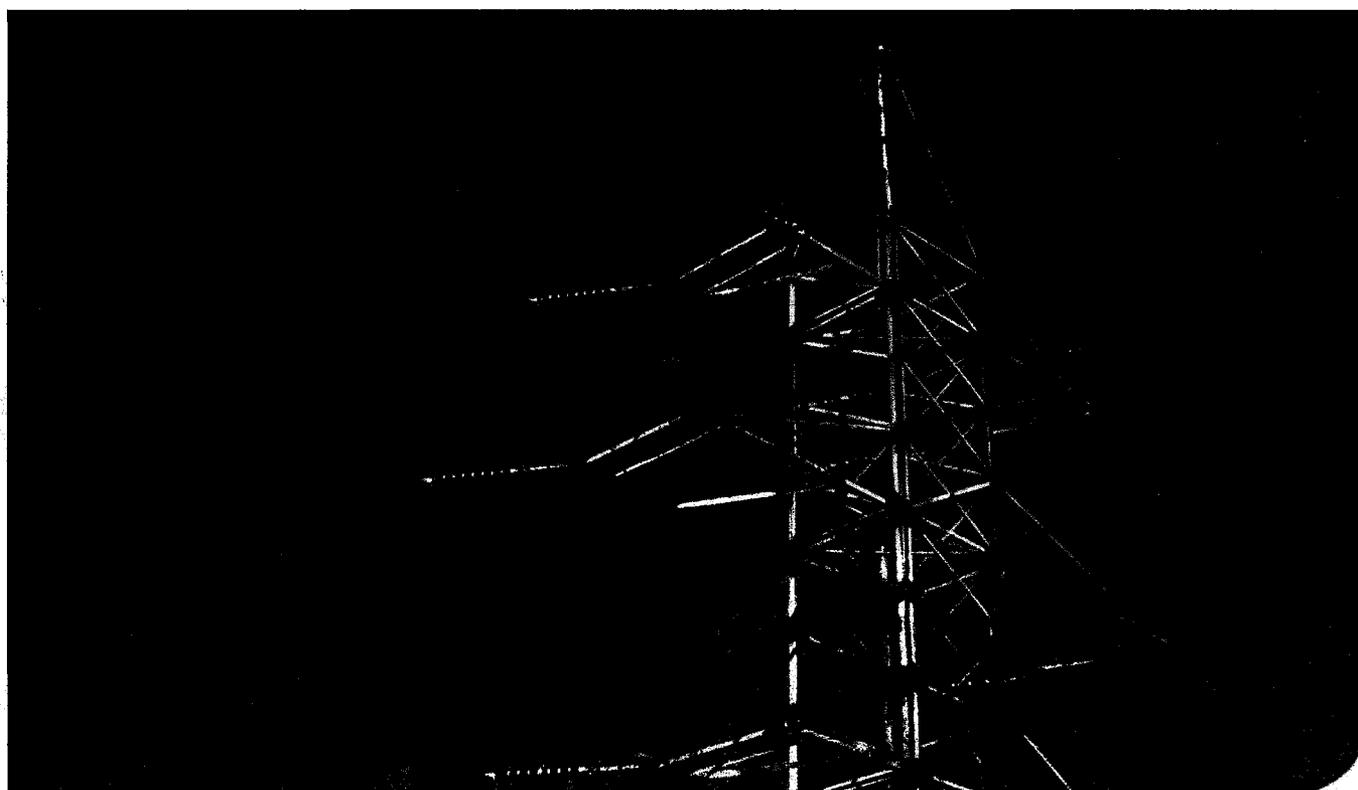


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# Sixth Biennial Transmission Assessment 2010-2019 Draft Report

Docket No. E-00000D-09-0020.



Approved by the Arizona Corporation Commission on November \_\_, 2010 in ACC  
Decision No. \_\_\_\_\_

Arizona Corporation Commission

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- Arizona’s Sixth Biennial Transmission Assessment (“BTA”) is based upon ten year plans filed with the Commission by parties in January 2010, and certain filings during 2009. It also incorporates information and comments provided by participants and attendees in the BTA workshops and report review process. The ACC Staff and KEMA Inc. are appreciative of the contributions, cooperation and support of industry participants throughout Arizona’s Sixth Biennial Transmission Assessment process.
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- Exhibit 21 – Listing of Projects by Voltage Class
- Exhibit 22\* - Arizona Public Service Project Summary
- Exhibit 23\* - Salt River Project Summary
- Exhibit 24\* - Santa Cruz Water and Power District Project Summary
- Exhibit 25\* - Southwest Transmission Cooperative Project Summary
- Exhibit 26\* - Tucson Electric Power Project Summary
- Exhibit 27\* UniSource Electric Project Summary
- Exhibit 28\* - NEITC Corridor Map

\*To be added in next draft (title and content subject to change)



## Executive Summary

The Arizona Corporation Commission (“ACC” or “Commission”) biennially reviews ten year plans filed by parties intending to construct transmission facilities at 115kV or above, and issues a written decision regarding the adequacy of the existing and planned transmission facilities to reliably meet the present and future needs of the state<sup>1</sup>. Staff of the Utilities Division of the Commission (“Staff”), with the assistance of the consulting firm of KEMA Inc. (“KEMA”) reviewed and analyzed the ten year plans and related filings, conducted workshops for stakeholder input, and drafted this Sixth Biennial Transmission Assessment (“BTA”) report. Neither Staff nor KEMA performed any technical studies during this process, but relied upon studies prepared and filed by other parties. Staff and KEMA used an open, transparent and collaborative process to obtain utility and stakeholder input, including two public workshops.

Staff and KEMA reviewed all ten year plans and filings submitted to Docket No. E-00000D-09-0020. The filings included technical studies previously ordered by the Commission; transmission load serving capability of local load pockets, Reliability Must Run (“RMR”) studies, Extreme Contingency studies, and an assessment of transmission capacity needed and available to accommodate renewable energy development in Arizona. All entities which made presentations at the first workshop were asked to file the presentations in the docket. Staff and KEMA reviewed these presentations and the transcript of the first and second workshops. Preliminary and final drafts of this Sixth BTA report were prepared by KEMA and reviewed by Staff and was made available for industry and stakeholder comments. The collaborative local, subregional and regional transmission planning processes used by utilities and other stakeholders have yielded a significant number of relevant technical studies and other filings that were reviewed for this BTA.

This assessment is not intended to establish Commission policy. It also is not intended to assess individual transmission providers’ plans except in the context of their aggregate impact on Arizona electric transmission system adequacy, reliability, markets and renewable integration (e.g., aggregate ability to meet the existing and planned energy needs of the state). This BTA is not final unless and until approved by a written decision of the Commission.

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<sup>1</sup> Arizona Revised Statute §40-360.02

Staff's assessment has addressed five fundamental public policy questions during the course of this BTA:

- Does the combination of the filed ten year transmission plans meet the load serving needs of the state during the 2010-2019 timeframe in a reliable manner?
- Do the study reports filed in response to Commission ordered RMR, N-1, N-1-1 and Extreme Contingency studies comply with, and sufficiently meet, the intended goals of the Commission's orders?
- Do the transmission planning efforts effectively address concerns raised in previous BTAs about the adequacy of the state's transmission system to reliably support the competitive wholesale market in Arizona?
- Do transmission providers' ten year expansion plans, and specifically their renewable transmission project proposals, adequately address the overall needs for renewable resource development and integration into the Arizona and regional electric power system?
- Do the plans and planning activities comport with transmission planning principles and good utility practices accepted by the power industry and the reliability planning standards established by North American Electricity Reliability Corporation ("NERC"), Western Electricity Coordinating Council ("WECC"), and Federal Energy Regulatory Commission ("FERC")?

## **General Conclusions**

Staff and KEMA reached numerous conclusions during the 6th BTA, including the following key items:

- 1) A total of 59 transmission projects have been delayed since the 5th BTA, with an average delay of 3-4 years. In addition, 18 other transmission projects were cancelled. The combination of cancelled and delayed projects represents slightly more than half of the projects filed in the 5<sup>th</sup> BTA. These delays and cancellations are consistent with the reduction in statewide demand forecast since the 5<sup>th</sup> BTA and do not appear to threaten the adequacy of the system or its ability to reliably serve load.
- 2) The absence of information in the filings regarding planned transmission reconductor projects and substation transformer replacements, if unresolved, could impair the Commission's obligation "to biennially make a determination of the adequacy and reliability of existing and planned transmission facilities in the state of Arizona".

- 3) All Commission required studies related to adequacy and reliability have been filed. The following conclusions apply to the efficacy of the filed documents relative to the intent of the Commission ordered action:
- a) The Phoenix, Tucson and Yuma area RMR studies for 2013 and 2019 were thorough and well documented. These RMR studies also indicate that local RMR generation will not be dispatched out of merit order for significant hours or yield RMR costs sufficient to warrant advancing transmission improvements. The Mohave County 2013 and 2018, and Santa Cruz County 2013 and 2019 RMR studies, were also well documented. They also showed no RMR requirement. However, Santa Cruz County RMR analysis for 2010 showed an RMR requirement of 24 MW and provided emission metrics, but did not provide estimates of RMR energy, operating hours or costs.
  - b) The Commission's concern in the 5th BTA regarding the need for broader stakeholder involvement in the Yuma Area and Mohave County RMR studies have been satisfactorily addressed through the RMR studies for 2013 and 2019 filed in the 6<sup>th</sup> BTA. Affected utilities and stakeholders participated in the Yuma Area and Mohave County RMR cut plan definition, study plan and results.
  - c) The "Ten Year Snapshot Study" (previously referred to as the "N-1-1 Study") and the Extreme Contingency Study were performed by the CATS-EHV study group. Both of these studies represent composite assessments of the statewide Arizona transmission system and the performance of the ten year expansion plan under normal, single-contingency and more severe contingency scenarios. Staff and KEMA conclude that these studies demonstrate the ten year plan is robust and should provide adequate and reliable service to Arizona as evidenced by the following observations from these studies:
    - i) Staff concludes that the proposed definition of "continuity of service" described in the Cochise County Study Group's (CCSG) 2009 technical study report, as filed by SWAT in January 2010, is appropriate for planning of the Cochise County system and that transmission plan identified in the CCSG 2009 report represents a reasonable set of capital expansion projects to achieve the "continuity of service" objective in Cochise County.
    - ii) The SATS report and the SWTC ten year plan have both identified overload issues on the Apache-Butterfield 230kV line beginning in 2012. Although an upgrade of the line is planned for 2016, no clear resolution of this overload is provided for 2012-2015. Furthermore, the study has identified numerous

230kV and 115kV bus voltage deviations that may be unacceptable, and states that further analysis is needed to address these issues.

- iii) Santa Cruz County remains exposed to extended customer outages during a contingency of the radial transmission line serving the county. Additional transmission line improvements outlined in the UNSE ten year plan for Santa Cruz County will mitigate this exposure, but are contingent upon resolution of a long-standing federal permitting matter.
  - iv) The CATS-HV study of the planned 2019 Pinal County system assumed Southwest Public Power Resource's ("SPPR") "Three-Terminal" transmission plan (Pinal Central to ED5, ED5 to Test Track and ED5 to Marana 230kV lines). However, SPPR announced at workshop 1 that it has deferred plans for two of these line additions indefinitely. The impact of these deferrals on the results of the CATS-HV study of 2019 is unknown and cannot be determined from the filed studies.
- 4) The state of Arizona is fortunate that its transmission providers are engaged in, and providing leadership to, SWAT and WestConnect subregional planning processes. Completing Arizona's BTA might not be possible without access to such effective subregional transmission planning processes and the associated subregional planning studies.
  - 5) The implementation of mandatory reliability standards by FERC over the past two years, as discussed in the body of this report, raises new issues that bear on the BTA process. Staff and KEMA have attempted to address these issues through data requests and stakeholder workshop discussions, but proper recognition and integration of these issues into the BTA process will take additional time and effort. *[#NOTE - Discussion of these questions with the transmission providers and other stakeholders is expected to take place at BTA Workshop #2 on August 4, 2010 and may serve as the basis for further Staff/KEMA conclusions and recommendations in this regard.]*
  - 6) Technical studies filed in the 6th BTA describe a generally robust study process for assessing steady-state performance (base case and contingency scenarios) for the 2010-2019 planning period, but it is unclear if adequate transient stability work has been performed on the basis of the studies filed. *[#NOTE – this issue will also be explored further at Workshop #2]*

- 7) Regional and subregional planning studies have effectively addressed the interconnected EHV transmission that is critical to a functional interstate wholesale market. Studies indicate the existing and planned Arizona EHV system is adequate to support a robust wholesale market.
- 8) Developing Arizona's vast renewable resource potential requires a coordinated and multi-faceted strategy involving stakeholders representing utility, government, economic, developer, environmental, and other interests. Decisions by the Commission and the actions taken by the Arizona utilities and regional stakeholders are important steps towards the state's goal of becoming a national and world leader in renewable energy development.
- 9) The 2009 utility filings in response to the 5th BTA request for the utilities to identify their top three Renewable Transmission Projects ("RTP") are generally responsive to Commission request. An inclusive stakeholder process was developed and executed to identify the projects.
- 10) Most of the transmission corridors identified in the utilities initial RTP proposals to serve potential renewable generation are compatible with projects in the utilities' previous transmission plans. Therefore, most of the RTPs identified by the utilities are actually advancements of projects already found in previous transmission plans. This represents a small incremental investment for a maximum renewable benefit.
- 11) Because the selected projects are ones that have been identified in earlier transmission plans they should contribute to reinforcing the transmission for general use beyond the specific needs of renewable generation project. We would expect them to be effective in enabling delivery of renewable resources developed close to either the Phoenix-Tucson regions or the Palo Verde hub. As projects are developed farther from these areas, completely new transmission plans will likely need to be identified and developed.
- 12) The impact of utility-scale renewable generation should be incorporated into the utilities' transmission plans as part of their normal planning process. The utility 10-Year Plan, BTA, RTP and RTAP reports should keep the Commission informed as the situation evolves.

## Recommendations

Based upon observations and concerns discussed in the conclusions, Staff submits the following recommendations for Commission consideration and action:

- 1) Staff recommends that the Commission continue to support the use of the:
  - a) Guiding Principles for ACC Staff Determination of Electric System Adequacy and Reliability,” but also direct transmission providers to include planned transmission line reconductor projects and bulk power transformer replacements (i.e., capacity upgrades) in filings for future ten year plans in order to foster a more comprehensive assessment process.
  - b) NERC reliability standards, WECC planning reliability criteria and FERC enforcement policies regarding transmission system planning standards.
  - c) Collaborative study processes in Arizona and throughout the western region that are consistent with FERC Order 890.
- 2) Staff recommends that Commission continue to support the policy that generation interconnections should be granted a Certificate of Environmental Compatibility by the Commission only when they meet regional and national reliability standards and the requirements of Commission decisions.
- 3) Staff recommends that the Commission order TEP, UNSE and SWTC to file additional study results by January 2011 that demonstrate the ten year plans filed in the 6th BTA comply with dynamic stability performance requirements of the NERC Transmission Planning standards and WECC transient voltage criteria.
- 4) Staff recommends that the Commission order the utilities to report relevant findings from NERC/WECC reliability standards audits that occur prior to future BTA filing dates (i.e., the latest applicable audit) regarding compliance with NERC Transmission Planning standards, as well as a description of any mitigation plans the utility has implemented in order to correct findings of non-compliance with such planning standards.
- 5) Staff recommends that the Commission order SWTC to determine if an engineering “re-rating” of the Apache-Butterfield 230kV line as proposed in the 6th BTA filings would be an acceptable measure until the line is upgraded in 2016, and to file the results of this assessment by January 2011.

- 6) Staff recommends that the Commission order TEP to conduct the additional analysis of potential 230kV and 138kV low voltages in Southeastern Arizona as noted in the 2009 SATS study report and to identify a mitigation plan for this voltage concern in its ten year plan filing(s) for the 7th BTA in 2012.
- 7) Staff recommends that the Commission accept the definition of “continuity of service” following a transmission line outage as proposed in the Cochise County Study Group’s (CCSG) 2009 technical study report filed by SWAT in January 2010, and that the Commission accept the recommended transmission plan of service presented in the report in order to achieve this “continuity of service” objective in Cochise County.
  - a) Staff further recommends that the Commission establish a target date of December 31, 2011 for the regulated electric utilities in Cochise County to conclude negotiations with various parties over capital cost allocation and operational procedures that are described as a pending action item in the CCSG 2009 report.
- 8) Staff recommends that Commission regulated utilities be required to continue to perform RMR studies in accordance with the methodology set forth in Appendix C to this Sixth BTA, and shall file such studies with ten year plans for inclusion in future BTA reports.

# 1. Overview

## 1.1 Assessment Authority

Arizona statutes require every entity considering construction of any transmission line equal to or greater than 115 kV within Arizona during the next ten year period to file a ten year plan with the Arizona Corporation Commission (“ACC” or “Commission”) on or before January 31 of each year.<sup>2</sup> Every entity considering construction of a new power plant of 100 Megawatts (“MW”) or greater within Arizona is required to file a plan with the Commission 90 days before filing an application for a Certificate of Environmental Compatibility (“CEC”).<sup>3</sup> All such plans filed with the Commission must include power flow and stability analysis reports showing the effect of the planned facilities on the current and future Arizona electric transmission system.<sup>4</sup> The Commission is required to biennially examine the plans and “issue a written decision regarding the adequacy of the existing and planned transmission facilities in Arizona to meet the present and future energy needs of the state in a reliable manner”.<sup>5</sup>

## 1.2 Sixth Biennial Assessment – Purpose and Framework

The purpose of this report is to inform the Commission of currently planned transmission facilities and offer an assessment of the adequacy of the existing and planned Arizona electrical transmission system. This Sixth Biennial Transmission Assessment (“BTA”) evaluates the ten year transmission plans filed with the Commission in Docket No. E-00000D-09-0020. This report fulfills the statutory obligation to review these transmission plans and assess whether the Arizona transmission system is and will remain adequate throughout the ten year timeframe.

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<sup>2</sup> Arizona Revised Statute § 40-360.02.A

<sup>3</sup> Arizona Revised Statute § 40-360.02.B

<sup>4</sup> Arizona Revised Statute § 40-360.02.C.7

<sup>5</sup> Arizona Revised Statute § 40-360.02.G

The Commission ordered that supplemental study work also be performed by the industry as a portion of this sixth BTA.<sup>6</sup> These include Reliability Must Run (“RMR”), N-1-1 and extreme contingency studies as required in prior BTAs. The Commission also required an assessment of transmission capacity available or required for renewable energy development in Arizona, as well as the determination of the top three transmission for renewables projects by each Arizona utility. This report examines the transmission plans filed by the industry to address these topics as well as other Commission ordered studies.<sup>7</sup>

In the Arizona BTA process, entities conduct their own technical studies or engage in joint studies, participate in collaborative and open regional planning processes, and present the study results in their ten year plan reports and at public workshops. Commission staff (“Staff”) relies on the technical reports and documents filed with the Commission and other publicly available industry reports rather than performing independent technical study work. Staff continues to use a set of guiding principles in determining the adequacy and reliability of both transmission and generation systems.<sup>8</sup> Staff’s guiding principles are based upon best engineering/planning practices established in Arizona coupled with the use of Western Electricity Coordinating Council (“WECC”) planning principles, and are also intended to be consistent with applicable North American Electricity Reliability Corporation (“NERC”) reliability standards (e.g., TPL-001 through TPL-004)<sup>9</sup>, and FERC orders.

Staff retained KEMA Inc. (“KEMA”) to assist them with this Sixth BTA. Staff and KEMA critically reviewed and analyzed the filed transmission planning reports and ten year plans and addressed the following four key public policy questions:

- 1) Do the proposed Arizona transmission system plans meet the load-serving requirements of the state during the 2010-2019 timeframe in a reliable manner?

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<sup>6</sup> Decision No. 69389, Docket No. E-00000D-05-0040

<sup>7</sup> History of Commission Ordered Studies, Appendix B

<sup>8</sup> Guiding Principles for ACC Staff Determination of Electric System Adequacy and Reliability: Appendix A - Arizona’s Best Engineering Practices, Jerry D. Smith, ACC, pre-filed comments for the Gila Bend Power Plant Hearing, Docket No. E-00000V-00-0106, November 9, 2000

<sup>9</sup> NERC Reliability Standards, Transmission Planning (TPL) at <http://www.nerc.com/page.php?cid=2|20>

- 2) Are the required Reliability Must Run, N-1-1, Extreme Contingency, and Renewable Energy Transmission Assessment project proposals compliant with, and sufficiently meet, the intended goals of the Commission's orders?
- 3) Were steps taken in the most recent transmission planning studies to effectively address concerns raised in previous BTAs about the adequacy of the state's transmission system to reliably support the competitive wholesale market in Arizona?
- 4) Do transmission providers' ten year expansion plans, and specifically their renewable transmission project proposals, adequately address the overall needs for renewable resource development and integration into the Arizona and regional electric power system?
- 5) Do the processes utilized comport with transmission planning principles and good utility practices accepted by the power industry and the reliability planning standards established by NERC, WECC, and FERC?

## **1.3 Assessment Process**

A three-stage approach was used to prepare this BTA report. The first stage consisted of a workshop which offered participants the opportunity to make presentations supplementing their ten year plan filings. During the second stage, Staff and KEMA prepared, distributed and posted to the Commission's website the first draft report for public comment. The next stage of the process consists of a second workshop for Staff and KEMA to present their draft findings and facilitate discussion of the draft of the report. A revised, final draft of the report is prepared and posted on the website following the second workshop. A summary of each stage of the BTA process is described in the following sections.

### **1.3.1 Workshop I: Industry Presentations**

KEMA assisted Staff in arranging a two-day public Workshop on June 3-4, 2010 in Phoenix, Arizona. A complete listing of the Workshop I attendees and presenters is in Appendix E. Transmission Providers and Subregional Planning Groups presented information regarding their respective transmission expansion plans and related planning activities. Merchant transmission and generation developers reported on their respective development plans.

- 1) The Workshop provided an informal setting to promote effective discussion of each presentation.<sup>10</sup> Each presentation was followed by an open period of discussion including questions and comments from the audience. Staff and KEMA concluded the session with general comments and discussion of the schedule for completing the 6th BTA

### 1.3.2 Review of Industry Filings in 6th BTA

Table 1 shows a matrix of the various categories of ten year planning information filed by utilities during the 6<sup>th</sup> BTA.

**Table 1 - Matrix of Utility Filings in 6th BTA**

Utility	Ten Year Plan	2010-2019 Utility Technical Study Report	RMR Study Report	Planning Criteria & Ratings	Joint Study Report(s)
APS	X	X	X	X	Extreme Contingency Study <sup>11</sup>
Electric Districts (ED) 3&4	X				
SRP	X		<i>(Participated in APS Phoenix RMR Study)</i>		Ten Year Snapshot Study <sup>12</sup> CATS-HV Study <sup>13</sup>
SSEVC	X <sup>14</sup>				
SWTC	X	X	X	X	Cochise County Report <sup>15</sup>
TEP	X	X	X		SATS <sup>16</sup>
UNSE	X	X	X		

<sup>10</sup> The Workshop I agenda and presentation materials are located at <http://www.cc.state.az.us/divisions/utilities/electric/biennial.asp>

<sup>11</sup> Filed on behalf of CATS-EHV study group.

<sup>12</sup> Ten Year Snapshot Study (2019 system) filed on behalf of SRP, APS, WAPA, ED 3 & 4, et al.

<sup>13</sup> Filed on behalf of all study participants including APS, ED 2-5, SWTC, TEP, WAPA, et al

<sup>14</sup> SSVEC's filing is limited to comments on the Cochise County Report.

<sup>15</sup> Filed on behalf of all study participants including SWTC, APS, TEP, WAPA, SSVEC, et al.

<sup>16</sup> Southeast Arizona Transmission System Study Report filed on behalf of TEP/UNSE, WAPA, APS, et al.

Arizona Revised Statute § 40-360.02 (C) (7) requires that:

“The plans for any new facilities shall include a power flow and stability analysis report showing the effect on the current Arizona electric transmission system. Transmission owners shall provide the technical reports, analysis or basis for projects that are included for serving customer load growth in their service territories.”

The combination of individual studies and joint studies listed in Table 1 provides much of the basis for Staff to assess the adequacy of the 6th BTA ten year plan. Although individual studies are not filed in the 6th BTA by SRP, WAPA and other parties their plans are represented in the joint studies that were filed.

As also shown in Table 1, technical studies are augmented by other relevant information. APS and SWTC included their internal transmission planning criteria and system ratings in the 6th BTA filings as required by Arizona Corporation Commission (“ACC”) Decision No. 63876 (July 25, 2001). APS provided their planning criteria as part of their internal “Transmission Planning Process and Guidelines” included in the 6th BTA filings. However, some utilities failed to include this information. In regard to transmission planning principles, the jurisdictional utilities were required to file their planning criteria pursuant to Decision No. 63876. In case of TEP and SWTC, the SATS study provides a link to their criteria as follows:

“SWTC’s Internal Planning Criteria are posted on SWTC’s Open Access Same-Time Information System (OASIS) site at <http://www.oatioasis.com/SWTC/index.html>. TEP’s Planning Process and Guidelines are posted on TEP’s OASIS site at <http://www.oatioasis.com/tepc/index.html>.”

The information contained in such “process” documents provides useful reference material for use by Staff.

### **1.3.3 Preparation of Draft Report and Industry Comment**

Staff and KEMA provided an initial draft of the 2010 BTA report for industry review and comment in July 2010. The first draft report was based on the docketed ten year plans and information gathered at Workshop I.<sup>17</sup> The first draft report was placed on the Commission’s website and distributed via industry distribution lists to expedite the review process. Industry comments were collected and docketed for other parties review, comment and response.

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<sup>17</sup> Transcripts of Workshop I held June 3-4, 2010 are available on the ACC Docket Control site.

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**1.3.4 Workshop II: Staff/KEMA Presentation of Final Report**

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## 2. Ten Year Plans

Table 2 provides a list of entities that filed ten year transmission plans with the Commission in January 2010. The ten year plans for proposed power plants and their associated transmission lines must be filed annually once an initial filing is made in advance of an application for a Certificate of Environmental Compatibility (“CEC”) at the Commission. The 6<sup>th</sup> BTA assessment examines the aggregate of these ten year plans.

**Table 2 - List of Parties Filing Ten Year Plans in 6th BTA**

Abengoa Solar Inc.	Sempra Energy
Ajo Improvement Company <sup>18</sup>	Sonoran Solar Energy, LLC
Arizona Public Service Company	Southern California Edison
Bowie Power Station, LLC	Southwest Transmission Cooperative
Central Arizona Project <sup>19</sup>	Southwestern Power Group
El Paso Electric Company	Starwood Solar I, LLC
Electric Districts No. 3 and 4	Sulphur Springs Valley Electric Cooperative
Gila Bend Power Partners <sup>20</sup>	SunZia Southwest Transmission Project
Hualapai Valley Solar LLC	Tucson Electric Power
Public Service Company of New Mexico	UniSource Electric
Salt River Project	Welton-Mohawk Irrigation & Drainage District

Utilities in the United States are required by FERC to plan, design and operate their bulk transmission systems in accordance with the NERC/WECC Reliability Standards. In addition, utilities who are signatories to the WECC Reliability Agreement are also obligated to comply with the WECC Minimum Operating Reliability Criteria. Furthermore, the utilities observe guidelines established at the state level, and their own internal planning criteria, guidelines and

<sup>18</sup> Ajo’s filing simply reported no change in the status of its load serving projects since the 5<sup>th</sup> BTA

<sup>19</sup> Contains a filing by the Central Arizona Water Conservation District regarding the Harcuvar project

<sup>20</sup> The sponsor’s January 2010 filing states the project is on hold due to current market conditions

methods. These planning practices are utilized to ensure that the WECC interconnection and individual member systems are planned for reliable service to customers under various system conditions and that plans are coordinated through a consistent set of standards, criteria and guidelines.

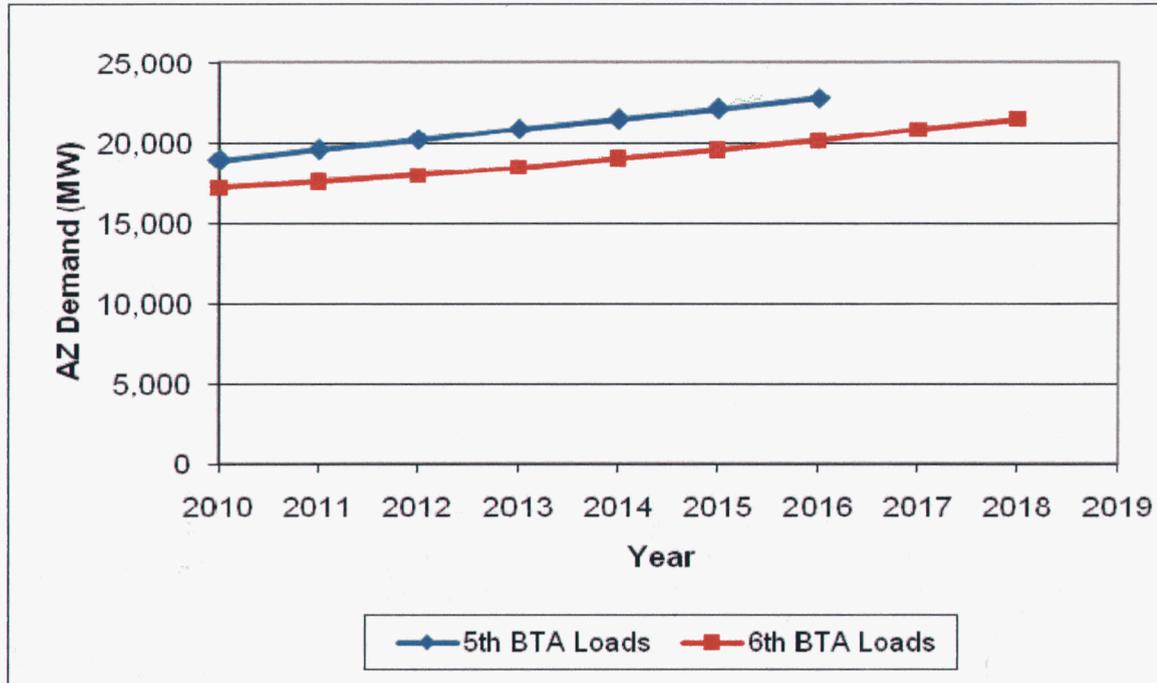
During Workshop I the following parties gave presentations regarding projects for which no ten year plan was filed in the 6th BTA: High Plains Express Initiative, TransWest Express Transmission Line, Navajo Transmission Project, Southline Transmission Project, Santa Fe Transmission Project, etc. While such projects are described in this report, they were not considered as planned system elements for the purpose of Staff's assessment of adequacy and reliability in the 6th BTA.

## 2.1 Summary of Arizona Plan

The BTA examines the aggregation of all of the docketed projects as a coordinated transmission system expansion plan for Arizona projects, from a system perspective, without regard to sponsorship or ownership. Projects that have not been filed are not included in this adequacy analysis for the BTA, but may still be depicted along with all other projects in the maps provided in Exhibits 1-6.

The principal driver for transmission plans filed by the utilities is reliability of supply to customers (e.g., "reliability-driven" projects). In the 6th BTA, a number of additional transmission proposals for integration of renewable resources have also been filed by the utilities, and those are addressed in Section 4 of Staff's report. In the current section Staff focuses on the reliability-driven projects. The need for and timing of reliability projects is driven primarily by the demand forecast. As shown in Figure 1, there has been a significant drop in the statewide demand forecast since the 5th BTA as a result of current economic conditions.

Figure 1: Change in Arizona Demand Forecast



As shown in Figure 1 the statewide demand forecast has shifted by about four (4) years since the 5<sup>th</sup> BTA (for detailed forecast data see Exhibit 7). All other factors being equal, this suggests that many planned reliability-driven transmission projects in Arizona could be delayed about four years from the in-service dates shown in the 5<sup>th</sup> BTA ten year plans. However, this isn't universally true since the percent change in local area forecasts can vary significantly from the statewide percentages. In addition, there may be reliability drivers for certain projects other than the demand forecast. Nevertheless, the "four year" rule of thumb is useful in assessing the filed changes in the current ten year plan.

A complete list of the individual projects filed as part of the 6<sup>th</sup> BTA ten year plan(s) is shown in Exhibit 6. The list of project changes only since the 5<sup>th</sup> BTA shown in Exhibit 18. Exhibits 20 and 21 sort the full list of projects in the 6<sup>th</sup> BTA by in-service date and voltage class, respectively.

Table 3 depicts the number of new transmission projects and associated mileage for each year of the ten year plans. Projects with a to-be-determined ("TBD") in-service date or that are beyond the Ten Year Plan timeframe have been grouped together as a single category. Phased projects with differing in-service dates for the respective phases were tabulated as separate projects.

**Table 3 - Summary of New Projects by Voltage Class**

Voltage Class	Number of Projects (2010 to 2019)	Number of Projects (Post 2019 and TBD)	Mileage
500 kV	1	3	235
345 kV	0	4	69
230 kV	2	4	195
138 kV	3	0	30
115 kV	2	1	36
<b>Total</b>	<b>8</b>	<b>12</b>	<b>565</b>

The projects filed in the 6th BTA include new transmission or substations, major reconfigurations (e.g., loop-ins), and upgrades from a lower design voltage to a higher design voltage (e.g., 115 kV to 138 kV). Two other significant classes of transmission system capital expansion in the industry are (i) reconductoring of existing transmission lines to increase capacity, and (ii) bulk power substation transformer bank additions (including replacements with larger banks). To the best of Staff's knowledge, ten year plans filed in the current and prior BTAs overlook these two important categories of transmission system expansion, even though such upgrades fill an important role in the overall ten year plan. The Commission's Guiding Principles for Determination of System Adequacy and Reliability state that the ACC is obligated "to biennially make a determination of the adequacy and reliability of **existing** and planned transmission facilities in the state of Arizona." (*emphasis added*)<sup>21</sup> Plans to reductor existing transmission lines and to install bulk power transformers in existing substations, even though they don't require a CEC, should still be filed in the BTA so that the Commission can perform a comprehensive assessment of transmission adequacy and reliability in the ten year plan.

[#TOPIC FOR DISCUSSION AT WORKSHOP 2#]

## 2.2 Plan Changes from Fifth BTA

Transmission plans inevitably evolve over time and are in a constant state of flux. Significant changes can occur as a result of regulatory actions, state and federal policy developments, siting and permitting challenges, shifts in load forecasts, identification of new generating plants, third-party interconnection and delivery requests, and changes in the economic or financial climate faced by a project sponsor. A combined list of changes for all voltage levels 115 kV and

<sup>21</sup> From paragraph 2 of the Guiding Principles (see Appendix A to this report).

above that have been filed since the 5th BTA is provided in Exhibit 18. For ease of reference a list of changes that have occurred at only 345 kV and above are provided in Table 4.

