



Transmission Development Update

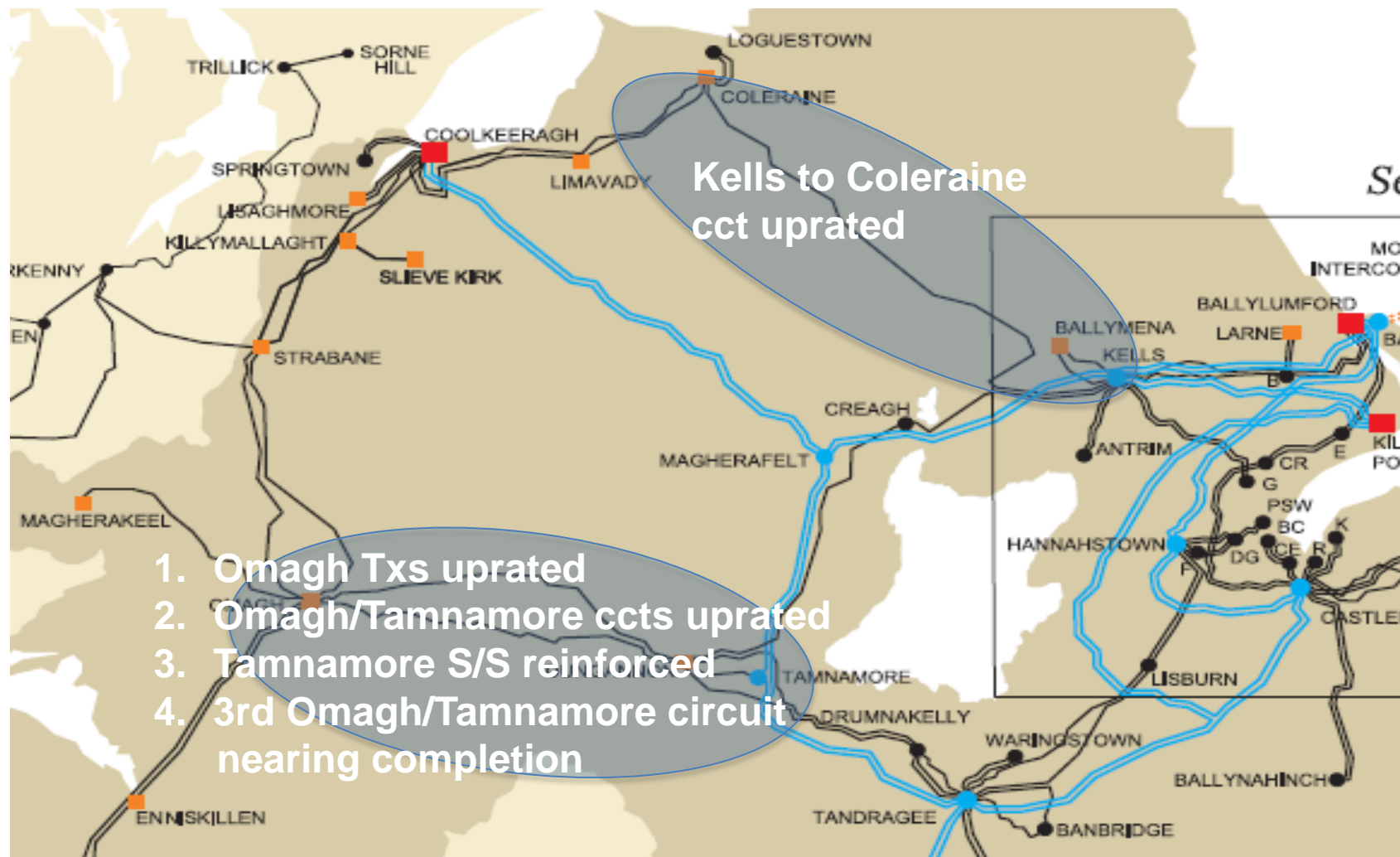
RGLG Meeting

