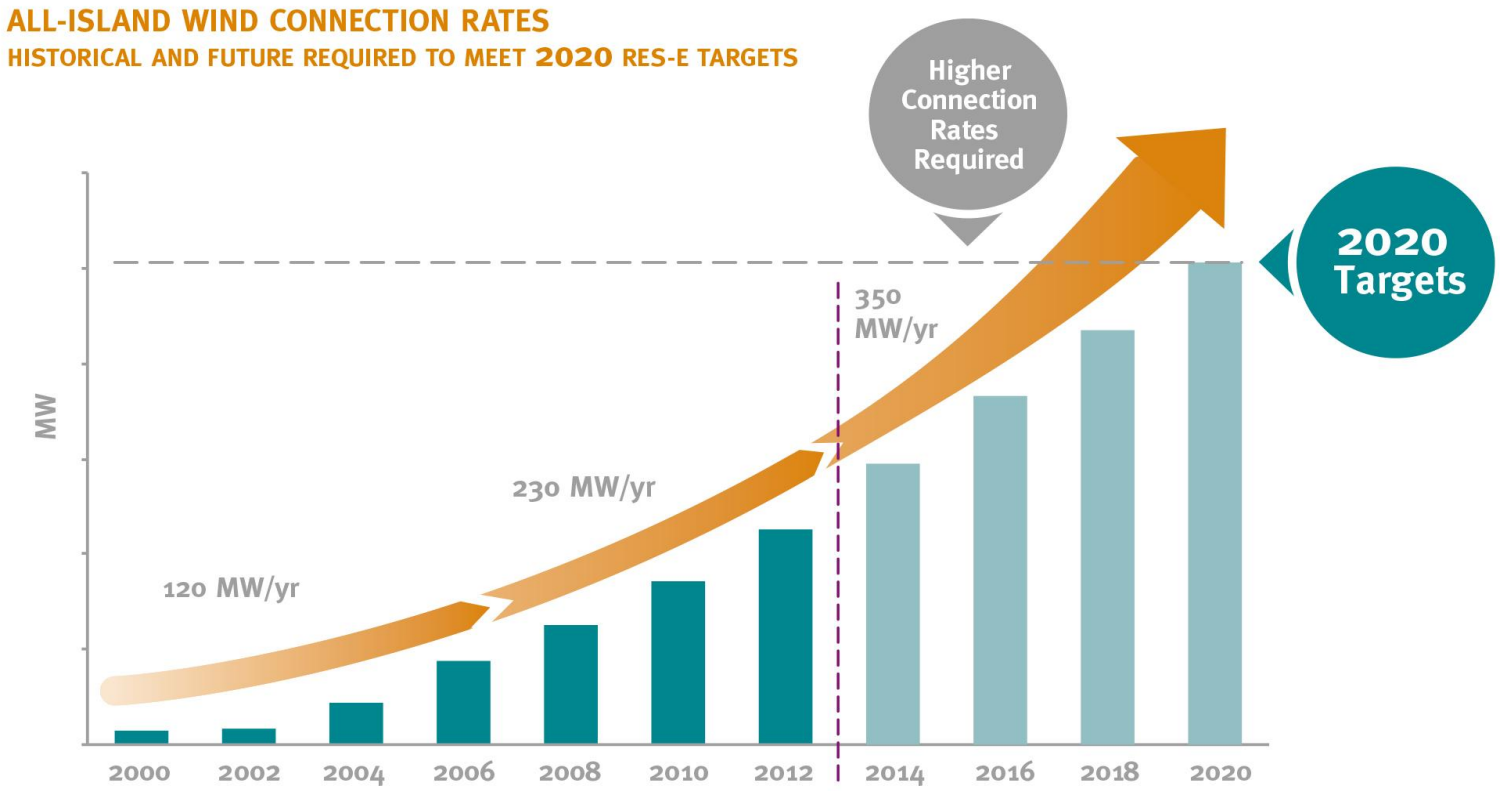
Frank Groome

Progress towards meeting the 2020 All Island Targets - Chapter 1



- Total Wind : c. 16.5%
- Total RES: c.18%
- Installed Wind: 2395 MW
- Installed RES: 2750 MW
- Maximum Wind Output: 2274 MW
- Maximum Wind week: 202 GWh (36 % of electricity demand)

All-Island connection rates need to Increase



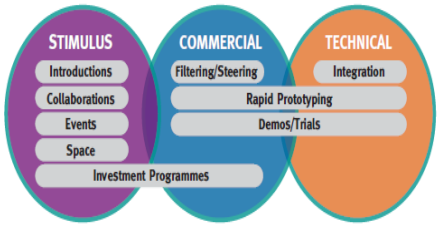
Source: EirGrid Group All-Island Renewable Connection Report and 36-Month Forecast (Qtr3, 2013).

EirGrid and RES-E Chapter 2

- DS3
  - ❑ Implementation Phase

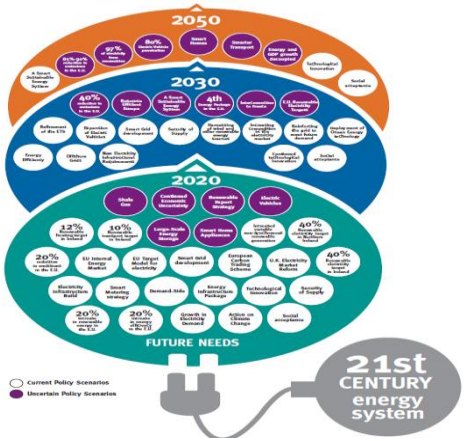
- Grid Development
  - ❑ 350 km new lines
  - ❑ 937 km uprated
  - ❑ Social Acceptance is Critical - ***Consultation Roadmap***

- Smart Grid Hub
  - ❑ (engaged with 500 individuals and 130 organisations)



Annual RES Report 2013

- **Chapter 3 (Policy Trends)**
  - ❑ Costs/Competitiveness
  - ❑ Energy Security
  - ❑ Climate Change
  - ❑ Increasing RES
  - ❑ Availability of Shale Gas/Nuclear



- **Chapter 4 (International Developments)**
  - ❑ EU:31 GW of RES (18% of electricity consumption)
  - ❑ USA:167 GW in 2012, 13% of total generation
  - ❑ China:16 GW of hydropower; 14 GW of wind was installed, total of 75 GW.

EU 2030 Energy Policy Developments
An Overview

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EU 2030 Energy Policy Framework

- **Why?**
  - ❑ 65 GW of existing plant to retire by 2030
  - ❑ EU oil and gas dependency >90% oil and 80% gas by 2030, €400 billion (energy diversification)
  - ❑ Costs of a low carbon transition equivalent to costs incurred from upgrading aging energy system in any event.
  - ❑ Investments in the transition to sustainable energy needed to protect the climate.
  - ❑ Risk that a European approach to decarbonisation, particularly of electricity systems, will be weakened by isolated initiatives by Member States
  - ❑ 2020 Achieved (except Energy Efficiency)

2030 Commission Proposals

EUROPEAN COMMISSION

Brussels, 22.1.2014
COM(2014) 15 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

A policy framework for climate and energy in the period from 2020 to 2030

{SWD(2014) 15 final}
{SWD(2014) 16 final}

EN EN

- **40% cut in greenhouse gas emissions**
  - ❑ GHG target split between ETS (43% reduction) and non ETS (30% reduction).
  - ❑ Allowance cap increase to 2.2 % post 2020.

- To achieve **at least a 27% share of renewable energy** consumption (MS flexibility)
  - ❑ RES-E increase from 21% 2013 to 45% in 2030.
  - ❑ No supports for mature RES technology.

- **No specific target for** Energy efficiency
- New EU governance structure (based on MS plans for a secure, competitive energy future).
- Reform ETS (market stability reserve for adjustments) .

EU Parliament Proposal

- EU Parliament last week voted for three binding energy and climate targets in 2030:
  - 40% energy efficiency target;
  - 40% cut in greenhouse gas emissions, and
  - 30% market share for renewables by 2030.
- MEPs to discuss their own proposals in greater detail in early February 2014.
- Next Steps…

Impact of Proposals

- **<u>No impact</u>** on the current 2020 targets.

- Likely electricity sector will need to increase share of RES.

- MS options to 2030:
  - ❑ Increase in RES-E?
  - ❑ Increase RES-T and RES-H?
  - ❑ Agricultural and Transport sector emissions will need to reduce

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Commission for Energy Regulation
An Coimisiún um Rialáil Fuinnimh

Regulatory Update on DS3

Presentation to DS3 Advisory Council

28th January, 2014

Commission for Energy Regulation
An Coimisiún um Rialáil Fuinnimh

Overview

- ROCOF
- System Services

Commission for Energy Regulation
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ROCOF: Proposed Framework

Modification

- Approve in principle
- Effective after confirmation from studies
- 18 Month timeline

Implementation

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

Financial Arrangements

- No Cost recovery
- GPI to apply after 18 months

Responses (1)

- Consultation closed on 9th August;
  - 12 responses received.
- 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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Next Steps

- RAs have agreed an aligned approach to the ROCOF decision
- RAs to inform SEM Oversight Committee in February
- CER and UR decisions will be published after this

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System Services

- SEMC Decision on Technical Definitions published 20th December
- RFT issued 17th January
- Poyry Paper on Procurement Options published for information 22nd January
- Economic Analysis
  - Demand Analysis: TSO modelling results due March
  - Supply Analysis: Due mid/late March
  - Procurement Analysis: On-going, to be completed using results of Supply & Demand Analysis
- SEMC Consultation planned May 2014

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Questions

RoCoF

28 January 2014

Tom McCartan

RoCoF update

- TSOs awaiting Regulators decision on Grid code modifications
- Ongoing discussions between TSOs and DSOs on RoCoF and over frequency generation tripping scheme
- Limited engagement with conventional generators
- TSOs undertaking additional analysis to assess the impact of ROCOF on the system

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System Services

28th January 2014

Jon O'Sullivan
Paul Brandon (CER)

