



Transmission System Development

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RGLG Meeting - 14th June 2016



Overview

- RIDP Assumptions
- Updated Assumptions
- Study Methodology
- Network Problems Identified
- Solutions considered
- Emerging Development Strategy

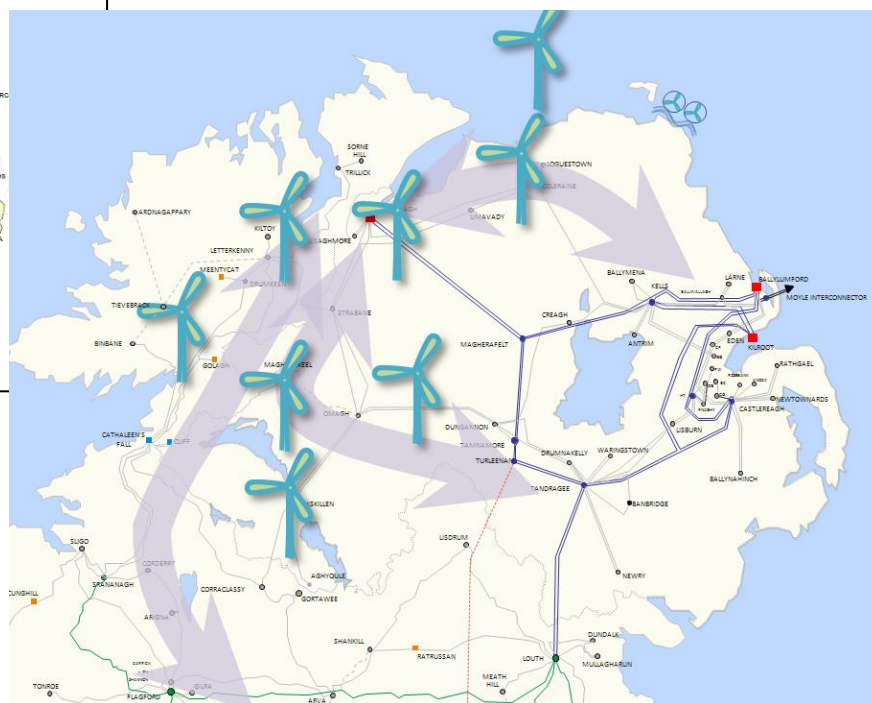
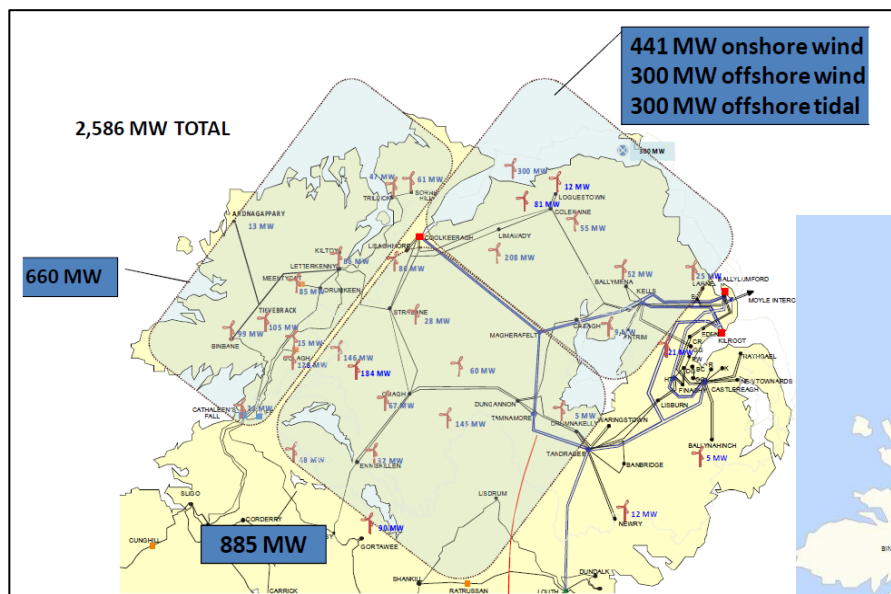


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RIDP Assumptions



What has changed?