**Table 4 - Significant EHV Project Changes since Fifth BTA**

In-Service Date	Project	Voltage Class	Description of Change
2012	Delaney-Palo Verde Line	500 kV	New project
	Interconnection at Flagstaff 345kV bus	345 kV	Delayed from 2010
2013	Mazatzal loop in of Cholla-Pinnacle Peak 345 kV line	345 kV	Delayed from 2011
	Moenkopi-Eldorado Series Capacitor	500 kV	Delayed from 2012
2014	Delany (formerly PV Hub)-Sun Valley line	500 kV	Delayed from 2010
	Pinal West-Pinal Central-Abel-Browning line	500 kV	Delayed from 2011
	Pinal Central-Tortolita line	500 kV	Delayed from 2011
	Palo Verde Hub-North Gila #2 Line	500 kV	Delayed from 2012
2015	n/a		
2016	Sun Valley-Morgan Line	500 kV	Delayed from 2012
TBD	Tortolita North Loop Line	345 kV	Delayed from 2014
	Winchester-Vail Double Circuit Line	345 kV	New project
	Interconnection of Greenlee-Winchester Line with Willow Substation	345 kV	New project
	Vail-Irvington Line	345 kV	New project
	Irvington-South Line	345 kV	New project
Other	Tortolita-Vail Phases 2 & 3 (North Loop-East Loop Lines)	345 kV	Cancelled

Table 5 shows the number of projects delayed (or advanced) since the 5th BTA by voltage level.

**Table 5 - Summary of Project Schedule Changes since 5th BTA**

Voltage Class	Advanced 1 Year or more	Delayed 1 Year	Delayed 2 Years	Delayed 3 Years	Delayed 4 Years	Delayed 5 Years or more
500 kV	0	1	1	2	4	0
345 kV	0	0	0	1	0	2
230 kV	1	1	1	2	0	6
138 kV	2	2	4	2	0	15
115 kV	2	6	0	1	1	2
Total	5	10	6	8	5	25

There were a total of 129 transmission projects listed in the previous ten year plan.<sup>22</sup> Table 6 indicates that of this previous total, 59 projects have had a change in planned in-service date since the 5th BTA. Eighteen additional projects were cancelled. This means the balance of the projects from the 5th BTA have either been placed in-service since or are still planned for the same in-service date as before. The average delay for projects that have changed in-service dates is four years or less. In Staff's opinion, these statistics on changes to the planned ten year transmission projects is reasonable given the reduced demand forecast shown in Figure 1. In spite of the economy and demand forecast, many transmission projects have no change in schedule and five projects have actually been advanced. This may reflect the fact that load growth in local areas often varies significantly from system-wide averages.

Some projects or proposed substations have undergone a name change in recent filings as shown in Table 6.

**Table 6 - Project Name Changes or Aliases**

Current Name	Formerly Known As
Delany	Harquahala Junction
Sun Valley	TS5
Pinal Central	Pinal South
Dinosaur	RS19
Trilby Wash	TS1
Sugarloaf	Second Knoll
Abel	Southeast Valley ("SEV")
Mineral Park	Mercator Mill
Scatter Wash	TS6
Morgan	TS9
Sun City	Catalina
Medina	SS NO 22

<sup>22</sup> Fifth Biennial Transmission Assessment 2008-2017, Docket No. E-000D-07-0376, page 15.

## 2.3 Interstate, Merchant and Generation Transmission Projects

Interstate transmission is essential to enabling a state's utilities access to the wholesale market for purchases and sales. Interstate and market driven transmission projects facilitate a more robust and viable wholesale market, complement the states' utilities electric infrastructure and allow for additional import/export points. Various generation market access projects, merchant generation interconnections and merchant transmission projects are discussed in this section of the BTA.

### 2.3.1 Navajo Transmission Project

The Navajo Transmission Project ("NTP") is a merchant 500 kV transmission line project with an approximate total length of 478 miles.<sup>23</sup> The line will extend from a new substation located near the Four Corners Power Plant in northwestern New Mexico to the Marketplace Substation, south of Boulder City, Nevada. A new Desert Rock power plant will interconnect to the line in New Mexico near Four Corners. The NTP will be constructed in three segments which traverse Arizona.

- Segment 1 – About 180 miles of 500 kV single circuit transmission from Desert Rock Generating Facility in northwestern New Mexico crossing Navajo lands to the proposed Red Mesa West Substation near Navajo Generating Station in northern Arizona.
- Segment 2 – 62 mile 500 kV single circuit transmission line from a new Red Mesa West substation to the existing Moenkopi Substation. This segment generally parallels an existing Glen Canyon to Flagstaff 345 kV transmission line corridor.
- Segment 3 – About a 218 mile 500 kV single circuit transmission line from the existing Moenkopi Substation to Marketplace Substation in Nevada. Segment 3 generally parallels an existing Moenkopi to El Dorado 500 kV transmission line.

No ten year plan was filed for this project in the 6<sup>th</sup> BTA. However, a project update was provided at the BTA Workshop I on June 3, 2010. NTP is evaluating a number of options for the design of the Desert Rock power plant including coal plus solar, or some other combination of resources including a blend of solar and natural gas fired generation. Regarding the 500 kV transmission segments, NTP believes that Segment 3 is currently the most needed due to existing congestion constraints in the system. An overview map showing the general routing of

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<sup>23</sup> CEC Case#103, Docket No. L-00000U-00-0103, approved under Decision #63197

each segment is included as Exhibit 9. Project schedule is yet to be determined, and therefore it has been excluded in the 2010-2019 planning studies filed in the 6th BTA. [#SUBJECT TO STAKEHOLDER CONFIRMATION#]

### 2.3.2 Palo Verde to Devers No. 2 500 kV Transmission Line

The Palo Verde to Devers No. 2 (“PVD2”) 500 kV Project<sup>24</sup> is a SCE sponsored interstate transmission project. The overall scope of the project extends approximately 270 miles from the proposed Delany Substation<sup>25</sup> in Arizona to SCE’s Devers Substation near Palm Springs, then continuing on to SCE’s Valley Substation near Romoland, California. On June 6, 2007, the Arizona Corporation Commission denied SCE’s application for a CEC for the portion of the PVD2 transmission line located in Arizona.<sup>26</sup> SCE’s ten year plan filing in the 6th BTA states that in November 2009, SCE received an order from the California PUC allowing SCE to proceed with construction of the California portion of PVD2. Based on the latest project configuration, the California portion extends eastward from Valley Substation via Devers to a newly proposed substation site referred to as Midpoint or the Colorado River 500kV Switchyard in the vicinity of Blythe, California. Based on this reconfiguration, SCE must seek further California PUC authorization before reinitiating the CEC approval process with the ACC. An overview map showing the general routing of the PVD2 transmission line is included as Exhibit 10. Specific routing for the Arizona portion of PVD2 would be determined through the CEC process. This Arizona portion of the reconfigured project consists of a single transmission line segment as follows:

Colorado River 500kV Substation - Delany Substation: A new 500 kV transmission line between Arizona and California. This segment is approximately 104 miles long. The proposed transmission line routing parallels the existing Palo Verde to Devers 500 kV transmission line.

On May 16, 2008, SCE filed a pre-filing application with FERC under Section 50.6 - Transmission Line Siting process. This filing triggered a project-wide National Environmental Policy Act (“NEPA”) review, preparation of a preliminary draft Environmental Impact Study (“EIS”), and a public notice process along the entire right-of-way. The Arizona Corporation

<sup>24</sup> ACC Docket No. [L-00000A-0295-00130](#)

<sup>25</sup> Delany Substation was previously known as Harquahala Junction

<sup>26</sup> ACC Decision No. 69638

Commission has responded to this FERC filing.<sup>27</sup> A project update posted by SCE in May 2009<sup>28</sup> stated that a recent update of the economic analysis for the project no longer demonstrates sufficient benefits to California customers to build the Arizona portion of the line. SCE gives the following reasons for this change in economics:

- The increase in California's mandated 2020 RPS target to 33%, together with the development of both renewable and conventional generation in the vicinity of the California River 500kV Switchyard, which will decrease the need for imports from Arizona.
- A decrease in the expected differential in fuel prices between Arizona and California.
- Reduced load growth in California as a result of changed economic conditions.

Therefore, SCE has stated it will cease its pre-filing activities at the FERC and put its plans for refiling with the ACC on hold.

### **2.3.3 Harcuvar Transmission Project**

The Harcuvar Transmission Project ("HTP") is a proposed 230 kV transmission project located approximately 60 Miles west of the Palo Verde Hub and is sponsored by various entities including renewable and thermal energy developers, merchant transmission providers, and load serving entities in Arizona. The Central Arizona Water Conservation District, as one of the project sponsors, filed ten year plans with the Commission in January 2009 and 2010.<sup>29</sup> The project consists of two principal components:

- Approximately a 90 mile 230kV loop in La Paz County, Arizona.
- Joint ownership, together with SCE, of the Arizona segment of the PVD2 500kV line.

In its latest BTA filing HTP notes that on May 15, 2009, SCE notified the ACC by letter that their latest economic "analysis does not support refiling with the ACC, at this time, for authorization of the Arizona portion of [PVD2]." The BTA filing goes on to state that because the PVD2 line is "critical to the success of the HTP", the HTP must either await the renewal of SCE's filing with the ACC for PDV2 "or some other project offering equivalent value and functionality." Therefore,

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<sup>27</sup> <http://elibrary.ferc.gov/idmws/nvcommon/NVViewer.asp?Doc=11687511:0> and <http://elibrary.ferc.gov/idmws/nvcommon/NVViewer.asp?Doc=11709962:0>

<sup>28</sup> [http://www.sce.com/NR/rdonlyres/0A5F8FEB-5357-4C11-BD93-07387DE4B2C1/0/090515\\_DP2ProjectUpdate\\_May2009.pdf](http://www.sce.com/NR/rdonlyres/0A5F8FEB-5357-4C11-BD93-07387DE4B2C1/0/090515_DP2ProjectUpdate_May2009.pdf)

<sup>29</sup> The filing is identified in the ACC E-Docket by "Central Arizona Project" as the filing party.

CAWCD is pursuing other options to enhance transmission capacity to its major pumping loads in La Paz and Mohave counties.

### **2.3.4 SunZia Southwest Transmission Project**

SunZia proposes to permit and construct up to two interstate merchant EHV transmission lines from a new substation in Lincoln County, New Mexico, to Pinal Central Substation in Arizona. The project is intended to transport renewable generation from wind, solar and geothermal resources to markets in the Arizona and the Western region. The primary alternative would construct two 500kV AC lines, but an option is also under study to build one of the lines as an HVDC (direct current) line. The project is sponsored by Southwestern Power Group. An overview map showing the general routing is included as Exhibit 15. The total estimated corridor length is 471 miles, of which approximately 176 miles are located in Arizona. The project would be constructed in phases, with the initial phase placed in service in 2014.

The SunZia ten year plan filed in January 2010 was not accompanied by power flow or stability studies. However, SunZia reports that a full set of technical studies will be prepared when the project's design is sufficiently finalized. It is involved in the regional and subregional planning process thru the following forums and activities:

- The WECC path rating process (e.g., through Phase 3) is expected to be complete by the end of 2010 (based on the two 500 kV AC line option).
- Subregional Planning — Regular project updates are provided to SWAT and its subcommittees.
- Open Season — Six parties have now signed the participation agreement (SRP, TEP, Tri-State G&T, Shell WindEnergy, Southwestern Power Group and Energy Capital Partners).

### **2.3.5 High Plains Express Initiative**

An update on the project was presented by Jerry Vaninetti of NextEra Energy at Workshop 1. High Plains Express ("HPX") is a multi-state, 500 kV transmission initiative that extends from Wyoming to Arizona. The project developers' vision is to significantly strengthen the eastern portion of the WECC grid, especially along a north to south backbone. A ten year plan has not been filed with the Commission for this project. Therefore, this project was not considered for the adequacy analysis nor included in the ten year plan statistics compiled for this BTA. An overview map showing the general routing and interconnection points of this project are included as Exhibit 16a.

According to NextEra, HPX could eventually incorporate many of the transmission projects already under development within its overall project footprint in eastern and southern WECC. A diagram depicting the potential impacts of the project on WECC transfer capabilities is shown in Exhibit 16b.

### **2.3.6 TransWest Express Transmission Project**

A ten year plan filing was not made for this project in the 6th BTA, but Gary Mirich of Energy Strategies gave an update on the TransWest Express Transmission Project at Workshop 1 (no slides were presented). The project is currently conceptualized as a 500 kV bi-polar transmission line from southeastern Wyoming to the El Dorado Valley region (south of Las Vegas, NV) with a rating of approximately 3,000 MW. The targeted in-service date is 2015. The project is currently owned by Anschutz Corporation, an Energy Strategies' client. An overview map showing the general routing of the line, as presented during the 5th BTA, is included as Exhibit 17.

Mr. Mirich discussed the evolution of the project from a "coal by wire" concept under the original proponent (APS) to a hybrid renewable/gas fired generation delivery transmission line as presently envisioned. He stated that the project is currently in Phase II of the WECC Path Rating Process, and that TransWest is negotiating with WAPA for potential acquisition of a 50% interest in the project.

### **2.3.7 San Luis Rio Colorado Plant and North Branch Transmission Project**

Generadora del Desierto, a wholly owned Mexican subsidiary of North Branch Holding Company, is proposing to construct a 600 MW gas fired combined cycle power plant in Mexico just south of the US/Mexico border south of Yuma, AZ. The plant will interconnect in the US via the North Branch Transmission Project which consists of two 230kV transmission lines which will connect to a new 230kV substation to be built next to WAPA's Gila 161kV substation. The new double circuit 230kV lines will continue to the APS North Gila 500kV station. On August 21, 2008, the DOE published, in the Federal Register, notice of its decision to issue a Presidential Permit to Generadora del Desierto to construct, operate, maintain and connect a

new double circuit 230kV transmission line across the U.S.-Mexico border into Yuma County, southeast of San Luis, Arizona.<sup>30</sup>

No plans have been filed regarding the project in the 6th BTA and no party presented an update at Workshop 1 on June 3-4, 2010. Therefore, the current status is unknown.

### **2.3.8 Southline Project**

No filing was made in the 6th BTA, but Bill Kipp of Black Forest Partners gave a slide presentation on this merchant transmission line at Workshop 1. He stated that the goal of the project is to accelerate the use of renewable energy through opportunities in electricity transmission, energy storage, and efficiency. This project was not considered for the adequacy analysis nor included in the ten year plan statistics compiled for this BTA.

Southline is contemplated to be a 345 kV EHV transmission line for renewable deliveries from southeastern New Mexico to the Palo Verde Hub area, passing through southeastern Arizona in route. In southern New Mexico, they plan to follow the route of an abandoned El Paso Railroad track in order to minimize environmental impacts. From southeast Arizona to Palo Verde, they may procure contractual delivery arrangements in lieu of physical line construction. They are also exploring options for partnering in expanded delivery paths west of Palo Verde. Black Forest is currently involved in joint technical studies with TEP, SWTC, Western and other parties. Study results should be available in the public domain in July 2010 and can be filed in the 6th BTA at that time. *[#FOR STAKEHOLDER CONFIRMATION#]* A simplified one-line diagram of the project is shown in Exhibit 17e.

### **2.3.9 Santa Fe Project**

Keith Sparks of Clean Line Energy Partners (“Clean Line”) gave a presentation on this merchant transmission line proposal at 6th BTA Workshop 1, but no filing has been received to date. Clean Line proposes to build the Santa Fe Project in order to bring up to 3,500 MW of wind and solar resources from New Mexico and the Texas Panhandle into Arizona and other energy demand centers in the desert southwest. They have signed a memorandum of understanding with the Navajo Nation to cooperate on project development. Clean Line stated they are working with WECC’s TEPPC on developing related study scenarios. No route map or technical

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<sup>30</sup> Federal Register / Vol. 73, No. 163/ Thursday, August 21, 2008/Notices, page 49447.  
<http://edocket.access.gpo.gov/2008/pdf/E8-19392.pdf>

studies are available. Therefore, the project was not considered for the adequacy analysis nor included in the ten year plan statistics compiled for this BTA.

### **2.3.10 Eldorado Valley Study Group**

An informational presentation on this new SWAT study group was given by Chuck Russell of SRP at 6th BTA Workshop 1, but no filing has been made in the BTA. This SWAT work group is still in its formative stages and is open to all stakeholders. It is not associated with any particular merchant or utility transmission project, and will look collectively at system impacts of the various transmission projects proposing to terminate at one or more of the EHV substations in the Eldorado Valley (e.g., Marketplace, Eldorado or Mead). The study scope is still being developed. Among other deliverables, it is expected that the scope will include short circuit impacts. A preliminary diagram of transmission projects connecting into the Eldorado Valley is shown in Exhibit 17f.

## **2.4 Generation-Driven Transmission Plans**

Several filings and/or workshop presentations were made by sponsors of specific generation related transmission projects as follows:

### **2.4.1 Bowie Power Station**

The Bowie Power Station owned by Southwestern Power Group (“SWPG”) is a natural gas fired 1,000 MW electric generation facility planned for southeastern Arizona near the community of Bowie in Cochise County. The Bowie Power Station will connect with TEP’s Greenlee-Winchester-Vail 345kV line at Willow Substation via two 345 kV transmission lines approximately 15 miles in length.

SWPG’s filing in the 6th BTA notes that the commission has extended the CEC for the project through December 31, 2010 in Decision No. 69339. The physical alignment of the line and Willow Substation were amended through Decision No. 70588 in November 2008. Exhibit 14 depicts the amended alignment.

PDS consulting gave a presentation on the project at Workshop 1. SWPG continues to be active in SWAT subcommittees, including SATS. A Final Facilities Study Report is expected from TEP in the third quarter 2010. The estimated operation date for the gen-tie is late 2013.

### **2.4.2 Hualapai Valley Solar**

Hualapai filed its first ten year plan in January 2010. The plan calls for a 345 kV or 500 kV gen-tie in northeastern Arizona to interconnect Hualapai’s proposed solar generation facility. The

line may connect into either the Mead Phoenix Project 500 kV transmission line, the Mead-Peacock-Liberty 345 kV transmission line, or the Moenkopi-Eldorado 500 kV transmission line. The proposed in-service date is the fourth quarter of 2013. Since a defined transmission plan of service hasn't been identified to date, the project wasn't modeled in any technical studies filed in the 6th BTA docket. [#SUBJECT FOR STAKEHOLDER CONFIRMATION#] However, Hualapai states that power flow and stability analysis were filed as part of the power plant filings at the Commission in August 2009.<sup>31</sup>

### 2.4.3 Sonoran Solar Energy

Sonoran Solar Energy plans to build a 500 kV gen-tie to interconnect its proposed 375 MW solar generation project with SRP's Jojoba Substation. The 3 mile long line will be located in Maricopa County, Arizona and will be in service by summer 2013 to support plant start-up and testing. A map of the gen-tie route is shown in Exhibit 17a. Sonoran states that technical study reports for this interconnection plan were included as part of the 90-day filing notice in November 2009. In addition, Sonoran states that "planning criteria and system ratings filed annually by SRP with its Ten-Year Plans will serve as the surrogate record for Sonoran's planned transmission project (filing requirements)." However, as previously noted in Table 1, SRP has not filed such information in the 6th BTA.

### 2.4.4 Abengoa Solar

Abengoa Solar plans to build a 230 kV overhead gen-tie (approximately 20 mile) to interconnect its proposed 280 MW Solana solar generation project near Gila Bend, Arizona with APS' Gila River Substation.<sup>32</sup> A route map is shown in Exhibit 17b. The project will use concentrated solar power ("CSP") technology with storage capability. Technical planning studies were filed with the project's 90-day notice in July 2008. The project and gen-tie received a CEC in December 2008.<sup>33</sup> APS will procure the output under a 30-year purchase agreement. Abengoa states that an interconnection facilities study was completed by APS in August 2009 and concludes that an additional loop-in of the line through Gila River Substation en route to Gila Bend Substation, as contemplated at the time of the CEC application, is not needed.<sup>34</sup> The

<sup>31</sup> ACC Docket No. E-00000M-08-0170 and Docket No. L-00000NN-09-0541-00151

<sup>32</sup> Also known as Panda Substation.

<sup>33</sup> ACC Docket No. L-00000GG-08-0407-00139, Decision No. 70638 and Docket No. L-00000GG-08-0407-00140, Decision No. 70639

<sup>34</sup> The facilities study also specifies certain APS 69kV network upgrades that need to be completed.

facilities study was included in Abengoa's BTA filing. [#STAFF NEEDS TO REVIEW STUDY FOR CONCURRENCE#]

#### **2.4.5 Mesquite Solar Project**

Sempra Energy filed a ten year plan for its 230kV gen-tie from their Mesquite Solar photovoltaic project to Hassayampa Substation, which includes expansion of switchyard facilities at the existing Mesquite Generating Station adjacent to Hassayampa Substation. The solar plant will make use of an existing, spare 230/500kV transformer at Hassayampa. The project one-line diagram is shown in Exhibit 17c and the facilities will be completed in 2010.

#### **2.4.6 Starwood Solar I**

Starwood Energy filed a ten year plan for the Starwood Solar I project in June 2009. The plan describes a 500 kV gen-tie to connect the generating project to APS' planned Delaney Substation. Starwood refers to APS as the surrogate for meeting the ACC's requirement for filing of transmission planning criteria and system ratings. Construction of the gen-tie to Delaney Substation is expected to start in 2010 and be completed in 2013. A subsequent extension to Harquahala Substation is also mentioned in Starwood's ten year plan, but the timing of this segment is uncertain and dependent on an ongoing APS cluster interconnection study and commercial negotiations with the Harquahala Power Plant. No technical studies were filed. Starwood states that technical studies supporting its transmission plan will be filed upon study completion. Exhibit 17d provides more plan details.

#### **2.4.7 Mohave Sun Power LLC**

Mohave Sun Power filed a ten year plan in January 2009, which describes a conceptual 345 kV or 500 kV gen-tie from a solar power project to be built in northwestern Arizona to an existing EHV transmission facility. No route has been determined. The estimated in-service date is 4th quarter 2013. No BTA filing on the project was made in 2010.

#### **2.4.8 Arlington Valley Solar Energy**

AVSE LLC filed a Ten Year Plan in January 2009, describing two 115 kV or 230 kV gen-tie lines from the project site to Hassayampa Substation, plus 500-1000 feet of 500kV line on the high side of the step up transformer bank at Hassayampa. The gen-ties will be 3-7 miles in length and will originate at Arlington Valley Solar 1 and 2 Generating Plant switchyards, respectively. Aggregate generating plant capacity is approximately 250 MW. The estimated in-service date is 4th quarter 2012. No BTA update was filed in 2010.

## **2.4.9 Agua Caliente Solar Energy**

The project developer, NextLight Renewable Power LLC, filed a ten year plan in January 2009. The filing described a loop in of the existing APS Hassayampa – North Gila 500 kV line into a new APS 500 kV switchyard to be built in the vicinity of the Agua Caliente Solar Project site approximately 10 miles north of Dateland, Arizona in Yuma County. The 280 MW concentrating solar power plant will be located about 2 miles north of the existing 500 kV line. The filing envisions a short loop in of the Hassayampa – North Gila line into the new switchyard site, and construction of a gen-tie from the plant to the APS switchyard. The gen-tie voltage is not specified. A 90-day Plan filing was made in November 2008. The anticipated in-service date is mid-2012. No BTA filing was made in 2010.

## **2.5 Other Significant Transmission Projects**

### **2.5.1 Welton-Mohawk Supply Project**

The Welton-Mohawk Irrigation and Drainage District (“WMIDD”) is planning a 230 kV transmission project to be connected to the planned Palo Verde to North Gila No. 2 500 kV project. A new 500/230 kV receiving station will intersect with the planned 500 kV line approximately 40 miles east of the North Gila Substation. Welton-Mohawk plans on constructing a 230 kV transmission line from that receiving station and most likely connecting to the existing WAPA Ligurta Substation, which serves as the delivery point to WMIDD. In addition to the 230 kV transmission line, WMIDD plans to participate as a minority owner in APS’ PV-North Gila No. 2 500kV line project. WMIDD is participating in subregional planning forums, including SWAT, to assure that its project plans are properly vetted and coordinated within the region. An overview map showing the general routing the 230kV project are included as Exhibit 12.

### **2.5.2 Southwest Public Power Resources Project**

Santa Cruz Water and Power District (“SCWPD”) did not file an update in the 6th BTA for the Southwest Public Power Resources (“SPPR”) group generation project. However, Dennis Delaney of K.R. Saline & Associates (“K.R. Saline”) gave a presentation on the project at 6th BTA Workshop 1.

A Three Terminal Plan (“TTP”) transmission project was proposed during the 5th BTA in order to interconnect SPPR’s Sawtooth Generation Project No. 1 located in Pinal County and deliver power to the SPPR participants. Sawtooth was being planned as a 2-on-1 combined cycle gas-

fired 620 MW plant. The TTP project consisted of the following three new 230 kV transmission elements:

- Santa Rosa/Test Track to ED5 (Circuit 1)
- ED5 to Pinal Central (Circuit 2)
- ED5 to Marana (Circuit 3)

In its presentation at Workshop 1, K.R. Saline advised that SPPR has stopped development on the Sawtooth generation project due to changing requirements related to the economic turndown. In place of generation development, SPPR will now pursue an RFP for power purchases (preferably at Palo Verde) for delivery to its load area. The focus of the RFP will be on procurement of a renewable resource portfolio. Based on the new approach, SPPR is changing its ten year plan as follows:

- Delay addition of TTP Circuits 2 and 3 (e.g., beyond ten year plan)
- Interconnect TTP Circuit 1 through new 500/230 kV transformation at Test Track
- Install a 230/115 kV transformer at ED5
- Extend the Southeast Valley (“SEV”) project from Pinal West to Test Track and Pinal Central by 2014 (the existing portion of SEV includes Hassayampa – Pinal West and a 500/345 kV transformation at Pinal West).

In addition to these system changes, SPPR will pursue negotiations aimed at integrating the Southeast Valley (“SEV”) project transmission rights with Western Parker-Davis System delivery rights in order to secure a complete transmission path for delivery of the new power purchase(s) to SPPR, as indicated in Exhibit 13.

### **2.5.3 WECC Transfer Path Changes Affecting Arizona**

Exhibit 8 provides a map of the WECC rated transmission paths in Arizona. Ratings of these transmission paths are increased in two ways: either a new line is constructed and integrated into an existing path or existing lines in a path are upgraded to achieve an increased path rating. Two paths in Arizona have recently been upgraded and other EHV transmission line upgrades are currently underway that will increase another path in 2010. Such path rating changes must go through an exhaustive WECC path rating process, which includes technical studies, in order to implement such path rating increases attributable. The following path rating increases were completed since the 5<sup>th</sup> BTA:

- The rating of the East of River (“EOR”) Path or Path 49 increased due to the Navajo to Crystal 500 kV line upgrade and the Perkins to Mead 500 kV line upgrade in 2008 and

2009, respectively. This increased the path rating by an additional 1245 MW in the East to West direction to a new rating of 9300 MW.

- The Coronado to Silver King 500 kV series capacitors were upgraded in 2009 with a resulting increase in the Path 54 rating by 400 MW in the East to West direction. The path is now rated 1,533 MW.

The following path upgrade is in-progress in 2010:

- Series capacitors on the Navajo Transmission Southern System (Path 51) consisting of the Navajo-Westwing 500 kV line and the Moenkopi-Yavapai 500 kV line will increase the path rating by 800 MW in the North to South. The new path rating will be 4,000 MW.

No other WECC path ratings in Arizona are currently approved for the 2010-2019 period, but it is likely that some increases will occur in this period due to major interstate transmission projects described in this report. Future WECC path rating studies will determine the timing and amount of these increases.

### **3. RENEWABLE TRANSMISSION ACTION PLAN(S)**

Developing Arizona's vast renewable resource potential requires a coordinated and multi-faceted strategy involving stakeholders representing many sectors and interests including utility, government, economic, developer, environmental, and others. Decisions by the Commission and the actions taken by the Arizona utilities and regional stakeholders are important steps towards the state's goal of becoming a national and world leader in renewable energy development.

#### **3.1 Background**

The Commission's 5th BTA Decision directed Commission-regulated utilities to develop plans to identify future renewable transmission projects ("RTPs") and to propose funding mechanisms to construct the top three RTPs in their respective service territories. In addition, the Commission directed the utilities to conduct a joint workshop or series of planning meetings to develop ways in which new RTPs could be identified, approved for construction, and financed in a manner that supports renewable energy growth.

##### **3.1.1 The Arizona Renewable Resource and Transmission Identification Subcommittee**

In response to a prior Commission directive in the 4th BTA, the SWAT Sub-Regional Planning Group formed a Renewable Transmission Task Force ("RTTF") to consider transmission needs for developing renewable resources. In response, the RTTF established the Arizona Renewable Resource and Transmission Identification Subcommittee ("ARRTIS") to identify those areas in Arizona with the best potential for renewable generation project development to aid the utilities' response to the BTA Decision. The primary tasks of ARRTIS were to:

- Identify potential constraint areas for Arizona renewable resource development;
- Assist the RTTF by providing information to assess transmission options; and
- Inform and assist the regulated utilities in their response to the BTA Order.

The ARRTIS convened an approximately five-month process to gather, review and map renewable resource and environmental sensitivity data for the state of Arizona and to provide input and support to the RTTF renewable transmission planning efforts. The process identified areas within the state where solar and wind resources were technically ideal for utility-scale generation development, defined and located environmentally sensitivity areas and those that would be excluded by statute or law would from consideration for generation facilities.

Recommendations by ARRTIS participants were used in a four-tier process to characterize land area into categories to provide specific data. The ARRTIS took a position that (1) Exclusion Areas would be the only areas in the state that should be considered precluded for utility-scale generation, and (2) no assumption of any specific renewable generation project's viability should be made based on its location.

The analysis found that approximately half of Arizona's land area could be appropriate for utility-scale generation. The further application of ARRTIS-defined sensitivity criteria allowed the RTTF to more strategically define the state's potential transmission network to support renewables. The RTTF used the information provided by the ARRTIS to identify transmission options that would link the resource areas to the existing transmission system and/or to load pockets within the state or to export markets."

### **3.1.2 The RTTF Finance Subcommittee**

The RTTF also established a Finance Subcommittee to develop a methodology for identifying, planning, and facilitating RTP development in Arizona, including methods for providing utilities with a means to effectively finance and construct RTPs.

The RTTF assigned the Finance Subcommittee the tasks of investigating and recommending financing methodologies for RTPs in Arizona. The findings and recommendations of the Subcommittee were to be submitted to the RTTF and the jurisdictional utilities subject to the Decision. In coordination with its companion RTTF subcommittee, and the ARRTIS, the Finance Subcommittee also supported the utilities responsible for the Workshops as directed by the ACC. This information was intended for the utilities' consideration as part of their response to an ACC decision requiring the utilities to identify and develop plans for the top three renewable transmission projects, submit a report by 31 October 2009, and have this report discussed in the Commission's next BTA.<sup>35</sup>

### **3.1.3 ARRTIS findings**

Five maps were developed as part of the ARRTIS process:

- Arizona Solar Resources
- Arizona Wind Resources
- Environmental Exclusion and Resource Sensitivity Areas (Solar)
- Environmental Exclusion and Resource Sensitivity Areas (Wind)

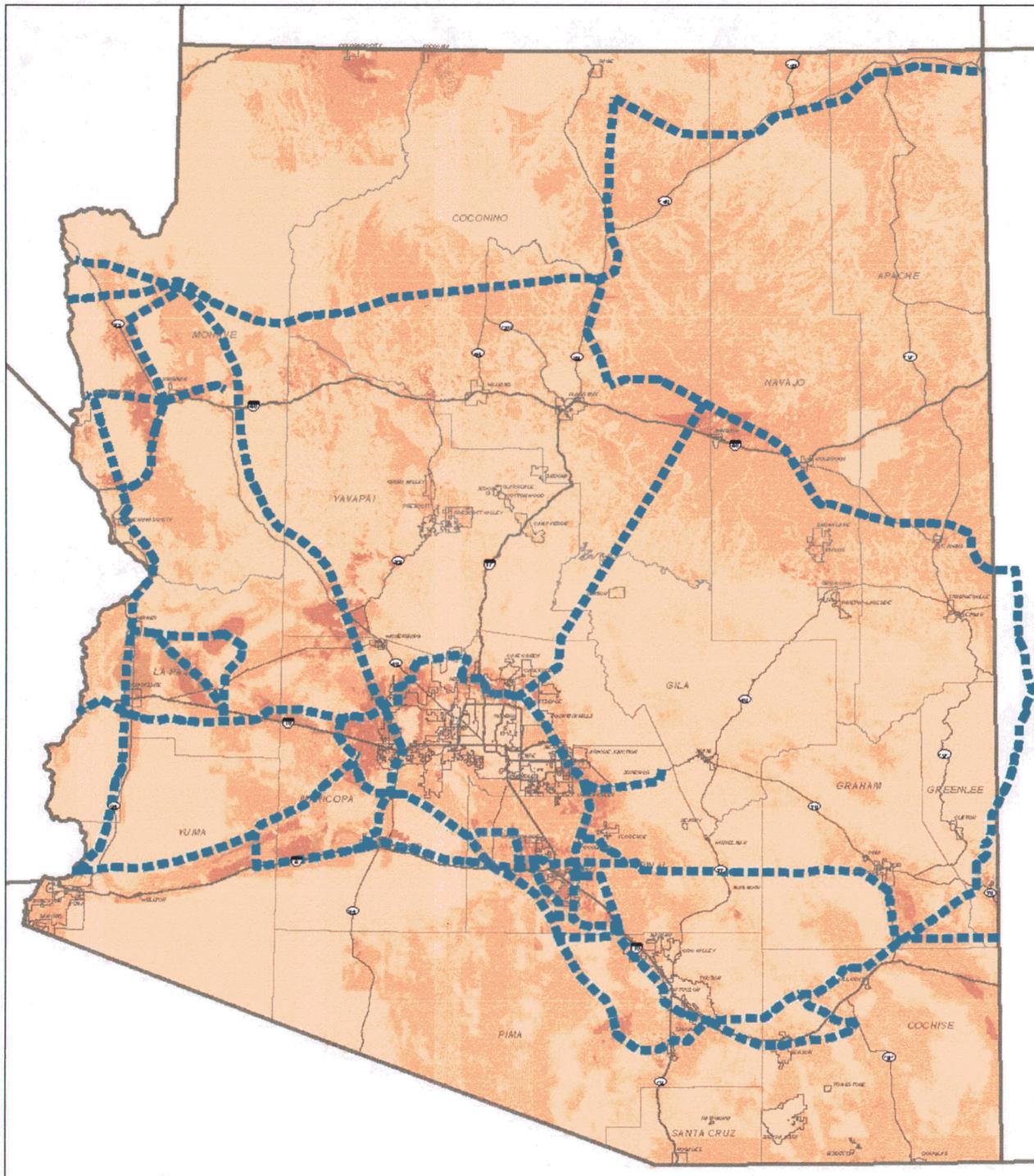
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35. ACC Decision No. 70635, issued on December 11, 2008.

- Non-Exclusion Solar Resource Areas Identified by ARRTIS

These maps were use by SWAT to identify transmission corridors suitable for delivering renewable generation. The map of these corridors is shown in Figure 2.

