ORIGINAL

BEFORE THE ARIZONA POWER PLANT AND TRANSMISSION LINE SITING COMMITTEE

IN THE MATTER OF THE APPLICATION OF UNS ELECTRIC, INC. FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY FOR THE VAIL TO VALENCIA 115 KV TO 138 KV TRANSMISSION LINE UPGRADE PROJECT, ORIGINATING AT THE EXISTING VAIL SUBSTATION IN SEC. 4, T.16S., R.15E., PIMA COUNTY, TO THE EXISTING VALENCIA SUBSTATION IN SEC. 5, T.24S., R.14E., IN THE CITY OF NOGALES, SANTA CRUZ COUNTY, ARIZONA.

Docket No. L-00000F-09-0190-00144

Case No. 144

Notice of Filings of

DRAFT Certification of Environmental Compatibility (Cleaned Condensed and Redlined Versions)

and

Summary Testimony (with Exhibits MM-1 to MM-10) of Marshall Magruder

29 May 2009

This filing consists of the following:

a. Marshall Magruder DRAFT Certification of Environmental Compatibility (CEC) for Case No. 114, in a clean, condensed version, and a Redlined Version that contains the baseline CEC plus initial Applicant's inputs plus Magruder Inputs. This was presented at the Pre-hearing Conference held on 26 May 2009, and slightly modified to include comments made during and afterward with the Applicant.

b. Summary Testimony of Marshall Magruder with Exhibits MM-1 through MM-10.

Mailed to all parties and DATED this 29th day of May 2009.

Respectfully submitted,

Marshall Magruder

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BEFORE THE ARIZONA POWER PLANT AND TRANSMISSION LINE SITING COMMITTEE

IN THE MATTER OF THE APPLICATION OF UNS ELECTRIC, INC. FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY FOR THE VAIL TO VALENCIA 115 KV TO 138 KV TRANSMISSION LINE UPGRADE PROJECT, ORIGINATING AT THE EXISTING VAIL SUBSTATION IN SEC. 4, T.16S., R.15E., PIMA COUNTY, TO THE EXISTING VALENCIA SUBSTATION IN SEC. 5, T.24S., R.14E., IN THE CITY OF NOGALES, SANTA CRUZ COUNTY, ARIZONA.	Docket No. L-00000F-09-0190-00144 Case No. 144

CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY

Pursuant to notice given as provided by law, the Arizona Power Plant and Transmission Line Siting Committee (the "Committee") held public hearings on June 2, 3, 4, 2009 in Rio Rico, all in conformance with the requirements of Arizona Revised Statutes ("A.R.S.") § 40-360, *et seq.*, for the purpose of receiving evidence and deliberating on the Application of UNS Electric, Inc.("Applicant"), incorporated herein, for a Certificate of Environmental Compatibility ("CEC") in the above-captioned case (the "Project").

The following members and designees of members of the Committee were present at one or more of the hearings for the evidentiary presentations and/or for the deliberations:

John Foreman	Chairman, Designee for Arizona Attorney General Terry Goddard
David L. Eberhart, P.E.	Designee for Chairman, Arizona Corporation Commission
Paul Rasmussen	Designee for Director, Arizona Department of Environmental Quality
Jessica Youle	Designee for Director, Energy Department, Arizona Department of Commerce
Jeff Maguire	Appointed Member
Bill Mundell	Appointed Member
Patricia Noland	Appointed Member
Michael Palmer	Appointed Member
Michael Whalen	Appointed Member
Barry Wong	Appointed Member

The Applicant was represented by J. Matthew Derstine and Jason D. Gellman of Roshka, DeWulf & Patten, PLC, and Marcus G. Jerden of UniSource Energy Corporation.

The following parties were granted intervention pursuant to A.R.S. § 40-360.05: Marshall Magruder and Elizabeth Webb, both in pro persona.

At the conclusion of the hearings, the Committee, having received the Application, the appearances of the parties, the evidence, testimony and exhibits presented at the hearings, and being advised of the legal requirements of A.R.S. §§ 40-360 to 40-360.13, upon motion duly made and seconded, voted X to X to grant the Applicant this CEC (Case No. 144) for the Project to rebuild the existing 115 kV transmission line as a 138 kV transmission line and interconnect that transmission line to the Vail Substation as set forth in the Application.

The Project as approved consists of approximately 57.8 miles of 138 kV transmission line and ancillary facilities along the route as described below. The Project starts at the Vail Substation, and ends at the Valencia Substation. A legal description and general location map of the Project is attached as Exhibit A.

As explained in the Project Application, the Project will:

- Interconnect the northern end of the line with the Vail 345/138 kV Substation instead of the Nogales Tap.
- Upgrade the line voltage from 115 kV to 138 kV.
- Replace wooden H-frame structures with steel monopoles.

As explained in the Project Application, the Project Alignment (the route granted for the Project in this CEC), consisting of a 500-foot-wide planning corridor except where noted, and as further described in attached Exhibit A and the Application, is as follows: The Project Alignment originates from the Vail Substation in Section 4, Township 16 South, Range 15 East. The Project Alignment then extends westerly parallel to TEP's Vail-Robert Bills (138 kV) and Vail-Irvington (138 kV) lines along an access road which is an east extension of the Old Vail Connection Road to where Old Vail Connection Road intersects Wilmot Road (2.3 miles). At this intersection, the Alignment turns south extending to the Nogales Tap and interconnects to the existing line (1.5 miles). From that interconnection, the alignment then continues south to the Kantor Substation (27.8 miles) utilizing the existing line that was previously rebuilt in accordance in the Application in Line Siting Case No. 78 and approved in Decision No. 56097 (July 6, 1988). No improvements, pole replacements, or construction are necessary therein and the existing line in this portion is hereby designated for operation at 138 kV.

The Project Alignment leaves the Kantor Substation southerly along the foothills of the Santa Rita Mountains east of the Santa Cruz River. South of Josephine Canyon, the Project Alignment drops out of the foothills and into the Santa Cruz River Valley (11.8 miles). To this point from the Nogales Tap the Project Alignment follows the alignment for the existing 115 kV transmission line. North of the intersection of that existing 115 kV transmission line alignment and Pendleton Drive, the Project Alignment deviates from the existing 115 kV transmission line alignment and shifts 0.2 miles to the easterly edge of the UPRR right-of-way.

The Project Alignment then continues paralleling the UPRR right-of-way to the Cañez Substation (1.8 miles), and then continuing southerly adjacent to the UPRR in the Santa Cruz River Valley (6.4 miles). Near the intersection of Pendleton Drive and Avenida Coatimundi, the alignment shifts from the UPRR right-of-way and parallels Avenida Coatimundi east to the Sonoita Substation (0.3 miles).

The Project Alignment extends southerly out of the Sonoita Substation along the existing line across Sonoita Creek and the Santa Cruz River to Old Tucson Road, and then parallels Old Tucson Road to a point near the intersection with Grand Avenue (5.9 miles).

At the intersection of Old Tucson Road and Grand Avenue, the line departs from the existing line to proceed east of and parallel to Grand Avenue on the east side of Nogales Wash through an industrial area (0.9 miles). The Project Alignment then returns to the existing line alignment near where Frank Reed Road intersects Grand Avenue, and continues south, along the west side of the Santa Cruz County Complex (0.8 miles) The Alignment then shifts east and passes through the Preston Mobile Home Park (0.3 miles) with a 1250-foot-wide planning corridor for this course only.

The Project Alignment then turns to the south through the Mariposa Mall, across Mariposa Road, and through the Loma Linda Shopping Center (0.4 miles). The Project Alignment

continues on the existing line's alignment and turns to the east, entering the Valencia Substation located in Section 5, Township 24 South, Range 13 East (0.4 miles).

The Project will replace the existing wooden H-frame structures with steel monopoles as described in the Application. Steel monopoles will also be used between Vail Substation and the Nogales Tap; the existing transmission line portion constructed pursuant to Line Siting Case No. 78 is already on steel monopoles.

CONDITIONS

This Certificate is granted upon the following conditions:

1. The Applicant shall obtain all approvals and permits required by the United States, the State of Arizona, Pima County, Santa Cruz County, the City of Tucson, the City of Nogales, the City of Sahuarita, US Bureau of Land Management ("BLM") and any other governmental entities having jurisdiction necessary to construct the Project.
2. The Applicant shall comply with all existing applicable statutes, ordinances, county comprehensive plans, city/town general plans, master plans, project area development and subdivision plans, and regulations of the United States, the State of Arizona, Pima County, Santa Cruz County, the City of Tucson, the City of Nogales, the City of Sahuarita and any other governmental entities having jurisdiction during the construction and operation of the transmission line.

2A. Applicant shall construct the Project transmission lines only within the corridor more fully described in Exhibit A, attached hereto. [Case No. 111, Condition 3, ACC Decision 64356]

3. If any archaeological, paleontological or historical site or object that is at least fifty years old is discovered on federal, state, county or municipal land during the construction or operation of the transmission line, the Applicant or its representative in charge shall promptly report the discovery to the Director of the Arizona State Museum, and in consultation with the Director, shall immediately take all reasonable steps to secure and maintain the preservation of the discovery as required under A.R.S. § 41-844.
4. If human remains and/or funerary objects are encountered on private land during the course of any ground-disturbing activities relating to the construction or operation of the transmission line, the Applicant shall cease work on the affected area of the Project and notify the Director of the Arizona State Museum as required under A.R.S. § 41-865.
5. The Applicant shall comply with the notice and salvage requirements of the Arizona Native Plant Law (A.R.S. §§ 3-901 et seq. as applicable), County and municipal plant ordinances, and shall, to the extent feasible, minimize the destruction of native plants during the construction and operation of the transmission line.
6. The Applicant shall not assign this Certificate or its interest in the Project authorized by this Certificate unless both Applicant (as Transferor/Assignor) and Transferee/Assigned has signed a "Notice of Transfer of Certificate of Environmental Compatibility" ("Notice") as required under A.R.S. § 40-360.08(A) and A.A.C. R14-3-213(F). That Notice must be filed in this Docket. Transferee/Assignee, as part of acquiring any interest in the Project, must agree to comply with all terms, limitations and conditions contained within this Certificate originally issued to Applicant by the Arizona Power Plant and Transmission Line Siting Committee and approved and/or issued by the Arizona Corporation Commission.

6A. Where appearing below, "Applicant" includes any assignees.

7. This authorization to construct this Project shall expire five years from the date the Certificate is approved by the Commission unless the transmission line is capable of operation. However, prior to expiration, the Applicant will have the right to apply to the Commission for an extension of this time limitation up to six months prior to expiration. [Case No. 111, Condition 17 modified, ACC Decision 64356]
8. In the event that the Project requires an extension of the term of this Certificate prior to

completion of construction, Applicant shall use reasonable means to notify, including by first class mail, all landowners, neighborhood associations registered with the local governing jurisdiction, and residents within one mile of the Project corridor, all persons who made public comment at this proceeding, and all parties to this proceeding of the request, the date, time and place of the hearing in which the Commission will consider its request for extension. [CONDITION 7 IN CASE 137 DECISION NO. 70460]

9. The Applicant shall make every reasonable effort to identify and correct, on a case specific basis, all complaints of interference with radio or television signals from operation of the transmission lines and related facilities addressed in this Certificate. The Applicant shall maintain written records for a period of five years of all complaints of radio or television interference attributable to operation, together with the corrective action taken in response to each complaint. All complaints shall be recorded to include notations on the corrective action taken. Complaints not leading to a specific action or for which there was no resolution shall be noted and explained. A copy of these records will be provided to the ACC Staff, upon request.

10. Within 120 days of the Commission decision granting this Certificate, Applicant will post signs, at least 3-feet by 3-feet in size, in public rights-of-way giving notice of the Project corridor to the extent authorized by law. The Applicant shall place signs in prominent locations at reasonable intervals such that the public is notified along the full length of the transmission line until the transmission structures are constructed. To the extent practicable, within 45 days of securing easement or right-of-way for the Project, the Applicant shall erect and maintain signs providing public notice that the property is the site of a future transmission line. The signs shall advise:
    (a) That the site has been approved for the construction of Project facilities;
    (b) The expected date of completion of the Project facilities;
    (c) A phone number for public information regarding the Project;
    (d) The name of the Project;
    (e) The name of the Applicant; and
    (f) The website of the Project.

11. Applicant shall design the transmission lines to incorporate reasonable measures to minimize impacts to raptors.

12. Applicant shall use non-specular conductors and with

12A. A dulled surface color suitable for the terrain and vegetation [excerpt from Case No. 111, Condition No. 11(a)] will be used for transmission line structures with a goal that the visual contrast between the pole finish and background be minimized. After approval of the final alignment by the Committee, the applicant shall submit a Pole Plan within 30 days the proposed pole finish for each part of each segment to the parties. The criteria used shall be that poles in the open terrain shall have a dulled galvanized steel finish and when looking from where the greatest population would see these poles with a sky background. In areas where poles are sited where the greatest population having a terrain background behind the pole such as in a valley away from a road, then self-weathering finish will be satisfactory.

12B. Applicant shall retain an archaeologist satisfactory to the State Historical Preservation Office (SHPO). The archaeologist shall be on site during construction activities where new routes are being developed to advise Applicant in connection with additional archeological and preservation efforts for archaeological sites that may be required and to manage cultural and historical preservation efforts for archeological sites that may be affected by the construction of new transmission lines. The archeologist shall meet and confer with representatives of local American Nations and historical societies to determine any sensitive areas and if and how they can be avoided or mitigated. [Case No. 111, Condition 8, Decision 64356]

12C. Applicants shall retain a biologist satisfactory to the Arizona Game and Fish Department. The biologist is to be on-site during construction activities in connecting with any

additional biological and related studies that may be required and to advise Applicant in connection with mitigation efforts for any endangered, threatened and sensitive species that maybe affected by the construction of the project transmission lines. [Case No. 111, Condition 9, Decision 65356]

13. Before construction on this Project may commence, the Applicant shall file a construction Mitigation and Restoration Plan with ACC Docket Control and copies to all parties. Where practicable, the Plan shall specify the Applicant's plans for construction access and methods to minimize impacts to wildlife and to minimize vegetation disturbance outside of the Project right-of-way particularly in drainage channels and along stream banks, and shall re-vegetate, unless waived by the landowner, native areas of construction disturbance to its preconstruction state outside of the power-line right of way after construction has been completed. The Plan shall specify the Applicant's plans for coordination with the Arizona Game and Fish Department and the State Historic Preservation Office. The Applicant shall use existing roads for construction and access where practicable and the Plan shall specify the manner in which the Applicant makes use of existing roads.
14. With respect to the Project, Applicant shall participate in good faith in state and regional transmission study forums to coordinate transmission expansion plans related to the Project and to resolve transmission constraints in a timely manner.
15. The Applicant shall provide copies of this Certificate to the City of Tucson, the City of Sahuarita, the City of Nogales, Pima County, Santa Cruz County, the Arizona State Land Department, the State Historic Preservation Office, and the Arizona Game and Fish Department.
16. Prior to the date construction commences on this Project, the Applicant shall provide known homeowners and businesses, realtors, homebuilders, neighborhood associations registered with the local jurisdictions, and developers of record, within one mile of the center line of the Certificated Project Alignment the identity, location, and a pictorial depiction of the type of power line being constructed, accompanied by a written description, and encourage the developers and homebuilders to include this information in the developers' and homebuilders' homeowners' disclosure statements. [SEE CONDITION 6 IN CASE 137 DECISION NO. 70649].

16A. Applicant shall, within one year of completion of the Project, rehabilitate to its original state any and all areas disturbed by construction of the Project, except for any road that maybe necessary to access the transmission lines for maintenance and repair. The goals of the Mitigation and Restoration Plan will be to avoid impacts where practicable; and where impacts are unavoidable, minimize impacts; and focus on site preparation to facilitate natural processes to revegetation. Other key elements of this Plan are to

- Emphasize final site preparation to encourage natural revegetation;
- Prohibit use of any non-native plants or seeds during revegetation;
- Avoid (i.e., reserve) where practical, mature native trees;
- Preserve topsoil and plant materials from the right-of-way before grading, and re-spread over the right-of-way after construction is complete;
- Imprint the restored right-of-way to provide indentations to catch seed and water;
- Implement best management practices to protest the soil;
- Apply restoration methods that have been shown to work in the desert environment;
- Prevent the spread of noxious weeds or other undesirable species; and
- Apply methods to discourage unauthorized off-highway-vehicle (OHV) use of the right-of-way for all segments. [Case No. 111, Condition 13, ACC Decision 64356]

17. Before commencing construction of Project facilities located parallel to and within 100 feet of any existing natural gas or hazardous liquid pipeline, the Applicant shall:
    (a) Perform the appropriate grounding and cathodic protection studies to show that the Project's location parallel to and within 100 feet of such pipeline results in no material adverse impacts to the pipeline or to public safety when both the pipeline and the

Project are in operation. If material adverse impacts are noted in the studies, Applicant shall take appropriate steps to ensure that such material adverse impacts are mitigated. Applicant shall provide a copy of all such studies to Commission Staff ; and

(b) Perform a technical study simulating an outage of the Project that may be caused by the collocation of the Project parallel to and within 100 feet of the existing natural gas or hazardous liquid pipeline. This study should either: i) show that such outage does not result in customer outages; or ii) include operating plans to minimize any resulting customer outages. Applicant shall provide a copy of this study to Commission Staff.

18. Applicant will comply the latest Western Electricity Coordinating Council/North American Electric Reliability Corporation Planning standards as approved by the Federal Energy Regulatory Commission, and National Electrical Safety Code construction standards.
19. The Applicant shall submit a self-certification letter annually, identifying progress made with respect to each condition contained in the Certificate, including which conditions have been met. Each letter shall be submitted to the Docket Control of the Arizona Corporation Commission and the parties on August 1 beginning in 2010. Attached to each certification letter shall be documentation explaining how compliance with each condition was achieved. Copies of each letter along with the corresponding documentation shall be submitted to the Arizona Attorney General and Department of Commerce Energy Office. The requirement for the self-certification shall expire on the date the Project is placed into operation.
20. Within sixty (60) days of the Commission decision granting this Certificate, the Applicant shall make good faith efforts to commence discussions with private landowners, on whose property the Project Alignment is located, to identify the specific location for the Project's right-of-way and placement of poles.
21. The Applicant shall expeditiously pursue reasonable efforts to work with private landowners on whose property the Project right-of-way will be located, to mitigate the impacts of the location, construction, and operation of the Project on private land.
22. This Certificate recognizes that, as part of this Project, the existing line in Segment 1B will now operate at 138 kV.

FINDINGS OF FACT AND CONCLUSIONS OF LAW

This Certificate incorporates the following findings of fact and conclusions of law:

1. The Project is in the public interest because it aids the state in meeting the need for an adequate, economical and reliable supply of electric power.
2. In balancing the need for the Project with its effect on the environment and ecology of the state, the conditions placed on the CEC by the Committee effectively minimize its impact on the environment and ecology of the state.
3. The conditions placed on the CEC by the Committee resolve matters concerning the need for the Project and its impact on the environment and ecology of the state raised during the course of proceedings, and as such, serves as the findings on the matters raised.
4. In light of these conditions, the balancing in the broad public interest results in favor of granting the CEC.

DATED this ___ day of _____ 2009.