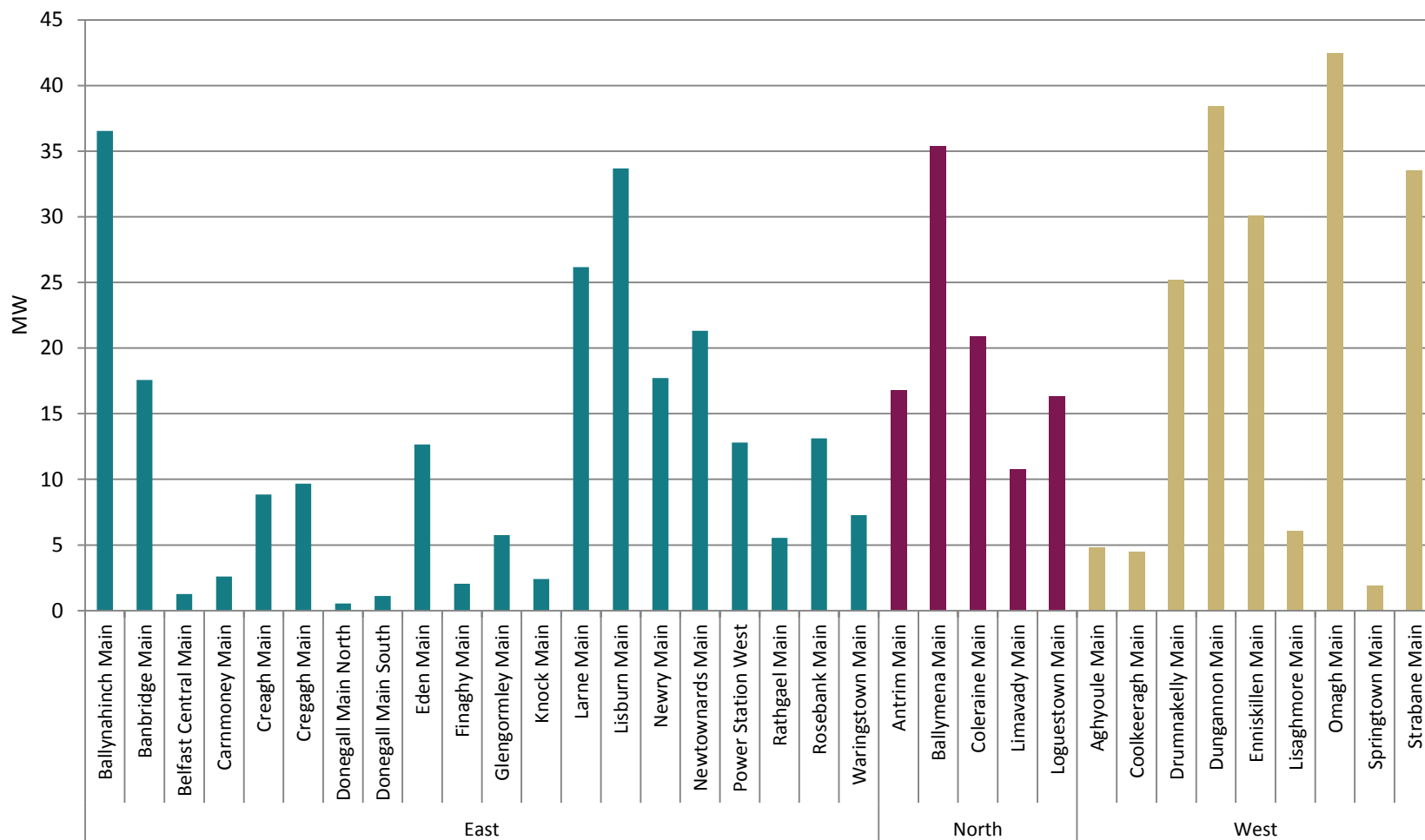
- Generation assumptions
 - MW Installed
 - Technology type i.e. introduction of solar generation
 - Inclusion of Small Scale Generation (<5 MW)
- Planning Assumptions – seasonal dispatches for RES
- Assumptions of geographic location of renewable generation / Study Area
- Large influx of applications following the removal of planning permission pre-requisite
- DfE midterm review of Strategic Energy Framework
- Early removal of Northern Ireland Renewable Obligation Certificate
- Donegal and Mayo expected wind generation levels

