DS3 Programme Status Update

19/06/13

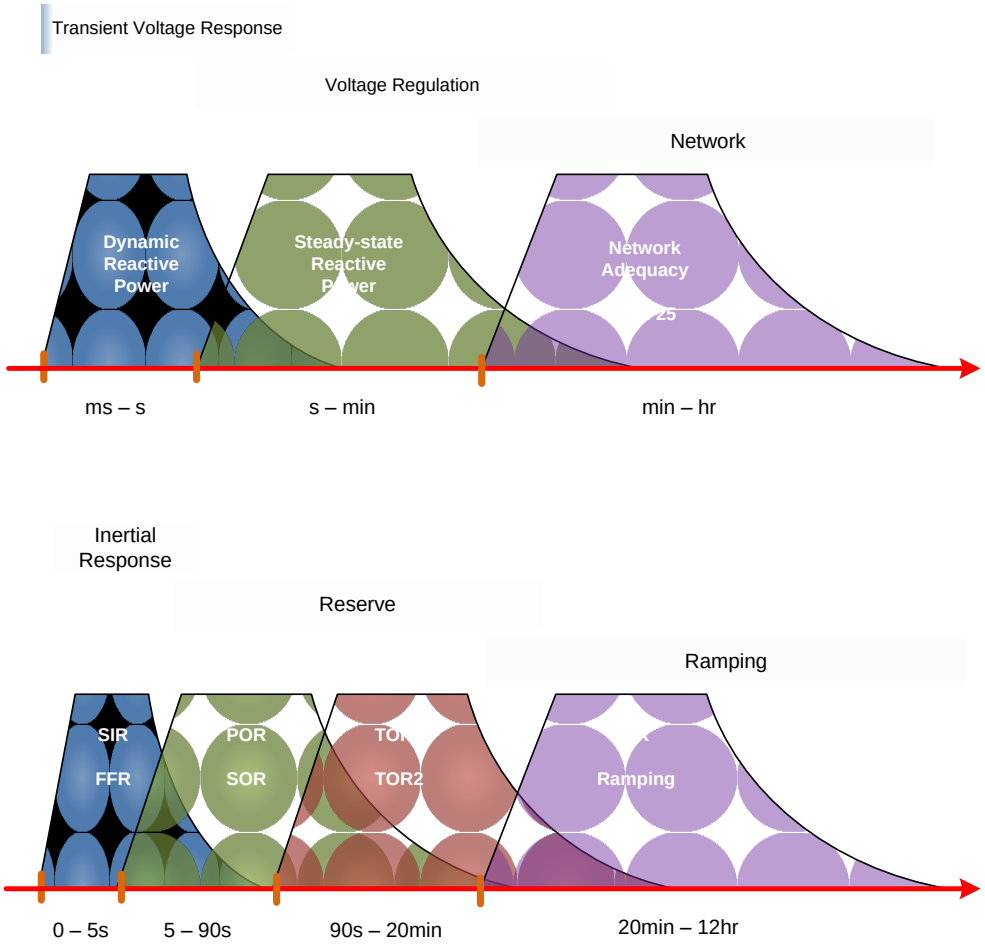
Yvonne Coughlan

DS3 -Critical Phase in terms of delivery

1. System Services
   - Decision on System Services
2. Grid Code Changes and Implementation (incl. RoCoF)
   - Some modifications approved
   - Others in progress
3. Progressing Distribution Code changes
   - Taking Grid Code changes and applying to Distribution Code
4. Operational Policies
   - Minimum No of Units, SNSP

System Services

- TSO Recommendations Paper published
  - May 2013
- Workshop scheduled – 26 June 2013
  - Overview of responses to Third Consultation
  - Key Recommendations
    - Products
    - Contractual
    - Remuneration
  - Financial Modelling
- Planning for next phase of System Services dependent on RAs' Proposed Decision



Grid Code

- Wind Farm Modifications - Ireland
  - Approved by CER in Feb 2012
  - EirGrid has written to all transmission connected wind farms requesting confirmation of compliance with new Grid Code standard
    - Deadline of 22 May 2013
    - Responses now received from all parties
    - Responses received do not fully address the technical queries
    - No timelines received from wind farm owners
    - Derogation requests need to be submitted by 2nd August 2013 (to facilitate review by EirGrid)
  - For wind farms without operational certificates
    - Existing Process is in place for obtaining Operational Certificates by 1st December 2013
    - Compliance with New Grid Code Modifications or mitigation actions will be assessed by TSO (including any derogations)
  - For wind farms with operational certificates
    - Revert with derogation request or mitigation actions to be taken

Grid Code

- Wind Farm Settings Schedule
  - Not approved by UREGNI
- ESBN Distribution Code modifications
  - ESBN Distribution Code Review Panel Meeting held on 18 June
  - Ramping, reactive power, fault ride through, voltage control requirements (similar to Grid Code) for Type A and Type B (some differences) recommended for approval
  - Next Steps: Progress wind farm modifications for other Wind Farm Types
- NIE Distribution Code modifications
  - Most requirements are covered in WFPS Settings Schedule
  - Unclear how Distribution Code changes are made in Northern Ireland

Grid Code

- RoCoF Modifications
  - Generator RoCoF Standard with CER/UREGNI for approval
  - Received ESBN report on RoCoF settings (outstanding questions)
  - Have not received full NIE report (2 page summary received)

- Dynamic Model modifications
  - Joint Grid Code working group meeting scheduled for end July
  - Plan to submit a modification for approval in Ireland – Sept 2013
  - Working out interaction with WFPS Settings Schedule

Model Development & Studies

- Significant studies underway
  - New dynamic models developed by Powertech
- Min Gen Pilot Study
  - Initial studies complete
- Validating Frequency Model
  - For inclusion in WSAT
  - For accurate calculation of RoCoF in real time
- Voltage Studies underway
  - Optimisation of voltage control
  - Over-compensation/PV analysis

DSM

- Grid Code
  - DSU modification Consultation concluded in Northern Ireland
  - Ireland DSU modification passed to CER for consideration
  - Workshop planned with industry for July
- New communications protocol being trialled
  - Secure “Inter Control Centre Protocol” (ICCP)
  - Electricity Exchange
- Workshop with existing DSUs and applicants
  - Planned for July 2013
  - Forum to look at changes/improvements that can be made
- Updated Plan to be provided in Q3 2013

Performance Monitoring & Testing

- Enhanced Performance Monitoring workshops
  - Held on 6th June in Belfast and 11th June in Dublin
  - 4 Presentations on Industry Perspective
  - Industry supportive of performance monitoring
    - Call for greater transparency and for TSOs to make performance assessment methodologies available

- Next Steps
  - Final comments on performance monitoring - end June
  - TSOs to publish views from workshops – End July
  - Follow up workshop on business processes

- Roll out of Enhanced System – Q4 2014

Performance Monitoring & Testing

- Developing sample all island test procedure – June 2013
  - Template for other test procedures
- Drafting of other test procedures
  - Due to commence Q3 2013
- Testing Guidelines in draft
  - Wind Farm Modifications

Actions from Last Advisory Council Meeting

Vector Shift

- Have held a meeting with NIE on Vector Shift
- High Level analysis carried out
- Potential Vector Shift Ranges
  - 10 - 15 and 3.5 - 9.8 (dependent on specific connection arrangement)

Loss of Largest Infeed

- The largest single electricity source is known as the largest infeed
- System operators maintain sufficient spinning reserve to cover the loss of the largest system infeed
- Loss of the maximum infeed may not have the greatest impact on system security
  - Unit with high inertia carrying significant reserve may have a greater impact
- Also cover “Less Probable Contingencies” (HILP Events)
- New Risk of “loss of Embedded Generation”
- Paper will be published in Q3 2013

Operational Limits

- Greater focus on other binding constraints on system (other than SNSP)
  - Investigation underway
  - Min Number of Sets (Pilot Study complete – further study planned)
  - Inertia (calculating frequency of curtailment)
  - Examining estimate of various factors for inclusion in curtailment report
  - Update will be given at next Advisory Council meeting

Relevant Industry Developments

- Gate 3 constraint reports issued

Assumptions

- DS3 work plans assumed RoCoF workstream fully resolved by the end of 2013
- Based on above, System Operators expected to increase SNSP to 60% by start of 2014
- Delays now expected to this date
- Re-programming dependent on outcome of RoCoF decision by RAs
- Initial Estimate – Movement of SNSP will be delayed to start of 2015
  - Will impact on projected curtailment levels in 2014

Industry Perspective

19th June 2013

Peter Harte

Industry Perspective

19th June 2013

Joe Duddy

RoCoF Update

19th June 2013

Robert O'Rourke

DS3 Voltage Control Studies
Reactive Power and Wind Farm Clusters

Paul Cuffe

erc electricity research centre

UCD DUBLIN

Background

- Wind generation Grid Code modifications:
  - Control Modes (Power Factor, Voltage, Reactive Power)
  - Reactive Power Capability
  - Fault Ride Through Requirements

- New standards will also apply to distribution connected wind generation (via WFPS setting schedule in Northern Ireland and Distribution Code modifications in Ireland)

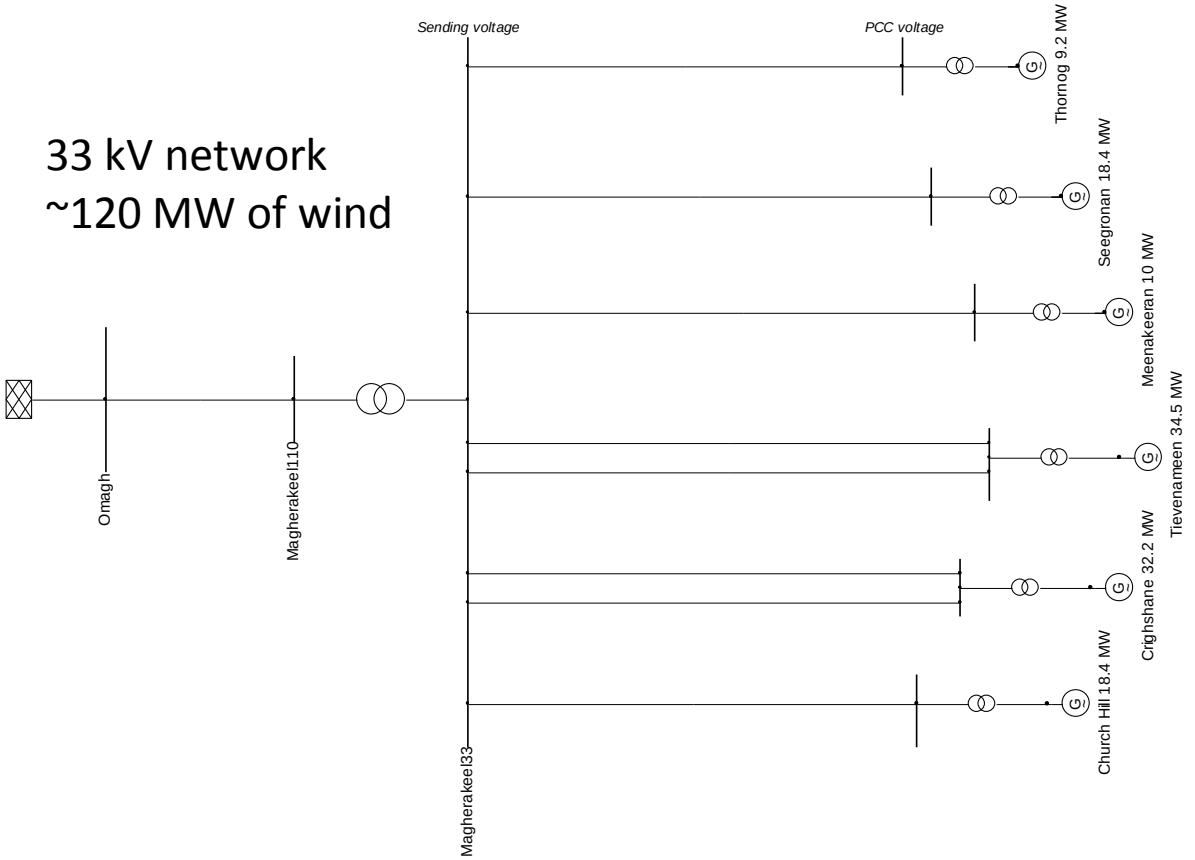
- Study recently undertaken to look at performance of different control schemes on a sample of distribution connected wind-farm clusters.