THE ARIZONA POWER PLANT AND TRANSMISSION LINE SITING COMMITTEE

_____
Hon. John Foreman, Chairman

Exhibit A

A transmission line corridor, with the centerline, as determined from Arizona State Plane Coordinate mapping, more particularly described as follows:

Beginning at **Vail Substation**, at grid coordinate (X) 1041085.39, (Y) 391274.36, of Central Zone of Arizona State Plane Coordinate System 1983, and to which National Geodetic Survey point PUMP (PID - CZ0252) bears South 42 degrees 20 minutes 38 seconds West, 4,870.50 feet;
thence North 88 degrees 44 minutes 54 seconds West, 307.61 feet;
thence North 60 degrees 17 minutes 58 seconds West, 1,037.36 feet;
thence North 00 degrees 07 minutes 58 seconds West, 1,017.67 feet;
thence South 89 degrees 32 minutes 32 seconds West, 11,891.07 feet;
thence South 05 degrees 40 minutes 55 seconds West, 1,744.96 feet;
thence South 00 degrees 34 minutes 52 seconds East, 6,224.41 feet to a point in **Nogales Tap Substation**;
thence South 00 degrees 34 minutes 52 seconds East, 50,753.00 feet;
thence South 34 degrees 21 minutes 34 seconds West, 95,891.68 feet;
thence South 88 degrees 34 minutes 55 seconds West, 121.34 feet to a point in **Kantor Substation**;
thence South 03 degrees 13 minutes 57 seconds East, 158.25 feet;
thence South 21 degrees 14 minutes 55 seconds East, 22,453.78 feet;
thence South 00 degrees 29 minutes 36 seconds East, 9,011.69 feet;
thence South 19 degrees 02 minutes 10 seconds West, 1,723.59 feet;
thence South 00 degrees 29 minutes 28 seconds East, 12,408.16 feet;
thence South 12 degrees 35 minutes 44 seconds East, 2,722.98 feet;
thence South 00 degrees 28 minutes 50 seconds East, 13,826.04 feet;
thence South 56 degrees 02 minutes 44 seconds West, 1,101.12 feet to the beginning of a non-tangent curve concave to the southwest, having a radius of 5,853.84 feet, and to which a radial line bears North 47 degrees 55 minutes 45 seconds East;
thence southeasterly 2,370.68 feet along said curve through a central angle of 23 degrees 12 minutes 13 seconds;
thence South 18 degrees 52 minutes 02 seconds East, 5,858.00 feet to a point 172 feet westerly of the west side of **Cañez Substation**;
thence South 18 degrees 52 minutes 02 seconds East, 12,393.42 feet to the beginning of a curve concave to the northeast and having a radius of 5,553.78 feet;
thence southeasterly 3,974.97 feet through a central angle of 41 degrees 00 minutes 28 seconds;
thence South 59 degrees 52 minutes 30 seconds East, 1,369.94 feet;
thence North 64 degrees 22 minutes 52 seconds East, 1,337.41 feet to a point 63 feet southerly of the south side of **Sonoita Substation**;
thence South 25 degrees 54 minutes 45 seconds East, 2,434.49 feet;
thence South 18 degrees 53 minutes 51 seconds East, 6,598.53 feet;
thence South 87 degrees 22 minutes 02 seconds East, 6,610.08 feet;
thence South 00 degrees 35 minutes 23 seconds East, 7,555.17 feet;
thence South 30 degrees 26 minutes 05 seconds West, 1,143.95 feet;
thence South 03 degrees 55 minutes 22 seconds East, 3,724.62 feet;
thence South 17 degrees 58 minutes 34 seconds East, 3,169.01 feet;
thence South 79 degrees 39 minutes 56 seconds East, 1,303.27 feet;
thence South 43 degrees 47 minutes 11 seconds East, 1,683.12 feet;
thence South 04 degrees 49 minutes 19 seconds West, 1,849.85 feet;
thence South 00 degrees 35 minutes 14 seconds East, 3,980.53 feet;
thence North 74 degrees 35 minutes 02 seconds East, 1,332.75 feet;
thence South 01 degrees 13 minutes 18 seconds East, 1,873.85 feet;
thence North 88 degrees 43 minutes 12 seconds East, 2,191.97 feet to the terminus of said centerline at **Valencia Substation**, at grid coordinate (X) 1007459.01, (Y) 133493.23, of said Central Zone, and to which National Geodetic Survey point M423 (PID – CG0883) bears South 23 degrees 09 minutes 01 seconds East, 34,502.53 feet.
Said centerline is 57.785 miles in length, more or less.

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Jeff Maguire	Appointed Member
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The Project as approved consists of approximately 57.8 miles of 138 kV transmission line and ancillary facilities along the route as described below. The Project starts at the Vail Substation, and ends at the Valencia Substation. A legal description and general location map of the Project is attached as Exhibit A.

As explained in the Project Application, the Project will:

- Interconnect the northern end of the line with ~~a major import substation (~~the Vail 345/138 kV Substation~~)~~ instead of the Nogales Tap.
- Upgrade the line voltage ~~of the existing~~from 115 kV ~~line~~ to 138 kV.
- Replace ~~aging~~ wooden H-frame structures with steel monopoles.

As explained in the Project Application, the Project Alignment (the route granted for the Project in this CEC), consisting of a 500-foot-wide planning corridor except where noted, and as ~~more further~~further described in attached Exhibit A and the Application, is as follows:

The Project Alignment originates from the Vail Substation in Section 4, Township 16 South, Range 15 East. The Project Alignment then extends westerly parallel to TEP's Vail-Robert Bills (138 kV) and Vail-Irvington (138 kV) lines along an access road which is an east extension of the Old Vail Connection Road to where Old Vail Connection Road intersects Wilmot Road (2.3 miles). At this intersection, the Alignment turns south extending to the Nogales Tap and interconnects to the existing line (1.5 miles). From that interconnection, the alignment then continues south to the Kantor Substation (27.8 miles) utilizing the existing line that was previously rebuilt in accordance in the Application in Line Siting Case No. 78 and approved in Decision No. 56097 (July 6, 1988). No improvements, pole replacements, or construction are necessary therein and the existing line in this portion is hereby designated for operation at 138 kV.

The Project Alignment leaves the Kantor Substation southerly along the foothills of the Santa Rita Mountains east of the Santa Cruz River. South of Josephine Canyon, the Project Alignment drops out of the foothills and into the Santa Cruz River Valley (11.8 miles). To this point from the Nogales Tap the Project Alignment follows the alignment for the existing 115 kV transmission line. North of the intersection of that existing 115 kV transmission line alignment and Pendleton Drive, the Project Alignment deviates from the existing 115 kV transmission line alignment and shifts 0.2 miles to the easterly edge of the UPRR right-of-way.

The Project Alignment then continues paralleling the UPRR right-of-way to the Cañez Substation (1.8 miles), and then continuing southerly adjacent to the UPRR in the Santa Cruz River Valley (3.4 miles). Near the intersection of Pendleton Drive and Avenida Coatimundi, the alignment shifts from the UPRR right-of-way and parallels Avenida Coatimundi east to the Sonoita Substation (0.3 miles).

The Project Alignment extends southerly out of the Sonoita Substation along the existing line across Sonoita Creek and the Santa Cruz River to Old Tucson Road, and then parallels Old Tucson Road to a point near the intersection with Grand Avenue (5.9 miles).

At the intersection of Old Tucson Road and Grand Avenue, the line departs from the existing line to proceed east of and parallel to Grand Avenue on the east side of Nogales Wash

through an industrial area (0.9 miles). The Project Alignment then returns to the existing line alignment near where Frank Reed Road intersects Grand Avenue, and continues south, along the west side of the Santa Cruz County Complex (0.8 miles) The Alignment then shifts east and passes through the Preston Mobile Home Park (0.3 miles) with a 1250-foot-wide planning corridor for this course only.

The Project Alignment then turns to the south through the Mariposa Mall, across Mariposa Road, and through the Loma Linda Shopping Center (0.4 miles). The Project Alignment continues on the existing line's alignment and turns to the east, entering the Valencia Substation located in Section 5, Township 24 South, Range 13 East (0.4 miles).

The Project will replace the existing wooden H-frame structures with steel monopoles as described in the Application. Steel monopoles will also be used between Vail Substation and the Nogales Tap; the existing transmission line portion constructed pursuant to Line Siting Case No. 78 is already on steel monopoles.

CONDITIONS

This Certificate is granted upon the following conditions:

1. The Applicant shall obtain all approvals and permits required by the United States, the State of Arizona, Pima County, Santa Cruz County, the City of Tucson, the City of Nogales, the City of Sahuarita, US Bureau of Land Management ("BLM") and any other governmental entities having jurisdiction necessary to construct the Project.

2. The Applicant shall comply with all existing applicable statutes, ordinances, county comprehensive plans, city/town general plans, master plans, project area development and subdivision plans, and regulations of the United States, the State of Arizona, Pima County, Santa Cruz County, the City of Tucson, the City of Nogales, the City of Sahuarita, ~~the City of Tucson, the City of Nogales~~the County ~~of [county],~~ and any other governmental entities having jurisdiction during the construction and operation of the transmission line ~~[power plant]~~.

2A. Applicant shall construct the Project transmission lines only within the corridor

more fully described in Exhibit A, attached hereto. [Case No. 111, Condition 3, ACC Decision 64356]

3. If any archaeological, paleontological or historical site or object that is at least fifty years old is discovered on federal, state, county or municipal land during the construction or operation of the transmission line ~~[power plant]~~, the Applicant or its representative in charge shall promptly report the discovery to the Director of the Arizona State Museum, and in consultation with the Director, shall immediately take all reasonable steps to secure and maintain the preservation of the discovery as required under A.R.S. § 41-844.

4. If human remains and/or funerary objects are encountered on private land during the course of any ground-disturbing activities relating to the construction or operation of the transmission line ~~[power plant]~~, the Applicant shall cease work on the affected area of the Project and notify the Director of the Arizona State Museum as required under A.R.S. § 41-865.

5. The Applicant shall comply with the notice and salvage requirements of the Arizona Native Plant Law (A.R.S. §§ 3-901 et seq. as applicable), County and municipal plant ordinances, and shall, to the extent feasible, minimize the destruction of native plants during the construction and operation of the transmission line ~~[power plant]~~.

6. The Applicant shall not assign this Certificate or its interest in the Project authorized by this Certificate unless both Applicant (as Transferor/Assignor) and Transferee/Assigned has signed a "Notice of Transfer of Certificate of Environmental Compatibility" ("Notice") as required under A.R.S. § 40-360.08(A) and A.A.C. R14-3-213(F). That Notice must be filed in this Docket. Transferee/Assignee, as part of acquiring any interest in the Project, must agree to comply with all terms, limitations and conditions contained within this Certificate originally issued to Applicant by the Arizona Power Plant and Transmission Line Siting Committee and approved and/or issued by

the Arizona Corporation Commission.

6A. Where appearing below, "Applicant" includes any assignees. ~~without prior approval of the Commission. Any assignment of this Certificate shall require the assignee to assume all responsibilities of the Applicant listed in this Certificate.~~

7. This authorization to construct this Project shall expire five years from the date the Certificate is approved by the Commission unless the transmission line ~~[power plant]~~ is capable of operation. However, prior to expiration, the Applicant ~~or its assignees may~~ will have the right to apply to ~~request that the~~ Commission for an ~~extend~~ extension of this time limitation up to six months prior to expiration. [Case No. 111, Condition 17 modified, ACC Decision 64356]

8. In the event that the Project requires an extension of the term of this Certificate prior to completion of construction, Applicant shall use reasonable means to notify, including by first class mail, all landowners, neighborhood associations registered with the local governing jurisdiction, and residents within one mile of the Project corridor ~~[location]~~, all persons who made public comment at this proceeding, and all parties to this proceeding of the request, ~~an,d Applicant will provide~~ the date, time and place of the hearing in which the Commission will consider ~~itsthe~~ request for extension. [CONDITION 7 IN CASE 137 DECISION NO. 70469]

9. The Applicant shall make every reasonable effort to identify and correct, on a case-specific basis, all complaints of interference with radio or television signals from operation of the transmission lines and related facilities addressed in this Certificate. The Applicant shall maintain written records for a period of five years of all complaints of radio or television interference attributable to operation, together with the corrective action taken in response to each complaint. All complaints shall be recorded to include notations on the corrective action taken. Complaints not leading to a specific action or for which there was no resolution shall be noted and explained. A copy of these records will be provided to the ACC Staff, upon request.

10. Within 120 days of the Commission decision granting this Certificate, Applicant will post signs, at least 3-feet by 3-feet in size, in public rights-of-way giving notice of the Project corridor to the extent authorized by law. The Applicant shall place signs in prominent locations at reasonable intervals such that the public is notified along the full length of the transmission line until the transmission structures are constructed. To the extent practicable, within 45 days of securing easement or right-of-way for the Project, the Applicant shall erect and maintain signs providing public notice that the property is the site of a future transmission line. ~~Such signage shall be no smaller than a normal roadway sign.~~ The signs shall advise:

(a) That the site has been approved for the construction of Project facilities;

(b) The expected date of completion of the Project facilities;

(c) A phone number for public information regarding the Project;

(d) The name of the Project;

(e) The name of the Applicant; and

(f) The website of the Project.

11. Applicant~~, or its assignee(s),~~ shall design the transmission lines to incorporate reasonable measures to minimize impacts to raptors.

12. Applicant~~, or its assignee(s),~~ shall use non-specular conductors and with

12A. A dulled surface color suitable for the terrain and vegetation [excerpt from Case No. 111, Condition No. 11(a)] will be used~~s~~ for transmission line structures with a goal that the visual contrast between the pole finish and background be minimized. After approval of the final alignment by the Committee, the applicant shall submit a Pole Plan within 30 days the proposed pole finish for each part of each segment to the parties. The criteria used shall be that poles in the open terrain shall have a dulled galvanized steel finish and when looking from where the greatest population would see these poles with a sky background. In areas where poles are sited where the greatest population having a terrain background behind the pole such as in a valley away from a road, then self-weathering finish will be satisfactory.

12B. Applicant shall retain an archaeologist satisfactory to the State Historical Preservation Office (SHPO). The archaeologist shall be on site during construction activities where new routes are being developed to advise Applicant in connection with additional archeological and preservation efforts for archaeological sites that may be required and to manage cultural and historical preservation efforts for archeological sites that may be affected by the construction of new transmission lines. The archeologist shall meet and confer with representatives of local American Nations and historical societies to determine any sensitive areas and if and how they can be avoided or mitigated. [Case No. 111, Condition 8, Decision 64356]

12C. Applicants shall retain a biologist satisfactory to the Arizona Game and Fish Department. The biologist is to be on-site during construction activities in connecting with any additional biological and related studies that may be required and to advise Applicant in connection with mitigation efforts for any endangered, threatened and sensitive species that maybe affected by the construction of the project transmission lines. [Case No. 111, Condition 9, Decision 65356]

13. Before construction on this Project may commence, the Applicant shall file a construction Mmitigation and Rrestoration Pplan ~~("Plan")~~ with ACC Docket Control and copies to all parties. Where practicable, the Plan shall specify the Applicant's plans for construction access and methods to minimize impacts to wildlife and to minimize vegetation disturbance outside of the Project right-of-way particularly in drainage channels and along stream banks, and shall re-vegetate, unless waived by the landowner, native areas of construction disturbance to its preconstruction state outside of the power-line right of way after construction has been completed. The Plan shall specify the Applicant's plans for coordination with the Arizona Game and Fish Department and the State Historic Preservation Office. The Applicant shall use existing roads for construction and access where practicable and the Plan shall specify the manner in which the

Applicant makes use of existing roads.

14. With respect to the Project, Applicant shall participate in good faith in state and regional transmission study forums to coordinate transmission expansion plans related to the Project and to resolve transmission constraints in a timely manner.

15. The Applicant shall provide copies of this Certificate to the City of Tucson, the City of Sahuarita, the City of Nogales, Pima County, Santa Cruz County, ~~[all affected governmental entities, e.g., affected cities and counties,~~ the Arizona State Land Department, the State Historic Preservation Office, and the Arizona Game and Fish Department~~]~~.

16. Prior to the date construction commences on this Project, the Applicant shall provide known homeowners and businesses, realtors, homebuilders, neighborhood associations registered with the local ~~governing~~ jurisdictions, ~~-~~and developers of record, within one mile of the center line of the Certificated Project Alignment~~route [power plant]~~ the identity, location, and a pictorial depiction of the type of power line ~~[plant]~~ being constructed, accompanied by a written description, and encourage the developers and homebuilders to include this information in the developers' and homebuilders' homeowners' disclosure statements. [SEE CONDITION 6 IN CASE 137 DECISION NO. 70649].

16A. Applicant shall, within one year of completion of the Project, rehabilitate to its original state any and all areas disturbed by construction of the Project, except for any road that maybe necessary to access the transmission lines for maintenance and repair. The goals of the Mitigation and Restoration Plan will be to avoid impacts where practicable; and where impacts are unavoidable, minimize impacts; and focus on site preparation to facilitate natural processes to revegetation. Other key elements of this Plan are to

- Emphasize final site preparation to encourage natural revegetation;
- Prohibit use of any non-native plants or seeds during revegetation;
- Avoid (i.e., reserve) where practical, mature native trees;

- Preserve topsoil and plant materials from the right-of-way before grading, and re-spread over the right-of-way after construction is complete;
- Imprint the restored right-of-way to provide indentations to catch seed and water;
- Implement best management practices to protest the soil;
- Apply restoration methods that have been shown to work in the desert environment;
- Prevent the spread of noxious weeds or other undesirable species; and
- Apply methods to discourage unauthorized off-highway vehicle (OHV) use of the right-of-way for all segments. [Case No. 141, Condition 13, ACC Decision 64356]

17. Before commencing construction of Project facilities located parallel to and within 100 feet of any existing natural gas or hazardous liquid pipeline, the Applicant shall:

(a) Perform the appropriate grounding and cathodic protection studies to show that the Project's location parallel to and within 100 feet of such pipeline results in no material adverse impacts to the pipeline or to public safety when both the pipeline and the Project are in operation. If material adverse impacts are noted in the studies, Applicant shall take appropriate steps to ensure that such material adverse impacts are mitigated. Applicant shall provide ~~to Commission Staff reports~~a copy of all such studies to Commission Staff ~~of studies performed~~; and

(b) Perform a technical study simulating an outage of the Project that may be caused by the collocation of the Project parallel to and within 100 feet of the existing natural gas or hazardous liquid pipeline. This study should either: i) show that such outage does not result in customer outages; or ii) include operating plans to minimize any resulting customer outages. Applicant shall provide a copy of this study to Commission Staff.

18. Applicant will ~~follow~~ comply the latest Western Electricity Coordinating Council/North American Electric Reliability Corporation Planning standards as approved by the Federal Energy Regulatory Commission, and National Electrical Safety Code construction standards.

19. The Applicant shall submit a self-certification letter annually, identifying progress made with respect to each condition contained in the Certificate, including which conditions have been met. Each letter shall be submitted to the Docket Control of the Arizona Corporation Commission and the parties on ~~SeptemberDecemberAugust~~ 1 beginning in 20102009. Attached to each certification letter shall be documentation explaining how compliance with each condition was achieved. Copies of each letter along with the corresponding documentation shall be submitted to the Arizona Attorney General and Department of Commerce Energy Office. The requirement for the self-certification shall expire on the date the Project is placed into operation.

20. Within sixty (60) days of the Commission decision granting this Certificate, the Applicant shall make good faith efforts to commence discussions with private landowners, on whose property the Project Alignment~~corridor~~ is located, to identify the specific location for the Project's right-of-way and placement of poles.

21. The Applicant shall expeditiously pursue reasonable efforts to work with private landowners on whose property the Project right-of-way will be located, to mitigate the impacts of the location, construction, and operation of the Project on private land.

22. ~~The Certificate does not grant to the Applicant to right to construct a second circuit in Segment 1B the existing line approved in Decision No. 56097 (July 6, 1988) on single steel poles that is currently operating at 115 kV. As explained in the Application under Line Siting Case No. 78, that line is designed to be able to operate at 138 kV.~~ This Certificate recognizes that, as part of the Vail to Valencia 115 kV to 138 kV Transmission Line Upgrade Project, the existing line in Segment 1B will now operate at 138 kV.

FINDINGS OF FACT AND CONCLUSIONS OF LAW

This Certificate incorporates the following findings of fact and conclusions of law:

1. The Project is in the public interest because it aids the state in meeting the need for an adequate, economical and reliable supply of electric power.

~~1.~~2. In balancing the need for the Project with its effect on the environment and ecology of the state, the conditions placed on the CEC by the Committee effectively minimize its impact on the environment and ecology of the state.

~~2.~~3. The conditions placed on the CEC by the Committee resolve matters concerning the need for the Project and its impact on the environment and ecology of the state raised during the course of proceedings, and as such, serves as the findings on the matters raised.

4. In light of these conditions, the balancing in the broad public interest results in favor of granting the CEC.

DATED this ___ day of _____ 2009.