28 March 2017

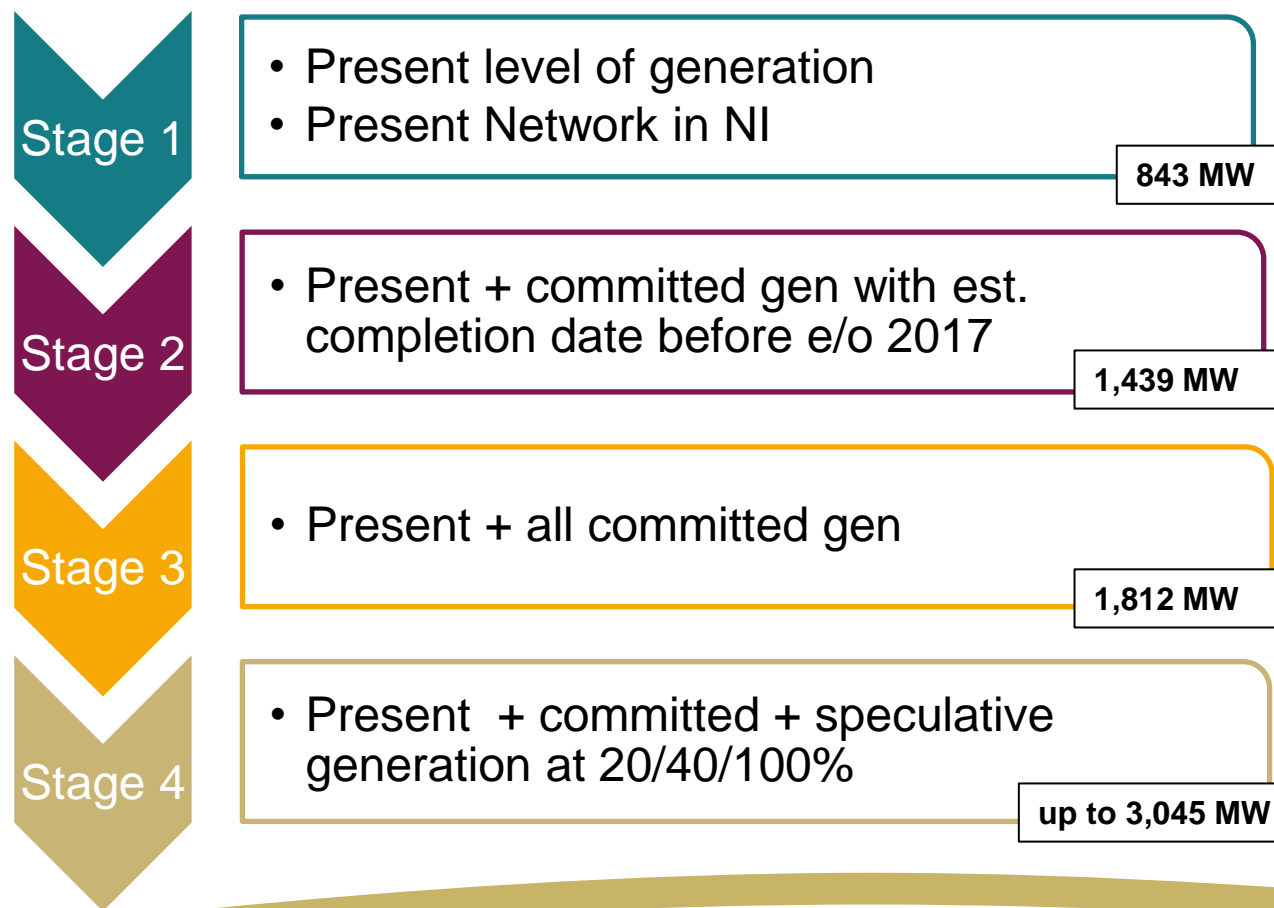
Gerry Hodgkinson



Developments to date