**Figure 2: Transmission Corridors for Renewable Generation Identified by ARTTIS**



## 3.2 Utility RTP filings

Each of the jurisdictional utilities filed responses by 31 October 2009. It is interesting to note that many of the corridors identified by ARRTIS as shown in Figure 2 are compatible with projects in the utilities' previous transmission plans.

### 3.2.1 Arizona Public Service

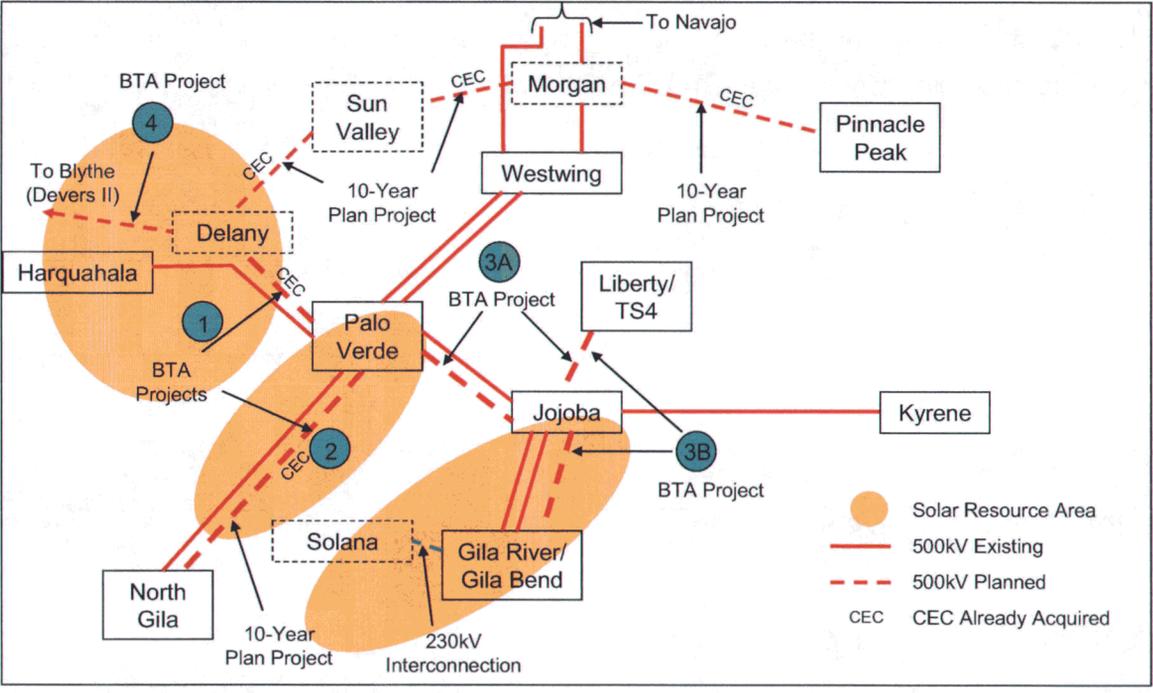
In determining its top RTPs APS considered the input from the two workshops, the ARRTIS' work, the Finance Subcommittee's work, and the RTTF's work. They assessed the comparative economic value of viable renewable resource and transmission line combinations. Based upon its analysis, APS identified the RTPs that it believes were best suited to support the growth of renewable resources in Arizona while considering the costs and benefits to APS customers.

APS identified four RTP projects:

1. Delaney to Palo Verde 500 kV;
2. Palo Verde to North Gila 500 kV #2;
3. Palo Verde to Liberty and Gila Bend to Liberty 500 kV; and
4. Delaney to Blythe (e.g., SCE's proposed Colorado River 500 kV Substation)

A fourth project was included because APS believes it would significantly support development of renewable resources in Arizona for exports to California and to deliver solar resources to Arizona utilities at the Delaney switchyard. These four projects are shown in Figure 3.

**Figure 3: APS' identified RTP Projects**



*[#Editor's Note - circles enclosing numbers should be lighter to make them readable#]*

**3.2.1.1 Delany to Palo Verde 500 kV**

This project is a 500 kV transmission line from the Palo Verde hub to a new Delany switchyard, about 18 miles west of the Palo Verde hub. The new switchyard would be located along a 500 kV loop that will eventually run from Palo Verde around the west and then north side of the Valley to the Pinnacle Peak substation.

The Delany area has excellent solar conditions, which should result in competitive pricing of solar resources compared to other available solar resource pricing. There are interconnection requests for several thousand MW of renewable generation in the Delany area—a clear indicator that there is a robust interest in renewable resource development.

**3.2.1.2 Palo Verde to North Gila 500 kV #2**

This project is a potential 500 kV transmission line from the Palo Verde hub area to the North Gila Substation, located outside of Yuma. It is approximately 114 miles in length and would parallel an existing jointly-owned 500 kV line.

The area has excellent solar conditions, which should result in comparably good pricing of solar resources. There are interconnection requests to the area adjacent to this line indicating a

robust interest in this renewable resource area. This line would also provide additional transmission to the Yuma load pocket, increasing load-serving capability in Yuma, and providing additional resource flexibility to serve both the Valley and Yuma load pockets.

Due to the magnitude of project costs, this project is conceived as a participant transmission project. SRP, the Imperial Irrigation District, and the Wellton-Mohawk Irrigation and Drainage District are the other current participants, each holding a 20% share of the project. In addition, the Western Administration Power Administration has expressed an interest in participating in the project. WAPA involvement would provide the potential for federal government funding for WAPA transmission expansions that foster renewable energy.

### **3.2.1.3 Palo Verde to Liberty and Gila Bend to Liberty 500 kV**

This two-part conceptual transmission project includes a 500 kV transmission line from the Palo Verde hub to a new substation near the existing Liberty substation in the West Valley and a 500 kV transmission line from the Gila Bend/Gila River area to a new substation near the existing Liberty substation.

The area around the Palo Verde hub and the Gila Bend area have excellent solar conditions, which could result in the development of significant solar generation facilities. APS believes that completion of these projects would mitigate inconsistency between the periods required to construct transmission lines and renewable resource facilities—where transmission infrastructure takes longer to build than renewable resource facilities.

### **3.2.1.4 Delany to Blythe**

This project was originally proposed by Southern California Edison. APS supports development of this transmission line because it could influence additional solar resource development in Arizona given the potential for additional export capability to California.

### **3.2.1.5 APS Cost Analysis**

APS worked with the other utilities and interested stakeholders to develop plans to identify the best three RTPs. APS used the methodology developed by the Finance Subcommittee for identifying RTPs. APS selected the RTPs considering the costs and benefits to APS customers. APS established a plan to develop the project, proposed funding mechanisms, provided background explaining the value of the project in supporting renewable energy development in Arizona, and described potential rate impacts to APS's customers for the projects selected.

APS used the National Renewable Energy Laboratory's Western Wind Resource Dataset to estimate annual capacity factors of the four potential wind sites. Likewise, the Department of Energy's Solar Advisory Model was used to model concentrating solar power and solar photovoltaic plants at the twelve potential solar sites. Transmission costs were estimated using the capital costs for 500 kV transmission lines used in the Western Governors Association Western Renewable Energy Zone process, model, and report.

APS used an adjusted delivered-cost analysis to compare the candidate resource/transmission pairs. This method calculates the average cost of a renewable resource, including the cost to deliver the energy from the production location to the Phoenix load center, or in the case of export options, to the California border. The equation for calculating the adjusted delivered cost is:

$$\begin{aligned} & \text{Generation busbar cost} \\ & + \text{Transmission cost} \\ & + \text{Substation cost} \\ & = \text{Delivered cost} \\ & + \text{Integration cost} \\ & - \text{Capacity credit} \\ & - \text{Energy credit} \\ & = \text{Adjusted delivered cost} \end{aligned}$$

APS presents the adjusted delivered costs and later the cost of the proposed projects and their retail rate impacts, but it is difficult to understand the connection, or if there even is a connection, between these costs and the proposed projects.

### 3.2.2 SRP

In selecting its top three RTP projects, SRP considered these factors:

- Closeness to renewable resources
- Supports SRP's long term needs
- Able to provide access to renewable resources and to serve multiple purposes
- Accessible to multiple resources, resource dense areas or energy hubs
- Relative cost and schedule
- Proximity to SRP's service territory
- Integration into local transmission & generation system

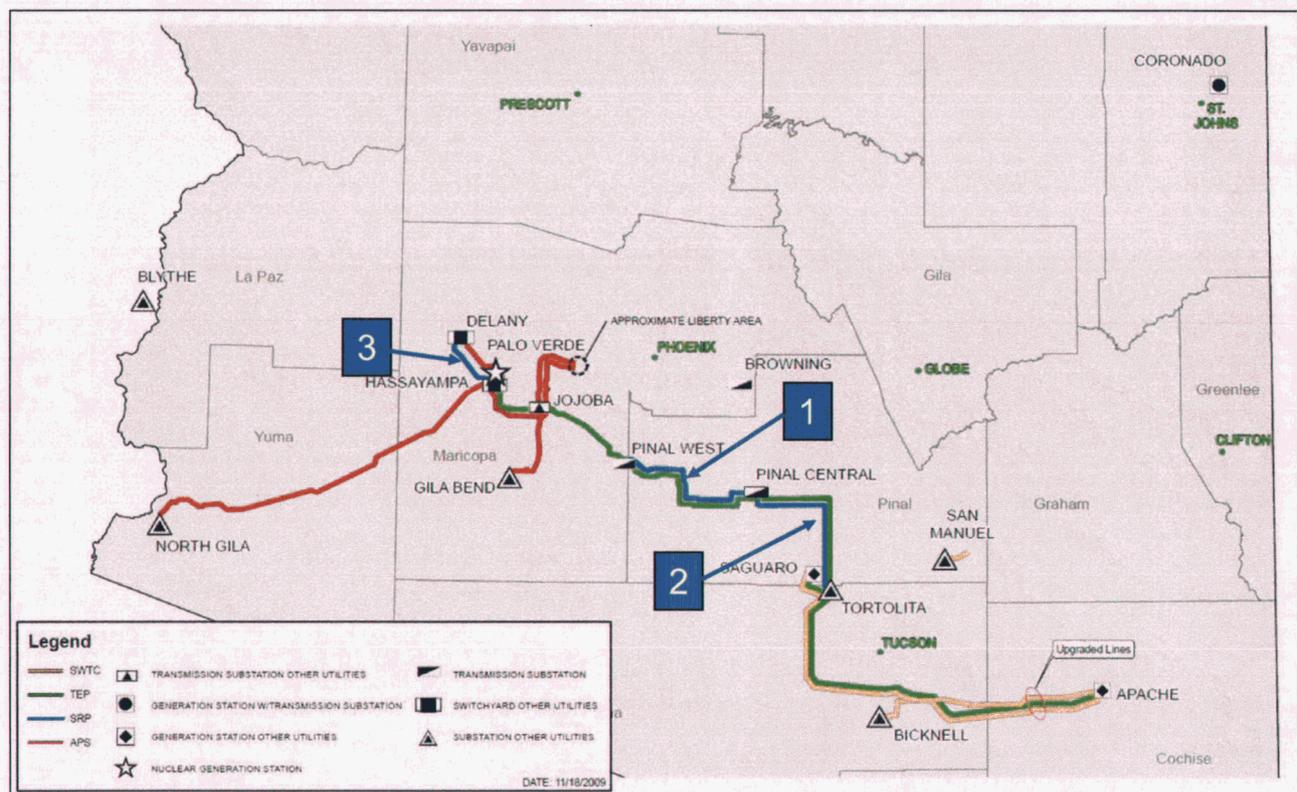
- Ability to align partnerships
- Likelihood of meeting permitting requirements
- Enhancing system reliability

The three projects identified by SRP, as shown in Figure 4, were:

1. Pinal West – Pinal Central 500 kV
2. Pinal Central – Tortolita 500 kV
3. Delaney – Palo Verde 500 kV

It should be noted that SRP’s RTP #3 is same as APS’s RTP #1 (e.g., a joint participation project).

**Figure 4: APS, SWTC, SRP and TEP Identified RTP Projects**



### **3.2.2.1 Pinal West – Pinal Central 500 kV**

This project is an integral piece of the Hassayampa to Pinal West to Pinal Central to Browning project. Today there are 11 interconnection requests to that line—all solar—for 3,500 MW. The line adds a critical link from the SRP Southeast Valley to Palo Verde. It also provides another parallel path from the Palo Verde area into the valley, and gives access for Pinal County resources to Palo Verde.

### **3.2.2.2 Pinal Central to Tortolita 500 kV**

This project is a 30-mile line that allows renewable development between the Phoenix and Tucson areas. There are 500 MW of interconnection requests—all solar. There is also some biomass potential in southern Pinal County. The main benefit of the project is improving the reliability for SRP, APS, and central Arizona.

### **3.2.2.3 Delaney to Palo Verde**

This project is a short transmission project—18 miles. There are seven requests for interconnection totaling 3,300 MW—all solar in the area. It is part of the Palo Verde-TS-5 APS project. The proposed Delany Substation site is located in the very rich solar resource area of Harquahala Valley. As previously noted, this is a jointly-owned project with APS and also appears on their list of RTP's.

## **3.2.3 Tucson Electric Power Company and Unisource Energy**

TEP and UNSE jointly filed their RTP project report in the Docket in 2009. Three projects were selected:

1. Palo Verde to Pinal West to Pinal Central 500 kV
2. Pinal Central to Tortolita 500 kV
3. Western Apache to Tortolita 115 kV to 230 kV Line Upgrade

The first two of these projects were also proposed by SRP, as discussed above (e.g., the represent joint ownership projects). Only the third project is unique to TEP and is discussed in more detail below.

### **3.2.3.1 Western Apache to Tortolita 115 kV to 230 kV Upgrade**

The third project is an upgrade of the existing 115 kV system that been in service for many years. The project is shown in green in the bottom right of Figure 4, above. Originally it was to

deliver power to preference customers from hydro units delivered over the 115kV lines. Over the years the rest of the system and local load has grown up around these facilities.

TEP observes that efforts to move renewable resources across the existing 115 kV system will experience congestion due to single-contingency criteria. The upgrade of the selected line to 230 kV will remove those legacy limitations and facilitate renewable development. This third project would also interconnect with the radial lines reaching down into southeast Arizona and provide opportunities for renewables to connect to the system and be delivered throughout the state.

### **3.2.4 Other comments**

The Finance Subcommittee of the RTTF raised five questions for consideration by the Commission:

1. Is the BTA the best forum for determining cost-recovery status of rate-based assets since there is no filing in a BTA?
2. Should RTPs be submitted annually (i.e. included in the 10-year plans) or biennially (i.e. as part of the BTA and 10-year plans)?
3. How are legitimate RTPs that arise unannounced, to be afforded RTP treatment by the Commission?
4. Do the Commission and Staff require further guidelines to assist with differentiation of a candidate RTP and transmission projects proposed in the ordinary course of business?
5. Do the Commission and its Staff have the tools to make allocation decisions that might be required under '4', above?

### **3.3 ACC Staff Observations and Conclusions**

The proposed RTPs described above represent the first utility filings in response to the 5th BTA request for an analysis of the impact of renewables on transmission plans. On the whole the filings are responsive to the Commission's request. An inclusive stakeholder process was also developed and executed to identify the initial set of transmission RTPs. The proposed RTPs are not entirely new proposals, but actually represent advancement of projects that have already been in planning for reasons other than renewable integration.

### **3.3.1 Effectiveness of RTP Projects Selected by the Utilities**

The projects identified by the utilities are all found in previous transmission plans of the utilities to meet other needs than renewable integration. Since the majority of conceptual transmission corridors identified in the ARRTIS report and the RTAP process were generally along existing and planned corridors, this set of RTPs should not be a surprise. They appear to be a reasonable set of initial renewable development projects that will facilitate renewable resource development in the southern half of the state, close to either the Phoenix or Tucson load regions or the resource rich Palo Verde hub region.

We conclude that the projects selected should be effective in enabling development and delivery of renewable resources to either the Phoenix-Tucson regions or the Palo Verde hub.

### **3.3.2 Impact of RTP Projects on the Arizona Transmission System**

Because the selected projects are ones that have been identified in earlier transmission plans they should contribute to reinforcing the transmission for general use beyond the specific needs of renewable generation project.

### **3.3.3 Impact of RTP Projects on Development of Renewable Resources**

The identified projects should be effective in enabling delivery of renewable resources developed close to either the Phoenix-Tucson regions or the Palo Verde hub. As projects are developed farther from these areas, truly new transmission plans will likely need to be developed.

### **3.3.4 Utility Estimates of RTP Project Costs**

If there was a weakness in the RTP report(s) and related information presented by the utilities it was the economic analyses. These analyses were confusing and appeared to be inconsistent in the depth of their presentation and explanation. Even so, the initial set of RTPs selected are logical based on the close match between the ARRTIS corridors identified and previous transmission plans.

In addition, Staff concurs with the following comments offered by SWAT in regard to questions raised by the RTTF Finance Committee:

**1. *Is the BTA the best forum for determining cost-recovery status of rate-based assets since there is no filing in a BTA?***

“The BTA and RTAP processes should not be used for cost-recovery or rate-base decisions by the Commission. The goal should be to identify transmission projects for Arizona, describe their justifications, to present a ranking or priority to the projects, and to inform the Commission of changes in the transmission plans from year-to-year.

The RTAP and renewable needs analyses should also be largely be for informational purposes. The Commission is seeking a better understanding as to how expanded renewable generation development would affect transmission plans. The economic analysis is also intended to establish a technical, procedural, and economic means for the utilities to identify, prioritize and incorporate changes to transmission plans that should be made due to potential renewable generation expansion.

Projects identified by the RTAP process should be given priority and be expedited by the Commission in the approval and ratemaking process.”

**2. *Should RTPs be submitted annually (i.e. included in the 10-year plans) or biennially (i.e. as part of the BTA and 10-year plans)?***

“In the long run the RTAP should be developed and submitted biennially with the BTA. However, if the pace of renewable generation development warrants, then annual filings may be required.”

**3. *How are legitimate RTPs that arise unannounced to be afforded RTAP treatment by the Commission?***

“The RTAP process should identify the top three RTPs, but, as was done this year, additional projects can also be identified for informational purposes. The Commission would then have an expectation as to what transmission projects might be needed to support other renewable projects. In any case, the Commission would be open to applications for “unexpected” renewable resource developments that might require an *ad hoc* RTAP.”

**4. Do the Commission and Staff require further guidelines to assist with differentiation of a candidate RTP and transmission project proposed in the ordinary course of business?**

“The emphasis here should be on identifying projects that need priority handling/processing outside the ordinary course of business and that can be justified specifically to support renewable generation projects.”

**5. Does the Commission and Staff have the tools to make allocation decisions that might be required under ‘4’, above?**

**INTENTIONALLY LEFT BLANK - COMMENTS TO BE ADDED**

**3.3.5 Impact of RTP Implementation on REST Requirements**

The Renewable Energy Standard and Tariff R14-2-1801 (“REST”) became effective August 14, 2007, following approval by the Commission. Among other things, the REST rules require jurisdictional utilities to generate or purchase at least 15% of their total annual retail energy requirements from eligible renewable energy resources by 2025, with smaller amounts required in earlier years. For the calendar year 2009, the Commission established a requirement of 2.0 percent of a utility's 2009 total retail kWh sales, with 15 percent of that requirement to be satisfied through energy received from distributed energy (“DE”) resources. The REST requirements for the 2008-2025 period are shown in Table 7.

**Table 7: REST requirements 2008-2025**

<b>Year</b>	<b>REST goals</b>	<b>Year</b>	<b>REST goals</b>
2008	1.75% (10% DE)	2017	7.00% (30% DE)
2009	2.00% (15% DE)	2018	8.00% (30% DE)
2010	2.50% (20% DE)	2019	9.00% (30% DE)
2011	3.00% (25% DE)	2020	10.00% (30% DE)
2012	3.50% (30% DE)	2021	11.00% (30% DE)
2013	4.00% (30% DE)	2022	12.00% (30% DE)
2014	4.50% (30% DE)	2023	13.00% (30% DE)
2015	5.00% (30% DE)	2024	14.00% (30% DE)
2016	6.00% (30% DE)	2025	15.00% (30% DE)

In general, the utilities have met or exceeded the overall REST goals—total renewable energy of 2.00% from renewables. The goal for DE to have been 15% of the total has generally not been met, though each of the utilities reports a surge in new DE added in 2009.

The REST requirements are likely to affect the transmission plans of Arizona utilities in two general ways—first, utility-scale renewable generation will likely require at least some transmission improvements that would not otherwise be needed; and, second, the DE component will, in effect, reduce the load on the distribution and transmission systems.

- The information in the utility REST reports can be used to make a comparison of the scale of the REST goals with the delivery capability of the transmission projects proposed in the Arizona utilities' 2009 RTAP filings. The 15% energy requirement by 2025 could require total renewable generating capacity equal to 24-41% of the system peak load. This assumes an annual capacity factor for all renewable sources to be 25-35% and a system load factor of 55%. So 10,000 MW peak load would be 48,180,000 MWh/year. A 15% renewable requirement would be 7,226,000 MWh annually or an average of 825 MW. If total renewable generation had an annual capacity factor of 20% (the low end of a reasonable range) then 4,125 MW of renewables would be needed to supply the 7,226,000 MWh of annual energy. If renewables have an annual capacity factor of 35% (the high end of a reasonable range) then only 2,357 MW of renewables would be required.
- The utility-scale renewable generation requirement could range from 17% to 29% (i.e., 70% of the total installed renewable capacity) of the system peak load. This is a significant amount of utility-scale generation and would require transmission reinforcement of some consequence. The amount of renewable generation today is still relatively low and so has not had a significant impact on transmission plans.
- By 2025 the DE portion of renewables would amount to 7-12% of system peak load (i.e., 30% of the total installed renewable capacity). This is equivalent to 2-4 years of load growth. So the adjusted 2025 system demand would be at the

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forecasted 2021-2023 level and would, in effect, represent a 2-4 year delay in the transmission plans that would otherwise be necessary.<sup>36</sup>

It is unclear from the utility RTAP filing(s) to date how much renewable generation could be delivered as a result of the RTP projects proposed by the Arizona utilities. **[#This question will be explored at Workshop #2#]**

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<sup>36</sup>. APS estimated the Phoenix area growth from 2013 to 2019 to average 3.2% annually. (See Table ES1 of their *Reliability Must-Run Analysis, 2010-2019*, January 30, 2010)

## **4. OTHER COMMISSION ORDERED STUDIES**

### **4.1 History and Purpose**

In addition to the assessment of transmission needs for renewable resource integration discussed in Section 3 above, over the years the Commission has ordered that certain other supplemental study work be performed by Arizona utilities to broaden and facilitate biennial assessments. In addition to the current effort to examine transmission needs for renewable integration, study work previously ordered by the Commission falls into three categories.

- The transmission load serving capability of specified local load pockets has been a study requirement since the First BTA.
- Reliability must run (“RMR”) studies have been required for selected constrained transmission import areas with local generation since the Second BTA.
- N-1-1 and Extreme Contingency studies have been required to ascertain the transmission system’s robustness to withstand more severe emergency scenarios since the Third BTA.

Such studies have a twofold purpose. First, the ordered studies are intended to improve the thoroughness and accuracy of the conclusions and recommendations resulting from the BTA. Second, the ordered studies are intended to better inform the Commission areas of the transmission system that potentially need improvement, and identify if additional Commission focus on such areas is prudent. These three categories of results in the 6th BTA are discussed in more detail below.

### **4.2 Local Area Transmission Load Serving Capability Assessment**

In the First BTA, Staff identified five load pockets in Arizona that should be monitored for transmission import constraints: Phoenix, Tucson, Yuma, Mohave County and Santa Cruz County. The Second BTA added a sixth area located in Southeastern Arizona (Cochise County). The Third BTA added Pinal County as a local area that needed to be monitored.

The transmission import capability for these seven local areas remains a consideration for this BTA. Utility Distribution Companies have the obligation to assure that adequate import capability is available to meet the load requirements of all distribution customers within their

service areas.<sup>37</sup> The Commission has adopted the use of two terms as indicators of the load serving capability of local load pockets: Simultaneous Import Limit (“SIL”) and Maximum Load Serving Capability (“MLSC”).<sup>38</sup> APS, SRP, TEP and SWAT have filed studies with the Commission in the 6<sup>th</sup> BTA that address the supply limits to these load pockets.

#### 4.2.1 Cochise County Import Assessment

The Cochise County load serving entities are APS, TEP, and Sulphur Springs Valley Electric Cooperative (“SSVEC”). The Cochise County load, from Ft. Huachuca to Douglas, is served via four radial transmission lines (115kV and 230kV). The loss of any one of these lines during summer peak could require dropping of some customers until manual restoration procedures can be performed. Utilities serving Cochise County have historically had a “restoration of service”<sup>39</sup> paradigm in their planning and operating procedures for transmission outages. This has been of concern to Staff since the first BTA over a decade ago. The critical nature of Fort Huachuca’s mission and the accompanying load growth occurring in southern Cochise County (predominantly in Sierra Vista) mitigates for transition to a “continuity of service”<sup>40</sup> planning and operating paradigm for transmission outages.

In the 5th BTA Staff report it was noted that APS, SSVEC and TEP each have an obligation to assure that adequate transmission import capability is available to meet the load requirements of all distribution customers within their service areas.<sup>41</sup> Following the 5th BTA, the Commission determined that perpetuating a “restoration of service” paradigm for single contingency transmission outages in Cochise County is not in the public’s interest. Therefore, the Commission ordered that APS, SSVEC and TEP perform studies in order to develop a transmission plan of service that assure “continuity of service” for single contingency transmission lines in Cochise County within the next five to ten years.<sup>42</sup>

In response to the Commission’s order, the Cochise County Study Group (“CCSG”) of SATS conducted a new technical planning study in 2009. A map of the study area is shown in Exhibit

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<sup>37</sup> Arizona Administrative Code R14-2—1609.B

<sup>38</sup> Appendix C, RMR Conditions and Study Methodology

<sup>39</sup> Defined in Appendix F of the Fifth BTA

<sup>40</sup> Pursuant to Arizona Administrative Code R14-2-208(D) (1), “Each utility shall make reasonable efforts to reestablish service within the shortest possible time when service interruptions occur.”

<sup>41</sup> Arizona Administrative Code R14-2—1609.B

<sup>42</sup> Reference 5th Biennial Transmission Assessment (E-00000D-07-0376) (Section 5.1.3, pages 65-67); and Decision No. 70635 (5.d, page 3)

17g. The report from this study was included in SWTC's 6th BTA filing dated January 2010. The summary report on that study filed by SWTC elaborates the following interpretation of "continuity of service" that has been promulgated by the Commission:

"The CCSG agreed that a definition for continuity of service is that loss of any single transmission facility will not result in loss of load that requires subsequent System Operator intervention, either directly or through Energy Management System (action), to restore service. Specifying without Operator intervention reduces outage time to be within the timeframe that automated schemes typically operate (e.g. seconds to minutes). Implementing existing manual operational procedures could help restore at least partial power to the affected areas but this does not meet the continuity of service principle as defined by the ACC. The CCSG clarification offers significant improvement over historically experienced "restoration of service" by limiting potential interruptions to seconds or minutes versus historical outages lasting hours or days."

The CCSG 2009 study group primarily consisted of transmission planning staff from SSVEC, SWTC, TEP, Western, APS and Fort Huachuca. The study was performed using WECC approved 2013 and 2018 system models and was completed in November 2009. The summary report filed by SWTC states:

After a thorough technical analysis of the different potential transmission and/or generation alternatives proposed for resolving the continuity of service issue in the Cochise County, it became apparent that a combination of two or more initial alternatives would be needed to fully resolve the issue. The recommended transmission plan was tested and found to be technically capable of meeting the NERC Reliability Standards and the WECC System Performance Criteria as well as complying with the ACC Order 70635 to provide for continuity of service in Cochise County in both 2013 (or by a 308MW load level) and 2018 (or by a 348MW load level). The recommended transmission plan is detailed below:

- New Palominas - Hereford 69 kV line
- Proposed 50 MVA, 115/69 kV transformer at Boothill
- Loop Webb - Tombstone 69 kV line through Boothill
- Proposed Fort Huachuca 138 kV - Buffalo Soldier 69 kV tie (needed in 2018)
- Operate the following normally open circuits as normally closed circuits:
  - Charleston - Bella Vista 69 kV line
  - Keating Junction - Hawes 69 kV line
  - Mc Neal - San Pedro 69 kV line
- Install shunt capacitors at the following substations
  - 13.2 MVAR at Webb 69 kV substation

- 8 MVAR at Ramsey 69 kV substation
- 8 MVAR at Hawes 69 kV substation
- 8 MVAR at Pueblo 69 kV substation
- 6 MVAR at Webb 69 kV substation (needed in 2018)

Although capital cost estimates are not provided for this list of projects in the CCSG report, in Staff's opinion based on generic costs this set of capital expansion projects should turn out to be a reasonable level of expenditure to achieve the "continuity of service" paradigm in Cochise County. CCSG states that it intends to develop detailed cost estimates for these projects in 2010 and to open negotiations for the related contractual arrangements including "cost responsibility, wheeling arrangements, EPC (engineering, procurement, and construction), Operations and Maintenance (O&M), Load Serving agreement, etc." so that these can be completed in time to construct the facilities when needed.

#### **4.2.2 Santa Cruz County Import Assessment**

Santa Cruz County, similar to Cochise County, is served by a radial transmission line. UNSE is the load serving entity in Santa Cruz County. The customer service and system impacts and risks associated with the loss of the single transmission line serving Santa Cruz County are well chronicled in prior BTA assessments and siting proceedings of the Gateway 345 kV transmission project.<sup>43</sup> The Gateway Transmission Project was proposed as a solution and a Certificate of Environmental Compatibility was approved by the Commission. A NEPA environmental impact study has been concluded for the project but Federal Records of Decision and a Presidential Permit for the new 345 kV Gateway Transmission Project are still pending with federal agencies.

UNSE analyzed transmission needs in Santa Cruz County in 2009 to develop transmission plans that address the recommendations in the 2008 Biennial Transmission Assessment (BTA) related to continuity of service. A Santa Cruz County Continuity of Service Summary Report and Reference Filing was made... [#TO BE CONFIRMED#]

The UNSE ten year plan includes the Gateway Project and associated 138 kV line from Gateway to Valencia. UNSE received a CEC in 2009 (Case No. 144, Decision No. 71282) to rebuild and convert the existing 115kV line between Western's Nogales switchyard and the UNSE Valencia substation to 138kV. Part of this project includes transferring the point of interconnection of UNSE from Western's Nogales switchyard to a future interconnection in

<sup>43</sup> ACC Docket No. L-00000-01-0111

TEP's Vail Substation. However, this project alone will not achieve the continuity of service objective for Santa Cruz County until the 345 kV Gateway Project is completed. At present, Santa Cruz County remains exposed to service outages for all of its UNSE customers following the loss of the single transmission line serving the county. The most recent reported outage occurred on July 16, 2008 and resulted in 63,455 customer hours of service interruption.<sup>44</sup> The ten year plan also includes a Gateway – Sonoita 138kV line, which will improve local reliability but is still contingent upon permitting and completion of the Gateway Project.

Also note the discussion of Santa Cruz County RMR requirements in section 4.2.5 below.

### **4.2.3 Mohave County Import Assessment**

As directed in the fifth Biennial Transmission Assessment (BTA), UNSE is working with the CRT to address issues in Mohave County. UNSE and Mohave Electric Cooperative ("MEC") are the load serving entities in Mohave County. UNSE still shows the Griffith – North Havasu 230kV line in its ten year plan and has an approved Certificate of Environmental Compatibility (CEC) (Case #88). The N. Havasu – Franconia section is built and operating temporarily at 69 kV, but the Franconia – Griffith section is not needed until 2016 or beyond, according to UNSE's 6th BTA filing. UNSE is considering a request for extension of the CEC to 2016 or beyond, pending further review of the results of the Mohave County RMR study. Other UNSE transmission projects in Mohave County are postponed indefinitely due to the economic downturn.

See section 4.2.5 below for discussion of the Mohave County RMR study.

### **4.2.4 Pinal County Import Assessment**

The load serving entities providing electric service in Pinal County are APS, Electrical District Nos. 2, 3, 4, and 5, and the San Carlos Irrigation District ("SCIP"). These entities, other utilities and stakeholders participated in the Central Arizona Transmission System – High Voltage ("CATS-HV") Study for the area, which was filed in the 6th BTA by SWAT in September 2009. The CATS-HV Study provides a comprehensive analysis of all projects in the ten year plan period for Pinal County, as well as the underlying 69 kV system, by analyzing the planned 2019 system.

The CATS-HV Study of 2019 addressed base case (NERC Category A) and n-1 (NERC Category B) conditions. It did not address other more severe overlapping contingency events,

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<sup>44</sup> Records of Arizona Corporation Commission, Outages Forms, Reported by Rick Molina with UNS Electric on July 17, 2008

as was done in prior CATS-HV studies, because the ten year plan has not changed significantly in the area this BTA. The study performed power flow analysis, but did not address stability analysis. No overloads were identified within Pinal County in the study. Some 69 kV undervoltages were found for loss of the Coolidge – Valley Farms 115 kV line, but can be corrected by routine shunt capacitor additions during the planning cycle.

It should be noted that the study for 2019 assumed SPPR's "Three-Terminal" transmission plan (Pinal Central to ED5, ED5 to Test Track and ED5 to Marana 230kV lines). As previously discussed in section 2, SPPR has now deferred plans for two of these line additions indefinitely. The impact of these project deferrals on the results of the CATS-HV study of 2019 is unknown.

#### **4.2.5 Import Assessments Requiring RMR Studies**

Five of Arizona's seven load pockets contain local generation with potential RMR conditions. An RMR condition exists when the local load served by a utility distribution company ("UDC"), or group of UDCs, exceeds the SIL of the local transmission system. The Commission has adopted a definition of RMR Conditions and Study Methodology to be utilized for RMR study requirements,<sup>45</sup> requires that two representative years be studied for each RMR area in the BTA, and that the RMR studies identify the following four RMR metrics by area:

- RMR hours - The number of hours during which the local load is above the SIL
- RMR energy - The amount of energy served from RMR generation
- RMR peak demand - The maximum RMR amount of capacity that the RMR generators would be required to produce
- RMR costs - The costs of out-of-merit-order<sup>46</sup> dispatch from RMR generation

A summary of the RMR study results filed in the 6th BTA is provided in Table 8.