THE ARIZONA POWER PLANT AND TRANSMISSION LINE SITING COMMITTEE

_____
Hon. John Foreman, Chairman

BEFORE THE ARIZONA POWER PLANT AND TRANSMISSION LINE SITING COMMITTEE

IN THE MATTER OF THE APPLICATION OF UNS ELECTRIC, INC. FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY FOR THE VAIL TO VALENCIA 115 KV TO 138 KV TRANSMISSION LINE UPGRADE PROJECT, ORIGINATING AT THE EXISTING VAIL SUBSTATION IN SEC. 4, T.16S., R.15E., PIMA COUNTY, TO THE EXISTING VALENCIA SUBSTATION IN SEC. 5, T.24S., R.14E., IN THE CITY OF NOGALES, SANTA CRUZ COUNTY, ARIZONA.	Docket No. L-00000F-09-0190-00144 Case No. 144

WITNESS SUMMARY

FOR MARSHALL MAGRUDER

29 May 2009

Submitted to the Arizona Power Plant and Transmission Line Siting Committee and parties in accordance with Procedural Orders of 27 April 2009 and 20 May 2009 for Line Siting Case No. 144.

Personal Background.

I am Marshall Magruder, from Tubac, Arizona, UNS Electric ratepayer. Having served on the Santa Cruz County/City of Nogales Joint Energy Commission, I have gained a detailed understanding of our county's electricity utilities. My resume is an Attachment, but my "Large systems" systems engineering experience, gives a unique perspective. Many consider system engineers as best of breed. We usually are the first to really look at the "need" for a system. I've lead many requirements analysis teams to determine what is necessary to solve somebody's problem. Finding the "best" solution is what systems engineers do for a living. It takes several approaches before the "best" is found. We say it's really not designed until Rev C, the fourth revision. We "bracket and half", overshoot, and then undershoot, decreasing error each time. No one knows the "best" solution in isolation. Only when teams, an integrated product team (IPT), with all disciplines represented, such as your committee, can all the necessary environmental factors are put on the table. Reviewed and analyzed, then synthesized into a Product or Project. The "total environmental" requirements for this committee are about a broad a term as possible.

Background of a Project Review.

All factors need review. This Committee would not exist if human judgments were not required to assess the many unknown impacts. The A.R.S. 40-360 statutes specify a committee from various backgrounds. Some factors aren't included; others may not be key players in every decision. For years, I had psychologists on my projects, because they come from a different discipline, with different

and diverse points of view, and usually are the best at understanding how "people" will change or should use the "system." In fact, many systems are redesigned if this discipline is not property employed at the "needs assessment" phase of requirements analysis. Another key discipline is reliability engineering, the engineering specialist critical to "keep it operating". Through simple, well sometimes rather complex, through probability analysis, failures are predicted and sequenced, as they cascade through a system. We do this over and over again, changing the design, so that high failure items always have redundancy designed into the system. Use of mean time between failure and mean time to repair permits one to estimate rather closely when a system will fail and usually what component will fail first. Usually, that "first to fail" component is redesigned so a new "first to fail" component emerges. And we repeat that process again. Reliability engineering is not used in the electric utility industry, other than at nuclear power plants, probably because of the heavy influence of Admiral Rickover trained nuclear engineers who are top-notch professionals.

Issues Related to the Project.

For the "Vail-Valencia 138 kV upgrade", I am not yet convinced a "need" really exists, nor if the WAPA to TEP transmission services change is "best" for Santa Cruz County ratepayers.

The major concern is changing the northern terminal for the transmission line from the WAPA Nogales Tap to the TEP Vail Substation. DOES this really benefit for Cruz County ratepayers in terms of economic, energy (electricity) and total environmental factors.

At this stage, with discovery questions not been fully answered, I'm unsure about the "need" and cost-benefit for customers this project.

Some questions I plan to explore during witness cross-examination include:

1. The Application seems to indicate that WAPA has a 50.9 MW "constraint" on providing electricity to the Nogales Tap. In response to my Data Request 1.1, the Company's report stated that after December 2008, an upgrade in the WAPA transmission line would add a tap at the Pantano substation that increases this "constraint" to 65.8 MW. (Exhibit MM-1, DR 1.1 response)
   a. What is the WAPA constraint?
   b. How does this constraint change?
   c. What is the impact of EPA of 2005, section 1221, which provided up to $500 million annually for 5 years to remove WAPA transmission constraints?
   d. What is WAPA's future plans for the Sahuaro-Pantano 115 kV line?
   e. When has 50.9 MW actually been the maximum power delivered by WAPA?
   f. How much does WAPA charge to use its transmission system, e.g., the wheeling charges in $ per kW-month?

2. What are the differences between using the Nogales Tap and Vail substations?
   a. What are the respective transmission line charges, and the differences impact on ratepayers? [TEP was $2.33/kW-month in 2001]
   b. What are the transmission (energy) losses differences on each transmission system? [WAPA was approximately 4.95% in 2001, Nogales Tap to delivery was approximately 10.45%]

c. What equipment owed by UNS Electric at the Nogales Tap will not be used after a potential transfer to Vail and what is its cost? [$2.1M switch Exhibit MM-2]
d. How much new equipment will be required at Vail to support UNS Electric and what is its cost?
e. Can the Citizens' installed three-ring bus switch be used by changing from Apache to Vail, with an inline 115:138 kV transformer, so that both the Nogales Tap and Vail substations can provide two different power sources to support UNS Electric? (Exhibit MM-2)

3. Do these poles really require replacement? (Exhibit MM-3)

a. Has the company tested these poles to determine if they require replacement?
b. What do the UNSE statistics on pole failure on this line indicate? (DR refused)
c. What are the reliability statistics on this transmission line? (DR refused)
d. What are the new objective reliability measures that show the improvement before and after pole replacement? (DR refused)
e. What will be the change in total capacity of the 138 kV compared to the existing 115 kV? [Present line thermal limit is 132 MW except at southern end, new 138kV has 120 MW capacity => no change] (Exhibit MM-4)
f. Validation of Peak Demand forecasts for SCC. (Exhibits MM-5, MM-6, and MM-7)
g. What and where will the conductor be replaced?
h. Where will the existing poles and acquired right-of-way not be adequate for pole replacement?
i. Where will cor-ten poles and dulled galvanized steel poles be sited?

4. What are the UNS Electric Renewable Energy Transmission Project's impact on the WAPA 115 kV line to Nogales Tap? (Exhibit MM-8)

a. How will UNS Electric perform on this contract if there is no Nogales Tap?
b. How will the two 230 kV new WAPA lines plus the 230 kV line to Pantano impact Santa Cruz County?
c. If WAPA has adequate future supply adequate to meet the load demands, other than changing poles, is there any other reason for this project (other than TEP receiving wheeling charges)?

5. What are the plans for archeological and biologic professionals to survey for unexpected disturbance of archeological sites and plant life?

a. How will OHV traffic on maintenance roads be curtailed?
b. How will construction and restoration be performed to return the disturbed lands back to its original conditions?

6. Will there be any public process or dialog occurring after the CEC is granted?
a. Will there be different groups for the UNSE and TEP customers?
b. Where and how frequent will these briefing and discussion sessions occur?
c. Will they be open, advertized, and make public?
d. Does the company see that such meetings can improve its image?
e. Will a website and any newsletter be used after CEC approval?

7. How much will this project really cost?
a. What are the component costs for each segment?
b. Where will you deviate from the existing 100-foot wide ROW, when replacing poles?
c. On new ROW, how close will your 100-foot wide ROW be with respect to the UPRR ROW, in other words, is your ROW directly adjacent to the RR?

Prefiled Testimony.

My Prefiled Direct Testimony is planned to provide the background and discuss these and related issues but, in general, most of these questions are planned for cross-examination. It will not be ready until AM Monday and will be put into the "box" for each Committee person staying at the Rio Rico Esplendor Hotel by noon and available by 0800 on 2 June for others.

Exhibits.

Exhibits in this Summary are to be provided before the hearing to the Committee and parties.

Pre-Filed Exhibits (all have been provided to the Applicant)

MM-1 UniSource Energy Services – UNS Electric (Santa Cruz) System Conversion from Point-to-Point to Network Integrated Transmission Service, 22 May 2008 (in DR 1-1 response)
MM-2 Citizens Plan of Action Excerpt (sent to UNSE via email)
MM-3 Article from T&D on Pole Replacement practices (provided as a handout 26 May)
MM-4 Excerpt from Magruder Testimony 8 July 2005 (conductor capacities)
MM-5 Peak Demand Forecasts for Santa Cruz County (various sources since 2000)
MM-6 UES Loads and Resources Peak Demand Forecast (UES website)
MM-7 Santa Cruz Generation Forecasts 2008-2028 (UES website)
MM-8 UES Letter to WAPA Transmission Infrastructure Program (p. 30-36) (in DR 1-3 response)
MM-9 SWTC Substation ID Info
MM-10 Magruder Witness Summary (this document less other exhibits)

Mailed to all parties and DATED this 29th day of May 2009.

Respectfully submitted,

Marshall Magruder
PO Box 1267
Tubac, AZ 85646
marshall@magruder.org
520.398.8587

Attachments

A. Resume of Marshall Magruder

Service List

Docket Control (Original and 25 copies)
Arizona Corporation Commission
1200 West Washington Street
Phoenix, Arizona 85007

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Elizabeth Buchroeder-Webb
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Vail, Arizona 85641

Attachment A

RESUME OF MARSHALL MAGRUDER

EDUCATION

MS in Systems Management, University of Southern California (1981); MS in Physical Oceanography, Naval Postgraduate School (1970); BS, US Naval Academy (1962)

EXPERIENCE

Over 25 years as Systems Engineer associated contractor, consultant, Raytheon-Hughes in systems engineering, training and naval systems, C4I simulation and modeling; over 40 years experience with 25 years US Navy

- **Large-system development** at all levels
  From pursuit, analysis, winning strategy, Request for Proposal evaluation, proposal management, system requirements analysis, architectures, specifications, design synthesis, trade-off studies, requirements allocation tracking,
  To system, level test planning, deployment, implementation, through sign-off,
  For technical systems of all complexities.
- **Developed** Antisubmarine Warfare, Electronic Warfare, Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance operational concepts, procedures, and tactical employment.
- **Used, operated, and planned** Navy, Army, Air Force, Coast Guard, Joint systems, world-wide.
- **Coordinated multi-platform employment** from sensor to tactical platform to Battle Force to Theater levels.
- **Qualified systems engineer-manager** for trainers, artillery, Command & Control, countermeasures, any platform.
- **Specialties:** environmental analysis, documentation, sensor/weapon predictions, C4ISR, Electromagnetic and Emission Control (EMCON) decision criteria.
- **Battle Force/Group Tactical Action Officer** on 8 aircraft carriers, TAO Instructor, 20 months combat.

RECENT POSITIONS

Commissioner, Santa Cruz County/City of Nogales Joint Energy Commission (2001-2008), intervened in Line Siting Case No. 111 and 144; Rate Cases (two Natural Gas, one Electric, one Water), Renewable Energy Standard participation, and various other ACC issues.

C4I Architect and **C4I Support Plan Lead** for the Carrier for the 21st Century (CVX) Delivery Task.

- Completed *CVX C4I Support Plan, v1.0,* Joint Operational Architecture development for Joint and Naval staff space allocations for CVX (1999) and Joint Command and Control ship (2002).
- Drafted *CVN 77 Electronics System Integrator Statement of Work* for WBS Group 400 tasks and IPTs (1999), *Integrated Management Plan*;
- **Royal Navy Future Aircraft Carrier** WBS proposal (2002)

Lead Systems Engineer, Operations Analyst and **Site Survey Leader** for Saudi Arabian Minister of Defense National Operational Command Centers and C4I System (completed August 1997).

- Completed *System Specification, System Description Document, Site Survey, Interface Requirements Documents*

Proposal Technical Volume Manager for the following **winning proposals**:

- **Vessel Traffic Service 2000 system**, US Coast Guard command center for surface surveillance using radar, visual, communications links. (evaluated A++, won Phase I, Phase II delayed then restructured)
- **Anti-submarine Warfare Team Trainer** (Device 20A66), an integrated, multi-ship, submarine and aircraft training system for Naval Task Groups. ($56M contract, best technical, lowest cost)
- **Electronic Warfare Coordination Module**, an Intelligence/EW spectrum planning and management system for Task Force Command Centers. (won Phase I, best technical)

Program Manager for the Border Patrol Strategic Border Initiative and National Training Center (2008)

- Training Standards for Border Patrol personnel performing maintenance on Virtual Fence equipment, establish a National Border Patrol Training Center with interactive and life-time Performance Measurement

Subsystem, for maintenance and operational personnel.

Assistant Program Manager for the Training Effectiveness Subsystem, Device 20A66

- Performance Measurement Subsystem, observed real-time performance of operators, teams, multi-ship and aircraft units during exercises and compared to the standard

Senior Systems Engineer responsible for writing **specifications** in following **proposals**:

- **Fire Support Combined Arms Team Trainer** *System Specification*, a US Army field artillery multiple cannon and battery training system. (awarded $118M contract, still under contract)
- **Warfighter's Simulation 2000** (WARSIM 2000) *System Specification*, a US Army Force XXI Century battalion to theater levels, training system with actual C4I systems. (won Phase I)
- **US Navy Tactical Combat Training System**, *Exercise Execution Software Requirements Specification* for simulation and computer models to run real-time, driving sensors, weapons and links on 35 ships, 100 aircraft and submarines (won Phase I contract, wrote SRS in Phase 2 proposal)
- **US Army Virtual Proving Ground (VPG)** - Performed *C4ISR Architecture Framework* development, implementation and documentation using the DoD *Architecture Framework,* for Operational, Technical and Systems architecture products. (2001-2002).
- **MBA Instructor, University of Phoenix,** for "Operations Management for Total Quality" and "Managing R&D and Innovation Processes" courses.

January 1998 to present – H&R Block, Senior Tax Advisor Level III, seasonal tax preparer (January to April 15), part time, **AARP Tax Consulting for the Elderly** (pro bono) tax preparer, IRS qualified.

Networthiness Certification (Jan. 2005-2007), prepared proposal for the Army Network Command (NETCOM), for this several million-dollar program involving over 3,200 Army computer programs at all Army installations, worldwide. Prepared Quality Control and Risk Management Plan.

Cryptologic Support and Logistic Analysis (Oct. 2004-2006), prepared proposal for Army Communications-Electronics Command, Ft. Huachuca, Arizona.

Proposal Manager, Law Enforcement Driver Trainer System for California.
Led pre-proposal and proposal team to develop a design for high-technology driver trainer systems for the Peace Officers and Safety Training (POST) Commission. (Hughes won)

AWARDS

Arizona Golden Rule Citizen Award, by Arizona Secretary of State Janice K. Brewer for exemplifying the spirit of the Golden Rule daily: "treat others the way you would like to be treated", nomination made by Santa Cruz County Supervisor Ron Morris, of August 2004 for accomplishments on the Santa Cruz County/City of Nogales Joint Energy Commission.

Merit Award, Raytheon and Hughes, four times, for achievement and excellence in performance.

National Security Industrial Association (NSIA) Anti-Submarine Warfare Committee, Meritorious Award from the NSIA President, Admiral Hogg USN (ret), for leading ASW training industry and government studies. (1992)

Military Awards include Meritorious Service Medal, Naval Commendation Medal with Combat "V" and Gold Star, Navy Unit Commendation, Navy Meritorious Unit Commendation, National Defense Medal, Armed Forces Expeditionary Medal (Dominican Republic), Vietnam Service Medal with three Bronze Stars, Vietnam Campaign Medal with "1960-", Overseas Service Ribbon (Italy).

Exhibits

EXHIBIT
MM - 1

UniSourceEnergy SERVICES

UNS ELECTRIC (SANTA CRUZ) SYSTEM

CONVERSION FROM POINT-TO-POINT SERVICE TO NETWORK INTEGRATION TRANSMISSION SERVICE

PREPARED FOR THE WESTERN AREA POWER ADMINISTRATION

TEP
Bobby Chavez
Transmission System Planning

May, 22 2008

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EXECUTIVE SUMMARY

The Santa Cruz system is a Radial System supplied from the interconnected transmission system via a connection at the WAPA Nogales 115 kV station; and that, as such, it is inherently designed to accept load shedding for any single contingency outage that trips its radial feed from the WAPA Nogales station.

In accordance with this technical study, UNSE operations will develop a system operating procedure to operate Valencia turbines to regulate the import at NOGALES. As identified, a single Valencia Turbine will be operating as the NOGALES import approaches 51MW and additional Valencia Turbines will be operated as the NOGALES import approaches 65MW, pending the system addition of the PANTANO tie into Western's NOGALES to ADAMS 115kV circuit.

The UniSource Energy Services (UNSE) Santa Cruz 115kV System is currently served through a 65MW Point-to-Point service contract, metered at the Western Area Power Administration's Nogales switchyard. UNSE Santa Cruz is interested in converting this from Point-to-Point service to Network Integration Transmission Service (NITS).

With the planned December 2008 addition of the Southwest Transmission Cooperative (SWTC) PANTANO tie into the WAPA NOGALES to ADAMS 115kV circuit on the UNSE Santa Cruz system supplied from the 115kV WAPA NOGALES TAP will adequately serve load into the 2013 time frame and beyond.

The UNSE Santa Cruz Import Capability from the 115kV NOGALES TAP varies with the commitment and dispatch of the local Valencia combustion turbines.

UNSE is planning to add distribution capacitors to its system which will improve the power factor. In contemplation of this correction UNSE has run a study with these revised power factors.

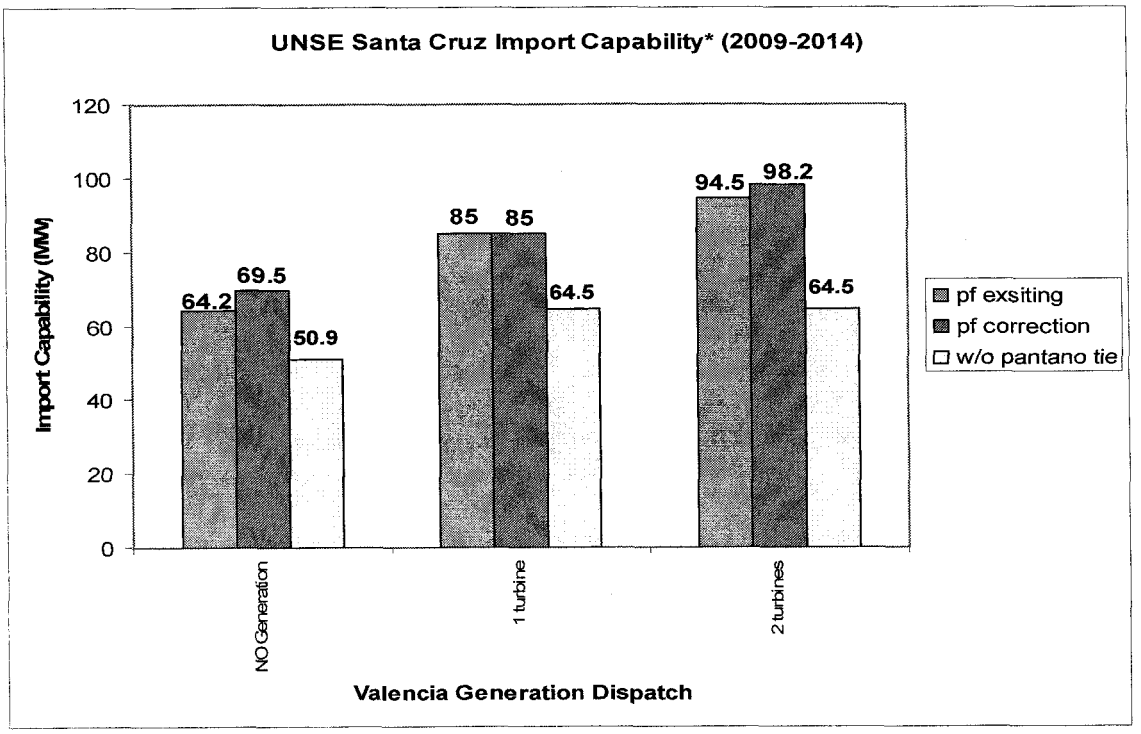

Figure 1: UNSE Santa Cruz Import Capability
*UNSE Santa Cruz Import Capability Study assumes that SWTC ties into the WAPA 115kV circuit via PANTANO tie-in (December 2008) unless noted.

