

# Arizona Corporation Commission 2010 Biennial Transmission Assessment

10 YEAR SNAPSHOT AND  
PROJECT OUTAGE STUDY  
(FORMERLY N-1-1)



June 3 & 4, 2010

Workshop #1 – LeeAnn Torkelson, SRP

# The Biennial Transmission Assessment (BTA) Study

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- A Ten Year snapshot study = BTA study
  - ▣ Performed every two years, an Arizona requirement
  - ▣ All Arizona entities 10 year plan projects included in the base case
  - ▣ Power flow analysis (thermal and voltage screening)
    - Pre and post contingency (N-0 and N-1 analysis)
  - ▣ Includes “Project Outage” analysis (formerly N-1-1 analysis)
    - Take out one planned project and perform power flow analysis on remaining system.
    - Thermal and voltage screening pre and post contingency

# The 2019 Case

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- 2019 transmission, generation, and load configuration known at the time of the case development (Jan-April 2009).
- CATS EHV members developed case in a round-robin approach.
- Requested verification of results and corrections (islanding, divergence, and overloading) from members.
- Applied corrections to 2019 base case.

# Transmission Participants

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- Arizona Public Service
- Salt River Project
- Electrical District #3
- Southwest Transmission Cooperative
- Tucson Electric Power
- Western Area Power Administration

# Study & Report Findings

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- The 2019 system is robust
  - ▣ Few overloads due to outages
  - ▣ Few voltage deviation issues
  - ▣ Consistent loadings/voltage deviations even with simulated delay of individual Projects
- Planned Projects (generation and transmission) are vital to a strong Arizona transmission system that can weather changes in development.
- Delay of multiple projects could have significant negative impact.
- Study results were accepted by CATS EHV &SWAT

# Pre-contingency (N-0) Results

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- N-0 results showed that there were no overloaded elements in the base case.
  - ▣ No transformer or line exceeded its “normal” rating.
- Inconsequential voltage violations.
  - ▣ Both high voltage (more than 10% above nominal) and low voltage (more than 5% lower than nominal)
  - ▣ Voltage violations can be corrected easily by generation re-dispatch, transformer settings, or removal of capacitors.

# Contingency (N-1) Results

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- Contingencies produced overload conditions on ten 230kV and 138kV facilities
  - ▣ Overloads can be mitigated by a variety of solutions including planned reconfigurations, upgrade conductor, and upgrading of facilities.
  - ▣ Mitigation offered in text of Report.
- Contingencies showed 23 buses with voltage deviations greater than five percent.
  - ▣ Over half of the voltage violations were due to modeling errors on the radial Bagdad system.
  - ▣ Mitigation offered in the text of the report.

# Project Outage Analysis (formerly N-1-1)

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- Take a planned 10 year Project out of service
- Run contingencies against this Project Outage case
- Compare thermal/voltage results to base case with the project in service
  - ▣ Did thermal loadings increase over the base case results? How much?
  - ▣ Did voltage results worsen? How much?
- Remember this study was based on the 2009 Ten Year Plan filings, project dates have changed.

# APS Project Outage (formerly N-1-1)

Case Code	Planned Project modeled as initially out of service for N-1-1 analysis	In service Date
	<ul style="list-style-type: none"> <li>Bullet items are facilities identified for removal for the project</li> </ul>	
APSo1	Palo Verde-Sun Valley (formerly TS5) 500 and 230 kV system <ul style="list-style-type: none"> <li>Delany-Sun Valley 500 kV line</li> <li>Sun Valley 500/230kV transformer</li> <li>Sun Valley 500/230 kV transformer</li> <li>Sun Valley-Trilby Wash 230kV line</li> <li>Trilby Wash 230/69 kV transformer</li> </ul>	2014
APSo2	Palo Verde-Sun Valley – Raceway 500 and 230 kV systems <ul style="list-style-type: none"> <li>All of APSo1 plus</li> <li>Sun Valley – Raceway 500 kV line</li> </ul>	2014
APSo3	Raceway-Avery-Pinnacle Peak 230kV line <ul style="list-style-type: none"> <li>Raceway-Avery 230kV line</li> <li>Avery-TS6 230kV line</li> <li>TS6-Pinnacle Peak 230kV line</li> <li>Both TS6 230/69 kV transformers</li> </ul>	2010 OR 2012
APSo4	Palm Valley-TS2-Trilby Wash (TS1) 230kV line <ul style="list-style-type: none"> <li>Palm Valley-TS2 230kV line</li> <li>TS2-Trilby Wash 230kV line</li> </ul>	2015
APSo5	Raceway-Pinnacle Peak 500kV line <ul style="list-style-type: none"> <li>Raceway-Pinnacle Peak (APS) 500kV line</li> <li>All 3 Pinnacle Peak 500/230kV transformers</li> </ul>	2010
APSo6	Raceway 500kV to 230kV transformer <ul style="list-style-type: none"> <li>Raceway 500/230kV transformer</li> </ul>	2016
APSo7	Sun Valley (TS5) – Raceway (TS9) 500kV line <ul style="list-style-type: none"> <li>Sun Valley – Raceway 500kV line</li> </ul>	2016
APSo8	Hassayampa-North Gila 500kV ckt 2 <ul style="list-style-type: none"> <li>Hassayampa-North Gila 500kV line (ckt 2)</li> </ul>	2014
APSo9	Pinal Central – Sundance 230kV line <ul style="list-style-type: none"> <li>Pinal Central-Sundance 230kV line</li> </ul>	2013

In-service dates from 2009

# SRP, TEP, PV-DEV Project Outage

(formerly N-1-1)