The Questions

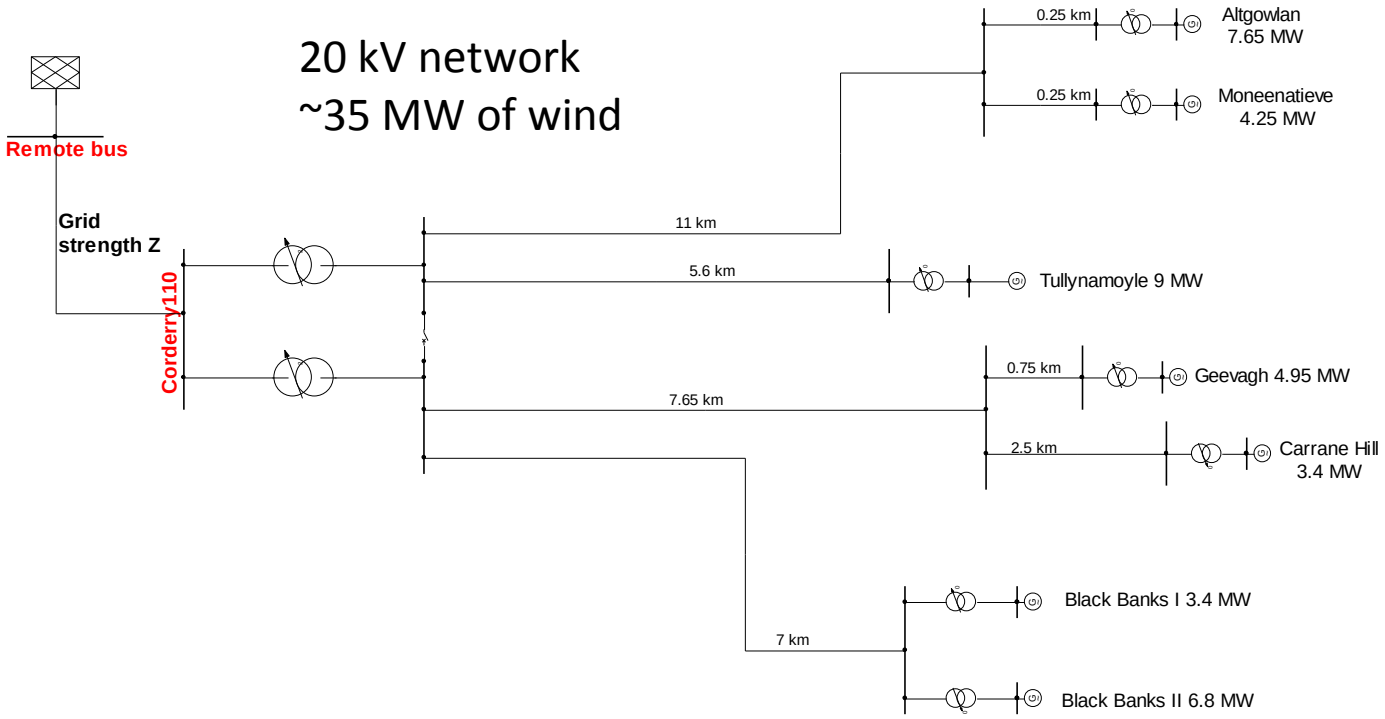
- How to use reactive power from wind farm clusters?
- Will enabling voltage control help at the transmission level?
- What about tap-changing bulk supply transformers?

The Networks: Magherakeel

33 kV network
~120 MW of wind



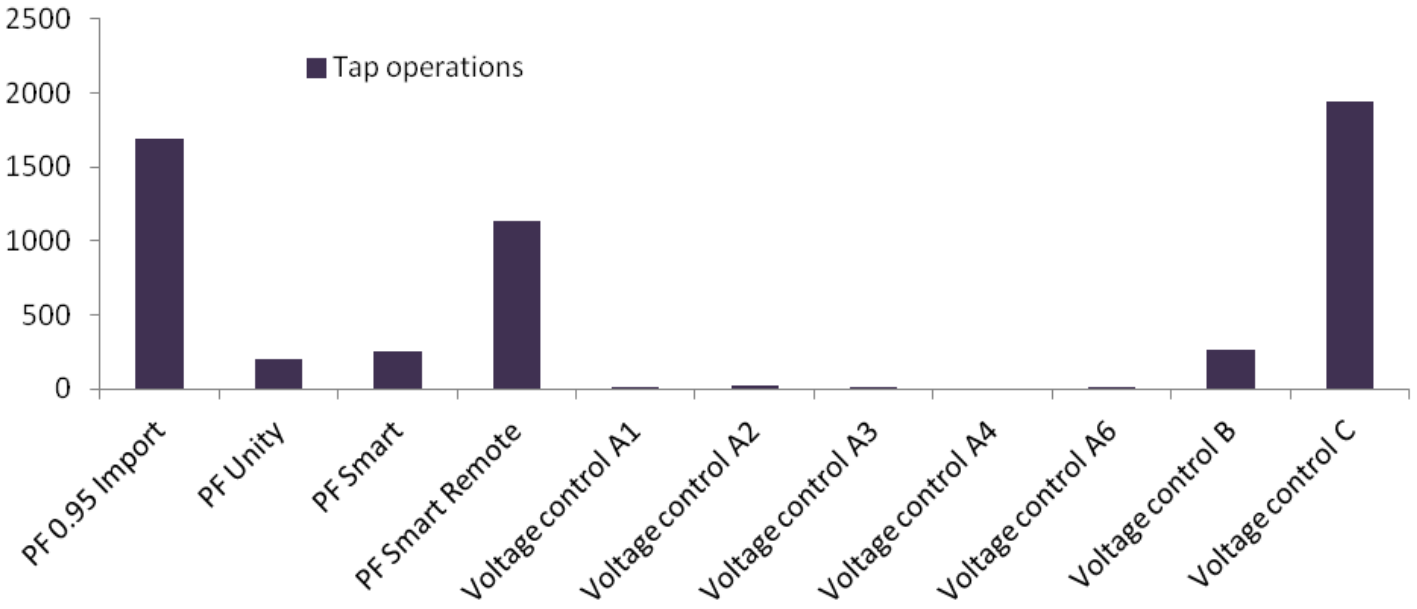
The Networks: Corderry



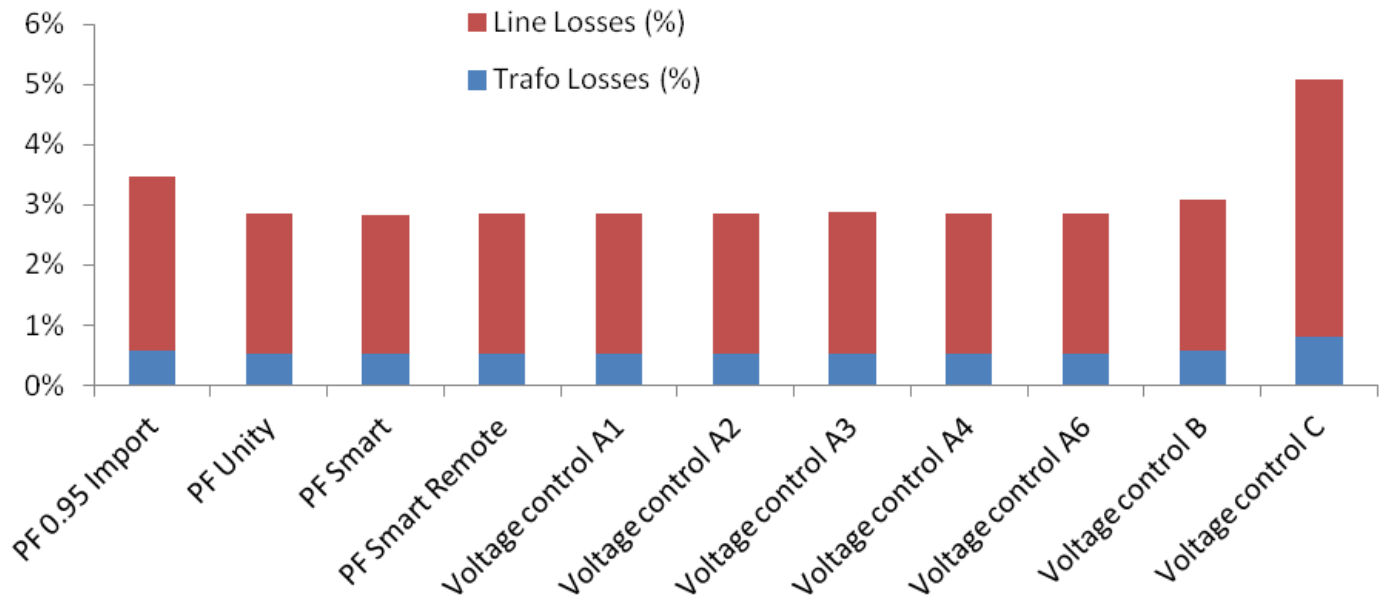
Study approach

- Many simulation cases:
  - Power factor regimes
  - Voltage control modes
  - Active control schemes
- Load flow every minute over test month
- Re-tap transformer if voltage deviation persists for two minutes

