

SunZia Southwest Transmission Project

WECC Phase 2 Path Rating Study



WECC PEER REVIEW GROUP MEETING #2
TEMPE, ARIZONA
FEBRUARY 10, 2010



Agenda

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- INTRODUCTION
- PROJECT OVERVIEW AND STATUS
- STUDY SCOPE UPDATE
- SUNZIA NON-SIMULTANEOUS RESULTS
- SIMULTANEOUS STUDY-NEXT STEP
- PARALLEL STUDY UPDATE
- STUDY SCHEDULE UPDATE

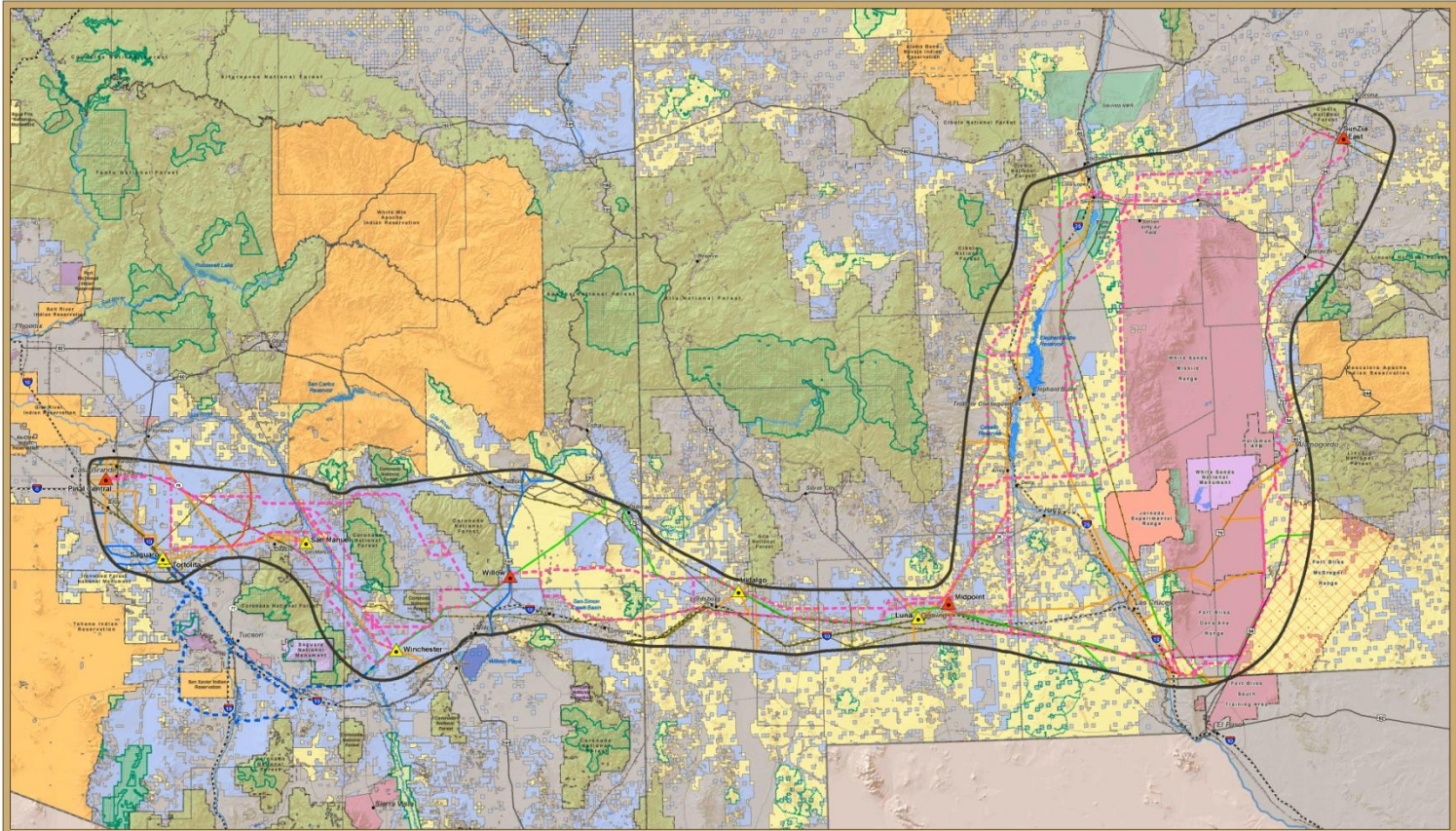
Project Overview and Status

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- The Proponents of the SunZia Southwest Transmission Project are proposing to construct two new ~460-mile long transmission lines between New Mexico and Arizona. The planned operating date is early 2014.
- The proposed rating is 3,000 MW non-simultaneous.
- The Project is needed to provide New Mexico and Arizona with renewable energy from the Southwest.
- Increase the transfer capability and reliability across the SWAT region.
- Make efficient use of available transmission corridors.

SunZia Transmission – Proposed Route

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LEGEND

<p>Project Features</p> <ul style="list-style-type: none"> Study Area Alternative Routes Routes Subject to Feasibility Study Proposed Substation 	<p>Existing Utilities</p> <ul style="list-style-type: none"> 110kV