

# PowerWorld (PW) QV Tool Governor Power Flow Solution Option

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PowerWorld User Group Meeting

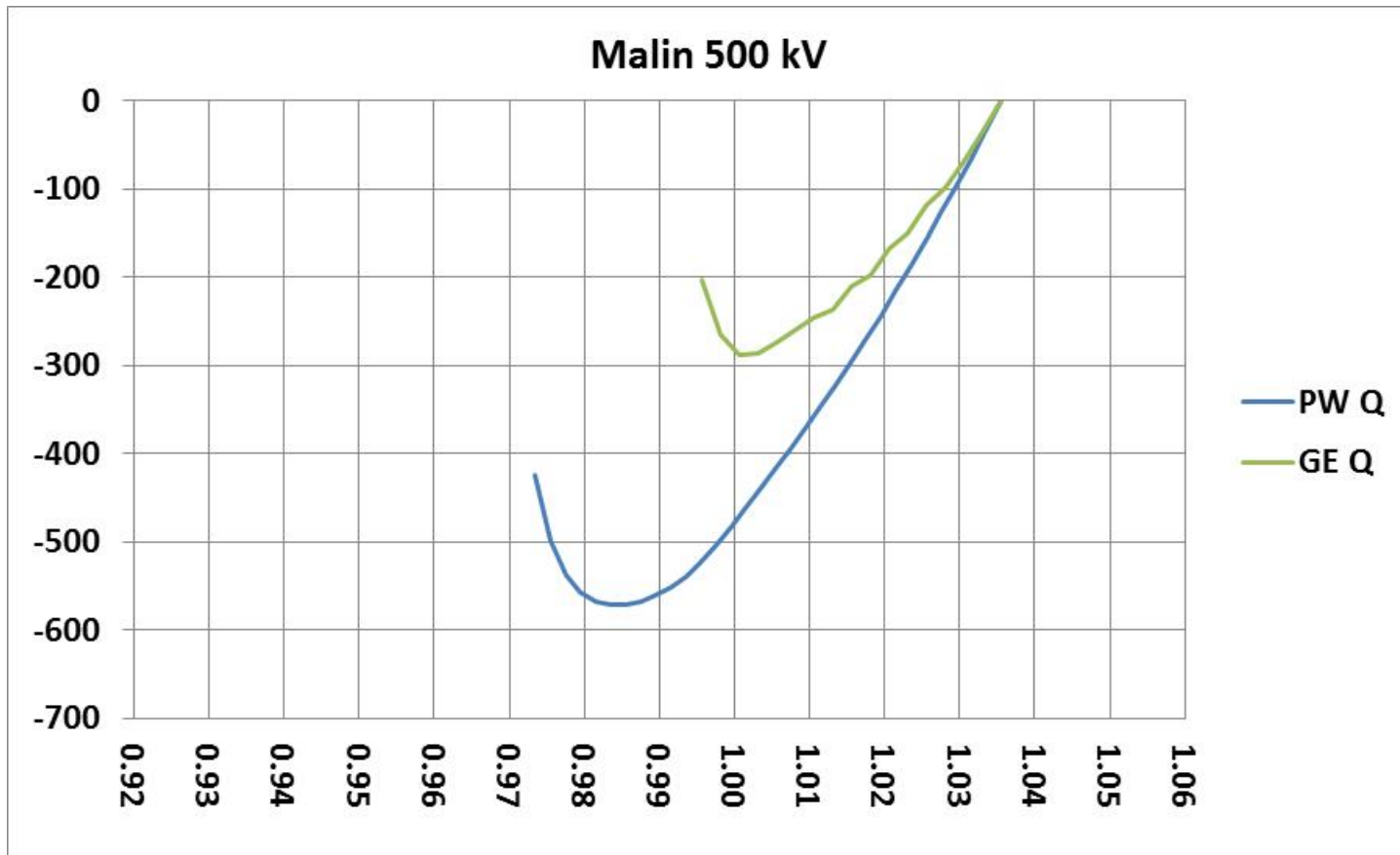


# Comparing QV Reactive Margin Results Between PW and PSLF

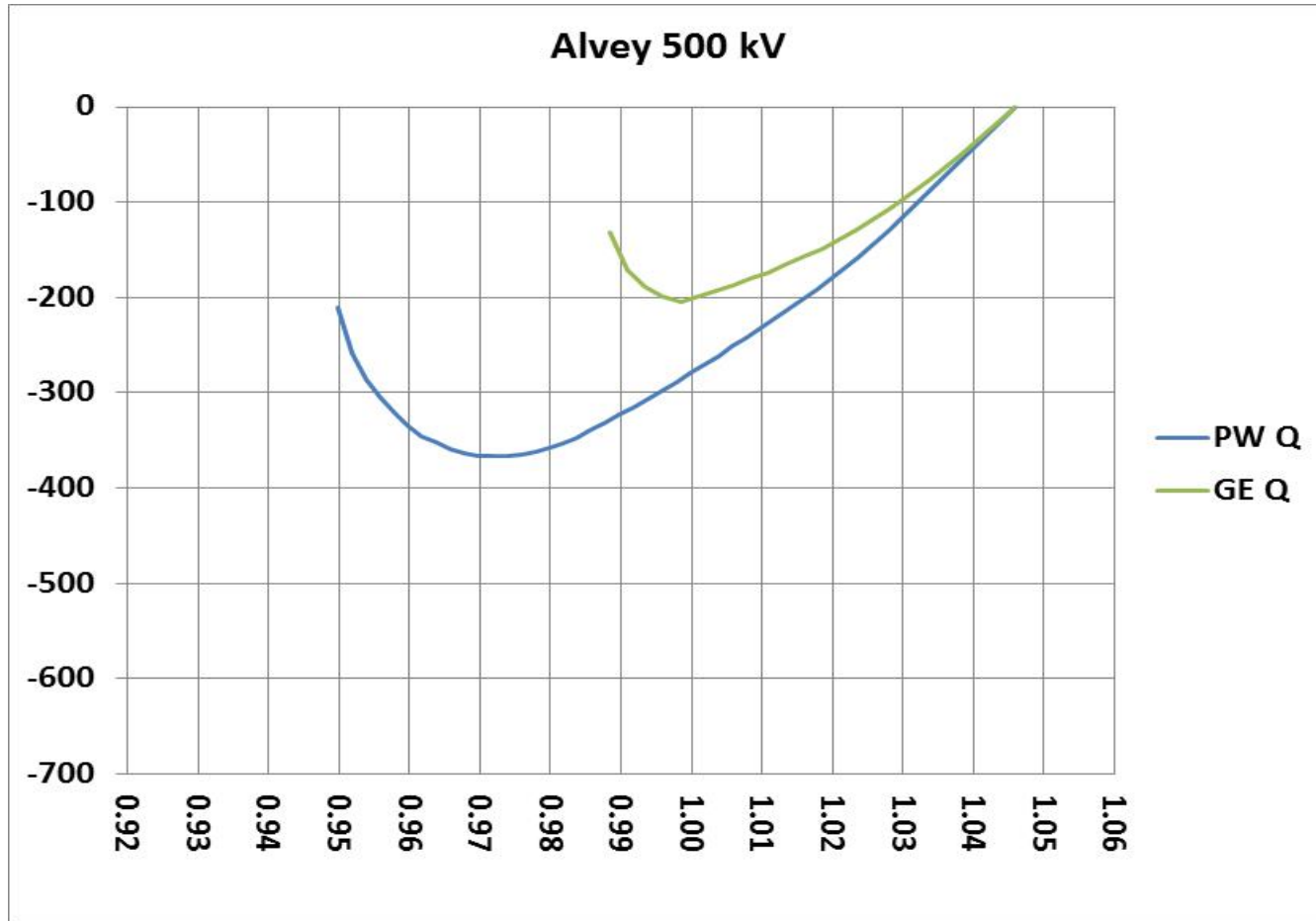
- BPA Planning staff were reviewing study results from the SunZia Project's WECC Path Rating Reports
- SunZia QV studies were performed in PSLF
- BPA converted one of the study cases (summer 2018 case) to re-run the QV results in PW for comparison
- BPA found more reactive margin in the PW results than reported for the PSLF results provided by SunZia
- BPA started running PSLF and PW QV comparisons studies