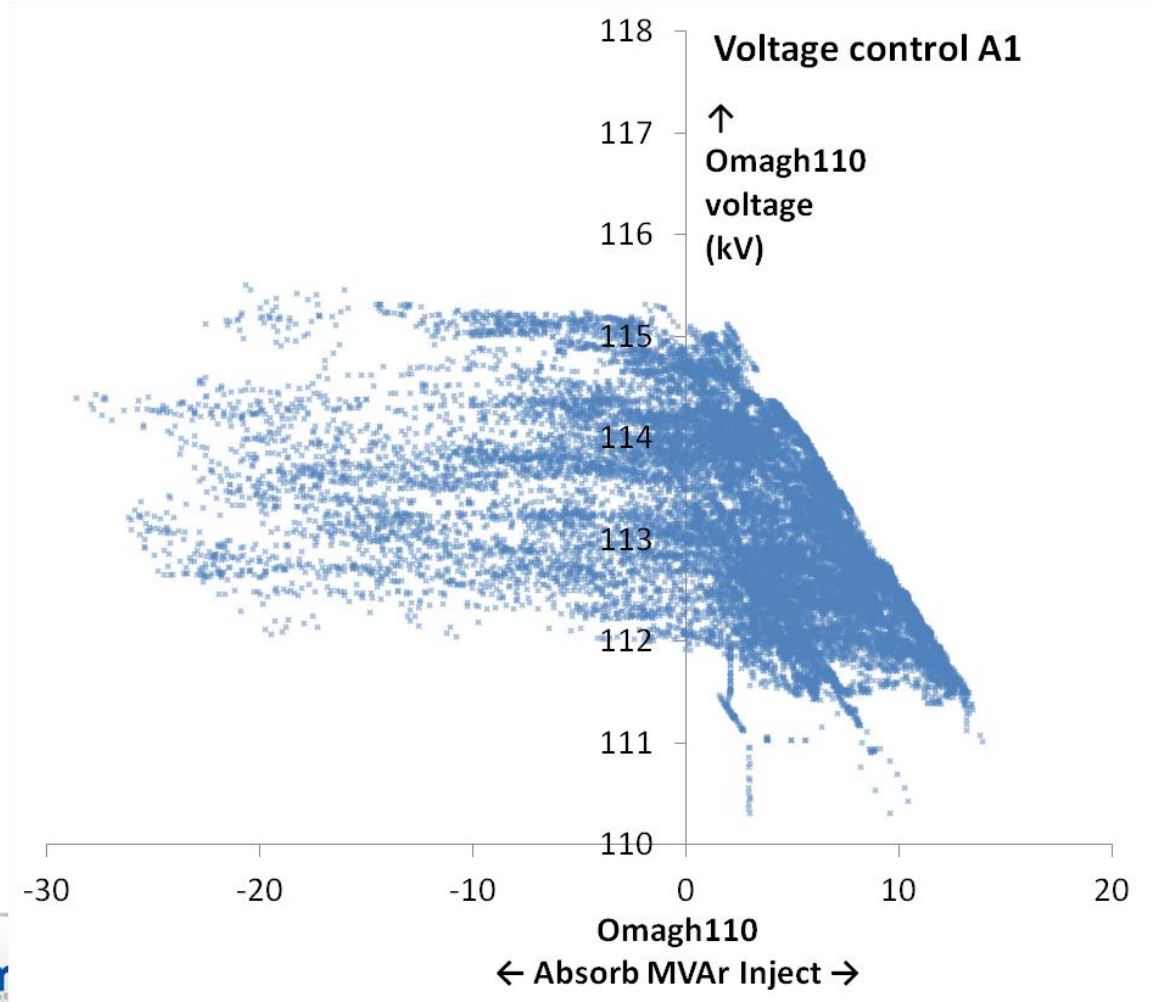
M’keel results: Taps



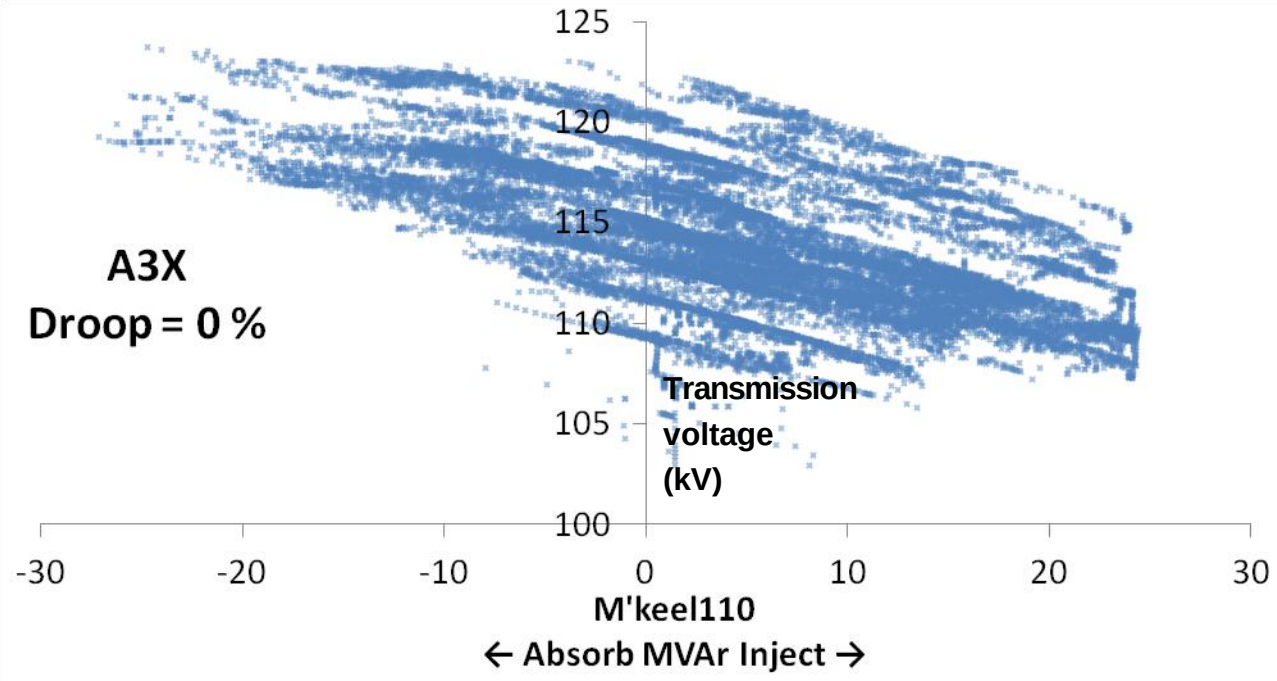
M'keel results: Losses



M’keel results: Voltage control



M’keel results: Effect of droop



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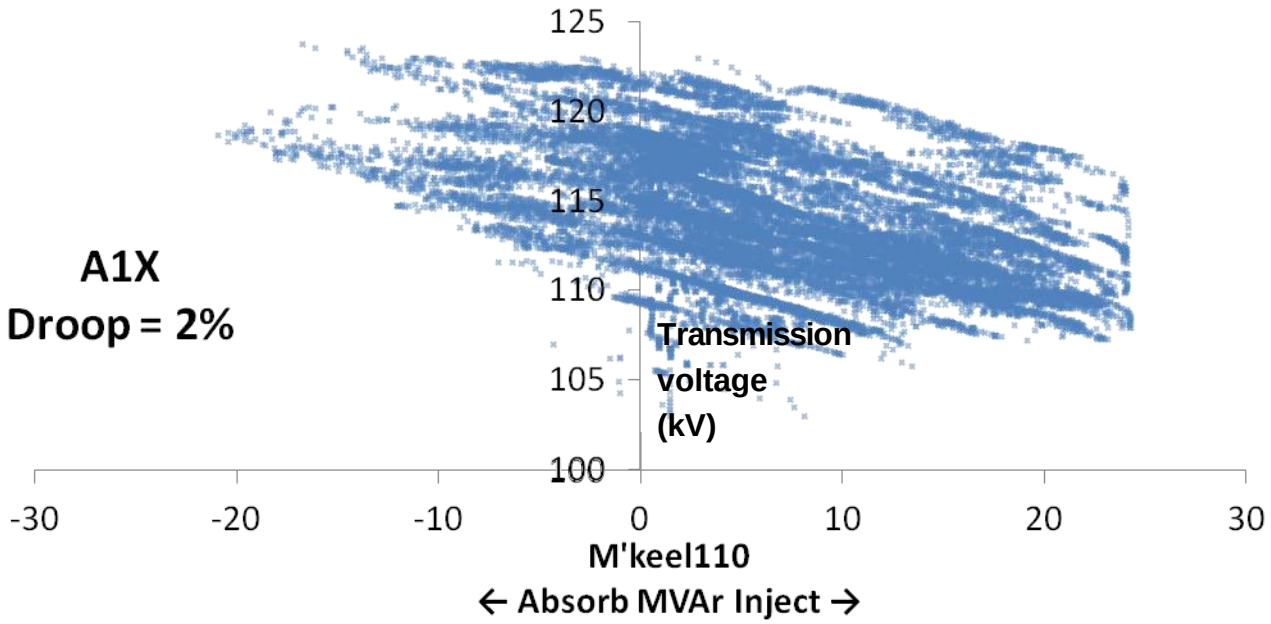
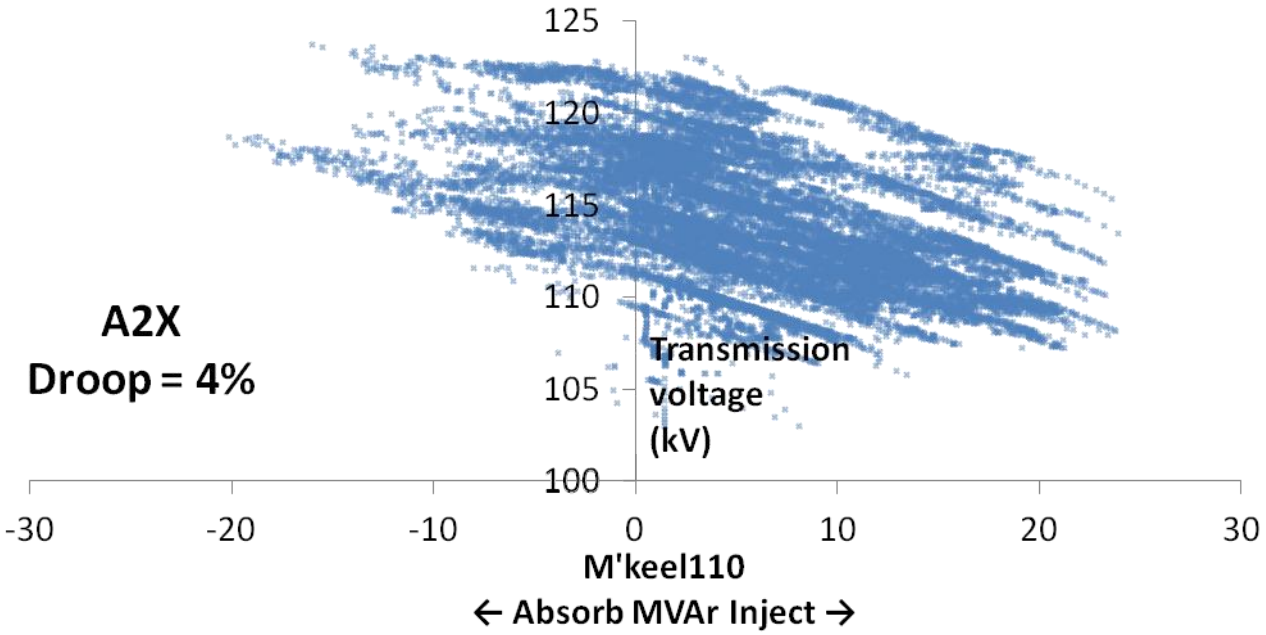
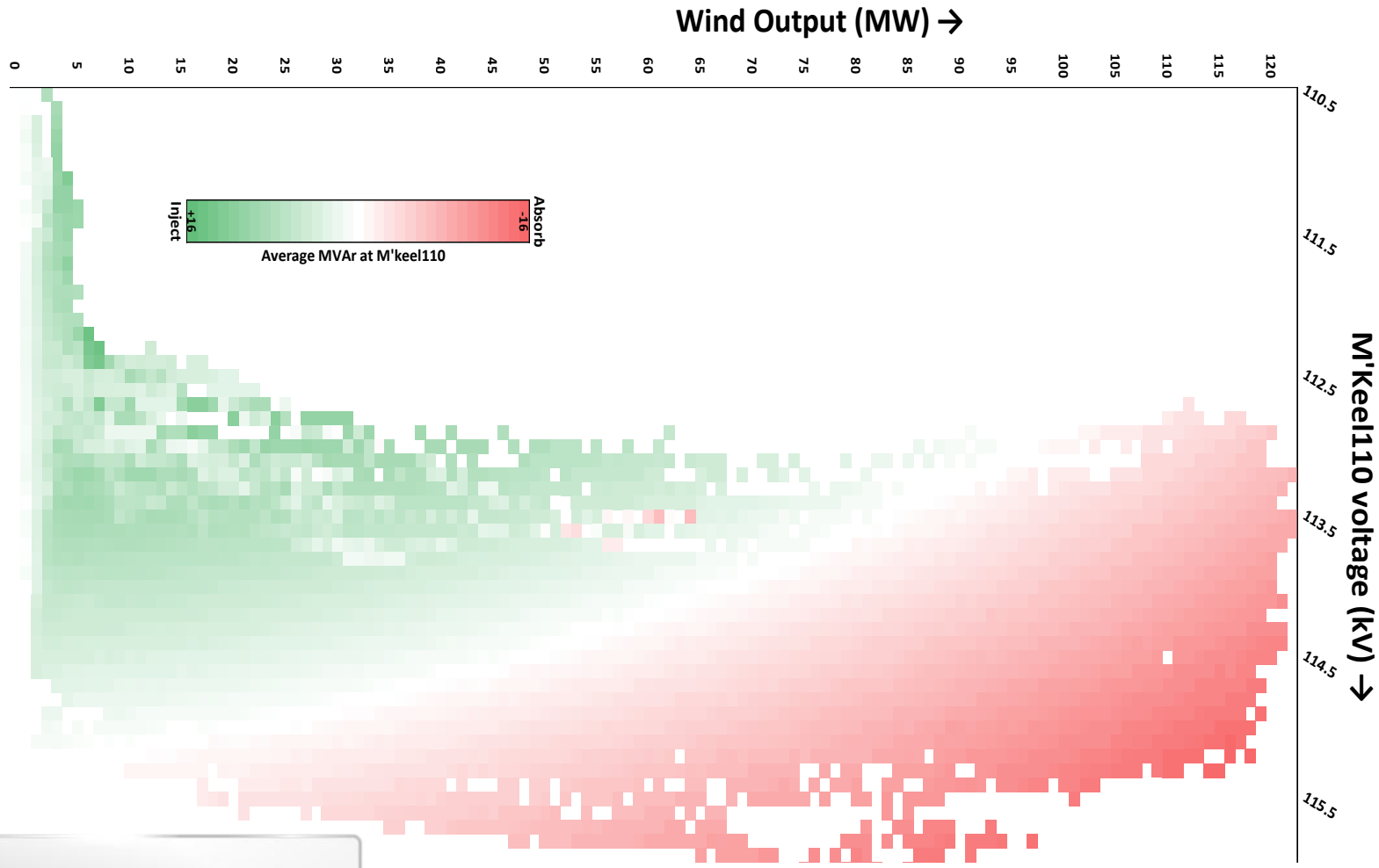