Transmission Line 230kV Transmission Line 345kV Transmission Line 500kV Transmission Line Pipeline (Diameter: 6") Existing Substation 	<p>Reference Features</p> <ul style="list-style-type: none"> City River/Stream Lake/Reservoir State Highway US Highway Interstate Railroad State Boundary County Boundary Jurisdictional Boundary Wilderness Area Wilderness Study Area 	<p>Land Ownership</p> <ul style="list-style-type: none"> Bureau of Land Management Military BLM Withdrawal National Park Service U.S. Forest Service Indian Reservation Federal/Other U.S. Fish and Wildlife Service State Trust Land Local or State Parks Private/Other
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Alternative Routes

January 29, 2010

SunZia Southwest Transmission Project

Project Location

Sources:
 AZ Blue Book
 AZ State Land Department and ARLIS 2008
 GISD 2008/2009, Western RMP 1998
 US AR 2008
 The County RMP 2008
 FWS 2008/2009
 USFS 2008/2009
 ©2008 Photo, A Division of The McGraw-Hill Companies
 01008, EPA, Inc. 2008



SunZia Non-Simultaneous Results – Summary

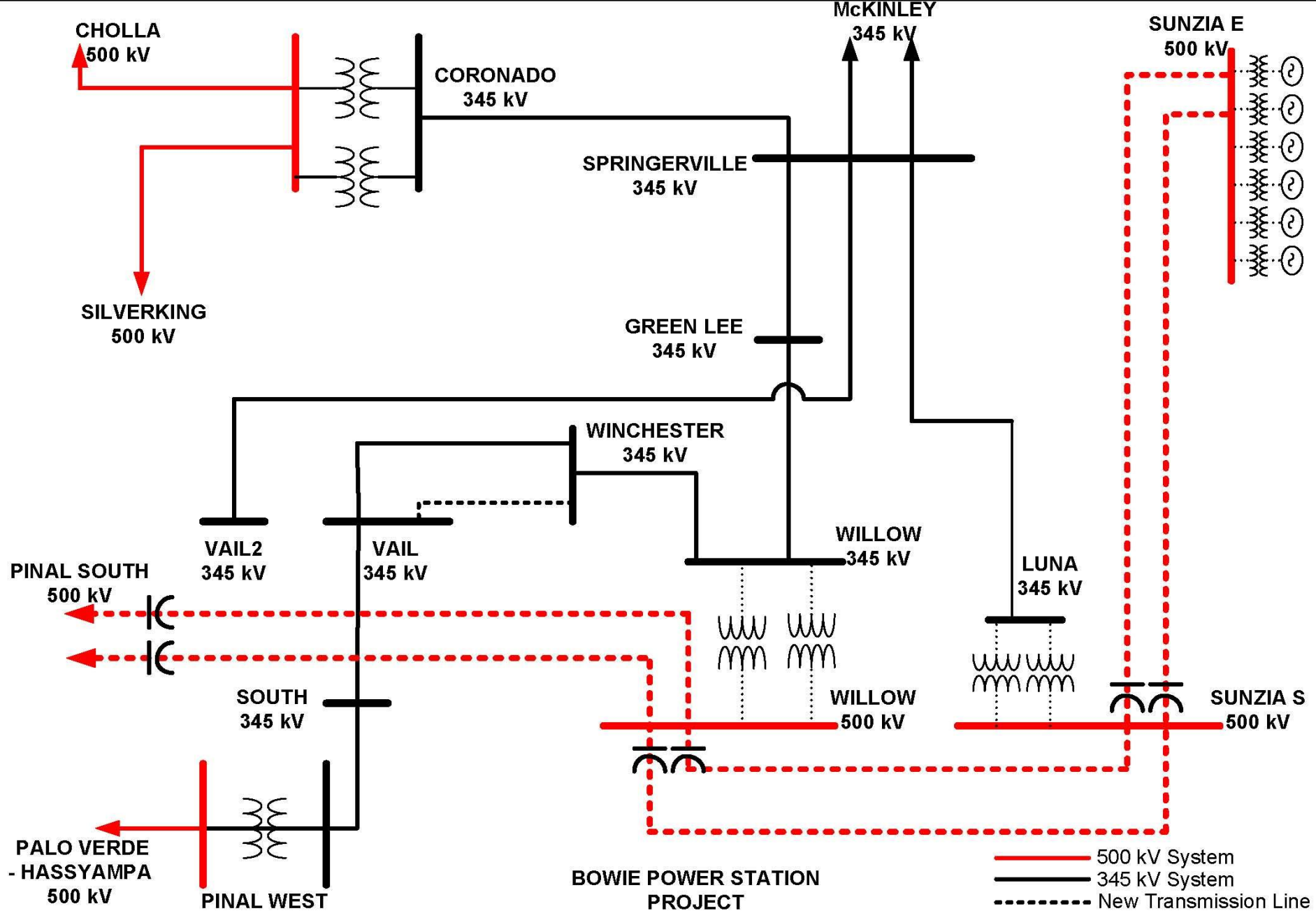
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- Original “Plan of Service” still valid to achieve a 3,000 MW rating
- Criteria Met for:
 - Power Flow-Thermal & Voltage
 - Transient Stability
 - Post-Transient