Comparison of Assumptions

Large Scale Generation

Region of Northern Ireland	Renewable Capacity (MW)		Difference in Assumptions (MW)
	Original RIDP Assumptions	Updated Assumptions (November 2015)	
North	1,041	888	-153
West	885	1,467	+582
<i>Sub - Total</i>	<i>1,926</i>	<i>2,355</i>	<i>+429</i>
East	N/A	188	+188
Total	1,926	2,543	+617

Small Scale Generation Assumptions



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Updated Assumptions

Category	Definition	LSG Capacity (MW)	SSG Capacity (MW)	Total Capacity (MW)	Cumulative Total (MW)
1	Connected	647	196	843	843
2	Contracted/With PP	702	268	970	1,813
3	Applied with no PP	797	63	860	2,673
4	In planning process	372*	-	372	3,045

*An amount of this generation may now be in category 3 –assumptions are as per November 2015

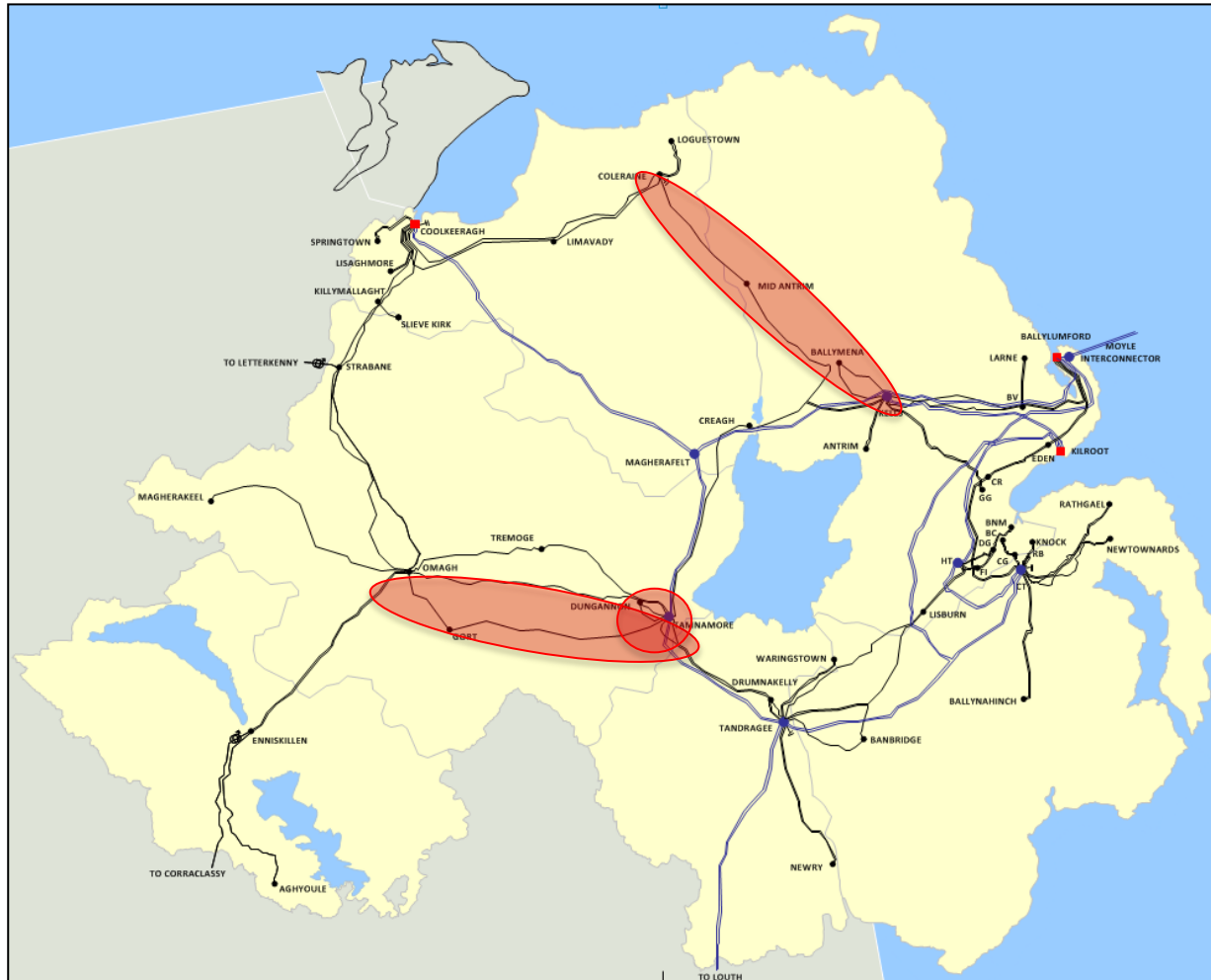


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Medium Term Plan