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<sup>45</sup> Appendix C, RMR Conditions and Study Methodology

<sup>46</sup> Out-of-merit order generation is more expensive than generation in the economic dispatch order

**Table 8 - RMR Study Metrics**

Area	Year	Peak Load (MW)	SIL (MW)	Import (MW) @ Peak	RMR Gen MW @ Peak	RMR Hours Per Yr	Annual RMR GWh	Annual Cost (\$000)
Phoenix	2013	12,129	11,296	11,232	897	45	15	0
	2019	14,621	11,693	12,459	2,162	497	317	0
Tucson	2013	2,592	1,948	2,162	430	697	42	\$624
	2019	2,883	2,442	2,853	30	252	15	\$261
Yuma	2013	446	312	285	161	950	43	0
	2019	562	473	477	85	171	4	0
Mohave County <sup>47</sup>	2013	826	816 <sup>48</sup>	816	10	n/a	n/a	0
	2018	935	889 <sup>49</sup>	895	40	n/a	n/a	0
Santa Cruz County <sup>50</sup>	2010	93.5	51	n/a	24	n/a	n/a	n/a
	2013	100	127	100	0	0	0	0
	2018	117	127	117	0	0	0	0

#### 4.2.6 Phoenix Metropolitan Area RMR Assessment

The interconnected transmission system serving the metropolitan Phoenix area is owned and operated by APS, SRP and WAPA. Approximately 99% of the Phoenix area electric energy requirements during the course of the year are served by imports of remote resources into the area over the transmission system. However, an RMR condition exists for the Phoenix area because the peak load for the area exceeds the SIL of the existing and planned transmission system serving the area.

The Phoenix area 2010-2019 RMR study performed detailed RMR analysis for 2013 and 2019. The study concludes that RMR requirements for the Phoenix metropolitan area are not significant and advancement of transmission projects to increase import capability is presently not cost justified. The required metrics are shown in Table 7. Other key RMR study findings for the Phoenix metropolitan area are as follows:

<sup>47</sup> Mohave County RMR generation values quoted are less than the hydro plant output required at summer peak for water release requirements according to USBR

<sup>48</sup> Assumes Black Mesa 230 kV bus is not connected to Parker Davis System

<sup>49</sup> Assumes Black Mesa 230 kV bus is connected to Parker Davis System via Parker-N.Havasu 230 kV

<sup>50</sup> Area peak load includes a 5% demand margin for voltage security analysis

- 1) Planned Phoenix area transmission and local generation can reliably serve Phoenix area peak load in 2013 and 2019. In addition, the projected local generation reserve margin exceeds the required reserve margin by 2,265 MW in 2013 and 1,000 MW in 2019.<sup>51</sup> This translates into a Loss of Load Probability of much less than one day in ten years.
- 2) Local generation is not expected to be dispatched out of economic dispatch order in 2013 and 2019.
- 3) There are no emission impacts due to RMR generation energy production in 2013 and 2019 because the local units are not dispatched out of economic dispatch order.
- 4) Phoenix area RMR conditions pose no impact to local generation capacity factor and total yearly natural gas consumption by the Phoenix area generators because the local units are already scheduled in economic dispatch order irrespective of the SIL being exceeded.

The Phoenix area RMR study is thorough and well documented. The study comports to the Commission's RMR study methodology and actually performs production cost simulations using industry accepted study tools and publicly available data. No flaws in assumptions or modeling are evident in the report.

#### **4.2.7 Tucson Area RMR Assessment**

The Tucson area is interconnected to the EHV transmission system via three 345 kV substations: Tortolita, South and Vail. These three stations interconnect and supply energy to the local TEP 138 kV system. An RMR condition exists for the Tucson area because the local TEP load exceeds the SIL of the existing and planned local TEP transmission system.

As shown in Table 7, the Tucson area peak load forecast for 2013 and 2019 both exceed the reported SIL for the respective years. Therefore, an RMR condition will exist. TEP filed an amended Tucson area RMR Study report in February 2010 that contains the information necessary for Staff to complete its assessment of RMR needs. Staff has reviewed the amended report and finds the RMR study to be complete and a thorough representation of RMR conditions that exist in the Tucson area.

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<sup>51</sup> The RMR area reserve requirement is based on a Loss of Load Probability (LOLP) criteria of one day in ten years (i.e., some unserved load is permitted 1 day in each 10 years).

In the absence of RMR generation, the Tucson area is subject to voltage collapse and cascading overloads during transmission contingencies. TEP developed an estimate of the capital expenditures necessary to mitigate these reliability issues absent RMR generation. They concluded that \$156.5 - \$197.6 million in upgrades would be required in 2013, and \$1.5 - \$3.4 million would be required in 2019. Given the magnitude of the RMR costs as shown in Table 7 for 2013 and 2019, TEP concludes that the incremental capital expenditures are not justified. Staff concurs with this conclusion.

The Tucson area RMR study is thorough and well documented. The study comports to the Commission's RMR study methodology and the results of production cost simulations. Assumptions and modeling evident in the report are accurate and appropriate for the TEP system.

In addition, the study makes the following conclusions regarding operation of the Tucson area under 2010 peak load conditions, which were studied per Commission order in the 5th BTA.

- The TEP system can survive N-2 contingencies of parallel lines in the Springerville to Vail corridor at 2010 peak load levels.
- The TEP system can survive loss of all transformers at any given EHV substation 2010 peak load levels.

#### **4.2.8 Yuma RMR Conditions and Import Assessment**

The Yuma area is served by an internal APS 69-kV sub transmission network containing the entire APS load in the transmission import limited area. There are external ties to WAPA at Gila Substation and the Imperial Irrigation District ("IID") at Yucca Substation. There is also a 500 kV bulk power interface at North Gila with 500kV lines running east to the Palo Verde Hub and west to Imperial Valley in California.

As part of the ACC Fifth BTA, Per Decision No. 70635, under Section 5.2 Efficacy of Commission Ordered Studies, item IC states: There needs to be a system perspective of the RMR conditions for the entire Yuma County area in the future rather than limiting the RMR analysis solely to the APS 69kV system. This is particularly true given that the SIL and MLSC import limits to the APS system are restricted by the overloads on other transmission providers' systems. This is underscored by the fact that major system changes are being proposed for that area by other interconnected entities such as WAPA, WMIID, IID and parties seeking LGIA interconnections in the area.

For the 2010 RMR study effort, APS formed an open forum under the guidance of the Colorado River Transmission (CRT) sub-regional study group of SWAT and held several meetings to discuss the need to incorporate the plans of all entities in Yuma County. As a result of this stakeholder process WAPA, IID, WMIDD have all agreed that the cut plane for the Yuma RMR study should remain as previously defined.

The APS Yuma area 2008 RMR study concludes that RMR conditions do exist for the Yuma area and that there is some limited amount of RMR costs in 2011. The planned APS transmission improvements in the area are sufficient to mitigate RMR cost that would otherwise be associated with 2016 RMR conditions. APS reported that advancement of planned transmission projects to increase import capability in earlier years is not warranted. The following other key RMR study findings were reported for the APS Yuma area:

- 1) Planned Yuma area transmission and local generation can reliably serve area peak load in 2013 and 2019. In addition, the projected local generation reserve margin exceeds the required reserve margin by 152 MW in 2013 and 228 MW in 2019. This translates into a Loss of Load Probability of much less than one day in ten years.
- 2) The Yuma area load is expected to exceed the available transmission import capability for 950 hours in 2013 and 171 hours in 2019. The import constraint could cause APS Yuma generation to be dispatched out of economic dispatch order for 22 hours in 2013 and zero hours in 2019.
- 3) The estimated annual economic cost of Yuma area generation required to run out of economic dispatch order is negligible 2013 and 2019.
- 4) Removing the transmission constraint would reduce total Yuma area air emissions by a minimal amount for 2013 and 2019.
- 5) Removing the transmission constraint could reduce total yearly natural gas consumption by 0.006 BCF for 2013 and has no impact on 2019.

The APS Yuma area RMR study is thorough and well documented. The study comports to the Commission's RMR study methodology and actually performs production cost simulations using industry accepted study tools and publicly available data. Assumptions and modeling evident in the report are accurate and appropriate for the APS system, and reflect stakeholder concurrence on modeling and cut plane definition as ordered by the Commission in the 5th BTA.

#### **4.2.9 Santa Cruz County RMR Assessment**

UNS Electric, Inc. filed the 2010 RMR study of the Mohave County Study System on March 8, 2010. The existing Santa Cruz UNS Electric system was explicitly modeled within the 2010, 2013 and 2019 Arizona coordinated heavy summer cases prepared by the Southeast Arizona Transmission Study (“SATS”) group. The cases were revised to include detailed representations of TEP’s 138 kV system and UNS Electric’s 115 kV transmission radial line in Santa Cruz County. The 115 kV to 138 kV conversion is detailed in the 2013 and 2019 cases. Actual power factor data, representing UNS Electric’s power factor improvement program, was used to model substation reactive demand in the 2010 study (unity power factor loads were assumed in the 2008 study).

For N-1 contingencies the SIL was calculated to be 51 MW in the 2010 case, prior to upgrade of the Nogales-Valencia line from 115 kV to 138 kV. Since the forecast load exceeds import capability there is an RMR requirement of 24 MW in 2010. The report provides estimates of RMR emissions, but no estimates of RMR operating hours/year, RMR GWh, or RMR costs.

In 2013 and 2019 the SIL increases to 127 MW due to the line conversion to 138 kV and the improved voltage regulation afforded by the stiffer source served directly from TEP’s Extra High Voltage (“EHV”) system via a new 345/138 kV transformer, Vail T3, which is assumed to be in-service by 2013. There is no RMR requirement in 2013 or 2019.

#### **4.2.10 Mohave County RMR Assessment**

UNS Electric, Inc. filed the 2010 RMR study of the Mohave County Study System on March 8, 2010.<sup>52</sup> The study was performed for 2013 and 2018 under the oversight of the Colorado River Transmission (“CRT”) Study Group. The scope of this study required an assessment of the portion of the WAPA Desert Southwest Region (“DSW”) transmission network within Mohave County, Arizona. DSW owns and operates all of the transmission network facilities within the Mohave County Study System.

In the 2008 RMR study, SIL calculations were based on the assumption that certain hydro units were operated in a base load condition. However, in the 2010 study, the SIL was calculated with no generation was on line per ACC RMR study guidelines. Another key difference from the 2008 study is the change in the study interface shown in Exhibit 17h. The 2008 cut plane passed through the Mead to White Hills, Round Valley to Peacock, and Peacock to Liberty

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<sup>52</sup> Filed on behalf of various parties including Western, APS, Mohave Electric Coop, IID, TEP, et al

transmission lines. The CRT agreed that the 2010 cut plane more accurately defines the transmission ties that supply the Study System. Thermal overloads outside of the study area were ignored because they were physically removed from the study area cut plane, and it is assumed the respective load serving entities (“LSE”) will address such limitations in the supply plans for their own service areas.

Power flow simulations show the Study System is reliable and capable of serving all load within the specified cut plane. The SIL analysis indicates that a relatively small amount of generation may be required in the 2013 and 2018 planning horizon. Hydroelectric generation within the study system must be run regardless to meet minimum river flow requirements. No additional generation is needed to assure system reliability.

### **4.3 Ten Year Snapshot**

The CATS EHV workgroup filed a report in September 2009 documenting results of its 2009 Ten Year Snapshot Study which looked at the 2019 system. The study is done every other year, and was previously referred to as the “N-1-1 Study”. The CATS EHV workgroup was included representatives from the following transmission owners: APS, SRP, SWTC, TEP, WAPA and Electrical District 3. The report was compiled by SRP on behalf of the workgroup. It was approved by SWAT in August 2009.

Whereas some of the Arizona transmission owners have filed technical study reports for their respective areas of the system as part of the 6th BTA, the CATS Ten Year Snapshot Study represents the only comprehensive assessment of 2019 Arizona transmission plans (i.e., the end of the ten year plan). Furthermore, unlike prior Ten Year Snapshots that focused on the Central Arizona system, for the first time the Ten Year Snapshot Study done in 2009 includes all transmission and generation projects statewide. This makes the report uniquely valuable for assessing the overall adequacy of Arizona transmission plans in 2019.

The Ten Year Snap Shot Study consists of conducting N-0 and N-1 power flow analyses that determine the adequacy of the Ten Year Plan. In addition, fifteen base case project deferral scenarios (nine APS projects, four SRP projects, one TEP project and the Palo Verde-Devers #2 500kV line) were analyzed under both N-0 and N-1 conditions to assess the impact of such deferrals on system performance. All Arizona transmission system facilities with design voltages of 115kV or greater were monitored for compliance with thermal (loading) and voltage criteria for all contingencies tested. The 2009 Ten Year Snapshot Study reached the following major conclusions:

- 1) The 2019 transmission plan is robust

- 2) There were no overloaded transmission system elements in the 2019 base case (e.g., the plan complies with the NERC TPL-001 reliability standard).
- 3) There were few overloads or voltage issues due to outages (in most cases operating solutions are available to resolve these; in some cases the utilities are still considering mitigation measures)
- 4) Even with delay or cancellation of any individual transmission project in the 2019 plan, loading levels and voltage deviations were acceptable for contingencies.
- 5) Delay of multiple projects in the planned 2019 system could have significant impacts on performance.

Additional staff observations regarding the study are as follows:

- 1) The 2019 base case (model) used for the study was based on the complete list of projects that were planned to be in service at the time of base case development, which took place from January-April 2009. In other words, there may be some differences between the 2009 Snapshot case and the current 2010-2019 plans covered by the maps and exhibits in the 6th BTA. This means that the projects modeled in the 2009 Snapshot Study are a “hybrid” of the 5th BTA and 6th BTA project plans. The impact of this on performance of the 2019 system is unknown, but in SRP’s opinion the model is very close to the 6th BTA plan for 2019.
- 2) The 2009 Snapshot Study assumed a statewide peak demand forecast of 25,340 MW for 2019. This is a 689 MW (2.65%) reduction from the Arizona demand level assumed in the previous 2018 CATS EHV base case, and reflects the impact of the current economic recession. This 2.65% demand reduction is actually much smaller than the demand reduction reported by the Arizona utilities in response to data request(s) during the 6th BTA. Comparing the 2017 forecast from the 5th BTA vs. the 2018 forecast from the 6th BTA shows a drop in demand of 6-7%. This change is a much greater than the 2.65% drop modeled in the 2009 Snapshot Study, which tends to make the Snapshot Study a more “rigorous” test of 2019 system performance. This also helps offset the impact of any projects in the 2009 Snapshot Study model subsequently postponed or deleted in the 6th BTA plans filed in January 2010.
- 3) The 2009 Ten Year Snapshot Study includes a comprehensive set of “steady-state” analysis, but does not include any “dynamic” stability analysis. Both types of analysis are required by NERC reliability standards. At this time it’s unclear if or

what dynamic analysis has been performed by any Arizona utility for the 2019 transmission plan.

#### **4.3.1 Extreme Contingency Study Work**

The Commission directed that parties continue to address and document extreme contingency outage studies for Arizona's major generation hubs and major transmission stations, and identify associated risks and consequences, and possible mitigating infrastructure improvements is necessary. The 6th BTA Extreme Contingency Study was conducted by the SWAT Sub-Regional Transmission Planning Group and was filed by APS on May 27, 2010. The study examined steady-state performance (i.e., power flows and voltages) throughout the Arizona and sub-regional system for selected extreme contingencies in the 2011 and 2016 heavy summer system models which reflected the filed ten year project plans. This analysis generally corresponds to NERC Category C and D events (e.g., NERC Reliability Standards TPL-003 and TPL-004), but did not include an assessment of transient stability performance as specified in the NERC standards.

The EHV common corridor and transformer outages analyzed chosen based upon exposure to forest fires and other extreme common-mode contingency scenarios, included the following multiple facility contingencies:

- Cholla-Saguaro and Coronado-Silver King 500kV lines
- Navajo Westwing 500kV lines
- Four Corners-Cholla-Pinnacle Peak 345kV lines
- Glen Canyon-Flagstaff-Pinnacle Peak 345kV lines
- Loss of all EHV transformer banks at Browning Substation

The details of these study results were provided to the Commission in the report filed by APS, which was provided under a Protective Agreement. Therefore, detailed study results could be made available for presentation to the Commission in closed session, but only a general summary is included in the public BTA report.

In both the 2011 and 2016 extreme contingency analysis, all customer loads can be served (or restored), but some of the contingencies would require generation re-dispatch or a limited amount of local system reconfiguration to alleviate overloads.

## 5. National and Regional Transmission Issues

### 5.1 NERC Mandatory Reliability Standards

On July 26, 2006, the NERC was designated as the nation's ERO for the purpose of establishing and overseeing a system of mandatory and enforceable electric system reliability standards. These mandatory reliability standards apply to users, owners and operators of the bulk power system designated by NERC through its compliance registry procedures.

In the spring of 2007, FERC approved NERC's blueprint for the contractual relationship between NERC and eight regional reliability entities. This agreement includes a Compliance Monitoring and Enforcement Program to be used by NERC and regional entities to monitor, assess and enforce compliance with FERC approved mandatory reliability standards. The WECC was authorized as one of the eight regional entities, and a delegation agreement with the WECC was approved by FERC in June 2007. That same month, FERC approved eight proposed regional Reliability Standards for the WECC,<sup>53</sup> in addition to the 83 mandatory NERC reliability Standards.

Over the last three years, NERC has conducted numerous on-site audits and overseen compliance with its mandatory standards. Compliance and violation statistics are compiled monthly and posted on the NERC website ([www.nerc.com](http://www.nerc.com)). According to NERC, "These statistics provide...information regarding new violations that were identified during the current month, as well as updates to previous violations that are making their way through the compliance process." A review of these statistics shows that as of May 2010,

- Total active violations (i.e. all violations that have not been closed or dismissed) at both NERC and the Regional Entities totaled almost 2300.
- Many of these violations are related to NERC standards on critical infrastructure protection (in particular, Standards CIP-002 through CIP-009).

NERC also identifies the "Top 10 Most Violated Standards" for a rolling 12 month period for NERC as a whole and for each of the 8 regional entities. For WECC, it is interesting to note that:

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<sup>53</sup> <http://www.ferc.gov/EventCalendar/Files/20070608171203-RR07-11-000.pdf>

- All of NERC's top 5 violations are included in WECC's top 6 violations, though not in the same order.
- The top 6 WECC violations include those standards related to:
  - Transmission and Generation Protection Systems (PRC-005)
  - System Restoration Plans (EOP-005)
  - Sabotage Reporting (CIP-001)
  - Normal Operations Planning (TOP-002)
  - Personnel & Training (CIP-004)
  - Systems Security Management (CIP-007)
- None of the Top 10 Most Violated Standards for WECC (or NERC as a whole) is related to Transmission Planning (TPL).

## 5.2 FERC Siting Authority/National Interest Electric Transmission Corridor

As amended by the EAct of 2005, the Federal Power Act ("FPA"), provides for federal "backstop" siting of certain proposed electric transmission facilities that would be located within a National Interest Electric Transmission Corridor ("NIETC") established by the Department of Energy.<sup>54</sup> On October 2, 2007, DOE issued its National Electric Transmission Congestion Report and order formally designating the Mid-Atlantic and Southwest National Corridors.<sup>55</sup> The Southwest NIETC includes seven counties in Southern California and three counties in western Arizona. These NIETC designations became effective October 5, 2007, and will remain in effect until 2019 unless DOE rescinds, renews, or extends them.

On April 26, 2010, DOE released its 2009 *National Electric Transmission Congestion Study*, which reexamines transmission congestion in both the Eastern and Western Interconnections. This report notes both progress made and continuing concerns in and around key load centers. Specifically, with regard to the Southwestern region of WECC, the report finds:

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<sup>54</sup> <http://www.ferc.gov/industries/electric/indus-act/siting.asp>

<sup>55</sup> Federal Register / Vol. 72, No. 193 / Friday, October 5, 2007 / Notices

- “...(T)he Southern California region remains challenged...Although many promising generation and transmission projects are now in the planning or regulatory approval stages...(s)low development of new generation and transmission facilities could compromise near-term grid reliability in Southern California, despite growing demand response and smart grid capabilities. For these reasons, the Department concludes that Southern California remains congested, and that it should retain its status as a Critical Congestion Area.”
- “Based on the progress in addressing congestion issues, the Department no longer identifies the Phoenix-Tucson area as a Congestion Area of Concern.” In supporting this statement, the DOE report specifically cites the Department’s agreement with the ACC’s Fifth Biennial Transmission Assessment that states, “The existing and planned transmission systems serving the Phoenix, Santa Cruz County, Tucson and Yuma areas are adequate and should reliably meet the local energy needs of the respective areas through 2017.”

### 5.3 Regional Transmission Planning – WestConnect

WestConnect is composed of electric utility companies<sup>56</sup> providing transmission services throughout the southwestern United States. Its members work collaboratively to assess stakeholder and market needs and to develop cost-effective enhancements to the western wholesale electricity market. WestConnect is committed to coordinating its work with other regional industry efforts to achieve as much consistency as possible in the Western Interconnection. A WestConnect Steering Committee is charged with the task of overseeing development and implementation of a variety of initiatives for the above stated purpose on behalf of the WestConnect members.<sup>57</sup> A WestConnect Regional Planning Management Committee reports directly to the Steering Committee. Annually, WestConnect prepares a ten year integrated regional transmission plan that is derived from the study efforts of its subregional planning groups.

Charles Reinhold of WestConnect presented an overview of their activities and an update on regional transmission planning processes at the 6<sup>th</sup> BTA Workshop 1 on June 3-4, 2010. A major objective of WestConnect is to address seams issues in appropriate forums through the WECC region. It also has an active work group on large generator interconnection processes.

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<sup>56</sup> The membership of WestConnect is available at: [http://www.westconnect.com/about\\_steeringcomm.php](http://www.westconnect.com/about_steeringcomm.php)

<sup>57</sup> 2007 WestConnect Planning Report, page 3

The process for developing WestConnect's 2010-2019 transmission plan was approved by the Regional Planning Management Committee on April 26, 2010. The plan is expected to reflect about \$15 billion in capital infrastructure expansion. Complete maps of the plan will be available on WestConnect's website. This includes 6,255 miles of "planned" lines above 100 kV of which 1,573 miles are in Arizona. It also includes another 4,145 miles of "conceptual" lines of which 830 miles are in Arizona.

### **5.3.1 SWAT Subregional Planning Group**

WestConnect subregional transmission planning is performed by the Southwest Area Transmission Subregional Planning Group ("SWAT"), the Colorado Coordinated Planning Group ("CCPG") and any other subregional transmission planning ("STP") groups that comprise the WestConnect planning area. The goal of SWAT is to promote subregional planning in the Desert Southwest including Arizona. SWAT is comprised of transmission regulators/governmental entities, transmission users, transmission owners, transmission operators and environmental entities. APS, SRP, SWTC, TEP, Western, Tri-State Transmission and Generation Association, IID, El Paso Electric, Nevada Power, and Public Service Company of New Mexico are both transmission providers and SWAT participants.

SWAT subcommittees and study groups have been performing studies in response to Commission ordered study requirements for the BTA for a number of years. The SWAT regional planning group includes seven main subcommittees which are overseen by the SWAT Oversight Committee. Separate web pages are provided for each of this subcommittees and the SWAT Oversight Committee on the WestConnect website.<sup>58</sup> SWAT subcommittees' meeting notices, notes, presentations and reports are posted on their respective web pages. Most of the following SWAT chair-persons and subcommittees have overseen or performed study work and produced reports that are crucial to this BTA.

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<sup>58</sup> SWAT website: [http://westconnect.com/planning\\_swat.php](http://westconnect.com/planning_swat.php)

**Table 9 - SWAT Subcommittees Contributing to 6th BTA**

Oversight Committee – Robert Kondziolka  
 CRT Subcommittee – Josh Johnston  
 CATS Subcommittee – Joe Herrera\*  
 CATS-EHV Subcommittee – LeeAnn Torkelson & CATS-HV Subcommittee – Joe Herrera\*  
 (Note – CATS EHV & CATS HV have now consolidated as the CATS Subcommittee)  
 SATS Subcommittee – Gary Trent  
 NM Subcommittee – Tom Duane  
 Short Circuit Working Group – Kevin Salsbury  
 Renewable Energy Transmission Task Force – Peter Krzykos  
 Arizona Renewable Resources & Transmission Identification Subcommittee (ARRTIS)\*\* - Amanda  
 Ormond\* and Greg Bernosky  
 Finance Subcommittee\*\* - Tom Wray\*  
 Common Corridor Structure Separation Task Force\*\* – Brian Keel  
 Transmission Corridor Planning Committee – Greg Bernosky  
 Eldorado Valley Area Study Group – Chuck Russell

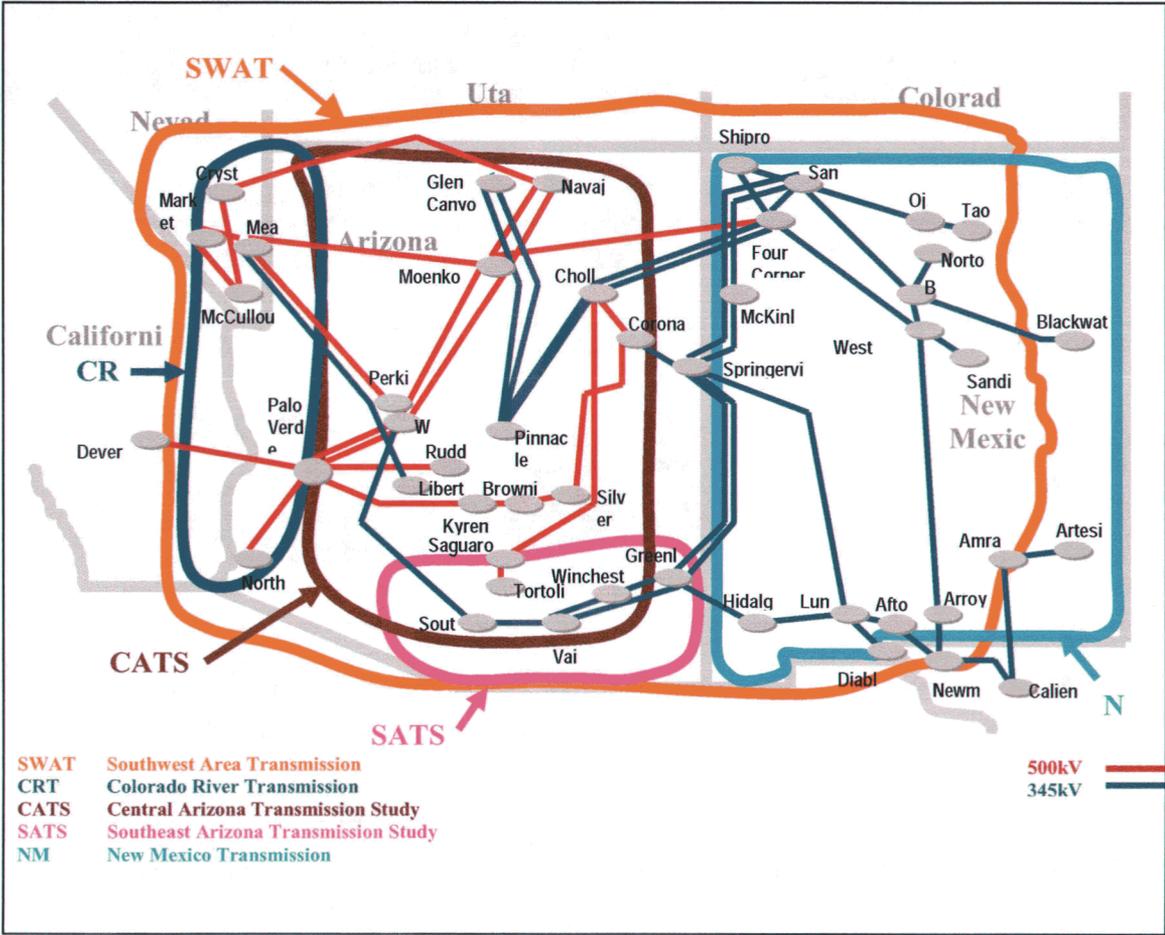
\* Non Transmission Provider

\*\* Task Force Work Completed – No Longer Active

In particular in this BTA, the Commission wishes to acknowledge the efforts of Mr. Robert Kondziolka, SWAT Steering Committee Chair who has announced his resignation of the chairmanship due to a new job assignment at SRP. His leadership in SWAT and many contributions to the BTA process over the years are greatly appreciated by the Commission.

The geographic area(s) covered by SWAT and various subcommittees are shown in Figure 5.

**Figure 5: SWAT Footprint**



The Commission acknowledges the work of the ARRTIS subcommittee as well as the Common Corridor Structure Separation Task Force, which have both been recently disbanded, for their reports in 2009.

**5.3.2 Colorado River Transmission Planning Group**

The Colorado River Transmission subcommittee (“CRT”) was formed to study the area within the geographic region straddling the Colorado River from southern Nevada to Yuma, Arizona. This study group includes the participation of: Arizona Power Authority, WAPA, Nevada Power Company, SCE, IID, California ISO, Los Angeles Department of Water and Power, APS, SRP, SWTC, TEP, CAP, and other interested Stakeholders. The CRT study group has been actively engaged in technical studies of the Harcuvar Project and its interconnection with the Palo Verde to Devers No. 2 500 kV project, as well as the 2010 RMR studies of the Yuma Area and Mohave County.

### 5.3.3 Central Arizona Transmission Study – High Voltage

Prior to merging with CATS-EHV, the CATS HV study area consisted of the high voltage transmission system in Pinal County. The CATS HV 2009 study report focused on generation development scenarios and transmission corridor development in Pinal County using a 2018 power flow base case.

### 5.3.4 Central Arizona Transmission Study – Extra High Voltage

The Central Arizona Transmission Study Extra High Voltage (“CATS EHV”) study group has the most longevity as a coordinated transmission planning forum in Arizona. Arizona transmission providers that participate in the CATS EHV study group are APS, SRP, SWTC, TEP and WAPA. Over the past few years this SWAT study group has shouldered a large portion of the burden of performing the Commission ordered transmission studies for the BTA process.

The following studies were conducted by CATS EHV to establish the adequacy of the ten year plans and were presented at the 6th BTA Workshop I.<sup>59</sup>

- Tenth Year Snap Shot Study (2019) – considers N-0, N-1 contingencies and N-1-1 analysis of the ten year planned projects (e.g., NERC Category A, B and C scenarios).
- 2014 and 2018 RMR for the Metropolitan Phoenix Area filed with the APS Ten Year Plan.
- A Common Corridor and Extreme Contingencies study report were filed by SWAT as a confidential document (NERC Category C and D).

Details of these study results are provided elsewhere in this Staff report.

### 5.3.5 Short Circuit Working Group

The SWAT Short Circuit Working Group (“SCWG”) was formed for the purpose of developing a coordinated short circuit study model of the SWAT subregional area transmission system. This study tool is needed to enable a consolidated and coordinated short circuit model that yields consistent and accurate short circuit results. The tools and model developed by the SCWG are needed by transmission planning groups and by transmission providers performing system impact studies for proposed interconnections. SCWG is currently expanding its model into California as needed for various studies.

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<sup>59</sup> [http://www.azcc.gov/Divisions/Utilities/Electric/Biennial/2008%20BTA/SRP%20ACC\\_BTA\\_Workshop-Directed%20Work.ppt](http://www.azcc.gov/Divisions/Utilities/Electric/Biennial/2008%20BTA/SRP%20ACC_BTA_Workshop-Directed%20Work.ppt)

### 5.3.6 Southeast Arizona Transmission Study

The SWAT Southeast Arizona Transmission Study (“SATS”) Subcommittee was formed to study the Southeastern Arizona region. The SATS study area encompasses the southeastern portion of Pinal County, southern Graham County, most of Pima and all of Cochise Counties and Santa Cruz County. The following transmission providers are participants in the study process:

**Table 10 - SATS Participating Transmission Providers**

Arizona Public Service Company	Southwest Transmission Cooperative
Central Arizona Project	Tucson Electric Power
El Paso Electric Company	Western Area Power Administration
Public Service Company of New Mexico	US Bureau of Reclamation

Numerous local load serving entities and other stakeholders have been participating in the SATS study process. These entities include Fort Huachuca Military Reservation Sulphur Springs Valley Electric Cooperative, Trico Electric Cooperative, and UniSource Electric. Graham County Electric Cooperative is the only local load serving entity in the study area that has not participated.

SATS vision is a 20 year transmission plan covering the SATS study area, which is effected through an agreement between participants to conduct the study as a “single system” (i.e., non-parochial) approach. The 2009 SATS study was filed in the 6th BTA in March 2010 and compliments the Long Range Plan conceived for central Arizona by the original CATS study group. The study also impacts broader regional plans and the SATS 2009 final report is posted on the WestConnect website.

The 2009 SATS Study analyzed southeast Arizona transmission plans for 2010-2014 and 2019 based on NERC Category A-D scenarios. The report concludes that with the planned projects and the additional mitigation measures proposed for each year, the transmission system within the SATS footprint meets the NERC Reliability Standards and WECC System Performance Criteria. However, the report notes that up to ten 115, 138, and 230 kV buses have voltage deviations greater than 5% for a single contingency and up to six 115 and 230 kV buses had voltage deviations greater than 10% for Category C contingencies. The report says this voltage concern will continue to be evaluated, but does not give a timetable for resolving this concern. In addition, the report notes overloads of the SWTC Apache – Butterfield 230kV line occurred in most of the study years and mentions the following mitigation options:

- Upgrade line capacity in 2016<sup>60</sup>
- Implement an interim “re-rating” of the line until actual upgrade, or
- Trip a selected upstream 345kV facility in order to unload this 230kV line

Staff notes that tripping of an additional EHV facility to mitigate this contingency overload could further weaken the interconnected grid, and should only be used as a last resort.

## **5.4 Western Area Power Administration Transmission Infrastructure Program**

Western did not submit a filing in the 6<sup>th</sup> BTA, but gave a presentation on their Transmission Infrastructure Program (“TIP”) at Workshop 1. The program derives from Western’s responsibility to implement Section 402 of the American Recovery and Reinvestment Act, which grants Western borrowing authority of \$3.25 billion for transmission projects that meet certain key project criteria including:

- Have at least one terminus in the area served by Western
- Be in the public interest
- Have a reasonable expectation of repayment of the loan (payments must be made solely from revenues accrued by the project)
- Use a public process to set rates for the facility

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<sup>60</sup> SWTC’s Ten Year Plan filed in January 2010 states they are also considering construction of a new Winchester–Vail 345kV line as an alternative to upgrading the Apache-Butterfield 230kV line

- Independently provides for generation ancillary services

Western is accepting proposals for projects that meet the above criteria, including projects intended to delivery (or facilitate delivery of) renewable resources. Over 200 project proposals have been received to date, including several major proposals that directly impact Arizona such as:

- TransWest Express
- SunZia
- Sonoran-Mohave Renewable Transmission (“SMRT”) Project (see Exhibit 17h)

Western is seeking projects with broad-based participation.

## **5.5 WGA/DOE Western Transmission and Renewable Energy Initiatives**

### **5.5.1 Western Renewable Energy Zone Identification Process**

The Western Governor’s Association (“WGA”) and DOE issued a joint Phase 1 report on renewable energy opportunities in the western region in June 2009.<sup>61</sup> The report indentified Qualified Resource Areas, but not Western Renewable Energy Zones (“WREZ”). The report includes a map of renewable resource concentrations or “Hubs” that may be most cost-effective for integration through development of suitable regional transmission infrastructure. WREZ working groups are currently in the process of identifying Western Renewable Energy Zones based on the information from the Phase 1 report as well as environmental considerations that may limit development of some of the raw renewable resources identified at the Hubs. The report also states that a new modeling tool that has been developed to assist in the Phase 2 process which:

“...will allow load-serving entities, regional planners, renewable energy developers, state and provincial regulators and other interested parties to estimate the relative economic attractiveness of delivering power from specific Western Renewable Energy Zones to existing load centers across the Western

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<sup>61</sup> The report is available at [http://www.westgov.org/index.php?option=com\\_content&view=article&id=55&Itemid=41](http://www.westgov.org/index.php?option=com_content&view=article&id=55&Itemid=41)

Interconnection. The model assists users in identifying robust renewable resource portfolios and the transmission required to deliver the renewable energy. More specifically, the model allows users to examine different renewable resource development scenarios by allowing them to test the relative economic attractiveness of different renewable resource choices under user-customized assumptions.

