

SWAT N-1-1 Study (Ten Year Snapshot)

Eighth Biennial Transmission Assessment E-00000D-13-0002

May 15, 2014

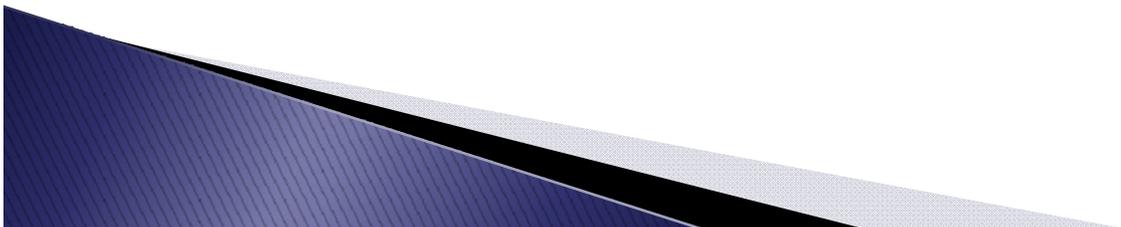
10 Yr Snapshot Study Purpose

- ▶ Required to be Provided for the Arizona Corporation Commission Biennial Transmission Assessment – filed Jan. 2014
- ▶ Objective
 - Analyze how the ten year plans perform as a whole in a regional environment in the tenth year of the plan
 - Assess the affect of omitting individual planned transmission projects

10 Yr Snapshot Study Base Case

▶ Starting Case

- Heavy summer 2023
- All proposed Initially Out of Service (IOS) facilities are modeled in the case and energized
- Round Robin approach to base case updates
- Shared case with adjacent planning areas and other interested stakeholders



10 Yr Snapshot Study Base Case

▶ Case Modifications:

- Removed SONGS based on coordination with SCE/CAISO
- Updated WAPA Loads and tap settings, increased Hoover to cover load increase
- Adjusted area 22 gen so swing $p_{gen} < p_{max}$
- Corrected r&x values on Perkins–WW 500kV to be non-negative
- Corrected HANG2 shunts
- Applied SunZia EPC, Sunzia on
- Applied changes from SWTC
- Applied TEP rating change on Winchester–Vail
- Corrected status of SCE Huntington Beach synchronous condensers

IOS Cases

- ▶ **APS IOS Cases**
 - Palm Valley – TS2 – Trilby Wash 230kV (2015)
 - Delaney – Sun Valley 500kV (2016)
 - Includes Sun Valley – Trilby Wash 230kV (2016)
 - NG – Orchard (TS8) 230kV line (2016)
 - Morgan – Sun Valley 500kV line (2018)
- ▶ **SRP IOS Cases**
 - Rogers – Santan 230kV (2016)
 - Price Road Corridor (2016)
- ▶ **TEP IOS Cases**
 - Pinal Central – Tortolita (2016)
- ▶ **Independent Developer IOS Cases**
 - SunZia (2018)
 - Bowie (2018)

What is an IOS Case?

- ▶ IOS case = base case minus a planned facility (or project)
- ▶ Example: APS Case Palm Valley – TS2 – Trilby Wash 230kV (2015)
 - Started with the Final 2023 case
 - Changed the status to “off” for
 - Palm Valley – TS2 230kV line and
 - TS2 – Trilby Wash 230kV
 - Solved & saved the IOS
 - Ran same contingency list as with base case

Monitoring Criteria

Outage Type		Thermal Criteria	Voltage Criteria
N-0	No Outage, All lines in service	No element exceeding 100% of its normal rating	No bus voltage less than 0.95 pu or greater than 1.05 pu
N-1	Single Element Outage	No element exceeding 100% of its emergency rating	No voltage deviation greater than 5%
Project Outage (N-1-1)	Project Outage (with system adjustments) followed by another contingency	No element exceeding 100% of its normal rating following system adjustment after the Project Outage and no element exceeding 100% of its emergency rating following the subsequent outage.	No bus voltage less than 0.95 pu or greater than 1.05 pu with system adjustments for the Project Outage and no voltage deviation greater than 5% for the subsequent outage.

Thermal overloading results were screened for elements above 230kV. Voltage results were screened for bus voltages 230kV and higher.

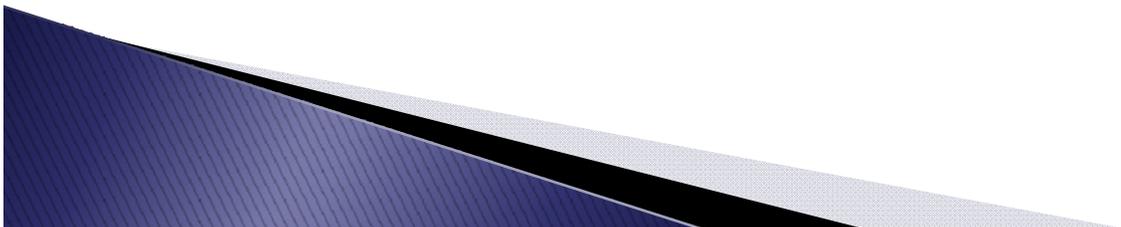
Base Case Results Summary

- ▶ Prior to any outages (N-0 conditions) – base case showed no busses outside of voltage criteria or exceeding thermal ratings.
- ▶ Single contingency (N-1) – showed no busses with voltage or voltage deviation outside of criteria and only one facility exceeding its emergency thermal rating (Copper Verde Transformer).
- ▶ Contingencies studied included Arizona transmission lines and transformers with voltages equal to or greater than 230kV.

IOS Thermal Results Summary

- ▶ Delay or Cancellation of:
 - Pinal Central – Tortolita (2016)
 - SunZia (2018)

Showed thermal loadings at least 3% higher than the base case (with the project in service), indicating delay of these projects beyond their in-service date or 2023 may necessitate other system improvements.



IOS Voltage Deviation Summary

- ▶ No voltage (high or low) violations for the Project Outage scenarios.
- ▶ Two Project Outage cases showed voltage deviations of 5%, just at the criteria limit.
 - Palm Valley–TS2–Trilby Wash (TS1) 230kV line
 - Pinal Central–Tortolita 500kV line

Summary of findings

- ▶ The most critical project for the overall Arizona transmission system is completion of the Pinal Central –Tortolita Facility based on thermal loadings
- ▶ Delay of other projects in this study beyond their in-service dates or 2023 may not impact the Arizona transmission system but could have significant impacts on underlying load-serving facilities.

Thank You

- ▶ Thank you to everyone that contributed to completion of the Study.
- ▶ A special thank you to LeeAnn Torkelson who led this Study for us.