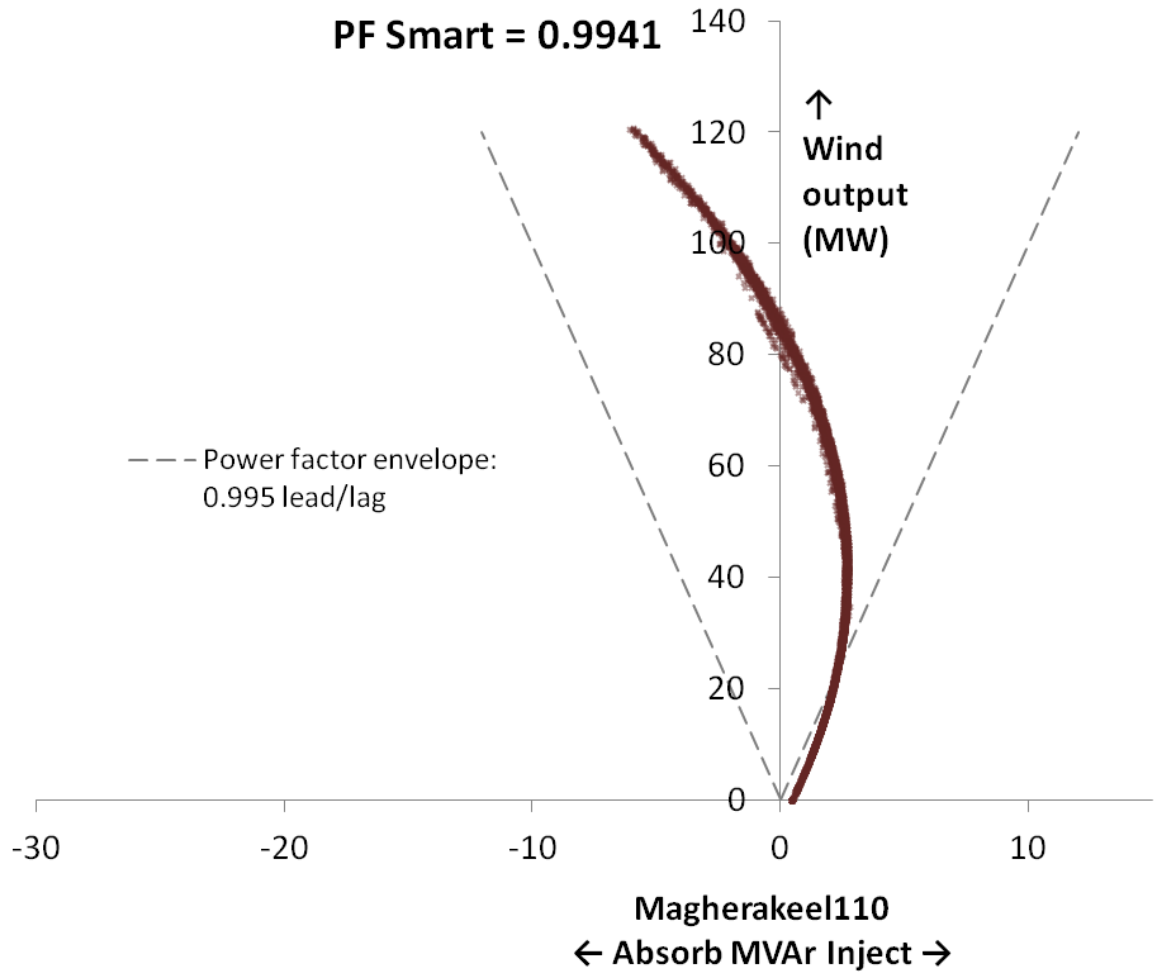
M’keel results: Effect of droop



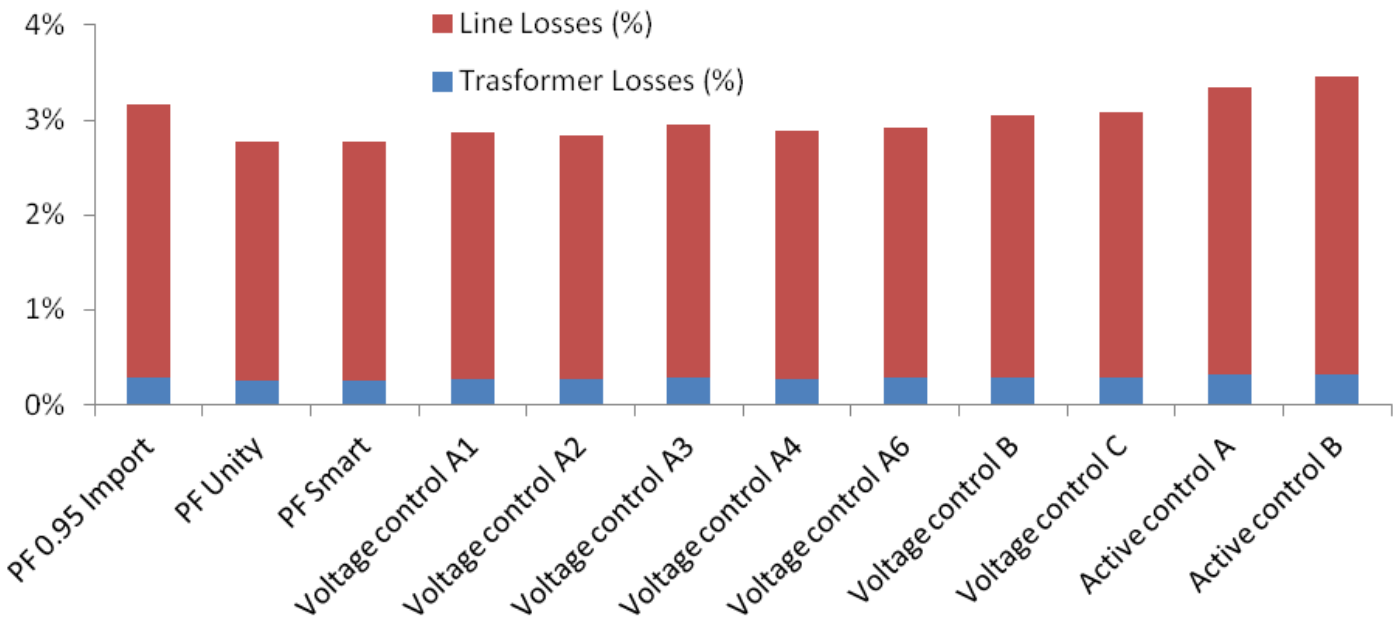
M’keel results: P, Q, V



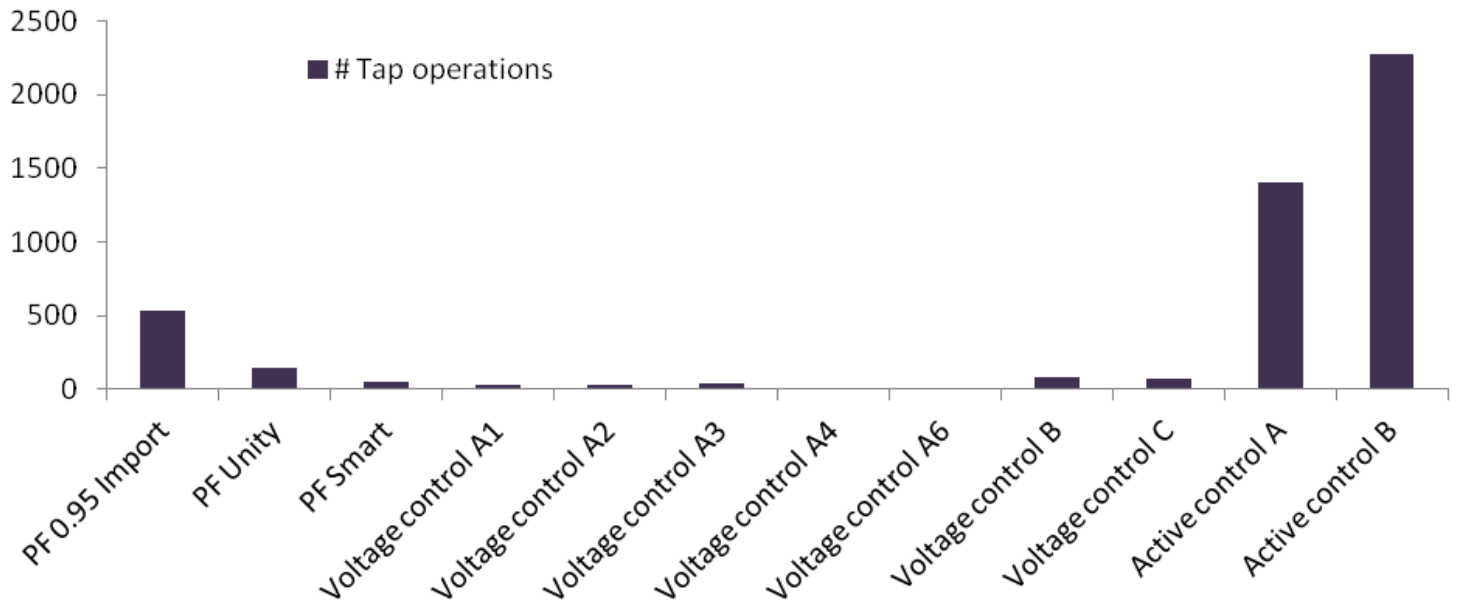
M’keel results: Smart power factor



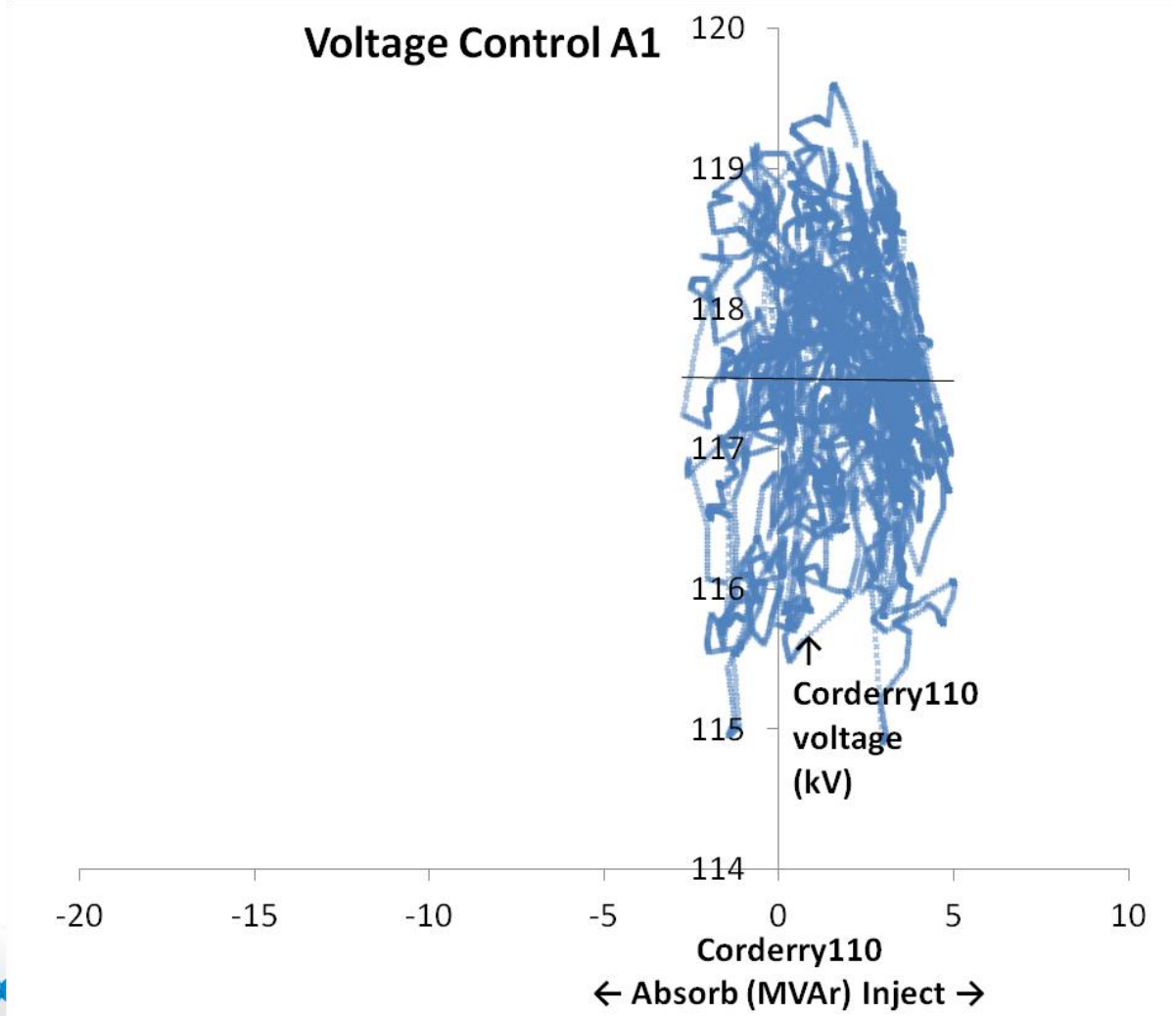