The model will continue to be refined during Phase 2 of the WREZ initiative. The Phase 1 report is available on the WGA website.

## **5.5.2 Westwide/WGA Transmission Planning Initiatives**

Amanda Ormond of Western Energy Group gave a presentation at the 6<sup>th</sup> BTA Workshop 1 on the status of Westwide transmission planning initiatives. Major funding allocations totaling some \$16 million were announced in 2010 by the DOE for this activity in the west. A portion of these funds are allocated to the WECC for interconnection wide transmission planning processes. The WECC has formed a Scenario Planning Steering Committee (“SPSC”) to develop recommendations and guidance on how these funds should be utilized. DOE allocated \$12 million of the WGA to expand the 2009 WREZ study on resource assessments and transmission planning, including integration of renewable generation. The WGA has formed a state-provincial steering committee to oversee use of the DOE funding allocation and has also assigned representatives to the SPSC.

The WECC SPSC has formulated the following set of goals for its portion of the DOE funding:

- Transmission planning: Develop sound interconnection-wide transmission plans that inform investment decisions and government policy decisions.
- Integration of variable generation: Promote technological and institutional improvements that minimize the cost of integrating variable renewable generation while maintaining system reliability.
- Efficient use of the grid: Evaluate and promote reforms to increase use of the existing transmission system ....to move renewable power.
- Better Integration of utility level resource and transmission plans.

The state-provincial has submitted an initial scenario study request to the WECC TEPPC.

### 5.5.3 NREL/DOE Western Wind and Solar Integration Study

The National Renewable Energy Laboratory (“NREL”) is the nation's primary laboratory for renewable energy and energy efficiency research and development. NREL's mission and strategy are focused on advancing the U.S. Department of Energy's and our nation's energy goals. The laboratory's scientists and researchers support critical market objectives to accelerate research from scientific innovations to market-viable alternative energy solutions.<sup>62</sup>

The focus of the Western Wind and Solar Integration Study (WWSIS), which was funded by the DOE, was to investigate the operational impact of up to 35% energy penetration of wind, photovoltaic (PV), and concentrating solar power (CSP) generation on the power system operated by the WestConnect group of utilities in Arizona, Colorado, Nevada, New Mexico, and Wyoming (excluding the WestConnect member systems in California). The study concludes that:

“...it is operationally feasible for WestConnect to accommodate 30% wind and 5% solar energy penetration, assuming the following changes to current practice could be made over time:

- Substantially increase balancing area cooperation or consolidation, real or virtual;
- Increase the use of sub-hourly scheduling for generation and interchanges;
- Increase utilization of transmission;
- Enable coordinated commitment and economic dispatch of generation over wider regions;
- Incorporate state-of-the-art wind and solar forecasts in unit commitment and grid operations;
- Increase the flexibility of dispatchable generation where appropriate (e.g., reduce minimum generation levels, increase ramp rates, reduce start/stop costs or minimum down time);
- Commit additional operating reserves as appropriate;
- Build transmission as appropriate to accommodate renewable energy expansion;

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<sup>62</sup> NREL Overview at: <http://www.nrel.gov/overview/>

- Target new or existing demand response programs (load participation) to accommodate increased variability and uncertainty;
- Require wind plants to provide down reserves.<sup>63</sup>

APS, TEP, SRP, WAPA and Tri-State G&T had representatives on the technical review committee.

## 5.6 WECC TEPPC Interconnection Wide Grid Planning Efforts

Robert Kondziolka, SRP gave an update on the WECC TEPPC efforts at the 6<sup>th</sup> BTA Workshop 1. He reiterated that TEPPC's analyses and studies focus on studies with Interconnection-wide implications including reliability, cost, and emissions. TEPPC's role does **not** include

- Detailed project-specific studies
- Advocating projects
- Identifying potential "winners" and "losers"
- Siting and cost allocation

One of TEPPC's key roles is to provide governance over the RTEP (Regional Transmission Expansion Project) process, which implements region-wide transmission planning activities pursuant to WECC's \$14.5 million funding grant under DOE-FOA000068. This represents an extraordinary opportunity to expand the capability of planning processes in the West, provides for broader input from a wider range of stakeholders into planning processes, expands WECC's ability to study a broader range of scenarios, and to ascertain the impacts of policy and technology drivers. Mr. Kondziolka emphasized that this does not result in a change in TEPPC governance. Although TEPPC has an expanded range of responsibilities, WECC will not take on any role related to transmission siting or cost allocation issues.

RTEP's desired outcomes are:

- Increased coordination among entities in the Western Interconnection
- Increased awareness of how energy policy decisions impact reliability and cost

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<sup>63</sup> See executive summary of report at: <http://www.osti.gov/bridge>

- Ability to answer key policy questions at State, Provincial and Federal levels
- Additional information for use by decision makers in siting and cost allocation proceedings

A flow chart of the TEPPC scenario planning process is shown in Exhibit 17i.

## 5.7 DOE PEIS for Federal Energy Corridors in Western States

Section 368 of EPAAct 2005 addresses energy right of way corridors on federal lands. Section 368 requires the Departments of Commerce, Defense, Energy and Interior to consult with each other and within 2 years:

1. Designate, under their respective authorities, corridors for energy facilities on Federal land in eleven contiguous Western States
2. Perform any environmental reviews that may be required to complete the designation of such corridors
3. Incorporate the designated corridors into the relevant agency land use and resource management plans or equivalent plans.

In November 2008, the Final West-wide Energy Corridor PEIS<sup>64</sup> was issued. It describes a Proposed Action Alternative that designates “131 Section 368 energy corridors, totaling approximately 6.112 miles in length....(These) corridors would occur in all 11 western states and would be designated for pipeline and transmission line (multimodal) use, with a width of 3,500 feet, unless specified otherwise because of environmental or management constraints or local designations.” According to the PEIS, “The vast majority of the proposed corridors in each state fall on lands managed by BLM...” The numbers and lengths of corridors were designated for states in southwestern WECC:

- In Arizona, 16 corridors totaling 650 miles;
- In New Mexico, 4 corridors totaling 293 miles;
- In Nevada, 34 corridors totaling 1622 miles; and

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<sup>64</sup> US Department of Energy, Programmatic Environmental Impact Statement, *Designation of Energy Corridors on Federal Land in the 11 Western States* (DOE/EIS-0386), November 2008.

- In California, 20 corridors, totaling 823 miles.

Subsequently, in January 2009, Records of Decision were issued by both the Bureau of Land Management (BLM) and the USDA Forest Service (FS). The only modification made by BLM was the exclusion of a segment of corridor 81-272 in the Mimbres planning area in New Mexico. However, BLM did offer numerous clarifications to the Final PEIS, including three in the State of Arizona. These are cited on page 9 of the ROD.

According to the Forest Services ROD, "Designation of the Section 368 energy corridors...requires the FS to amend specific land plans...Only those plans where Section 368 corridors are located are amended by this ROD." The ROD lists the specific forest or grassland land use plans affected for each of the 11 states. In Arizona, these include the Land Management Plans (LMPs) for: Apache-Sitgreaves NF, Coronado NF, Kaibab NF, Prescott NF, and Tonto NF.

## 5.8 FERC 890 Planning Principles

On June 17, 2010, FERC issued a Notice of Proposed Rulemaking (NOPR) addressing changes to its transmission planning and cost allocation policies. This action was taken to remedy a preliminary finding that deficiencies continue to exist in the rules previously established in FERC Order 890. Interested parties have 60 days to respond as of the June 17 issuing date.

FERC's NOPR calls for reforms in three specific areas, including:

- **Participation in Regional Planning Processes.** Each transmission provider must participate in a regional transmission planning process that produces a regional transmission plan. The regional planning process should result in a plan that identifies the facilities that cost-effectively meet the needs of transmission providers, their customers, and other stakeholders.
- **Public Policy Driven Projects.** In addition to evaluating proposed transmission enhancements based on considerations of reliability and overall cost reduction, transmission providers would be required to consider projects proposed to facilitate compliance with public policy requirements established by state or federal laws or regulations, such as renewable portfolio standards.
- **Nonincumbent Transmission Developers' Participation in the Transmission Development Process.** Provisions that establish a Federal right of first refusal for an

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incumbent transmission provider with respect to facilities that are included in a regional transmission plan would be eliminated. Non-incumbent transmission developers should have full opportunity to participate in the regional planning process.

## 6. Conclusions

The quantity and quality of industry reports and Commission ordered BTA study results available for the BTA process have progressively improved over the past ten years. The body of reference documents and presentations available for this BTA are among the best filed with the Commission to date. The industry's commitment and focus on supplying transmission plans and associated information addressing issues and concerns of importance to the Commission is appreciated. A wide range of public policy concerns regarding reliable service to Arizona customers have been addressed during more than a decade that the BTA process has been active.

The conclusions of this BTA are organized to answer five key policy questions:

- Does the combination of the filed ten year transmission plans meet the load serving needs of the state during the 2010-2019 timeframe in a reliable manner?
- Do the study reports filed in response to Commission ordered RMR, N-1, N-1-1 and Extreme Contingency studies comply with, and sufficiently meet, the intended goals of the Commission's orders?
- Do the transmission planning efforts effectively address concerns raised in previous BTAs about the adequacy of the state's transmission system to reliably support the competitive wholesale market in Arizona?
- Do transmission providers' ten year transmission expansion plans, and specifically their renewable transmission project proposals, adequately address the overall needs for renewable resource development and integration into the Arizona and regional electric power system?
- Do the plans and planning activities comport with transmission planning principles and good utility practices accepted by the power industry and the reliability planning standards established by NERC, WECC, and FERC?

### 6.1 Adequacy of System to Reliably Serve Local Load

Out of 129 new transmission projects included in the 5th BTA, total of 59 projects have been delayed by an average of several years in the ten year plans filed for the 6th BTA. In a normal biennial planning cycle, delay of 46% of the transmission projects identified in the prior BTA would be cause for some concern. However, given the current economic slowdown and the resulting shift in statewide demand forecast (see Figure 1), Staff and KEMA conclude that the delay of this many projects is consistent with the demand forecast and does not threaten the adequacy of the system to reliably serve load.

However, on a broader note, Staff and KEMA have some concern that the scope of ten year plan filings may not be adequate for the Commission to fulfill its obligation “to biennially make a determination of the adequacy and reliability of existing and planned transmission facilities in the state of Arizona”<sup>65</sup> due to the absence of information regarding planned transmission reconductor projects and bulk power transformer additions (including replacements) in existing substations. Ten year transmission plans filed in the current (and prior) BTA’s focus on projects that require a CEC (e.g., new transmission lines and substations, transmission reconfigurations (e.g., loop-ins) and upgrade of the design voltage of existing transmission lines (e.g., 115 kV to 138 kV). This represents a subset of the transmission capital investment needed to ensure an adequate and reliable transmission system in the state of Arizona, but ignores a large category of transmission system capital expansion projects. Therefore, Staff and KEMA conclude that the filed plans should be augmented by additional information on planned transmission reconductor projects and substation transformer additions and replacements (capacity upgrades).

Based on the ten year plans, technical studies, criteria and assumptions filed in the 6th BTA and/or obtained through subsequent data requests, Staff and KEMA also reach the following conclusions:

- 1) The SATS report and the SWTC Ten Year Plan have both identified overload issues on the Apache-Butterfield 230kV line beginning in 2012. Although an upgrade of the line is planned for 2016, no clear resolution of this overload is provided for earlier years. Mitigation prior to 2016 is based on tripping of an upstream 345kV EHV facility or possible implementation of an interim “uprate” (e.g., an engineering analysis to rerate the existing facility without any physical upgrading). An “uprate” of the line, if supported by thorough engineering analysis, would be preferable to tripping of EHV facilities as an interim mitigation. Furthermore, the study has identified numerous 230kV and 115kV bus voltage deviations that may be unacceptable, and states that further analysis is needed to address this issue. Staff agrees and views this as a potential deficiency in the 2009 SATS report.
- 2) UNSE’s long-standing effort to permit and construct a second line to Santa Cruz County remains stalled due to i) lack of a National Environmental Protection Act (“NEPA”) Record of Decision (“ROD”) from federal agencies and ii) delay in issuance of a Presidential Permit. UNSE has included an upgrade of the Nogales – Valencia 115 kV line to 138 kV in its current ten year plan, which will clearly help to support

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<sup>65</sup> From paragraph 2 of the Guiding Principles (see Appendix A to this report)

adequacy of supply to Santa Cruz County. However, Santa Cruz County remains exposed to extended outages for all of its UNSE customers following the loss of the radial transmission line serving the county. Additional transmission line improvements outlined in the UNSE Ten Year Plan for Santa Cruz County are contingent upon resolving the pending federal permitting matter.

## 6.2 Efficacy of Commission Ordered Studies

All Commission required studies related to adequacy and reliability have been filed. APS and TEP filed RMR studies; SWAT studies filed by SRP that address N-1-1 contingencies (i.e., the “Ten Year Snapshot Study”) and the Extreme Contingency Study performed by the CATS–EHV study group, the CATS–HV Study of Pinal County; the Southeast Arizona Transmission Study (“SATS” study) performed under SWAT and filed by TEP; and the Cochise County Study Group 2009 technical study performed under SATS and filed by SWTC. The following conclusions apply to the efficacy of the filed documents relative to the intent of the Commission ordered action:

- 1) The Phoenix area, Tucson area and Yuma area RMR studies of 2013 and 2019 were thorough and well documented. These studies comport with the Commission’s RMR study methodology and production cost simulations were performed using industry accepted study tools and publicly available data. No flaws in assumptions or modeling are evident in these three reports. The studies show that each RMR area will have sufficient maximum load serving capability to reliably serve the respective area’s load during the next ten year period. The RMR studies also indicate local RMR generation will not be dispatched out of merit order for significant hours or yield RMR costs sufficient to warrant advancing transmission improvements. The Mohave County 2013 and 2018, and Santa Cruz County 2013 and 2019 RMR studies, were also well documented. They also showed no RMR requirement. Santa Cruz County RMR analysis for 2010 showed an RMR requirement of 24 MW and provides emission metrics, but no estimate of RMR energy, operating hours or costs.
- 2) The Commission’s concern expressed in the 5th BTA in regard to the need for additional stakeholder involvement in the Yuma Area RMR study has been satisfactorily addressed in the RMR study of 2013 and 2019. WAPA, WMIID, IID and other stakeholders participated in the APS RMR study of the Yuma area have concurred with the cut plan definition, study plan and results.
- 3) The Commission’s concern expressed in the 5th BTA about the need for a coordinated RMR cut plan definition and joint study of Mohave County, including

WAPA participation, has been satisfactorily addressed in the RMR study of 2013 and 2018.

- 4) A Ten Year Snap Shot Study (previously referred to as the “N-1-1 Study”) and an Extreme Contingency Study were performed by the CATS – EHV study group. The filed studies were well documented and comport with the study scope previously directed by the Commission.<sup>66</sup> The studies comport with the study effort outlined by Commission Staff. These studies both represent a composite assessment of the Arizona system reflecting all filed projects the ten year plan, and the performance of the overall system under normal, single-contingency and selected more severe contingency scenarios. While this pair of studies alone does not include all of the categories of analysis described in the NERC reliability standards for transmission planning (e.g. TPL-001 through TPL-004), Staff and KEMA conclude that these studies demonstrate the ten year plan is generally robust and should provide adequate and reliable service to Arizona as evidenced by the following observations from these studies:
  - a) No thermal overloads or significant voltage problems occur in the 2019 base case.
  - b) Eleven transmission facilities experience thermal overloads in the N-1 analysis of 2019. The report notes that these will be mitigated through transmission line reconductors or upratings, transformer replacements, and reconfigurations. As previously noted in this report, Staff and KEMA cannot determine solely from the information filed in the ten year plans does if these corrective measures are included in the filed expansion plans. Therefore, it appears that additional data requests will be required for this purpose in the 6th BTA.
  - c) Excessive voltage deviations also noted in about two dozen N-1 scenarios, but the report states these will be addressed through routine measures such as corrections to system modeling, operational measures and selected substation shunt capacitor additions. Staff concludes this approach is reasonable for addressing the voltage violations.
- 5) Two EHV line overloads and five HV line overloads for N-1-1 conditions were unresolved by the Ten Year Snapshot study. Most of these overloads occur for the N-1-1 scenario that modeled deferral of the Raceway – Pinnacle Peak 500 kV line

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<sup>66</sup> The Extreme Contingency Study is filed with the Commission under confidentiality

planned for completion in 2010. Given the advanced stage of construction on this project, Staff concludes that such delay is unlikely.

- 6) The CATS-HV study of the planned 2019 Pinal County system assumed SPPR's "Three-Terminal" transmission plan (Pinal Central to ED5, ED5 to Test Track and ED5 to Marana 230kV lines). As previously discussed in section 2, SPPR has now deferred plans for two of these line additions indefinitely. It is unclear when this deferral decision was made relative to the development of the CATS-HV study base cases and the impact of these project deferrals on the results of the CATS-HV study of 2019 is unknown and cannot be determined from the filed studies.
- 7) Staff concludes the proposed definition of "continuity of service" described in the Cochise County Study Group's (CCSG) 2009 technical study report, as filed by SWAT in January 2010, is appropriate for planning of the supply system to Cochise County and that transmission system plan of expansion identified in the CCSG 2009 report represents a reasonable set of capital expansion projects to achieve the "continuity of service" paradigm in Cochise County.

### **6.3 Adequacy of System to Reliably Support the Wholesale Market**

Studies and information filed in the 6<sup>th</sup> BTA indicate the existing and planned Arizona EHV system is adequate to support a robust wholesale market in the 2010-2019 timeframe. Two key factors that contribute to a robust market are the availability of sufficient generation (above and beyond local and statewide demand) and the availability of sufficient transmission capability for transferring power to meet the needs of the wholesale market both within Arizona and across state borders.

Regarding the first factor, the Ten Year Snapshot study of 2019 shows an excess of 7,600 MW more generation in the state than required to serve Arizona loads, based on a statewide demand forecast of 25,340 MW. This represents an excess of 30% above Arizona's internal supply requirements (ignoring reserve requirements). Even after meeting the state's reserve requirements, much of this excess is available for sale on the wholesale market and for export out of Arizona. In addition, this excess generation augments the local resources of Arizona's utilities in the event of major forced power plan outages or other resource emergencies.

Regarding delivery, the Ten Year Snapshot study looks at N-1-1 conditions and demonstrates that even after removing any one of the major planned EHV transmission projects in the current ten year plan, the 2019 Arizona system will still perform with minimal problems. From this result

it can be inferred that sufficient statewide transmission capacity will exist on a day to day basis to handle both native load requirements and wholesale power transactions without a significant risk of congestion on Arizona's EHV delivery paths.

Exhibit 16b provides another metric of transmission delivery capability across Arizona's borders. As shown in the exhibit, the bi-directional transfer capability between Arizona and Southern Nevada is over 4700 MW and with New Mexico/Four Corners is over 5600 MW. This excludes delivery capability from Arizona to California, which is also on the order of 5000 MW. In aggregate this represents some 15,000 MW of interchange capability - nearly 60% of Arizona's 2019 statewide demand or about 45% of Arizona's planned 2019 generating capacity. In addition, the exhibit shows a bi-directional transfer capability of approximately 7,000 MW between the Palo Verde Hub and Arizona load centers. This represents a significant transmission capacity available for wholesale transactions within the state of Arizona from this extremely important energy trading hub, and also does not include the export capacity available over westbound transmission paths from the Verde Hub to California and Nevada. Although it is not currently included in the Arizona ten year plan, Exhibit 16b shows that if the High Plains Express initiative is completed, it could bolster the transfer capability into and out of the state of Arizona by another 3,500 MW.

## 6.4 Adequacy of Renewable Transmission Action Plan(s)

Staff and KEMA reached the following conclusions in this regard:

1. Developing Arizona's vast renewable resource potential requires a coordinated and multi-faceted strategy involving stakeholders representing utility, government, economic, developer, environmental, and other interests. Decisions by the Commission and the actions taken by the Arizona utilities and regional stakeholders are important steps towards the state's goal of becoming a national and world leader in renewable energy development.
2. The 2009 utility filings in response to the 5th BTA request for the utilities to identify their top three RTPs are generally responsive to Commission request. An inclusive stakeholder process was developed and executed to identify the projects.
3. Most of the transmission corridors identified in the utilities initial RTP proposals to serve potential renewable generation are compatible with projects in the utilities' previous transmission plans. Therefore, the RTPs identified by the utilities are actually advancements of projects already found in previous transmission plans. This represents a small incremental investment for a maximum renewable benefit.

4. Because the selected projects are ones that have been identified in earlier transmission plans they should contribute to reinforcing the transmission for general use beyond the specific needs of renewable generation project. We would expect them to be effective in enabling delivery of renewable resources developed close to either the Phoenix-Tucson regions or the Palo Verde hub. As projects are developed farther from these areas, completely new transmission plans will likely need to be identified and developed.
5. The impact of utility-scale renewable generation should be incorporated into the utilities' transmission plans as part of their normal planning process. The utility 10-Year Plan, BTA, RTP and RTAP reports should keep the Commission informed as the situation evolves.

## **6.5 Suitability of Transmission Planning Processes Utilized**

The state of Arizona is fortunate its transmission providers are engaged in and providing leadership to the SWAT and WestConnect subregional planning processes. These planning forums utilize an open, transparent and collaborative approach to transmission planning. Stakeholder participation has been broad based and inclusive of all parties that desire to engage in the planning process. Arizona's BTA would be impossible without access to an effective subregional transmission planning forum that dependably performs studies in support of the BTA.

While Arizona's transmission providers have effectively addressed a broad range of study requirements in this BTA, implementation of mandatory reliability standards by FERC over the past two years as discussed in section 5.1 raises new issues that bear on the BTA process. In this regard, it is important to recognize that each of the categories of contingencies defined in NERC reliability standards TPL-001 through TPL-004 have been addressed at least to some extent in studies filed in the BTA. On the other hand, it's important to note that the BTA process has not determined if Arizona's ten year plans are in full compliance with the NERC transmission planning standards. In fact, responsibility for determining utility compliance with NERC standards depends upon the NERC/WECC audit process, and not upon an assessment by ACC Staff. Nevertheless, a finding of compliance by NERC/WECC audits for each of the Arizona transmission providers would help to ensure the Commission that the planning studies being performed in Arizona are comprehensive and adequate. Similarly, any findings of non-compliance by NERC/WECC would help the Commission to focus on issues that are relevant to ensuring reliability of the Arizona transmission system. With such goals in mind, Staff has issued the following data request questions to APS, TEP and SWTC during the 6th BTA:

- Has a NERC/WECC reliability standards audit been conducted that assessed your utility's compliance with the NERC Transmission Planning Standards (i.e., TPL-001 through TPL-004)? If so, advise when the most recent set of audit findings were issued and provide a summary of such findings as regards TPL-001 through TPL-004.
- If your most recent NERC/WECC audit reached a finding of non-compliance with any part(s) of TPL-001 through TPL-004, have such findings been accepted by the utility? If the findings have been accepted, describe your mitigation plan(s) to correct such non-compliance, as well as the status and timetable for completing such mitigation. If the finding(s) are in dispute, describe the nature and status of the dispute.

*[#NOTE - Discussion of these questions is expected to take place at BTA Workshop #2 on August 4, 2010 and may serve as the basis for further Staff/KEMA conclusions and recommendations in this regard.]*

Staff/KEMA also makes the following observations and conclusions as regards the suitability of study processes and technical reports in the 6th BTA:

- 1) SATS is the first SWAT Subcommittee to study and coordinate local HV and EHV transmission system plans in a common forum. This approach to subregional planning has produced useful study results in the 6th BTA and may be well suited for other local areas in Arizona.
- 2) Although technical studies filed in the 6th BTA indicate a generally robust study process for assessing Arizona transmission system performance, Staff can't determine on the basis of the filed studies if Arizona utilities are fully complying with NERC transmission planning standards. Table 9 shows the categories of studies filed by the utilities in the 6<sup>th</sup> BTA vs. those required under NERC planning standards TPL-001 through TPL-004 (e.g., Contingency Categories A-D).

**Table 10 - NERC Contingency Categories Covered by Studies Filed in 6th BTA**

Study	Category A	Category B	Category C	Category D
SWAT Ten Year Snapshot Study	X	X	X	
SWAT Extreme Contingency Study			X	X
SATS Study	X	X	X	X
APS Internal Study	X	X		
SRP Internal Study				
TEP Internal Study	X	X		
UNSE Internal Study	X	X		
SWTC Internal Study	X	X		

*Note – ACC Staff has not determined if these studies achieve full compliance with the applicable NERC TPL's*

It could be inferred from Table 9 that SWAT studies fulfill NERC's Category C and D study requirements on behalf of the individual utilities, however, this remains to be confirmed. The Commission has issued a data request to jurisdictional utilities in Arizona in an attempt to ascertain their current compliance status with NERC planning standards. Responses are pending. *[#TOPIC FOR DISCUSSION AT WORKSHOP#2]*

- 3) The 6th BTA filings only documented a limited amount of study work assessing dynamic stability performance<sup>67</sup>. Staff assumes that dynamic stability analysis performed by Arizona utilities is being reviewed for compliance with relevant standard requirements during their respective NERC/WECC audits. In the 6<sup>th</sup> BTA, APS and SWTC are the only utilities that filed internal stability analysis. APS filed such studies for 2013 and 2018 in January 2010, and SWTC filed such studies for 2013 in January 2009. The SWTC filing showed poor “damping” of oscillations on Apache GT Unit 1 for various contingencies, which SWTC speculated was due to erroneous modeling data from the GT manufacturer. However, Staff is not aware of any subsequent confirmation from SWTC in regard to this suspected modeling error.

<sup>67</sup> For the purpose of this report, Staff uses the terms “dynamic stability” and “transient stability” interchangeably in reference to time domain studies that model fault events or other disturbances.

## 7. Recommendations

Based upon the observations and questions discussed in the conclusions, Staff submits the following recommendations for Commission consideration and action:

- 1) Staff recommends that the Commission continue to support the use of the:
  - a) “Guiding Principles for ACC Staff Determination of Electric System Adequacy and Reliability,” and direct transmission providers to include planned transmission line reconductor projects and bulk power transformer replacements (i.e., capacity upgrades) in filings for future ten year plans in order to foster a more comprehensive assessment process.
  - b) NERC reliability standards, WECC criteria and FERC orders and enforcement policies regarding transmission system reliability and planning standards.
  - c) Collaborative study processes in Arizona and throughout the western region that are consistent with FERC Order 890.
- 2) Staff recommends that Commission continue to support the policy that generation interconnections should be granted a Certificate of Environmental Compatibility by the Commission only when they meet regional and national reliability standards and the requirements of Commission decisions.
- 3) Staff recommends that the Commission order TEP, UNSE and SWTC to file additional study results by January 2011 that demonstrate the ten year plans filed in the 6th BTA comply with dynamic stability performance requirements of the NERC Transmission Planning standards and WECC transient voltage criteria.
- 4) Staff recommends that the Commission order the utilities to report relevant findings from NERC/WECC reliability standards audits that occur prior to future BTA filing dates (i.e., the latest applicable audit); specifically findings regarding compliance with NERC Transmission Planning standards as well as a description of any mitigation plans the utility has implemented in order to correct findings of non-compliance (if any) with such planning standards.
- 5) Staff recommends that the Commission order SWTC to determine if an engineering “re-rating” of the Apache-Butterfield 230kV line as proposed in the 6th BTA filings would be an acceptable measure until the line is upgraded in 2016, and to file the results of this assessment by January 2011.

- 6) Staff recommends that the Commission order TEP to conduct the additional analysis of potential 230kV and 138kV low voltages in Southeastern Arizona as noted in the 2009 SATS study report and to identify a mitigation plan for this voltage concern in its ten year plan filing(s) for the 7th BTA in 2012.
- 7) Staff recommends that the Commission accept the definition of “continuity of service” following a transmission line outage as proposed in the Cochise County Study Group’s (CCSG) 2009 technical study report filed by SWAT in January 2010, and that the Commission accept the recommended transmission plan of service presented in the report in order to achieve this “continuity of service” objective in Cochise County.
  - a) Staff further recommends that the Commission establish a target date of December 31, 2011 for the regulated electric utilities in Cochise County to conclude negotiations with various parties over capital cost allocation and operational procedures that are described as a pending action item in the CCSG 2009 report.
- 8) Staff recommends that the Commission order Unisource Electric (“UNSE”) and Mohave Electric Cooperative (“MEC”) to file a Mohave County RMR study report by January 2011 that includes the impacts, influences, and system performance of all proposed local HV and EHV transmission improvements and potential generation interconnections occurring in the area.
- 9) Staff recommends that Commission regulated utilities be required to continue to perform RMR studies in accordance with the methodology set forth in Appendix C to this Sixth BTA, and shall file such studies with ten year plans for inclusion in future BTA reports.

## **Sixth Biennial Transmission Assessment for 2010-2019**

### ***Exhibits [#Partial set – to be expanded#]***

#### ***Table of Exhibits***

- Exhibit 6 – Arizona Planned Project Lookup Table
- Exhibit 7 – Arizona Demand Forecast Data (5<sup>th</sup> BTA vs. 6<sup>th</sup> BTA)
- Exhibit 13 – ED5-PV Project
- Exhibit 14 – Bowie Power Project
- Exhibit 15 – SunZia Southwest Transmission Project
- Exhibit 16a – High Plains Express (HPX) Map
- Exhibit 16b – HPX Transfer Path Diagram
- Exhibit 17a – Sonoran Solar Energy Project
- Exhibit 17b – Abengoa Solar Project
- Exhibit 17c – Mesquite Solar Project
- Exhibit 17d – Starwood Solar I Project
- Exhibit 17e – Southline Transmission Project
- Exhibit 17f – Eldorado Valley Study Group
- Exhibit 17g – Cochise County Transmission Plan
- Exhibit 17h – SMRT Project and Study Area
- Exhibit 18 – Plan Changes Between Fifth and Sixth BTA
- Exhibit 19 – Generation Interconnection Queue(s)
- Exhibit 20 – Listing of Projects by In-Service Date
- Exhibit 21 – Listing of Projects by Voltage Class



Exhibit 6 - Arizona Planned Project Lookup Table

Reference #	Description	Participants	Mileage	Permitting/Siting Status
2008-102A	Tortolita-North Loop-Rancho Vistoso and Tortolita-Rancho Vistoso corridor expansion and reconfiguration Project - Phase 1 <sub>yr</sub>	TEP	14.30	CEC APPROVAL Case # 149 Project is in-service
2008-106	Apache/Hayden-San Manuel 115 kV line	SWTC	4.50	CEC Approved - Case #142; Deferred from 2010 to 2014
2008-134		TEP	1.00	CEC Approved - Case #124 Project is in-service
2008-66	Griffith-North Havasu 230 kV line	UNISOURCE	40.00	CEC Approved/Extended - Case #88 Deferred to 2016, CEC Extension request not yet filled
2008-67	Golden Valley 230 kV Project - McConico-Mercator Mill 230 kV line	UNISOURCE	20.00	CEC Not Yet Filed Customer has delayed project In-service date is delayed until customer specifies need date
2008-74		TEP	0.95	CEC Approved - Case #62 Project is in-service
2008-87		TEP	0.00	CEC Not Required Project is in-service
2008-9	Hassayampa-Pinal West 500 kV #1 line	SRP, TEP, SWTC, ED2, ED3, ED4	51.00	CEC Approved - Case #124
2009-102B	Tortolita-North Loop-Rancho Vistoso and Tortolita-Rancho Vistoso corridor expansion and reconfiguration Project - Phase 2 Corridor Expansion	TEP	11.10	CEC Approved - Case #149 Project in-service delayed to Q4 2010
2009-107	Western 115 kV line loop-in to Pantano	SWTC	0.20	Project cancelled
2009-108	Saguaro-Naviska 115 kV line	SWTC	3.20	Project renamed to Saguaro to North Loop; CEC approved - Case #149; Deferred from 2009 to 2010

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Deleted: Interconnection of Westwing-South 345kV with future Hassayampa-Pinal West 500 kV

Deleted: Loop existing West Ina - Tucson 138 kV line  
Deleted: Northeast 138 kV Static Var Compensator (SVC)  
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2009-109	Valencia-CAP Black Mountain 115 KV line	SWTC	2.60	CEC Approved - Case #152; Deferred from 2009 to 2010.	Deleted: Not Yet Filed
2009-110	CAP 115 KV line loop-in to SWTC Sandarrio	SWTC	0.60	CEC Approved - Case #152; Deferred from 2009 to 2010.	Deleted: Not Required
2010-102C		TEP	18.00	CEC Approved Case #149 This is now a 2 phase project.	Deleted: 2009-2
2010-111	Marana-Avra Valley 115 KV Line Upgrade	SWTC	8.75	CEC Not Yet Filed, Deferred from 2010 to 2011	Deleted: Tortolita-North Loop- Rancho Vistoso Project - Phase 3 - Corridor Expansion
2010-112	Naviska-Thornydale 115 KV line	SWTC	7.00	Project replaced by Saguaro to North Loop Project; CEC Approved - Case #149; Deferred from 2009 to 2010.	Deleted: Not Yet Filed
2010-113	Thornydale-Rattlesnake 115 KV line	SWTC	19.00	Project replaced by North Loop to Rattlesnake Project; CEC Approved - Case #152; Deferred from 2009 to 2010.	Deleted:
2010(2012) - 17	345/69 KV Interconnection at Western's Flagstaff 345 KV bus	APS	0.95	CEC Not Required	Deleted: CEC Not Yet Filed
2010-28	White Hills substation	UNISOURCE	0.00	CEC Not Required	
2010-29	Bowie Power Project	BOWIE	15.00	CEC Approved - Decision #64626	Deleted: Palo Verde Hub
2010(2014)-3	Delamoy-Sun Valley 500 KV line	APS, SRP, CAWCD	28.00	CEC Approved - Decision #68063	Deleted: 45
2010(2014)- 31	Sun Valley-Trilby Wash - 230 KV line	APS	15.00	CEC Approved - Decision #67828	Deleted: TS1
2010(2015)- 32	Palm Valley-TS2-Trilby Wash, 230 KV line	APS	12.00	CEC Approved - Decisions #66646 and #67828	Deleted: TS1
2010-33	Morgan-Raceway-Avery-Scatter Wash-Pinnacle Peak 230 KV line	APS	27.00	CEC Approved - Decision #69343	Deleted: TS9
2010-4	Morgan-Pinnacle Peak 500 KV line	APS, SRP	26.00	CEC Approved - Decision #69343	Deleted: TS6
2010-77	Rancho Vistoso-(Future) Sun City, 138 KV line	TEP	3.50	CEC Not Required - Catalina renamed to Sun City and deferred indefinitely	Deleted: TS9
2010-80A	Vail-Cienega-Spanish Trail Project - Phase 1 - Vail- Cienega 138 KV line	TEP	12.20	CEC Approved - Case #137 Cienega extension is in-service.	Deleted: Catalina

