

## **The Relationship of the Bowie, Arizona, Power Plant to the Evolution and Scope of the SunZia Project**

**Norm “Mick” Meader of the Cascabel Working Group, September 17, 2010**

### **Summary**

1. *Fall 2006*: The original proposed SunZia configuration is centered around the Bowie power plant, with single 500-kV lines going east and west from the plant. The line to the west is routed through the Winchester substation and down the San Pedro Valley to reach southeast Phoenix. The eastern line ends near the Luna substation at Deming, New Mexico.
2. *August 2007*: In the next iteration of the project, the terminus of the eastern 500-kV line is moved to somewhere near El Paso (no distinct point defined). The Newman power station at El Paso is considered a possibility by *Energy Prospects West*. At this time the SunZia project does not connect directly with wind-energy generation areas. SunZia presumes that transmission from these areas to the SunZia terminus will be built by other entities.
3. *October 2007*: A presentation by Mark Etherton of SunZia at a Southwest Area Transmission (SWAT) meeting shows that the two principal potential purchasers of SunZia transmission capacity are the Bowie power plant and several unnamed power-generation facilities in New Mexico. This presentation shows the project terminus to be El Paso and indicates that the project was initiated in June 2006.
4. *January 2008*: SunZia’s presentation to the New Mexico Renewable Energy Transmission Authority provides the first official map of the SunZia Project, showing it centered on the Bowie power plant and terminating to the east at the Afton substation between Deming and El Paso. To the west the line is as previously described, running through the Winchester substation to southeast Phoenix.
5. *July 2008*: A presentation to a Southeast Arizona Transmission Study (SATS) meeting finally shows the current proposed SunZia route between Corona, New Mexico, and Phoenix, with the interconnection with the Bowie plant replaced by an interconnection with the Willow substation.
6. The Willow substation was originally proposed and approved by the Arizona Corporation Commission in March 2002 as part of the Bowie power plant project and was not conceived as a part of the SunZia Project. SunZia would incorporate a 500-kV transformer into the Willow substation plan, presumably to take on Bowie power.

## **The Relationship of the Bowie, Arizona, Power Plant to the Evolution and Scope of the SunZia Project**

The earliest formal discussion concerning the SunZia Southwest Transmission Project seems to have occurred at a Southwest Area Transmission (SWAT) meeting held in October of 2006<sup>1</sup>. A summary of Mr. Etherton's remarks taken from these minutes is as follows (italics added for emphasis):

*SWAT Meeting Minutes 10.18.06 Las Vegas*

**Sun Zia SW Transmission Project:** Mark Etherton reported.

- *Two 500 kV lines out of Bowie, one going east, one going west.*
- *Will create transmission path from southern New Mexico to southern Arizona.*
- Target in service - as early as 2011.
- Proposed as participation project.
- Open season participation letter expected end 2006/early 2007.
- Development agreement targeted mid 2007.
- Segments targeted to be permitted within 24-36 months.
- *Southwest Power Group interested in 50% ownership.*

In his associated PowerPoint presentation<sup>2</sup> Etherton discusses principally the transmission needs and impacts of the Southwestern Power Group's (SWPG's) Bowie power plant. He notes that the plant could connect to the extra-high-voltage grid in southern Arizona in two possible ways: (1) through TEP's 345-kV Springerville-to-Tucson lines, or (2) by building a new 500-kV line from Bowie to the Winchester substation to connect with CATS/SATS's (Central Arizona Transmission System/ Southeast Arizona Transmission Study) proposed 500-kV line from the Southwest Valley area near Phoenix down the San Pedro River Valley to provide a transmission link to east Tucson. In his final slide, Etherton proposes combining the CATS/SATS 500-kV line with 500-kV lines running east and west from the Bowie power plant to form the SunZia Project (Figure 1). This initial formulation of the project did not address collecting and distributing renewable energy, just conventional power distribution.