Plan of Service

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- Two New 500 kV lines from SunZia E to SunZia S (205 mile each)
- Two New 500 kV lines from SunZia S to Willow (122 mile each)
- Two New 500 kV lines from Willow to Pinal Central (134 mile each)
 - Sensitivity of one line to Pinal Central and one line to Tortolita
- New SunZia S 500 kV Substation with up to two 500/345 kV transformers (360 MVA each)
- New Willow 500 kV Substation with up to two 500/345 kV transformers (360 MVA each)
- All New 500 kV lines will have 50% to 70% series compensation
- An equivalent of 400MVAR of Static Var compensator (SVC)



SUNZIA SOUTHWEST TRANSMISSION PROJECT
CONCEPTUAL ONE-LINE DIAGRAM

(N-1) Power Flow Result-Summary

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- **2013 Heavy Summer**

- SunZia E-SunZia S 500kV #1 (99.1% Rating)
- SunZia S- Willow 500kV #1 (92.4 % Rating)

- **2013 Heavy Winter**

- SunZia E-SunZia S 500kV #1 (99.3% Rating)
- SunZia S- Willow 500kV #1 (89.6 % Rating)

(N-2) Power Flow Result-Summary

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- **2013 Heavy Summer**

- *Winchester-Vail 345kV Overload (106.8%) for Greenlee-Willow & Springerville-Vail2 Outage (RAS: Reducing SunZia Generation by 650 MW)*
- *Winchester-Vail 345kV Overload (105.0%) for Springerville-Greenlee & Springerville-Vail2 Outage (RAS: Reducing SunZia Generation by 500 MW)*

- **2013 Heavy Winter**

- *None*

Sensitivity Power Flow Result-Summary

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<u>Sensitivity</u>	<u>Additional Violation</u>	<u>Additional Mitigation</u>
PNM/EPE 500MW	None	None
TEP/EPE 500MW	None	None
TEP 1000MW	None	None
Bowie & Luna Gen Off-Line	None	None