Corderry results: Losses



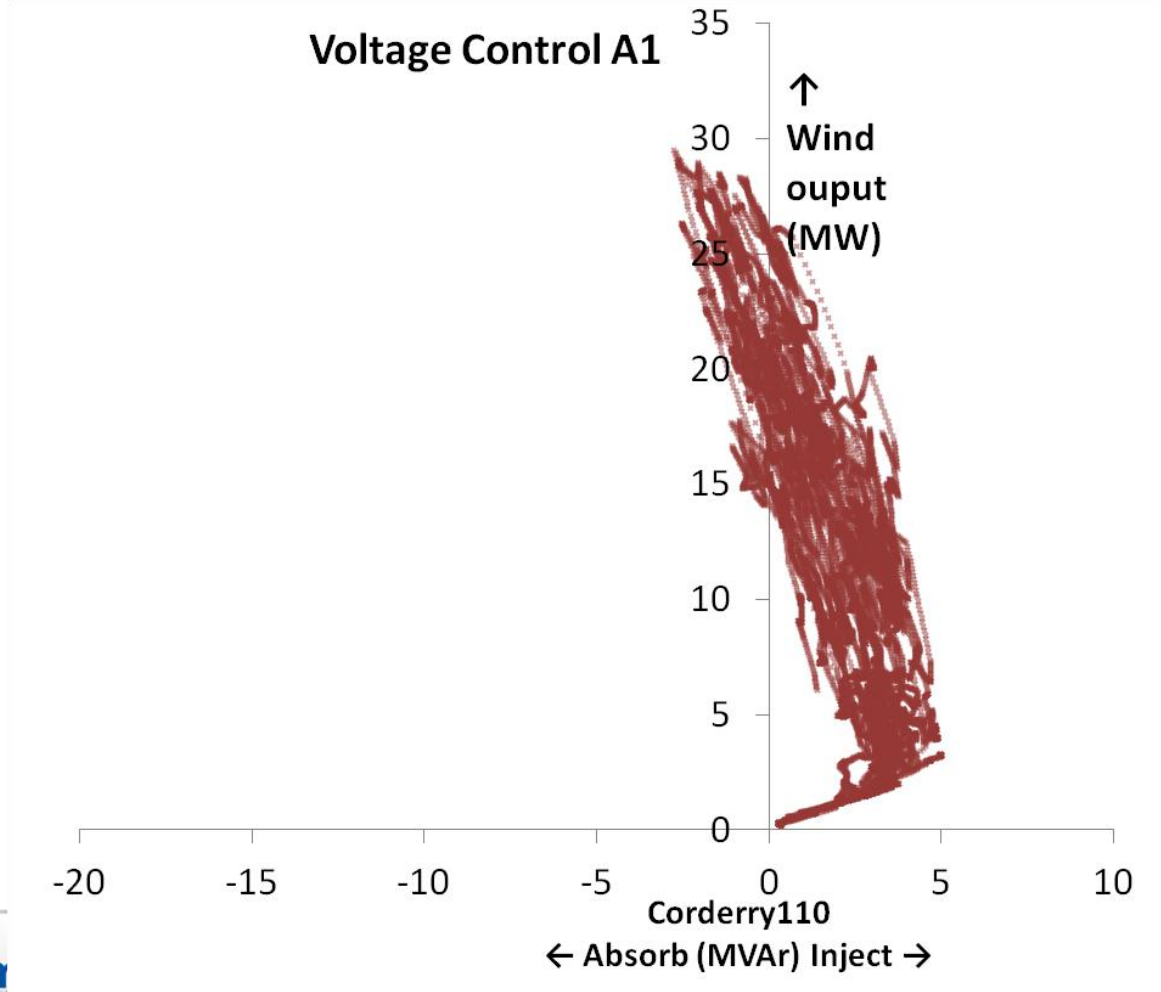
Corderry results: Taps



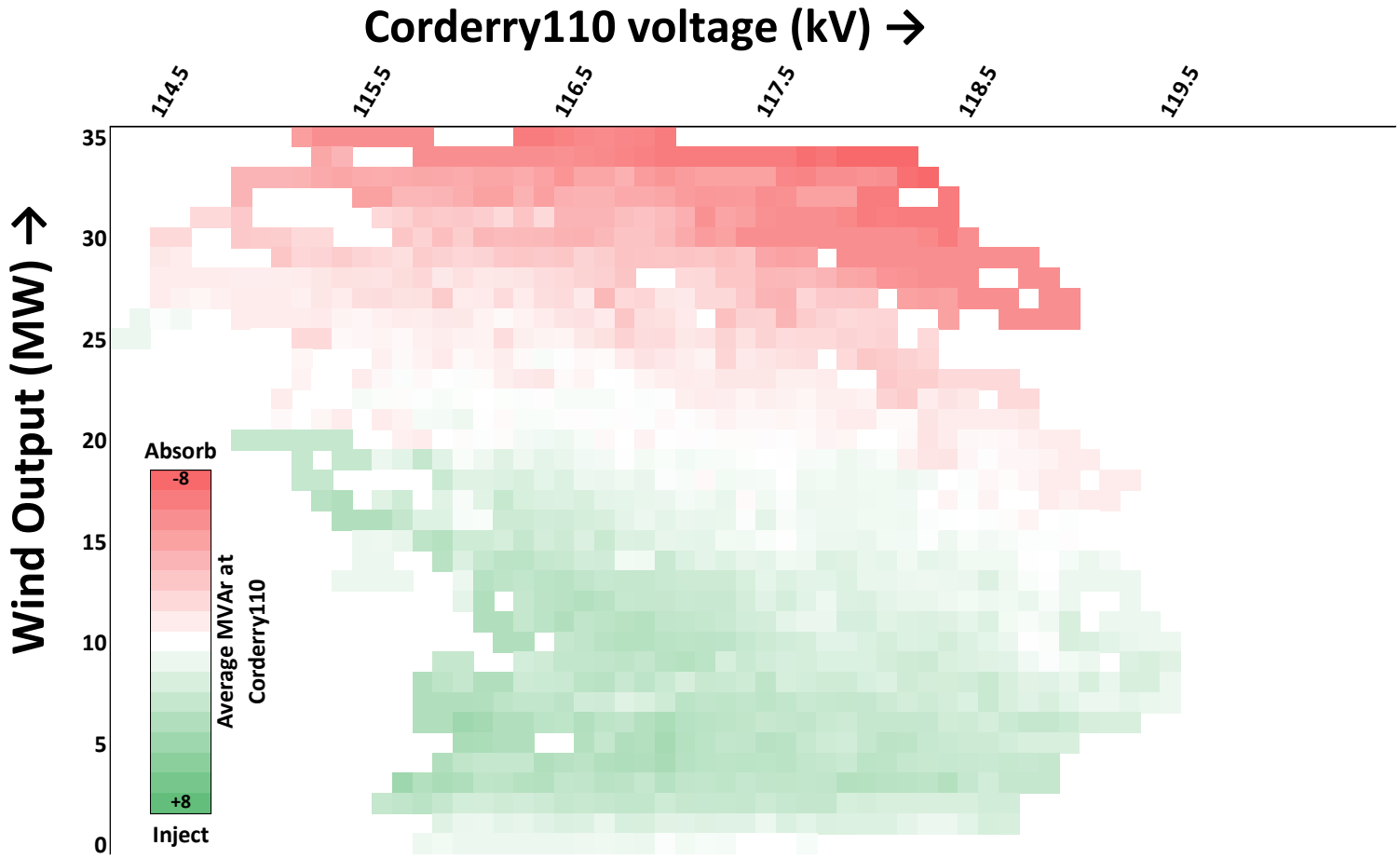
Corderry results: Voltage control



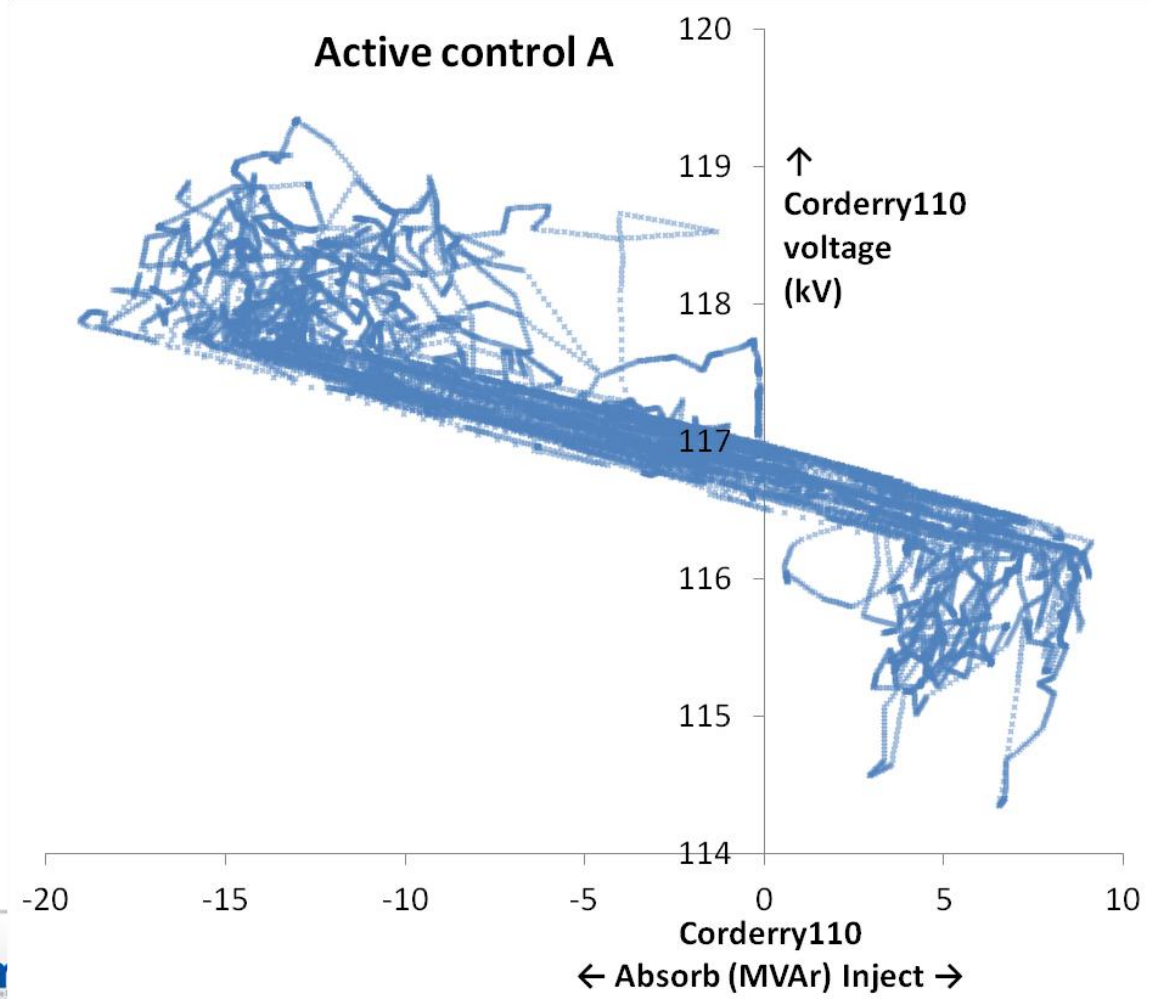
Corderry results: Active and reactive flows