The chart above shows the import capability of the 115kV UNSE Santa Cruz system served as a radial from the NOGALES TAP. Before summer 2013 the UNSE Santa Cruz 115kV system will be rebuilt to a 138kV circuit and tied into the TEP Vail 138kV substation.

System Operating Limits for Santa Cruz system import capability and load-serving capability are N-0 (NERC Category A) conditions and N-1 (NERC Category B) conditions. Due to outages external to the UNSE Santa Cruz system operating limits are reached within the UNSE Santa Cruz system or on the external system depending on Valencia generation dispatch. As shown in table 1, the Import Capability and Load Serving capability are limited by Load Tap Changers at Valencia or Sonoita under normal conditions or by voltage deviations greater than 5% at the Valencia or Nogales 115kV substations due to outages on the WAPA 115kV system.

IMPORT CAPABILITY

Sensitivities		Valencia Generation (MW)		Import Capability (MW)	UNSE Santa Cruz Load (MW)	Critical Element	Critical Outage	Stable with 5% margin
w/o Pantano Tie-In	pf correction	no generation	0	50.9	49	ΔV on Valencia 115kV	Del Bac - Nogales 115kV	solve
		1 Turbine	8.6	64.5	70	ΔV on Nogales 115kV	Del Bac - Nogales 115kV	solve
		2 Turbines	10.1	64.5	71.5	ΔV on Nogales 115kV	Del Bac - Nogales 115kV	solve
With Pantano Tie-In	pf correction	no generation	0.0	69.5	65.8	ΔV on Valencia 115kV	Nogales-Pantano 115kV	solve
		1 Turbine	12.2	85	92.0	ΔV on Valencia 115kV	Del Bac - Nogales 115kV	solve
		2 Turbines	18.0	98.2	109.0	ΔV on Nogales 115kV	Del Bac - Nogales 115kV	solve
	pf existing	no generation	0.0	64.2	61.0	Load Tap Changer on Valencia2		solve
		1 Turbine	12.2	85.0	92.0	ΔV on Valencia 115kV	Del Bac - Nogales 115kV	solve
		2 Turbines	17.5	95.1	106.0	Load Tap Changer on Sonoita1		solve

Table 1: Import Capability for various sensitivities.

A 5% load margin was added to all Import Capability models seen in Table 1 above. All models satisfy the WECC 5% MW load margin criteria.

BACKGROUND

The existing UNSE Santa Cruz 115kV system is currently tied into the Western Area Power Administration (WAPA) 115kV line as seen in the Figure 1. By December 2008 Southwest Transmission Cooperative (SWTC) plans to loop in the existing WAPA NOGALES – ADAMS TAP 115kV circuit to the SWTC PANTANO Substation as shown in Figure 2.

This proposed interconnection by SWTC will provide an additional path for APACHE generation to flow and thus increase the reliability of the 115kV system in this area.

Figure 1: UNSE Santa Cruz 115kV system and surrounding systems

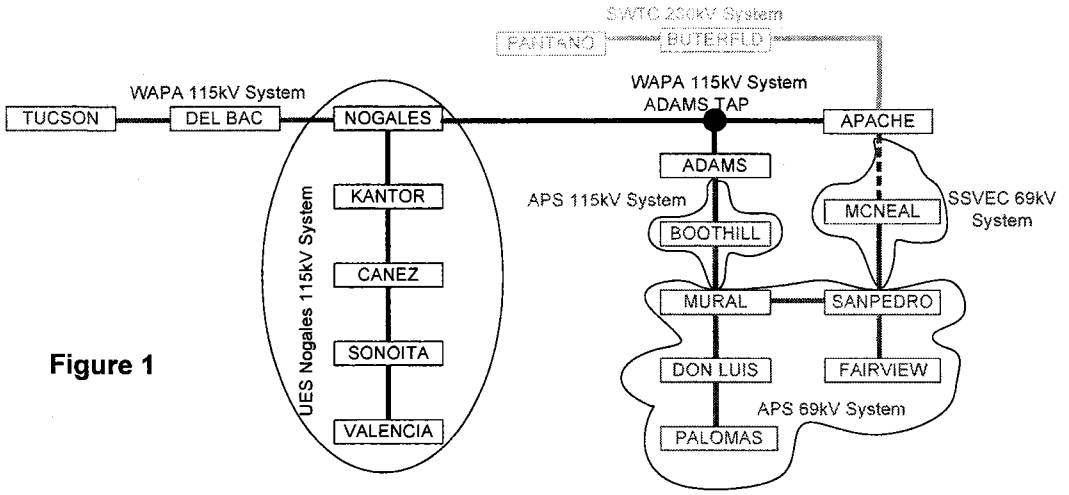

Figure 1

Figure 2: UNSE Santa Cruz and surrounding systems with Pantano 230/115kV loop-in

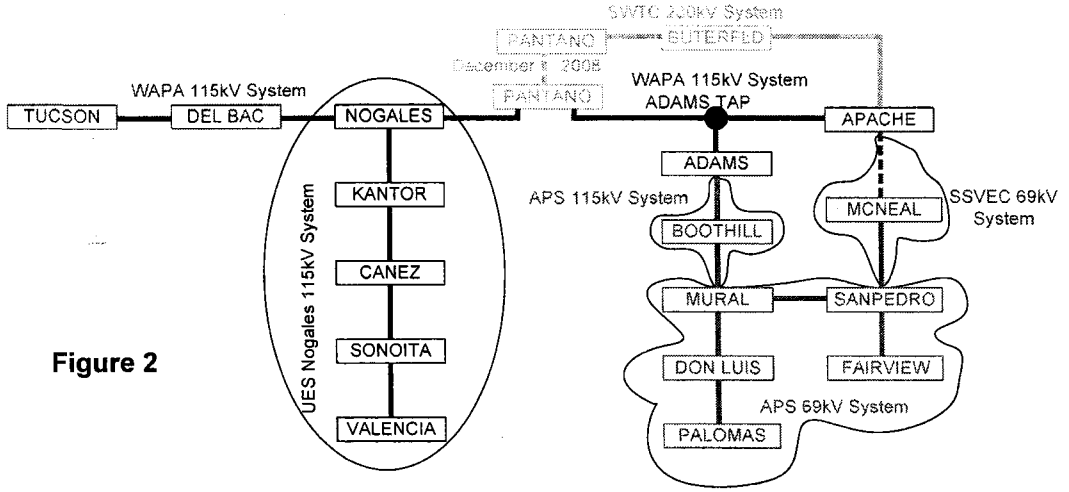

Figure 2

SCOPE

Determine if Network Integration Transmission Service (NITS) will justify additional load serving capability for the UNSE Santa Cruz 115kV System.

MODELING ASSUMPTIONS

Import Capability Limitations

Import Capability will be limited by one of the following N-1 criteria violations:

1) Overload on any UNSE Santa Cruz 115/13.2kV load serving transformer

2) Overload on any UNSE Santa Cruz 115kV circuit

3) LTC (Load Tap Changer) voltage regulation below 1.0 p.u. on the 13.2kV side of any UNSE Santa Cruz 115/13.2kV load serving transformer with All Lines In Service (ALIS).

4) Delta V violations (5%+/-) on any UNSE Santa Cruz 115kV bus for N-1 outages
5) Meet all NERC/WECC criteria seen in the table 2 below:

WECC DISTURBANCE-PERFORMANCE TABLE
OF ALLOWABLE EFFECTS ON OTHER SYSTEMS

NERC and WECC Categories	Outage Frequency Associated with the Performance Category (outage/year)	Transient Voltage Dip Standard	Minimum Transient Frequency Standard	Post Transient Voltage Deviation Standard (See Note 2)
A	Not Applicable	Nothing in addition to NERC		
B	≥ 0.33	Not to exceed 25% at load buses or 30% at non-load buses. Not to exceed 20% for more than 20 cycles at load buses.	Not below 59.6 Hz for 6 cycles or more at a load bus.	Not to exceed 5% at any bus.
C	0.033 – 0.33	Not to exceed 30% at any bus. Not to exceed 20% for more than 40 cycles at load buses.	Not below 59.0 Hz for 6 cycles or more at a load bus.	Not to exceed 10% at any bus.
D	< 0.033	Nothing in addition to NERC		

Table 2: NERC/WECC Criteria

N-1 Outages under Consideration

The following N-1 outages were analyzed after consultation with WAPA. These N-1 outages are the worst N-1 outages because they have the greatest affect on the UNSE Santa Cruz 115kV system with no loss in load.

(1) TUCSON TO DEL BAC 115kV
(2) DEL BAC TO NOGALES 115kV
(3) NOGALES TO PANTANO 115kV
(4) PANTANO TO ADAMS TAP TO APACHE 115kV
(5) NOGALES TO ADAMS TAP TO APACHE 115kV

The following transient stability disturbances were evaluated:

(1) Fault at TUCSON 115kV bus with clearing of the TUCSON TO DEL BAC 115kV circuit
(2) Fault at DEL BAC 115kV bus with clearing of the TUCSON TO DEL BAC 115kV circuit
(3) Fault at DEL BAC 115kV bus with clearing of the DEL BAC TO NOGALES 115kV circuit
(4) Fault at NOGALES 115kV bus with clearing of the DEL BAC TO NOGALES 115kV circuit
(5) Fault at NOGALES 115kV bus with clearing of the NOGALES TO PANTANO 115kV circuit
(6) Fault at PANTANO 115kV bus with clearing of the NOGALES TO PANTANO 115kV circuit
(7) Fault at PANTANO 115kV bus with clearing of the

PANTANO TO ADAMS TO APACHE 115kV circuit
(8) Fault at ADAMS 115kV bus with clearing of the PANTANO TO ADAMS* TO APACHE 115kV circuit
(9) Fault at ADAMS 115kV bus with clearing of the NOGALES TO ADAMS* TO APACHE 115kV circuit

Each transient stability simulation included a 3 phase fault cleared in 5 cycles.

* the NOGALES TO ADAMS TO APACHE 115 kV circuit outage event is a line fault that trips two breakers in the NOGALES station (ring) and one breaker in the APACHE station (main-and-transfer) and, in so doing, trips the "unbreakered" line tap to the ADAMS load-serving system.

Category C Outage Assumptions

The Santa Cruz system is a Radial System supplied from the interconnected transmission system via a connection at the WAPA Nogales 115 kV station; and that, as such, it is inherently designed to accept load shedding for any common mode contingency outage that trips the radial feed from the WAPA Nogales station.

Remote Generation to UNSE Santa Cruz 115kV system

Generation dispatched per the 11hs1b WECC case (2011 Heavy Summer Load) which was approved by WECC on 01/12/2007. The 2011 HS1B base case represents a general case for study work reflecting realistic flows throughout WECC using generation economic dispatch.

Local Valencia Generation

The Valencia gas turbines are rated as shown in Table 1 below:

Turbine	Minimum Power Output	Maximum Power Output	Minimum Reactive Output	Maximum Reactive Output
Valencia turbine #1	5 MW	13.8 MW	-5.5 MVAR	9.8 MVAR
Valencia turbine #2	5 MW	13.8 MW	-5.5 MVAR	9.8 MVAR
Valencia turbine #3	5 MW	13.8 MW	-5.5 MVAR	9.8 MVAR
Valencia turbine #4	5 MW	20 MW	-25 MVAR	15 MVAR

Table 3: Valencia Gas Turbine Ratings

SWTC Pantano 230/115kV Tie-In

SWTC plans to loop-in WAPA's Nogales – Adams 115kV circuit into the SWTC Pantano Substation in December 2008. Refer to Figure 2, above.

Load Forecasting

Load forecasts have been applied to the UNSE Santa Cruz 115kV system and the Cochise County APS 115 and 69kV systems. These load forecasts are the same forecasts used as part of the Southeast Arizona Transmission System (SATS) Study.

Sensitivities were performed to evaluate the impact of load growth of the SWTC system. SWTC load was increased to the forecasted 2012 load. The UNSE system required additional power factor correction to prevent delta V violations. It is assumed that UNSE will perform power factor correction to mitigate issues due to neighboring load growth.

The UNSE Santa Cruz system load is to be distributed in the following manner based on historical data:

Substation	Percentage of total
Kantor	9%
Canez	9%
Sonoita	30%
Valencia	52%

Table 4: UNSE Load Allocation

The UNSE Santa Cruz system load forecast is shown below in, Tables 5 and 6.

		2008		2009		2010	
bus name	kV	MW	MVAR	MW	MVAR	MW	MVAR
"KANTOR"	13.2	7.05	0.1	7.3	0.1	7.54	0.11
"CANEZ"	13.2	7.05	-1.22	7.3	-1.27	7.54	-1.31
"SONOITA1"	13.2	8.61	-0.24	8.92	-0.25	9.22	-0.26
"SONOITA2"	13.2	14.88	-4.54	15.41	-4.71	15.92	-4.86
"VALNCIA1"	13.2	22.71	0.91	23.52	0.94	24.3	0.97
"VALNCIA2"	13.2	18.01	2.53	18.65	2.62	19.27	2.7
Total		78.31	-2.46	81.1	-2.57	83.79	-2.65

Table 5: 2008 – 2010 UNSE Load Forecast

		2011		2012		2013	
bus name	kV	MW	MVAR	MW	MVAR	MW	MVAR
"KANTOR"	13.2	7.79	0.11	8.02	0.11	8.26	0.12
"CANEZ"	13.2	7.79	-1.35	8.02	-1.39	8.26	-1.43
"SONOITA1"	13.2	9.52	-0.27	9.8	-0.28	10.1	-0.29
"SONOITA2"	13.2	16.44	-5.02	16.93	-5.17	17.44	-5.33
"VALNCIA1"	13.2	25.09	1	25.84	1.03	26.62	1.07
"VALNCIA2"	13.2	19.9	2.79	20.49	2.87	21.11	2.96
Total		86.53	-2.74	89.1	-2.83	91.79	-2.9

Table 6 2001-2013 UNSE Load Forecast

Power Factor (UNSE Santa Cruz 115kV System)

Table 7 shows the UNSE Santa Cruz system existing power factors which were based on metered 2007 peak data and the assumed power factor correction.

Load	Existing Power Factor	Power Factor Correction
Kantor	0.9999	0.9999
Canez	-0.9853	-0.9853
Sonoita 1	-0.9996	**-0.98**
Sonoita 2	-0.9564	-0.9564
Valencia 1	0.9992	0.9992
Valencia 2	0.9903	**1**

Table 7: UNSE Power Factor, pf correction (**Δbold**)

POWER FLOW SENSITIVITIES

(1) With Pantano 230/115kV tie-in (existing power factor results)

NITS will adequately meet system load with associated local Valencia generation scenarios for the period 2008 though 2014.

(2) With Pantano 230/115kV tie-in (power Factor Correction results)

UNSE proposed actions

UNSE is planning to add distribution capacitors to its system which will improve the power factor. In contemplation of this correction UNSE has run a study with these revised power factors.

NITS will adequately meet system load with associated local Valencia generation scenarios for the period 2008 though 2014 with the '***UNSE proposed actions***' described above.

If the power factor was corrected on the 13.2kV distribution side (Table 7) import capability increases for NO generation and the 2 turbine generator scenarios.

(3) Without Pantano 230/115kV tie-in (power Factor Correction results)

As a sensitivity the UNSE Santa Cruz load was served without the planned December 2008 addition of the Southwest Transmission Cooperative (SWTC) PANTANO loop in to the WAPA NOGALES to ADAMS TAP 115kV circuit.

POWER FLOW RESULTS

Figure 1 and tables 8 and 9 below compare the results of the three sensitivities, outline above. Comparisons are based on import capability and required must run generation.

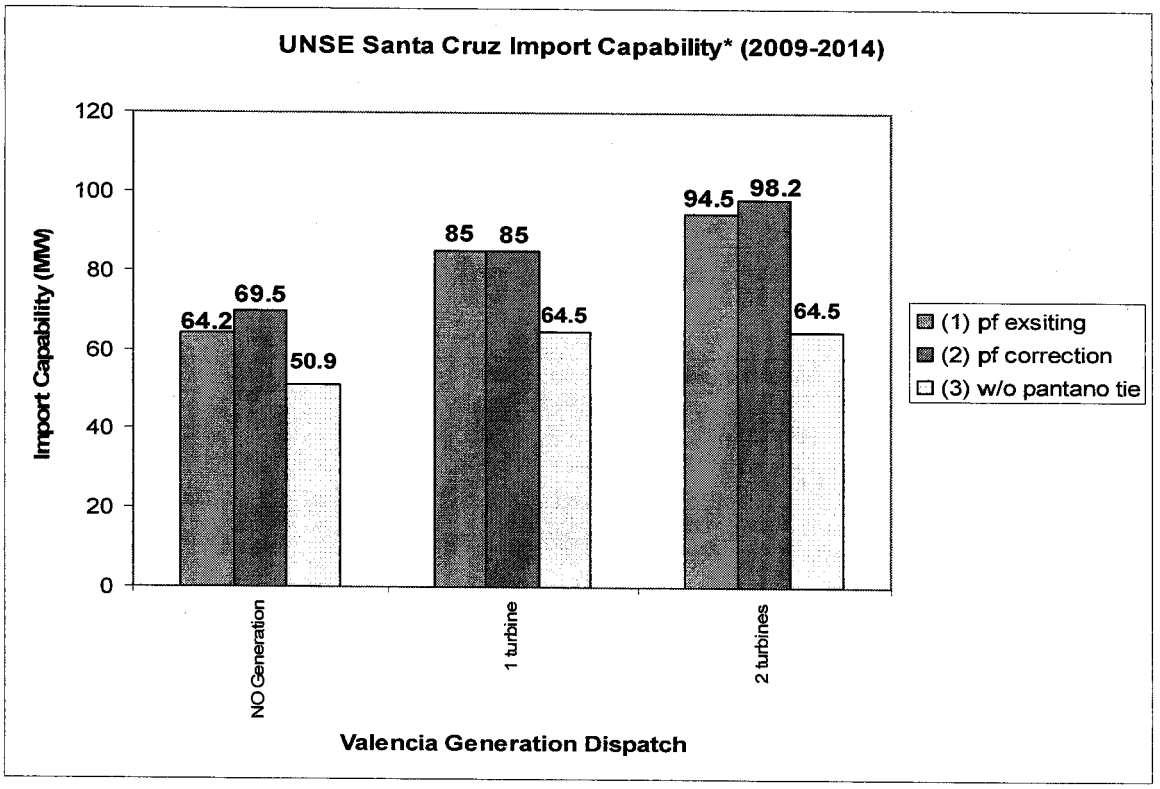

Figure 1: UNSE Santa Cruz Import Capability

*UNSE Santa Cruz Import Capability Study assumes that SWTC ties into the WAPA 115kV circuit via PANTANO tie-in (December 2008) unless noted.

		with Pantano tie-in		w/o pantano tie-in
Year	Forecast Peak Load (MW)	Annual Local Generation Hours (NO power factor correction)	Annual Local Generation Hours (power factor correction)	Annual Local Generation Hours (power factor correction)
2008	78	214	66	1170
2009	81	356	122	1453
2010	84	483	191	1716
2011	87	633	315	2031
2012	89	723	392	2269
2013	92	911	515	2652
2014	95	1102	654	3024

Table 8: Required Must-Run Generation

Sensitivities			Valencia Generation (MW)		Import Capability (MW)	UNSE Santa Cruz Load (MW)	Critical Element	Critical Outage	Stable with 5% margin
(1)	With Pantano Tie-In	pf correction	no generation	0.0	69.5	65.8	ΔV on Valencia 115kV	Nogales-Pantano 115kV	solve
			1 Turbine	12.2	85	92.0	ΔV on Valencia 115kV	Del Bac - Nogales 115kV	solve
			2 Turbines	18.0	98.2	109.0	ΔV on Nogales 115kV	Del Bac - Nogales 115kV	solve
(2)		pf existing	no generation	0.0	64.2	61.0	Load Tap Changer on Valencia2		solve
			1 Turbine	12.2	85.0	92.0	ΔV on Valencia 115kV	Del Bac - Nogales 115kV	solve
			2 Turbines	17.5	95.1	106.0	Load Tap Changer on Sonoita1		solve
(3)	w/o Pantano Tie-In	pf correction	no generation	0	50.9	49	ΔV on Valencia 115kV	Del Bac - Nogales 115kV	solve
			1 Turbine	8.6	64.5	70	ΔV on Nogales 115kV	Del Bac - Nogales 115kV	solve
			2 Turbines	10.1	64.5	71.5	ΔV on Nogales 115kV	Del Bac - Nogales 115kV	solve

Table 9: Import Capability for various sensitivities. This table outline sensitivities (1), (2) and (3)

Table 9 above outlines the Import Capability and the associated Critical Elements and Outages for the various Valencia generation scenarios and sensitivities. A 5% load margin was added to all Import Capability models seen in Table 9 above. All models satisfy the WECC 5% MW load margin criteria.