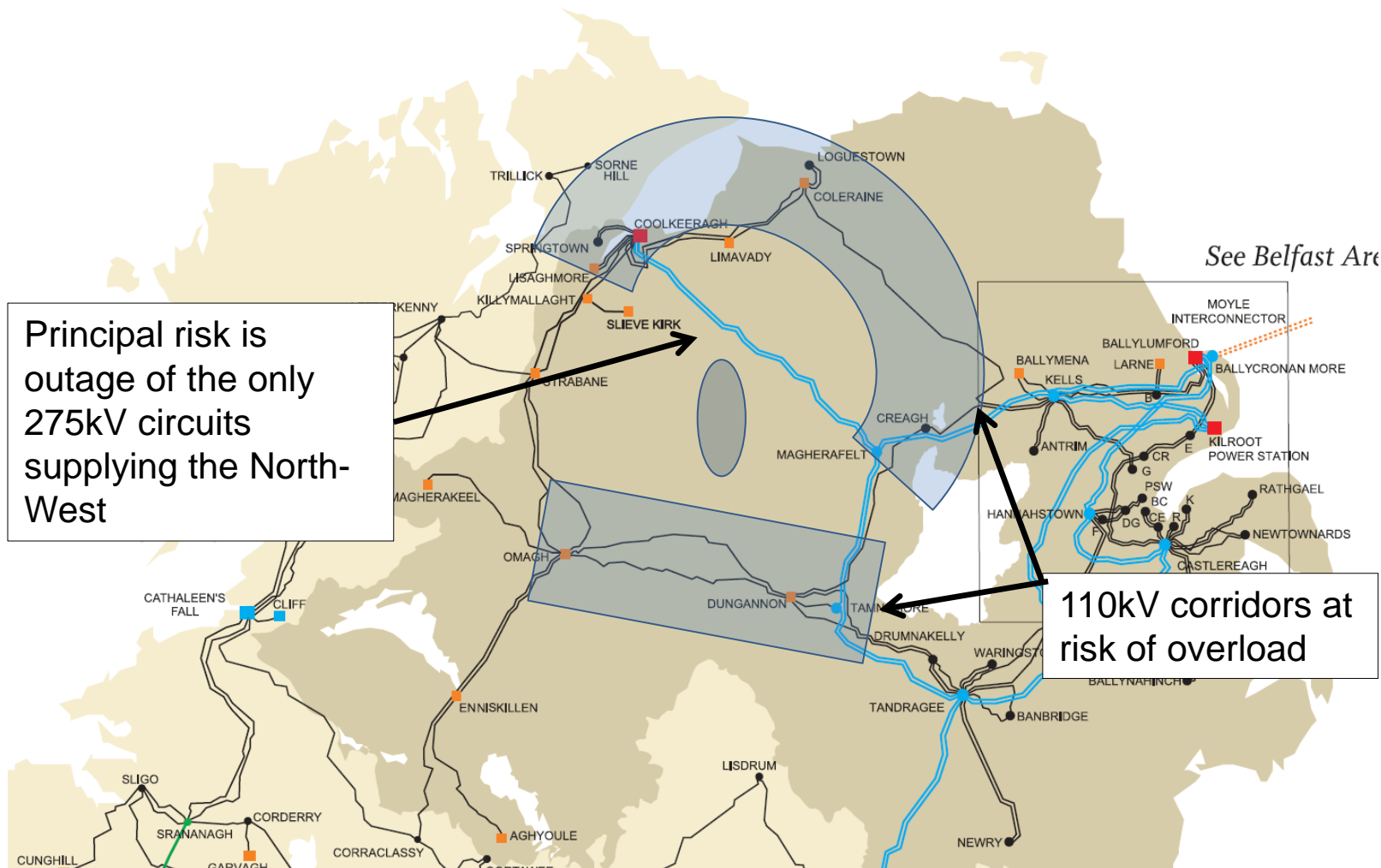
Study of Future Development Requirements