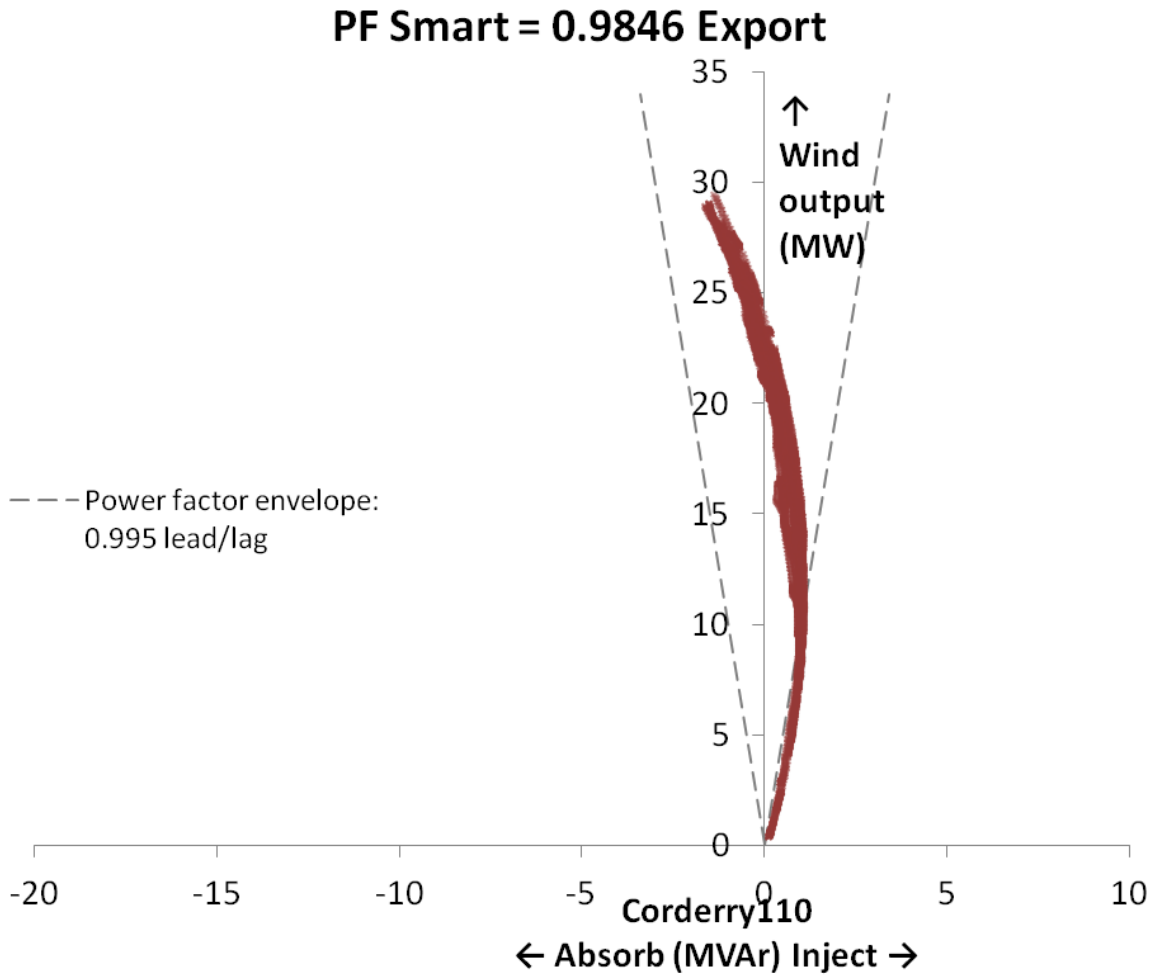
Corderry results: P, Q, V



Corderry results: Active control



Corderry results: Smart power factor



Performance Summary

- Performance achievable is dependant on each distribution network
- Transmission system reactive power requirements vary by location
- A number of options are available, and it probably isn't *one-size-fits-all*

Control scheme	Tapping activity	Active losses	Q/V response	Q/P response	Ease of roll-out
Voltage control	↘	→	↗	↓	↘
Unity power factor	↘	→	→	↘	↑
Enhanced power factor	↘	→	→	↑	↑
Active control	↓	↘	↑	↑	↓

Next Steps

- These studies focused on the performance of two sample embedded wind-farm clusters. Further analysis is underway to determine the wider transmission system impact (Q4 2013).

- The TSOs and DSOs are to work together on further consideration of control arrangements and their implementation – further planning of the work in this area is required.

- Ultimately an agreed TSO/DSO reactive/voltage control protocol is envisaged (Q4 2014).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System Services Update

19th June 2013

Michael Preston

TSO Recommendations Paper

- Paper sent to the RA's in late April
  - Delayed by 4 weeks due to additional time and materiality of the responses
- Paper published on the TSO's websites on 24th May 2013
- Engagement with RA consultants Poyry in last three weeks

Principle Recommendations

- The system service products are, in so far as possible, technology neutral.
- Price regulation based on value approach informed by incremental capital cost and allocated by relative service approach option 3.
- Flat tariff, fixed for at least 5 years.
- New system services:
  - Synchronous Inertial Response
  - Fast Frequency Response
  - Fast Post Fault Active Power Recovery
  - Ramping (1, 3 and 8 hour)
  - Dynamic Reactive Power.

Detailed Recommendation

- System service rates should be determined by the recommended approach.

- The total benefit from System Services is €355 million and should be used to determine the product tariffs to be employed from 1st Oct 2015.

- The determination of how these revenues interact with Capacity Payments is a matter for the SEMC.

Recommendation for further consultation

- The exact portfolios and methodology to be used in determining the allocation between system services.
- The System Services contract framework including termination clauses.
- The process and implementation details for determining the performance scalars.
- The details associated with the implementation of the products and their remuneration.
- The process for determining and setting the rate scalars (including reference price).

Next Steps

- May- June Working with RA consultants Poyry
- June 26th System Services Forum to clarify and explain TSO recommendation
- June TSO make short presentation to SEMC
- July 2013 - SEMC proposed decision to be issued following Poyry report
- Sep 2013 - SEMC High level decision to be issued
- Phase 2 begins


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Curtailment Report 2012

19/06/2013

Jon O'Sullivan

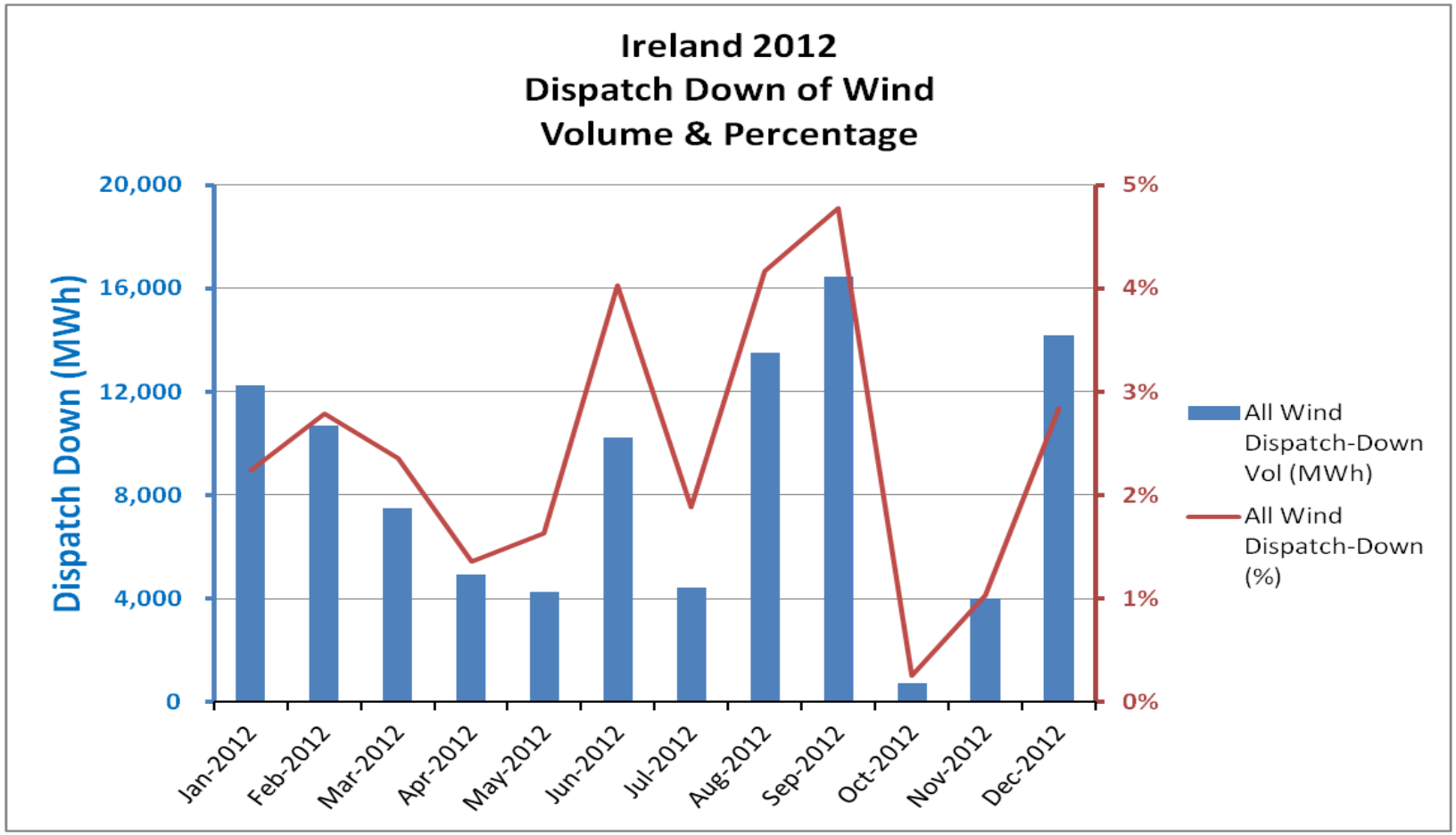
Results for 2012

- EU legal obligation (Art 16 RES Directive)
- SEM 011-62
  - Hierarchy used based on VPTG
- Operational Issues of Note
  - Turlough Hill (Refurbishment)
- EWIC- no counter-trading in 2012

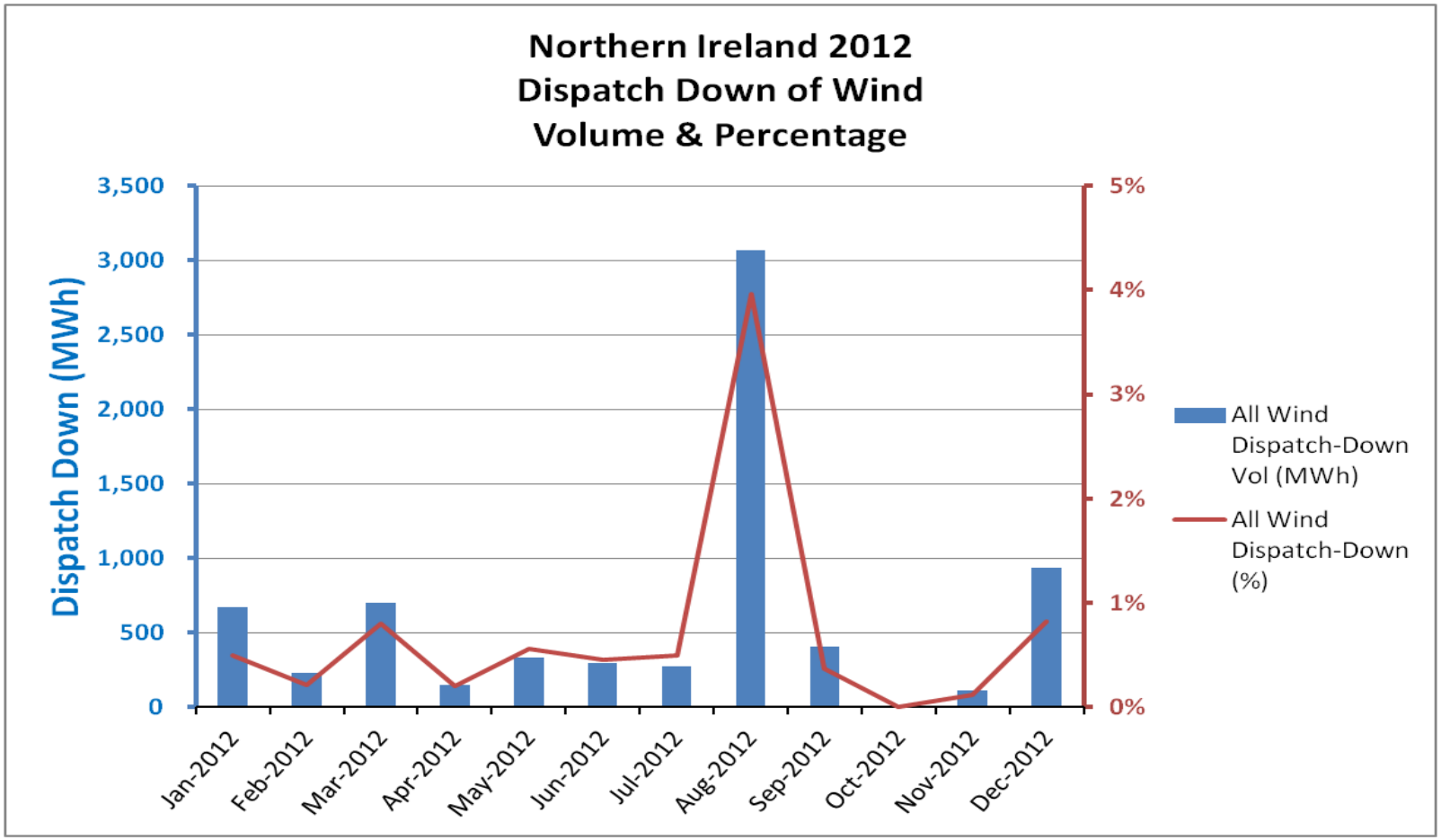
Jurisdictional Breakdown 2012

	IRE	NI	All Island
Total RES-E	17.3%	12.5%	16.5%
Dispatched Down Wind (GWh)	103.1	7.2	110.3
Dispatched Down Wind (%)	2.5%	0.7%	2.1%
Dispatched Down VPTG Wind (GWh)	80.9	7.2	88.1