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TSO - DSO Engagement

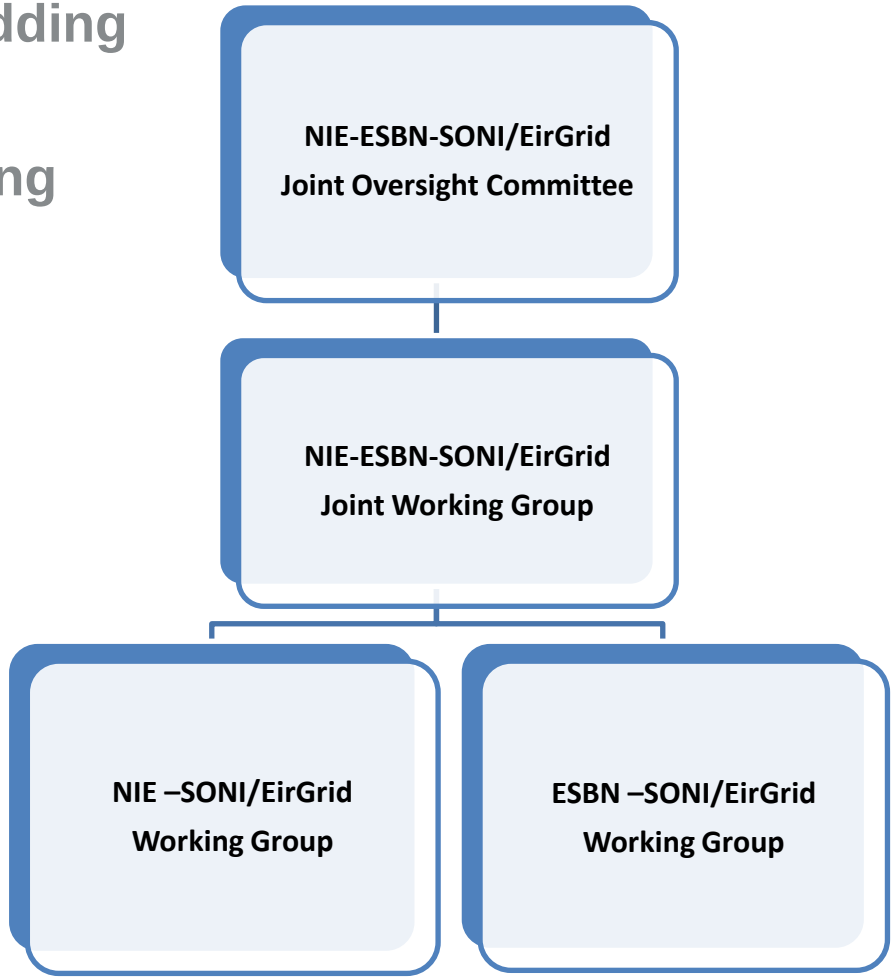
28th January 2014

Simon Tweed

DSOs

TSO-DSO DS3 Engagement

- Loss of Mains / RoCoF
- High Frequency Generation Shedding
- Voltage Control
- Enhanced Performance Monitoring
- Demand Side Management



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Advisory Council Review

28th January 2014

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Afternoon Technical Session

28th January 2014

Nodal Control of Distribution Connected Windfarm Clusters

28th January 2014

DSO Representative

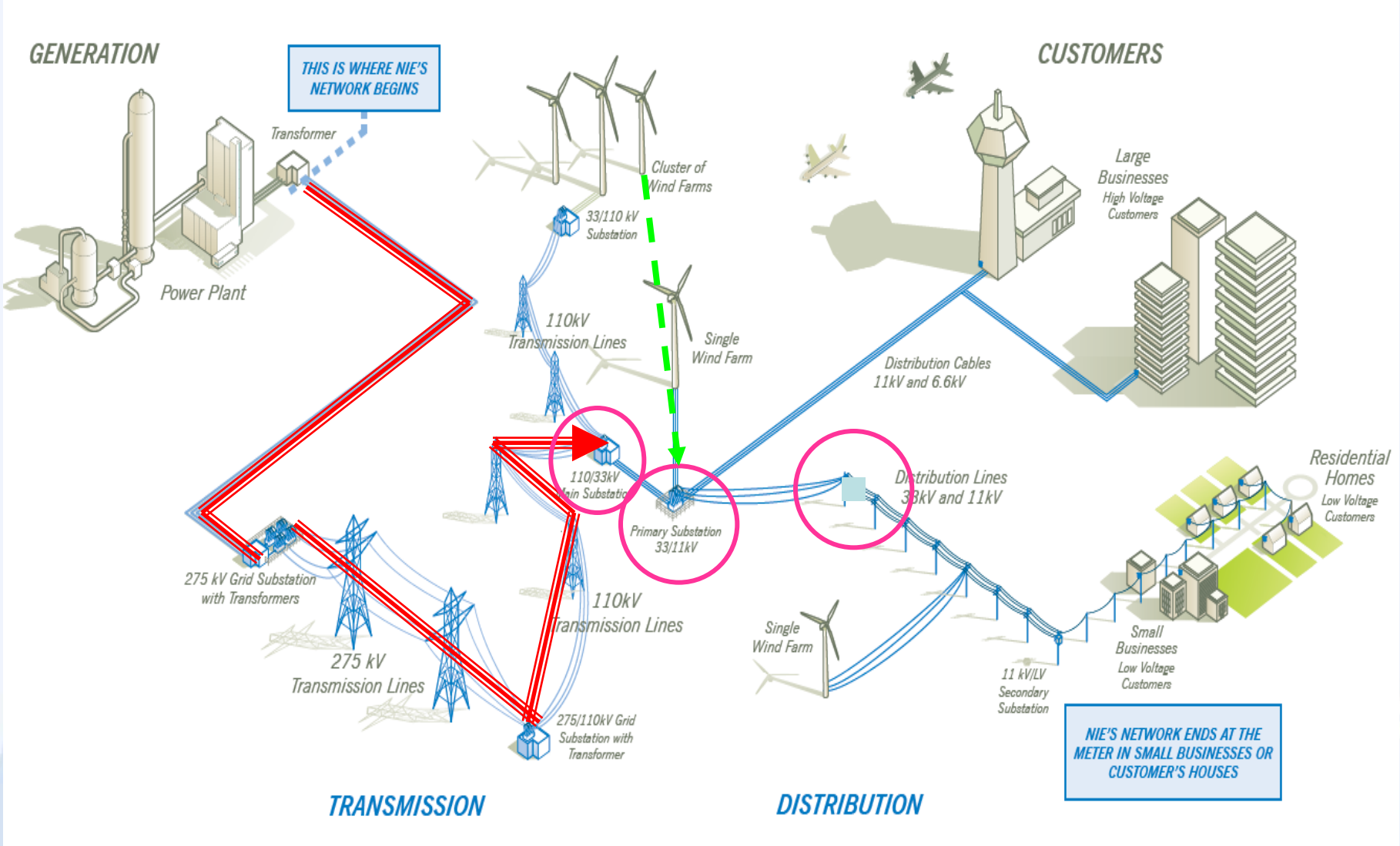
Future HV/MV Grid Monitoring and Control: Nodal Control

Sam Alexander NIE Network Generation Manager

Agenda

- Nodal Control Concept
- Cluster Nodes
- Hybrid Nodes
- Step-down Nodes
- Next Steps

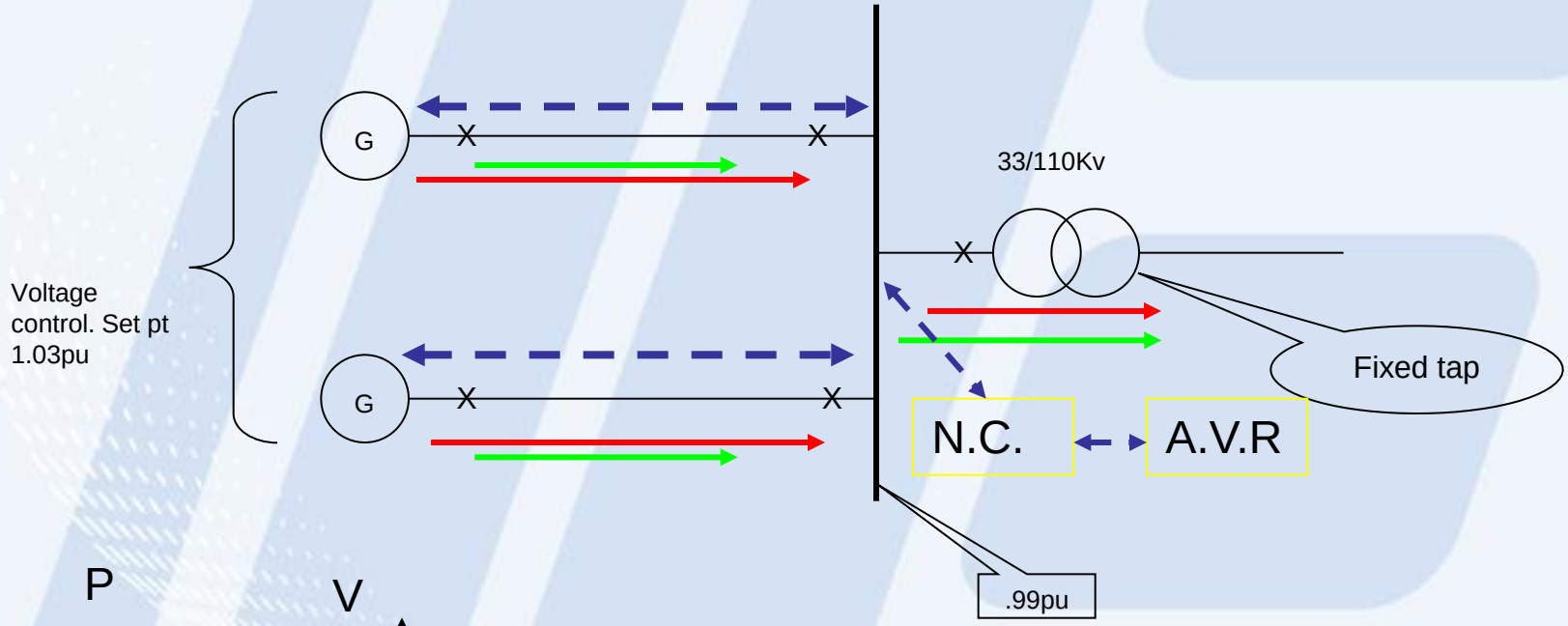
Nodal Concept

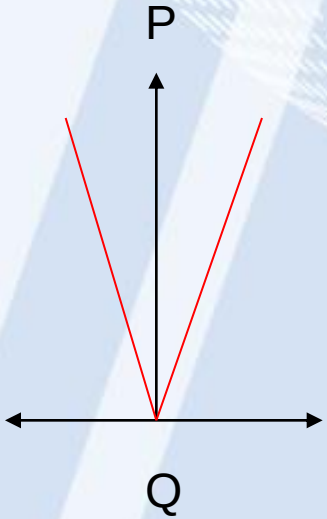


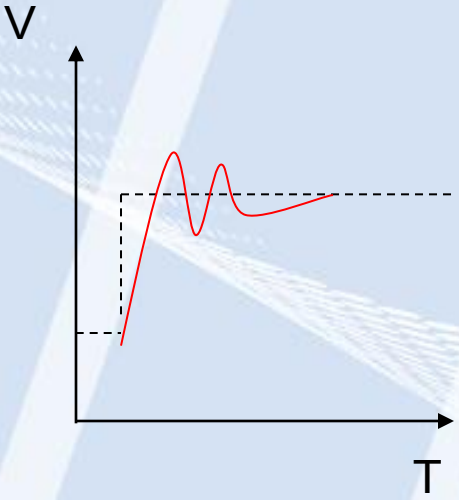
Why?