(N-1) Stability Results-Summary

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- Severity ranking was indicated as follows:
 - A three-phase fault at SunZia E 500kV bus with loss of one SunZia E- SunZia S 500kV line and generation tripping of 1500 MW
 - A three-phase fault at SunZia S 500kV bus with loss of one SunZia S- Willow 500kV line and generation tripping of 500 MW
 - A three-phase fault at Willow 500kV bus with loss of one Willow-Pinal_C 500kV line
 - 400 MVAR of SunZia SVC was modeled
 - All other cases tested met the voltage dip, damping and frequency deviation limits

(N-2) Stability Results-Summary

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Severity ranking was indicated as follows:

- A three-phase fault at SunZia E 500kV bus with loss of two SunZia E- SunZia S 500kV line and generation tripping of 3000 MW
 - A three-phase fault at SunZia S 500kV bus with loss of two SunZia S- Willow 500kV line and generation tripping of 2000 MW
 - A three-phase fault at Willow 500kV bus with loss of two Willow-Pinal_C 500kV line and generation tripping of 1500 MW
- All other cases tested met the voltage dip, damping and frequency deviation limits

Sensitivity Stability Results-Summary

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<u>Sensitivity</u>	<u>Violation</u>	<u>Additional Mitigation</u>
Wind Type 3	No	None
3000MW Wind	No	None
2000MW Wind 1000MW Thermal	No	None
No Qgen for Wind	No	None
No SVC @ SunZia E	No	None

(N-1) Post-Transient Results-Summary

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Severity ranking was indicated as follows:

- Loss of one SunZia S- Willow 500kV (Tripping 500MW Gen)
(Willow 500kV drop 2.4% in HS Vs. 2.4% in HW)
- Loss of one Willow-Pinal_C 500kV line (No Gen Tripping)
(Willow 500kV drop 2.3% in HS Vs. 2.3% in HW)
- Loss of one Winchester-Vail 345kV line
(Vail 345kV drop 3.1% in HS Vs. 1.2% in HW)
- All other N-1 cases tested met the 5% voltage deviation limit

(N-2) Post-Transient Results-Summary

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Severity ranking was indicated as follows:

- Loss of Winchester-Vail & Springerville-Vail2 345kV Lines (With RAS of Tripping Gen & Adding Shunt Cap)
(Vail 345kV drop 7.4% in HS Vs. 4.2% in HW)
- Loss of Two Willow-Pinal_C 500kV Lines (No RAS)
(Vail 345kV drop 5.6% in HS Vs. 4.6% in HW)
- Loss of Two SunZia S-Willow 500kV (Tripping 2000MW Gen)
(Greenlee 345kV drop 4.7% in HS Vs. 3.7% in HW)
- All other N-2 cases tested met the 10% voltage deviation limit

Simultaneous Studies

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- Evaluate SunZia Simultaneous Impacts with the following Path:
 - Path 47 (NM1): 1048 MW
 - Path 48 (NM2): 1970 MW
 - Path 54 (COR-SKG): 1494 MW
 - Path 50 (CHO-PPK): 1200 MW
 - Path 22 (Four Corners West): 2325 MW
 - Path 66 (COI): 4800 MW
- Mitigations will be developed if any violations are discovered in power flow, stability and post-transient criteria limits.

Sensitivity Studies

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- **Projects Similarly Situated**
 - Path 51 (Navajo South) at 3200 MW
- **Projects Not Similarly Situated**
 - Collection System
 - High Plains Express
 - PNM Connection
 - Springerville Injection
- **Luna/Hidalgo/SunZia S Substations**
- **Willow-Tortolita 500kV Line Alternative**

Sensitivity Analyses Scope

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- Studies will be limited to running the sensitivity case on the non-simultaneous basis and under the most critical contingency only.
- If criteria violations are found, no attempt at identifying mitigation measures will be pursued.
- Study results to be used only for information purpose.

Parallel Studies

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- Switchable Shunt Line Reactors Study
- RAS Arming Study
 - Generation & Load Drop Sizes & Locations
 - Arming
- Short Circuit
- Others ?

