

**Report on the Phase I Study
Of the
Central Arizona Transmission System
(CATS)**

**Prepared For the
CATS Steering Committee**

By

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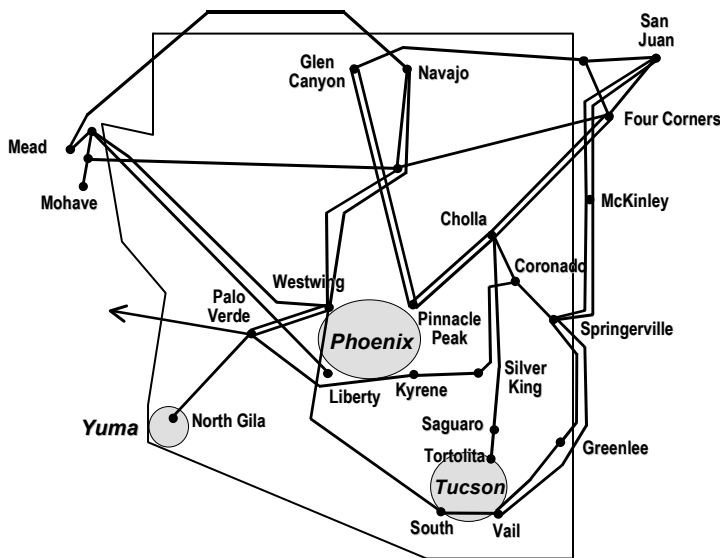
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Executive Summary

I. Introduction

Historically, Arizona's EHV transmission system has been developed to interconnect large generating resources to major load centers primarily located in the Phoenix and Tucson metropolitan areas. With the exception of Palo Verde, the resultant transmission development within Arizona was located in the northeastern and northwestern portions of the state (Figure 1). And, while the resultant transmission development interconnected these generation facilities with their consumers located in the Phoenix and Tucson areas, they also provided stronger ties to neighboring states such as California, New Mexico, Colorado, and Utah. In the early stages of developing the transmission system for the Palo Verde generation facility, consideration was given to building a 500kV line from Palo Verde to the Tucson area. However, the final Palo Verde transmission system design moved towards strengthening EHV transmission interconnection in the Phoenix area, resulting in the construction of the second Palo Verde-Westwing 500kV line. This left development of future EHV transmission ties between the Phoenix and Tucson areas for future consideration.

Figure 1
Arizona EHV Transmission



Over the last ten years Arizona has experienced significant increases in business and residential growth in the Phoenix and Tucson areas. As Arizona's electric utility industry continues a breakneck pace to keep up the increasing growth and demand, resource developers vie for opportunities to site and build new generation to access market opportunities in the Arizona and California areas. Under these newer growth scenarios, Arizona's EHV system capability continues to experience higher flows and denser utilization. As projected growth continues to outstrip the ability of the Phoenix and Tucson transmission system's ability to deliver needed energy to their respective areas, new generation proposals are seeking to tap all existing transmission capability to achieve access to as many markets possible. Due to the attractiveness of the Palo Verde switchyard as a market hub, existing gas pipeline capability, and the existing Phoenix and Tucson growth markets, much of the proposed generation, in excess of 10,000 MW, is being sited in the CATS study area, within the central Arizona region between Palo Verde, Phoenix, and Tucson.

Unfortunately, EHV transmission is limited in this area and local utilities are struggling to keep pace with their near term transmission infrastructure requirements to accommodate the expected growth in customer load while posturing themselves to tap the pool of proposed resource additions that are being proposed.. Others are looking at opportunities to use proposed CATS transmission alternatives to facilitate siting of their generation in a manner that would stimulate economical and reliable transmission service from their facility to existing and future energy markets. Early discussion of these transmission needs occurred between Salt River Project (SRP), Arizona Public Service (APS), and Tucson Electric Power (TEP). In principle, the utilities agreed that a regional transmission planning effort was needed to assess EHV transmission needs and opportunities in the central Arizona area.