- Electricity represents almost 20% of the UK energy consumption
- The EU has legislated a requirement on electricity retailers to source specific proportions of total electricity produced from renewable energy sources in a fixed time frame.
- The EU baseline target is 40% by 2020 (75% SNSP)
- Requires NIE to add and manage more renewable energy sources to the grid
- Support the TSO in the stability of the Grid (reactive support)

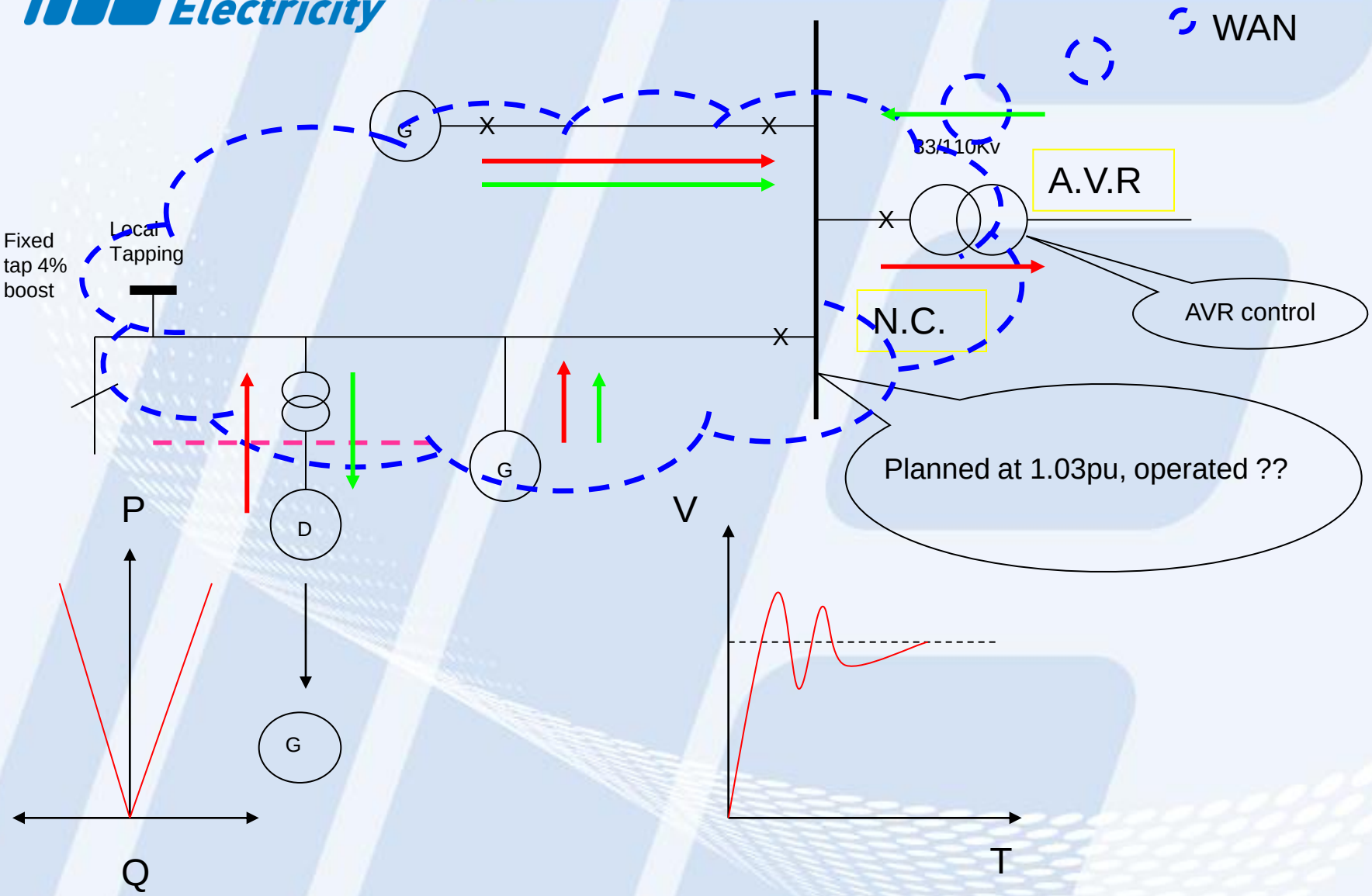
Cluster Nodes



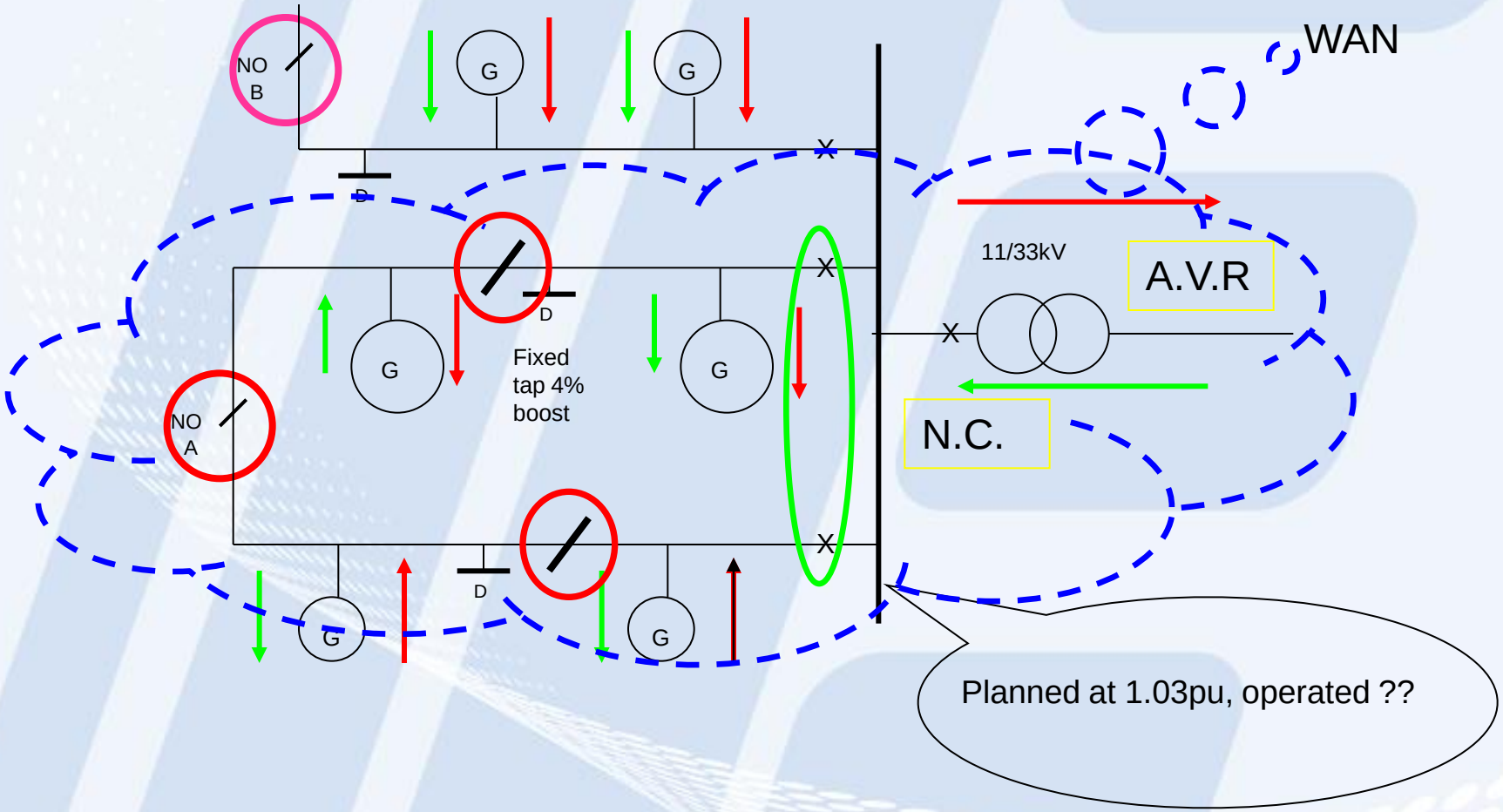




Hybrid Nodes



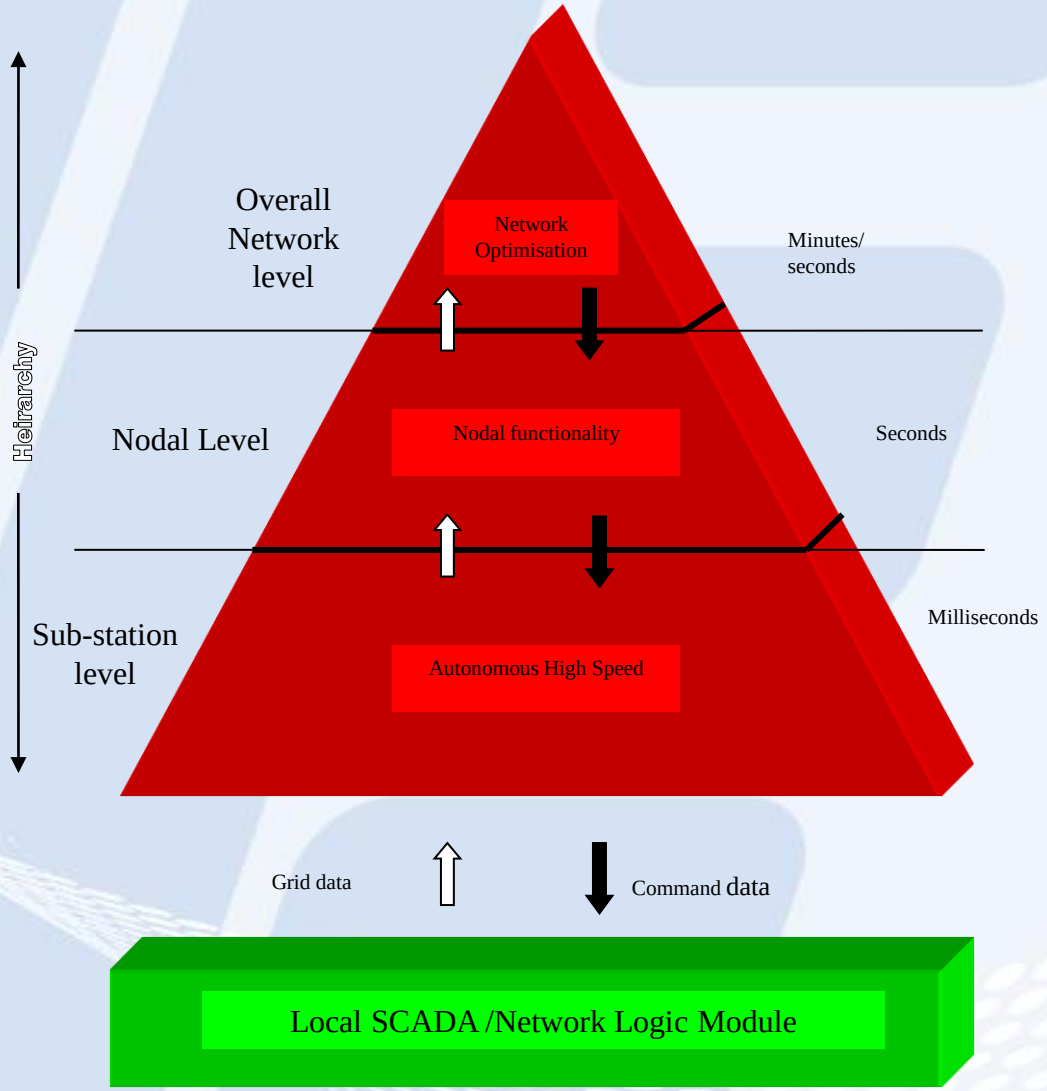
Step-down Nodes



Scada Data Hierarchy Model

Information would be transferred to a high level system platform where decisions would be taken perhaps over several minutes to optimise total system management , this would include network optimisation for example data would be received from the sub routines and used to optimise performance at nodal level.
The time scales would be typically several seconds.