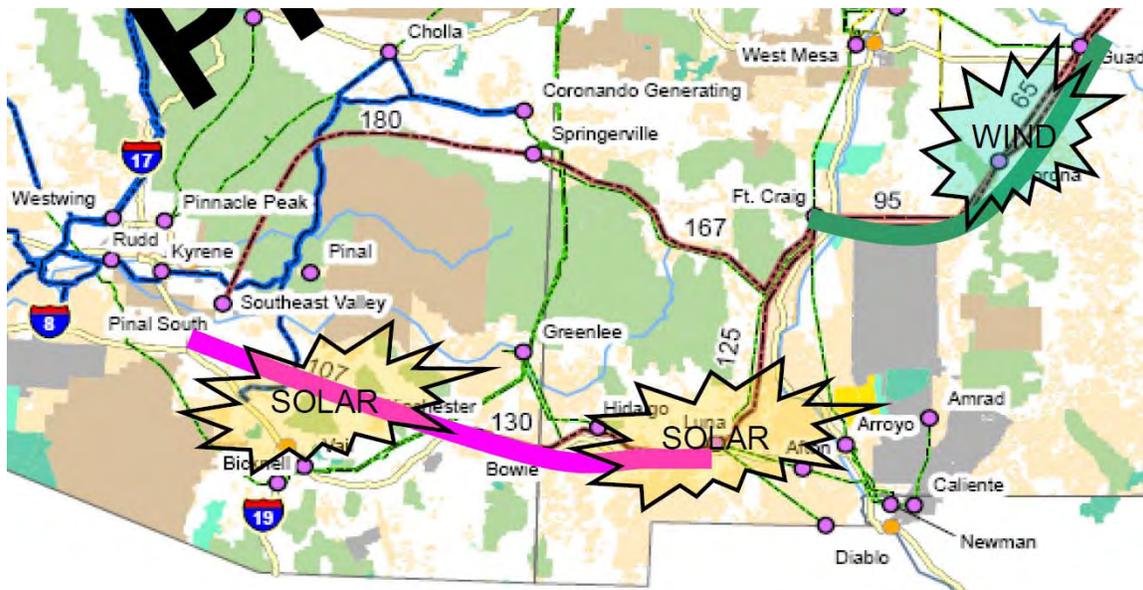
This indicates that as originally conceived, the SunZia Project was a much smaller project restricted to southern Arizona and southern New Mexico. In this initial design, single-circuit 500-kV lines went east and west from the Bowie plant, with the westerly line as noted above and the easterly line terminating near the Luna substation at Deming (Figure 2). In later versions of this early design, SWPG/SunZia suggested permitting the right-of-way for two 500-kV lines. Both the SunZia Southwest Transmission Project and the Bowie power plant are proposed and overseen by the Southwestern Power Group.

Figure 2, an older, initial map included in a 2010 presentation of the HPX Project to stakeholders<sup>3</sup>, bears this out. Initially the 500-kV line proceeding east from the Bowie plant terminated at the Luna substation near Deming, New Mexico, and the connection of SunZia to the wind-generating area in central New Mexico was to be provided by the High Plains Express Project (HPX). In mid-2008 the SunZia Project was expanded to incorporate the full extent of the HPX line to central New Mexico, creating a single transmission project to link Arizona with this wind-generating area.

## SunZia Southwest Project

- Bowie (SWPG II) interested in assisting with development of new 500kV line in/out Bowie
- Southern New Mexico to Southern Arizona with segments in-service as early as 2011
- Participation Project with other interconnections as requested by Participants (e.g. Luna, Winchester, etc.)
- Continued feasibility review through 2006 and assess any preliminary “fatal flaw” environmental issues
- “Open Season” letter end of 2006/early 2007
- Estimate start of development by mid-2007
- Estimate segments to be permitted 24-36 months

**Figure 1.** The initial formulation of the SunZia Project as presented by Mark Etherton at the SWAT Steering Committee meeting on October 16, 2006, incorporating the Bowie power plant into the project<sup>2</sup>. The 500-kV line to the west from Bowie would tie into the Winchester substation and the 500-kV line proposed down the San Pedro Valley by CATS/SATS (Central Arizona Transmission System/Southeast Arizona Transmission Study).