From this discussion, the Central Arizona Transmission System (CATS) study effort was proposed. The primary participants were to include all of Arizona's transmission utilities including Arizona Public Service, Salt River Project, Tucson Electric Company, Arizona Electric Power Cooperative, Citizens Communications Company, Western Area Power Administration, and the Arizona Corporation Commission Staff. Recognizing the need to involve all stakeholders in the process, an invitation letter was sent to SWRTA (Southwest Regional Transmission Association) members and other interested parties. Consequently several other utilities, independent power producers, and other interested parties are actively participating in the CATS effort.

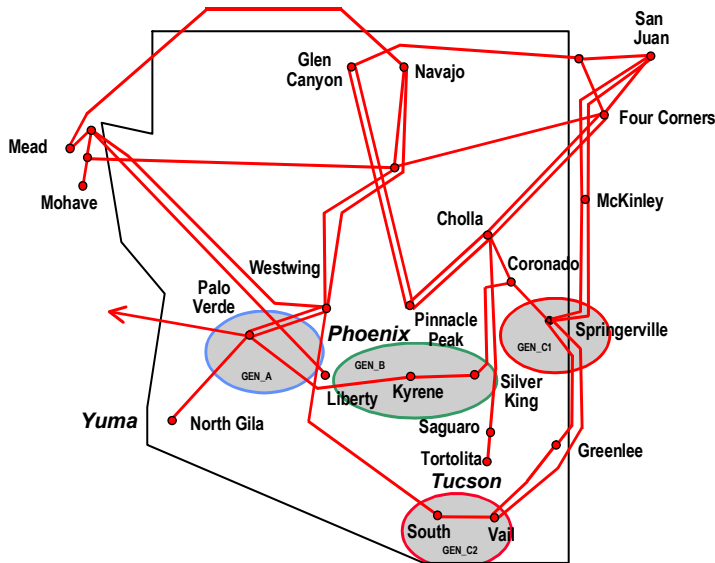
The central Arizona region for the (CATS) study encompasses an area bounded by the Phoenix Metropolitan area to the north, the Tucson

- Increase import capability to Phoenix and Tucson from the Coronado/Springerville generation sites, where plans for new generation are being considered.

The scope of the study work was limited to a power flow analysis of all transmission alternatives and generations dispatch scenarios for N-0 and N-1 disturbances. Transient stability and post-transient analysis will be performed in the Phase II study effort.

During the course of the study it was recognized that several transmission alternatives would be required to address the needs of all the participants. In addition, the development of new generation resources in the CATS study area also suggested that different dispatch scenarios would also be required to fully assess the system performance of the transmission alternatives. For example, generation sited in the Palo Verde area would most likely benefit the Phoenix area system more than the Tucson area system. Conversely, generation sited in the Saguaro area would most likely benefit the Tucson area system more than the Phoenix area system. For this reason, the assessment of the transmission alternatives was divided into four different generation areas. These generation areas are highlighted on Figure 3.

**Figure 3
Central Arizona Transmission System
(CATS) Generation Study Areas**



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While all four generation areas were considered in the study, generation in the Phoenix and the central Arizona areas was studied extensively. The generation area located in the Coronado/Springerville region was also considered late in the study but not studied in detail.

Based on input received from the CATS study members, six transmission paths were determined to be of significant interest to the study members. These paths are listed below.

- Palo Verde to Saguaro 500kV Line (4 different variations).
- Palo Verde to Southwest Phoenix Valley 500kV Line (2 different variations)
- Use of Westwing to South 345kV Line (2 different variations)
- 500kV Line to the Southeast Phoenix Valley (1 variations)
- Loop-In of the Cholla to Saguaro 500kV Line into Silverking (2 different variations)
- Saguaro to Tucson Area at 500kV, 345kV or 230kV (4 different variations)

As can be seen from the above list, numerous transmission variations were developed and considered for study. It should also be noted that the scope of this study was to focus on the high voltage transmission system. Up to this time, no attempt has been made to address local area transmission problems or issues. As such, local area enhancements and improvements will be required and need to be evaluated in the next study phase. General one-lines of the study alternatives are included in Appendix 1 through Appendix 13.

