Commission Ordered Studies

Arizona Corporation Commission
2016 Biennial Transmission Assessment

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Commission Ordered Studies

- Ten Year Snapshot (aka N-1-1 study)
  - Examines the adequacy of the Arizona transmission system without planned projects
- Arizona Extreme Contingency Study
  - Examines adequacy of the Arizona transmission system with long term outage of major transmission import points located in forested areas

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

10 Year Snapshot Study Purpose

- Filed January 2016 by APS on behalf of SWAT
- 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 Year Snapshot Study Base Case

- Starting Case
  - Heavy summer 2025
  - All proposed Initially Out of Service (IOS) facilities are modeled in the case and energized
  - Case recently approved by WECC, so used “off the shelf”
  - Minor refinements to shunt caps and generation selection

10 Year Snapshot Study Coordination

- TEP/UNSE and AEPCO indicated no project for Ten Year Snapshot evaluation
- Coordinated study with SRP, but each individually performed IOS analysis
- Coordination and approval of study plan and with SWAT-AZ
- Shared preliminary results with SWAT-AZ
- Approval of final report with SWAT-AZ

APS IOS Cases

Case Code	Planned Project modeled as initially out of service for N-1-1 analysis • Bullet items are facilities identified for removal for the project	In service Date
APS01	North Gila – Orchard (TS8) 230kV line • North Gila – Orchard 230kV line • North Gila 500/230 kV transformer	2021
APS02	Morgan – Sun Valley 500kV line • Morgan – Sun Valley 500 kV line • Sun Valley – Hassayampa Pump 230 kV line	2018

Ten Year Snapshot Study
SRP IOS Cases

Case Code	Planned Project modeled as initially out of service for N-1-1 analysis • Bullet items are facilities identified for removal for the project	In service Date
SRP01	RS-28 230/69kV Substation and RS-28 – Schrader 230kV line • RS-28 230/69kV Substation • RS-28 – Schrader 230kV Line	2018
SRP02	Browning – Corbell 230kV and Santan – Rogers 230kV line reconfiguration • Browning – Corbell 230kV line • Santan – Rogers 230kV Line • (Browning – Rogers 230kV Line put back in service)	2020

What is an IOS Case?

- IOS case = base case minus a planned facility (or project)
- Example: APS Case Sun Valley – Morgan 500 kV Project (2018)
  - Started with the Final 2025 case
  - Changed the status to "off" for
    - Sun Valley – Morgan 500 kV line
    - Sun Valley – Hassayampa Pump 230 kV line
  - Solved & saved the IOS and readjusted the system, if needed
  - 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	Less than 0.95 or greater than 1.05 of nominal voltage
N-1	Single element outage	No element exceeding 100% of its emergency rating	No voltage deviation greater than 8%
Project Outage (N-1-1)	Project outage (with system adjustments) followed by another contingency	Reducing loadings to 100% (or less) of normal rating following the removal of a project and 100% or less of the emergency rating for the subsequent outage	No voltage deviation greater than 8%

- All Arizona elements 115 kV and above monitored

Base Case Results Summary

- Prior to any outages (N-0 conditions) low voltages at PD-Morenci 230 kV
- Contingencies studied included Arizona transmission lines and transformers with voltages greater than or equal to or 115kV
- Single contingency (N-1)
  - Saguaro East – Marana and Three Points – Sandario 115kV lines overloaded for several outages
  - No solve for Marana – Saguaro 115 kV (Breaker to Breaker) outage
  - Notified impacted utilities
  - These overloads and no-solves are currently being investigated and mitigations, if required, will be incorporated into future 10 year plans. One possible mitigation is the ED-5 – Saguaro – Marana 115 kV bypass of Saguaro to become ED-5 – Marana 115 kV. (Western has implemented this project)

IOS Results Summary

- No additional violations or concerns identified in IOS cases (compared to the base case results)
  - All thermal overloads pre-existing in base case
  - No-solve remained from base case
  - All voltage/voltage deviations pre-existing in base case

Summary of Findings

- This study indicated the planned 2025 Arizona transmission system is robust, as shown by the few instances of localized voltage and thermal violations in the base case.
- APS project outage scenarios indicated that a delay of any one project did not have a significant negative impact on the remaining transmission system.
- Delay of projects investigated in this study beyond their in-service dates may not impact the Arizona BES transmission system, but it could have impacts on underlying local load-serving facilities

Arizona Extreme Contingency Study

AZ Extreme Contingency Study

- Filed under a NDA with the ACC
- CEII information
- High level summary of study results

Extreme Contingency Study Coordination

- Coordination and approval of study plan and with SWAT-AZ
- Shared preliminary results with SWAT-AZ

Study Assumptions

- Utilize the 2016 and 2024 heavy summer power flow cases
- The integrated Arizona power system is represented
- Corridors are chosen based upon exposure to forest fires and other extreme events
- A bank of 500/230 kV transformers at one substation

Summary of Results (2016 and 2024)

- For all outages studied, all load can be served & local Phoenix reserve requirements met
  - Some outages from remote generation would require redispatching from other available sources
    - Maximum redispatch requirement is @ Cholla/Coronado
    - Generation made up or purchased from available AZ and CA units
  - Some outages would require some system reconfiguration to alleviate overloads

Questions?

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