**Figure 2.** The original configuration of the High Plains Express (HPX) and SunZia Projects<sup>3</sup>. The wide purple line is the extent of the SunZia Southwest Transmission Project as of late 2006. In an October 2007 version of the project (Figure 5), the eastern terminus was extended to the Afton substation. The wide green line is the proposed wind-energy collection system for Public Service Company of New Mexico. HPX 500-kV lines are shown as thin, red lines. The HPX project originally contained two full routes to Phoenix from central New Mexico, including the SunZia portion shown here. Green lines are current 345-kV lines, and blue lines are current 500-kV lines.

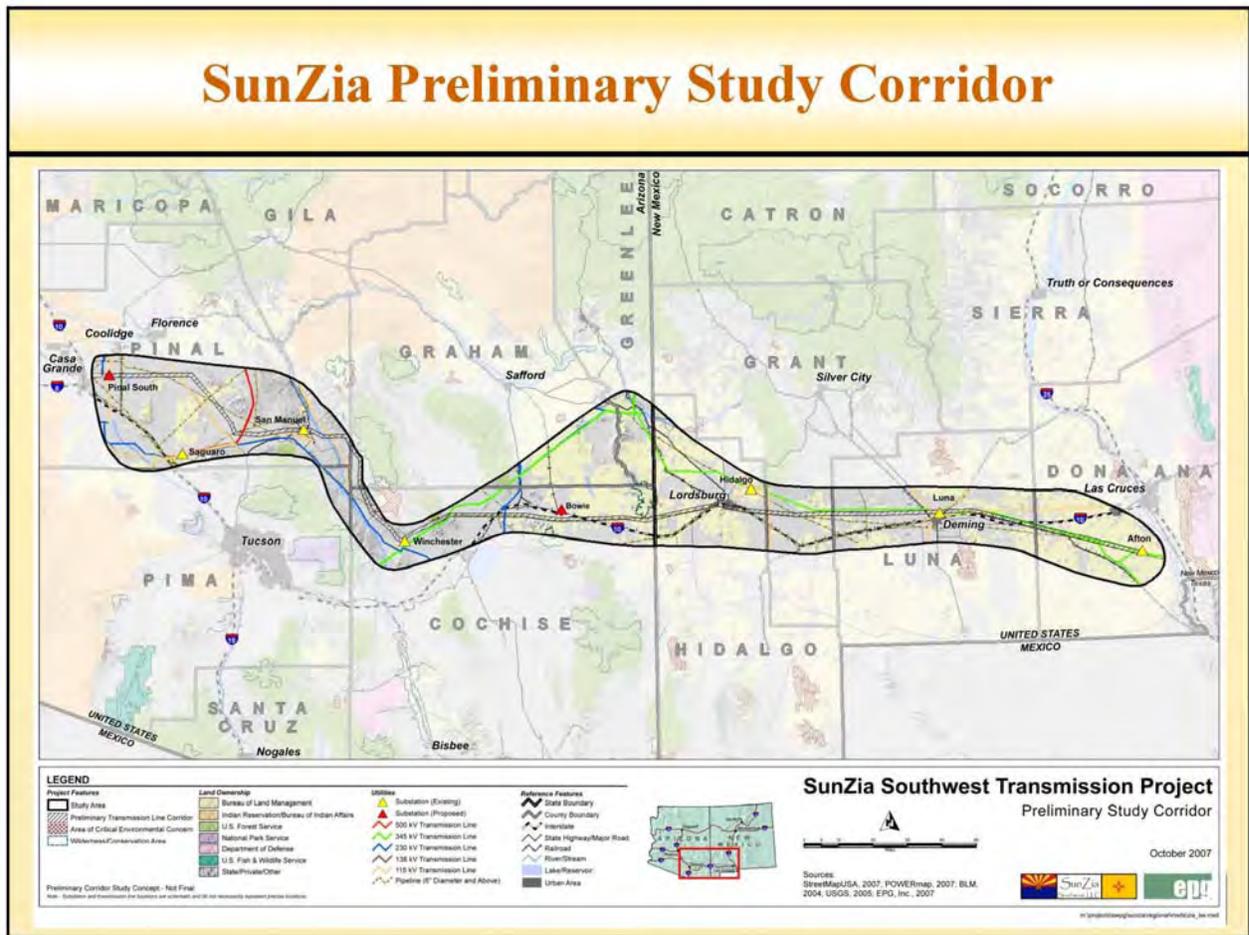
The close connection between the SunZia Southwest Transmission Project and the Bowie power plant is mentioned in three other documents also, the first being the May 1, 2007 edition of *Energy Prospects West*<sup>4</sup>. The lead article notes “that the markets for its [the Bowie power plant’s] clean coal [now natural gas] could blossom if the proposed SunZia Southwest Transmission Project is built” and that SunZia’s connection to the Pinal West–Southeast Valley line “would mean that Bowie’s clean coal and wind energy from New Mexico could travel on up to Palo Verde and from there to California.” The route and extent of the SunZia project mentioned in the article are very similar to what is shown in Figure 2.