Study Methodology

Stage 1

- Category 1 generation
- MTP Network in NI

843 MW

Stage 2

- Category 1 & Category 2 with est. completion date before e/o 2017
- MTP Network & any potential reinforcement options identified

1,439 MW

Stage 3

- All Category 1 and Category 2 generation
- MTP Network & any potential reinforcement options identified
- Sensitivity analysis re. inclusion of Coolkeeragh – Trillick

1,812 MW

Stage 4

- All Category 1 & Category 2 generation, plus Category 3 & 4 at 20/40/100%
- MTP Network & any potential reinforcement options identified
- Sensitivity analysis re. inclusion of Coolkeeragh – Trillick

up to 3,045 MW

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

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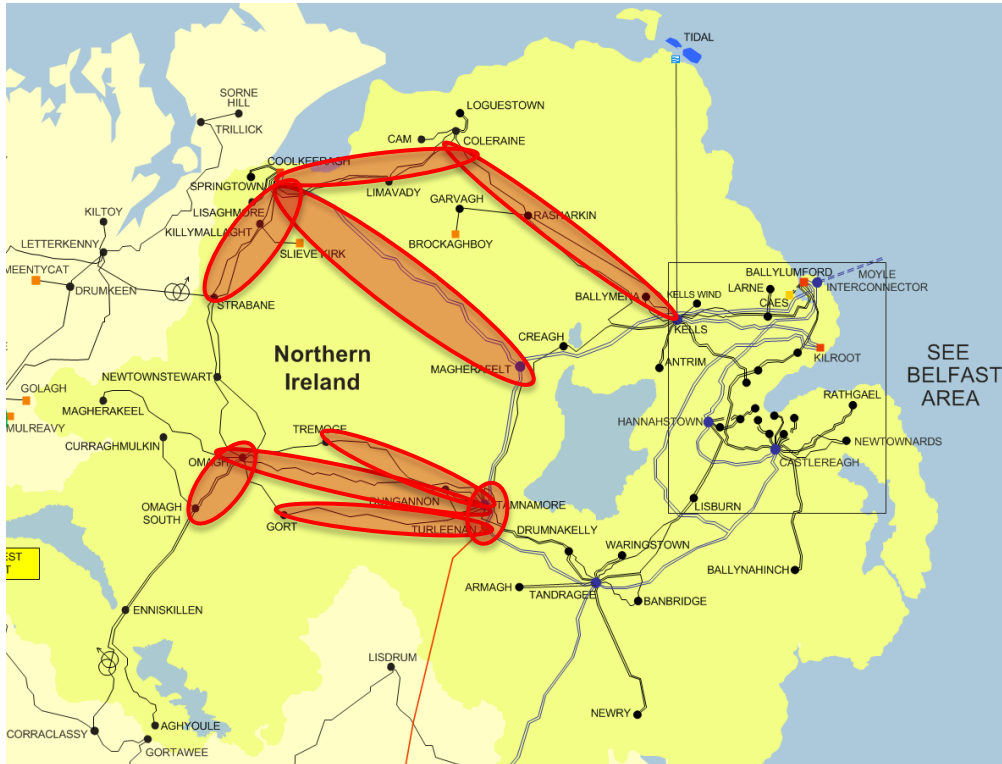
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Network Problems Identified