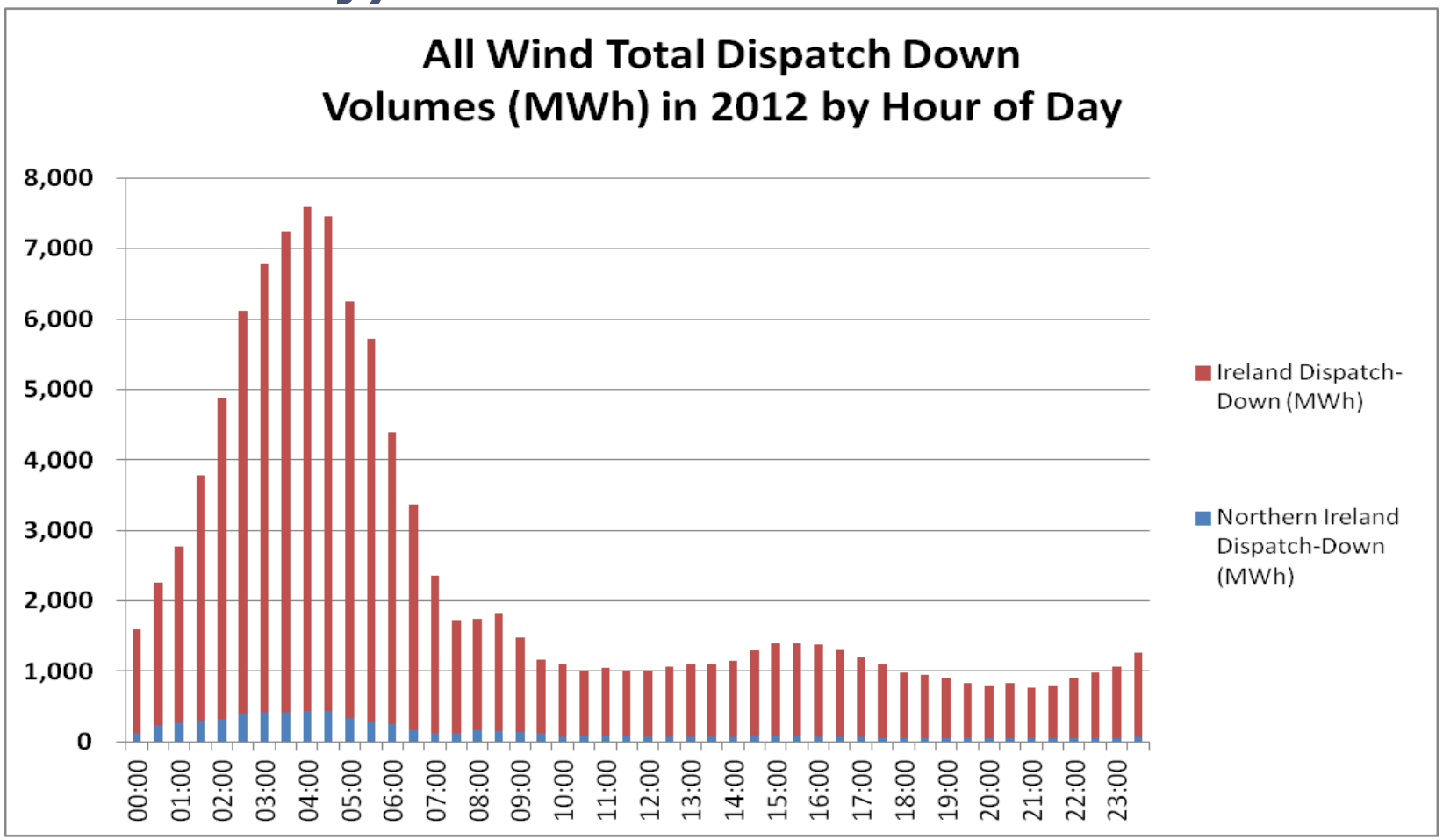
Ireland- Dispatch Down of Wind 2012



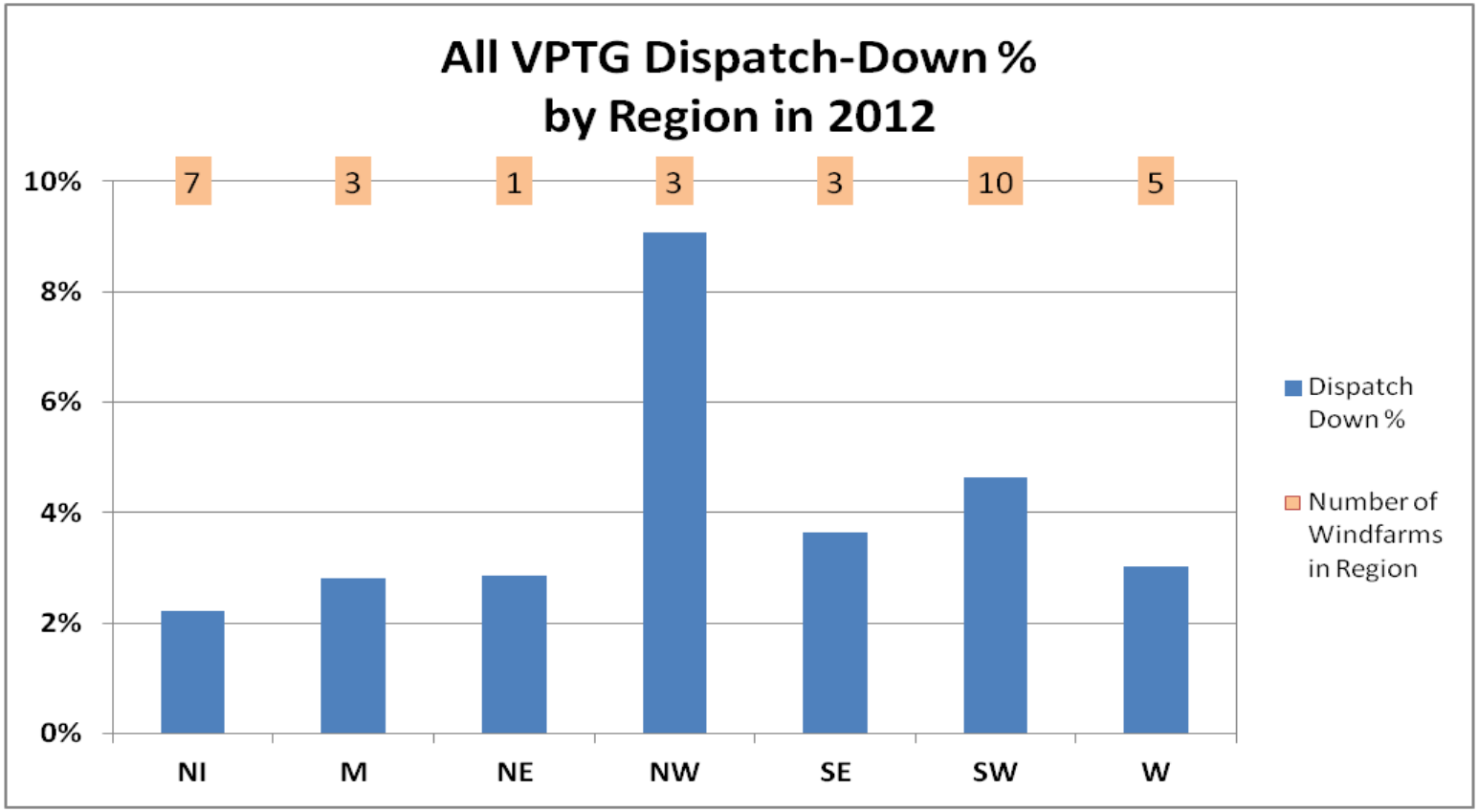
N. Ireland- Dispatch Down of Wind 2012



All-Island Dispatch Down of Wind 2012 (by Hour of Day)



VPTG Dispatch Down by Region

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All-Island High SNSP Reports 2012

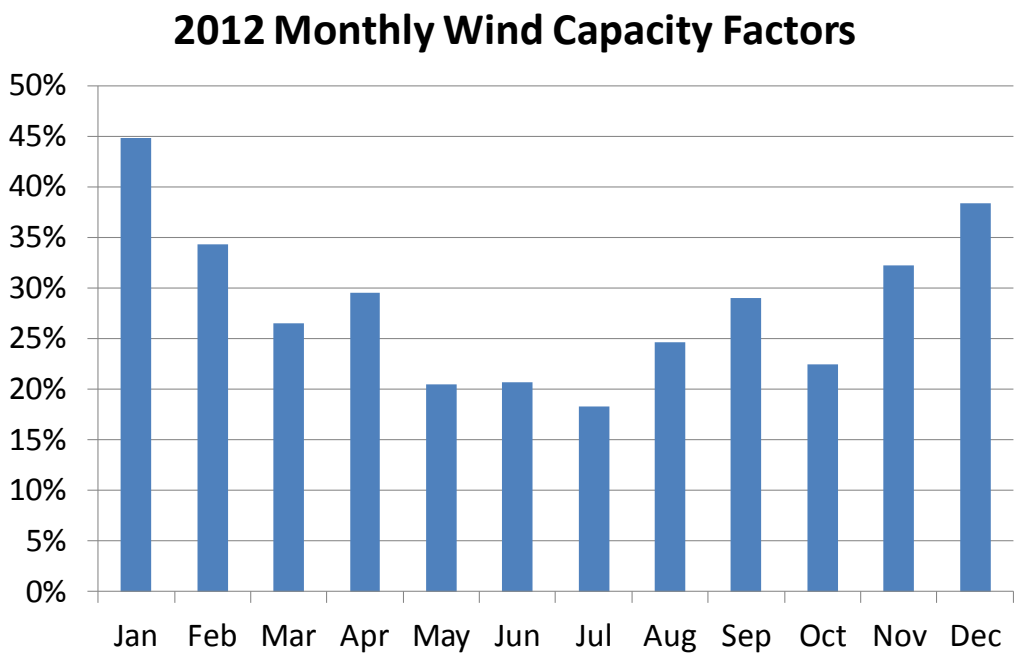
David Cashman

DS3 Advisory Council Meeting

19th June 2013

Wind Statistics

- Capacity Factor 2012: 28.5%
- All-Island Wind Generation record of 1875 MW on December 18th 2012 (SNSP 48.11%)
- On December 28th wind accounted for 37.3% of demand
- Maximum recorded SNSP: 50%
- 49 Days in 2012 where wind exceeded 40% of demand