In addition, in an August 2007 presentation to the Southwest Renewable Energy Conference<sup>5</sup>, Mark Etherton of SunZia presented a slide showing that at that time the two potential users of SunZia transmission capacity would be the Bowie power plant and generation facilities in New Mexico (Figure 3). This shows that the eastern termination point for the SunZia Project had been moved from the Luna substation near Deming, New Mexico, eastward to El Paso, possibly El Paso Electric Company’s gas-fired Newman power station. At this time El Paso was apparently considered a possible interconnect point for wind-generated power coming from a north-south band in east-central New Mexico. SunZia expected other operators to build the transmission lines needed for wind-generated power to reach the terminus of its line.

Development Interests		SunZia Southwest Transmission Project		
<p>◆ Discussion of approximate capacity interest, start and end points, approximate need date, etc.</p>				
Company Name	Capacity Interest	Approximate Need Date	Probable Interconnect Point(s)	Probable Interconnect Termination
SunZia Southwest	600 MW	2012/2013	Bowie P.S.	El Paso Winchester Pinal South
Others (6 – 10)	1500MW to 3000MW	2011/2015	Eastern NM SW NM	Various

**Figure 4.** Entities expressing interest in using SunZia Project transmission capacity as of August 1, 2007, as shown in Mark Etherton’s presentation to the Southwest Regional Energy Conference<sup>5</sup>. The two end points for the SunZia Project at this time were the Pinal South (now Pinal Central) substation southeast of Phoenix and possibly El Paso Electric Company’s gas-fired Newman power station. The Winchester substation is located in the San Pedro Valley northeast of Benson, Arizona, and ties in with Tucson Electric Power Company’s 345-kV lines. The Winchester-to-Pinal South connection would have used a previously approved route for a 500-kV line down the San Pedro Valley that has never been built. (Note: “SunZia Southwest” in the table should perhaps read “Southwestern Power Group.” The 600-MW capacity refers to that of the Bowie power plant when SWPG considered using coal-gasification technology.)

Finally, a January 18, 2008 SunZia presentation to the New Mexico Renewable Energy Transmission Authority<sup>6</sup> provides the first official map (Figure 5; dated October 2007) of the SunZia Project, showing it centered on the Bowie power plant and terminating to the east at the Afton substation between Deming and El Paso. To the west the line is as previously described, running through the Winchester substation to southeast Phoenix. It was not until a July 17, 2008 presentation to a Southeast Arizona Transmission Study (SATS) meeting<sup>7</sup> that the initial configuration for the SunZia Project as we know it today was revealed.