TRANSIENT STABILITY RESULTS

All outages evaluated for the various Valencia generation scenarios meet criteria for voltage and frequency deviations. In addition, angular stability plots show the generators at Saguaro and Apache to be stable and damped, except Apache CT1 and CT4 for all N-1 outages.

Apache CT1 is not damped. The oscillations continued beyond the transient stability run time. Apache CT4 is showing loss of angular synchronization with respect to Apache CT2 and CT3.

As a sensitivity, the transient stability run time was extended to 60 seconds for the Del Bac to Nogales 115kV circuit outage. This outage causes the greatest 115kV voltage deviation on the UNSE Santa Cruz system. Approximately 15 seconds after the disturbance Apache CT4 levels off and demonstrates synchronization. Apache CT1 demonstrated damping with excessive oscillations.

As a sensitivity, the UNSE Santa Cruz system was removed from the power system model and the response of Apache CT1 and CT4 was monitored. Apache CT1 and CT4 demonstrated the same transient stability issues as seen for all the N-1 outages with UNSE Santa Cruz modeled. With the UNSE Santa Cruz system removed from the sensitivity case, the Apache CT1 and CT4 units continued to exhibit stability problems. Based on the results of this sensitivity, it can be concluded that the UNSE Santa Cruz system is not the cause of the Apache combustion turbine stability problems. The Apache CT angular stability plots for theses sensitivities can be seen in APPENDICES G and H. Worst Condition Analysis (WCA) output and Stability plots can be found in APPENDICES A – F in which there are no violations.

CONCLUSION

The Santa Cruz system is a Radial System supplied from the interconnected transmission system via a connection at the WAPA Nogales 115 kV station; and that, as such, it is inherently designed to accept load shedding for any single contingency outage that trips its radial feed from the WAPA Nogales station.

System Operating Limits for Santa Cruz system import capability and load-serving capability are N-0 (NERC Category A) conditions and N-1 (NERC Category B) conditions. Due to outages external to Santa Cruz system operating limits are reached within the Santa Cruz system or on the external system depending on Valencia generation dispatch.

The results of the power flow and transient stability simulations show that the UNSE Santa Cruz 115kV system can be served through a combination of transmission import capability and local generation. In fact with a correction to the power factor in Santa Cruz the import capability without local generation on-line increases. Due to the UNSE Santa Cruz system being unable to support the projected loads without additional shunt capacitors or operation of the Valencia generation, UNSE will develop an operating procedure based on the results of this system impact study. This operating procedure will be provided to WAPA. In accordance with this technical study, UNSE operations will develop a system operating procedure to operate Valencia turbines to regulate the import at NOGALES. As identified, a single Valencia Turbine will be operating as the NOGALES import approaches 51MW and additional Valencia Turbines will be operated as the NOGALES import approaches 65MW, pending the system addition of the PANTANO tie into Western's NOGALES to ADAMS 115kV circuit.
Therefore, conversion of the UNSE Santa Cruz load from Point-to-Point to Network Integration Transmission Service on the Parker-Davis System results in no system problems.

UNSE will develop an operating procedure for the Valencia turbines. This operating procedure is necessary due to the UNSE Santa Cruz system being unable to support projected loads without additional shunt distribution capacitors or operation of the Valencia turbines. This operating procedure will be based on the results of the system impact study and will be provided to WAPA.

EXHIBIT

MM – 2

BEFORE THE ARIZONA CORPORATION COMMISSION

JIM IRVIN
COMMISSIONER-CHAIRMAN
TONY WEST
COMMISSIONER
CARL J. KUNASEK
COMMISSIONER

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IN THE MATTER OF THE JOINT NOTICE OF INTENT OF CITIZENS UTILITIES COMPANY, CITIZENS TELECOMMUNICATIONS OF THE WHITE MOUNTAINS, NAVAJO COMMUNICATIONS COMPANY, INC., CITIZENS UTILITIES RURAL COMPANY, INC., CITIZENS TELECOMMUNICATIONS COMPANY, SUN CITY SEWER COMPANY, SUN CITY WATER COMPANY, SUN CITY WEST UTILITIES COMPANY, CITIZENS WATER SERVICE COMPANY OF ARIZONA, CITIZENS WATER RESOURCES COMPANY OF ARIZONA, TUBAC VALLEY WATER COMPANY, INC., AND ELECTRIC LIGHTWAVE, INC. TO ORGANIZE A PUBLIC UTILITY HOLDING COMPANY AND FOR RELATED APPROVALS OR WAIVERS PURSUANT TO R14-2-801, *ET SEQ.*

DOCKET NO. E-01032A-98-0611
T-03214A-98-0611
T-02115B-98-0611
T-01954B-98-0611
T-02755A-98-0611
SW-2276A-98-0611
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WS-02334A-98-0611
W-03454A-98-0611
W-03455A-98-0611
W-01595A-98-0611
T-03054A-98-0611

NOTICE OF FILING

Citizens Utilities Company hereby provides notice of filing its Supplement to Santa Cruz Electric Division Transmission Alternatives and Plan of Action.

RESPECTFULLY SUBMITTED this 7th day of May, 1999.

Deborah R. Scott
Associate General Counsel
Citizens Utilities Company
2901 N. Central Avenue, Suite 1660
Phoenix, Arizona 85012

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SANTA CRUZ POWER SUPPLY IMPROVEMENTS

SANTA CRUZ POWER SUPPLY IMPROVEMENTS

Citizens is actively pursuing and implementing improvements to the transmission and generation system serving its customers in Santa Cruz County. Work to be completed before the summer of 1999 includes the addition of a new system to synchronize Citizens' generation units with the Western Area Power Administration ("WAPA"); installation of new 115-kV switching station to replace the existing tie to the WAPA's system; and planning efforts for a second transmission source into the service area. The following is a description of each project.

GENERATOR SYNCHRONIZATION

New control and communication equipment have been installed at the Nogales Tap and at the Valencia Power Plant. A synch-check relay has been added to the 115-kV breaker that will automatically close the breaker and re-establish the tie to WAPA's system when Citizens has been carrying the load on its own generation. The relay equipment was installed in January 1999, and is ready for operation. A telephone line has been ordered from US West to complete the communication link, and a contract has been issued to General Electric Company to inspect, test, and calibrate the generator protection and control systems and develop improved operating procedures for the units. The estimated cost of these improvements is approximately $100,000. The benefits of these improvements are: 1) the units and operators will be prepared to start and carry load on Citizens' generation if there is an extended outage of the transmission line; and 2) when a transmission problem has been repaired and transmission service is again available, it will not be necessary to interrupt service to our customers when we shut down the generators. Attachment I describes the Synchronization Project additions in more detail.

NOGALES SWITCHING STATION

Citizens has contracted with WAPA to construct a new, three breaker switching station to replace the existing tap station serving Citizens' customers in Santa Cruz County. The new station is being constructed on the north side of the existing tap station and will sectionalize WAPA's Del Bac – Apache 115-kV line. It will provide three line terminations in a ring-bus configuration. Building an entirely new station allows for service to continue over the existing facilities during construction and greatly reduces the need for planned service interruptions or the possibility of unintended outages. The estimated cost of the new switching station is $2.1 million and it is scheduled to be in-service by June 30, 1999. The benefit of this improvement is that service to Citizens'

customers will no longer be interrupted every time WAPA's transmission line has an interruption. By using a ring bus arrangement, the possibility that transient or permanent faults on WAPA's line or inside the switching station will cause an interruption to Citizens' customers is greatly reduced. This will significantly improve the power supply service reliability to our customers. Attachment II provides a more detailed description of the Nogales Switching Station Project.

SECOND TRANSMISSION LINE

In February 1999, Citizens provided responses to Staff's first set of data requests in Docket No. E-01032B-98-0621, the Nogales Complaint. The responses addressed the company's efforts to complete planning efforts for a second 115-kV transmission line to serve its customers in Santa Cruz County. A copy of those data responses has been attached as Attachment III. The purpose of this document is to provide an update on the transmission planning efforts since the initial responses.

In the initial response, four potential interconnections and potential line routes were identified. Three of the interconnections would be with Arizona Electric Power Cooperative ("AEPCO") and one would be with Tucson Electric Power Company ("TEP").

The four alternatives and their preliminary cost estimates are summarized as follows:

INTERCONNECTION WITH	FROM SUBSTATION	TO SUBSTATION	COST (Millions)
AEPCO	Bicknell	Valencia	$10.6
AEPCO	Sierra Vista	Valencia	$11.6
AEPCO	Pantano	Valencia	$14.0
TEP	Vail	Valencia	$16.25

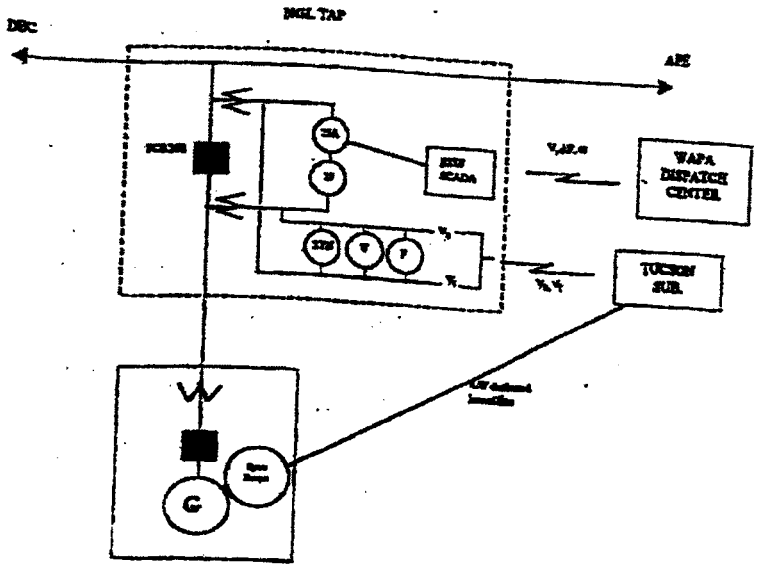
POWER FLOW STUDIES

AEPCO has completed preliminary power flow studies and provided copies of the study results. The studies support the Bicknell alternative as the preferred electrical alternative. TEP has performed preliminary power flow studies and responded verbally. TEP's studies indicate an interconnection at its Vail 345 kV substation would perform satisfactorily.

A second 115-kV line into the Nogales area would need to operate in parallel with WAPA's transmission system. Additional power flow studies are expected

INSTALLATION OF SYNCHRONIZING SYSTEM AT NOGALES TAP

The meeting at Nogales Tap between Western Area Power Administration ("WAPA") and Citizens Utilities Company (CUC) on December 16, 1998, resulted with an agreement to adopt a synchronizing scheme that will eliminate outages on CUC distribution system when transferring loads from CUC generators to WAPA 115-kV system. The scheme, shown in the diagram below, involves the procurement and installation of Beckwith auto-synchronizer, sync-check relay, and transducer, as well as synchroscope, voltmeters and frequency meters at Nogales Tap. In addition, CUC requires a synchroscope at Valencia power plant that will allow their operator to remotely monitor the voltages and sync condition at the Nogales Tap power circuit breaker (PCB 362).



Nogales Tap Auto-synchronizing Scheme

The Beckwith auto-synchronizer (M-0193) and transducer (M-0214) provide analog signals of incoming and running voltages, differential voltage, phase angle and slip to WAPA's dispatcher at Phoenix office via RTU/SCADA channels. With the SCADA data, the dispatcher will be able to coordinate with CUC operator in closing PCB 362 while the generators are on line. By providing telemetered voltages to CUC power plant, the plant operator will be able to observe the sync condition of line-side and generator-side voltages at Nogales Tap and act appropriately to facilitate breaker closing. In the event of telemetry failure, the local synchroscope at Nogales Tap will allow direct observation of the sync condition of voltages across the breaker by CUC personnel. Coordination with plant operator can be accomplished via mobile radio or cellular phone.

The subject relays have been delivered and installed. The Valencia power plant is presently capable of synchronizing to WAPA through the Nogales Tap by receiving real-time instructions from WAPA dispatch regarding machine speed.

The next stage of this project involves implementation of an actual synchroscope at the Valencia Power Plant, thereby eliminating the need to rely on WAPA dispatch to instruct the machine operators. The telemetry equipment needed for this part of the project has been ordered. Orders have also been placed to install phone lines that will be used as communication.

Project Name: Nogales Switching Station

Purpose and Need:

Citizens' load in Santa Cruz County is presently served through a radial 115-kV transmission line that connects to the transmission system of WAPA at an interconnection point near Tucson. When a electrical fault on WAPA's transmission line serving this tap point occurs, circuit breakers at the remote ends of WAPA's line open to clear the fault. Opening WAPA's line results in interruption of service to all of Citizens' customers in the county. During 1998 there were 10 outages of WAPA's line, three of which resulted in extended outages to Citizens' customers. This project will replace the existing facilities at the point of delivery with three transmission voltage circuit breakers that will automatically sectionalize WAPA's transmission line during faults and avoid outages to Citizens' customers caused by those faults.

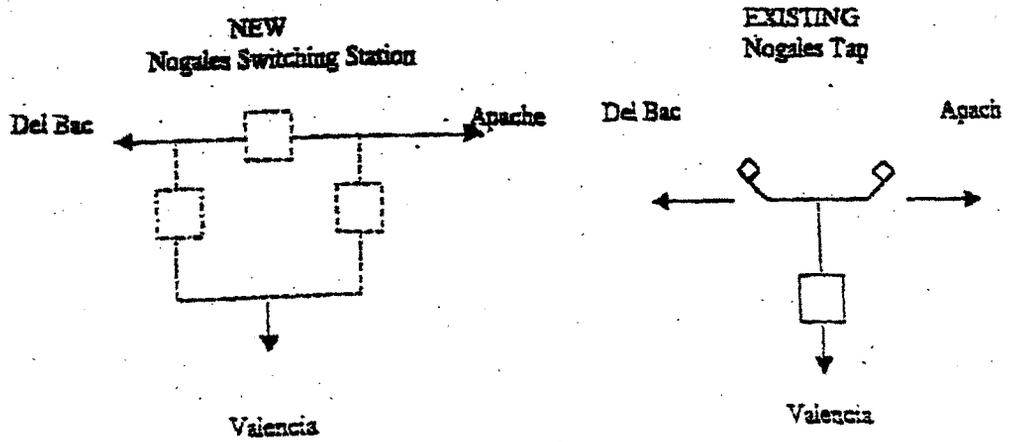
Scope:

Install three 115-kV circuit breakers and associated protective relaying, six bus switches, one motor operated line switch, bus work, a control building with supervisory control and data acquisition (SCADA) facilities and dual ported RTU and modify relaying and communications facilities at other affected substations (Del Bac, Adams Tap, Apache, and Vail).

Remove one 115-kV circuit breaker, three disconnect switches and associated bus work and station service equipment owned by Citizens. Remove two motor operated disconnect switches, metering and SCADA equipment owned by WAPA.

Schedule: In-Service Date: June 30, 1999.

Cost: $2,100,000



ATTACHMENT II

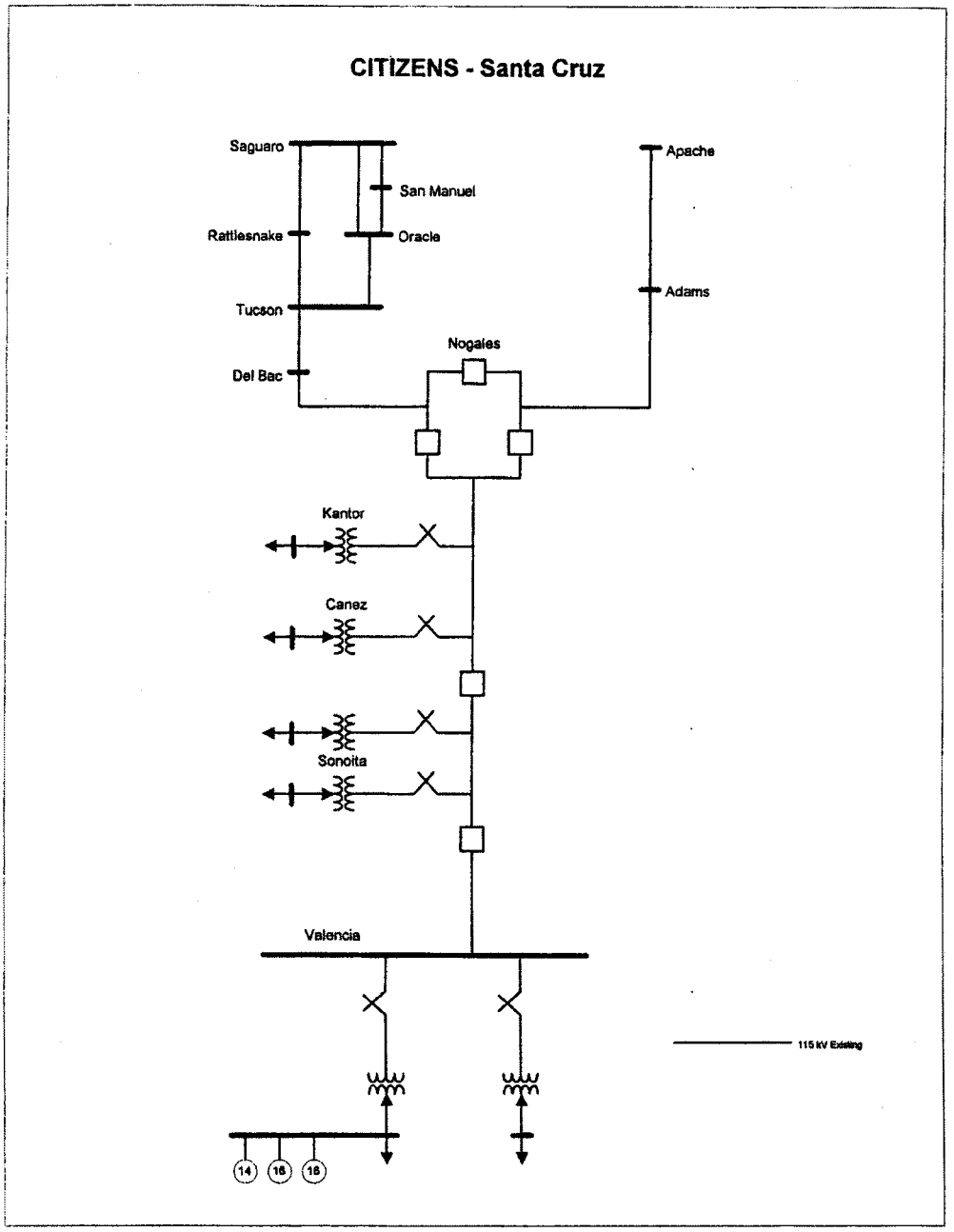

CITIZENS - Santa Cruz
Saguaro
San Manuel
Rattlesnake
Oracle
Tucson
Del Bac
Apache
Adams
Nogales
Kantor
Canez
Sonoita
Valencia
14
16
16
115 kV Existing

Exhibit 1

EXHIBIT
MM – 3

Aussie Widget Measures Wood Pole Strength

TRANSMISSION & DISTRIBUTION WORLD
Feb 1, 2009 12:00 PM
By H. Stewart Martin, Georgia Power

Accurate MPT field test enables Georgia Power to safely extend life of pole fleet.

T&D Poles are an Electric Utility's Greatest Single Infrastructure Investment. They represent one of the utility's biggest risks, as pole failure can seriously impact public safety and reliability. There has been no proven technique to provide an accepted empirical measure of the remaining strength of in-service poles — that is, until recently. After learning more about the benefits of mechanical pole testing (MPT), Georgia Power (Atlanta, Georgia, U.S.), a Southern Company, put this new type of inspection method to the test.

