

**Final SATS Transmission Planning Study Group Meeting Notes**  
**TEP's Offices, Training Room B**  
**August 4, 2008**

Meeting Attendees:

Ron Belval, TEP  
Bobby Chavez, TEP  
Laura Pinnas, TEP  
Jim Rein, SWTC  
Ray Som, SWTC  
Bruce Evans, SWTC  
EvaMarie King, SWTC  
Leonard York, Western  
John Kyei, PDS Consulting

No formal agenda was available for the meeting.

Ron Belval stated at the outset of the meeting that it would be a brainstorming session for the 2010-2018 time frame. Several maps were set out for participants to use in the brainstorming process. He distributed a document that he prepared entitled "SATS – Study Area Definition and Summary of Characteristics / Potential Solutions," dated July 23, 2008, which is reproduced here below:

**SATS – Study Area Definition and Summary of Characteristics / Potential Solutions**  
July 23, 2008

The purpose of this paper is to get the ball rolling on the joint planning effort to address issues and to identify possible joint projects. As discussed during our teleconference on July 22<sup>nd</sup>, we generally agree on strategies to meet saturation load level needs. The critical problem is deciding the sequence of the alternative projects to pursue as well as how to allocate those costs in the 2010 to 2018 time frame. Therefore we agree that our focus be on evaluation of system constraints under a variety of scenarios, modeling cases in the 2011 to 2018 planning horizon. We are generally looking at three areas initially, and then integrating solutions among the three areas. The areas and their respective characteristics and potential solutions are described as follows:

**Greenlee to Vail EHV and 230kV Corridor Area**

*Characteristics:* This area includes two 345kV lines in parallel with an interconnected 230kV system. Key features are:

- Growing TEP and Trico loads are increasing stress on the parallel 345kV and 230kV transmission lines. The critical contingency is loss of the Express and the Winchester - Vail 345kV lines.
- WAPA owns a significant portion of the 115kV system paralleling the SWTC 230kV lines from Apache into Tucson. Limitations associated with this 115kV system are not clearly understood at this time.
- A new 500 MW generator is proposed to be interconnected at a new Willow 345kV switching station to be located on the Greenlee - Winchester 345kV line at the point where the Dos Condado - Red Tail 230kV line crosses. This power plant may become an important resource

to supply growing area loads, but will require certain EHV, and possibly other local system reinforcements. Critical contingencies involve loss of the Express line with either the Winchester - Vail 345kV or the Willow - Winchester 345kV lines.

- The 115kV line from Apache to Winchester is constructed at 230kV. Conversion to 230kV operation may be accomplished by adding 230/115kV transformation at Winchester to supply SWTC load to Hayden.
- Phelps Dodge plans to increase Morenci area load. Hackberry load growth is according to plans to achieve 100 MW by 2011. PD Morenci load has been reported to increase to 260-280 MW by 2008, and to 440-480 MW in the 2009/2010 time frame.
- Apache generation station may be considered for generation expansion?
- SunZia Project was announced to be in service by 2013. This project is not certain, but should be evaluated. Interconnection at Winchester, were it to occur, would require EHV reinforcement.

*Potential Solutions:* Alternatives to mitigate overloads caused by critical contingencies include the following:

- New 345kV Winchester – Vail double circuit line
- New 345kV Willow – Winchester double circuit
- Winchester – Tortolita 500kV line
- Uprate 230kV Apache – Bicknell line
- Convert Apache – Winchester 115kV to 230kV (Includes 230/115kV transformation at Winchester)
- Add 2<sup>nd</sup> 345/230kV transformer at Winchester
- Add 345/230kV interconnection at Willow station (Possible mitigation for increasing PD Morenci load)
- Add new 230kV San Rafael – Kartchner (or Ft Huachuca) line and rebuild to Pantano (or 230kV interconnection further west). This might be supported by SSVEC and Ft H?

### **South of Tucson Area**

*Characteristics:* This area has the lowest ratio of TEP to Trico service territory land area. TEP and Trico agree that opportunities for cost-effective joint load serving substation expansion within this area appear to be great. This area includes two parallel 345kV lines, plus a parallel 230kV line. Key features are:

- The Vail – Bicknell 345kV SWTC line passes close by the South Loop substation. A critical contingency is loss of the Vail – South Loop 345kV line, potentially causing overloads on the parallel 138kV system.
- A 230 kV line from Pantano, which parallels a significant portion of the WAPA 115kV line to Del Bac, terminates at the Bicknell station. Possible loop-in at South at either 230kV or 345kV could provide mutual benefits.
- There are several transformations at Bicknell, including 345/230kV and 230/115kV. The 115kV terminal supplies the SWTC 115 kV system that interconnects with WAPA at Marana Tap.