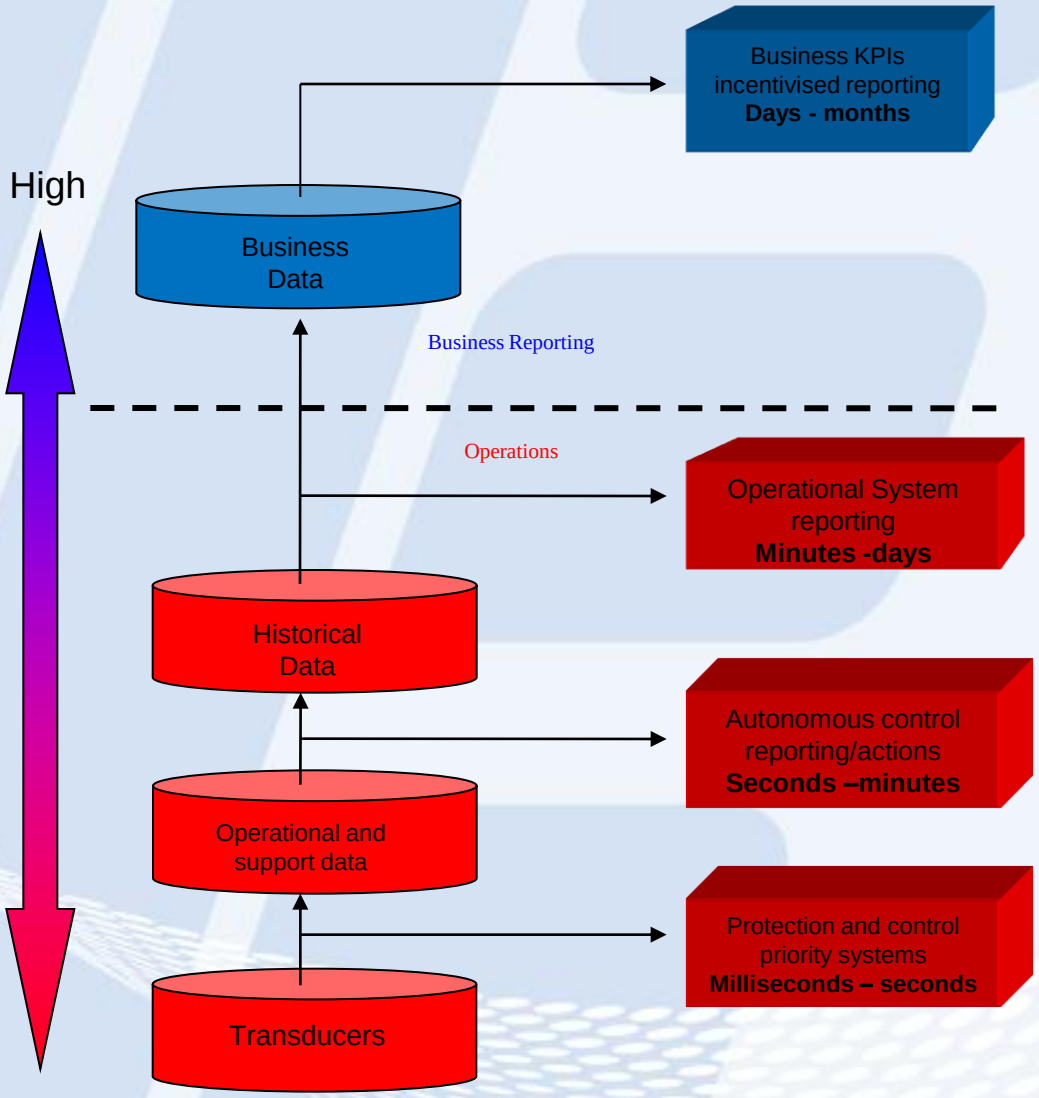
High speed high frequency logic operating autonomously at speeds ranging from milliseconds to seconds.



Communications Data, Pathway and Latency

The diagram illustrates how the massive amount of data generated by a smart network could be incorporated, assimilated and utilised within the business.

By attributing required timescales and Identifying human interfaces we have a basis whereby we can establish parameters for communication solutions including security and priority signal paths.



Next Steps

- Develop a nodal control
- Introduction of nodal and distribution system state estimators (autonomous level)
- Develop a communications network and critical paths
- Prioritise signals and nodal hierarchy
- Regulatory and Planning Framework changes

Questions

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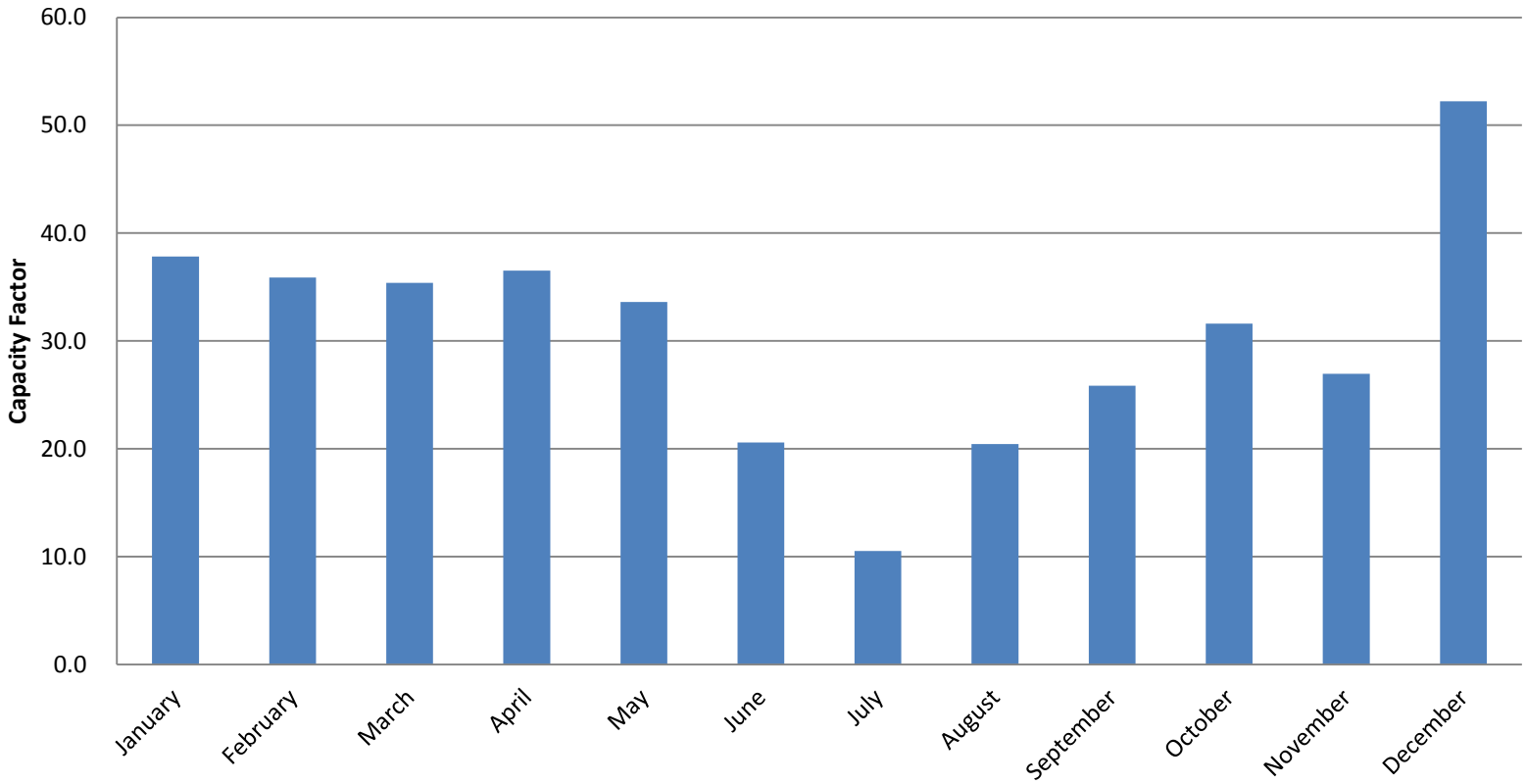
Recent High Wind Generation

28th Jan 2014

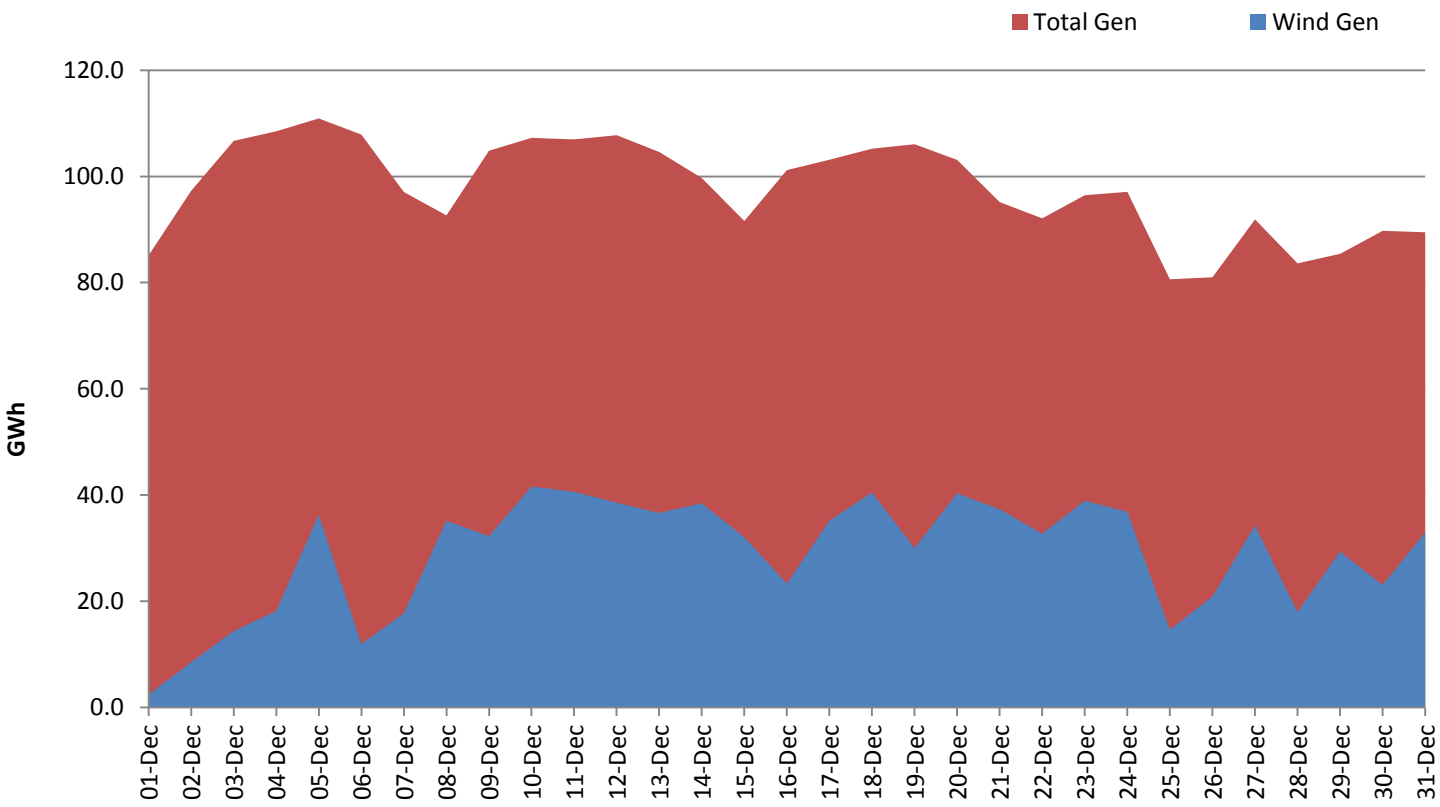
Maria Geraghty
Grid Operations Near Time