Phase II Rating Study Milestone Schedules

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- Develop Draft Working Study Plan 08/20/09 X
- PRG Meeting #1 08/27/09X
- Develop Pre-Project Base Cases 09/18/09X
- Finalize Working Study Plan 09/25/09X
- Develop Post-Project Non-Simultaneous Cases 10/15/09X
- Complete Non-Simultaneous Studies 12/25/09X
- PRG Meeting #2 01/07/10 to 02/10/10
- Develop Simultaneous Base Cases 01/15/10 to 03/01/10
- Complete Simultaneous Studies 05/28/10
- PRG Meeting #3 06/18/10
- Develop Sensitivity Base Cases 06/25/10
- Complete Sensitivity/Parallel Studies 09/10/10
- Draft Report 09/30/10
- PRG Meeting #4 10/08/10
- Final Report 10/15/10



**SunZia Southwest Transmission Project
MINUTES
WECC Phase 2 Peer Review Group Meeting #2**

Date of Meeting: Wednesday, February 10, 2010
10:00 AM to 2:00 PM MST

Location of Meeting: PDS Offices, Tempe, Arizona

Utility Companies/Organizations & Attendees Representing:

Salt River Project (SRP):

Ramirez, Maria
Hernandez, John

Shell WindEnergy (SWE):

Chen, Grant

El Paso Electric (EPE):

Tumarin, Boris

Tucson Electric Power Company (TEP):

Patton, Ryan
Trent, Gary

Project Management Group (PDS):

Etherton, Mark
Hsu, Jim
Chavez, Evan

Arizona Public Service Company (APS):

Kokanos, Barrie

Public Service Company of New Mexico (PNM):

Reedy, Karen

Kleinfelder:

Hutton, Phil

Agenda Items:

1. Introduction

This was the second meeting for the SunZia WECC Phase 2 Peer Review Group. One additional meeting will occur during the course of the study and a final one in October prior to the completion of the Phase 2 study. The meeting was kicked off by Mark Etherton (Assistant Project Manager) introducing himself, followed by the attendees' self introduction. Mark went on to briefly summarize the SunZia Project as follows:

2. Project Overview and Status

- Project Participants: Overview of the six (6) project development partners, including the recent addition of Tri-State Generation and Transmission to the Project.
- Project Study Area: Mark discussed the transmission project corridor and possible alternative routes. The routing may have a minor impact on the overall line impedance and will be monitored throughout the permitting process that is currently running in parallel with the rating studies.
- The WECC 3-Phase Rating process and overview was discussed. Most recently, WECC granted SunZia Phase 2 status and a non-simultaneous rating of 3000 MW on July 27, 2009.
- An overview of the Plan of Service was discussed as currently identified in the Comprehensive Progress Report (CPR).
- The potential need for a 400 MVAR SVC at the SunZia East switching station was discussed, and will be a placeholder as various wind turbines are identified.
- The plans for SunZia paralleling the existing transmission system were discussed. In most cases, approximately 1,000 to 1,500 feet of separation may be required.
- The group discussed the EIS permitting process, status of the Scoping Meetings, and the Cooperating Agencies currently participating in the EIS.
- SunZia's proposed In-Service date is currently the beginning of 2014, however a single 500kV line staging development plan will be assessed and reviewed in the Phase 2 study as phasing of the Project may be required.

3. Comments on Permitting

- Permitting now includes an expanded study area around White Sands Missile Range.
- The Department of Defense (DOD) is concerned about how the transmission lines will impact their operations.
- There are potential issues for routes proposed north of Highway 380 in NM because of the DOD flight path and possible avian fly-way conflicts between two wildlife refuges. An underground crossing of the Rio Grande is being evaluated for inclusion in the draft

EIS. This effort was briefly discussed as a potential mitigation to the concerns raised by the two wildlife refuges.

- One of the alternate routes follows the TEP twin circuit 345kV lines from the Willow area towards the existing Winchester substation. This area may need additional separation for mitigation of any common corridor technical findings.
- Other environmental concerns have been expressed along potential routes in AZ, and will be fully reviewed as part of the draft EIS as well.

4. Study Scope

Jim Hsu summarized the main points of the study results. A number of Phase 2 study results summaries were e-mailed and distributed to the PRG prior to the meeting. This meeting discussed and highlighted the study results; various study sensitivities; and adjustment of the study's milestone schedule according to possible system development changes.

A. Non-Simultaneous Study

- Reconfirm 3,000MW Non-Simultaneous rating, the internal SunZia generation composition change as well as transmission network changes were evaluated.
- The group reviewed and discussed in detail the study results from the SunZia wind generator models/data variations and reactive power support sensitivities. The results of sensitivities for evaluating the impact by the different dispatch assumptions for the external system such as the Luna and Bowie power plant's operating conditions were reviewed and discussed.

