

Reactive Power requirements

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Reliable Sustainable Connected

Reactive Capabilities – Introduction



Fundamental

- Voltage in electricity grids can only be influenced by the use of devices that are able of either absorbing or feeding reactive power.
- Reactive power cannot be transmitted over long distances.
- Local reactive power capabilities are crucial for voltage stability which is a key issue for system security (next slide)

Today

- DSO networks and consumers are mostly passive concerning reactive power.
- Reactive power comes from large transmission connected generators.
- TSO adapts the reactive power produced (or absorbed) by the large generators to the reactive need of the consumers.

Future

- In future only few (or even no) big generators will be in service to the transmission grid.
- Generation will either be far away from load centers or will be dispersed in distribution networks.
- In both cases, there will be significantly less reactive reserves directly available for the TSO.
- As a consequence, other reactive power sources must be installed.

Voltage Withstand Capabilities – Historical experience

Location	Date	Frequency Stability	Voltage Stability	Transient Stability	Small-Signal Stability
Black out in France	19/12/1978	x	x	x	
France-Spain incident	10/08/1981			x	
France-Spain incident	30/12/1981			x	
Voltage Collapse in France	12/01/1987		x		
Black out in USA	10/08/1987			x	x
Voltage Collapse in Netherlands	23/06/1997		x		
Storm in South-West France	21/06/1999	x		x	
Black out of the southern part of Portugal	09/05/2000	x	x		
Black out USA-Canada	14/08/2003	x	x		
Black out in Scandinavian countries	23/09/2003		x		
Black out in Italy	28/09/2003	x	x	x	
Black out in the southern part of Greece	12/07/2004		x		
Rhineland/Palatinate/Luxembourg incident	02/09/2004		x		x
CE inter-area oscillations	01/05/2005				x
Voltage Collapse in Poland	26/06/2006		x		
Denmark Islanding	26/05/2007	x			
South-Balkans Disturbance	24/07/2007	x			

Reactive Capabilities – Requirements

Static reactive requirements

- Requirements divided into:
 - Demand Facilities no generation
 - Demand Facilities with generation
 - Distribution Networks
- TSO Maximum range is 0.9PF to unity of MIC

Network charging requirements

- At 25% of MIC loading
- 0 Mvar exchange (tolerance +/-5% of MW MIC)
- 5% allows steps due to block sizes of reactive support
- Static point - compliance by simulation

Dynamic reactive requirements

- If justified, consulted and accepted by NRA
- TSO has right to require DN to dynamically control reactive power exchange
- Control to be agreed with TSO/DN
- Roadmap to be in justification

