



# Transmission System Development

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RGLG Meeting - 14<sup>th</sup> June 2016



# Overview

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



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# What has changed?

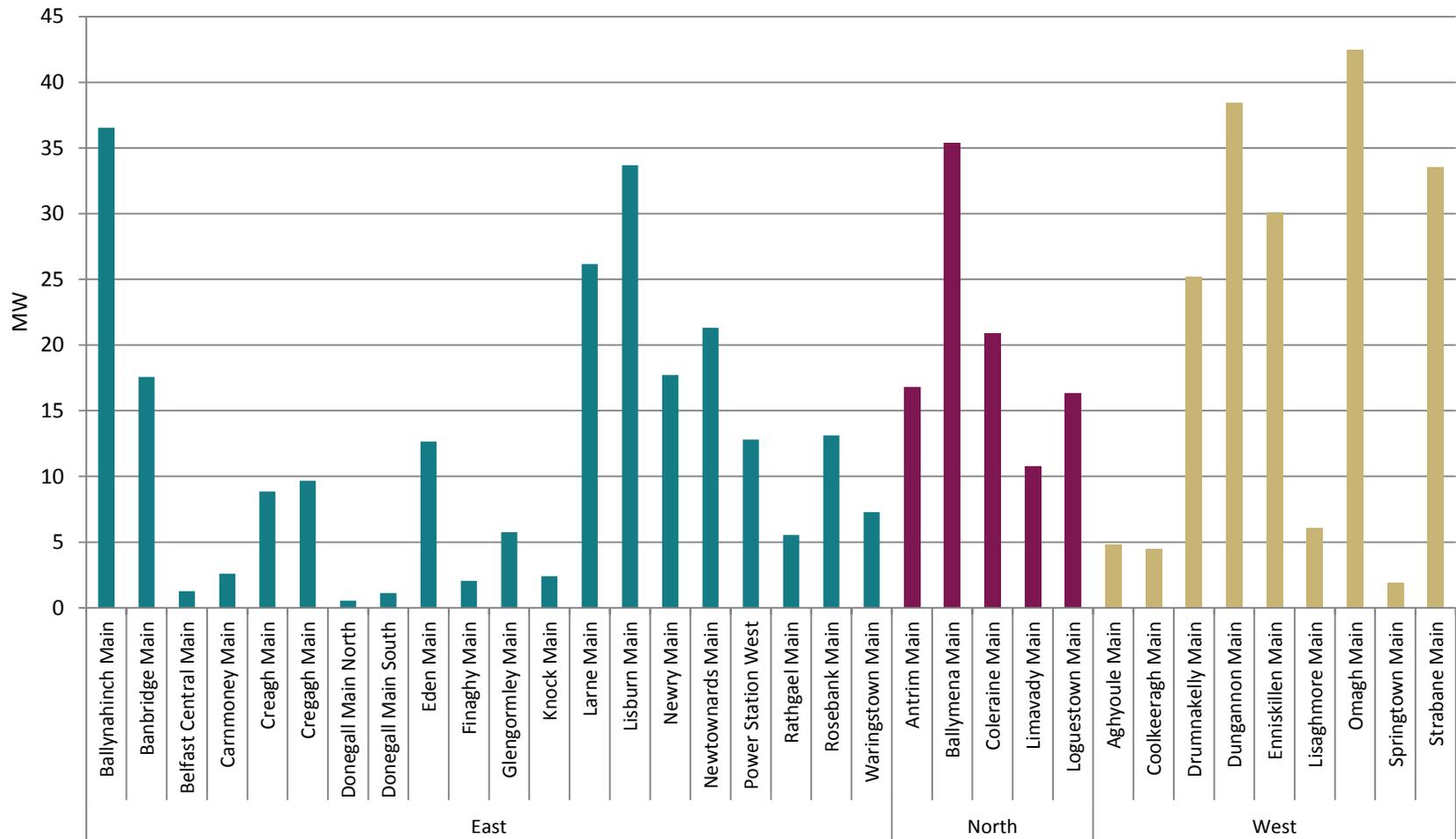
- Generation assumptions
  - MW Installed
  - Technology type i.e. introduction of solar generation
  - Inclusion of Small Scale Generation ( <5 MW)
- Planning Assumptions – seasonal dispatches for RES
- Assumptions of geographic location of renewable generation / Study Area
- Large influx of applications 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
<b>Total</b>	<b>1,926</b>	<b>2,543</b>	<b>+617</b>