POLES AND INSPECTIONS

The distribution poles at Georgia Power are primarily of the Southern Pine species and are subjected to very hot and moist weather conditions. The utility's older poles — mostly pressure-treated creosote — normally begin to deteriorate below ground at about 20 to 25 years into their service life.

Georgia Power has had a robust inspection and treatment program in place since the late 1980s. Prior to 1987, the utility primarily used the hammer-sounding test as the initial means of identifying suspect poles — there was no remedial treatment program in place. All of Georgia Power's purchased poles have been supplier treated with chromated copper arsenate (CCA) preservative since the late 1980s. To date, the utility has seen no deterioration of properly manufactured and treated CCA poles.

In addition to the decay damage done to Georgia Power's creosote poles prior to 1987, many attachments have been added to the poles for telecommunications, Internet and cable TV equipment. This all adds to the horizontal and vertical loading of the poles. The additional loading must be accounted for and compared to the pole strength for in-service poles.

It is imperative that unserviceable poles be removed from the system or properly reinforced. However, it is just as important not to remove serviceable poles prematurely. The cost of pole replacements vary from US$400 to $10,000, depending on the complexity of the attachments and the equipment on the pole.

In recent years, Georgia Power was finding that pole inspection vendors were becoming increasingly conservative in their evaluation of poles to reduce their risk and that of the utility. Georgia Power pole replacement crews expressed to management that they were being asked to replace more poles that appeared to be sound than in previous years.

MECHANICAL POLE TESTING

Georgia Power's Distribution Design and Performance group, which handles the asset management guidelines for the distribution side of the business, recently decided to pilot and evaluate a new type of inspection method: the MPT 40. This process was developed by Deuar Pty Ltd. (Burpengary, Queensland, Australia). It was quite different than any of the traditional pole inspection methods used by most electric utilities in the United States.

Georgia Power began discussions with Dr. Kris Deuar in early 2006 to better understand the technology, safety issues and costs. The utility was initially concerned about the safety of these partial load tests, because it only would be testing weakened poles occasionally. It became convinced of the safety of the tests, as the weaker poles would be found with either a good visual and sounding inspection, or with only a minimal amount of force applied by the MPT device.

The MPT 40 approach made sense to Georgia Power. It gave a "direct" indication of the pole's strength, taking into account the differences inherent in the wood species used to produce the pole, the orientation of the defects and so forth. The theory is that by applying a known bending force, and then measuring very accurately how the pole geometry changes, the bending strength of the pole can be calculated. MPT had been used extensively in Australia, New Zealand and China with good reported success. Furthermore, the Forest Service Research Institute of New Zealand recommended it as the best method available for determining in-service pole strength.

The method uses digital protractors, attached to a pole, which measure the tilt (bending back) of the pole as the small pressure against the pole (always much less than the residual pole strength) is first applied and then released. Each pole is audio-visually inspected and subjected to a small initial load of 200 lb to 300 lb (91 kg to 136 kg) and then analyzed for safety before a final target load of 2000 lb to 3000 lb (907 kg to 1360 kg) is applied.

THE PILOT TEST EXPERIENCE

In late summer 2006, Georgia Power had two conventional inspection vendors set to inspect and treat poles in Savannah, Georgia. Each vendor was to inspect and treat half of Savannah's pole plant. The utility contracted with Deuar to come to Savannah and perform tests on 100 of these poles. Two segments of the Savannah poles were selected to compare the MPT methodology for assessing serviceability with that of each conventional inspection contractor. In each vendor's assigned area, 50 poles were first tested by MPT, then later by one of the two conventional inspection vendors who did not know the result of the MPT evaluation.

In many cases, the two approaches (conventional versus MPT) were in close agreement and resulted in the same pass/fail determination ("fail" was given to poles that were less than two-thirds of their original nominal strength). However, in many cases, there was quite a bit of difference in the percentage-strength determinations.

Tables 1, 2 and 3 summarize the results of the pilot. It is significant to note that:

* Six poles that had been rejected by conventional inspections were rated by MPT as still serviceable.
* Four poles that had been found to be still serviceable by conventional means were rated by MPT as unserviceable.

Table 1. Reject Poles Life Extended with MPT 40 Tests

Pole tag number	MPT 40		Conventional tests		
	Remaining strength	Status	Remaining circumference	Remaining strength	Status
5452	68%	Pass	79%	50%	R2
5477	96%	Pass	77%	45%	R1
5481	67%	Pass	45%	9%	R3
5511	84%	Pass	67%	30%	R3
5521	71%	Pass	86%	63%	R1
5533	99%	Pass	63%	25%	R3

Table 2. Weak Poles Discovered (Risk Removed) with MPT 40 Tests (Not Rejects Previously)

Pole tag number	MPT 40		Conventional tests		
	Remaining strength	Status	Remaining circumference	Remaining strength	Status
5456	57%	Fail	100%	100%	OK
5515	65%	Fail	100%	100%	OK
5523	62%	Fail	100%	100%	OK
5524	66%	Fail	100%	100%	OK

Table 3. Poles Where MPT 40 Tests Agreed with Conventional Evaluation (Rejects Only)

Pole tag number	MPT 40		Conventional tests		
	Remaining strength	Status	Remaining circumference	Remaining strength	Status
5495	39%	Fail	45%	9%	R3
5498	66%	Fail	78%	48%	R1
5507	52%	Fail	33%	4%	R3
5519	8%	Fail	47%	10%	R3
5520	17%	Fail	29%	3%	R3
5531	57%	Fail	85%	61%	R1

However, the question remained: Was the MPT evaluation more accurate or just different?

LABORATORY RESULTS

In an attempt to answer this question, Georgia Power joined an industry coalition in 2006 to perform pole tests with the National Electric Energy Testing, Research and Applications Center (NEETRAC). Several pole testing providers conducted independent analyses of the poles' remaining strength while they were still in-service. The poles were removed from service in 2007, and later break tested by NEETRAC in the lab.

Those tests proceeded slowly and were finally completed in the summer of 2007. The recently published report NEETRAC report showed the MPT process as one of the top-two predictors of pole strength. However, there were concerns about the useful application of the results. There was possible degradation of the poles over time and when they were removed and transported from the field location to Atlanta. Additionally, a great number of the poles failed at points well above the ground line, but every field vendor analysis addressed strength at ground line. Another series of tests is planned in 2009, where the test poles will be break tested in situ after the various vendors provide the predicted strength numbers to NEETRAC. Those involved believe that this will resolve the concerns of the previous tests.

ANOTHER ROUND OF TESTS

In December 2006, Georgia Power asked Deuar to test 10 poles in Atlanta, nine of which recently had been rejected (found to have less than 67% remaining strength) during a conventional evaluation. The utility's plan was to have Deuar test all of those poles using the partial load, nondestructive methodology. After completing those tests, Deuar would then use the more robust MPT 20 to break test these poles in situ.

Because the final series of tests was destructive, Georgia Power took precautions to ensure the safety of personnel and property. The utility's worries were put to rest during the break tests, as none of the poles failed in a way that required support of the pole. None fell over. At failure, the poles

simply quit resisting the force of the MPT 20, the pressure dropped and the highest force was recorded to calculate the breaking strength.

The nondestructive round of tests, conducted with an MPT 40, calculated that eight of the nine poles previously rejected by the conventional evaluation were still serviceable and confirmed one as unserviceable. The MPT 40 test agreed with the conventional vendors on the one pole they found serviceable.

Georgia Power then had Deuar test the same 10 poles in situ, using an MPT 20, by applying force against them until they actually broke. These tests closely matched the MPT 40 findings, with eight poles still reflecting years of serviceable life and only one pole that had been found serviceable in the nondestructive test was found to be borderline reject in the destructive test (see the comparison of results in Table 4).

Table 4. Comparison of Results Nondestructive MPT, Destructive MPT and Conventional

Pole number	Conventional test		Mechanical pole tests				Observations and conclusions
			Nondestructive		Destructive		
	Evaluation	Status	Test	Status	Test	Status	
A-1	49%	R1	82%	Pass	127%	Pass	Both MPT tests show pole still serviceable.
A-2	49%	R1	82%	Pass	127%	Pass	Both MPT tests show pole still serviceable
A-3	14%	R3	70%	Pass	64%	Fail	Nondestructive MPT test shows borderline pass; destructive MPT test shows borderline fail.
A-4	50%	R1	75%	Pass	68%	Pass	Both MPT tests show pole still serviceable.
A-5	14%	R3	20%	Fail	23%	Fail	All methods agree pole serviceable.
M-1	59%	R1	92%	Pass	99%	Pass	Both MPT tests show pole still serviceable
M-2	24%	R3	92%	Pass	N/A	N/A	Nondestructive MPT test shows pole serviceable (not destructive tested)
M-3	48%	R1	84%	Pass	69%	Pass	Both MPT tests show pole still serviceable
M-4	59%	R1	84%	Pass	66%	Pass	Destructive shows pole near pass, nondestructive shows fail status.
M-5	52%	R1	73%	Pass	77%	Pass	Both MPT test show pole serviceable
A-1 to A-5 represent poles embedded in concrete pavement; M-1 to M-5 represent poles embedded in soil; R1 represents rejected nonreinforceable pole; and R3 represents priority rejected pole.							

FORT GORDON TESTS

Although lacking an independent laboratory comparison test, Georgia Power nonetheless felt more confident seeing the reasonably close agreement of the nondestructive tests with the observed destructive tests. It also felt that the upcoming NEETRAC tests would further prove the worth and accuracy of the MPT technology. With this confirmation in hand, Georgia Power wanted to do

additional testing. The late 2006 conventional inspection and treatment of poles in Fort Gordon and in the Atlanta operating area gave the utility an ideal opportunity.

The company had seen an above-average reject rate in Atlanta and Fort Gordon. The utility also knew how compelling the business case is for extending the life of a pole. Although it could not justify retesting all 50,000 poles in Atlanta, or all 4500 in Fort Gordon, Georgia Power knew it would only have to avoid replacing a small percentage of the reject poles with the MPT tests to make a good return on its investment.

Dr. Deuar was asked to test 234 rejected — and destined for replacement — poles in the Atlanta and Fort Gordon areas. All of these poles had been found unserviceable in early 2007 by conventional ground line inspection. Poles were selected for MPT that were high-cost replacement poles, those with either transformer banks, electrical junctions or other equipment that made replacement more expensive than simpler poles. Of the 234 conventionally rejected poles, 132 poles (56%) were evaluated by the MPT tests as being still serviceable.

Looking at the financial side of this approach, for its business case, Georgia Power established or assumed (historical records):

* The average cost of replacement of one of these rejected poles was estimated to be around $4000.
* The cost of testing each pole was approximately $200, which was relatively high as only a few widely scattered poles were chosen. Startup costs also were a big part, because all the men and equipment had to come from the other side of the globe for this project only. It is expected that these costs will come down as the process becomes more automated and the number of poles tested rises in a given cycle.

As a result, the cost savings were as follows:

* Cost of pole testing 234 × $200 = $46,800
* Cost saved on pole replacements 132 × $4000 = $528,000
* Net savings $528,000 - $46,800 = $481,200.

The costs savings were all on the capital side of the financial analysis; the testing was an operating cost. Most utilities, Georgia Power included, regard these costs differently, but these savings are significant in any form of cash.

SAFETY IMPACT

From a safety standpoint, it also should be noted that out of 102 failed poles, the MPT found 21 poles (21%) to be much weaker than originally predicted by the conventional pole inspection methods. This allowed Georgia Power to place a higher priority on those poles that were previously thought to be low-priority replacements or reinforcements.

The traditional methods of testing a pole's strength — by hammering, listening to the pole's echo and boring — are recognized to be pretty unreliable. Most traditional pole testing methods assume consistent wood strength by species, age and remaining amount of good wood. Experience has shown these are false assumptions. Knowing a pole's species, age and degree of decay does not guarantee an accurate assessment of its remaining strength (or longevity). This knowledge can only be indicative of a pole's strength.

The initial stages of fungus growth, commonly known as an incipient decay, eludes all conventional methods of testing a pole's strength and, to date, can only be identified by costly microscopic examinations in a biological laboratory. It is not always detectable by drilling, yet incipient decay can reduce pole strength by up to 50%.

Additionally, more advanced internal decay or termite damage in a pole is often missed by drilling, especially if the pole cannot be fully excavated to inspect for belowground decay. Some Georgia Power poles had failed in-service due to belowground damage that had eluded inspectors.

AN EXCELLENT NEW TOOL

Georgia Power believes the recent field testing proves the MPT system is an excellent supplemental tool to conventional pole inspection and treatment methods. As the cost of the test is driven down by process improvements and higher volumes, it may even become more of a primary tool.

Although MPT cannot replace the remedial treatments performed by the traditional service providers, it could prevent the need to replace or reinforce poles that are either heavily loaded or found to have significant decay, rejected by conventional evaluations.

The business case is already convincing to support the use of MPT for performing a follow-up evaluation of poles rejected by the conventional inspection methods. For poles that a utility is unable to excavate, MPT also may be used to more accurately evaluate remaining strength, removing significant risk for the utility.

DATA TABLES

* Table 1. Reject Poles Life Extended with MPT 40 Tests
* Table 2. Weak Poles Discovered (Risk Removed) with MPT 40 Tests (Not Rejects Previously)
* Table 3. Poles Where MPT 40 Tests Agreed with Conventional Evaluation (Rejects Only)
* Table 4. Comparison of Results Nondestructive MPT, Destructive MPT and Conventional

ACKNOWLEDGEMENT

The author thanks Dr. Kris Deuar for his assistance during these pilots and Troy M. Doyle of ONE Management Consulting Services, Dr. Deuar's North American representative.

EXHIBIT
MM - 4

BEFORE THE ARIZONA CORPORATION COMMISS

COMMISSIONERS

JEFF HATCH-MILLER, Chairman
WILLIAM A. MUNDELL
MARC SPITZER
MIKE GLEASON
KRISTIN K. MAYES

IN THE MATTER OF SERVICE QUALITY ISSUES, ANALYSIS OF TRANSMISSION ALTERNATIVES AND PROPOSED PLAN OF ACTION IN THE SANTA CRUZ ELECTRIC DIVISION OF CITIZENS UTILITIES COMPANY

Docket No. E-01032A-99-0401

NOTICE OF FILING OF TESTIMONY OF MARSHALL MAGRUDER

8 July 2005

As indicated in the Procedural Order of 14 March 2005, as modified on 20 May 2005, the prefiled Testimony of Marshall Magruder is hereby submitted to the Parties as of this date based on the ACC Decision No. 67506 of 20 January 2005 that ordered this docket and Decision No. 62011 to be reopened.

Respectfully submitted on this 8th day of July 2005 to all parties.

MARSHALL MAGRUDER

By Marshall Magruder

Marshall Magruder
PO Box 1267
Tubac, Arizona 85646
(520) 398-8587
marshall@magruder.org

b. In summary, the existing 115 kV transmission line is adequate for 100 MW of power (see Attachment 3 for Peak Load Analysis). A peak load of 100 MW will not occur in this Santa Cruz service area for several decades.[74]

F.1.3.1 Thermal Rating for Various Transmission Lines.

Table F.1.3-1 shows the thermal ratings or maximum capacity for Transmission lines in the Santa Cruz grid in Megawatts (MWs). The lowest thermal rating is in the last 4.8 miles north of Nogales, This analysis did not recommend it be upgraded.

Table F.1.3-1 ***Proposed and Existing 115 kV Transmission Lines Capacity Ratings in the Santa Cruz Grid.*** "Thermal" ratings determine the maximum capacity or load carrying capabilities for transmission lines.[75]

Line Status	Line Section (Location)	Length in miles	Conduct or Type	Structure Type	Thermal Ampacity Rating (amperes)	Thermal Rating at 115 kV (MVA)
WAPA-owned Lines (before Citizens 115 kV)	Del Bac (WAPA) to Nogales Tap (Tucson)	---	---	---	603*	**120 MW**
	Adams (WAPA) to Nogales Tap (Tucson)	---	---	---	803**	**160 MW**
Existing 115 kV transmission line	Nogales Tap (Tucson) to Amado (Kantor substation)	27.7	559.5 AAAC	Steel Monopole	663**	**132 MW**
	Amado (Kantor) to North Rio Rico (Canez substation)	13.5	559.5 AAAC	H-Frame	663**	**132 MW**
	North Rio Rico (Canez) to South Rio Rico (Sonoita substation)	3.3	559.5 AAAC	H-Frame	663**	**132 MW**
	South Rio Rico (Sonoita) to the Conductor Change	3.6	559.5 AAAC	H-Frame	663**	**132 MW**
	1Conductor Change to Nogales (Valencia substation)	4.8	4/0 ACSR	H-Frame	340***	**68 MW**
Proposed 115 kV line from Gateway	115 kV Gateway Substation to Nogales (Valencia substation)	3.5	559.5 AAAC	Steel Monopole	663**	**132 MW**

* Thermal ampacity ratings for Del Bac and Adams substations to Nogales Tap at the Nogales Switchyard in Tucson were obtained from the WSCC database.

** The thermal ampacity rating for the 559.5 AAAC conductor reference is the *Southwire Handbook*, (*Citizens Santa Cruz 2002 Plan of Action).*

*** The thermal ampacity rating for the 4/0 ACSR conductor is from the Westinghouse Transmission and Distribution Reference Book.

The existing 559.5 All-Aluminum Alloy Conductor (AAAC)[76] and the older 4/0 Aluminum Conductor Steel-Reinforced (ACSR) conductors could be replaced by more modern, higher thermal rated, lighter and more efficient (less power losses) conductors, such as aluminum conductor composite core (ACCC), aluminum conductor composite reinforced (ACCR) GAP conductors or In-line VAR conductors to reduce voltage losses.

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74 *Ibid.* pp. 7-8.

75 *Ibid*, Table 2, at 9. This Study uses MVA (apparent power) and MW (active power) interchangeably when discussing this table, thus the right column shows MW for each line segment.

76 Citizens installed the 559.5 AAAC conductors and steel monopoles between 1988-1989, which replaced the older 4/0 AWG ACSR conductors with AAAC conductors. (TEP/UNS Electric Report Attachment 1)

The ACCR conductors, which are not being considered by any of the TEP or its other alternatives, are state-of-the art, with the following characteristics:

a. Increased ampacity (current capacity),
b. Increased in load capacity for a designated Right of Way width (~100%),
c. Larger increases in power transfer (~200-500%),
d. Higher power gain (~100%),
e. Longer span crossings (~100-600%) with fewer towers,
f. Reduced tower loading, Higher ice loading,
g. Reduced tower heights,
h. Reduced environmental impacts,
i. Reduced installation time and
j. Faster restoration times.[77]

F.1.3.2 Voltage Level Support Issues.

In addition, the *Citizens Santa Cruz 2002 Plan of Action* stated

> "Transmission system voltage levels are below the planning criteria of 0.95 per unit with the existing load of 57MW."[78] For a single contingency (N-1) outage for the existing system, the worst case 115 kV outage is between the Nogales Tap (Tucson) and the Amado (Kantor) substation. This outage would disconnect the Santa Cruz grid, which would require the Santa Cruz grid to be supported by the Nogales generators and any other distributed generation."[79]

F.1.3.3 Impacts of the New 46 kV Transmission Line on Meeting Demand.

The new UNS Electricity 5.6 mile 46 kV transmission line adds an additional 22 MW[80] to the Santa Cruz Grid, which would then total 70 MW whenever there was an outage on the existing 115 kV line north of the Kantor substation[81]
The addition of the 46 kV (22 MW) line would meet the present peak load conditions when used during emergency conditions.

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[77] Modern conductors could also be used on the proposed TEP 345 kV line with significantly reduced costs, in terms of fewer and significantly smaller towers, less sag and higher temperatures, with three conductors (ACCC) at 345 kV carrying over 1,700 MW, instead of 12 conductors, less losses, higher strength wires and other benefits. See www.3m.com/accr and "It's Time to Address the Critical Issue of VAR Compensation" in *Transmission & Distribution World,* April 2004, pp. 92-94 at www.tdworld.com.

[78] *Citizens Santa Cruz 2002 Action Plan*, p. 3.

[79] *Ibid.* The potential distributed generation at the Nogales International Wastewater Treatment Plant, the customer with the highest demand in Santa Cruz service area, may remove up to 8 MW of demand since it will use both biomass and natural gas fuels. In mid-2008, a new natural gas line is expected to be installed between Nogales, Sonora and Nogales, Arizona to "east" of Tucson, where it will connect with the east-west El Paso Natural Gasline.