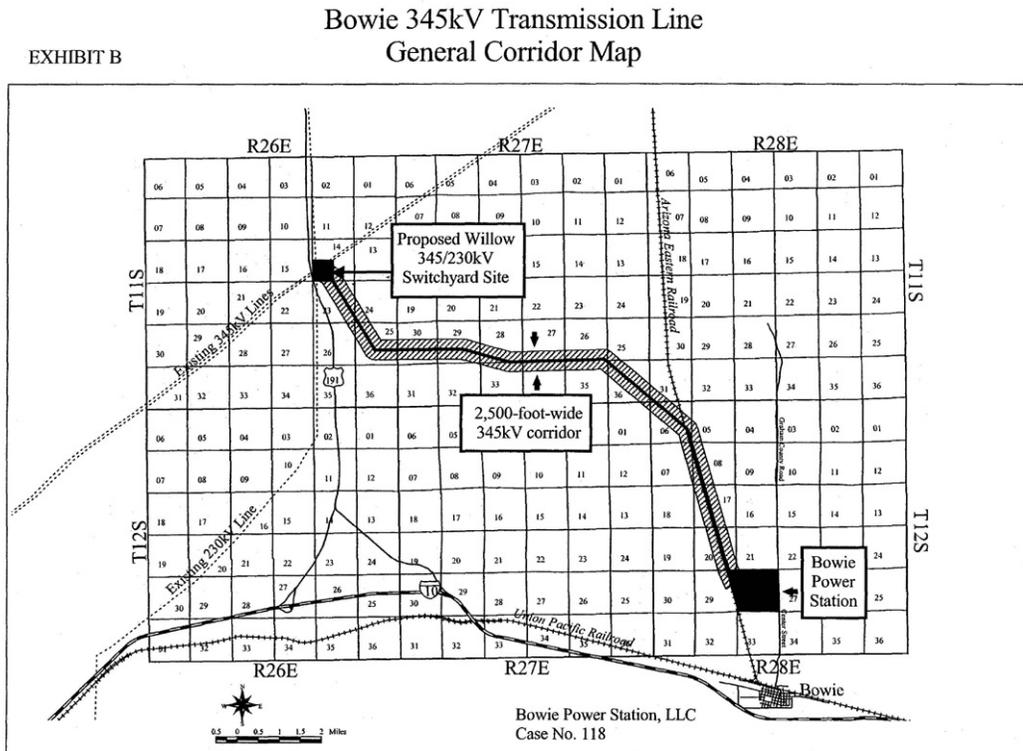


**Figure 5.** Initial extent and route for the SunZia Southwest Transmission Project as of October 2007<sup>6</sup>. This version of the project was presented to conferences and agencies through at least the end of May 2008.

### Relationship of the Bowie Power Plant and SunZia to the Proposed Willow Substation

In all of its later presentations of the SunZia Project to the public, SunZia has shown the Willow substation south of Safford as an integral part of SunZia. This substation, SunZia has said, would be built to transfer power to Tucson Electric Power Company’s 345-kV lines and to help strengthen and stabilize TEP’s southern Arizona grid. The impression given to the public is that this interconnection would provide Tucson and southern Arizona with some measure of renewable energy.

However, originally the Willow substation was not a part of the SunZia Project but of the Bowie power plant project and was proposed and permitted with the Bowie project to transfer the plant's power to Tucson Electric Power Company's and Southwestern Transmission Cooperative's lines. This is to say, it has already been approved by the Arizona Corporation Commission (AzCC) and is not a part of SunZia. The AzCC approved building the Willow substation with the Bowie power plant in decision No. 64626 of March 7, 2002. Figure 6 shows the map of the substation (switchyard) in conjunction with the plant. SunZia would essentially be adding a 500-kV transformer to the Bowie project plan to take on power from the plant, not building the entire substation. While this connection in itself would add stability and resilience to the southeast Arizona grid, SunZia has at no time acknowledged the integral role of the Bowie plant in the project and has, indeed, dismissed the notion that the SunZia project and the Bowie plant are at all related.



**Figure 6.** Map from Arizona Corporation Commission Case 118, Decision No. 64626, Docket No. L-00000BB-01-0118, dated March 7, 2002, showing the Bowie power plant facilities and corridor that were approved<sup>8</sup>.

The Corporation Commission's decision requires SWPG to prove prior to construction that transmission facilities will be available to carry all 1000 MW of power from the plant. TEP's 345-kV lines currently have no available transfer capacity, a measure of available transmission capacity for sale, which presents a serious difficulty for the full build-out of the Bowie plant. To date, TEP and SWPG have modeled only the effects of power from the first 500-MW generator to determine if the grid would be stable. If the Bowie plant is fully built out at 1,000 MW, there is little question that SWPG would have to use SunZia's lines to carry the power, meaning that the plant could use up to one-third of SunZia's transmission capacity.

