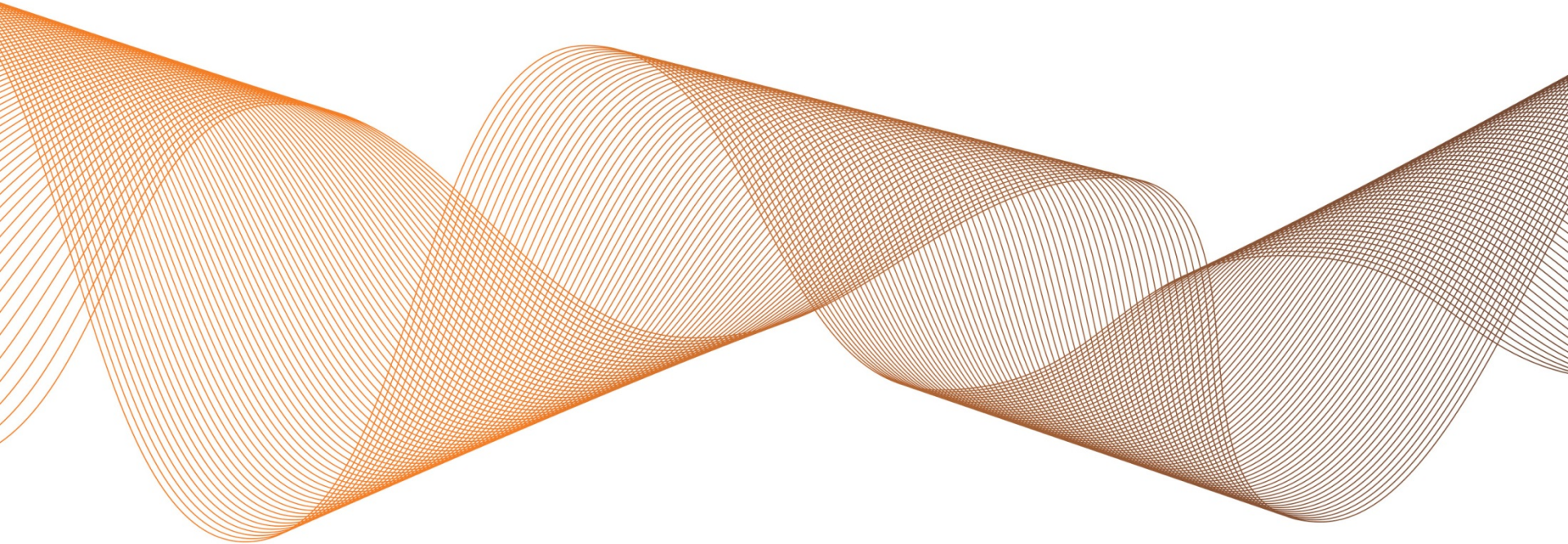# Constrained Network Access

Connecting people with electricity

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Constrained connections for new generation

Situation

Under the Access Code, WP must make all reasonable endeavours to connect customers.

WEM Rules assume unconstrained network, but many gens connected with post-contingent run-back schemes

Network = quasi-constrained.

Network has reached the limits of post-contingent run-back schemes – any more and there is a risk of cascading failures.

Given the state of the network, unconstrained generation connections are prohibitively expensive – and applicants have requested constrained connections.