The following are on-going task activities:

- Optimize SVC requirements – in particular related to economic size and the best location vs. wind generator model/type.
- Optimize Special Protection System (SPS)—based on the updated system configuration changes to search for an optimum scheme in the event of the most critical disturbance condition.

B. Simultaneous/Sensitivity Study

The future task activities are listed below:

- The objective of the simultaneous study is to determine possible interactions between the SunZia Southwest Transmission Project path and the adjacent existing major paths. Five possible interaction paths in the interconnected vicinity were identified. Two paths (#47 & #48) in New Mexico and three paths (#22, #50 & #54) in Arizona.
- In addition, interaction with the California-Oregon Intertie (COI) path needs to be evaluated in the event of N-2 outage of the SunZia transmission lines that resulted in tripping all SunZia generation (3,000MW). It was suspected a same consequence of Palo Verde G-2 loss (approximately 2,800MW).

- The PRG agreed that the identified path will be stressed to the maximum capacity rating level under the pre-project operating conditions by the operating agent of the specific path as benchmark; and the post-Project would then be added to determine the potential interaction. It was a general consensus to use the same operating nomogram scope and methodology as used in the past WECC Operating Study approach.
- At the last PRG meeting, Barrie Kokanos of APS wanted to include Path 51 (Navajo South) of 3,200 MW for simultaneous/sensitivity evaluation.

5. Responses to Comments on WECC Phase 1, Comprehensive Progress Report

The comments were previously discussed and deemed acceptable for incorporation to the Phase 2 study items. The following specific comments were recaptured and need to be remedied:

- PNM and TEP comments related to the use of future generation project assumptions in determining the WECC new project path rating. This is not a unique issue and will be the same to apply to all other new transmission projects associated with renewable generation resources.
- PNM commented on the use of certain types of wind generator model/data in our Phase 1 study in determining the WECC new project path rating. It used GE Type#2 dynamic model with typical data in the study. PNM suggested using GE Type#3 dynamic models/data in the Phase 2 study. Since SunZia has not yet acquired wind generator turbine suppliers, we will collect all sources of technical information and select the appropriate model/data for the Phase 2 study. SunZia will manage this issue based on known WECC policy and guidelines related to the power system transfer capability requirements and the system limitations associated with wind generation models/data.
- SRP commented on “How are the following projects going to affect the SunZia path rating: a. Collection System, b. High Plains Express (HPX), c. PNM Connection and d. Springerville Injections. Those four projects as mentioned have not been clearly defined and are not in service at this time; therefore, no such system models/data are available for inclusion in our Phase 2 studies. We plan to evaluate the impact on the path ratings in a manner appropriate for any similarly situated projects and sub-regional projects to the extent these projects and sub-projects have developed a preferred plan of service that can be modeled in the rating studies.

6. Parallel Studies

- A number of parallel study items will be conducted to meet local and operational requirements. Study items include: switchable shunt reactor study, short circuit study, transmission common corridor outage study and construction phase study, etc.

- Voltage and reactive control study has been raised and will be a part of the Phase 2 study item to determine reactive control equipment requirements. It may fall into the engineering and design study phase when wind generator vendors are known.

7. Study Schedule:

- An updated list of Phase 2 rating study milestone schedules was presented and discussed.
- The Phase 2 study will cover approximately a one-year time span and is expected to extend its completion by October 2010.
- The draft report should be circulated during September 2010 and a final report submitted to WECC by October 2010.
- WECC Phase 3 status is expected to be granted by November 2010.

8. Action Items:

- Review of sensitivity study results: Jim Hsu will send out a number of sensitivity cases to the potentially impacted parties. Comments are needed by March 18.
- Development of simultaneous base cases: A number of various simultaneous base cases need to be developed by the owners of the affected paths by March 1st.

9. References:

The following list summarizes the references which led to the discussions at this meeting:

- 1) SunZia PRG Meeting #1 Minutes
- 2) SunZia Summary Materials (Power Point Presentation Slides)
- 3) SunZia PRG Meeting#2 Attendance List

10. The meeting adjourned at 2:00 PM.