Reactive power – Demand only demand facility

If MIC 100MW

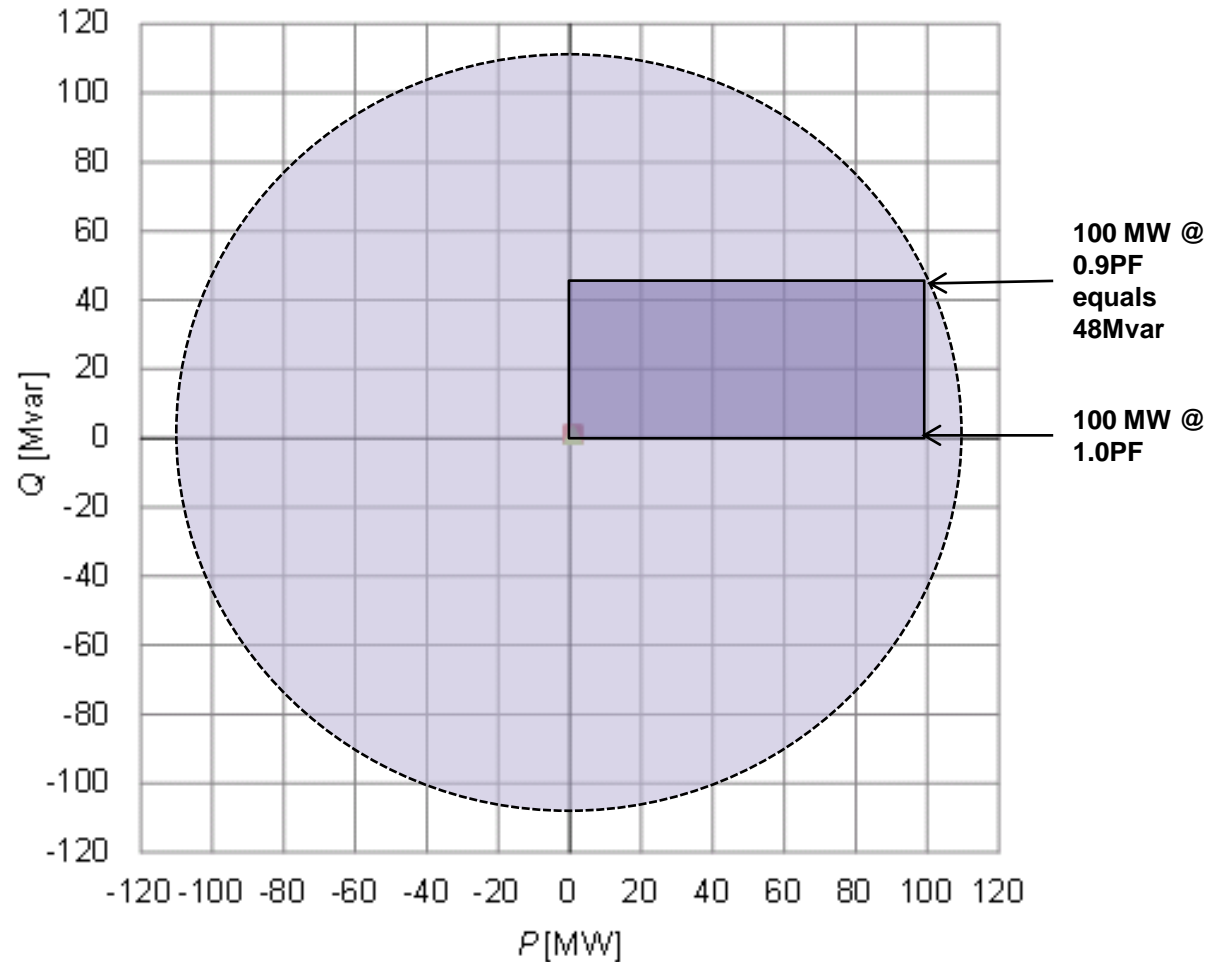
Maximum range of 0.9PF of MIC is 48Mvar

Therefore 0 - 48Mvar is widest European envelope that can be specified

TSO can specify any reactive power range within this envelope

Reactive power range beyond this can be specified outside of this if justified by technical and financial benefits

Examples maybe paid for reactive support on TSO side to compensate or system voltage reduction reasons