All Island Wind Capacity Factor 2013

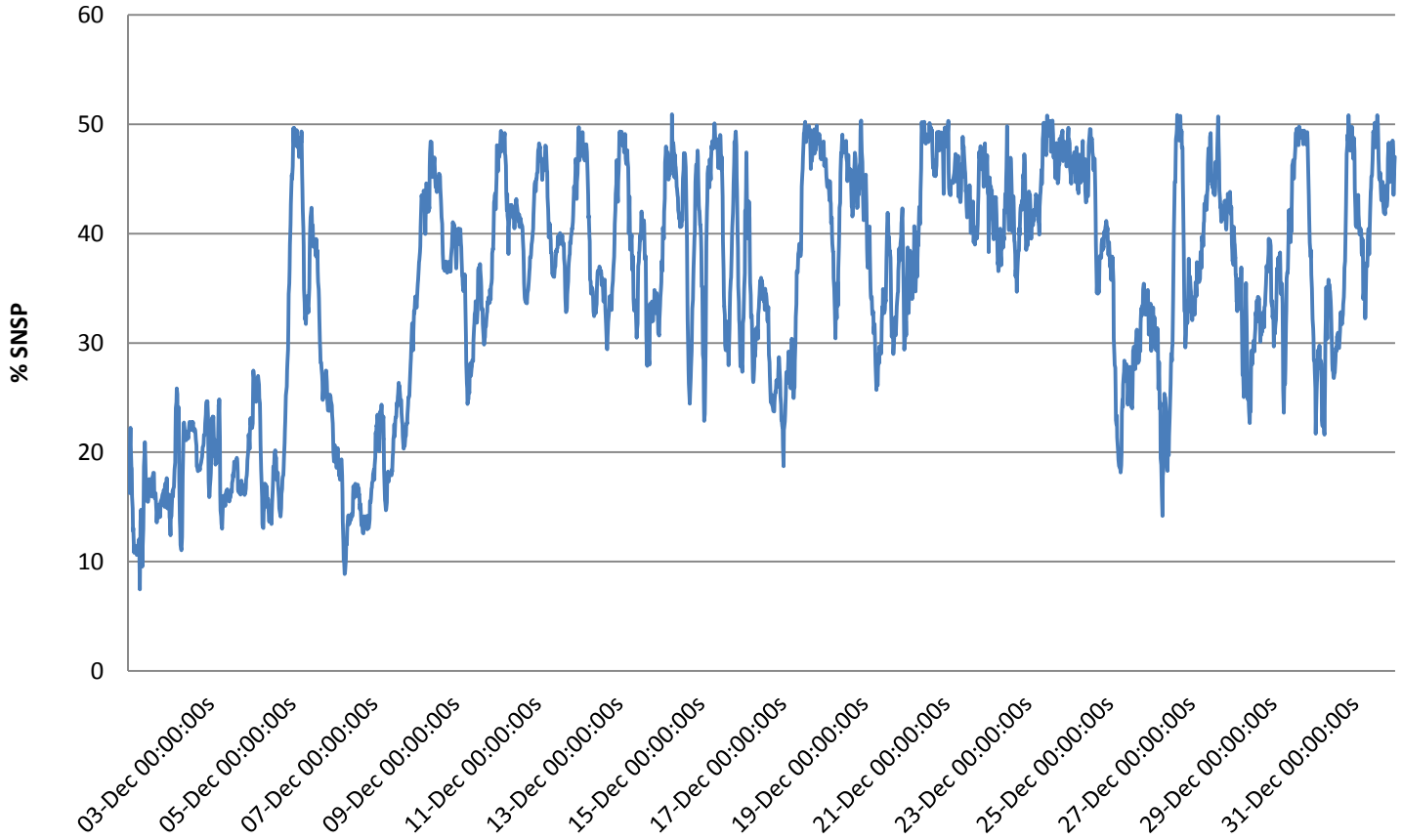


Note: All values usedare based on 15 min historical SCADA values

December 2013: Wind and Total GWh



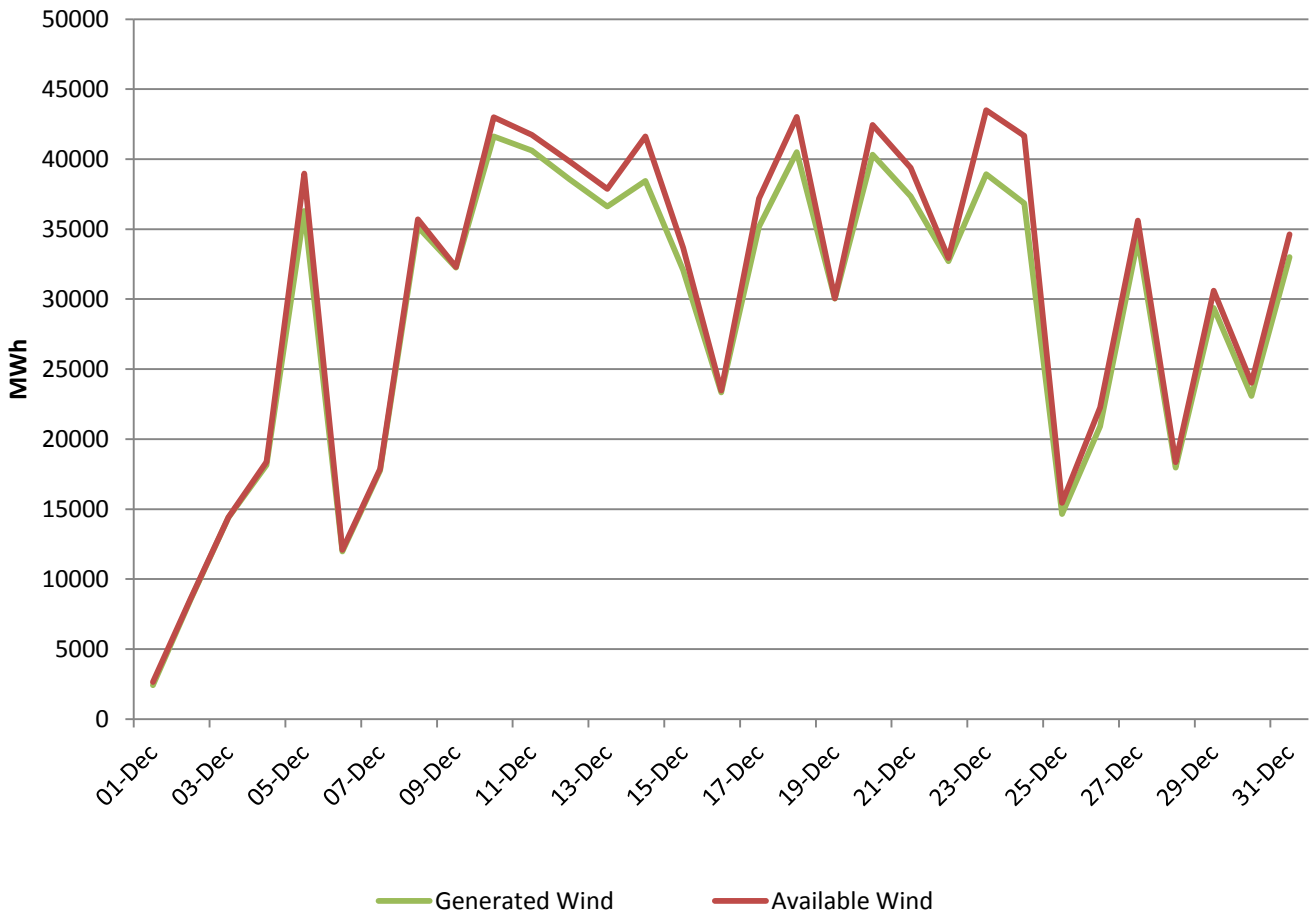
December 2013: SNSP



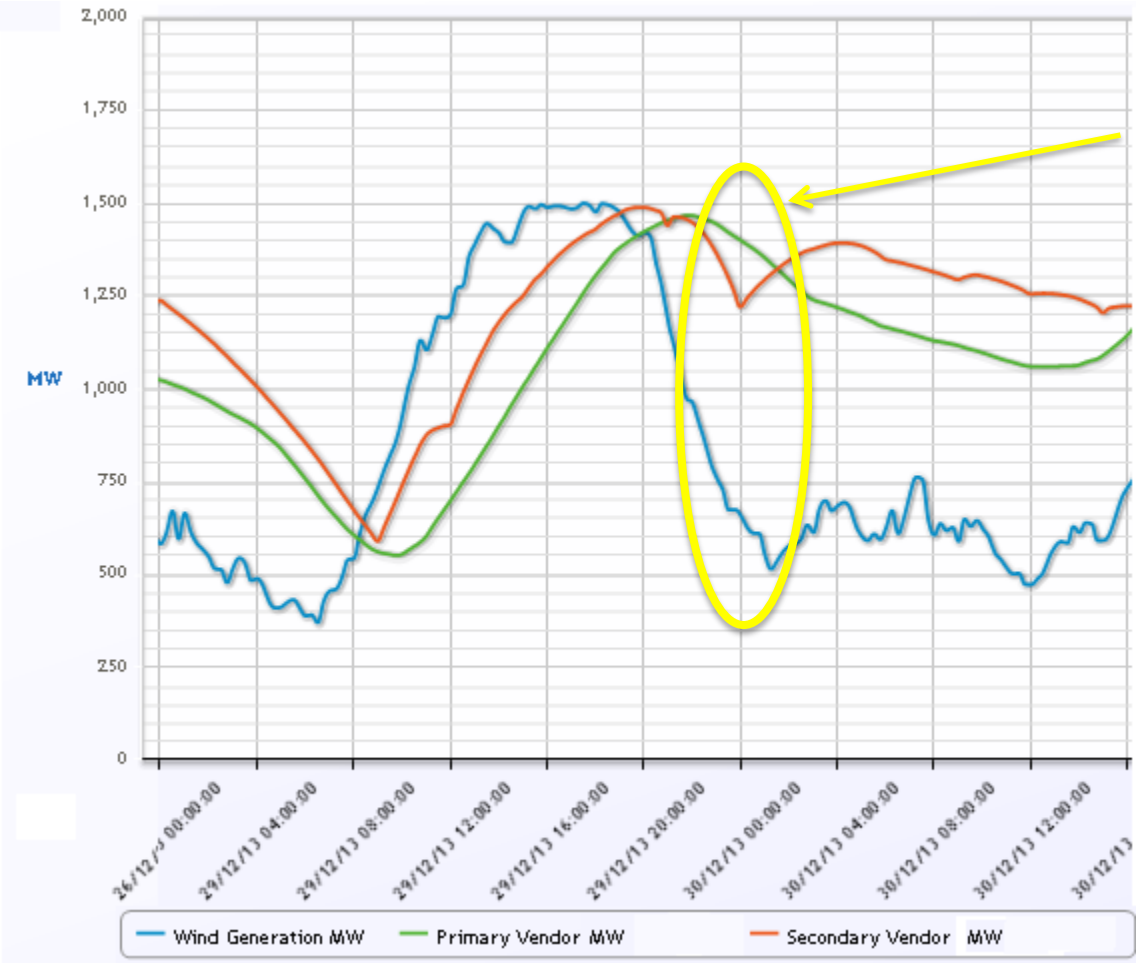
All Island Peak Demand

	2013
Peak System Demand (MW)	6192
Time of Peak Demand	17th Dec 17:30
Wind Generation at Peak (MW)	2274
% Wind of Total Demand	36