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Rancho Vistoso Project - Phase 3 -  
Corridor Expansion

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2010-85	Tortolita Rancho Vistoso 138 kV tap for future Naranja substation	TEP	24.50	CEC Not Yet Filed Deferred from 2010 to 2015	Deleted: North Loop- Deleted: d
2010-86	DeMoss Petrie-Tucson 138 kV line	TEP	4.50	CEC Not Yet Filed Deferred from 2010 to 2011	
2011	Dinosaur - Abel - Randolph 230kV line	SRP		CEC Approved - Case # 126	
2014	Pinal West-Pinal Central - Randolph - Abel-Browning 500 kV line	SRP, TEP, SWTC,ED2,ED3, ED4	50.00	CEC Approved - Case # 126 Decisions #68093 and #69291	Deleted: SRP, TEP, SWTC,ED2,ED3, ED4
2011-114	Avra Valley-Sandario Tap 115 kV Line Upgrade	SWTC	2.80	CEC Not Yet Filed	Deleted: 2011-11
2011-115	Sandario Tap-Three Points 115 kV Line Upgrade	SWTC	13.71	CEC Not Yet Filed Deferred from 2011 to 2014	Deleted: Pinal West-Southeast Valley-Browning 500 kV line
2011-12	Devers - Palo Verde 500 kV #2 line	SCE	230.00	CEC Denied - Case #130	Deleted: 50.00
2011-14	Pinal Central-Tortolita 500 kV line	TEP, SWTC, SRP, SunZia	30.00	CEC Not Yet Filed Deferred from 2011 to 2014	Deleted: CEC Approved - Case #126
2011(2013) - 18	Mazatzal Loop-in of Cholla-Pinnacle Peak 345 kV line	APS	0.95	CEC Not Required	
2011(2013)- 34	TS12 Loop-in of Saguaro-Casa Grande 230 kV line	APS	0.95	Not Required	Deleted: SE10
2014-35	Desert Basin-Pinal Central 230 kV	APS, SRP	21.00	CEC Approved - Decisions #68093, #68291, #69183 and #69647	Deleted: 2011-35 (2014)
2011(2014) - 36	Sundance-Pinal Central, 230 kV line	APS, ED2	6.00	CEC Filed - Case #136	Deleted: Desert Basin-Pinal Central
2011-46	Pinal South-Southeast Valley/RS22	SRP	30.00	CEC Approved - Decisions #68093 and #69291	Deleted: South
2011-82	North-East-Snyder 138 kV Tap for Craycroft-Barril substations	TEP	8.00	CEC Not Required Deferred from 2011 to 2013	Deleted: 230 kV
2012-116	Marana Tap-Marana 115 kV Line Upgrade	SWTC	0.20	CEC Not Required In-service date changed from 2012 to 2011	Deleted: South
2012(2013)- 13	Moenkopi-Eldorado 500 kV Series Capacitor Upgrade Project	SCE, APS	0.00	CEC Not Required	Deleted: 08
2012(2014)- 37	North Gila-TS8 230 kV line	APS	15.00	To be Filed in 2010	Deleted: 2012-47
2017-47	Abel - RS24-Moody (RS17) #1230 kV line (formerly	SRP	20	CEC Approved - Decision #71441	Deleted: SRP
					Deleted: TBD
					Deleted: CEC Not Yet Filed

	RS17-RS24)		SRP						
2018-48	Abel - RS24 - Moody (RS17) #2 230kV line (formerly RS24-RS22/SEV)		SRP	2Q	CEC Approved - Decision #71441				Deleted: RS17-RS24 230 KV line
2012(2016)-5	Sun Valley-Morgan, 500 KV line		APS, SRP, CAWCD	TBD	CEC Approved - Decision #70850				Deleted: 2012-48
2012(2014)-6	Palo Verde Hub-North Gila 500 KV #2 line		APS, SRP, IID, WMIDD	110.00	CEC Approved - Decision #70127				Deleted: SRP
	Irvington-Kino-UA Med-Tucson 138 KV line				CEC Not Yet Filed				Deleted: TBD
2012-83			TEP	10.90	Line and Kino Substation scheduled for 2015.				Deleted: CEC Not Yet Filed
					UA Med Substation scheduled for 2019				Deleted: CEC Not Yet Filed
2012-97			TEP	1.00	Removed from TEP's Ten Year Transmission Plan				Deleted: TS9
2013-100	Upgrade existing 115 KV transmission line to Nogales		UNISOURCE	60.00	CEC Approved - Case #111				Deleted: Tap for future Kino substation
2013-117	CS1-Three Points 115 KV line		SWTC	0.50	2012 Completion date.				Deleted: Tucson-Downtown 138 KV line
2013-129	SunZia Project		SWPG, SRP, TEP, ECP, Shell, TSGT	500.00	Project cancelled.				Deleted: CEC Not Yet Filed
2013(TBD)-38	Jojoba Loop-in of TS4-Panda 230 KV line		APS	0.95	CEC Approved - Decision #62960				Deleted: Not Yet Filed
2013-63	Future CS1-Bicknell 230 KV line		SWTC	21.00	Project cancelled.				Deleted: CEC Not Yet Filed
2013-75			TEP	20.00	Combined with project 2019-89.				Deleted: CEC Not Yet Filed
2013-76B	South-Duval CLEAR - Phase 2b - Extend 138 KV line from Canoa Ranch-(Future) Duval		TEP	24.00	CEC Approved - Case #84				Deleted: Extend Midvale-(Future) Spencer-(Future) San Joaquin 138 KV line
2013-78			TEP	5.00	Moved forward from 2013 to 2012				Deleted: EC Not Yet Filed
2013-84A	Tortolita-Marana-North Loop Project - Phase 1 - Tortolita-Marana 138 KV line		TEP	22.00	Removed from TEP's Ten year Transmission Plan.				Deleted: Irvington-Vail 138 KV #2 line
2013-90A	Irvington-Corona-South 138 KV line		TEP	16.10	CEC Not Yet Filed				Deleted: CEC Not Yet Filed
2013-93	La Canada-Orange Grove-Rillito 138 KV line		TEP	5.40	Deferred from 2013 to 2015				Deleted: Irvington-South Project - Phase 1 -
2013-95	South-Hartt-Green Valley 138 KV line		TEP	14.50	CEC Not Yet Filed				
					Deferred from 2013 to 2016				
					CEC Not Yet Filed				
					Deferred from 2013 to 2014				
					CEC Not Required				

2014-101	Gateway-Sonoita 138 KV line	UNISOURCE	10.00	Deferred from 2013 to 2015 CEC Not Yet Filed	Deleted: Yet Filed
2014-120A	Tortolita North Loop 345 KV line	TEP	60.00	CEC Not Yet Filed Deferred, new in-service date TBD	Deleted: -Vai Deleted: I Deleted: Project - Phase 1 - Tortolita-North Loop
2016-90B		TEP	13.10	Phases 2 and 3 of this project removed from TEP's Ten Year Transmission Plan	Deleted: Irvington-South Project - Phase 2 - Corona-SS N026-South 138 KV line
2016-96		TEP	7.10	Removed from TEP's Ten Year Transmission Plan	Deleted: CEC Not Yet Filed
2017-94	Orange Grove-East Ina 138 KV line	TEP	3.60	CEC Not Yet Filed	Deleted: Hart-SS N029 138 KV line Deleted: CEC Not Yet Filed
2018-90C		TEP	16.10	Phase 2 and 3 of this project removed from TEP's Ten Year Transmission Plan	Deleted: SS N06
2019-89	Midvale-Spencer-Medina-Raytheon-South 138 KV line	TEP	13.00	CEC Not Yet Filed Spencer extension deferred from 2013 to 2015 Loop-in for SS NO 22 (renamed Medina) moved forward from 2019 to 2018 Added loop-in for Raytheon Substation scheduled for 2019	Deleted: Irvington-South Project - Phase 3 - Corona-Swan Southlands and Swan Southlands-SS NO 26 138 KV lines Deleted: CEC Not Yet Filed
2020	Pinal Central – Abel #2 500KV line	SRP	TBD	CEC Not Yet Filed	Deleted: SS N022 Deleted: Vail-SS N027-Cienega-SS N022-Spanish Trail Project - Phase 2 - Vail-SS N027 138 KV line
2020-80B		TEP	5.30	Phase 2 of this project has been removed from TEP's Ten Year Transmission Plan	Deleted: CEC Not Yet Filed
2020-99		TEP	10.00	Removed from TEP's Ten Year Transmission Plan	Deleted: CEC Not Yet Filed
2023-80C		TEP	14.00	Phase 3 of this project has been removed from TEP's Ten Year Transmission Plan	Deleted: Vail-SS N027-Cienega-SS NO
2023-84B		TEP	13.50	Phase 2 of this project has been removed from TEP's Ten Year Transmission Plan	Deleted: o Deleted: 22-Spanish Trail Proj... [3] Deleted: Tortolita-Marana-Nor... [4] Deleted: CEC Not Yet Filed

							Transmission Plan
2026-98			TEP			13.50	Removed from TEP's Ten Year Transmission Plan
2030-88			TEP			15.80	Removed from TEP's Ten Year Transmission Plan
TBD	Abel – RS20 500KV		SRP			TBD	CEC Not Yet Filed
TBD	RS20 – Coronado 500KV		SRP			TBD	CEC Not Yet Filed
TBD-10	Hassayampa - Pinal West 500 kV #2 line		SRP, TEP, SWTC, ED2, ED3, ED4			51.00	CEC Approved – Case #124
2014-103	RS26-Fountain Hill substation		SRP			TBD	CEC Not Yet Filed
TBD-104	Nogales Transmission line #2 (Gateway – Valencia)		UNISOURCE			3.00	CEC Approved - Case # 111
TBD-105	New Hayden 115 kV Station Loop-in,		SRP			0.75	CEC Not Yet Filed
TBD-130	Gila Bend Power Plant		GBPP			0.00	CEC Approved – Case#109 – Extension Expires 4/2011
TBD-131	Hassayampa-Jojoba 500 kV line		GBPP			19.00	CEC Approved – Case#119 – Extension Request Pending
TBD-132	Test Track-Empire-ED4 230 kV line		WAPA, SCWPDA			20.00	CEC Not Required
TBD-133	Wellton-Mohawk 230 kV Line Project		WMIDD			35.00	CEC Not Yet Filed
TBD-15	Tortolita-Winchester 500 kV line		TEP			80.00	CEC Approved - Case #23
TBD-16	Gateway 345/115 kV or 345/138 kV substations		UNISOURCE			0.00	CEC Approved - Case #111
TBD-19	Greenlee switching station through Hidalgo to Luna		ELPE, PNM, TXNMPC			28.00	CEC Approved – Case #21
TBD-21	Winchester-Vail 345 kV line, #2 and #3		TEP			40.00	CEC Not Yet Filed
TBD-22	Vail-South 345 kV line - 2nd circuit		TEP			14.00	CEC Not Required
TBD-2-20B							Phase 2 of this project has been removed from TEP's Ten Year Transmission Plan
TBD-23	Springerville-Greenlee 345 kV line - 2nd circuit		TEP			0.00	CEC Not Yet Filed
TBD-24	Tortolita-South 345 kV line		TEP			110.00	CEC Approved - Case #50
TBD-25	Westwing-South 345 kV line - 2nd circuit		TEP			68.00	CEC Approved - Case #15
						178.00	CEC Approved - Case #15

**Deleted:** DeMoss Petrie-SS N014-Northeast 138 kV line  
**Deleted:** CEC Not Yet Filed  
**Deleted:** North Loop-SS N04-Demoss Petrie 138 kV line  
**Deleted:** CEC Not Yet Filed

**Deleted:** TBD-103

**Deleted:** Point on Kearny-Hayden 115 kV line to Future Hayden

**Deleted:** - 2nd circuit

**Deleted:** Tortolita-Vail 345 kV Project - Phase 2 - North Loop-East Loop line

**Deleted:** CEC Not Yet Filed

TBD-26	Interconnection line -South-future Gateway 345 KV line	TEP, UNISOURCE	60.00	CEC Approved - Case #111
TBD-27	Future Gateway-Comision Federale de Electricidad 345 KV line	TEP	2.00	CEC Approved - Case #111
TBD-31-B	Sun Valley-Trilby Wash, 230 KV line # 2	APS	15.00	CEC Approved - Decision #68063
TBD-3-20C		TEP	0.00	Phase 3 of this project has been removed from TEP's Ten Year Transmission Plan.
TBD-32-B	Palm Valley-TS2-TS1 230 KV line # 2	APS	12.00	CEC Approved - Decision #67828
TBD-39	Sun Valley-TS11-Buckeye 230 KV line	APS	TBD	CEC Not Yet Filed
TBD-40	Sun Valley-TS10-TS11 230 KV line	APS	TBD	CEC Not Yet Filed
TBD-41	Sun Valley-Morgan, 230 KV line	APS	TBD	CEC Approved - Decision #70850
TBD-43	Yucca-TS8 230 KV line	APS	TBD	CEC Not Yet Filed
TBD-44	Westwing-EI Sol 230 KV line	APS	11.00	CEC Approved - Docket#U-1345
TBD-45	Westwing-Raceway 230 KV line	APS	7.00	CEC Approved - Decision#64473
TBD-49	RS17 230 KV Loop-in line	SRP	0.95	CEC Approved - Decisions #59791 and #60099
TBD-50	Dinosaur-RS21 230 KV line	SRP	TBD	CEC Not Yet Filed
TBD-51	Rogers-Browning 230 KV line	SRP	9.00	CEC Not Yet Filed
TBD-52	Silver King-Browning 230 KV line	SRP	38.00	CEC Approved - Case #20
TBD-53	Silver King-Browning/Superior 230 KV tie	SRP	0.50	CEC Not Yet Filed
TBD-55	Pinnacle Peak-Brandow 230 KV line	SRP	TBD	CEC Approved - Case #69
TBD-56	Rogers-Corbell 230 KV line	SRP	12.00	CEC Not Required
TBD-57	Silver King-Knoil-Future Hayden 230 KV line	SRP	35.00	CEC Not Yet Filed
TBD	Thunderstone-Santan 230 KV line #2	SRP	13.00	CEC Not Yet Filed, if Needed
TBD-58	Santa Rosa-ED5 230 KV line	SCWPDA, SPPR	38.00	CEC Not Yet Filed
TBD-59	ED5-Pinal South (Pinal Central) 230 KV line	SCWPDA, SPPR	18.00	CEC Not Yet Filed
TBD-60	ED5-Marana 230 KV line	SCWPDA, SPPR	28.00	CEC Not Yet Filed
TBD-61	Pinal Central (Pinal South) - Future substation 6 miles northeast 230 KV line #1	SCWPDA, SPPR	6.00	CEC Not Yet Filed

- Deleted: TS1
- Deleted: -
- Deleted: Tortolita-Vail 345 KV Project
- Deleted: -
- Deleted: - Phase 3
- Deleted: -
- Deleted: - East Loop-Vail line
- Deleted: CEC Not Yet Filed
- Deleted: To be filed in 2008
- Deleted: TS9
- Deleted: TBD-42
- Deleted: -
- Deleted: TBD-54
- Deleted: Westwing-Pinnacle Peak 230 KV line
- Deleted: APS, SRP
- Deleted: 22.00
- Deleted: CEC Approved - Decision #64473
- Deleted: -
- Deleted: -

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Deleted: CEC Not Yet Filed

TBD-62	Pinal Central (Pinal South) - Future substation 6 miles northeast 230 kV line #2	SCWPPDA, SPPR	6.00	CEC Not Yet Filed
TBD-64	Upgrade of Apache-Butterfield 230 kV line	SWTC	16.00	CEC Not Yet Filed Project in-service date changed from TBD to 2016
TBD-65	Future Sloan-Huachuca 230 kV line	SWTC	24.00	Project cancelled,
New	Three Terminal Plan Circuit 1 Participation	SWTC	23.00	CEC Not Yet Filed; In-service date 2014
New	Three Terminal Plan Circuit 2 Participation	SWTC	31.00	CEC Not Yet Filed; In-service date 2014
New	Three Terminal Plan Circuit 3 Participation	SWTC	19.00	CEC Not Yet Filed; In-service date 2014
New	Winchester to Vail Double-Circuit 345 kV Line	SWTC/TEP	41.00	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
New	Butterfield to Bicknell 230 kV Line Upgrade	SWTC	68.70	CEC Not Yet Filed; In-service date 2017
New	Saguaro to Adonis 115 kV Line Loop-in to Naviska	SWTC	0.00	CEC Not Required; In-service date 2015
New	CAP 115 kV Line Loop-in to Picture Rocks	SWTC	0.00	CEC Not Required; In-service date 2018
New	CS2 Substation	SWTC	0.00	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
New	Kartchner to CS2 230 kV Line	SWTC	2.00	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
New	Pantano to Kartchner 115 kV Line Upgrade	SWTC	36.00	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
New	San Rafael to CS2 230 kV Line	SWTC	8.00	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)

TBD-7	Palo Verde-Saguaro 500 kV line	CATS Sub-regional Planning Group	130.00	CEC Approved – Decision #46802	Deleted: -
TBD-70	Valencia 115 kV substation expansion	UNISOURCE	0.00	CEC Approved – Case #111	Deleted: -
TBD-71C	Irvington-East Loop Project – Phase 3 – Irvington 22nd Street 2 <sup>nd</sup> Circuit	TEP	9.00	CEC Approved – Case #66	Deleted: -
TBD-72C	Vail-East Loop – Phase 3 – Third Vail-East Loop 138 kV line	TEP	22.00	CEC Approved – Case #8	Deleted: -
TBD-72D	Vail-East Loop – Phase 4 – Harrison Tap of Roberts-East Loop 138 kV line	TEP	0.00	CEC Approved – Case #8 In-service date changed from TBD to 2013	Deleted: -
TBD-73		TEP	13.00	CEC Approved – Case #47 Project is in-service. Final public improvement portions were completed in 2009	Deleted: -
TBD-79		TEP	24.50	Removed from TEP's Ten Year Transmission Plan	Deleted: -
TBD-8	Arlington Power Plant	Dynegy Arlington Valley	TBD	CEC Approved – Decision #64357	Deleted: East Loop-Northeast 138 kV line
TBD-81		TEP	4.70	Mountain View segment CEC denied – Case #137 Removed from TEP's Ten Year Transmission Plan	Deleted: Tortolita-Rillito 138 kV line
	Interconnection of Greenlee-Winchester 345kV line with future Willow Substation	TEP, Bowie		CEC obtained by Southwestern Power Group – Case #118	Deleted: CEC Not Yet Filed
	Vail – Irvington 345 kV line	TEP	~11	CEC Not Yet Filed In-service date - TBD	Deleted: Future Cienega-Mountain View 138 kV line
	Irvington – South 345 kV line	TEP	~16	CEC Not Yet Filed In-service date TBD	Deleted: CEC Not Yet Filed
	Vail-UA Tech Park-Irvington 138 kV line	TEP	~2	CEC Not Yet Filed In-service Date - 2015	Deleted: CEC Not Yet Filed
	Del Cerro-Anklam-Tucson 138 kV line	TEP	~2 mile dbi ckt extension	CEC Not Yet Filed In-service date - 2016	
	TEP System – Rosemont 138 kV line	TEP	~24	CEC Not Yet Filed In-service date - 2011	

TBD	Mural – San Rafael 230kV line	APS	TBD	CEC Not Yet Filed
2012	Delany – Palo Verde 500kV line	APS	15.00	CEC Approved – Decision #68063

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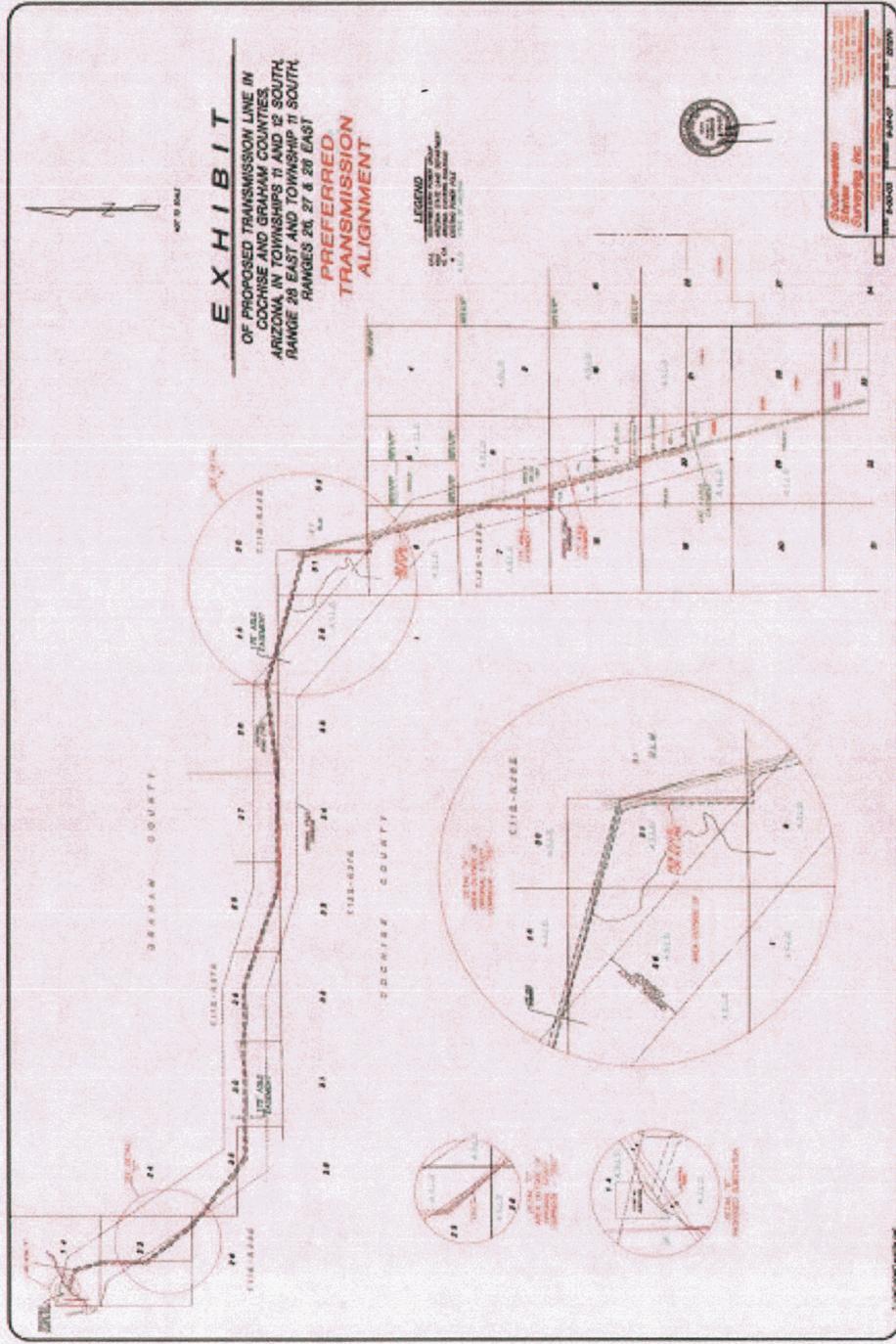
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Exhibit 7 - Arizona Demand Forecast Data (5<sup>th</sup> BTA vs. 6<sup>th</sup> BTA)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
APS										
5th BTA Loads (MW)	8,041	8,314	8,575	8,834	9,096	9,355	9,624	9,888	NA	NA
6th BTA Loads (MW)	7,299	7,403	7,536	7,764	8,047	8,264	8,591	8,922	9,229	9,539
Change (MW)	-742	-911	-1,039	-1,070	-1,049	-1,091	-1,033	-966	NA	NA
Change (% of 5th BTA)	-9.2%	-11.0%	-12.1%	-12.1%	-11.5%	-11.7%	-10.7%	-9.8%	NA	NA
SRP										
5th BTA Loads (MW)	7,726	7,989	8,253	8,519	8,786	9,054	9,323	NA	NA	NA
6th BTA Loads (MW)	7,100	7,295	7,502	7,720	7,955	8,194	8,428	8,702	8,984	NA
Change (MW)	-626	-694	-751	-799	-831	-860	-895	NA	NA	NA
Change (% of 5th BTA)	-8.1%	-8.7%	-9.1%	-9.4%	-9.5%	-9.5%	-9.6%	NA	NA	NA
TEP										
5th BTA Loads (MW)	2,556	2,629	2,702	2,777	2,853	2,931	3,010	3,091	NA	NA
6th BTA Loads (MW)	2,384	2,430	2,484	2,527	2,572	2,618	2,662	2,707	2,750	2,792
Change (MW)	-172	-199	-218	-250	-281	-313	-348	-384	NA	NA
Change (% of 5th BTA)	-6.7%	-7.6%	-8.1%	-9.0%	-9.8%	-10.7%	-11.6%	-12.4%	NA	NA
UNSE										
5th BTA Loads (MW)	616	652	690	725	759	791	819	845	NA	NA
6th BTA Loads (MW)	460	483	493	502	515	526	535	544	554	563
Change (MW)	-156	-169	-197	-223	-244	-265	-284	-301	NA	NA
Change (% of 5th BTA)	-25.3%	-25.9%	-28.6%	-30.8%	-32.1%	-33.5%	-34.7%	-35.6%	NA	NA
AZ TOTAL										
5th BTA Loads (MW)	18,939	19,584	20,220	20,855	21,494	22,131	22,776	NA	NA	NA
6th BTA Loads (MW)	17,243	17,611	18,015	18,513	19,089	19,602	20,216	20,875	21,517	NA
Change (MW)	-1,696	-1,973	-2,205	-2,342	-2,405	-2,529	-2,560	NA	NA	NA
Change (% of 5th BTA)	-9.0%	-10.1%	-10.9%	-11.2%	-11.2%	-11.4%	-11.2%	NA	NA	NA



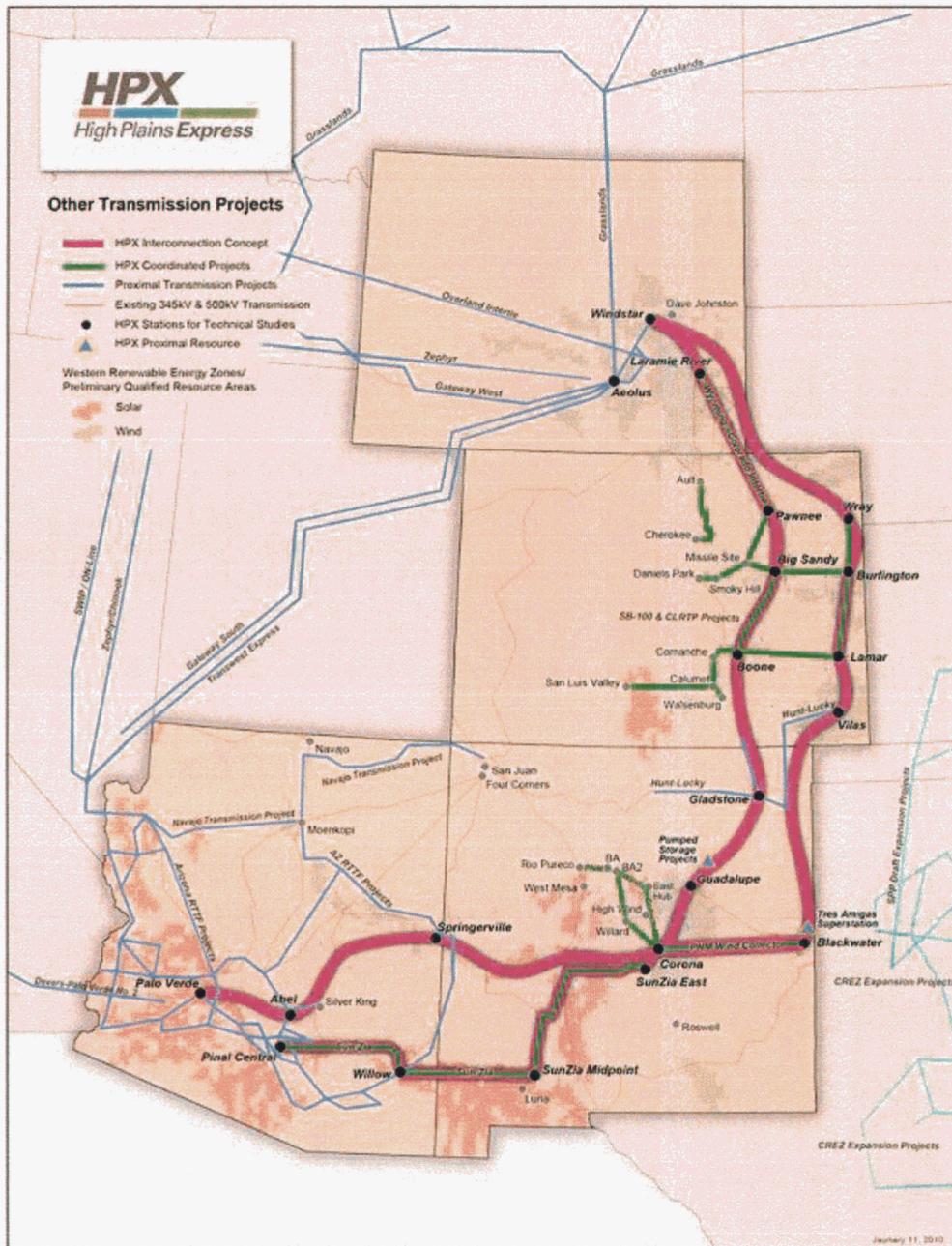
Exhibit 14 - Bowie Power Project



Sixth Biennial Transmission Assessment for 2010-2019  
Docket:  
Exhibits  
7/23/2010