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Case Code	Planned Project modeled as initially out of service for N-1-1 analysis	In service Date
	<ul style="list-style-type: none"> <li>Bullet items are facilities identified for removal for the project</li> </ul>	
SRP01	Desert Basin-Pinal Central 230kV line <ul style="list-style-type: none"> <li>Pinal Central -Desert Basin 230kV line</li> </ul>	2013
SRP02	PC Gen 500/230 kV transformer and all generation <ul style="list-style-type: none"> <li>PC Gen 500/230kV transformer</li> <li>All PC gen</li> </ul>	2018
SRP03	Pinal West – Pinal Central 500kV line <ul style="list-style-type: none"> <li>Pinal West – Santa Rosa</li> <li>Santa Rosa – Pinal Central</li> <li>Santa Rosa 500/230kV transformers</li> </ul>	2013
SRP04	RS24 All 230 kV lines and 230/69kV transformers at RS24 <ul style="list-style-type: none"> <li>RS24-Abel (1 and 2)</li> <li>RS24 230/69</li> <li>RS24-Schrader</li> <li>RS24-Santan</li> </ul>	2012
TEP01	Pinal Central-Tortolita 500kV line <ul style="list-style-type: none"> <li>Pinal Central-Tortolita 500kV line</li> </ul>	2013
PVD2	Palo Verde Devers #2 500kV line <ul style="list-style-type: none"> <li>Harquahala-Devers 500kV line</li> </ul>	TBD

In-service dates from 2009

# Project Outage Results (formerly N-1-1)

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- Greatest Impact to voltage violations:  $>5\%$ 
  - ▣ APS01 - Palo Verde-Sun Valley 500kV & 230kV (2014)
  - ▣ APS04 - Palm Valley-TS2-Trilby Wash 230kV line (2015)
  - ▣ APS 07 - Sun Valley-Raceway 500kV line (2016)

But further investigation revealed that voltage violations were due to radial connections and do not cause cascading problems.

# Project Outage Results (formerly N-1-1)

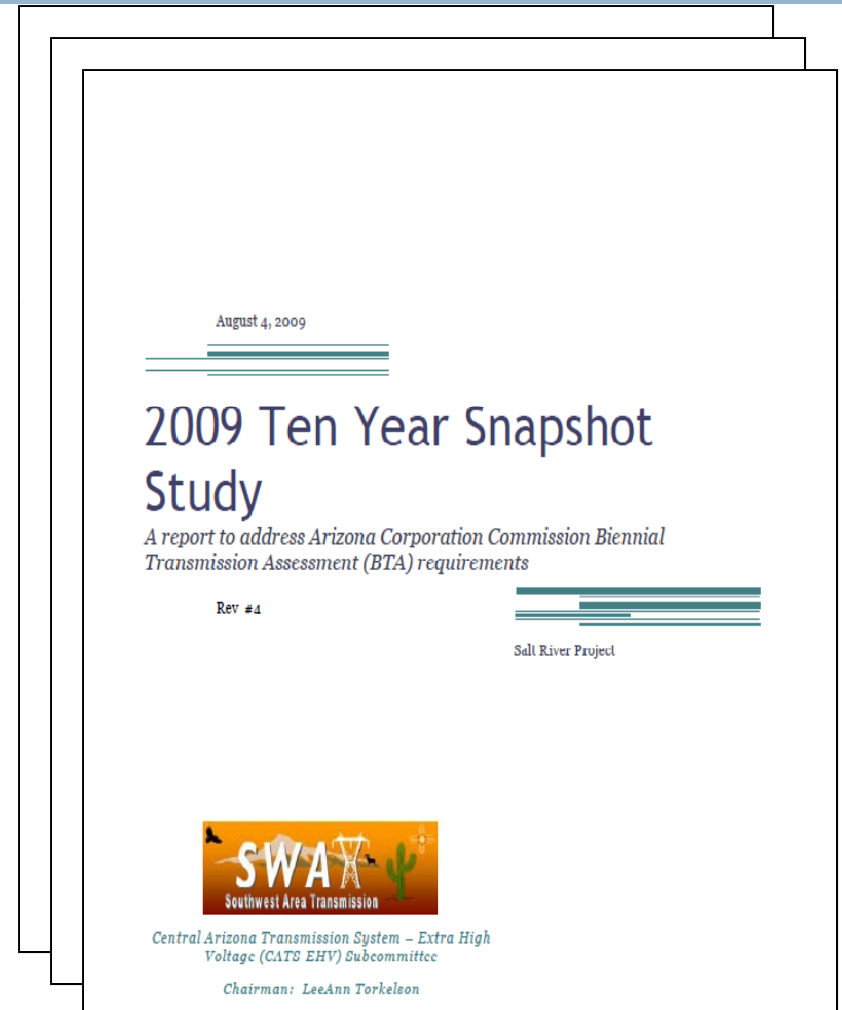
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- Greatest Impact to thermal overloads: >5%
  - ▣ APS03 - Raceway-Avery-Pinnacle Peak 230kV line (2010 or 2012)
  - ▣ APS05 - Raceway-Pinnacle Peak 500kV line (2010)
  - ▣ TEP01 - Pinal Central-Tortolita 500kV line (2013)
- The solutions to overloads in the base case would also be applicable for these project outage scenarios.

# Report Approval

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- ❑ CATS EHV accepted the results and report on August 4, 2009.
- ❑ SWAT approved the “2009 Ten Year Snapshot Study” on August 18, 2009 (Rev #4 dated August 4, 2009)
- ❑ Report docketed September 11, 2009



# Questions & Contact Info

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## Questions?

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