Reactive power – Demand and generation demand facility

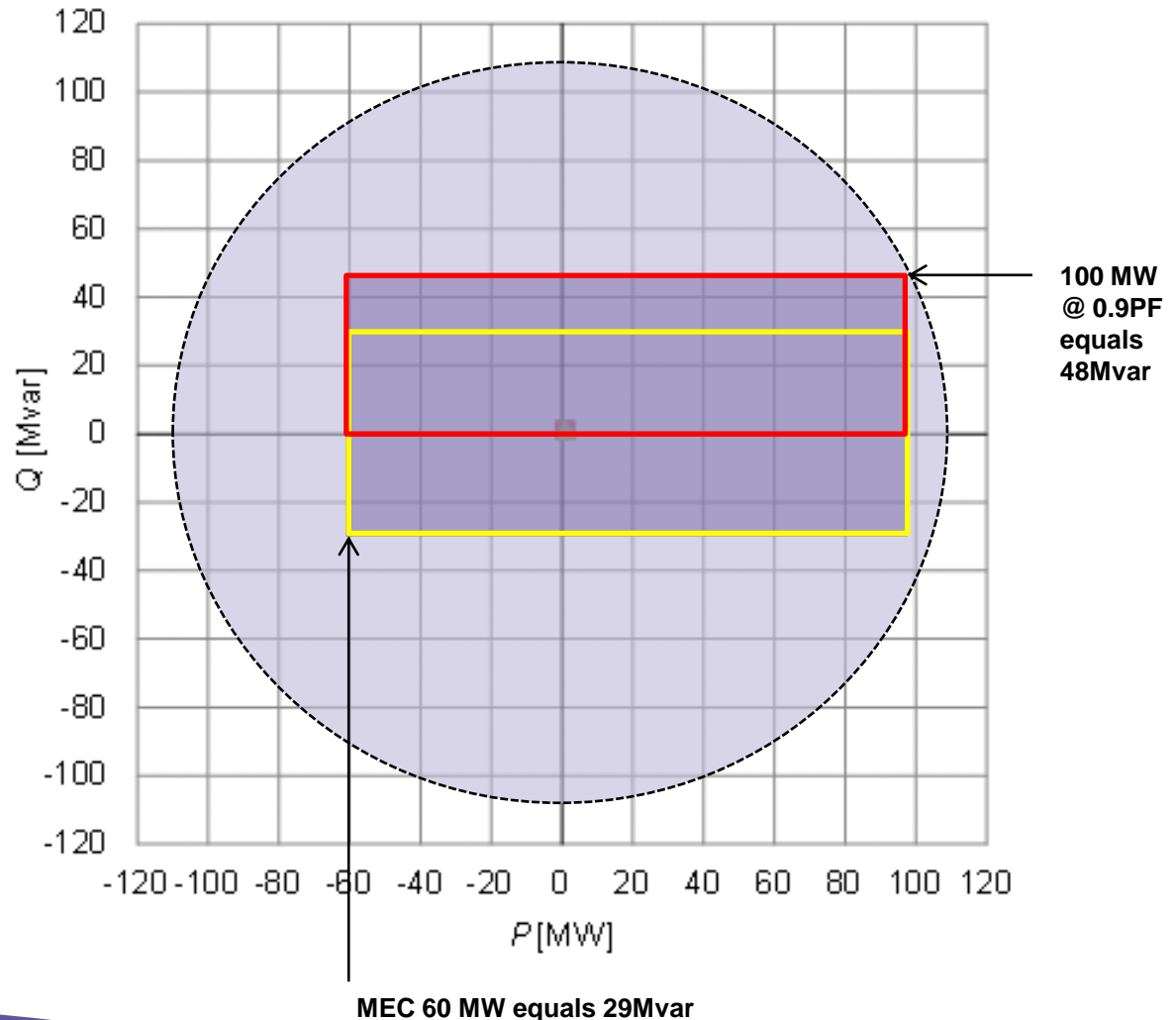
If MIC 100MW and MEC is 60MW

Maximum range of 0.9PF of MIC is 48Mvar and 0.9PF of 60MW is 29Mvar

Therefore -29 to 48Mvar is widest European envelope that can be specified

TSO can specify any reactive power range within this envelope

Reactive power range beyond this can be specified outside of this if justified by technical and financial benefits