As has been discussed, the intent of the (CATS) study was to provide a framework for the participating entities to plan, coordinate, and locate transmission lines and bulk power stations to meet their objectives. Phase I of the study was a screening effort that evaluated a group of transmission alternatives under a broad range of generation patterns to determine how the resultant system performance could meet the objectives of the study. The strengths and weaknesses of the transmission alternatives were evaluated and observed and ultimately used to narrow down the transmission options that merited further, more detailed, study in the second phase of the study effort.

Power flow studies were performed to assess the system performance of each of the proposed transmission alternatives for each of the generation dispatch patterns studied. The assessment was performed by raising generation in the generation area being studied and increasing load in the load area being studied. The system became constrained when a facility limit was reached. For example, increasing generation in the Palo Verde area and increasing load in the Phoenix area assessed the system performance of the Central Arizona Alternatives.

The study areas were broken down into four separate study areas. The following is a breakdown of the four areas and the responsible participant.

- Schedule new Generation from the Palo Verde area (Group A. Generation) into the Phoenix area (SRP).
- Schedule new Generation from the Coolidge area (Group B. Generation) into the Phoenix area (SRP).
- Schedule new Generation from Tucson (Group C. Generation), Saguaro and Springerville (Group C. Generation) and Palo Verde (Group A. Generation) into the Tucson and AEPCO areas (TEP).
- Schedule new Generation from the Palo Verde area (Group A. Generation) to the Colorado/New Mexico area. (APS).

II. Summary of Conclusions

Based on the studies performed, the following is concluded.

1. Building new transmission in the CATS area will increase transfers between Phoenix and Tucson.
2. While single alternatives can provide benefits to individual participants, more synergies are derived and more regional benefits can be achieved by combining alternatives.
3. SRP will derive more benefits from a new transmission alternative between Palo Verde and the Southeast Valley (Southeast Station).
 - a. Phoenix load serving capability
 - b. Interfacing with the “Build out of Browning”
4. Tucson will derive more benefits from a transmission alternative between Palo Verde – Saguaro – South and Palo Verde – Saguaro - Winchester.
5. AEPCO will derive more benefits from a transmission alternative between Palo Verde – Saguaro – Winchester.
6. The system performance of the Palo Verde – Saguaro and the Gila Bend – Saguaro alternatives is nearly the same. However, the recent establishment of new National Monuments in southeastern Arizona creates uncertainty about being able to build timely transmission for the Gila Bend – Saguaro alternative.
7. The availability of gas in the Saguaro/Southeast Valley area coupled with the proposed CATS transmission alternatives to these areas should enhance the siting of new generation in the Saguaro/Southeast Valley area.
8. Developing new generation in the Saguaro/Southeast Valley area will improve the efficiency of all the transmission alternatives studied and increase the load serving capability to Phoenix and Tucson.
9. Strengthening the interconnection between the Cholla/Saguaro and/or the Coronado/Silverking transmission system to the east of the Phoenix system will enhance exports from Palo Verde to Phoenix.
10. Developing new interconnections to the transmission system east of Tucson enhances exports from Palo Verde to Tucson.

11. Opportunities to tie Winchester to the Southeast Valley may improve the capability of the Springerville south system
12. The Alternatives chosen to advance to Phase II will need to incorporate consideration of TEP's' Two-County flow requirements.

III. Recommendations

Based on the conclusions of this study, the following is recommended.

1. Continue the CATS study work.
2. Perform Phase II of the CATS study to assess and quantify the components of CATS that the participants want to initially build.
3. Phase II studies should quantify the regional benefits of the following transmission alternatives:
 - a. Jojoba – Southeast Station 500kV line
 - b. Jojoba – Saguaro 500kV line
 - c. Southeast Station or Saguaro – Winchester 500kV line
4. Individual CATS participants evaluate and develop the underlying system requirements needed to integrate the proposed 500kV alternatives into their respective systems.
5. Quantify the regional benefits of strengthening the interconnection between the Cholla/Saguaro and/or the Coronado/Silverking transmission system to the east of the Phoenix system.
6. Facilitate discussions among CATS participants to develop the preferred transmission alternatives.
7. Initiate joint discussions among the CATS participants to begin developing principles for jointly developing a preferred CATS transmission alternative.