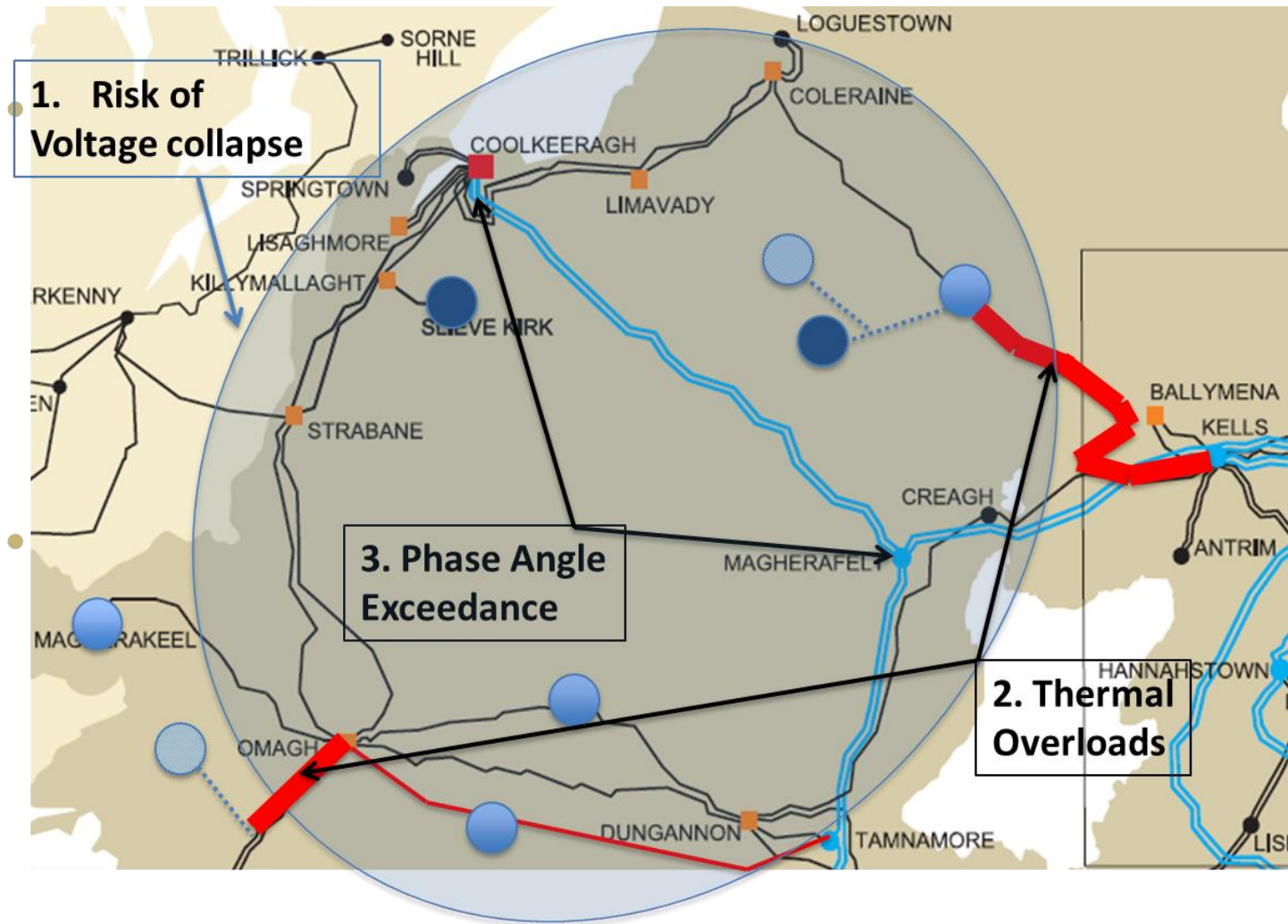
At each stage:

- Summer min/max and Winter max studied
- Full N, N-1 and N-DCT contingency analysis
- Each reinforcement option identified is tested for longevity at the next stage