*Potential Solutions:* A joint new interconnection between either 345kV or 230kV transmission to local area 138kV or 115kV transmission could be cost effective alternatives to expanding local area transmission to serve local load. Looping-in 345kV or 230kV could defer or eliminate the need for new 345kV or 230kV transmission. Alternatives follow:

- Loop-in the Vail – Bicknell 345kV line at South Loop. This relieves post-contingency loading on the 138kV system. Need to determine land availability and permitting requirements.
- Loop Pantano – Sahuarita 230kV line into South Loop. Possible multiple benefits include loading relief on the Apache – Butterfield 230kV line, stronger source for Bicknell and/or new

joint distribution substation east of Bicknell. Need to determine land availability and permitting requirements.

- New Three Points – Bicknell 345kV or 230kV line. Possible benefits may be available through increased transfer capability between South of Tucson Area and West of Tucson Area during contingencies.

### **West of Tucson Area**

*Characteristics:* The area west of Tucson is served by Trico and TEP. The TEP territory consists of a relatively narrow strip west of I-10 extending from Marana to the San Xavier District of the Tohono O'odham Nation. The Trico territory is generally west and south west of the TEP service area. Transmission located west of Tucson is provided by CAP, WAPA, SWTC and TEP. Key features are:

- The WAPA 115kV line, which is sourced from the APS Saguaro station, begins in a southwesterly direction and continues southeaster through the WAPA Tucson station to del Bac and beyond into the South of Tucson Area. Continuity of the WAPA 115kV system is necessary to meet contractual obligations to customers receiving transmission services from WAPA.
- Another WAPA 115kV line connects Saguaro to Oracle and continues south to the Tucson station. This line is the third side of a 115kV triangle with vertices at the Saguaro, Oracle and Tucson stations.
- The CAP system presently is a radial 115kV line supplied by the WAPA system through an interconnection at Rattlesnake. CAP owns the 115kV transmission facilities from Rattlesnake to Del Bac, the line is open at Del Bac. Radial service subjects the CAP pumping system to N-1 outages.
- The SWTC local 115kV system is interconnected to WAPA at the Marana Tap and the SWTC Bicknell station.
- SPPR has proposed a “Three Terminal Project” to deliver new generation output to its participants. One of the three terminals is proposed to connect to the SWTC and WAPA 115kV systems through a 230/115kV transformation at the Marana Tap station.

*Potential Solutions:* SWTC and CAP are in the process of integrating their respective systems through planned interconnections at Sandario (near Brawley) and Valencia (near San Xavier). SWTC is also planning to construct a new 115kV line from Saguaro as the 4<sup>th</sup> circuit on the new TEP “Quad” circuit. This new line is to connect proposed intermediate distribution substations along the corridor to the North Loop substation, and eventually terminate at the WAPA Rattlesnake station. Alternatives follow:

- Saturated load level (build-out) envisions a possible joint double circuit 345kV project between Tortolita and North Loop plus a Vail – Irvington (or SS NO30) – South Loop 345kV project. One of these EHV projects is anticipated to be in service by ~2014 (based on the current 2008 load forecast) unless a local Tucson area generation project is identified to defer such an upgrade. The second described project would be required within the next 15 to 20 year time frame.
- The SPRR Three Terminal proposal presents alternative strategy elements for SATS to develop and evaluate. Introduction of a new 230kV source at the Marana Tap location suggests that a 230kV line (possibly double circuit to retain the WAPA 115kV line) continuing into Tucson and terminating at a yet-to-be-determined location in either the South of Tucson or Greenlee to Vail Corridor Areas should be evaluated. Intermediate 230/138kV and/or 230/115kV connections at North Loop, DMP, del Bac, SS NO30 or other location may also be considered.
- A new 345/115kV connection at Three Points is an option for reinforcing the integrated SWTC/CAP system.
- A new 345 switching station at Three Points with a 345kV line replacing the existing 115kV line to Bicknell could strengthen the tie between the West of Tucson and South of Tucson



and tying SunZia to Winchester and/or Tortolita could be very helpful, although SunZia is not modeled this way in the cases. Further analysis will be required.

Jim Rein stated that SWTC is looking at potential generation at either the Apache Generating Station or Bowie. No detailed studies have been done for these options, but the studies show that either option puts additional stress on the 230 kV system.

Jim also informed the group that the Western 115 kV Line Loop-in Project to Pantano has been put on hold until all 230 kV issues can be resolved. Work that is ongoing with SSVEC is likely to change the dynamics of the 230 kV system at Pantano, resulting in the potential addition of another 230 kV transformer.