Complication

Moving to fully constrained network access may require all access contracts to be overturned

Requires Ministerial action

WP scale of rule change is significant

New generators want to be connected by 2016/2017, and WP must make all reasonable endeavours to progress a solution
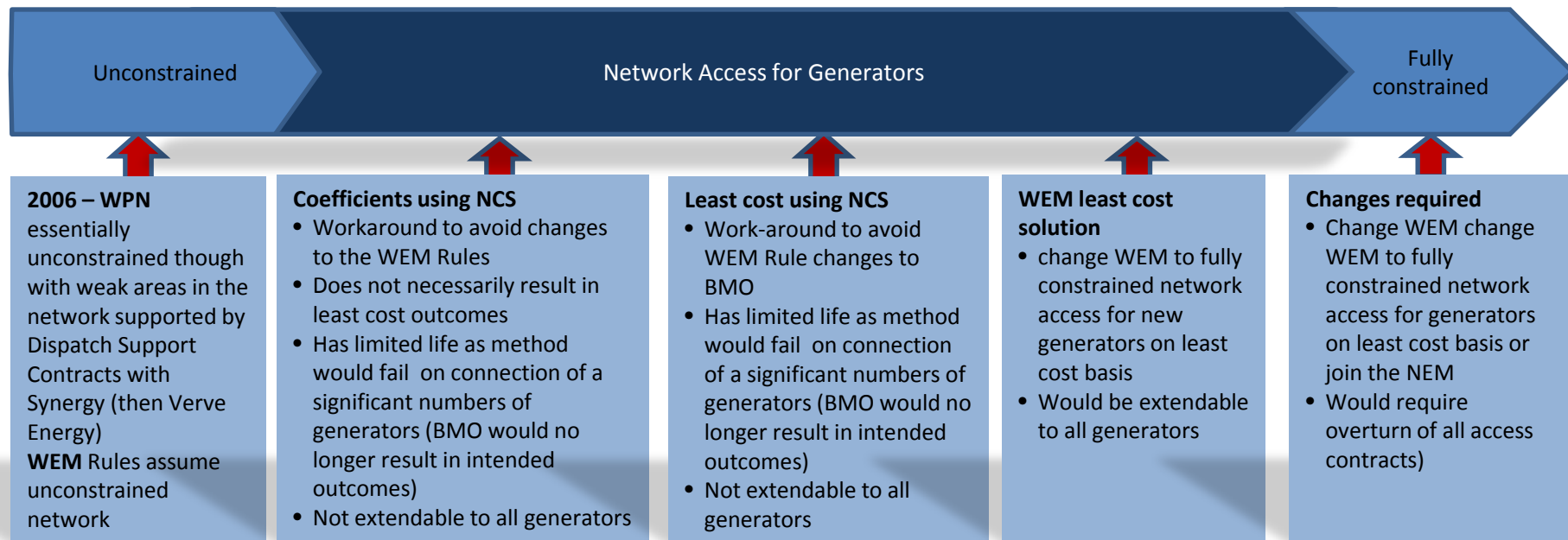
EMR?

Implication

Consider constrained access for new generators (partially constrained network access)

Minimise total electricity costs (both network and market) for connection of new generators

Pathway to constrained network access for all generators, or assist in any move to join NEM

Preliminary Access Offers due Feb 2015

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Rules-based least cost solution is a stepping stone to fully constrained network access

Unconstrained	Network Access for Generators	Fully constrained

2006 – WPN essentially unconstrained though with weak areas in the network supported by Dispatch Support Contracts with Synergy (then Verve Energy)
WEM Rules assume unconstrained network

Coefficients using NCS
- Workaround to avoid changes to the WEM Rules
- Does not necessarily result in least cost outcomes
- Has limited life as method would fail on connection of a significant numbers of generators (BMO would no longer result in intended outcomes)
- Not extendable to all generators

Least cost using NCS
- Work-around to avoid WEM Rule changes to BMO
- Has limited life as method would fail on connection of a significant numbers of generators (BMO would no longer result in intended outcomes)
- Not extendable to all generators

WEM least cost solution
- change WEM to fully constrained network access for new generators on least cost basis
- Would be extendable to all generators

Changes required
- Change WEM change WEM to fully constrained network access for generators on least cost basis or join the NEM
- Would require overturn of all access contracts)