North-West Vulnerability



Principal Issues for Committed Generation

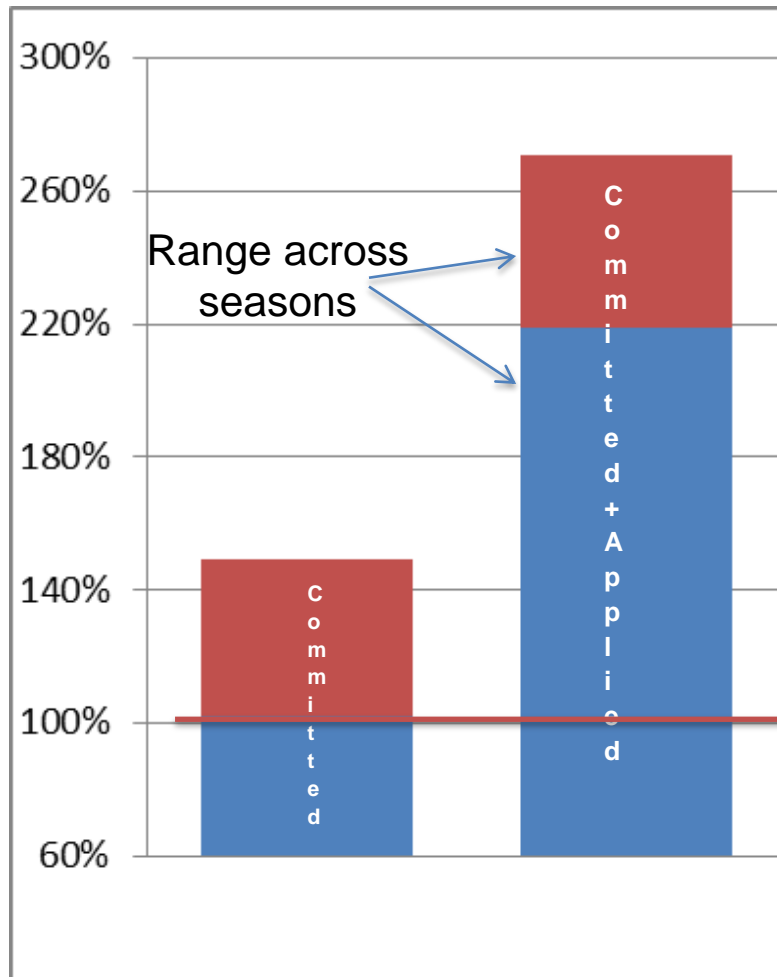


1. Voltage Support



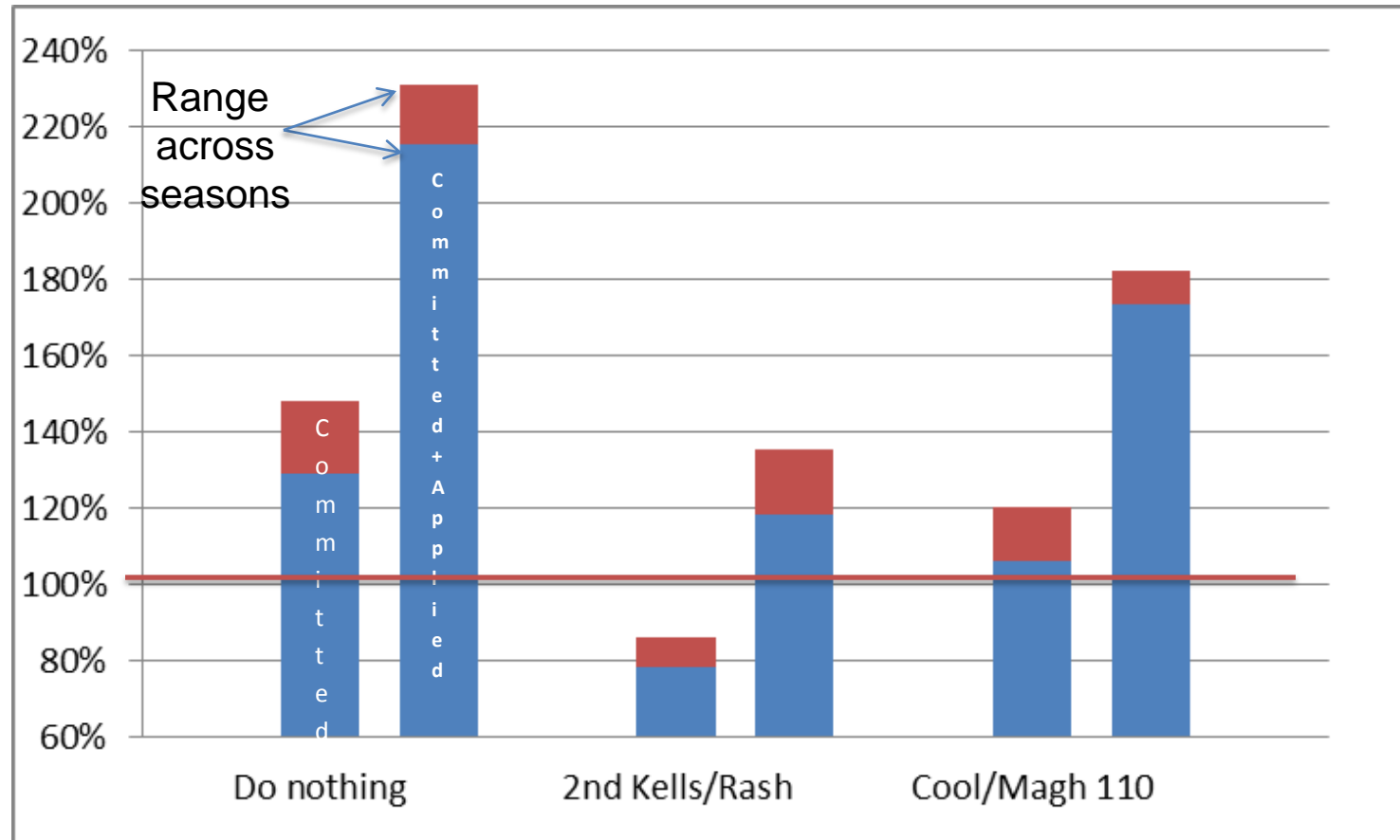
- Required at existing 110kV substations - Coleraine, Omagh and Tamnamore
- Technology identified
- Site investigations have begun