Exhibit 16a - High Plains Express (HPX) Map







# Exhibit 17b - Abengoa Solar Project

Q44 (280MW) - Facilities Study

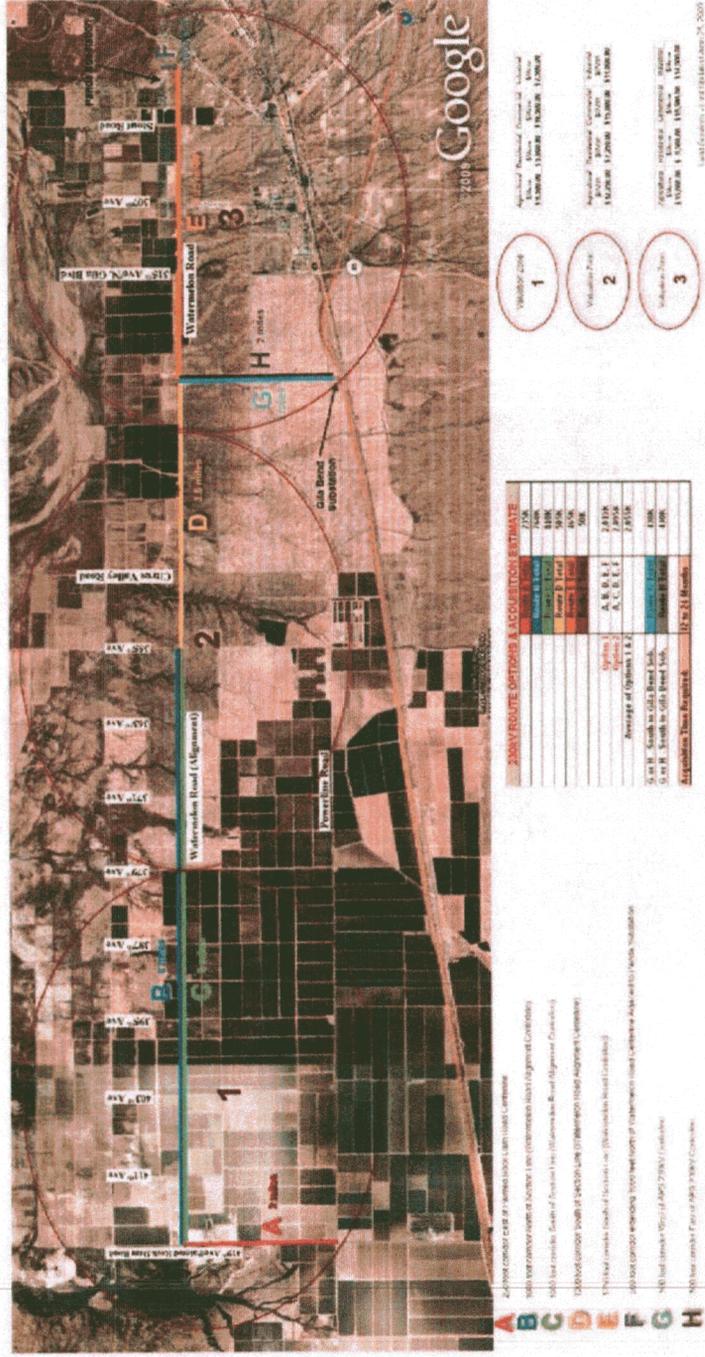


Exhibit 17c - Mesquite Solar Project

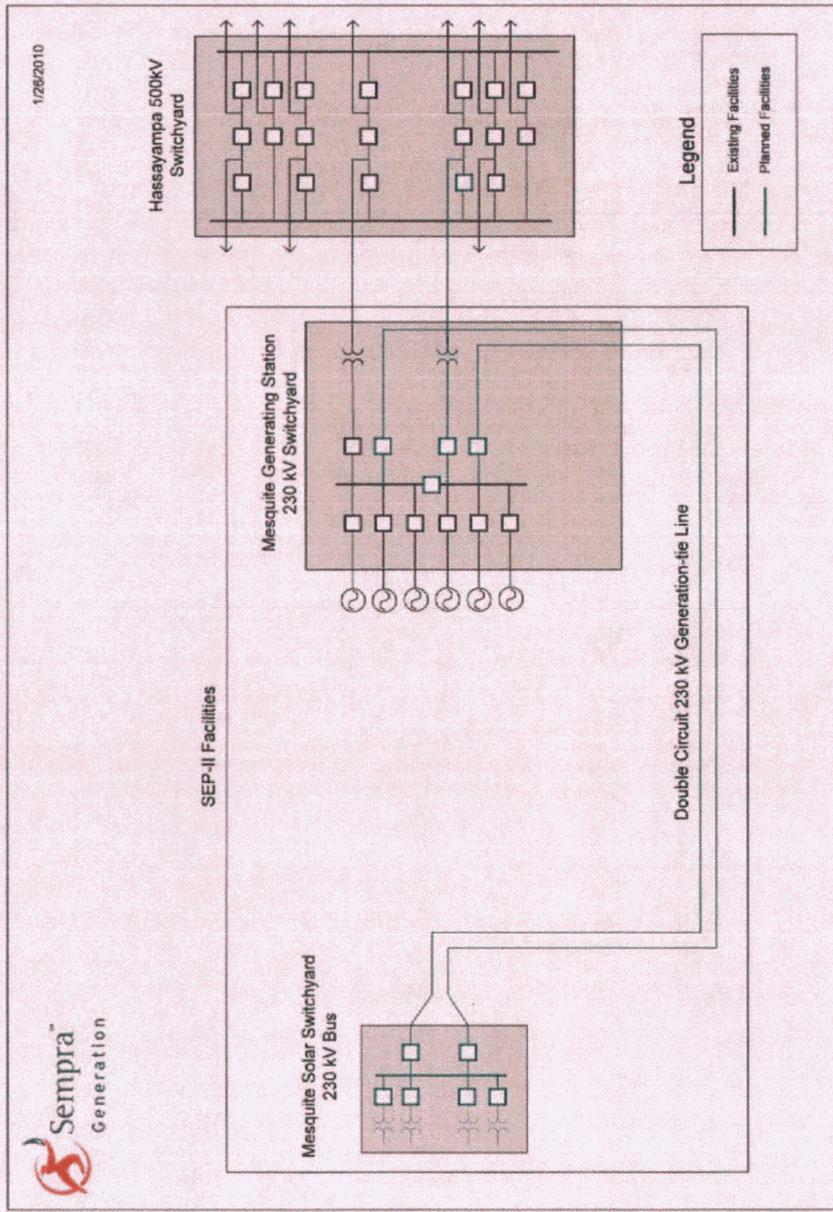
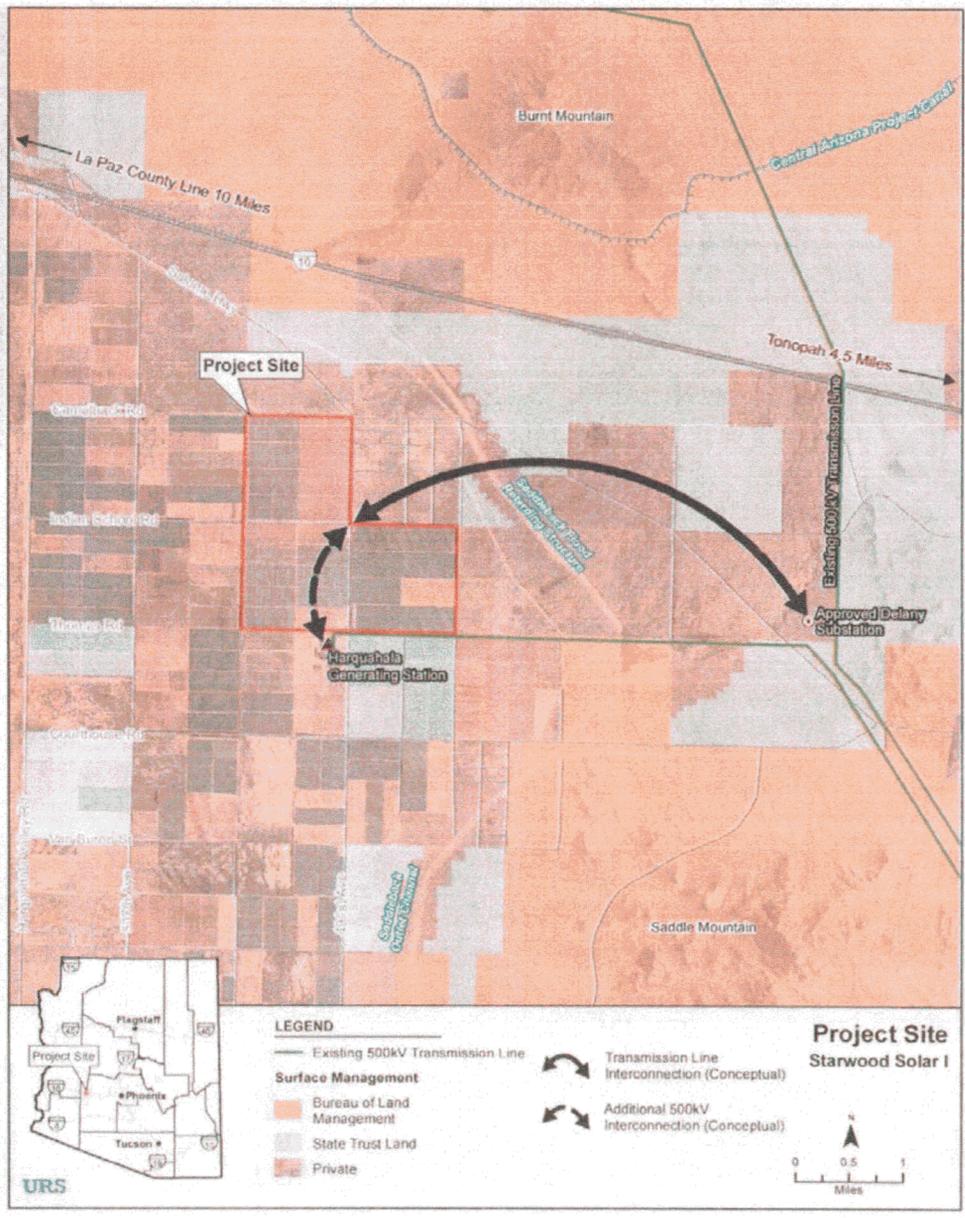


Figure 2: Sempra Generation (SEP-II) Ten-Year Transmission Plan

Exhibit 17d - Starwood Solar I Project



# The Southline



Exhibit 17f - Eldorado Valley Study Group

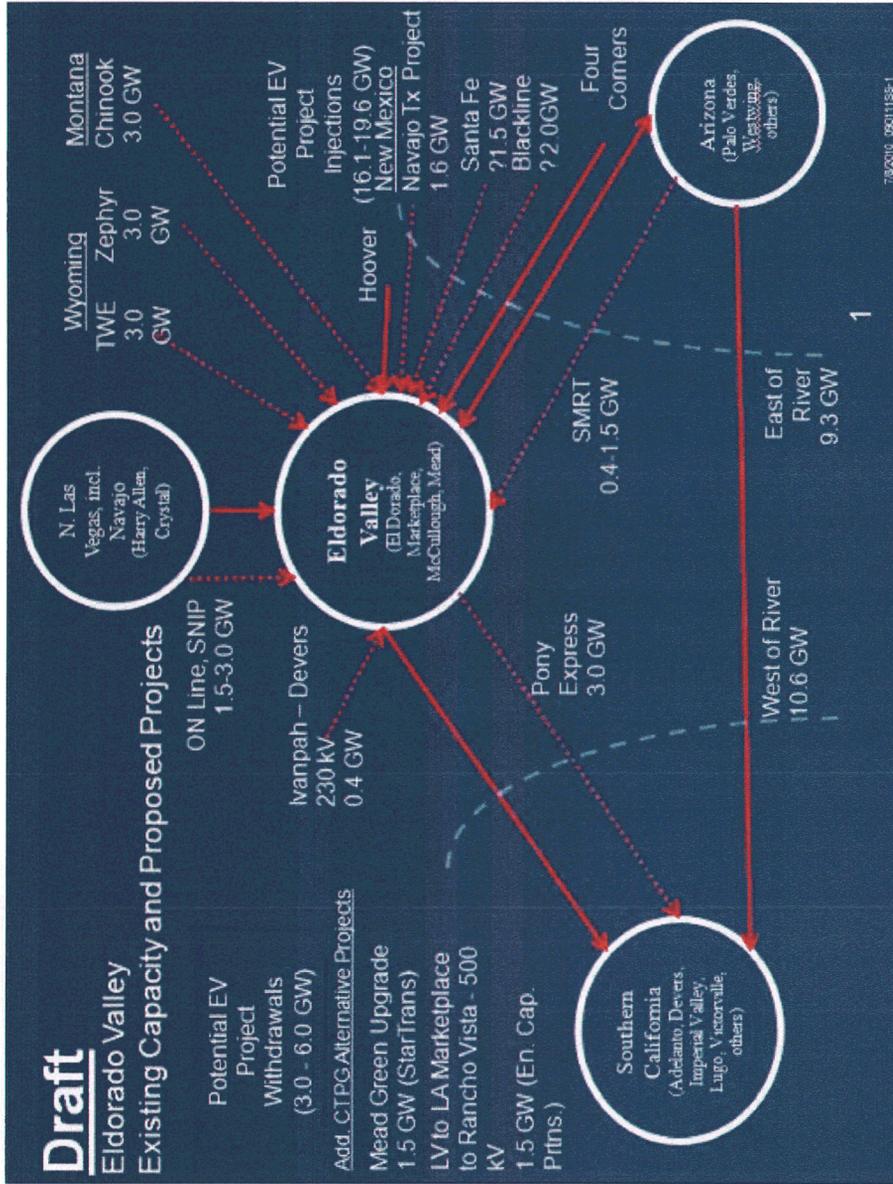
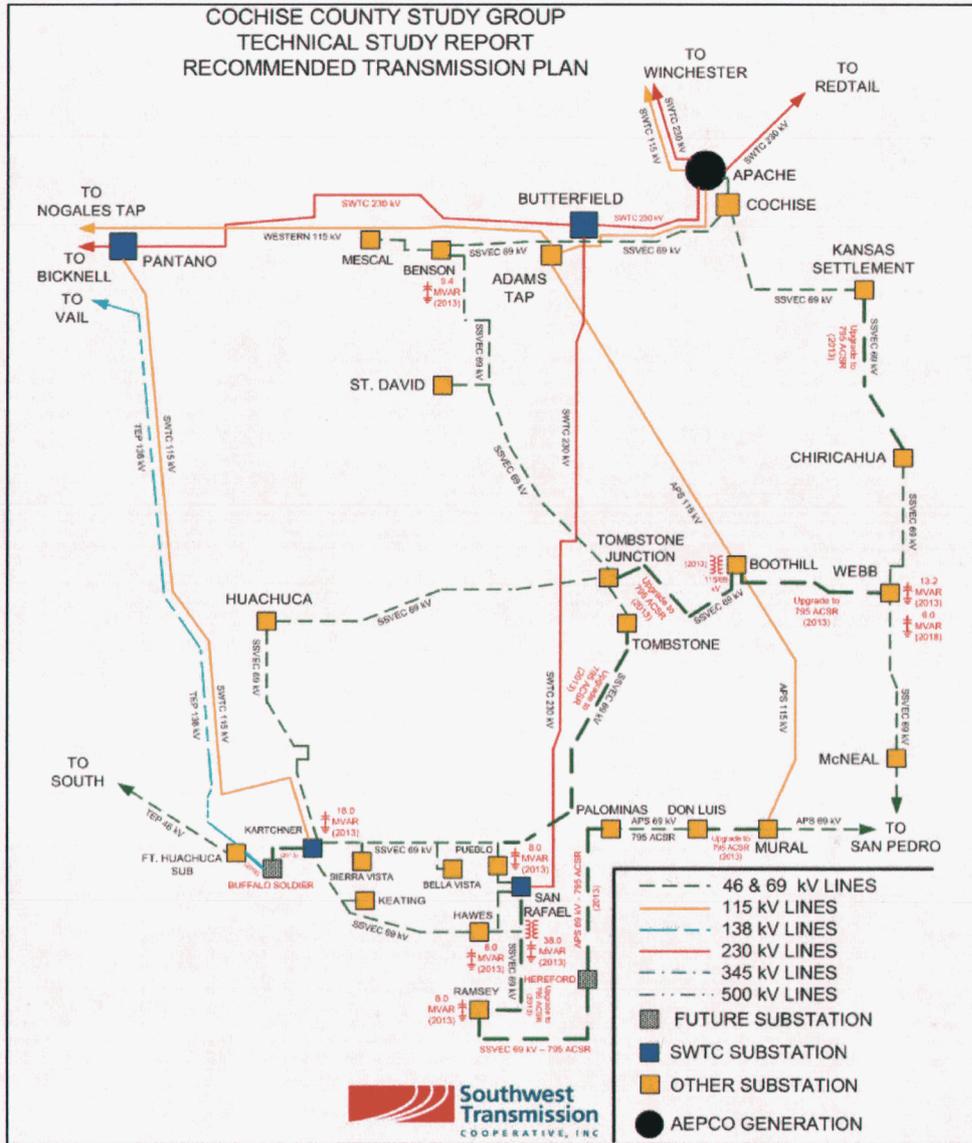
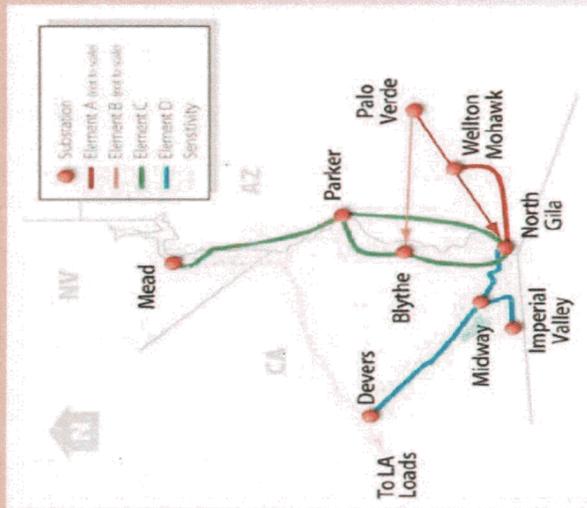


Exhibit 17g - Cochise County Transmission Plan



## SMRT PROJECT AND STUDY AREA OVERLAPS SOLAR POTENTIAL



### 4 Elements and 1 Sensitivity

#### A—Palo Verde-North Gila

- 500-kV, 100 miles

#### B—Palo Verde-Blythe

- 500-kV, 110 miles

#### C—North of Parker

- 230/500-kV 190 miles

#### South of Parker

- 230/500-kV, 330 miles

#### D- Imperial Valley Segment

- Details TBD

Exhibit 18 - Plan Changes Between Fifth and Sixth BTA

In-Service Date	Project	Voltage	Status
2008	Tortolita-North Loop-Rancho Vistoso and Tortolita-Rancho Vistoso corridor expansion and reconfiguration Project - Phase 1	138 kV	Project Name Change
2008	Interconnection of Westwing-South 345kV with future Hassayampa-Pinal West 500 kV	345 kV with 500 kV	Completed
2008	Loop existing West Ina – Tucson 138 kV line	138 kV	Completed
2008	Northeast 138 kV Static Var Compensator (SVC)	138 kV	Completed
2008	Hassayampa-Pinal West 500 kV #1 line	500 kV	Changed In-Service date from 2009
2009	Western 115 kV line loop-in to Pantano	115 kV	Project Cancelled
2009	East Loop-Northeast 138 kV line	138 kV	Completed
2010	Tortolita-North Loop-Rancho Vistoso and Tortolita-Rancho Vistoso corridor expansion and reconfiguration Project - Phase 2 Corridor Expansion	138 kV	Project Name Change & Delayed to Q4 2010
2010	Saguaro-North Loop 115 kV line	115 kV	Project Name Change Changed In-Service date from 2009
2010	Valencia-CAP Black Mountain 115 kV line	115 kV	Changed In-Service date from 2009
2010	CAP 115 kV line loop-in to SWTC Sandario	115 kV	Changed In-Service date from 2009
2010	Tortolita-North Loop-Rancho Vistoso Project – Phase 3 – Corridor Expansion	138 kV	Now a 2 Phase project

2010				Replaces Thornydale-Rattlesnake 115 kV project; Changed In-Service date from 2009
2010	North Loop-Rattlesnake 115 kV line	115 kV		
2010	Morgan-Raceway-Avery-Scatter Wash-Pinnacle Peak 230 kV line	230 kV		Project Name Changed
2010	Morgan-Pinnacle Peak 500 kV line	500 kV		Project Name Changed
2010	Vail-Cienega-Spanish Trail Project - Phase 1 (Vail-Cienega 138 kV line)	138 kV		Phase 1 Extension is In-Service
2011	Marana-Avra Valley 115 kV Line Upgrade	115 kV		Changed In-Service date from 2010
2011				Replaces Naviska-Thornydale 115 kV project; Changed In-Service date from 2010
2011	Saguaro-North Loop 115 kV line	115 kV		Changed In-Service date from 2010
2011	DeMoss Petrie-Tucson 138 kV line	138 kV		Changed In-Service date from 2010
2011	Marana Tap-Marana 115 kV Line Upgrade	115 kV		Changed In-Service date from 2012
2011	TEP System - Rosemont 138 kV line	138 kV		New Project - 2011
2012	345/69 kV Interconnection at Western's Flagstaff 345 kV bus	345/69 kV		Changed In-Service date from 2010
2012	TS12 Loop-in of Saguaro-Casa Grande 230 kV line	230 kV		Changed Project Name; Changed In-Service date from 2011
2012	Tucson-Downtown 138 kV line	138 kV		Project Cancelled
2012	Upgrade existing 115 kV transmission line to Nogales	115 kV		Changed In-Service date from 2013
2012	South-Duval CLEAR - Phase 2b - Extend 138 kV line from Canoa Ranch - (Future) Duval	138 kV		Changed In-Service date from 2013

2012	Delany – Palo Verde 500kV line		500 kV	New Project - 2012
2013	Mazatzal Loop-in of Cholla-Pinnacle Peak 345 kV line		345 kV	Changed In-Service date from 2011
2013	Northeast-Snyder 138 kV Tap for Craycroft-Barril substations		138 kV	Changed In-Service date from 2011
2013	Moenkopi-Eldorado 500 kV Series Capacitor Upgrade Project		500 kV	Changed In-Service date from 2012
2013	CS1-Three Points 115 kV line		115 kV	Project Cancelled
2013	Future CS1-Bicknell 230 kV line		230 kV	Project Cancelled
2013	Irvington-Vail 138 kV #2 line		138 kV	Project Cancelled
2013	Vail-East Loop – Phase 4 – Harrison Tap of Roberts-East Loop 138 kV line		138 kV	Changed In-Service date from TBD
2014	Delany (formerly Palo Verde Hub) -Sun Valley 500 kV line		500 kV	Project Name Changed; Changed In-Service date from 2010
2014	Sun Valley-Trilby Wash (formerly TS1) - 230 kV line		230 kV	Project Name Changed; Changed In-Service date from 2010
2014	Apache/Hayden-San Manuel 115 kV line		115 kV	Changed In-Service Date from 2010
2014	Pinal West-Pinal Central – Randolph – Abel-Browning 500 kV line		500 kV	Project Name Changed Changed In-Service date from 2011
2014	Sandario Tap-Three Points 115 kV Line Upgrade		115 kV	Changed In-Service date from 2011
2014	Pinal Central-Tortolita 500 kV line		500 kV	Changed In-Service date from 2011
2014	Desert Basin-Pinal Central 230 kV		230 kV	Project Name Changed; Changed In-Service date

2014				from 2011
2014	Sundance-Pinal Central 230 kV line		230 kV	Project Name Changed; Changed In-Service date from 2011
2014	North Gila-TS8 230 kV line		230 kV	Changed In-Service date from 2012
2014	Palo Verde Hub-North Gila 500 kV #2 line		500 kV	Changed In-Service date from 2012
2014	La Canada-Orange Grove-Rillito 138 kV line		138 kV	Changed In-Service date from 2013
2014	RS26-Fountain Hill Substation			Changed In-Service date from TBD
2014	SPPR Three Terminal Plan Circuit 1 Participation		115 kV	New Project - 2014
2014	SPPR Three Terminal Plan Circuit 2 Participation		115 kV	New Project - 2014
2014	SPPR Three Terminal Plan Circuit 3 Participation		115 kV	New Project - 2014
2016	Griffith-North Havasu 230 kV line		230 kV	Changed In-Service date from 2008
2015	Palm Valley-TS2-Trilby Wash 230 kV line		230 kV	Project Name Changed; Changed In-Service date from 2010
2015	Tortolita Rancho Vistoso 138 kV tap for future Naranja substation		138 kV	Changed In-Service date from 2010
2015	Irvington-Kino-UA Med-Tucson 138 kV line		138 kV	Project Name Changed; Changed In-Service date from 2012
2015	Extend Midvale-(Future)Spencer-(Future) San Joaquin 138 kV line		138 kV	Combined with 2019-89 project; Changed In-Service date from 2013

2015	Tortolita-Marana-North Loop Project - Phase 1 (Tortolita-Marana 138 kV line)	138 kV	Changed In-Service date from 2013
2015	Saguaro to Adonis 115 kV Line Loop-in to Naviska	115 kV	New Project - 2015
2015	Vail-UA Tech Park-Irvington 138 kV line	138 kV	New Project - 2015
2016	Sun Valley-Morgan 500 kV line	500 kV	Project Name Changed; Changed In-Service date from 2012
2016	Irvington-Corona-South 138 kV line	138 kV	Project Name Changed; Changed In-Service date from 2013
2016	Irvington-South Project - Phase 2 - Corona-SS N026-South 138 kV line	138 kV	Project Cancelled
2016	Hartt-SS N029 138 kV line	138 kV	Project Cancelled
2016	Upgrade of Apache-Butterfield 230 kV line	230 kV	Changed In-Service date from TBD
2016	Del Cerro-Anklam-Tucson 138 kV line	138 kV	New Project - 2016
2017	Abel - RS24-Moody (RS17) #1230 kV line (formerly RS17-RS24)	230 kV	Project Name Change; Changed In-Service date from 2012
2017	Orange Grove-East Ina 138 kV line	138 kV	Project Name Changed
2017	Butterfield to Bicknell 230 kV Line Upgrade	230 kV	New Project - 2017
2018	Abel - RS24 - Moody (RS17) #2 230kV line (formerly RS24-RS22/SEV)	230 kV	Project Name Changed; Changed In-Service date from 2012-2018
2018	Irvington-South Project- Phase 3 (Corona-Swan Southlands and Swan Southlands-SS NO 26 138 kV lines)	138 kV	Project Cancelled
2018	Midvale-Spencer-Medina-Raytheon-South 138 kV line	138 kV	Project Name Changed; Changed In-Service date

				from 2019
2018				
	CAP 115 kV Line Loop-in to Picture Rocks		115 kV	New Project - 2018
2020	Vail-SS NO 27- Cienega-SS NO22-Spanish Trail Project – Phase 2 – Vail-SS NO27 138 kV line		138 kV	Project Cancelled
2020				
	Vail-SS NO17-Irvington 138 kV line		138 kV	Project Cancelled
2023	Vail-SS NO27-Cienega-SS NO22-Spanish Trail Project – Phase 3 – Cienega-SS NO20 138 kV line		138 kV	Project Cancelled
2023				
	22-Spanish Trail Project – Phase 3 – Cienega-SS NO20 138 kV line		138 kV	Project Cancelled
2026				
	DeMoss Petrie-SS N014-Northeast 138 kV line		138 kV	Project Cancelled
2030				
	North Loop-SS N04-Demoss Petrie 138 kV line		138 kV	Project Cancelled
TBD				
	Golden Valley 230 kV Project - McConico-Mercator Mill 230 kV line		230 kV	In-Service date is TBD
TBD				
	Rancho Vistoso-(Future) Sun City 138 kV line		138 kV	Project Name Changed; In-Service date is TBD
TBD				
	Jojoba Loop-in of TS4-Panda 230 kV line		230 kV	Changed In-Service date from 2013
TBD				
	Tortolita North Loop 345 kV line		345 kV	Project Name Changed; Changed In-Service date from 2014
TBD				
	Nogales Transmission line #2 (Gateway – Valencia)		138 kV	Project Name Changed
TBD				
	New Hayden 115 kV Station Loop-in		115 kV	Project Name Changed
TBD				
	Winchester-Vail 345 kV line #2 and #3		345 kV	Project Name Changed
TBD				
	Tortolita-Vail 345 kV Project – Phase 2 – North Loop-East Loop line		345 kV	Project Cancelled

TBD	Sun Valley-Trilby Wash – 230 kV line # 2	230 kV	Project Name Changed
TBD	Tortolita-Vail 345 kV Project – Phase 3 – East Loop-Vail line	345 kV	Project Cancelled
TBD	Sun Valley-Morgan 230 kV line	230 kV	Project Name Changed
TBD	Future Sloan-Huachuca 230 kV line	230 kV	Project Cancelled
TBD	Winchester to Vail Double-Circuit 345 kV Line	345 kV	New Project - TBD
TBD	CS2 Substation		New Project - TBD
TBD	Kartchner to CS2 230 kV Line	230 kV	New Project - TBD
TBD	Pantano to Kartchner 115 kV Line Upgrade	115 kV	New Project - TBD
TBD	San Rafael to CS2 230 kV Line	230 kV	New Project - TBD
TBD	Tortolita-Rillito 138 kV line	138 kV	Project Cancelled
TBD	Future Cienega-Mountain View 138 kV line	138 kV	Project Cancelled
TBD	Interconnection of Greenlee-Winchester 345kV line with future Willow Substation	345 kV	New Project - TBD
TBD	Vail – Irvington 345 kV line	345 kV	New Project - TBD
TBD	Irvington – South 345 kV line	345 kV	New Project - TBD
TBD	Mural – San Rafael 230kV line	230 kV	New Project - TBD



Exhibit 19 – Generation Interconnection Queue(s)

Interconnecting Utility and Queue list	Maximum Output	Interconnection Location	In-Service Date	Technology
SRP Transmission	562	Randolph	9/1/2010	(project withdrawn) Natural Gas
SRP-ANPP	720	Hassayampa 500 kV	3/1 / 2010 – 2014 (one 180MW unit per year)	Photovoltaic
SRP-ANPP	500	Jojoba	12/1/2012	Concentrated Solar Power
SRP-ANPP	125	Hassayampa 500 kV	2011	Concentrated Solar Power
SRP-ANPP	125	Hassayampa 500 kV	2011	Concentrated Solar Power
SRP-ANPP	200	Hassayampa 500 kV	5/12/2013	Photovoltaic
SRP-ANPP	250	Jojoba	1/1/2013	Concentrated Solar Power
SRP-MP	500	Mead-Perkins	10/1/2009	Wind
SRP-MP	250	Mead-Perkins	10/1/2013	Concentrated Solar Power
SRP-MP	250	Mead-Perkins	4/8/2013	Concentrated Solar Power
SRP Transmission	700	Coronado 500kV	9/15/2012	Wind
SRP Transmission	658	Abel 230	9/1/2011	Natural Gas
SRP Transmission	304	Abel 69	9/1/2011	Natural Gas
SRP Transmission	1315	Pinal New Sub	9/1/2013	Natural Gas

SRP Transmission	200	CO-CH	12/1/2013	Wind
SRP Transmission	150	Cholla-Sugarloaf 500kV	12/31/2012	Wind
SRP Transmission	150	Cholla-Sugarloaf 500kV	12/31/2012	Wind
SRP-Joint Participation	125	Pinal Central 230kV	11/1/2012	Solar (steam)
SRP-Joint Participation	520	Pinal Central 500kV	6/15/2012	Natural Gas
SRP-Joint Participation	125	Pinal Central 500kV	6/15/2012	Natural Gas
SRP-Joint Participation	125	Pinal Central 500kV	6/15/2012	Natural Gas
APS	Unit 1 – 700	Four Corners 500kV Switchyard	8/1/2015	Coal
APS	Unit 2 – 700		8/1/2015	
APS	128	Cholla/Zeniff/Show Low Western 69kV line and Cholla/Show Low Eastern 69kV line	West = 8/17/2009 East = 10/1/2010	Wind
APS	22	Cholla/Zeniff/Show Low Western 36kV line	Q2 2008	Biomass
APS	100	Existing Yucca 36kV substation	6/1/2008	Gas Combustion Turbine
APS	Units 1-4 – 583 each (63 MW Net Increase per Unit)	Gila River 500kV		Gas Combined Cycle
APS	260	Ashfork-Pollock 69kV System and Seligman 230 kV to be studied	3/13/2012	Wind
APS	125	Cholla/Show Low Eastern 69 kV line	12/1/2012	Wind
APS	100	Adams – Mural 115kV line	12/31/2010	Wind
APS	102	Proposed Harquahala Junction (Delany) Switchyard	10/1/10-12/1/2011	Solar
APS	87	Paloma 69kV Substation	10/1/10-12/1/2011	Solar
APS	400	North Gila Substation	Q4 2012	Solar
APS	1000	Moenkopi 500kV	2015	Wind
APS	300	Cholla 500kV Substation	11/1/2010	Wind

APS	400	Proposed Harquahala Junction (Delany) Switchyard	7/31/2011-12/31/2012	Solar
APS	800	Proposed Harquahala Junction (Delany) Switchyard	1/1/2013-12/31/2014	Solar
APS	500	Moenkopi – El Dorado 500kV line	7/1/2010	Wind
APS	250	North Gila Substation	Q4 2012	Solar Thermal
APS	500	Proposed Harquahala Junction (Delany) Switchyard	6/30/2012	Solar
APS	500	PV-NG1 500kV line (New Hoodoo Wash 500kV Switchyard)	12/2011	Solar
APS	280	Panda 230 kV Substation	12/1/2011	Solar
APS	300	PV-NG1 500kV Line	10/1/2011 11/1/2011 3/1/2012	Solar
APS	250	Gila Bend 230kV Switchyard or Panda 230kV Switchyard	Q2 2013	Solar
APS	80	SW6 Substation	3/1/2013	Solar
APS	150	North Gila System	7/1/2012	Solar
APS	150	Cholla-PNPK 345 kV line	12/31/2013	Wind
APS	300	Proposed Delany Switchyard	9/1/2012	Solar
APS	99	Hassayampa-N Gila 500 kV line	Q2 and Q4 2012	Solar
APS	99	Hassayampa-N Gila 500 kV line	Q2 and Q4 2013	Solar
APS	40	Hassayampa-N Gila 500 kV line	Q2 2012	Solar
APS	500	Moenkopi 500 kV Switchyard	Q2 2012	Wind
APS	150	Gila Bend 230kV Substation	7/1/2013	Solar
APS	480	Hassayampa-N Gila 500 kV line	1/1/2014	Solar
APS	200	Panda Switchyard 230 kV or Gila Bend Substation 230 kV	PH-1 – 100MW 12/2014	Solar

				PH2 – 100MW 12/2015	
APS	600		PV-NG 500 kV Line (Q43 Switchyard)	6/1/2013	Solar
APS	300		Sun Valley 230 kV Switchyard	6/1/2015	Solar
APS	480		Hassayampa-N Gila 500 kV line	1/1/2014	Solar
APS	297		San Manuel 115kV Switchyard	12/30/2011	Solar
APS	20		Aztec Substation	3/31/2011	Solar
APS	20		Hyder Substation	3/31/2011	Solar
APS	20		Cotton Center Substation	3/31/2011	Solar
APS	20		Cotton Center Substation	3/31/2011	Solar
APS	70		Buckeye – Desert Sky 69 kV line	8/31/2013	Solar
APS	390		Four Corners – Cholla 345 kV line	12/31/2012	Wind
APS	20		Hyder-Saddle Mountain 69 kV line	6/1/2011	Solar
APS	20		ASARCO-SantaRosa 69 kV line	1/31/2011	Solar
APS	20		12 kV Interconnection – Buckeye	11/30/2011	Solar
APS	20		12 kV Interconnection – Ehrenberg	Q4 2010	Solar
APS	20		Vicksburg Area 69 kV	12/31/2012	Solar
APS	200		Cholla – Pinnacle Peak 345 kV line	12/31/2012	Wind
APS	50		69 kV Interconnection – Gila Bend Area	12/31/2011	Solar
APS	50		69 kV Interconnection – Tonopah Area	12/31/2011	Solar
APS	20		12 kV Interconnection – Ehrenberg	Q4 2010	Solar
APS	20		69 kV Interconnection 335 Ave & Dobbins Rd	12/31/2011	Solar
APS	20		69 kV Interconnection 335 Ave & Dobbins Rd	12/31/2011	Solar
APS	20		69 kV Interconnection – Gillespie Sub Area	1/1/2012	Solar
APS	20		69 kV Interconnection – Lower River Sub/or 12 kV into Baseline Sub	11/30/2011	Solar
APS	200		69 kV Interconnection – Sugarloaf Sub	12/2012	Wind

APS	Area	and	12/2013	Wind
120	Bagdad Area 115 kV Transmission System	12/1/2012		
30	Cotton Center 69 kV Substation	12/15/2012		Solar
30	Tonopah 69 kV Substation	12/15/2012		Solar
101	Moenkopi - Yavapai 500 kV line	8/1/2011		Wind
60	Salome 69kV Substation	12/21/12		Solar
20	69 kV Interconnection - Gila Bend Area	6/30/13		Solar
20	69 kV Interconnection - Gila Bend Substation Area	10/1/2012		Solar
20	69 kV Interconnection - Gila Bend Substation Area	2/28/2012		Solar
20	69 kV Interconnection - Gila Bend Substation Area	3/31/2012		Solar
20	69 kV Interconnection - Hwy 60 & Farm Access Road	4/30/2012		Solar
20	69 kV Interconnection - Hwy 60 & Farm Access Road	12/31/2011		Solar
20	Lower River - Wintersburg 69 kV line	12/31/2011		Solar
20	W. Riggs Rd & 170 <sup>th</sup> Ave	4/15/2012		Solar
20	Indian School Rd & 355 <sup>th</sup> Ave	12/31/2011		Solar
20	I-10 & 507 <sup>th</sup> Ave	9/1/2011		Solar
20	12 or 69 kV Interconnection - Hyder Substation	9/1/2011		Solar
20	12 or 69 kV Interconnection - Hyder Substation	11/30/2011		Solar
20	12 or 69 kV Interconnection - Harquahala Substation	2/28/2012		Solar
20	12 or 69 kV Interconnection - Salome	2/28/2012		Solar
20	12 or 69 kV Interconnection - Arlington	2/28/2012		Solar

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		Substation		
APS	20	69 KV Interconnection – 69KV line Palmas Rd and Dateland Rd	12/31/2010	Solar
APS	20	69 KV Interconnection – Gila Bend 69KV Watermelon Rd and 307 Ave.	12/31/2010	Solar
APS	20	12 KV bus-bar, transformer at Baseline Substation	11/30/2011	Solar
APS	20	12 or 69 KV Interconnection – Patterson Substation	12/31/2012	Solar
APS	50	Sugarloaf 69 KV Substation	12/1/2012	Solar
APS	20	69 KV between Hyder and Saddle Mountain Sub	2/28/2012	Solar
APS	20	Baseline Substation Area	2/28/2012	Solar
APS	20	69 KV line between Tonopah and Harquahala Subs	2/28/2012	Solar
APS	20	Saddle Mountain 69 KV Substation	81/2011	Solar
APS	99	Show Low 69 KV Substation	1/10/2012	Wind
APS	50	Hyder 69 KV Substation	8/1/2011	Solar
APS	20	Harqualaha 69 KV to 12 KV Switch location	5/1/2010	Solar
APS	50	69 KV line between Wintersburg & Lower River	12/31/2012	Solar
APS	20	69 KV Vicksburg Substation	3/31/2011	Solar
APS	20	Wintersburg 69 KV Substation Area	2/28/2012	Solar
APS	20	69 KV Cotton Center Substation	6/5/2012	Solar