[80] Mostly, TEP reports this line with 22 MW; however, 20 MW is also used in the *Supplemental TEP/UNS Electrical Outage Response* Plan.

[81] The original TEP 46 kV proposal used the 22 MW capacity for this line. There are 48 MW available from the Nogales turbines and 22 MW for the new 46 kV line. Subsequently, the later TEP/UNS Outage Restoration Report used 46 MW and 20 MW, respectively. No rationale for the chance was provided, other than a footnote about one of the turbines that is dismissed, as discussed later, as erroneous. Thus, with a single 46 kV backup transmission line, then there is a total of 70 MW available for the Santa Cruz grid.

Table F.1-1 Actual and Forecast Annual *Peak Demand for the Santa Cruz Service Area.* The actual observed values, in the second column, show the actual annual peak demand in MW, with forecasts that are "higher" than forecast in red and "lower" than forecast in **blue**. Each 10 MWhr is shaded in a different background color. Newer forecasts are to the left and older to the left. Above the line between 2006 and 2007 indicates "history" which future demand predictions are below.

EXHIBIT
MM - 5

REAL WORLD Data		FORECAST PEAK DEMAND for the Santa Cruz Service Area															
Year	ACTUAL Peak Demand	Ref 16	Ref 15	Ref 14	Ref 13 3% growth	Ref 12 5% growth	Ref 11	Ref 10 slow	Ref 9	Ref 8	Ref 7 Hot	Ref 6 High	Ref 5 Normal-ized	Ref 4 Hot	Ref 3 Normal	Ref 2	Ref 1
Year of Forecast		May 2008	May 2008	Oct 200?	Mar 2007	Mar 2007	Dec 2006	Oct 2005	July 2005	June 2004	Feb/Apr 2004	Feb-/Apr 2004	Feb 2004	2000	2000	1999	1998?
1993	40.0																
1994	43.7																
1995	41.6																
1996	41.9																
1997	42.5																
1998	45.3																
1999	50.36															46.7	50.5
2000	52.60														50.2A	48.0	52.6
2001	50.54													60.0	55.0	49.9	55.7
2002	57.99													62.0	58.0	51.6	56.9
2003	57.636										59.1		57.5	66.0	60.0	52.4	58.2
2004	60.768									61.4	61.4	64.4	59.7	67.0	62.0	54.5	59.5
2005	69.408			70			69.5			63.6	63.2	63.6	66.8	61.9	69.0	64.0	60.7
2006	73.152			73			71.1	72.7		65.3	64.9	65.8	69.0	64.0	72.0	66.0	
2007	No Data			74			74.0	74.1	63.6	66.7	66.5	67.9	71.3	66.1	74.0	68.0	
2008	No Data	75.55	78.31	76	76.1	76.1	76.5	76.5	65.3	68.1	68.0	70.1	73.5	68.2	76.0	70.5	
2009		76.99	81.10	77	78.4	79.9	79.1	77.0	66.7	69.4	69.5	72.2	75.8	70.3	78.0	73.0	
2010		78.45	83.79	78	80.7	83.9	81.7	78.5	68.1	70.8	71.0	74.5	78.2	72.5	80.0	74.0	
2011		79.93	86.53	80	83.2	88.1	84.3	79.9	69.4	72.2	72.5	76.8	80.6	74.7			
2012		81.45	89.10	81	85.7	92.5	86.9	81.5	70.8	73.6	74.0	79.2	83.1	77.0			
2013		83.00	91.79	83	88.2	97.1	90		72.2	74.9	75.4	81.6	85.7	79.4			
2014		84.62	95.00	85	90.9	102.0	92		73.6	76.1	76.7	84.1	88.3	81.8			
2015		86.17		86	93.6	107.1	95		74.9	77.3	78.8	86.7	91.0	84.3			
2016		87.61			96.4	112.4	98		76.1	78.5	79.3						
2017		88.99			102.3	118.1	101		77.3	79.7	80.6						
2018		90.33				124.0	103		78.5	80.9	81.9						
2019		91.58					105		79.7	82.0	83.3						
2020		92.80					107		80.9	83.3	84.6						

Historical Peak Demand Data

Historical Forecast Peak Demand Data

Forecast Peak Demand Data

Table F.1-1 Actual and Forecast Annual *Peak Demand for the Santa Cruz Service Area.* The actual observed values, in the second column, show the actual annual peak demand in MW, with forecasts that are "higher" than forecast in red and "lower" than forecast in **blue**. Each 10 MWhr is shaded in a different background color. Newer forecasts are to the left and older to the left. Above the line between 2006 and 2007 indicates "history" which future demand predictions are below.

EXHIBIT
MM - 5

REAL WORLD Data		FORECAST PEAK DEMAND for the Santa Cruz Service Area															
Year	ACTUAL Peak Demand	Ref 16	Ref 15	Ref 14	Ref 13 3% growth	Ref 12 5% growth	Ref 11	Ref 10 slow	Ref 9	Ref 8	Ref 7 Hot	Ref 6 High	Ref 5 Normal-ized	Ref 4 Hot	Ref 3 Normal	Ref 2	Ref 1
Year of Forecast		May 2008	May 2008	Oct 200?	Mar 2007	Mar 2007	Dec 2006	Oct 2005	July 2005	June 2004	Feb/Apr 2004	Feb-/Apr 2004	Feb 2004	2000	2000	1999	1998?
2021		93.95					109		82.0		86.3						
2022		95.05							83.3		88.0						
2023		96.09									89.8						
2024		97.07									91.6						
2025		97.99									93.4						
2026		98.97									95.3						
2027		99.96									97.2						
2028		100.96									99.1						
2029											101.1						
2030											103.1						
2031											105.2						
2032											107.3						
2033											109.4						
2034											111.6						
2035											113.9						
2036											116.1						
2037											118.5						
2038											120.8						
2039											123.2						
2040											125.7						

Historical Peak Demand Data

Forecast Peak Demand Data

Forecast Data Sources and notes (reading from left to right columns) that are identified by Ref # in parenthesis below:

***Actual Peak Demand (1993 to 2006)** – From UES website (27 May 2009), corrected 2005 peak data. In the UNSE Rate Case, ACC Docket E-04204A-06-0783, the peak loads for 2006 and 2005 were given as 71.7 MW and 69.6MW, but in UNSE Response to STF 1.1. In USNE response to MM DR 1.15 the peak load for 2006 was provided by UNSE to be 73.152 MW was provided as the 2006 peak load. In this UNSE response to MM DR 1.15, the peak load demands for 2003 through 2006 were provided which included a 2003 peak at 54.144 MW that occurred after 11 Aug 2003, under UNSE, while the actual 2003 peak occurred under Citizens at 57.64 MW earlier that summer. Additional peak data were in TEP's response to MM Data Request 221.c in ACC Docket E-01032A-99-0499

FORECAST DATA:

(Ref 16) UNSE Generation Forecast. From http://qawww.uesaz.com/Wholesale/ResPlan.asp on 27 May 2008.

(Ref 15) UNSE Forecast, UNSE Conversion from Point-to-Point Service to Network Integration Transmission Service, report for WAPA, dated 22 May 2008, in response to DR 1-1 in Line Siting Case 144.

(Ref 14) Santa Cruz Peak Demand Forecast, UES website 27 May 2008 (date is not on the page, Oct 200 is shown), similar format as Ref 11.

UNSE Rate Case (Ref 13) 3% growth, (Ref 12) 5% growth (Mar 2007) – In UNSE's response to MM Data Request 1.15 (Excel spread sheet) in ACC Docket E-04204A-06-0783 for years 2008 through 2018 using a 3% and 5% growth rates.

(Ref 11) UNS Electric and SEC (Dec. 2006) – For 2005 to 2012, from Testimony of Ed Beck in UNS Electric Rate case ACC Docket E-04204A-06-0783 and from 2013 to 2021 from the UniSource SEC Form 25 submitted in Dec 2006 and Exhibit MJD-1 to Michael DeConcini in the above UNS Electric Rate case. The SEC filing also included the earlier years, rounded off to an even MWhr as Weather Normalized Peak Demand Forecast.

(Ref 10) UNSE "Very Slow" Scenario (Oct 2005) – From UNSE Annual Peak Load Forecast, emails in March 2006, from MM Data Request 1.9.g in ACC Docket E-04204A-06-0783.

(Ref 9) TEP/UNS (July 2005) – From Beck Testimony of 8 July 2005, Exhibit 3 (Annual Peak Load Forecast for Santa Cruz County)

(Ref 8) UNS Electric (June 2004)– From UES "Long-term Transmission Plans for Santa Cruz County UNS Electric System," June 2004. For years 2021 and later, the forecast is extrapolated based on a 2% growth factor.

TEP (Ref 7) Hot, (Ref 6) High, and (Ref 5) Normalized Forecast (Feb/April 2004) – From Exhibit 4 (February 2004) where TEP forecast is for the average year (also in the RMR report for 2005, 2008, 2012) and the "high" for years that are hotter than normal.[1] This also has been published as "Nogales Retail Peak Forecast – April 2004:" with the years 2004 to 2020 designated as the "UniSource Forecast (MW)" and the years 2021 to 2040 as "Extrapolated Forecast (2% growth factor (MW)

UniSource Energy Services – Loads & Resources Peak (weather normalized) Demand Forecast (used by UniSource for the competition for a new Purchase Power Agreement for Santa Cruz County (February 2004)

RAC2 (Ref 4) Hot, (Ref 3) Normal (2000), Testimony of Rasel Craven, Citizens Director of Engineer, May 1, 2001, Docket No. L-00000C/F-01-0111, Line Siting Case No. 111, as Exhibit RAC-2, which indicated on June 30, 2000, a record of 50.2 MW was reached (marked by A) above. Values for 2001 to 2003 are from testimony, from 2004 to 2010 from Exhibit 4 (February 2004) as footnoted above. The "normal" and "hot" were for years which were average or higher than average. The R.W. BECK & Co. determined the RAC-2 forecasts in early 2000.

(Ref 2) Citizens' Cost-Benefit Analyses (1999) of Transmission-Line Alternatives, ACC Docket E-01032A-98-0611 in Exhibit F of July 13, 1999 at Nogales Tap for "normal weather."

(Ref 1) Citizens Briefing (1988) given to the Joint Santa Cruz County/City of Nogales Energy Commission in February 2001; however, content appeared to be dated about 1988.

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[1] See Exhibit 4 from the TEP and UES "Response to Commission Questions and Updated Response Plan for Santa Cruz County" of 9 February 2004, in Docket No. E-01032-99-0401.

EXHIBIT

MM - 6

UES - LOADS & RESOURCES PEAK DEMAND FORECAST

WEATHER NORMALIZED DEMAND FORECAST BY DIVISION

LOADS - PEAK DEMAND	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2
UES SYSTEM												
SANTA CRUZ	70	73	74	76	77	78	80	81	83	85	86	
MOHAVE	359	398	433	505	551	593	629	663	695	726	755	
RETAIL PEAK DEMAND NCP	**429**	**471**	**508**	**581**	**628**	**671**	**709**	**744**	**778**	**810**	**841**	

RESOURCES	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2
EXISTING RESOURCES												
THERMAL UNITS (REPORTING CAPACITY)	46	46	46	46	46	46	46	46	46	46	46	
FUTURE RESOURCES												
THERMAL UNITS - PLANNED	-	21	21	21	21	21	21	21	21	21	21	
RENEWABLE RESOURCES												
RENEWABLE - PLANNED	-	-	-	-	-	-	-	-	-	-	-	
TOTAL RESOURCES	**46**	**67**	**67**	**67**	**67**	**67**	**67**	**67**	**67**	**67**	**67**	
LOAD MANAGEMENT-INTERRUPTIBLE												
KINGMAN												
DEPT OF PUBLIC WORKS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
GOLDEN VALLEY WATER	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
BRACKETT AIRCRAFT	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
EQUITORIAL MINERAL PARK	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
MAUGHAN RANCHES	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
	3.5	**3.5**	**3.5**	**3.5**	**3.5**	**3.5**	**3.5**	**3.5**	**3.5**	**3.5**	**3.5**	
LAKE HAVASU												
DEPT OF PUBLIC WORKS	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	
AQUATIC CENTER	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
WATER TREATMENT PLANT	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
	4.0	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	
FIRM PURCHASES												
APS FULL REQUIRMENTS	428.6	471.1	507.6									
TOTAL EXISTING RESOURCES	**482.1**	**545.6**	**582.1**	**74.5**	**74.5**	**74.5**	**74.5**	**74.5**	**74.5**	**74.5**	**74.5**	
OPERATING RESERVE MARGIN, MW	53.5	74.5	74.5	(506.0)	(553.6)	(596.7)	(634.5)	(669.7)	(703.2)	(735.6)	(766.4)	(7
OPERATING RESERVE MARGIN, %	12.5%	15.8%	14.7%	-87.2%	-88.1%	-88.9%	-89.5%	-90.0%	-90.4%	-90.8%	-91.1%	-9
REQUIRED RESOURCE CAPACITY (7.5% MARGIN)	-	-	-	624.1	675.2	721.5	762.2	800.1	836.6	871.1	904.0	9

UES - ENERGY FORECAST

WEATHER NORMALIZED ENERGY FORECAST BY DIVISION — OCT-20

SALES FORECAST BY DIVISION	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2
RETAIL SALES (GWH)												
SANTA CRUZ	275.9	281.4	287.0	292.5	298.1	303.8	309.5	315.4	321.4	327.6	333.6	3
MOHAVE	1,225.1	1,340	1,429	1,641	1,774	1,899	2,016	2,125	2,228	2,327	2,420	2
TOTAL RETAIL ENERGY (GWH)	**1,501.0**	**1,621.4**	**1,715.9**	**1,933.4**	**2,071.7**	**2,202.9**	**2,325.8**	**2,440.3**	**2,549.0**	**2,654.8**	**2,754.1**	**2,8**
ESTIMATED SYSTEM LOSS FACTOR	9.91%	9.94%	9.93%	9.93%	9.93%	9.93%	9.93%	9.93%	9.94%	9.94%	9.94%	9
GENERATION REQUIREMENTS (GWH)												
SANTA CRUZ	302.8	309.0	315.1	321.2	327.3	333.5	339.8	346.3	352.9	359.7	366.4	3
MOHAVE	1,346.9	1,473.6	1,571.2	1,804.2	1,950.2	2,088.2	2,217.0	2,336.5	2,449.4	2,558.9	2,661.4	2,7
TOTAL RETAIL ENERGY (GWH)	**1649.7**	**1782.6**	**1886.4**	**2125.4**	**2277.5**	**2421.7**	**2556.8**	**2682.7**	**2802.3**	**2918.6**	**3027.8**	**3'**
LOAD FACTOR (%)												
SANTA CRUZ	53.18%	48.45%	48.45%	48.31%	48.45%	48.45%	48.45%	48.31%	48.45%	48.45%	48.45%	48
MOHAVE	44.31%	42.08%	41.25%	40.55%	40.27%	40.09%	40.11%	40.01%	40.12%	40.12%	40.13%	40
TOTAL RETAIL ENERGY (%)	45.71%	43.07%	42.30%	41.56%	41.27%	41.07%	41.05%	40.92%	41.01%	40.99%	40.98%	40
PEAK DEMAND GROWTH (%)												
SANTA CRUZ	8.87%	4.43%	1.99%	1.92%	1.90%	1.90%	1.89%	1.90%	1.91%	1.95%	1.84%	1
MOHAVE	14.88%	10.98%	8.79%	16.51%	9.13%	7.55%	6.13%	5.36%	4.82%	4.46%	4.00%	3
TOTAL RETAIL DEMAND (MW)	**13.89%**	**9.92%**	**7.74%**	**14.38%**	**8.19%**	**6.86%**	**5.63%**	**4.97%**	**4.50%**	**4.19%**	**3.78%**	**3**
ENERGY GROWTH (%)												
SANTA CRUZ	1.03%	2.04%	1.99%	1.92%	1.90%	1.90%	1.89%	1.90%	1.91%	1.95%	1.84%	1
MOHAVE	7.64%	9.41%	6.62%	14.83%	8.09%	7.07%	6.17%	5.39%	4.83%	4.47%	4.01%	3
TOTAL RETAIL ENERGY (GWH)	**6.36%**	**8.06%**	**5.87%**	**12.67%**	**7.15%**	**6.33%**	**5.58%**	**4.92%**	**4.46%**	**4.15%**	**3.74%**	**3**

EXHIBIT

MM - 7

Santa Cruz - Generation Forecast 2008 - 2028

Santa Cruz Generation Requirements, MWh

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	27,966	21,492	24,569	25,415	27,598	31,263	40,631	30,375	23,567	21,643	21,142	25,543	321,204
2009	28,500	21,901	25,035	25,896	28,119	31,857	41,407	30,948	24,014	22,065	21,537	26,028	327,308
2010	29,039	22,312	25,522	26,401	28,645	32,455	42,190	31,547	24,481	22,474	21,935	26,520	333,521
2011	29,603	22,741	25,996	26,890	29,174	33,080	43,007	32,129	24,935	22,902	22,349	27,019	339,824
2012	30,152	23,174	26,490	27,401	29,729	33,710	43,832	32,739	25,409	23,335	22,769	27,532	346,271
2013	30,726	23,612	26,992	27,920	30,311	34,349	44,669	33,358	25,907	23,774	23,196	28,060	352,874
2014	31,329	24,058	27,519	28,465	30,881	35,022	45,550	34,010	26,415	24,237	23,646	28,611	359,743
2015	31,942	24,522	28,030	29,008	31,467	35,662	46,382	34,622	26,888	24,666	24,059	29,103	366,351
2016	32,484	24,935	28,518	29,494	31,990	36,256	47,160	35,194	27,332	25,071	24,451	29,577	372,462
2017	33,016	25,339	28,961	29,951	32,505	36,841	47,921	35,754	27,752	25,451	24,820	30,032	378,343
2018	33,519	25,722	29,415	30,419	32,990	37,392	48,639	36,284	28,163	25,825	25,182	30,468	384,017
2019	34,012	26,096	29,825	30,841	33,444	37,907	49,314	36,781	28,550	26,176	25,521	30,883	389,350
2020	34,473	26,446	30,225	31,252	33,891	38,413	49,972	37,267	28,927	26,517	25,853	31,279	394,514
2021	34,923	26,788	30,615	31,655	34,326	38,884	50,588	37,721	29,278	26,837	26,162	31,655	399,431
2022	35,342	27,108	30,979	32,012	34,711	39,344	51,188	38,161	29,621	27,149	26,464	32,013	404,094
2023	35,734	27,406	31,317	32,379	35,108	39,771	51,745	38,572	29,940	27,438	26,743	32,351	408,504
2024	36,113	27,694	31,646	32,701	35,453	40,187	52,285	38,971	30,233	27,704	27,001	32,670	412,659
2025	36,464	27,960	31,949	33,031	35,789	40,568	52,784	39,335	30,516	27,962	27,250	32,969	416,579
2026	36,810	28,226	32,253	33,345	36,129	40,954	53,285	39,709	30,806	28,228	27,509	33,282	420,537
2027	37,160	28,494	32,559	33,662	36,472	41,343	53,791	40,086	31,099	28,496	27,770	33,598	424,532
2028	37,513	28,765	32,869	33,981	36,819	41,735	54,302	40,467	31,394	28,767	28,034	33,918	428,565

Santa Cruz Coincident Peak Demand, MW

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008	54.71	51.89	46.68	46.24	66.22	75.55	73.38	65.89	62.65	49.91	57.33	57.56	75.55
2009	55.75	52.88	47.57	47.12	67.48	76.99	74.78	67.14	63.84	50.86	58.41	58.65	76.99
2010	56.81	53.88	48.47	48.02	68.76	78.45	76.20	68.42	65.05	51.83	59.52	59.76	78.45
2011	57.88	54.90	49.38	48.93	70.06	79.93	77.64	69.71	66.28	52.81	60.65	60.89	79.93
2012	58.98	55.94	50.32	49.85	71.39	81.45	79.11	71.03	67.54	53.81	61.80	62.05	81.45
2013	60.11	57.01	51.28	50.80	72.75	83.00	80.62	72.39	68.83	54.83	62.98	63.23	83.00
2014	61.28	58.11	52.28	51.79	74.16	84.62	82.19	73.80	70.17	55.90	64.20	64.46	84.62
2015	62.40	59.18	53.24	52.74	75.53	86.17	83.70	75.15	71.46	56.93	65.38	65.65	86.17
2016	63.44	60.17	54.13	53.62	76.79	87.61	85.09	76.41	72.65	57.88	66.47	66.74	87.61
2017	64.44	61.12	54.98	54.47	78.00	88.99	86.44	77.61	73.80	58.79	67.52	67.80	88.99
2018	65.41	62.04	55.81	55.29	79.17	90.33	87.73	78.78	74.90	59.67	68.54	68.81	90.33
2019	66.32	62.90	56.58	56.06	80.27	91.58	88.95	79.87	75.94	60.50	69.49	69.77	91.58
2020	67.20	63.73	57.33	56.80	81.33	92.80	90.13	80.93	76.95	61.31	70.41	70.69	92.80
2021	68.04	64.53	58.05	57.51	82.35	93.95	91.25	81.94	77.91	62.07	71.29	71.57	93.95
2022	68.83	65.28	58.72	58.18	83.31	95.05	92.32	82.90	78.82	62.79	72.12	72.41	95.05
2023	69.58	65.99	59.37	58.81	84.22	96.09	93.33	83.80	79.68	63.48	72.91	73.20	96.09
2024	70.29	66.66	59.97	59.41	85.07	97.07	94.28	84.65	80.49	64.13	73.65	73.94	97.07
2025	70.96	67.30	60.54	59.98	85.88	97.99	95.17	85.46	81.26	64.73	74.35	74.65	97.99
2026	71.67	67.97	61.14	60.58	86.74	98.97	96.12	86.31	82.07	65.38	75.09	75.39	98.97
2027	72.38	68.65	61.76	61.18	87.61	99.96	97.09	87.18	82.89	66.04	75.84	76.15	99.96
2028	73.11	69.34	62.37	61.79	88.48	100.96	98.06	88.05	83.72	66.70	76.60	76.91	100.96

EXHIBIT
MM - 8

Statement of Interest
for a
Renewable Energy Transmission Project
By
Tucson Electric Power Co.
Southwest Transmission Cooperative, Inc.
April 3, 2009

Emailed Only (txrfi@wapa.gov)

Pursuant to Federal Register Vol. 74, No. 41, March 4, 2009, Western Area Power Administration Notice of Availability of Request for Interest, Tucson Electric Power Company and Southwest Transmission Cooperative, Inc. jointly submit, on their behalf and on behalf of other interested parties noted below in Potential Joint Participants, this statement of interest identifying transmission system enhancements in Southern Arizona to facilitate the delivery of renewable resources. The series of proposals contained in this project are entirely within Western's footprint, include upgrades to Western's system and other utility systems, and will facilitate the delivery of solar and wind resources from multiple proposed projects to multiple utilities.