# Sample QV Results From PSLF and PW 2PV Contingency



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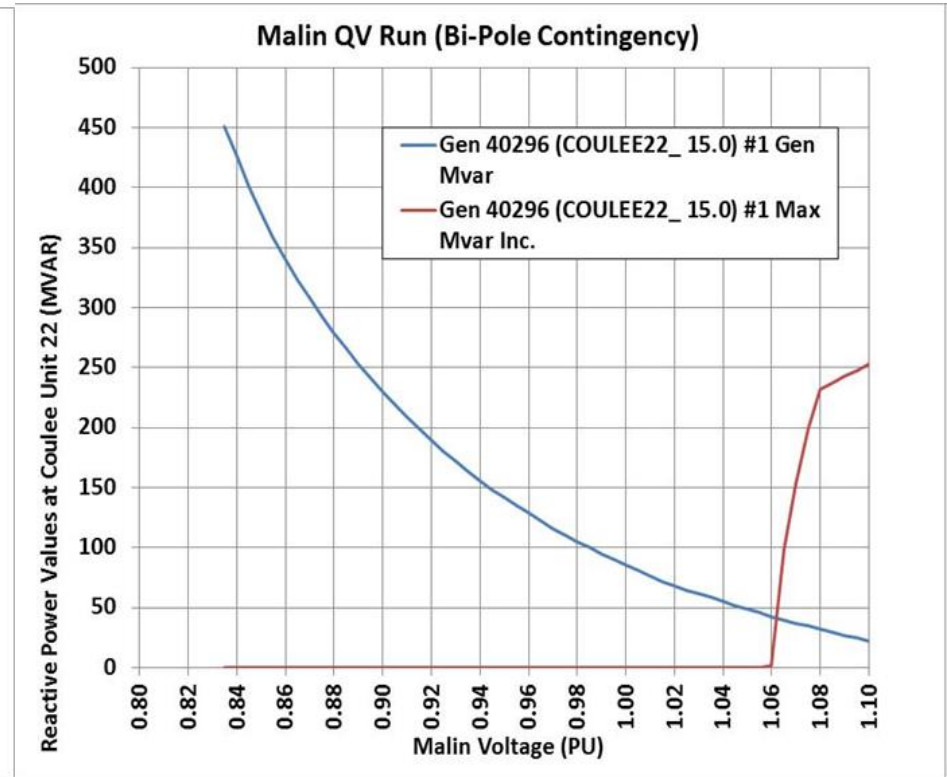
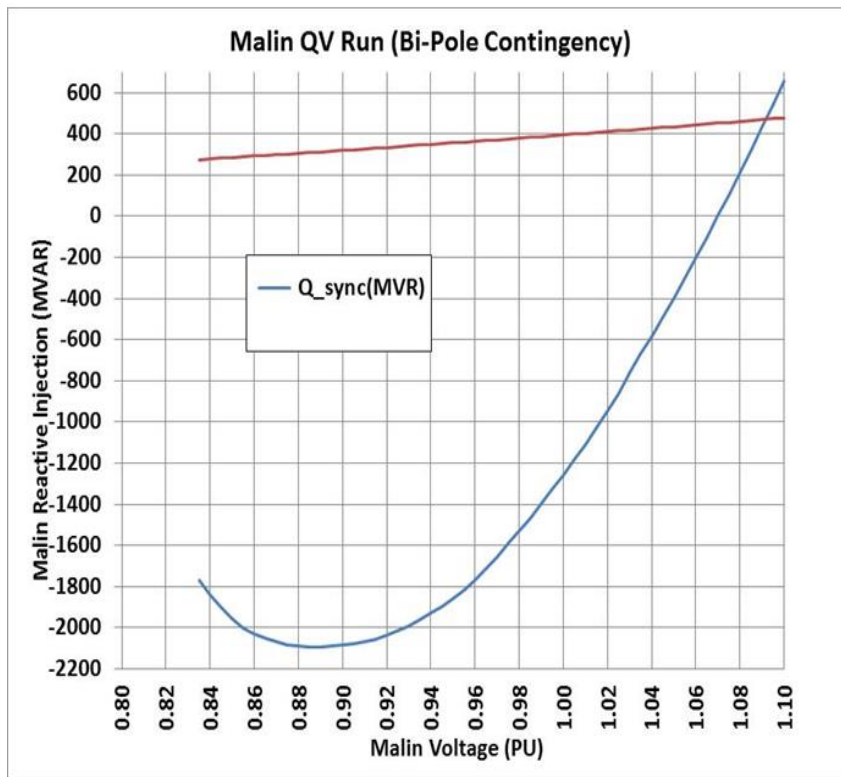