- A Rules-based Least Cost solution is extensible and will allow direct transition to a fully constrained network
- Any option using Network Control Services (NCS) is a work-around and will have limited longevity or ability to transition to a fully constrained network. Transition to fully constrained network will require substantial WEM redesign.
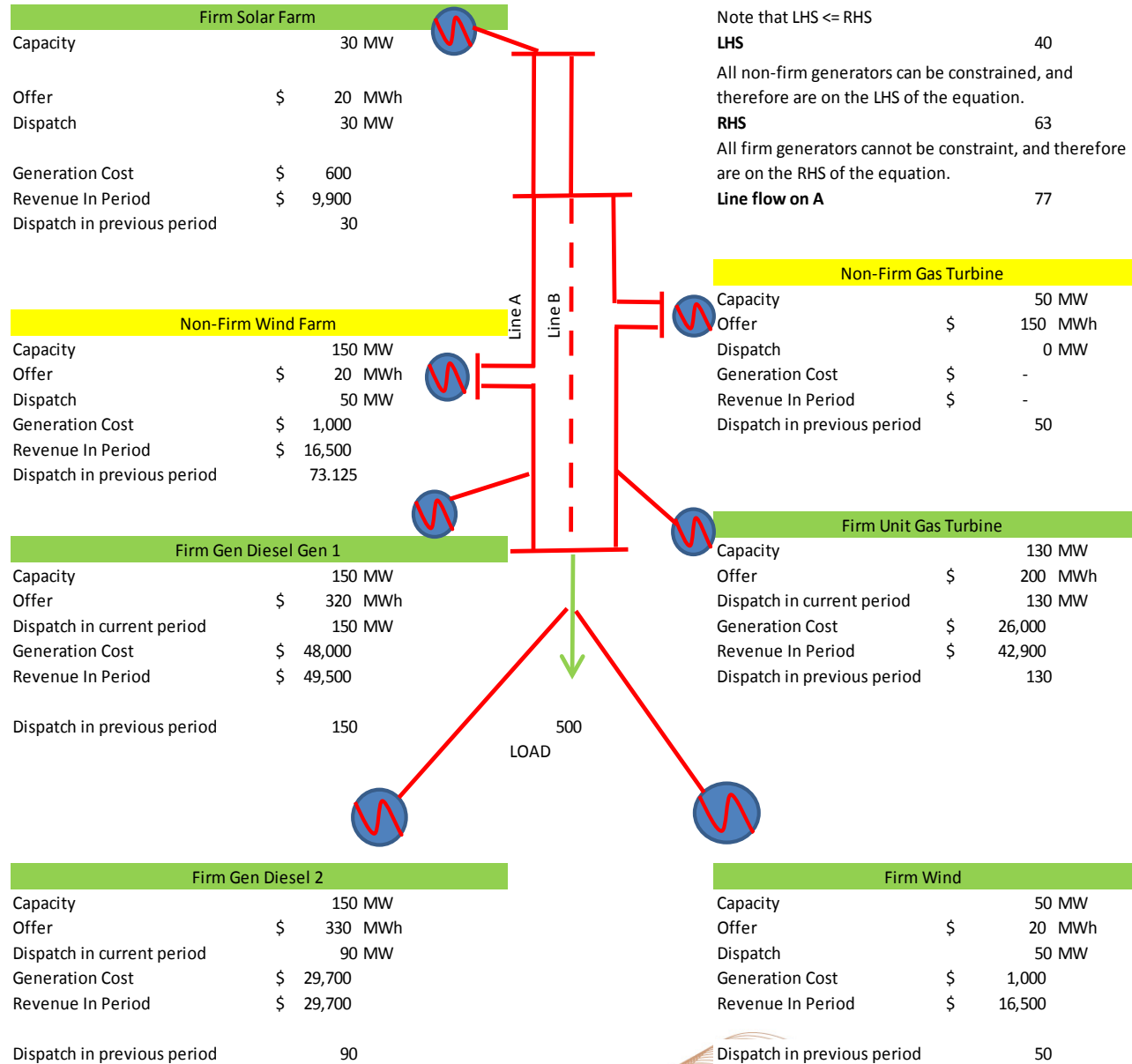
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Impact of Partially Constrained Network Access Solutions