The Bowie plant is nearly ten years behind schedule now. The first 500 MW of capacity was to be completed in 2005, but SWPG could not accomplish this and requested an extension to 2010. Again, this proved untenable, partly because of the economy, and SWPG has requested, and been granted, a second extension through 2015. The SunZia project is scheduled to complete its lines in 2014, which would provide the needed transmission capacity before the Bowie plant comes on line. Although the nation's economic woes have played a part in the current delay, it is very hard not to conclude that a major reason for postponing the Bowie plant is to get the needed transmission capacity in place beforehand. In addition, SWPG is looking hard to access the California market with Bowie power, which is much more lucrative, and SWPG needs SunZia to make that connection.

### **Additional Notes on Power Sources in Southwestern New Mexico and Modeling of the Bowie Power Plant's Usage of Tucson Electric Power Company's Transmission Lines**

#### *Relationship of SunZia to Conventional New Mexico Generating Stations*

Other relatively new generation facilities along the Sunzia southern Arizona/New Mexico portion of its route are summarized in Table 1. The SunZia Project would also build a new 500-kV substation (SunZia South) at or just to the east of the Luna substation at Deming, which is associated with the relatively new Luna Energy Facility. (This again begs the question of whether this would be a new full substation or the addition of a 500-kV transformer to the Luna substation.) This natural gas plant has a capacity of 570 MW and was completed in 2006 by PNM Resources (associated with Public Service Company of New Mexico) as a merchant facility to sell power throughout the Southwest. Tucson Electric Power Company owns one-third interest in the facility. Again, SunZia is connecting with 345-kV lines, which belong to PNM, El Paso Electric, and TEP.

**Table 1.** New gas-fired generation stations in southern New Mexico and Arizona along the SunZia route, from east to west

<b>Power Plant</b>	<b>Location</b>	<b>Owner*</b>	<b>MW</b>	<b>Date Completed</b>
Afton Generating Station	12 miles SW of Las Cruces, NM	PNM	235	Initial 210 MW completed in 2002; 25 MW added in 2006
Luna Energy Facility	Deming, NM	PNM, TEP, EPE	570	2006
Lordsburg Generating Station	Lordsburg, NM	PMN	80	2002
Pyramid Generating Station	12 miles SE of Lordsburg, NM	TSG&T	160	2003
Agua Prieta II	Agua Prieta, MX	EFE	400	Project initiated in 2006; contract awarded 2010
Bowie Power Plant	Bowie, AZ	SWPG	1000	First unit originally planned for 2005-6; now 2015

\* PNM = Public Service Company of New Mexico, TEP = Tucson Electric Power Company, EPE = El Paso Electric, TSG&T = Tri-State Generation and Transmission Association, CFE = Comisión Federal de Electricidad, SWPG = Southwestern Power Group.

Other new facilities include PNM's Afton generating plant to the east (the final termination of SunZia in its first incarnation), initially completed in 2002 to generate 210 MW of power and upgraded to 235 MW in 2006. PNM also built a new 80-MW natural gas plant at Lordsburg in 2002, and the Tri-State Generation and Transmission Association, a partner in SunZia, completed its new 160-MW natural-gas-fired Pyramid generation station just southeast of Lordsburg in 2003. More recent updated SunZia maps show an interconnection (substation) added at Lordsburg (Hidalgo) as well, which would allow SunZia to take on Lordburg power and provide transmission for expansion of these plants. In addition, in August 2010 after many years of delay, the Mexican government awarded a contract to the Spanish firm Elecnor to build a new 400-MW natural gas generating plant at Agua Prieta, Mexico, a project that is also a potential user of SunZia transmission capacity. The Agua Prieta plant will also have a 12-MW solar component.