Reactive power – Distribution Networks

If MIC 100MW and MEC is 60MW

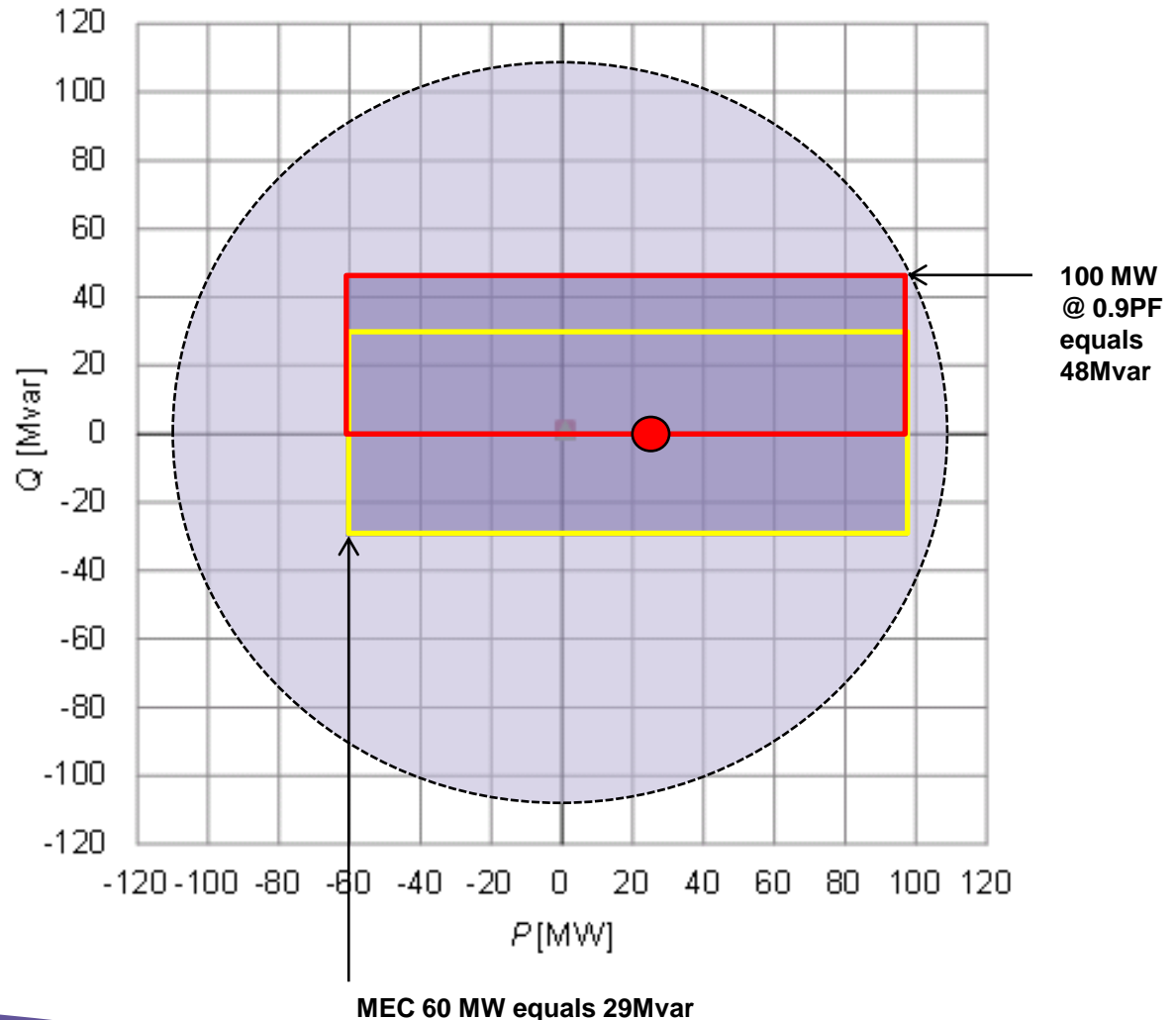
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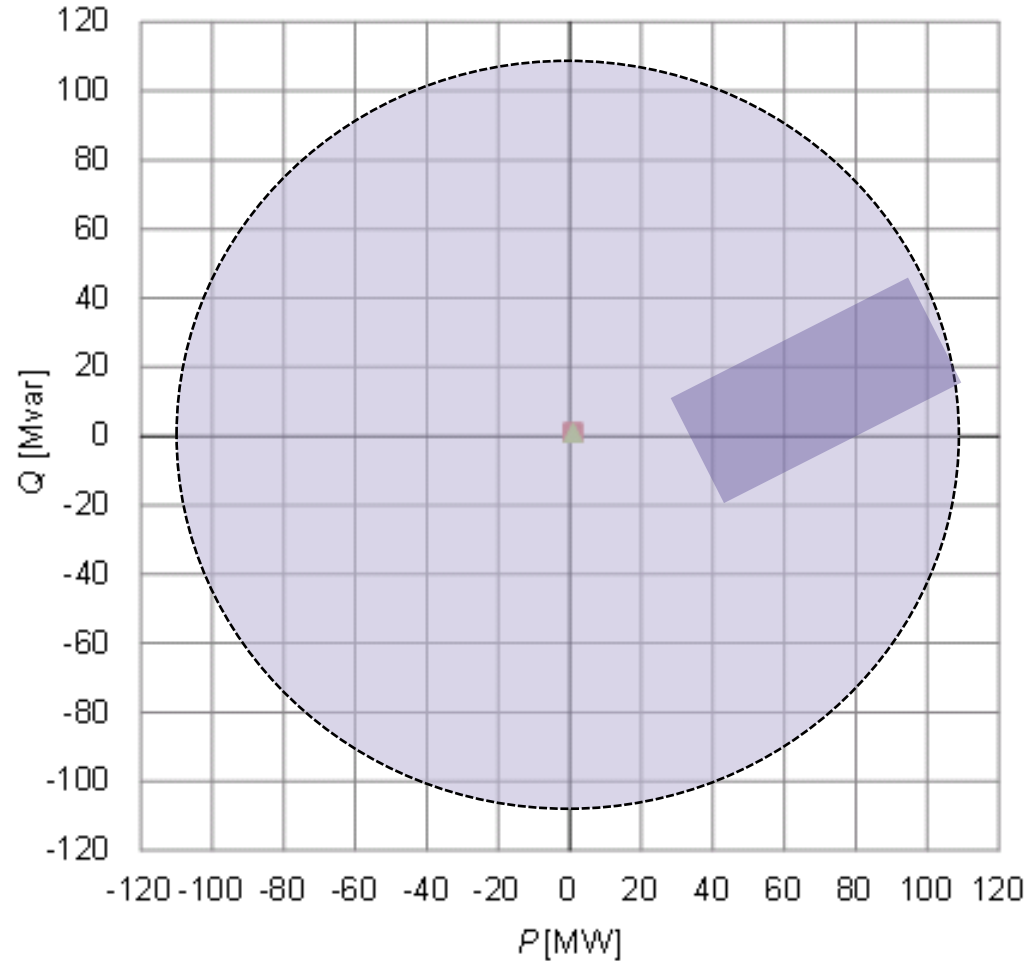
25% loading point in red is used to determine 0Mvar +/-5% positions point capability



Reactive power – Dynamic demand

Examining generation, DSR and demand in network allows dynamic area to be set

Generally a typical demand and generation combination plot would identify the reasonable size of a dynamic window





Thanks for your attention

Any questions