2. Thermal overload - Omagh/Dromore

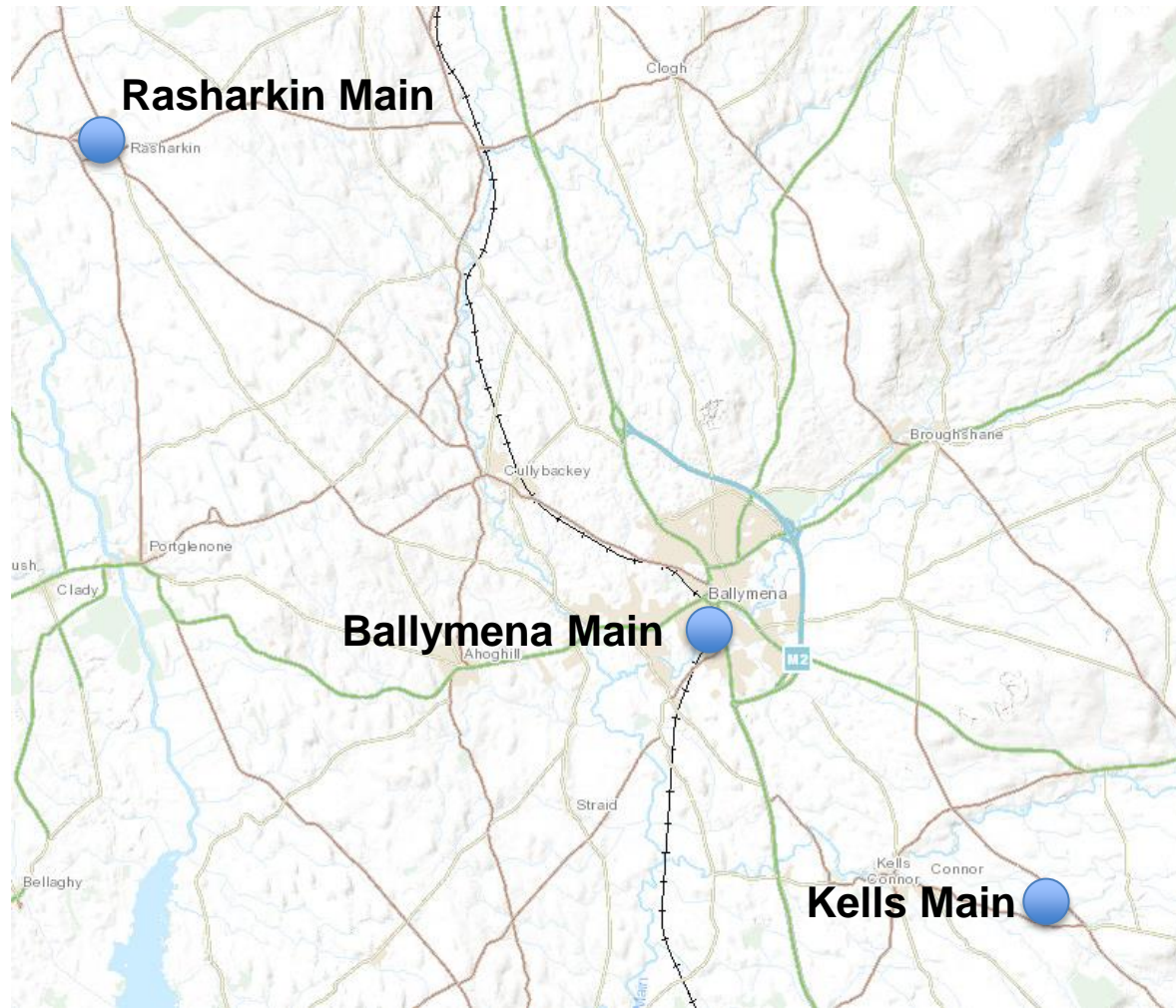


- Double circuit towerline
- Overload risk for N-1
- Can be resolved by uprating the conductor
- Options for degree of uprating are ongoing:
 - Type/size of conductor
- Seeking to avoid tower alterations