Some of the 230 kV options under consideration by SWTC:

- 1) Tying the SWTC 230 kV system into the proposed Willow Substation, that is being contemplated by the Bowie Power Station. Willow is planned to be located just off of Highway 191 that goes to Safford, where the TEP 345 kV and SWTC 230 kV lines cross.
- 2) Tying a 230 kV line from Apache to Winchester. The existing 230 kV line to Winchester from Apache is part of a double-circuit 230 kV line that contains the Apache to Hayden 115 kV line, operated at 115 kV, on one side of the double-circuit line. The Hayden line could easily be converted to 230 kV operation, with a 230/115 kV transformation at Winchester (to continue the 115 kV feed to Hayden) and the addition of a 230 kV breaker at Apache.
- 3) As the Western 115 kV line between the Western Tucson substation and Apache is heavily loaded, consideration should be given to upgrading this line to 230 kV operation. As part of this option, it would be necessary to establish a 230/115 kV transformation at Adam's Tap, to continue the 115 kV feed to APS. A new joint substation, dubbed "XY" for now, would be established somewhere near Nogales Tap. This could be a 230/138/115 kV yard. The possibility also exists of moving SWTC's proposed New Tucson Substation that is being built for Trico, closer to the Nogales Tap area, for the joint yard.

Jim stated that SWTC is interested in the Pinal Central to Tortolita 500 kV Line Project, but in order to be able to have benefit to the SWTC system, it would need to involve a line from Tortolita to CS1 or Marana.

The SPPR generation that is planned to be installed at ED5, with a 230 kV line coming into Marana needs to be worked through with SATS. A potential joint solution could be part of the joint SWTC/TEP 345 kV loop strategy that is planned to go from Tortolita to North Loop to Marana and back to North Loop, with 115 kV injections.

Leonard York mentioned that the task of determining how robust the joint systems are to become will be a weighty question, as there are a lot of uncertainties of where resources will be coming into the system and what kind of a system will need to be built to accommodate these resources for load-serving purposes.

The group began developing the following deliverables:

- 1) Load-serving capability analysis for the entire area for the years 2013-2018.
- 2) Base case assumptions:
  - a. 2013 Case (Will use the most recent WestConnect 2013 case)
    - i. Bicknell 115/25 kV transformer
    - ii. Bicknell 345/230 kV transformer (420 MVA)
    - iii. Cap Ties as completed by end of 2010
    - iv. Nogales Tap going to 138 kV

John stated that once the case is built, loads should be grown until something breaks. He suggested that a 2010 benchmark case be developed first, and that the group consider developing path rating studies also for the major transmission lines in the area. This will be important for when Bowie and SunZia come on-line.

Two alternatives were suggested as being included in the study:

- 1) Winchester to Vail double-circuit 345 kV line.
- 2) Upgrade of Western Apache to Nogales Tap 115 kV line to 230 kV.

Laura Pinna informed the group that the ACC is getting more and more into the purpose and need of projects that come before the Line Siting Committee for approval. In the hearings that she has attended lately, more and more questions are being asked about potential alternatives to those that are proposed for approval and she feels that it will be very helpful for future line siting cases involving projects proposed by TEP and SWTC, if both entities work together, using the same analysis for the projects in the area, and tie them all together as one coordinated plan.

Ron clarified that he sees the potential solutions for the area as being:

- 1) 230 kV double circuit line
- 2) 345 kV double circuit line
- 3) 345 kV bus ties (SP-GL-WN-VL) eventually with 1 or 2 above

In summary, the group agreed to the following:

- 1) Perform a load-serving capability study 2013-2018. Ron noted that this is timely, as 2013 is the last year of TEP's capital budget plan and this will provide information to decide which projects will be incorporated into the next 5 year budget plan to be submitted in 2009.
- 2) The studies will use the new WestConnect 2013 case. The old 2013 case used by TEP showed that EHV system reinforcement will be needed in 2014.
- 3) Alternatives will be:
  - a. Double-circuit 230 kV
  - b. Double-circuit 345 kV Ron noted that this project can be in excess of \$200M.

- c. 345 kV bus ties (SP-GL-WN-VL) eventually with 1 or 2 above
- 4) SWTC to get with Trico for permission to use load #'s for Areas 2, 3, and 4 (as drawn on one of the brainstorming maps)
- 5) Generation assumptions:
  - a. Bowie at 500 MW
  - b. Apache at 600 MW with the 230 kV bus at 1.03 p.u.
  - c. TEP local generation at 430 MW
  - d. New TEP SVC modeled in case
- 6) Cutplanes for studies will be:
  - a. West of Winchester 345kV and west of Apache 230kV
  - b. West of Willow 345kV / east of Red Tail 230kV

The FMI load increases will eventually be studied as sensitivity. A part of this sensitivity will include tying the 230 kV system in at Willow. John mentioned that as it regards load-serving, he would like to see SunZia come into Vail. However, Ron stated that this would not be practical.

Ron estimates that it will take about a week to do the load-serving capability study once the base cases have been updated. Bobby is to work with EvaMarie on the correct topology and load allocation/magnitude. When it is finished, he will arrange a conference call to discuss it with the participants.