- Thermal Overloads
 - For a range of contingencies
- Voltage performance
 - Principally associated with loss of Coolkeeragh – Magherafelt 275kV double circuit
- Phase Angle
 - Principally associated with loss of Coolkeeragh – Magherafelt 275kV double circuit

Thermal Overloads



Study Stage	No of Contingency / Overload Combos
1	0
2	12
3	45
4.1 (20% of batch)	79
4.2 (40% of batch)	92 (some overloads seen under N)
4.3 (100% of batch)	189 (some overloads seen under N)

Voltage Performance

- Existing proposal to install reactive power devices in Northern Ireland
 - Coleraine
 - Omagh
 - Tamnamore
- Stage 3 and beyond, requires additional voltage support is required due to the increased capacity of RES

Phase Angle

- Due to terrain DCT is a credible contingency (treated as N-1 in all seasons)
- Check Sync setting on auto-reclose 20°
- If scenario shown was to occur, auto-reclose would not operate
- Critical circuit unavailable for long period of time
- Re-dispatch of plant (wind in NW and CPS)
- Circuit would have to be reclosed manually



Phase Angle

- Phase Angle $> 20^\circ$ following CPS-MAG DCT



Phase Angle
Difference = 4.5°



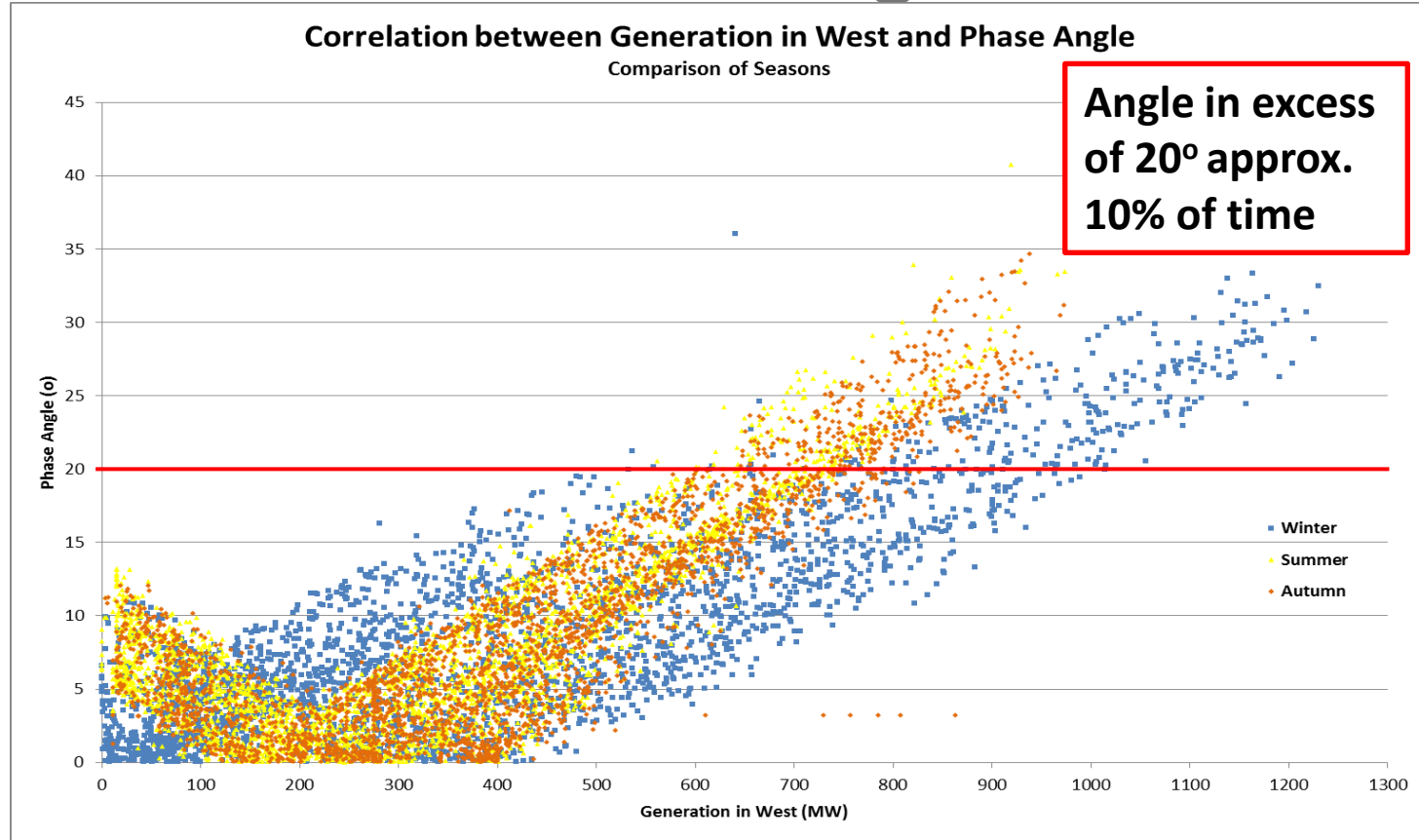
Phase Angle
Difference = 8.6°



Phase Angle
Difference = 43°



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.