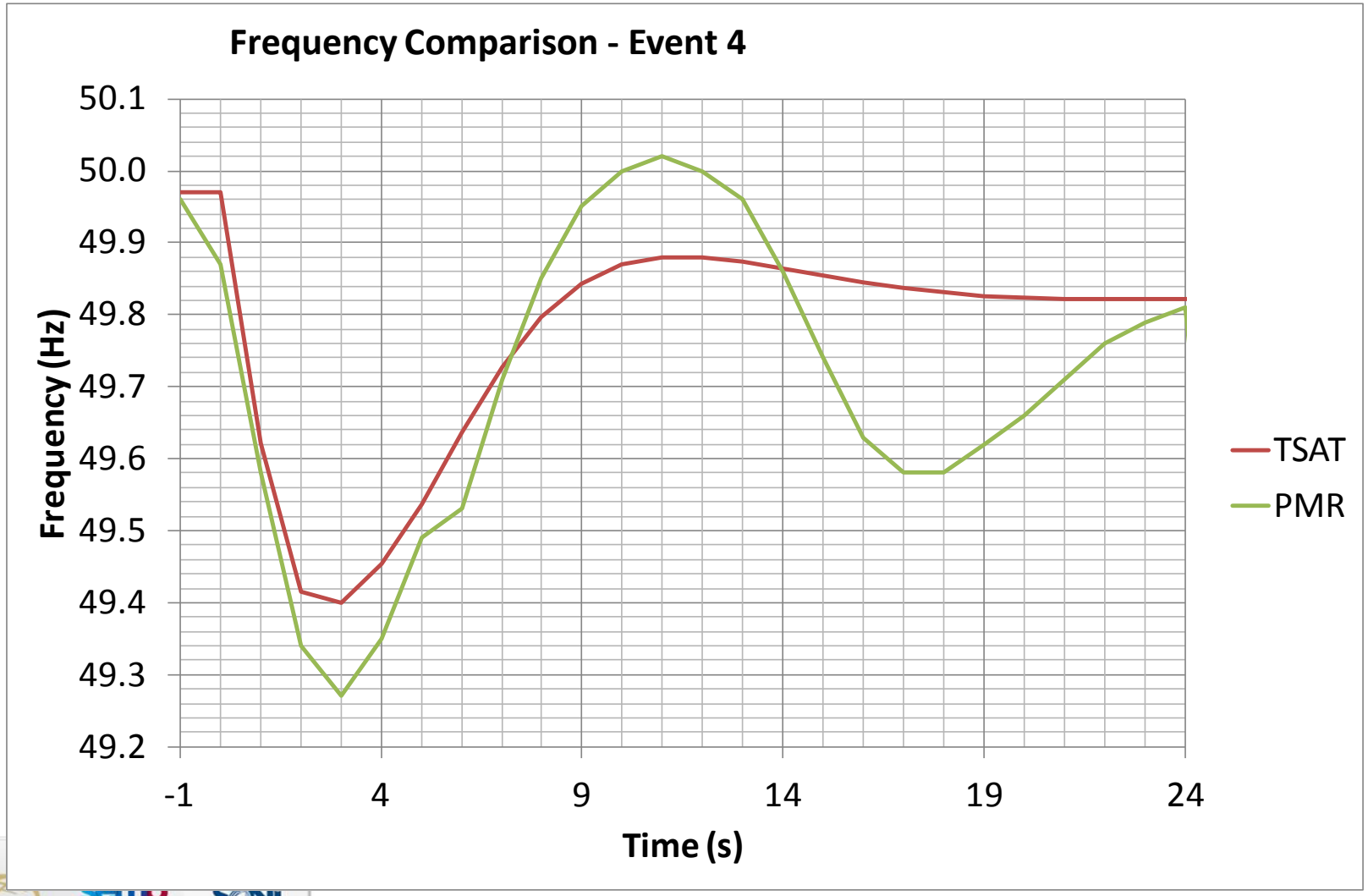
All-Island High SNSP Reports

- Snapshot of the All-Island System taken
  - High Wind
  - High SNSP
  - Low Inertia
  - Low Inertia relative to size of Largest In-/Out-feed
- Voltage Stability
  - Power transfer analysis
- Frequency Response
  - Fault followed by Loss of In-/Out-feed
- Critical Clearance Time
  - Angular stability

All-Island WSAT

- Moved from Ireland-only to all-island model in November 2012
- Currently used in both Control Centres for voltage and transient stability analysis
- Programme of continuous improvement is underway with a view to employing the frequency stability analysis capabilities of WSAT in both Control Centres
- Comparison against real events

All-Island WSAT Frequency Response



Analysis of All-Island High SNSP Reports - 2012

- All-Island WSAT model became available off-line in August 2012. 28 reports compiled between August and year end 2012
- At the beginning of 2013 a summary document was compiled outlining the major findings and operational recommendations in relation to transient, voltage and frequency stability.
- To date results do not demonstrate any voltage or transient stability issues at current levels of SNSP.

Date	SNSP %	Voltage Stability	Transient Stability
26-08-12	50	✓	✓
26-09-12	49	✓	✓
20-11-12	46	✓	✓
19-12-12	50	✓	✓
22-12-11	50	✓	✓

Analysis of All-Island High SNSP Reports - 2012

- Simulate 3-phase fault at HV terminals of generator followed by tripping of generator (highly onerous and low probability)
- RoCoF measured over 500 ms as per proposed Grid Code modification
- Investigating System Separation

Date	SNSP %	Fmin Hz	RoCoF Hz/s no Fault
26-08-12	50	49.6	0.21
26-09-12	49	49.5	0.36
20-11-12	46	49.5	0.22
19-12-12	50	49.5	0.28
22-12-11	50	49.5	0.22

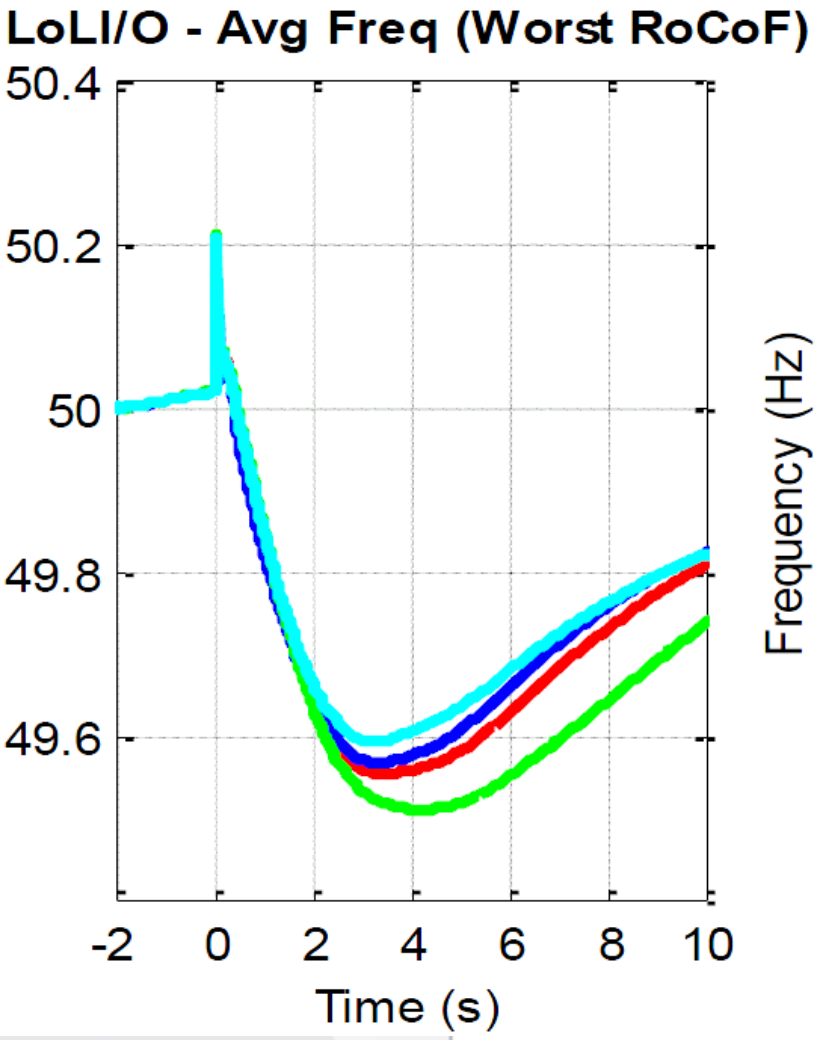
Analysis of All-Island High SNSP Reports - 2012

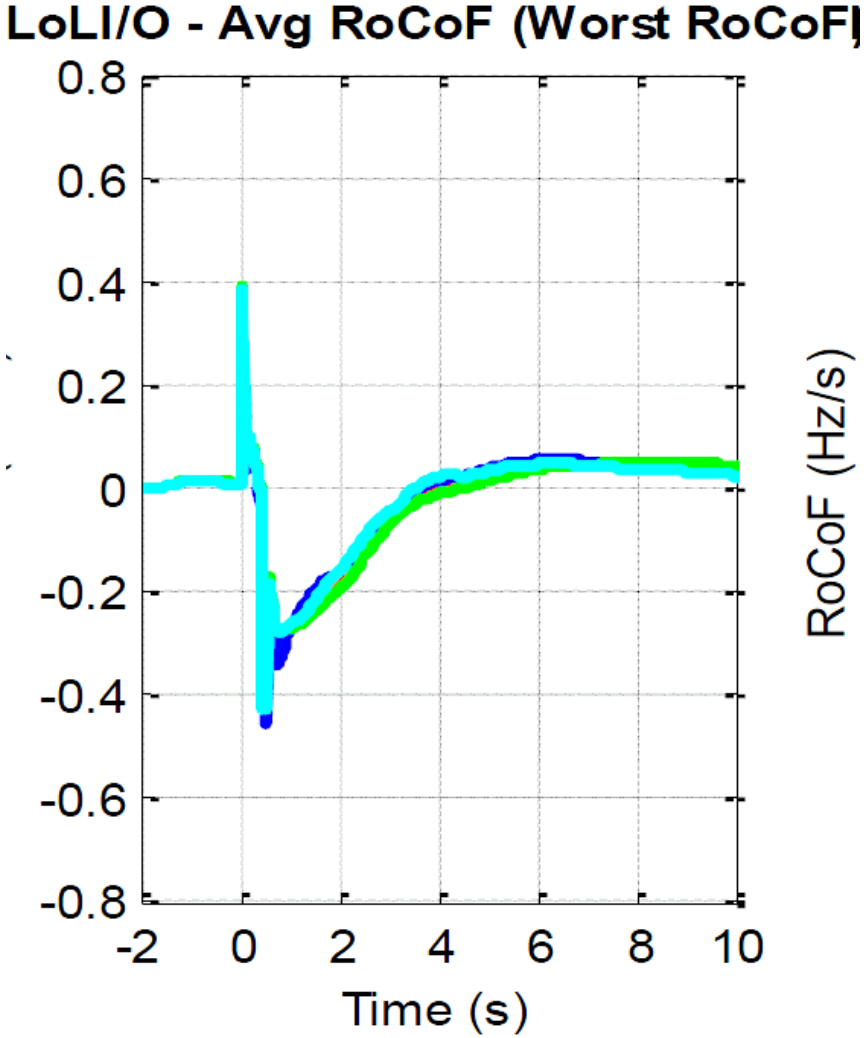
- Simulate 3-phase fault at HV terminals of generator followed by tripping of generator (highly onerous and low probability)
- RoCoF measured over 500 ms as per proposed Grid Code modification
- Investigating System Separation

Date	SNSP %	Fmin Hz	RoCoF Hz/s no Fault	RoCoF Hz/s with Fault
26-08-12	50	49.6	0.21	0.42
26-09-12	49	49.5	0.36	0.55
20-11-12	46	49.5	0.22	0.43
19-12-12	50	49.5	0.28	0.51
22-12-11	50	49.5	0.22	0.43

RoCoF Measurement

3ϕ faults at HV busbar followed by loss of generator or interconnector





Outcomes and next steps…

- Investigating the boundaries of operation
- Ensure correct protection settings on all transmission- and distribution-connected wind farm models
  - RoCoF relay model should be reflective of actual relay
  - Relay models should contain actual over- and under-frequency settings
- Investigate developing operational policy based on the ratio of System Inertia to Largest Infeed or Outfeed
  - Current Policy to monitor inertia from 25000 MWs and maintain above 20000 MWs
  - Inertia and Largest Infeed related to the RoCoF
  - Aim to develop policy linking Largest Infeed or Outfeed to inertia requirement
- Investigate accuracy of generator and load models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System Services Discussion

Jon O'Sullivan

19th June 2013

Minimum Number of Units Study (Pilot Results)

19th June 2013

Ivan Dudurych

Objective and Methodology

- The Objective of the Study is to define a Minimum number of Conventional Units (**MNU**) needed to stay on the system to insure that Operational Security Standards (**OSS**) are maintained.
- Conventional Units set under consideration includes all big CCGT and Moneypoint units.
- Components of **OSS** monitored: Frequency, Transient and Voltage Security, and Operational Reserve
- From on-line WSAT we selected 12 snapshots to create 28 high wind cases representing various system conditions during minimum load
- These cases were subjected to further *wind power increase* balanced by *conventional generation decrease* while making sure that **OSS** are maintained. In such a way **MNU** has been established for each of the cases.
- Note: System Separation was not analysed in this Pilot study

Main factors influencing the Minimum Number of Units

- The value of the largest in-feed
- Turloughill units mode of operation
- RoCoF settings of DSO-connected wind
- Availability of operating reserve, including static reserve (at Moyle and/or EWIC)
- Interconnectors flows
- Note: The local wind-related N-1 overloads (mostly North-West) can limit wind and thus potentially *increase* required number of conventional generators in the individual case

Summary of Pilot Studies

- 8 Set rule is generally sound for all traditional configurations
- Less than 8 sets is possible but only in certain circumstances
- Developing a robust rule set requires robust studies
- Some issues identified for 8 set rule in non traditional configurations

Next Steps – Full Study

- Additional 50 representative cases will be analysed using the same methodology and criteria as in a Pilot Study.
- System Separation will be included as a contingency in the study
- Ramping requirements will be included as additional component of OSS
- Impact of local overloads will be assessed
- A set of tables defining the minimum number of units in a range of operating conditions will be created
- Full study results will inform a new Min Gen Policy


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DS3 Advisory Council Review

19th June 2013

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