December 2013: Wind Curtailment



Wind Forecasting

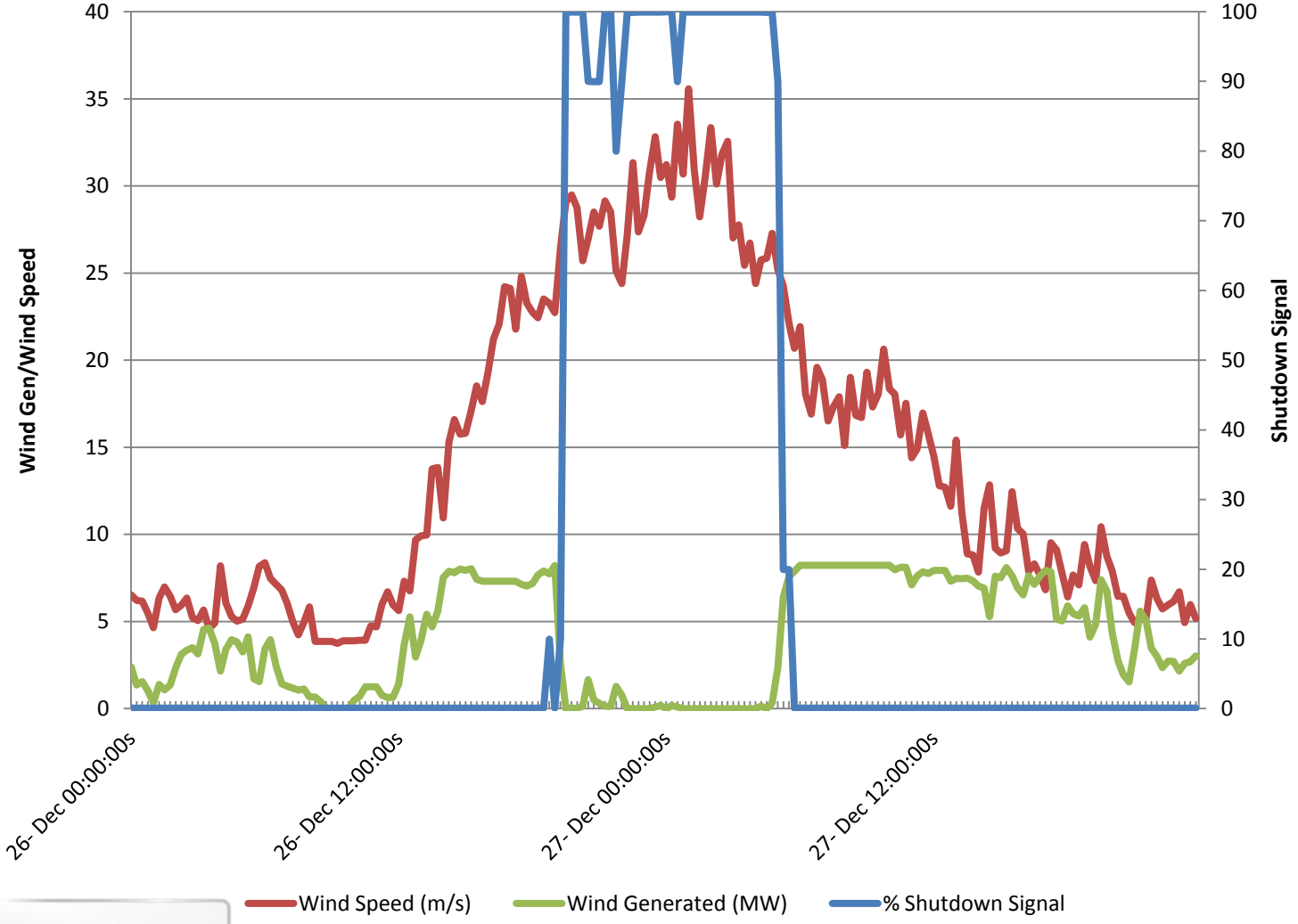


07:00 on 30th Dec

- Forecasted Values:
  Primary – 1150 MW
  Secondary – 1340 MW

- Actual Wind: 725 MW

High Speed Shutdown



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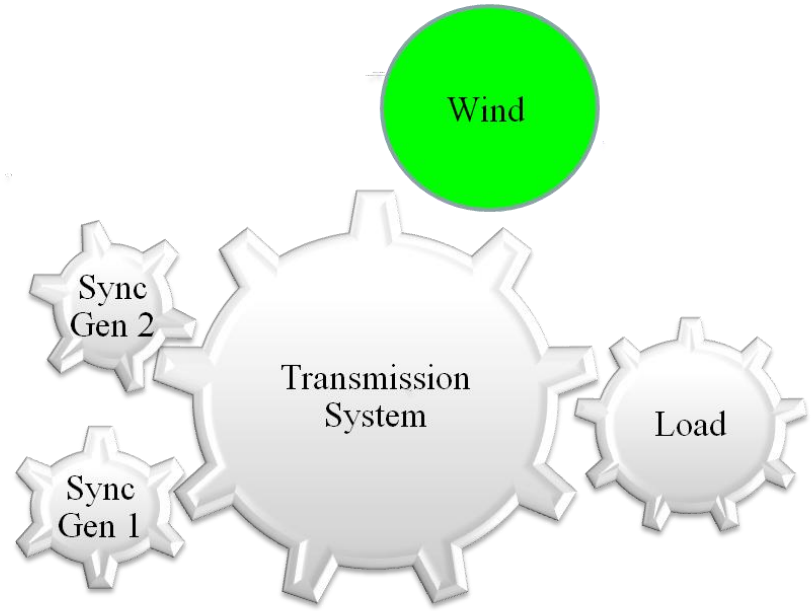
Frequency Response Studies Overview

28th January 2014

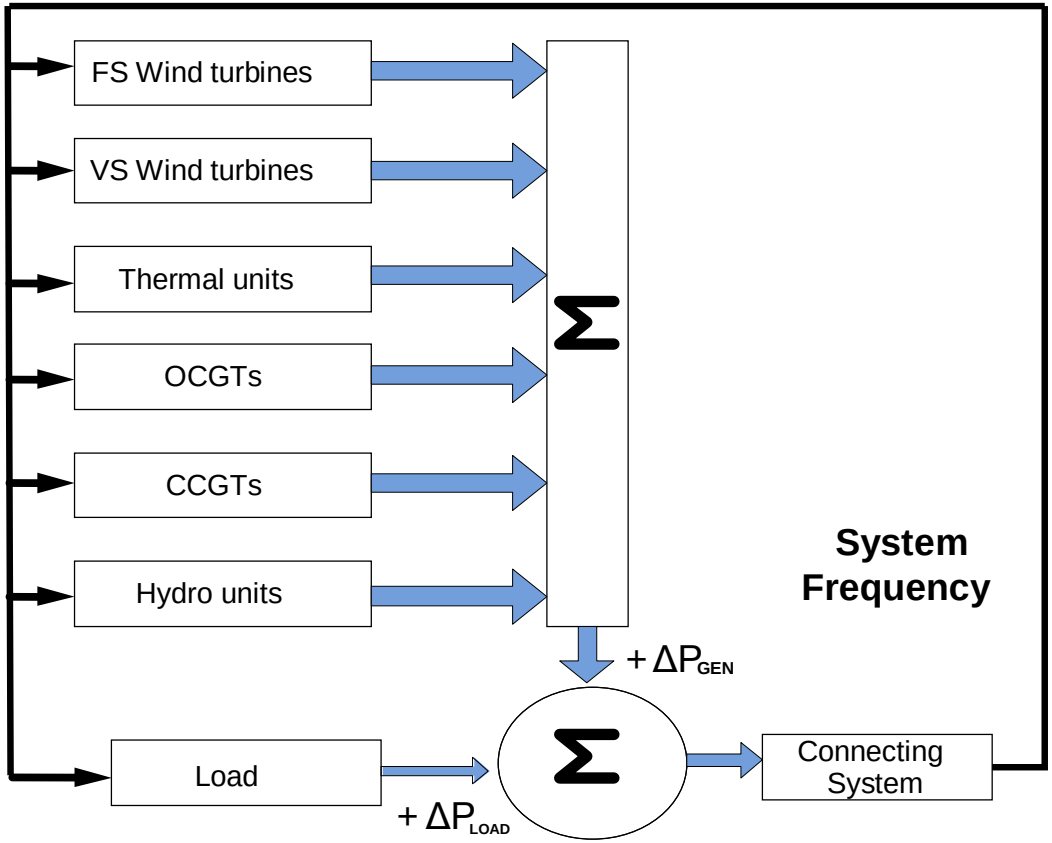
Lisa Ruttledge

Background

- Power balance on conventional systems well understood
- Higher wind penetration levels
- Fewer conventional generators ***plus*** associated ancillary services