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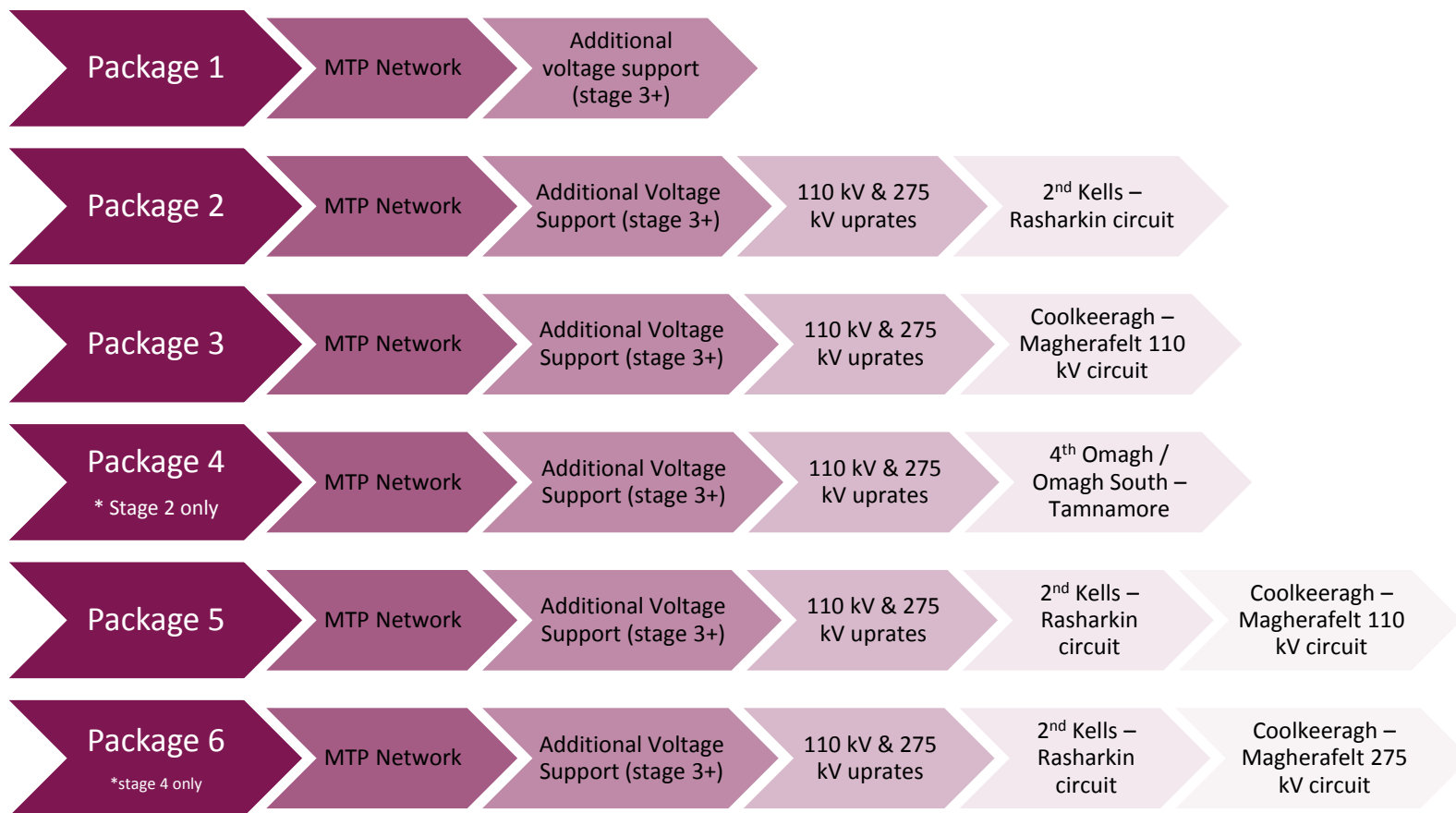


Network Solutions Considered

- Combinations of the following network solutions were considered:
 - 2nd Kells – Rasharkin
 - New Coolkeeragh – Magherafelt circuit (110 kV & 275 kV)
 - 4th circuit in southern corridor (Omagh/Omagh South – Tamnamore)
 - Uprates
 - Coleraine – Coolkeeragh – Limavady triangle
 - Coolkeeragh – Killymallaght – Strabane triangle
 - Omagh – Omagh South
 - Tamnamore - Turleenan
- Additional voltage support



Solution Packages Considered



This graphic does not show a timeline, it is demonstrating the staged approach used in the analysis.

Coolkeeragh – Trillick

- Normal flows will be from Donegal into NI (circa 100 MW)
- Under CPS-MAG double circuit contingency flows into NI reduce substantially
- Operational scenarios studied following DCT
 - Circuit fitted with PFC to maintain pre-fault flow into NI
 - Circuit fitted with PFC to reverse post-fault flow into ROI
 - No control equipment fitted to circuit
- Potential for flows to be directed into Donegal to be investigated further

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Emerging Development Strategy

- Reinforcement in Kells / Rasharkin corridor
- Reinforcement between 275 kV ring and the NW
 - 110 kV or 275 kV
- Upgrading existing circuits
 - 110 kV and 275 kV
- Coolkeeragh – Trillick to remain as part of the optimal ROI/NI development
 - ROI/NI implications to be fully assessed
- Voltage Support



Conclusions

- Substantial body of study work completed
- Further transmission system development will be needed beyond MTP
- CBA is on-going to finalise optimal development strategy
 - Define the individual projects to be taken forward
- Overall development plan will be prepared and will be subject to SEA