Issue	Rule issue	IT system issue	Required for Partially Constrained Network Access		Required for Constrained Dispatch
			Implementation Option 1 (NCS)	Implementation Option 2 (WEM Rules solution)	
Create and use constraint equations	X	X	X	X	X
System Management needs ability to vary balancing merit order to resolve constraints by curtailing generators	X	X	X	X	X
Constrained generators must not receive constrained off payments	X	X	X	X	X
System Management or IMO needs cost information to identify least cost outcome for constraining generators	X	X		X	X
Participants need to be able to re-bid to take into account impact of constraints	X	X			X

Example – Partially Constrained Dispatch

Line B trips causing a constraint

Firm Solar Farm

Capacity		30 MW
Offer	$	20 MWh
Dispatch		30 MW
Generation Cost	$	600
Revenue In Period	$	9,900
Dispatch in previous period		30

Non-Firm Wind Farm

Capacity		150 MW
Offer	$	20 MWh
Dispatch		50 MW
Generation Cost	$	1,000
Revenue In Period	$	16,500
Dispatch in previous period		73.125

Firm Gen Diesel Gen 1

Capacity		150 MW
Offer	$	320 MWh
Dispatch in current period		150 MW
Generation Cost	$	48,000
Revenue In Period	$	49,500
Dispatch in previous period		150

Firm Gen Diesel 2

Capacity		150 MW
Offer	$	330 MWh
Dispatch in current period		90 MW
Generation Cost	$	29,700
Revenue In Period	$	29,700
Dispatch in previous period		90

Line A

Line B

500
LOAD

Note that LHS <= RHS

LHS 40

All non-firm generators can be constrained, and therefore are on the LHS of the equation.

RHS 63

All firm generators cannot be constraint, and therefore are on the RHS of the equation.

Line flow on A 77

Non-Firm Gas Turbine

Capacity		50 MW
Offer	$	150 MWh
Dispatch		0 MW
Generation Cost	$	-
Revenue In Period	$	-
Dispatch in previous period		50

Firm Unit Gas Turbine

Capacity		130 MW
Offer	$	200 MWh
Dispatch in current period		130 MW
Generation Cost	$	26,000
Revenue In Period	$	42,900
Dispatch in previous period		130

Firm Wind

Capacity		50 MW
Offer	$	20 MWh
Dispatch		50 MW
Generation Cost	$	1,000
Revenue In Period	$	16,500
Dispatch in previous period		50

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Example Results

Pre-Constraint

Generator	Bid ($/MWh)	Capacity	Output (MW)	Change in Output (MW)
Firm Wind Farm	$20	50	50	-
Non-Firm Wind Farm	$20	150	150	-
Firm Solar Farm	$20	30	30	-
Non-Firm Gas Turbine	$150	50	50	-
Firm Gas Turbine	$200	130	130	-
Firm Diesel Gen 2	$290	150	70	-
Firm Diesel Gen	$320	150	0	-
Load on Line A (MW)	154.5			
Pool Price	$290			
Pool Price x total load	$139,200			

Post Constraint

Generator	Bid (MW/h)	Capacity	Output (MW)	Change in Output (MW)
Firm Wind Farm	$20	50	50	0
Non-Firm Wind Farm	$20	150	81.875	-68.125
Firm Solar Farm	$20	30	30	0
Non-Firm Gas Turbine	$150	50	50	0
Firm Gas Turbine	$200	130	130	0
Firm Diesel Gen 2	$290	150	138.125	68.125
Firm Diesel Gen	$320	150	0	0
Load on Line A (MW)	100			
Pool Price ($/MWh)	$290			
Pool Price x total load	$139,200			