# 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

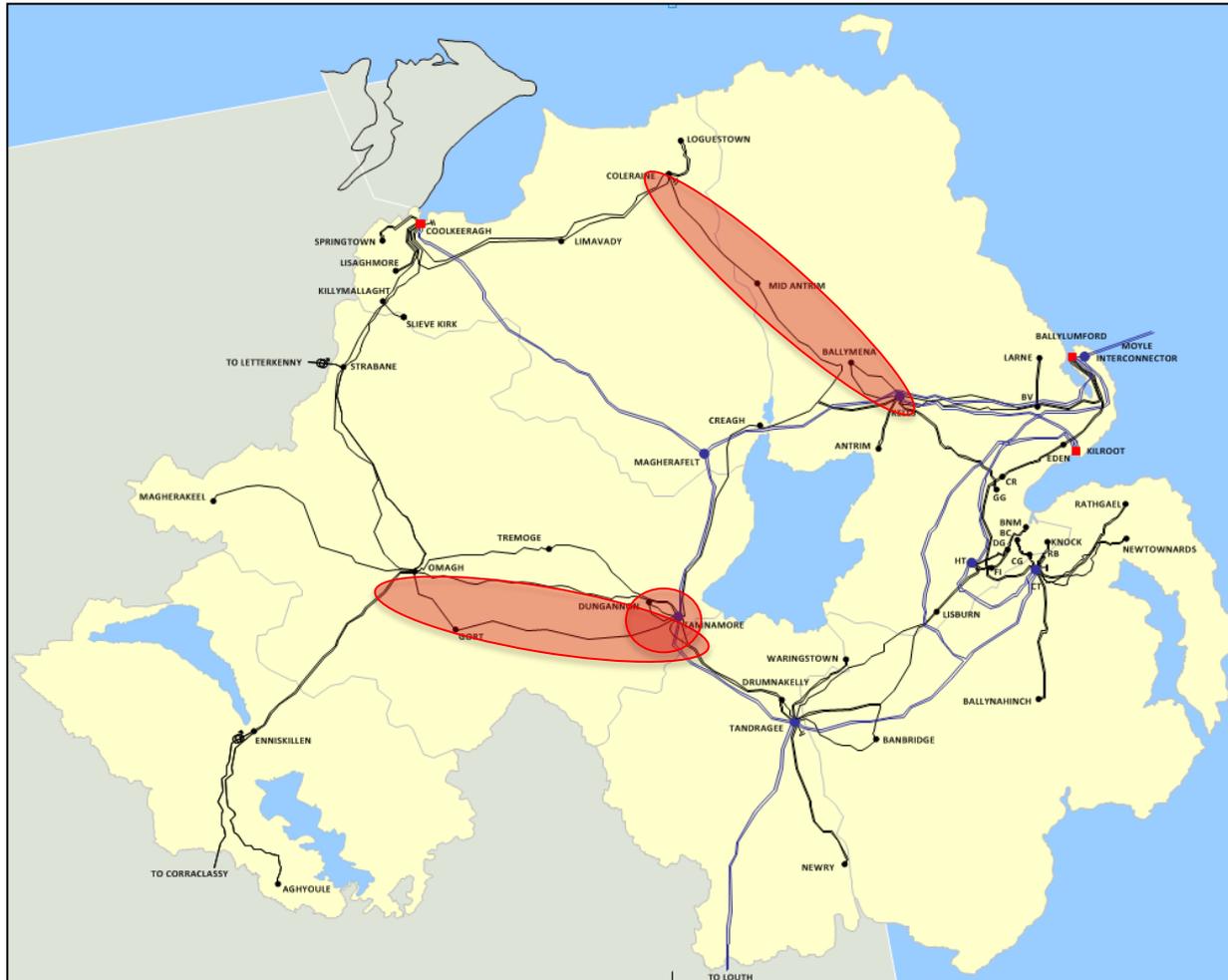


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# Medium Term Plan