Exhibit 20 – Listing of Projects by In-Service Date

In-Service Date	Description	Voltage	Participants	Permitting/Siting Status
2008	Hassayampa-Pinal West 500 KV #1 line	500 KV	SRP, TEP, SWTC, ED2, ED3, ED4	CEC Approved – Case #124
2008	Tortolita-North Loop-Rancho Vistoso and Tortolita-Rancho Vistoso corridor expansion and reconfiguration Project - Phase 1	138 KV	TEP	CEC APPROVAL Case # 149 Project is in-service
2008	Interconnection of Westwing-South 345KV with future Hassayampa-Pinal West 500 KV	345-500 KV	TEP	CEC Approved - Case # 124 Project is in-service
2008	Loop existing West Ina -Tucson 138 KV line	138 KV	TEP	CEC Approved - Case #62 Project is in-service
2008	Northeast 138 KV Static Var Compensator (SVC)	138 KV	0.00	CEC Not Required Project is in-service
2010	Morgan-Raceway-Avery-Scatter Walsh-Pinnacle Peak 230 KV line	230 KV	APS	CEC Approved – Decision #69343
2010	Morgan-Pinnacle Peak 500 KV line	500 KV	APS, SRP	CEC Approved – Decision #69343
2010	Bowie Power Project.		BOWIE	CEC Approved – Decision #64626
2010	Saguaro-Naviska 115 KV line	115 KV	SWTC	Project renamed to Saguaro to North Loop; CEC approved – Case #149; Deferred from 2009 to 2010
2010	Valencia-CAP Black Mountain 115 KV line	115 KV	SWTC	CEC Approved – Case #152; Deferred from 2009 to 2010
2010	CAP 115 KV line loop-in to SWTC Sandario	115 KV	SWTC	CEC Approved – Case #152; Deferred from 2009 to 2010
2010	Naviska-Thornydale 115 KV line	115 KV	SWTC	Project replaced by Saguaro to North Loop Project; CEC Approved – Case #149; Deferred from 2009 to 2010
2010	Thornydale-Rattlesnake 115 KV line	115 KV	SWTC	Project replaced by North Loop to

					Rattlesnake Project; CEC Approved - Case #152; Deferred from 2009 to 2010
2010	Tortolita-North Loop-Rancho Vistoso and Tortolita-Rancho Vistoso corridor expansion and reconfiguration Project - Phase 2 Corridor Expansion	138 kV	TEP		CEC Approved - Case #149 Project in-service delayed to Q4 2010
2010	Vail-Cienega-Spanish Trail Project - Phase 1 - Vail-Cienega 138 kV line	138 kV	TEP		CEC Approved - Case #137 Cienega extension is in-service
2010	East Loop-Northeast 138 kV line	138 kV	TEP		CEC Approved - Case #47 Project is in-service. Final public improvement portions were completed in 2009
2010	White Hills substation		UNISOURCE		CEC Not Required
2011	Devers - Palo Verde 500 kV #2 line	500 kV	SCE		CEC Denied - Case #130
2011	Dinosaur - Abel - Randolph 230kV line	230 kV	SRP		CEC Approved - Case #126
2011	Pinal South-Southeast Valley/RS22		SRP		CEC Approved - Decisions #68093 and #69291
2011	Marana-Avra Valley 115 kV Line Upgrade	115 kV	SWTC		CEC Not Yet Filed, Deferred from 2010 to 2011
2011	Avra Valley-Sandario Tap 115 kV Line Upgrade	115 kV	SWTC		CEC Not Yet Filed
2011	Marana Tap-Marana 115 kV Line Upgrade	115 kV	SWTC		CEC Not Required In-service date changed from 2012 to 2011
2011	TEP System - Rosemont 138 kV line	138 kV	TEP		CEC Not Yet Filed In-service date - 2011
2011	DeMoss Petrie-Tucson 138 kV line	138 kV	TEP		CEC Not Yet Filed Deferred from 2010 to 2011
2012	345/69 kV Interconnection at Western's Flagstaff 345 kV bus	345 kV	APS		CEC Not Required
2012	TS12 Loop-in of Saguaro-Casa Grande 230 kV line	230 kV	APS		Not Required
2012	Delany - Palo Verde 500kV line	500 kV	APS		CEC Approved - Decision #68063
2012	South-Duval CLEAR - Phase 2b - Extend 138 kV line from Canoa Ranch-(Future) Duval	138 kV	TEP		CEC Approved - Case #84 Moved forward from 2013 to 2012

2012	Upgrade existing 115 kV transmission line to Nogales	115 kV	UNISOURCE	CEC Approved – Case #111 2012 Completion date
2013	Mazatzal Loop-in of Cholla-Pinnacle Peak 345 kV line	345 kV	APS	CEC Not Required
2013	Moenkopi-Eldorado 500 kV Series Capacitor Upgrade Project	500 kV	SCE, APS	CEC Not Required
2013	SunZia Project		SWPG, SRP, TEP, ECP, Shell, TSGT	CEC Not Yet Filed
2013	Northeast-Snyder 138 kV Tap for Craycroft-Barril substations	138 kV	TEP	CEC Not Required Deferred from 2011 to 2013
2013	Vail-East Loop – Phase 4 – Harrison Tap of Roberts-East Loop 138 kV line	138 kV	TEP	CEC Approved – Case #8 In-service date changed from TBD to 2013
2014	Sun Valley-Trilby Wash - 230 kV line	230 kV	APS	CEC Approved – Decision #67828 To be Filed in 2010
2014	North Gila-TS8 230 kV line	230 kV	APS	CEC Filed – Case #136
2014	Sundance-Pinal Central 230 kV line	230 kV	APS, ED2	CEC Approved – Decisions #68093, #68291, #69183 and #69647
2014	Desert Basin-Pinal Central 230 kV	230 kV	APS, SRP	CEC Approved – Decision #68063
2014	Delany-Sun Valley 500 kV line	500 kV	APS, SRP, CAWCD	CEC Approved – Decision #70127
2014	Palo Verde Hub-North Gila 500 kV #2 line	500 kV	APS, SRP, IID, WMIDD	CEC Not Yet Filed
2014	RS26-Fountain Hill substation	500 kV	SRP	CEC Not Yet Filed
2014	Pinal West-Pinal Central – Randolph - Abel-Browning 500 kV line	500 kV	SRP, TEP, SWTC, ED2, ED3, ED4	CEC Approved - Case #126 Decisions #68093 and #69291
2014	Apache/Hayden-San Manuel 115 kV line	115 kV	SWTC	CEC Approved – Case #142; Deferred from 2010 to 2014
2014	Sandario Tap-Three Points 115 kV Line Upgrade	115 kV	SWTC	CEC Not Yet Filed Deferred from 2011 to 2014
2014	Three Terminal Plan Circuit 1 Participation	115 kV	SWTC	CEC Not Yet Filed; In-service date 2014
2014	Three Terminal Plan Circuit 2 Participation	115 kV	SWTC	CEC Not Yet Filed; In-service date 2014

2014	Three Terminal Plan Circuit 3 Participation	115 kV	SWTC	CEC Not Yet Filed; In-service date 2014
2014	La Canada-Orange Grove-Rillito 138 kV line	318 kV	TEP	CEC Not Yet Filed Deferred from 2013 to 2014
2014	Pinal Central-Tortolita 500 kV line	500 kV	TEP, SWTC, SRP, SunZia	CEC Not Yet Filed Deferred from 2011 to 2014
2014	Gateway-Sonoita 138 kV line	138 kV	UNISOURCE	CEC Not Yet Filed
2015	Palm Valley-TS2-Trilby Wash 230 kV line	230 kV	APS	CEC Approved - Decisions #66646 and #67828
2015	Saguaro to Adonis 115 kV Line Loop-in to Naviska	115 kV	SWTC	CEC Not Required; In-service date 2015
2015	Vail-UA Tech Park-Irvington 138 kV line	138 kV	TEP	CEC Not Yet Filed In-service Date - 2015
2015	Tortolita Rancho Vistoso 138 kV tap for future Naranja substation	138 kV	TEP	CEC Not Yet Filed Deferred from 2010 to 2015
2015	Irvington-Kino-UA Med-Tucson 138 kV line			CEC Not Yet Filed Line and Kino Substation scheduled for 2015. UA Med Substation scheduled for 2019
2015		138 kV	TEP	
2015	Extend Midvale-(Future) Spencer-(Future) San Joaquin 138 kV line	138 kV	TEP	Combined with project 2019-89 CEC Not Yet Filed
2015	Tortolita-Marana-North Loop Project - Phase 1 - Tortolita-Marana 138 kV line	138 kV	TEP	Deferred from 2013 to 2015
2015	South-Hartt-Green Valley 138 kV line	138 kV	TEP	CEC Not Required Deferred from 2013 to 2015
2016	Sun Valley-Morgan 500 kV line	500 kV	APS, SRP, CAWCD	CEC Approved - Decision #70850
2016	Upgrade of Apache-Butterfield 230 kV line	230 kV	SWTC	CEC Not Yet Filed Project in- service date changed from TBD to 2016
2016	Del Cerro-Anklam-Tucson 138 kV line	138 kV	TEP	CEC Not Yet Filed In-service date - 2016
2016	Irvington-Corona-South 138 kV line	138 kV	TEP	CEC Not Yet Filed Deferred from 2013 to 2016

2016	Griffith-North Havasu 230 kV line	230 kV	UNISOURCE	CEC Approved/Extended - Case #88 Deferred to 2016, CEC Extension request not yet filled
2017	Abel - RS24-Moody (RS17) #1230 kV line (formerly RS17-RS24)	230 kV	SRP	CEC Approved - Decision #71441
2017	Butterfield to Bicknell 230 kV Line Upgrade	230 kV	SWTC	CEC Not Yet Filed; In-service date 2017
2017	Orange Grove-East Ina 138 kV line	138 kV	TEP	CEC Not Yet Filed
2018	Abel - RS24 - Moody (RS17) #2 230kV line (formerly RS24-RS22/SEV)	230 kV	SRP	CEC Approved - Decision #71441
2018	CAP 115 kV Line Loop-in to Picture Rocks	115 kV	SWTC	CEC Not Required; In-service date 2018
2018	Midvale-Spencer-Medina-Raytheon-South 138 kV line	138 kV	TEP	CEC Not Yet Filed Spencer extension deferred from 2013 to 2015 Loop-in for SS NO 22 (renamed Medina) moved forward from 2019 to 2018 Added loop-in for Raytheon Substation scheduled for 2019
2020	Pinal Central - Abel #2 500kV line	500 kV	SRP	CEC Not Yet Filed
TBD	Jojoba Loop-in of TS4-Panda 230 kV line	230 kV	APS	CEC Approved - Decision #62960
TBD	Mural - San Rafael 230kV line	230 kV	APS	CEC Not Yet Filed
TBD	Sun Valley-Tribby Wash - 230 kV line # 2	230 kV	APS	CEC Approved - Decision #68063
TBD	Palm Valley-TS2-TS1 230 kV line # 2	230 kV	APS	CEC Approved - Decision #67828
TBD	Sun Valley-TS11-Buckeye 230 kV line	230 kV	APS	CEC Not Yet Filed
TBD	Sun Valley-TS10-TS11 230 kV line	230 kV	APS	CEC Not Yet Filed
TBD	Sun Valley-Morgan 230 kV line	230 kV	APS	CEC Approved - Decision #70850
TBD	Yucca-TS8 230 kV line	230 kV	APS	CEC Not Yet Filed
TBD	Westwing-EI Sol 230 kV line	230 kV	APS	CEC Approved - Docket#U-1345
TBD	Westwing-Raceway 230 kV line	230 kV	APS	CEC Approved - Decision#64473

TBD	Palo Verde-Saguaro 500 KV line	500 KV	CATS Sub-regional Planning Group	CEC Approved – Decision #46802
TBD	Arlington Power Plant		Dynegy Arlington Valley	CEC Approved – Decision #64357
TBD	Greenlee switching station through Hidalgo to Luna		ELPE,PNM, TXNMPC	CEC Approved – Case #21
TBD	Gila Bend Power Plant		GBPP	CEC Approved – Case#109 – Extension Expires 4/2011
TBD	Hassayampa-Joboa 500 KV line	500 KV	GBPP	CEC Approved – Case#119 – Extension Request Pending
TBD	Santa Rosa-ED5 230 KV line	230 KV	SCWPDA, SPPR	CEC Not Yet Filed
TBD	ED5-Pinal South (Pinal Central) 230 KV line	230 KV	SCWPDA, SPPR	CEC Not Yet Filed
TBD	ED5-Marana 230 KV line	230 KV	SCWPDA, SPPR	CEC Not Yet Filed
TBD	Pinal Central (Pinal South) – Future substation 6 miles northeast 230 KV line #1	230 KV	SCWPDA, SPPR	CEC Not Yet Filed
TBD	Pinal Central (Pinal South) – Future substation 6 miles northeast 230 KV line #2	230 KV	SCWPDA, SPPR	CEC Not Yet Filed
TBD	Abel – RS20 500KV	500 KV	SRP	CEC Not Yet Filed
TBD	RS20 – Coronado 500KV	500 KV	SRP	CEC Not Yet Filed
TBD	Thunderstone-Santan 230 KV line #2	230 KV	SRP	CEC Not Yet Filed, if Needed
TBD	New Hayden 115 KV Station Loop-in	115 KV	SRP	CEC Not Yet Filed
TBD	RS17 230 KV Loop-in line	230 KV	SRP	CEC Approved – Decisions #59791 and #60099
TBD	Dinosaur-RS21 230 KV line	230 KV	SRP	CEC Not Yet Filed
TBD	Rogers-Browning 230 KV line	230 KV	SRP	CEC Not Yet Filed
TBD	Silver King-Browning 230 KV line	230 KV	SRP	CEC Approved – Case #20
TBD	Silver King-Browning/Superior 230 KV tie	230 KV	SRP	CEC Not Yet Filed
TBD	Pinnacle Peak-Brandow 230 KV line	230 KV	SRP	CEC Approved – Case #69
TBD	Rogers-Corbell 230 KV line	230 KV	SRP	CEC Not Required
TBD	Silver King-Knoll-Future Hayden 230 KV line	230 KV	SRP	CEC Not Yet Filed

TBD	Hassayampa - Pinal West 500 kV #2 line	500 kV	SRP, TEP, SWTC, ED2, ED3, ED4	CEC Approved - Case #124
TBD	CS2 Substation		SWTC	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
TBD	Kartchner to CS2 230 kV Line	230 kV	SWTC	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
TBD	Pantano to Kartchner 115 kV Line Upgrade	115 kV	SWTC	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
TBD	San Rafael to CS2 230 kV Line	230 kV	SWTC	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
TBD	Winchester to Vail Double-Circuit 345 kV Line	345 kV	SWTC/TEP	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
TBD	Vail - Irvington 345 kV line	345 kV	TEP	CEC Not Yet Filed In-service date - TBD
TBD	Irvington - South 345 kV line	345 kV	TEP	CEC Not Yet Filed In-service date TBD
TBD	Rancho Vistoso-(Future) Sun City 138 kV line	138 kV	TEP	CEC Not Required - Catalina renamed to Sun City and deferred indefinitely
	Tortolita North Loop 345 kV line			CEC Not Yet Filed Deferred, new in-service date TBD
TBD		345 kV	TEP	
TBD	Tortolita-Winchester 500 kV line	500 kV	TEP	CEC Approved - Case #23
TBD	Winchester-Vail 345 kV line #2 and #3	345 kV	TEP	CEC Not Yet Filed
TBD	Vail-South 345 kV line - 2nd circuit	345 kV	TEP	CEC Not Required
TBD	Springerville-Greenlee 345 kV line - 2nd circuit	345 kV	TEP	CEC Not Yet Filed
TBD	Tortolita-South 345 kV line	345 kV	TEP	CEC Approved - Case #50
TBD	Westwing-South 345 kV line - 2nd circuit	345 kV	TEP	CEC Approved - Case #15

TBD	Future Gateway-Comision Federale de Electricidad 345 KV line	345 KV	TEP	CEC Approved - Case #111
TBD	Irvington-East Loop Project – Phase 3 – Irvington22nd Street 2 <sup>nd</sup> Circuit		TEP	CEC Approved – Case #66
TBD	Vail-East Loop – Phase 3 – Third Vail-East Loop 138 KV line	138 KV	TEP	CEC Approved – Case #8
TBD	Interconnection of Greenlee-Winchester 345KV line with future Willow Substation	345 KV	TEP, Bowie	CEC obtained by Southwestern Power Group – Case #118
TBD	Interconnection line -South-future Gateway 345 KV line	345 KV	TEP, UNISOURCE	CEC Approved - Case #111
TBD	Golden Valley 230 KV Project - McConico-Mercator Mill 230 KV line			CEC Not Yet Filed Customer has delayed project In- service date is delayed until customer specifies need date
TBD	Nogales Transmission line #2 - Gateway - Valencia	230 KV	UNISOURCE	CEC Approved - Case #111
TBD	Gateway 345/115 KV or 345/138 KV substations	345/115 KV & 345/138 KV	UNISOURCE	CEC Approved - Case #111
TBD	Valencia 115 KV substation expansion	115 KV	UNISOURCE	CEC Approved – Case #111
TBD	Test Track-Empire-ED4 230 KV line	230 KV	WAPA_SCWPDA	CEC Not Required
TBD	Wellton-Mohawk 230 KV Line Project	230 KV	WMIDD	CEC Not Yet Filed

Exhibit 21 – Listing of Projects by Voltage Class

In-Service Date	Description	Voltage	Participants	Permitting/Siting Status
2012	Delany – Palo Verde 500KV line	500 KV	APS	CEC Approved – Decision #68063
2010	Morgan-Pinnacle Peak 500 KV line	500 KV	APS, SRP	CEC Approved – Decision #69343
2014	Delany-Sun Valley 500 KV line	500 KV	APS, SRP, CAWCD	CEC Approved – Decision #68063
2016	Sun Valley-Morgan 500 KV line	500 KV	APS, SRP, CAWCD	CEC Approved – Decision #70850
2014	Palo Verde Hub-North Gila 500 KV #2 line	500 KV	APS, SRP, IID, WMIDD	CEC Approved – Decision #70127
TBD	Palo Verde-Saguaro 500 KV line	500 KV	CATS Sub-regional Planning Group	CEC Approved – Decision #46802
TBD	Hassayampa-Jobba 500 KV line	500 KV	GBPP	CEC Approved – Case #119 – Extension Request Pending
2011	Devers - Palo Verde 500 KV #2 line	500 KV	SCE	CEC Denied - Case #130
2013	Moenkopi-Eldorado 500 KV Series Capacitor Upgrade Project	500 KV	SCE, APS	CEC Not Required
TBD	Abel – RS20 500KV	500 KV	SRP	CEC Not Yet Filed
TBD	RS20 – Coronado 500KV	500 KV	SRP	CEC Not Yet Filed
2020	Pinal Central – Abel #2 500KV line	500 KV	SRP	CEC Not Yet Filed
TBD	Hassayampa - Pinal West 500 KV #2 line	500 KV	SRP, TEP, SWTC,ED2,ED3, ED4	CEC Approved – Case #124
2008	Hassayampa-Pinal West 500 KV #1 line	500 KV	SRP, TEP, SWTC,ED2,ED3, ED4	CEC Approved – Case #124
2014	Pinal West-Pinal Central – Randolph - Abel-Browning 500 KV line	500 KV	SRP, TEP, SWTC,ED2,ED3, ED4	CEC Approved - Case #126 Decisions #68093 and #69291

TBD	Tortolita-Winchester 500 kV line	500 kV	TEP	CEC Approved - Case #23
2014	Pinal Central-Tortolita 500 kV line	500 kV	TEP, SWTC, SRP, SunZia	CEC Not Yet Filed Deferred from 2011 to 2014
2008	Interconnection of Westwing-South 345kV with future Hassayampa-Pinal West 500 kV	345-500 kV	TEP	CEC Approved - Case #124 Project is in-service
TBD	Gateway 345/115 kV or 345/138 kV substations	345/115 kV & 345/138 kV	UNISOURCE	CEC Approved - Case #111
2012	345/69 kV Interconnection at Western's Flagstaff 345 kV bus	345 kV	APS	CEC Not Required
2013	Mazatzal Loop-in of Cholla-Pinnacle Peak 345 kV line	345 kV	APS	CEC Not Required
TBD	Winchester to Vail Double-Circuit 345 kV Line	345 kV	SWTC/TEP	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
TBD	Vail - Irvington 345 kV line	345 kV	TEP	CEC Not Yet Filed In-service date - TBD
TBD	Irvington - South 345 kV line	345 kV	TEP	CEC Not Yet Filed In-service date TBD
TBD	Tortolita North Loop 345 kV line			CEC Not Yet Filed Deferred, new in-service date TBD
TBD	Winchester-Vail 345 kV line #2 and #3	345 kV	TEP	CEC Not Yet Filed
TBD	Vail-South 345 kV line - 2nd circuit	345 kV	TEP	CEC Not Required
TBD	Springerville-Greenlee 345 kV line - 2nd circuit	345 kV	TEP	CEC Not Yet Filed
TBD	Tortolita-South 345 kV line	345 kV	TEP	CEC Approved - Case #50
TBD	Westwing-South 345 kV line - 2nd circuit	345 kV	TEP	CEC Approved - Case #15
TBD	Future Gateway-Comision Federale de Electricidad 345 kV line	345 kV	TEP	CEC Approved - Case #111
TBD	Interconnection of Greenlee-Winchester 345kV line with future Willow Substation	345 kV	TEP, Bowie	CEC obtained by Southwestern Power Group - Case #118
TBD	Interconnection line -South-future Gateway 345 kV line	345 kV	TEP, UNISOURCE	CEC Approved - Case #111
2014	La Canada-Orange Grove-Rillito 138 kV line	318 kV	TEP	CEC Not Yet Filed Deferred from 2013 to 2014

TBD	Jojoba Loop-in of TS4-Panda 230 KV line	230 KV	APS	CEC Approved – Decision #62960
TBD	Mural – San Rafael 230KV line	230 KV	APS	CEC Not Yet Filed
TBD	Sun Valley-Trilby Wash – 230 KV line # 2	230 KV	APS	CEC Approved – Decision #68063
TBD	Palm Valley-TS2-TS1 230 KV line # 2	230 KV	APS	CEC Approved – Decision #67828
TBD	Sun Valley-TS11-Buckeye 230 KV line	230 KV	APS	CEC Not Yet Filed
TBD	Sun Valley-TS10-TS11 230 KV line	230 KV	APS	CEC Not Yet Filed
TBD	Sun Valley-Morgan 230 KV line	230 KV	APS	CEC Approved – Decision #70850
TBD	Yucca-TS8 230 KV line	230 KV	APS	CEC Not Yet Filed
TBD	Westwing-EI Sol 230 KV line	230 KV	APS	CEC Approved – Docket#U-1345
TBD	Westwing-Raceway 230 KV line	230 KV	APS	CEC Approved – Decision#64473
2010	Morgan-Raceway-Avery-Scatter Walsh-Pinnacle Peak 230 KV line	230 KV	APS	CEC Approved – Decision #69343
2012	TS12 Loop-in of Saguaro-Casa Grande 230 KV line	230 KV	APS	Not Required
2014	Sun Valley-Trilby Wash - 230 KV line	230 KV	APS	CEC Approved – Decision #67828
2014	North Gila-TS8 230 KV line	230 KV	APS	To be Filed in 2010
2015	Palm Valley-TS2-Trilby Wash 230 KV line	230 KV	APS	CEC Approved - Decisions #66646 and #67828
2014	Sundance-Pinal Central 230 KV line	230 KV	APS, ED2	CEC Filed – Case #136
2014	Desert Basin-Pinal Central 230 KV	230 KV	APS, SRP	CEC Approved – Decisions #68093, #68291, #69183 and #69647
TBD	Santa Rosa-ED5 230 KV line	230 KV	SCWPDA, SPPR	CEC Not Yet Filed
TBD	ED5-Pinal South (Pinal Central) 230 KV line	230 KV	SCWPDA, SPPR	CEC Not Yet Filed
TBD	ED5-Marana 230 KV line	230 KV	SCWPDA, SPPR	CEC Not Yet Filed
TBD	Pinal Central (Pinal South) – Future substation 6 miles northeast 230 KV line #1	230 KV	SCWPDA, SPPR	CEC Not Yet Filed
TBD	Pinal Central (Pinal South) – Future substation 6 miles northeast 230 KV line #2	230 KV	SCWPDA, SPPR	CEC Not Yet Filed
TBD	Thunderstone-Santan 230 KV line #2	230 KV	SRP	CEC Not Yet Filed, if Needed
TBD	RS17 230 KV Loop-in line	230 KV	SRP	CEC Approved – Decisions #59791 and #60099
TBD	Dinosaur-RS21 230 KV line	230 KV	SRP	CEC Not Yet Filed

TBD	Rogers-Browning 230 kV line	230 kV	SRP	CEC Not Yet Filed
TBD	Silver King-Browning 230 kV line	230 kV	SRP	CEC Approved – Case #20
TBD	Silver King-Browning/Superior 230 kV tie	230 kV	SRP	CEC Not Yet Filed
TBD	Pinnacle Peak-Brandow 230 kV line	230 kV	SRP	CEC Approved – Case #69
TBD	Rogers-Corbell 230 kV line	230 kV	SRP	CEC Not Required
TBD	Silver King-Knoll-Future Hayden 230 kV line	230 kV	SRP	CEC Not Yet Filed
2011	Dinosaur – Abel – Randolph 230kV line	230 kV	SRP	CEC Approved – Case #126
2017	Abel – RS24-Moody (RS17) #1230 kV line (formerly RS17-RS24)	230 kV	SRP	CEC Approved – Decision #71441
2018	Abel – RS24 – Moody (RS17) #2 230kV line (formerly RS24-RS22/SEV)	230 kV	SRP	CEC Approved – Decision #71441
TBD	Kartchner to CS2 230 kV Line	230 kV	SWTC	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
TBD	San Rafael to CS2 230 kV Line	230 kV	SWTC	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
2016	Upgrade of Apache-Butterfield 230 kV line	230 kV	SWTC	CEC Not Yet Filed Project in-service date changed from TBD to 2016
2017	Butterfield to Bicknell 230 kV Line Upgrade	230 kV	SWTC	CEC Not Yet Filed; In-service date 2017
TBD	Golden Valley 230 kV Project - McConico-Mercator Mill 230 kV line			CEC Not Yet Filed Customer has delayed project In-service date is delayed until customer specifies need date
		230 kV	UNISOURCE	CEC Approved/Extended - Case #88
2016	Griffith-North Havasu 230 kV line	230 kV	UNISOURCE	Deferred to 2016, CEC Extension request not yet filled
TBD	Test Track-Empire-ED4 230 kV line	230 kV	WAPA, SCWPDA	CEC Not Required
TBD	Wellton-Mohawk 230 kV Line Project	230 kV	WMIDD	CEC Not Yet Filed
2008	Northeast 138 kV Static Var Compensator (SVC)	138 kV	0.00	CEC Not Required

						Project is in-service
TBD	Rancho Vistoso-(Future) Sun City 138 kV line	138 kV	TEP			CEC Not Required – Catalina renamed to Sun City and deferred indefinitely
TBD	Vail-East Loop – Phase 3 – Third Vail-East Loop 138 kV line	138 kV	TEP			CEC Approved – Case #8
2008	Loop existing West Ina -Tucson 138 kV line	138 kV	TEP			CEC Approved - Case #62 Project is in-service
2008	Tortolita-North Loop-Rancho Vistoso and Tortolita-Rancho Vistoso corridor expansion and reconfiguration Project - Phase 1	138 kV	TEP			CEC APPROVAL Case # 149 Project is in-service
2010	Tortolita-North Loop-Rancho Vistoso and Trotolita-Rancho Vistoso corridor expansion and reconfiguration Project - Phase 2 Corridor Expansion	138 kV	TEP			CEC Approved – Case #149 Project in-service delayed to Q4 2010
2010	Vail-Cienega-Spanish Trail Project - Phase 1 - Vail-Cienega 138 kV line	138 kV	TEP			CEC Approved – Case #137 Cienega extension is in-service
2010	East Loop-Northeast 138 kV line	138 kV	TEP			CEC Approved – Case #47 Project is in-service. Final public improvement portions were completed in 2009
2011	TEP System – Rosemont 138 kV line	138 kV	TEP			CEC Not Yet Filed In-service date - 2011
2011	DeMoss Petrie-Tucson 138 kV line	138 kV	TEP			CEC Not Yet Filed Deferred from 2010 to 2011
2012	South-Duval CLEAR - Phase 2b - Extend 138 kV line from Canoa Ranch-(Future) Duval	138 kV	TEP			CEC Approved - Case #84 Moved forward from 2013 to 2012
2013	Northeast-Snyder 138 kV Tap for Craycroft-Bairril substations	138 kV	TEP			CEC Not Required Deferred from 2011 to 2013
2013	Vail-East Loop – Phase 4 – Harrison Tap of Roberts-East Loop 138 kV line	138 kV	TEP			CEC Approved – Case #8 In-service date changed from TBD to 2013
2015	Vail-UA Tech Park-Irvington 138 kV line	138 kV	TEP			CEC Not Yet Filed In-service Date - 2015

2015	Tortolita Rancho Vistoso 138 kV tap for future Naranja substation	138 kV	TEP	CEC Not Yet Filed Deferred from 2010 to 2015
2015	Irvington-Kino-UA Med-Tucson 138 kV line			CEC Not Yet Filed Line and Kino Substation scheduled for 2015. UA Med Substation scheduled for 2019
2015	Extend Midvale-(Future) Spencer-(Future) San Joaquin 138 kV line	138 kV	TEP	Combined with project 2019-89
2015	Tortolita-Marana-North Loop Project - Phase 1 - Tortolita-Marana 138 kV line	138 kV	TEP	CEC Not Yet Filed Deferred from 2013 to 2015
2015	South-Hartt-Green Valley 138 kV line	138 kV	TEP	CEC Not Required Deferred from 2013 to 2015
2016	Del Cerro-Anklam-Tucson 138 kV line	138 kV	TEP	CEC Not Yet Filed In-service date - 2016
2016	Irvington-Corona-South 138 kV line	138 kV	TEP	CEC Not Yet Filed Deferred from 2013 to 2016
2017	Orange Grove-East Ina 138 kV line	138 kV	TEP	CEC Not Yet Filed
2018	Midvale-Spencer-Medina-Raytheon-South 138 kV line	138 kV	TEP	CEC Not Yet Filed Spencer extension deferred from 2013 to 2015 Loop-in for SS NO 22 (renamed Medina) moved forward from 2019 to 2018 Added loop-in for Raytheon Substation scheduled for 2019
2014	Gateway-Sonoita 138 kV line	138 kV	UNISOURCE	CEC Not Yet Filed
TBD	New Hayden 115 kV Station Loop-in	115 kV	SRP	CEC Not Yet Filed
TBD	Pantano to Kartchner 115 kV Line Upgrade	115 kV	SWTC	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
2010	Saguaro-Naviska 115 kV line	115 kV	SWTC	Project renamed to Saguaro to North Loop; CEC approved - Case

					# 149; Deferred from 2009 to 2010
2010	Valencia-CAP Black Mountain 115 kV line	115 kV	SWTC	CEC Approved – Case # 152; Deferred from 2009 to 2010	
2010	CAP 115 kV line loop-in to SWTC Sandario	115 kV	SWTC	CEC Approved – Case # 152; Deferred from 2009 to 2010	
2010	Naviska-Thornydale 115 kV line	115 kV	SWTC	Project replaced by Saguaro to North Loop Project; CEC Approved – Case # 149; Deferred from 2009 to 2010	
2010	Thornydale-Rattlesnake 115 kV line	115 kV	SWTC	Project replaced by North Loop to Rattlesnake Project; CEC Approved – Case # 152; Deferred from 2009 to 2010	
2011	Marana-Avra Valley 115 kV Line Upgrade	115 kV	SWTC	CEC Not Yet Filed; Deferred from 2010 to 2011	
2011	Avra Valley-Sandario Tap 115 kV Line Upgrade	115 kV	SWTC	CEC Not Yet Filed	
2011	Marana Tap-Marana 115 kV Line Upgrade	115 kV	SWTC	CEC Not Required In-service date changed from 2012 to 2011	
2014	Apache/Hayden-San Manuel 115 kV line	115 kV	SWTC	CEC Approved – Case # 142; Deferred from 2010 to 2014	
2014	Sandario Tap- Three Points 115 kV Line Upgrade	115 kV	SWTC	CEC Not Yet Filed Deferred from 2011 to 2014	
2014	Three Terminal Plan Circuit 1 Participation	115 kV	SWTC	CEC Not Yet Filed; In-service date 2014	
2014	Three Terminal Plan Circuit 2 Participation	115 kV	SWTC	CEC Not Yet Filed; In-service date 2014	
2014	Three Terminal Plan Circuit 3 Participation	115 kV	SWTC	CEC Not Yet Filed; In-service date 2014	
2015	Saguaro to Adonis 115 kV Line Loop-in to Naviska	115 kV	SWTC	CEC Not Required; In-service date 2015	
2018	CAP 115 kV Line Loop-in to Picture Rocks	115 kV	SWTC	CEC Not Required; In-service date 2018	
TBD	Valencia 115 kV substation expansion	115 kV	UNISOURCE	CEC Approved – Case # 111	

2012	Upgrade existing 115 kV transmission line to Nogales	115 kV	UNISOURCE	CEC Approved - Case #111 2012 Completion date
2010	Bowie Power Project		BOWIE	CEC Approved - Decision #64626
TBD	Arlington Power Plant		Dynegy Arlington Valley	CEC Approved - Decision #64357
TBD	Greenlee switching station through Hidalgo to Luna		ELPE,PNM, TXNMPC	CEC Approved - Case #21
TBD	Gila Bend Power Plant		GBPP	CEC Approved - Case#109 - Extension Expires 4/2011
2011	Pinal South-Southeast Valley/RS22		SRP	CEC Approved - Decisions #68093 and #69291
2014	RS26-Fountain Hill substation		SRP	CEC Not Yet Filed
2013	SunZia Project		SWPG, SRP, TEP, ECP, Shell, TSGT	CEC Not Yet Filed
TBD	CS2 Substation		SWTC	CEC Not Yet Filed; In-service date TBD (Outside of Ten Year Plan Horizon)
TBD	Irvington-East Loop Project - Phase 3 - Irvington2nd Street 2 <sup>nd</sup> Circuit		TEP	CEC Approved - Case #66
TBD	Nogales Transmission line #2 - Gateway - Valencia		UNISOURCE	CEC Approved - Case #111
2010	White Hills substation		UNISOURCE	CEC Not Required

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2009-1	Sugarloaf Loop-in of Coronado-Cholla 500 kV line	APS, SRP	0.95	CEC Not Required
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2009-2	DugasVV01 Loop-in of Navajo-Westwing 500 kV line	APS	0.95	CEC Not Required
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2009-30	Milligan Loop-in of Saguaro-Casa Grande 230 kV line	APS	0.95	Not Required
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22-Spanish Trail Project  
- Phase 3 - Cienega-SS N020 138 kV line

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Tortolita-Marana-North Loop Project - Phase 2 - Marana-SS N01-North Loop 138 kV line

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TBD-42	North Gila-Yucca 230 kV line	APS	TBD	CEC
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