## The Results Prompted BPA to Start a Study to Benchmark PW and PSLF QV Results

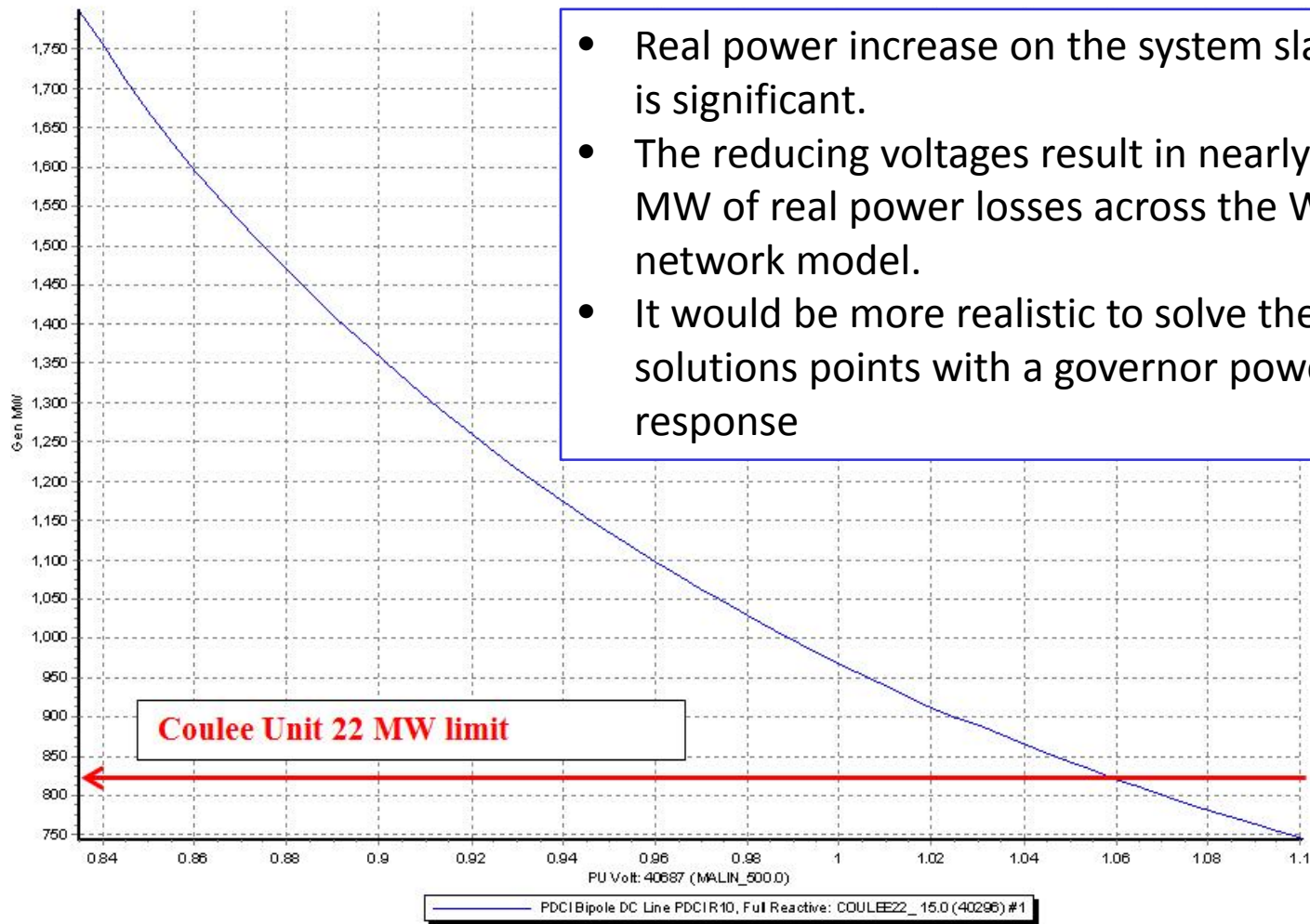
- Presently, the benchmarking studies are not complete and work will continue in 2015
- However, one solution option difference has been identified
  - The PSLF QV method applies a governor solution for the contingency and the QV points
  - The PW QV tool applied a governor solution for the contingency, then defaulted to the system slack bus for balancing real and reactive power during the QV solution points
- Generally, the main grid buses should have ample reactive margin and low voltage critical points. Therefore, the makeup of real and reactive power demand change is important.