# 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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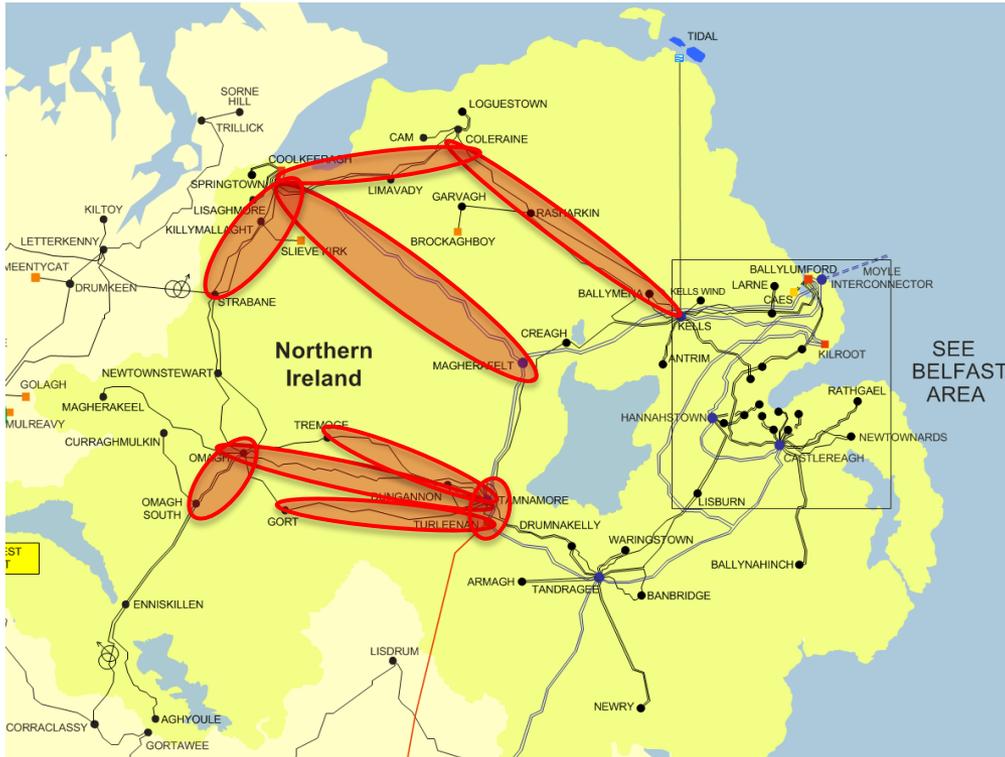
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# Network Problems Identified