Frequency Model



Two Studies

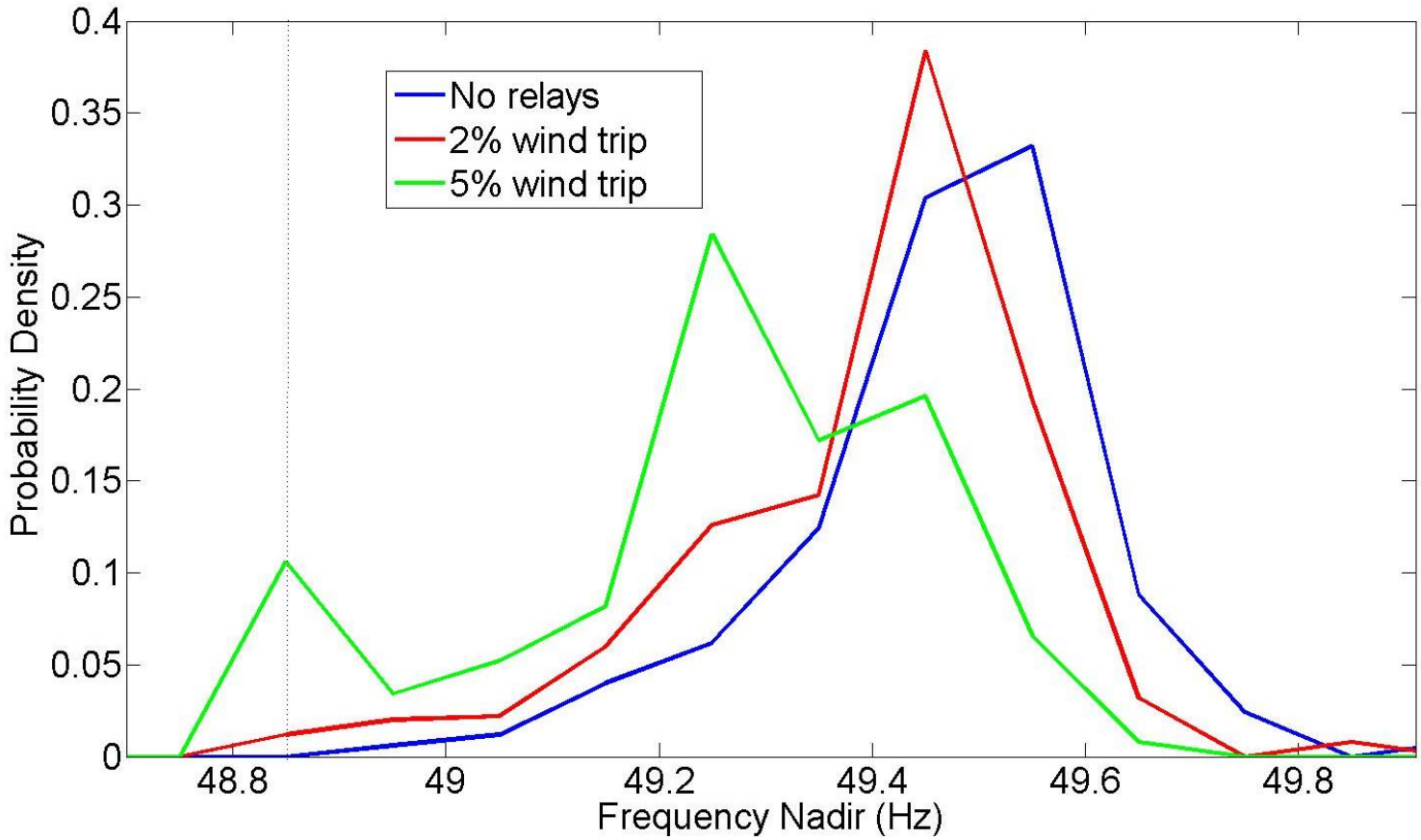
1. Impact of Embedded Generation LoM RoCoF Relays

2. Over Frequency Generation Shedding

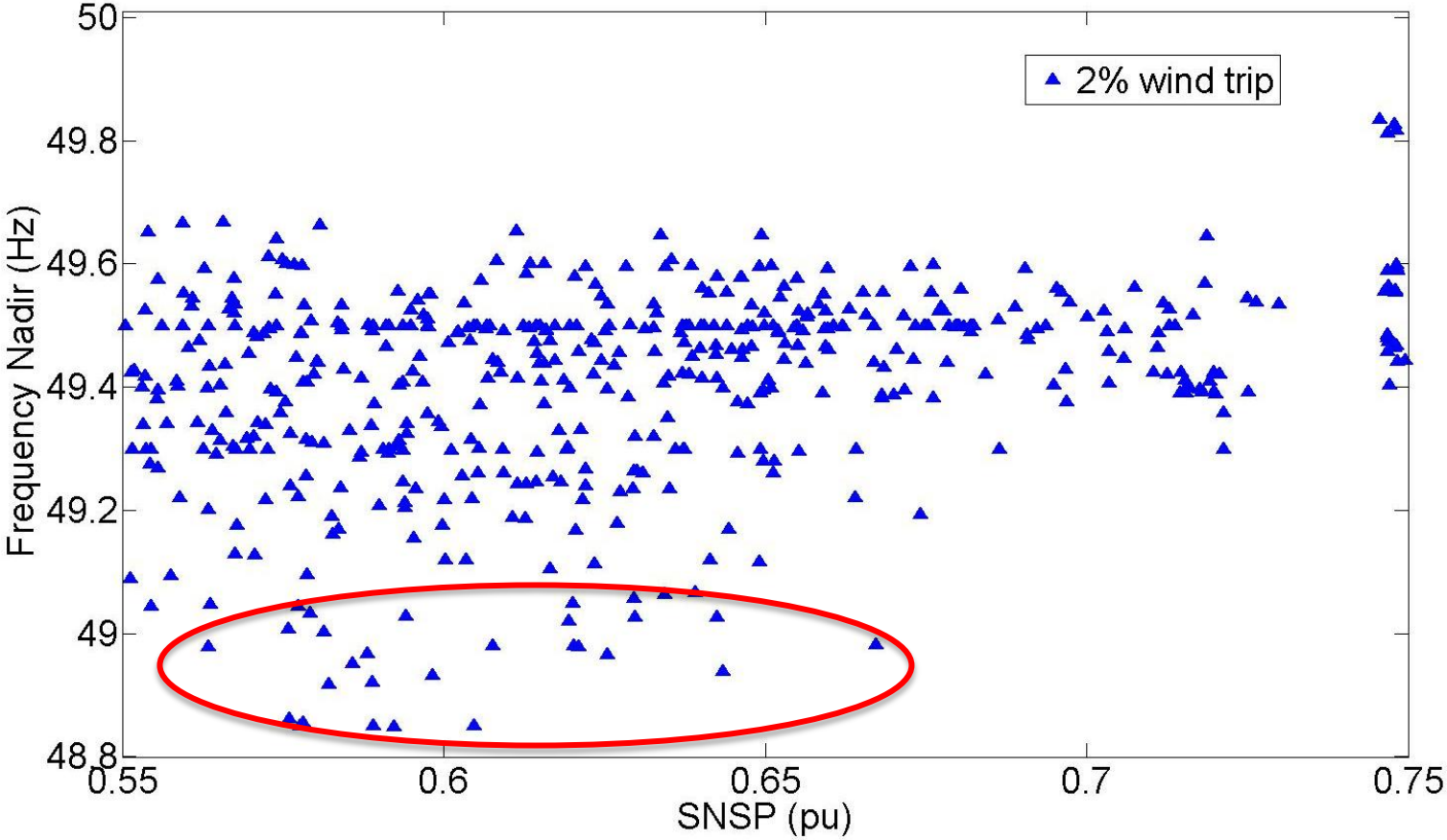
1. Impact of Embedded Generation LoM RoCoF Relays

Frequency Nadir Following LoM Trip

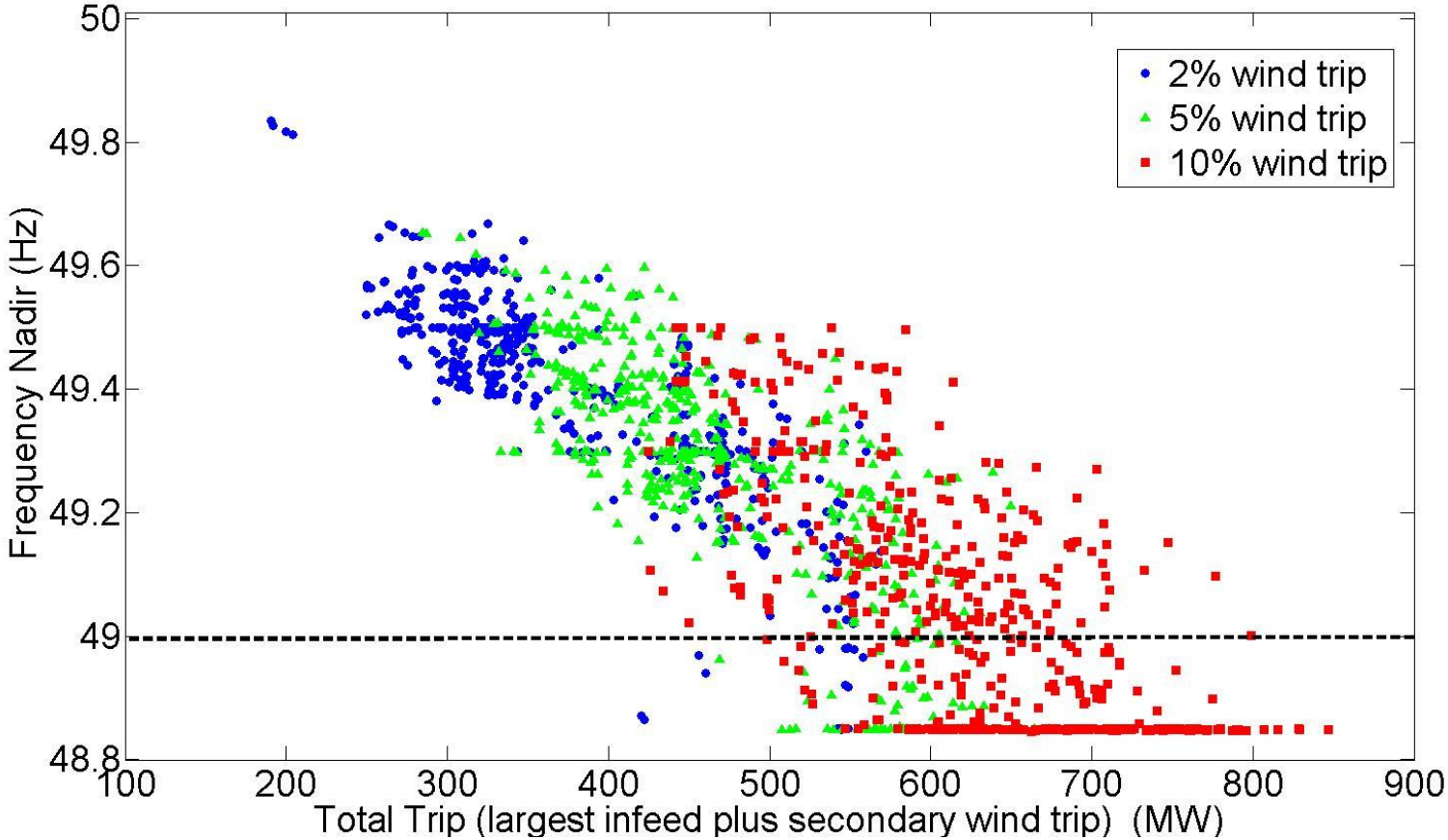
Frequency nadir distribution following tripping of varying wind levels