2. Thermal overload - Kells/Rasharkin



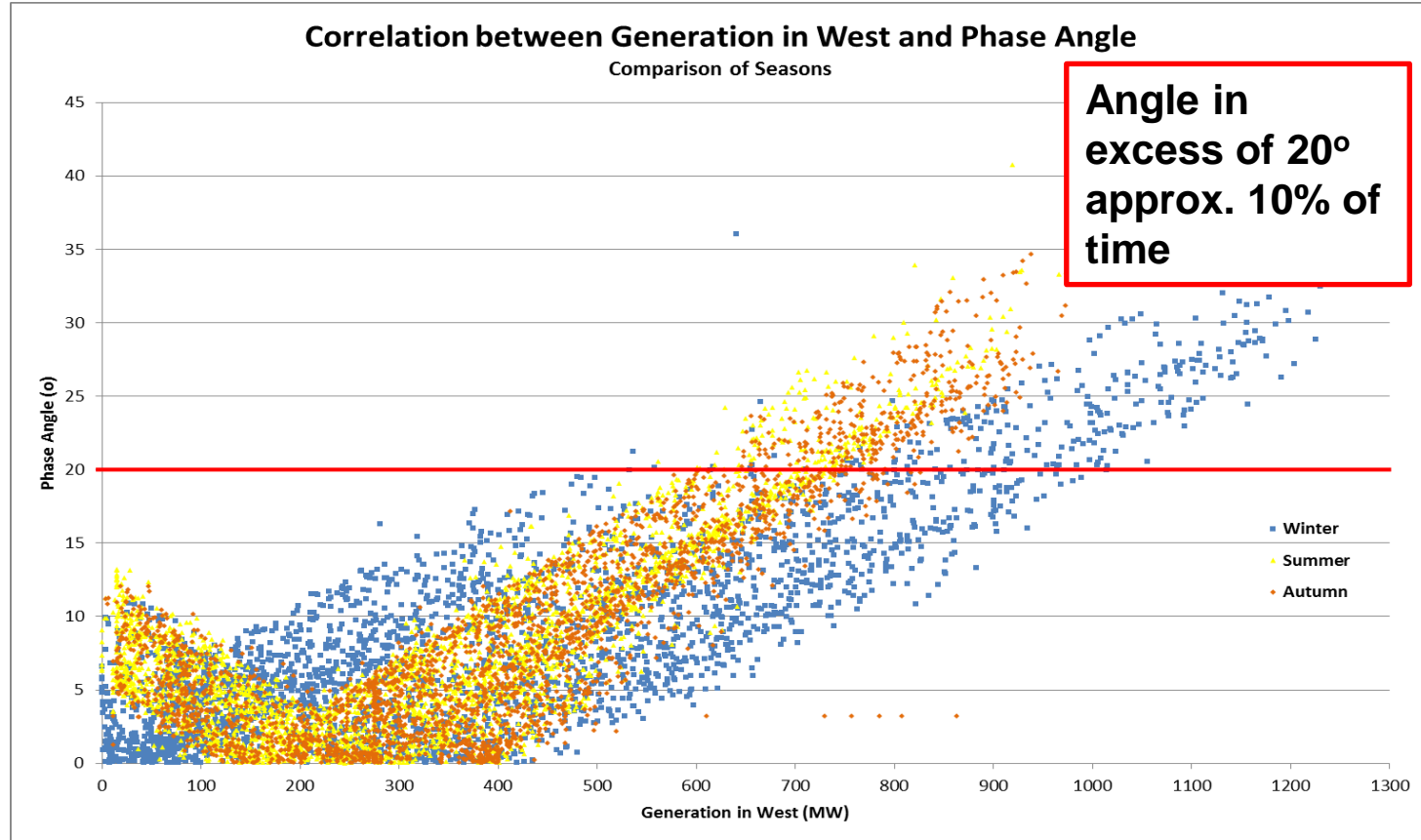
2. Area for Kells to Rasharkin Circuit



3. Phase Angle

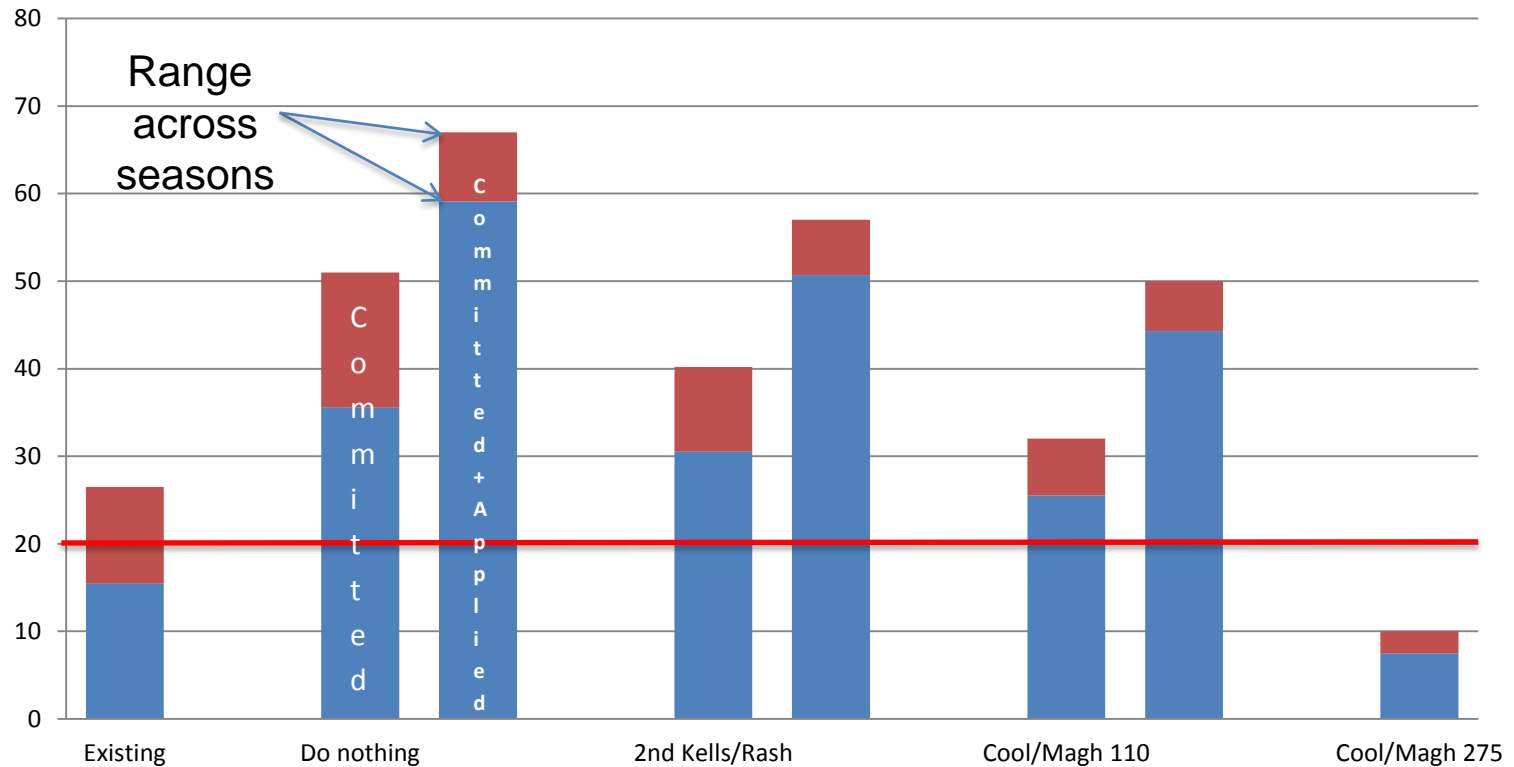
- For loss of Magherafelt to Coolkeeragh 275kV double circuit all generation in the west transfers onto 110kV
- Much higher impedance path
- Results in significant phase angle difference between Magherafelt and Coolkeeragh
- Unable to reclose the 275kV circuit
 - To avoid risk of damage to generation due to disturbance
- Critical circuit unavailable for potentially long period of time
 - Requires re-dispatch of plant (wind in NW and CPS)

3. Phase Angle



This analysis was carried out for an installed capacity of 1,360 MW of renewable generation (less than total of connected and committed generation) – percentage of time we could exceed 20° will increase as installed capacity increases.

3. Phase Angle Resolution through Development



3. Phase Angle - Operational Intervention

- Building a 275kV circuit would be high cost, long timeline
- Potential operational interventions
 - Pre fault constrain to prevent exceedance
 - Will result in significant constraints as wind increases
 - Post fault re-dispatch to reduce back to $<20^{\circ}$
 - Difficulties around speed of intervention, reserve level, risk of 110kV outages at same time
 - Increase acceptable level of phase angle reclosure
 - Need to investigate with generators, particularly CPS
- Potentially a combination of “non-capex” options require investigation to reduce scale of network capex solution



Development Summary

- Voltage support at Coleraine, Omagh & Tamnamore
- Omagh/Dromore and 2nd Kells Rasharkin will address principal thermal issues
 - Other upratings also likely for wind beyond committed level
- Phase angle exceedance
 - Whilst 2nd Kells/Rasharkin results in some reduction
 - We also require (i) operational interventions plus (ii) potentially further circuit development.
 - Unless we build at 275kV there will continue to be an operational element
 - Scale of further generation will be an important consideration