- 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

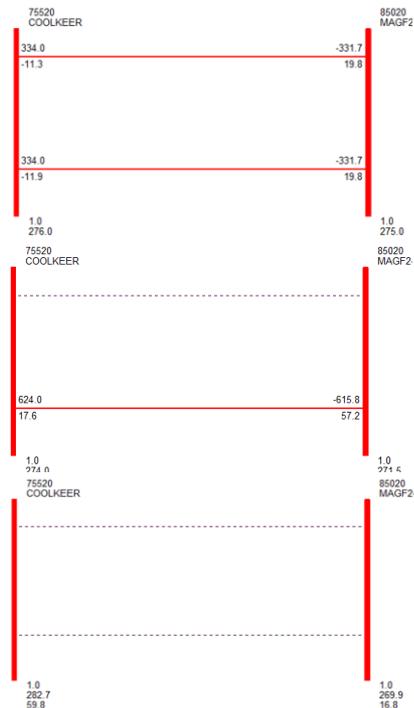
# Phase Angle

- 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 =  $4.5^\circ$



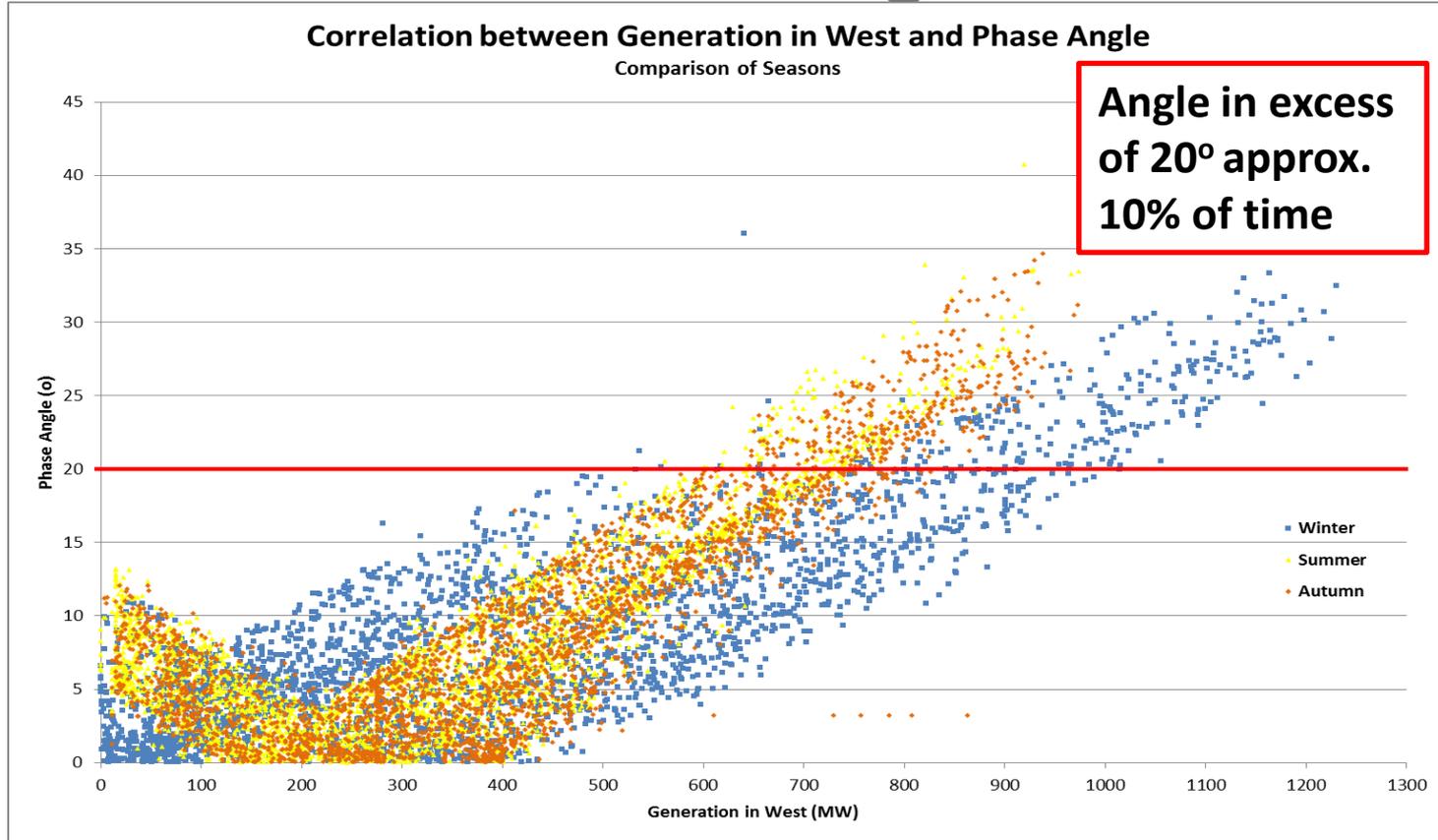
Phase Angle  
Difference =  $8.6^\circ$



Phase Angle  
Difference =  $43^\circ$



# 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  $20^{\circ}$  will increase as installed capacity increases.

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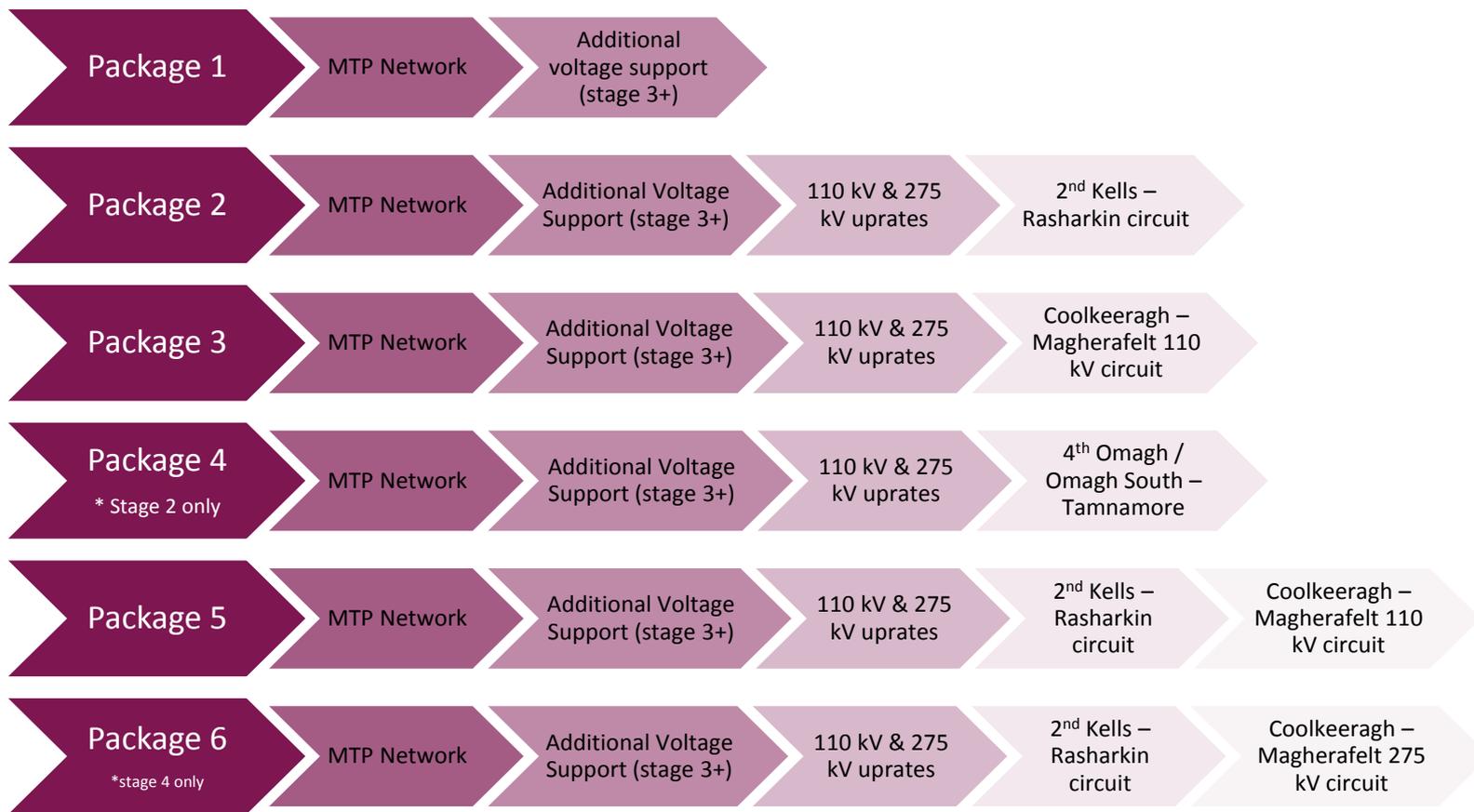
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# Network Solutions Considered

- Combinations of the following network solutions were considered:
  - 2<sup>nd</sup> 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