Largest Infeed plus 2% LoM Trip

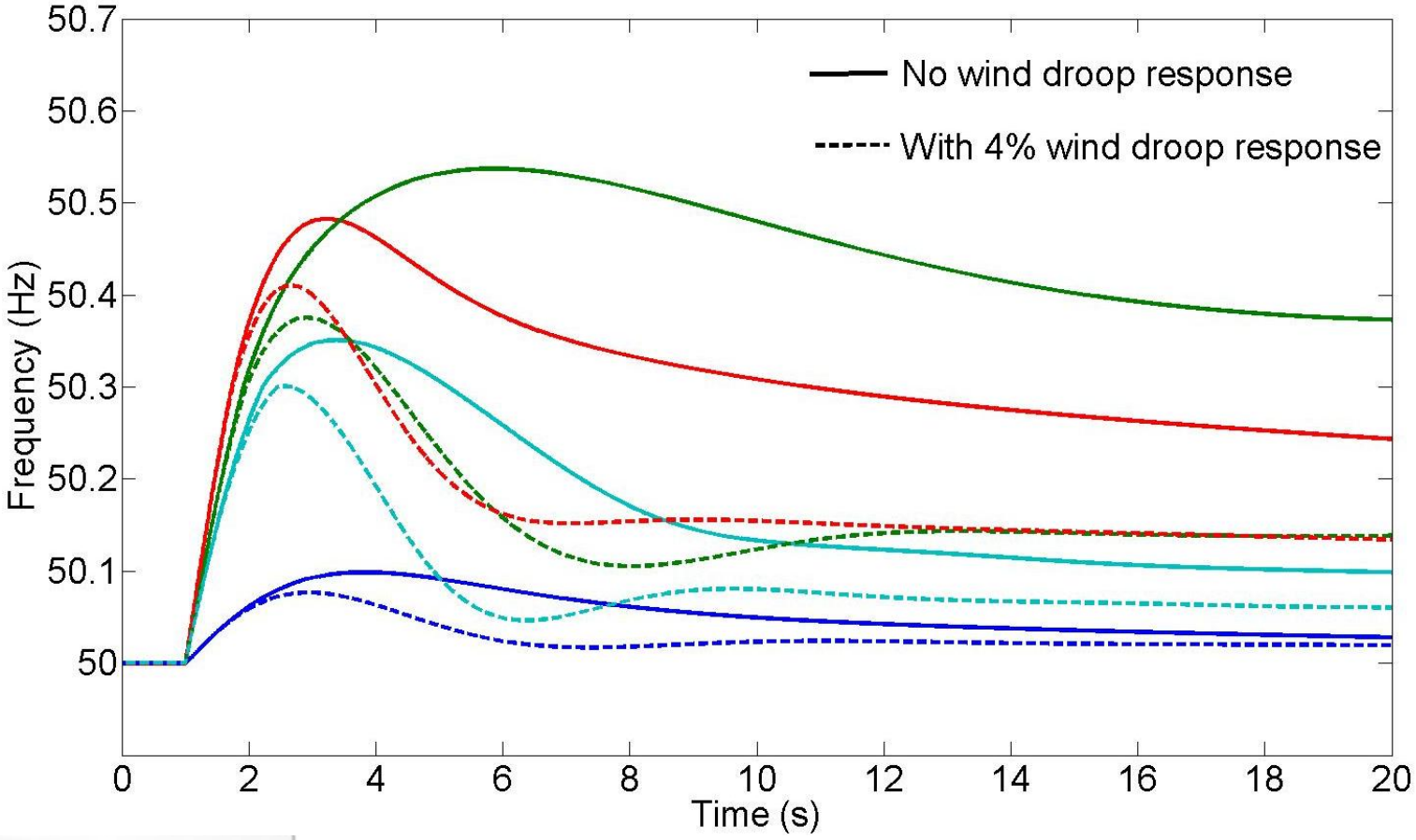


Impact of Total Trip Size

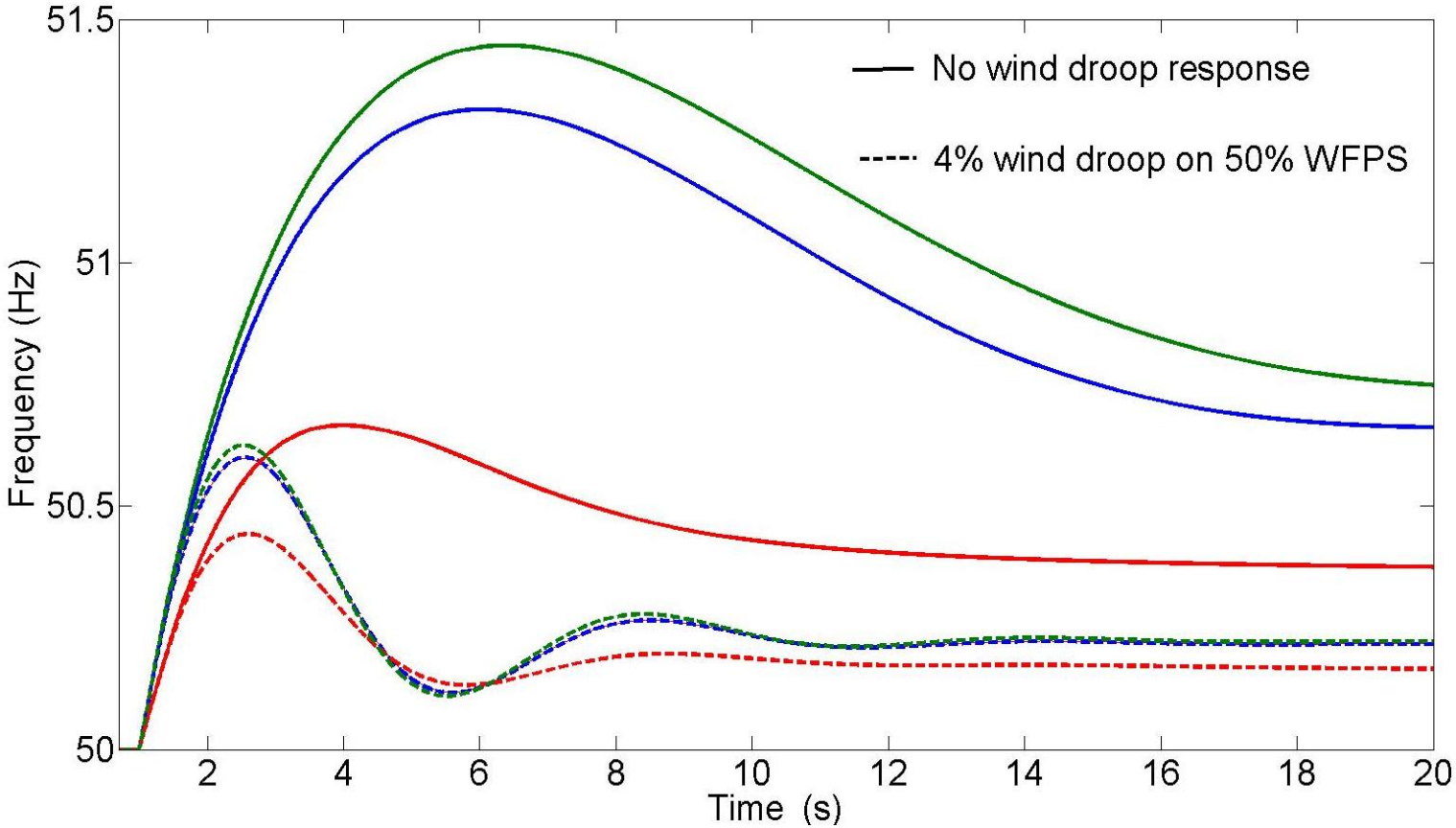


2. Over Frequency Generation Shedding

Large load Trip - 2013 Dispatches

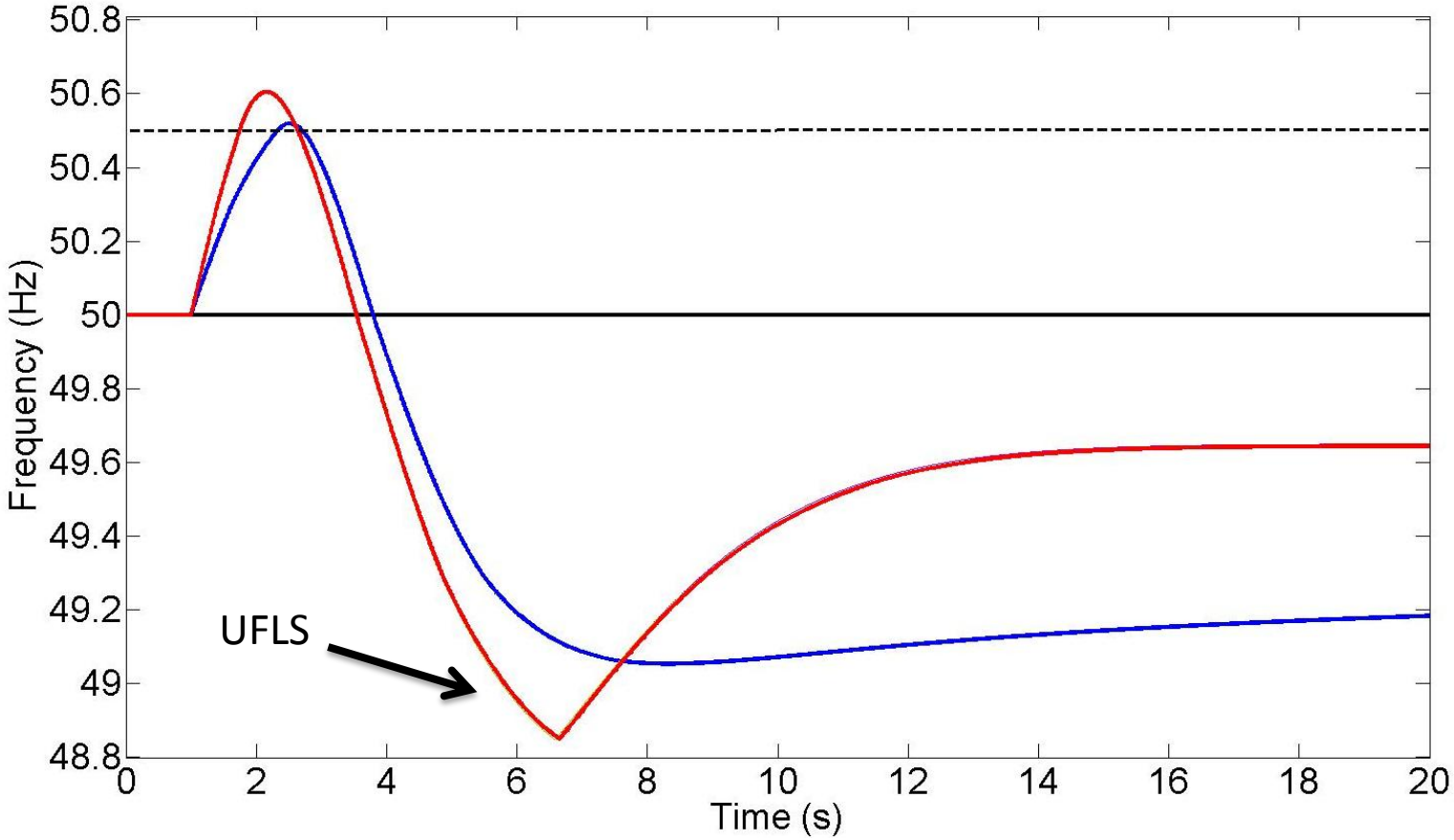


Large load Trip - Plexos 2020 Cases



Generation Shedding

Test with 1000 MW wind generation shedding at 50.5 Hz



Sample Generation Shedding

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

Conclusions

RoCoF findings

- Secondary tripping increases risk of UFLS

High frequency

- Increased risk of high frequency events
- Wind droop response can improve response
- Over frequency generation shedding settings should be monitored

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