# Sample QV Runs with the Default System Slack Bus Coulee Unit 22



## Sample QV Runs with the Default System Slack Bus Coulee Unit 22



- Real power increase on the system slack bus is significant.
- The reducing voltages result in nearly 800 MW of real power losses across the WECC network model.
- It would be more realistic to solve the QV solutions points with a governor power flow response



# PowerWorld Upgrades the QV Tool

The screenshot displays the PowerWorld software interface. The top menu bar includes 'File', 'Case Information', 'Draw', 'Onelines', 'Tools', 'Options', 'Add Ons', and 'Window'. The 'Options' tab is selected, showing various tool options like 'Primal LP', 'SCOPF...', 'OPF Case Info', 'QPF Options and Results...', 'PV...', 'QV...', 'Refine Model', 'ATC...', and 'Tran Stat'. A 'Run' button is visible in the top left. Below the menu bar, a text box provides instructions: 'To calculate QV curves at a set of buses, follow these steps: select the set of buses where you want QV curves to be calculated on the Buses tab, specify the settings for various options on the Options tab, and control and monitor the run from the Control/Results tab.'

The 'Options' panel is divided into 'Solution', 'Contingencies', and 'Output' tabs. The 'Solution' tab is active, showing 'Default solution parameters' and 'Power flow solution options'. The 'Default solution parameters' section includes:
 

- Voltage step size (pu): 0.0100
- Minimum voltage (pu): 0.4000
- Maximum voltage (pu): 1.0700
- Use initial voltage as Vmax (applies to all buses)

 The 'Power flow solution options' section includes:
 

- Global solution options ...
- QV Power Flow Solution Options...
- QV Make-Up Power:
  - System Slack
  - Same as Contingency Analysis

 The 'QV Make-Up Power' section is circled in blue.





# Slack Bus vs. Governor Power Flow 2 Palo Verde Contingency (Malin Bus QV)

Case – QV Run Solution Option	Change In COI
Slack Bus	Reduced ~270 MW
Same as Contingency Tool (gov. power flow)	Reduced ~130 MW

Slack Bus (original)				Governor Power Flow (new feature)				Change In Qmin
V at Q0	Q0	V at Qmin	Qmin	V at Q0	Q0	V at Qmin	Qmin	
1.08	0	-2708	0.886	1.08	0	0.926	-2406	<b>302</b>

**Note: Slack bus is San Juan Unit 4 in this comparison.**



## Conclusion

- Immediately after a major contingency, resulting in reduced voltages, the increase in real power losses will be balanced by the many units providing governor response.
- The new PW solution options lets the user keep the governor power flow representation for the QV solution points.
- This is more representative of the real system and maintains expected transmission flows following a major contingency and subsequent decay in voltages.
- This is a good upgrade to the PW QV tool.