#### *Potential Renewable Energy Resources Along the SunZia Route in Southwestern New Mexico*

On-line articles from 2006 mention a large solar (300-MW) PV facility to be built at Deming by New Solar Ventures and projected to be completed in 2011<sup>9</sup>. The developers, however, appear to have had financial and personal difficulties, and this project was apparently abandoned. In 2008, BrightSource Energy, Inc., of Oakland and NextLight Renewable Power, LLC., of San Francisco proposed building large solar concentrating plants here also (600 MW plus 125 MW for 725 MW total)<sup>10</sup>, but these projects are not listed among these companies' current projects. The 2008 on-line article states that NextLight was also considering building a 250-MW solar plant at Lordsburg, but company websites (NextLight was acquired by First Solar in 2010) currently contain no references to this. These projects do reflect the eventual potential for developing significant amounts of solar energy in southwestern New Mexico, which SunZia could potentially accommodate.

#### *Modeling of the Southeast Arizona Transmission System to Accommodate Bowie Power*

Regarding the stability of adding Bowie power to TEP's 345-kV lines, two modeling studies have been carried out that integrate the two, both for only 500 MW of power, however. The consequences of this interconnection were first modeled by TEP in 2002<sup>11</sup> and repeated in 2008 by SWPG<sup>12</sup>. Although the system would be stable under normal operating conditions with the addition of this first 500 MW of capacity, it is clear in TEP's report that the Bowie plant would stress the system in critical situations, most importantly when outages of other lines occur, and that the Bowie plant would have to have contingency plans to be taken out of service promptly so that it would not overload other transformers (substations) in the system. Regarding the second 500 MW of power proposed for Bowie (to make 1000 MW total), it is unlikely that the current system could handle this, thus requiring new transmission capacity. (See the associated report on transmission needs and associated problems for the Bowie project.)

### **Summary**

The evolution of the SunZia Project has been somewhat haphazard rather than well planned and was initially unrelated to renewable energy development. Although the Southwest Area Transmission Committee (SWAT) recognized the need for greater east-west transmission

capacity between Arizona and New Mexico, SunZia had its origins in the Southwestern Power Group's need for transmission for its Bowie power plant. This is unquestionably why SWPG took such a strong interest in SunZia and assumed the role as its chief sponsor. To create SunZia, SWPG combined CATS/SATS's plan to run a 500-kV line from east Phoenix to east Tucson with new 500-kV transmission lines to be built to serve the Bowie plant.

In addition, while SunZia has portrayed the Willow substation as strictly a component of the SunZia Project, in actuality the substation is associated with the Bowie power plant and was permitted and approved by the Arizona Corporation Commission as part of the Bowie project in March 2002. Rather than build this substation per se, SunZia would modify the current substation plan to include an interconnection for a 500-kV transformer. This transformer would provide the Bowie power plant with full access to energy markets throughout the Southwest, allowing SWPG to sell power to California.

As a caveat, this connection would ease the congestion on TEP's lines that the Bowie plant would otherwise exacerbate. This congestion could potentially prevent a full transmission connection with the Bowie plant, easily leaving the plant without adequate transmission capacity. Tucson Electric Power Company's 345-kV lines, which the Bowie plant would use for power distribution, are currently at capacity, and while they could accommodate some Bowie power under normal operating conditions, they are inadequate to accommodate the full generating capacity of the plant. This is undoubtedly a major reason why the Southwestern Power Group has so aggressively pursued SunZia and taken the principal role in promoting it.

It is clear that several other conventional power plants along the SunZia southerly route would use SunZia also. Although this does not negate the potential for using SunZia transmission to gather power from the notable solar resources in southwestern New Mexico or from wind resources in central New Mexico, by not fully acknowledging this, SunZia has misled the public and the Bureau of Land Management about how much renewable energy this project will actually carry. Because conventional generating stations would inevitably use SunZia and because wind power generation fluctuates greatly and would require significant conventional power resources to be incorporated into the project to offset these fluctuations, it is likely that that less than half of the power carried in SunZia's lines will eventually be from renewable sources.

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<sup>1</sup> "SWAT Meeting Minutes 10.18.06 Las Vegas," Accessed from [http://www.westconnect.com/filestorage/swat\\_mtg\\_min\\_101806.pdf](http://www.westconnect.com/filestorage/swat_mtg_min_101806.pdf), September 16, 2010.

<sup>2</sup> Mark Etherton, "SunZia Southwest Transmission Project, SWAT Steering Committee, October 16, 2006." Accessed September 16, 2010 from [http://www.westconnect.com/documents\\_detail.php?fileid=798](http://www.westconnect.com/documents_detail.php?fileid=798).

<sup>3</sup> HPX High Plains Express, "HPX Stakeholder Meeting Update of Stage 2 Activities & Input from Stakeholders," January 13, 2010, Albuquerque, NM." Accessed August 18, 2010 from [http://www.highplainsexpress.com/site/stakeholderMeetingDocuments/HPX\\_January\\_13\\_2010\\_stakeholder\\_meeting.pdf](http://www.highplainsexpress.com/site/stakeholderMeetingDocuments/HPX_January_13_2010_stakeholder_meeting.pdf) (no longer available on-line as of September 19, 2010).

<sup>4</sup> "Arizona IGCC plant would test terrestrial sequestration," *Energy Prospects West*, Issue 113: May 1, 2007. Accessed August 24, 2010 from <http://energyprospects.com/archives/113-print.html> (must register with energyprospects.com to access article).

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- <sup>5</sup> Mark Etherton, "Presentation to the Southwest Renewable Energy Conference for the proposed SunZia Southwest Transmission Project, August 1, 2007." Accessed August 23, 2010 from <http://www.swrec.org/2009/conf2007/doc/presentations/PP%20Etherton%20Mark.pdf>.
- <sup>6</sup> SunZia Southwest, LLC, SunZia Southwest Transmission Project NM RETA Update January 18, 2008. Accessed August 26, 2010, from <http://www.emnrd.state.nm.us/MAIN/documents/SunziaRETA1-18-08.ppt>.
- <sup>7</sup> "SunZia Southwest SATS Update, July 17, 2008." Accessed August 26, 2010 from cached version on Google. Originally available from [http://www.sunzia.net/pdf/SunZia\\_SATS\\_071708\\_VIEW\\_ONLY.pdf](http://www.sunzia.net/pdf/SunZia_SATS_071708_VIEW_ONLY.pdf).
- <sup>8</sup> A map of the approved Bowie power plant, associated transmission lines, and the Willow substation is available from the Arizona Corporation Commission at the following website: <https://edocket.azcc.gov/>. One must search on L-00000 to see cases posted for generation and transmission facilities. Documents related to the Bowie power plant are contained in Case No. 118. Files in pdf format of all documents for the case are available only by using Internet Explorer 8.
- <sup>9</sup> Renewable Energy.com, "300-MW solar farm in New Mexico moves to phase two," October 2006. Accessed from <http://www.renewableenergyworld.com/rea/news/article/2006/10/300-mw-solar-farm-in-new-mexico-moves-to-phase-two-46194>, September 10, 2010.
- <sup>10</sup> iStockAnalyst, "California Solar Developers Have Eye on Southwestern New Mexico," October 1, 2008. Accessed from <http://www.istockanalyst.com/article/viewiStockNews/articleid/2665944> September 10, 2010.
- <sup>11</sup> Jorge Chacon, "Bowie Power Partnership, Bowie Power Project, Interconnection Study, System Impact Study," Tucson Electric Power Company, revised October 10, 2002. Accessed September 16, 2010, from [http://www.oatioasis.com/TEPC/TEPCdocs/Bowie-TEP\\_merged\\_12032002.pdf](http://www.oatioasis.com/TEPC/TEPCdocs/Bowie-TEP_merged_12032002.pdf).
- <sup>12</sup> PDS Consulting, PLC, "Bowie Power Station Project Generator Interconnection Study, Final Report," May 13, 2008, prepared for Southwestern Power Group, LLC, on behalf of Tucson Electric Power. Accessed September 16, 2010 from [www.oatioasis.com/TEPC/TEPCdocs/Bowie\\_PS\\_Project\\_500\\_MW\\_GIS--FINAL\\_REPORT.pdf](http://www.oatioasis.com/TEPC/TEPCdocs/Bowie_PS_Project_500_MW_GIS--FINAL_REPORT.pdf). (Note: PDS Consulting, PLC, is the firm owned by Mark Etherton, Assistant Project Manger for SunZia and former employee of the Southwestern Power Group.)