Entities: Tucson Electric Power Co. (TEP) one of two electric subsidiaries of UniSource Energy Corporation (UNS). Founded in 1892, TEP is the principal subsidiary of UNS. TEP is an electric utility with more than 2,200 megawatts of generating capacity with an extensive transmission system serving customers in a southern Arizona service territory spanning 1,155 square miles. TEP's existing EHV transmission network, including jointly owned, consists of about 512 miles of 500kV and 1,098 miles of 345kV transmission of which approximately 2 miles and 239 miles of 500kV and 345kV respectively are wholly owned by TEP. The balance of 510 miles of 500kV and 859 miles of 345kV are jointly owned.

Southwest Transmission Cooperative, Inc. (SWTC) a non-profit corporation as defined and organized under the generation and transmission electric cooperative laws of the state of Arizona. SWTC was organized upon a restructuring of the Arizona Electric Power Cooperative, Inc. (AEPCO) on October 11, 2000 and owns approximately 610 miles of transmission lines to help serve its distribution cooperative service members and other transmission customers in a combined service territory that covers over 15,000 square miles in rural Arizona and parts of California and New Mexico.

Potential Joint Participants:

- Arizona Public Service (APS)
- Central Arizona Water Conservation District (CAWCD)
- Salt River Project (SRP)
- Southwest Public Power Resources (SPPR)
- UNS Electric (UNSE)

Some renewable project developers have expressed interest in joining in this SOI. However, due to concerns about equitable treatment, TEP and SWTC agreed to provide opportunities for additional potential joint participants as project development proceeds.

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Project Description: The proposed project, Apache – Saguaro 230 kV Renewable Transmission Project (RTP), consists of replacing Western's existing 115kV transmission line interconnecting the SWTC Apache substation and the APS Saguaro substation with a double circuit 230 kV transmission line. Termination facilities will be required at the Apache and Saguaro substations to maintain connectivity of the Western Parker-Davis system. Additional transformation from 230 kV to 115 kV would be required at Western's Marana Tap, Rattlesnake, Tucson, Nogales and Adams Tap switching stations. The second circuit, which is proposed to be constructed on the Western 230 kV double circuit structures is to be funded and owned separately by TEP and SWTC, along with other potential joint participants, and proposed to be operated at 230 kV. Refer to Figure 1. Apache – Saguaro 230 kV Renewable Transmission Project.

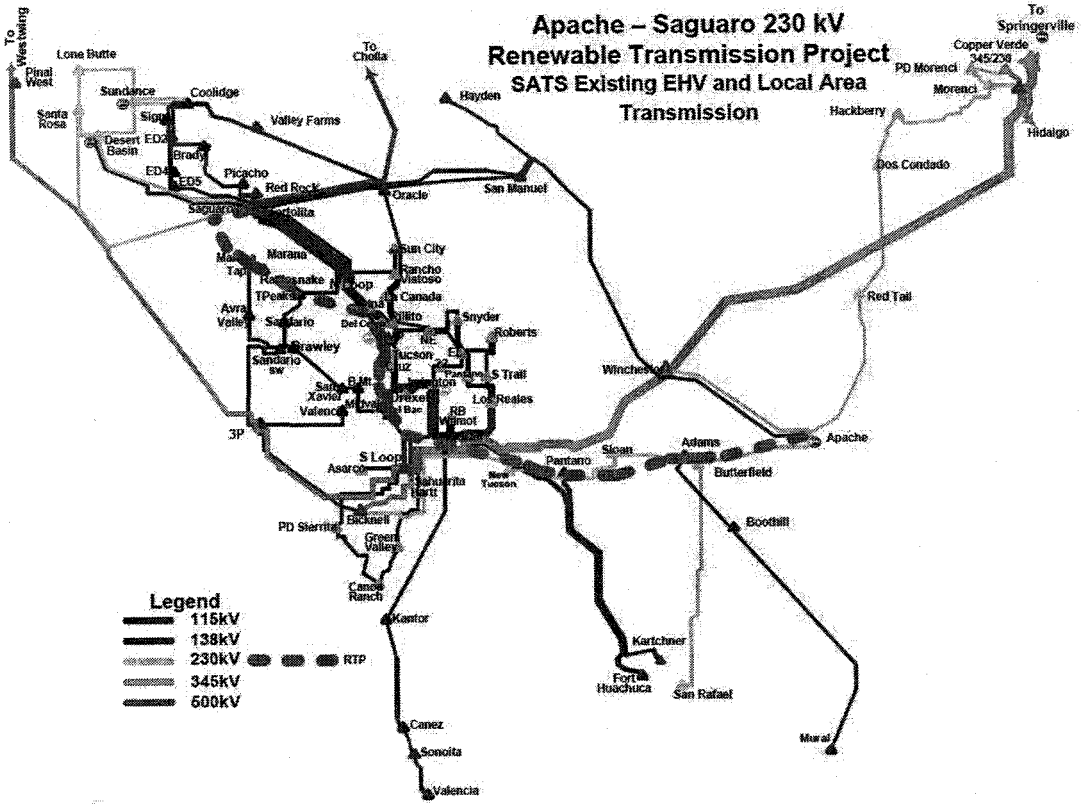

Figure 1. Apache - Saguaro 230 kV Renewable Transmission Project

The RTP is shown as a bold and dashed brown line in Figure 1. Upgrade of the portions of this 115 kV line were discussed and documented in the Southeast Arizona Transmission Study (SATS) report. SATS is a work group within the Southwest Area Transmission (SWAT). The goal of SWAT is to promote regional planning in the Desert Southwest and is comprised of transmission regulators/government entities, transmission users, transmission owners, transmission operators and environmental entities.

The SATS report was approved by the SWAT Oversight Committee and filed at the Arizona Corporation Commission (ACC) in January 2009. The report may be found at http://www.westconnect.com. Refer to Section 17 Western 115kV Transmission Corridors.

Studies that were done for the SATS report and subsequent studies indicate that some Western 115 kV segments, including lines connected to the Saguaro substation, limit transmission system transfer capability. In other locations, such as between the Winchester and Vail substations, transfer is limited by 230 kV or 345 kV facilities. Thus upgrade of the Apache to Saguaro 115 kV line to a double circuit 230 kV line could alleviate congestion caused by 115 kV overloads, and also provide needed incremental capacity to mitigate higher voltage facility overloads. The net effect is increased transmission capacity to transmit renewable resources to Western's customers in the Cochise, Santa Cruz Counties and others northwest of Tucson.

Siting the RTP on an existing Western right-of-way is a significant advantage to allow the project to be constructed relatively quickly. Thus the primary benefit of this RTP is that it may be implemented in time to accommodate new renewable energy projects as they come on line within two to five years. This project also has the advantage of being cost effective due to joint participation with TEP, SWTC and possibly others for the second 230 kV circuit.

This project is consistent with Western's ten year planning process. Customers, through the Joint Planning Agreement, rely on the Western system to serve existing and growing loads in the Southeast Region. While Western is not obligated to plan or provide transmission infrastructure for this load growth, it has taken a pro-active approach to analyze its system capabilities. Information developed through Western's annual technical studies is useful to customers planning for their future transmission needs.

Western's ten year plans benchmark the current transmission system and determine the existing system ratings. Future years are analyzed to determine customer projects' contribution to overall system capability and to internal marketing paths. These internal paths are increased as study results warrant it.

The Apache to Saguaro 230 kV project is an example of a project that will increase Western's transmission system capability. This project would provide incremental transmission capacity to transmit the output of many new renewable energy projects to Western's Parker-Davis customers including load serving entities located in the Cochise and Santa Cruz counties. Thus, if approved by Western, this RTP will be "shovel-ready" within the time frame required as renewable resource projects develop in southeast Arizona.

Renewable Resource Description: The RTP provides additional transmission transfer capability of as much as 1,000 MW. This would increase Western customers' access to renewable energy zones with a potential of 5,000 MW or more of new renewable resources in southern Arizona. This project would also enhance capacity for as much as 3,000 MW transmitted from New Mexico by the proposed SunZia renewable transmission project.

The proposed RTP will alleviate congestion that is anticipated to occur as wind, solar and geothermal generation projects are developed within the southern Arizona Renewable Energy Zone (REZ) shown in Figure 2. Developers of the renewable projects within the REZ have submitted interconnection requests under the Large Generator Interconnection Procedures (LGIP) with planned in service dates ranging from 2010 to 2013.

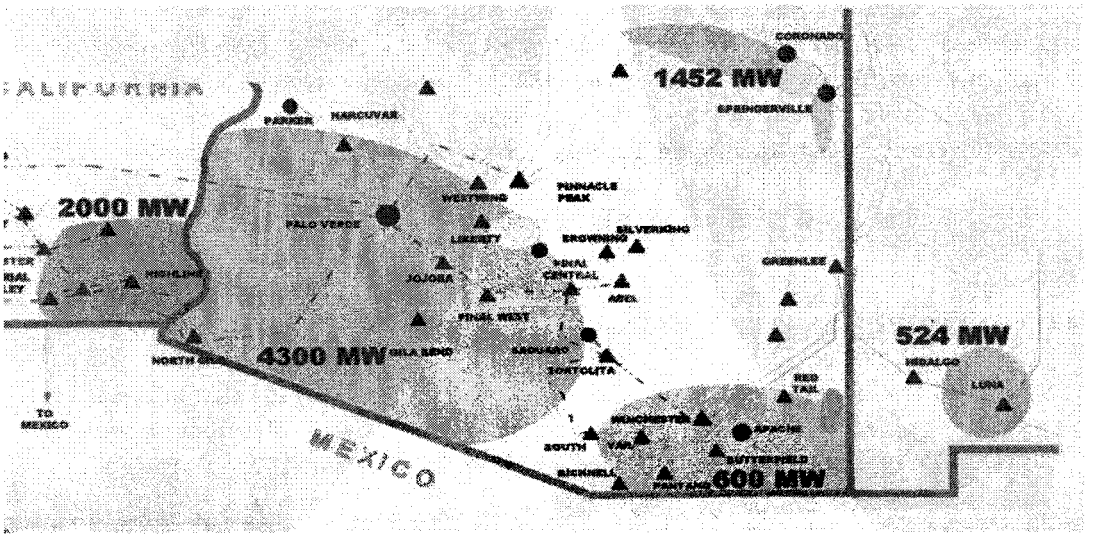

Figure 2. Southern Arizona Renewable Energy Zones

The renewable projects consist of the following:

- ~350 MW CSP (Estimated In Service – 2011)
- 250 MW CSP (Estimated In Service – 2012)
- Potential 3,000 MW SunZia Renewable Transmission Project (Estimated In Service – 2013, Specific renewable resource projects to be identified)
- Potential 600 MW WREZ Southeast Arizona (Specific renewable resource projects to be identified)
- Potential 4,300 MW WREZ Southwest Arizona (Specific renewable resource projects to be identified)

The total renewable generation benefiting from this RTP could be on the order of 1,000 MW of approximately 8,500 MW identified above.

Interconnection Request: There are no renewable generation interconnection requests that designate the proposed RTP as the Point of Interconnection. The RTP would provide benefit to approximately 1,000 MW of renewable resources.

Transmission Rights and/or Transmission Service: Transmission rights and/or service would be provided to the renewable energy project owner(s) or purchasing entities based on their respective needs. For example, if the purchasing entity is already a Western Network Customer, and they were to designate the renewable project as "network", then service could be offered as Network Integration Transmission Service (NITS).

Customers receive transmission service on Western's transmission system through NITS and Point-to-Point (PtP) reservations. Output from the renewable energy projects may be delivered through the same NITS and PtP services. Therefore cost recovery may be accomplished by including revenue requirements for the RTP in NITS and PtP services as appropriate. Other arrangements may be considered, such as joint ownership in the RTP.

Participant Roles: TEP and SWTC (plus APS, CAWCD, SRP, SPPR, UNSE) would cooperate and work with Western in obtaining regulatory approvals as needed to facilitate the RTP. TEP would offer to assist Western with necessary feasibility, system impact and other studies to ensure compliance with applicable NERC and WECC standards.

TEP would also offer to assist with engineering design, construction and procurement activities.

Public Interest: This project is in the public interest in several ways:

a. Use of Existing Corridors – much of the work proposed in this project requires upgrades of existing facilities. Such upgrades will make more effective use of existing rights or way and will have minimal impact on land use.

b. Economic Development and Job Creation – This project will provide for the delivery of energy from new renewable resource projects. The increase in transmission capacity will improve the feasibility of these renewable projects which will lead to increased manufacturing of materials and increased construction and operation jobs in the region.

c. Renewable Energy – As a matter of public policy it is recognized that increased use of renewable resources is in the public interest. This project will facilitate the use of more solar and wind resources to meet electric loads. It would reduce or eliminate congestion, thereby increasing transmission capacity as needed to allow renewable resource access to Western's Parker-Davis customers.

d. Reliability – The transmission facilities proposed for upgrades currently serve an ever increasing electrical demand. Many of these facilities have been in service for many years and require significant rehabilitation just to continue to reliably serve existing loads. The proposed project will provide for that rehabilitation in addition to increasing the capacity. In addition, new lines will be added that provide for overall system reliability improvements.

Prior Experience: TEP provides transmission planning, permitting, siting, engineering design, construction and operating services to UNSE in Mohave and Nogales as well as for the TEP system serving the Tucson metropolitan area. Founded in 1892, TEP is the principal subsidiary of UniSource Energy. TEP is an electric utility with more than 2,200 megawatts of generating capacity with an extensive transmission system serving customers in a southern Arizona service territory spanning 1,155 square miles. TEP's existing EHV transmission network, including jointly owned, consists of about 512 miles of 500kV and 1,098 miles of 345kV transmission of which approximately 2 miles and 239 miles of 500kV and 345kV respectively are wholly owned by TEP. The balance of 510 miles of 500kV and 859 miles of 345kV are jointly owned.

SWTC provides transmission planning, permitting, siting, engineering design, construction and operating services to its distribution cooperative service members and

other transmission customers. SWTC owns approximately 610 miles of transmission lines to help serve its distribution cooperative service members and other transmission customers in a combined service territory that covers over 15,000 square miles in rural Arizona and parts of California and New Mexico.

TEP and SWTC are also involved in joint projects with each other, as well as other utilities including Western.

Financial Capability: TEP and SWTC, and the other interested utilities are involved in the construction and financing of electrical facilities on an on-going basis. In addition, they are all active participates in the electric markets requiring financial security. They have proven abilities to access and utilize a variety of financial resources including commercial and/or public credit sources. Refer to attached credit application.

Participation of Other Entities: TEP and SWTC recognize that there are other load serving entities and transmission providers that may benefit from increased access to new renewable resources in the southern Arizona area. These include the member distribution cooperatives of SWTC, APS, SRP, CAWCD, SPPR and UNSE.

Other Information: There is a lot of focus on large new transmission projects to transmit renewable resources from remote locations to load centers. These projects are important and necessary. However, equally important are improvements to existing systems that will facilitate the delivery of those resources all the way to the load. This project will help facilitate deliveries of remote resources all the way to end use customers. In addition, it will provide for effective use of more localized renewable resources as well.

Interest in Other RTP Projects: TEP and SWTC are cognizant of and supportive of other RTP projects that will be submitted by APS and SRP as part of this Statement of Interest.

WESTERN AREA POWER ADMINISTRATION

CREDIT APPLICATION

Complete all sections of this form and submit to :

Western Area Power Administration

ATTN:

P.O. Box 281213

Lakewood, CO 80228-8213

Date: April 3, 2009

Applicant Name (Customer): Tucson Electric Power Co.
Address: One South Church Ave.
Tucson, AZ 85701

Type of Service Requested: _____

Expected Monthly Business: _____

DUNS Number: 00-690-2704

Credit Rating (if applicable): BBB-

Credit Manager or Point of Contact: Barbara McCormick

Phone: 520-884-3620 Fax: 520-884-3602 Email: BMcCormick@tep.com

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Is your company a subsidiary or affiliate of another company? Yes _x__ No __

Public Power Entities (not-for-profit):

Is your company a not-for-profit entity (governmental entity)? Yes __ No _X__

If your company is a not-for-profit entity, is it backed by the full faith and credit of a governmental entity (United States, state government, other government, if applicable)?

Yes ___ No _

If your company is a not-for-profit entity, do you have the ability to raise rates to cover outstanding obligations? Yes __ No ___

Emailed Only (txrfi@wapa.gov)

April 3, 2009

Transmission Infrastructure Program
Western Area Power Administration
P.O. Box 281213
Lakewood, Colorado 80228-8213

Re: Statement of Interest – Arizona System Enhancements

To Whom It May Concern:

Pursuant to Federal Register Vol. 74, No. 41, March 4, 2009, Western Area Power Administration ("Western") Notice of Availability of Request for Interest, Arizona Public Service Company, the Salt River Project Agricultural Improvement and Power District, Southwest Transmission Cooperative, Tucson Electric Power Company and UNS Electric, Inc. (collectively referred to as "The Parties") provide this statement of interest indentifying transmission system enhancements in Arizona to facilitate the delivery of renewable resources. The series of projects contained in this proposal are entirely within Western's service territory, include new facilities and/or upgrades to Western's system and other utilities' systems, and will facilitate the delivery of solar and wind resources from multiple proposed projects to multiple utilities.

The projects supported by The Parties, contained within this proposal, provide for increased transmission capacity thereby improving the feasibility of renewable generation projects. These proposed transmission projects will support in excess of 13,500 MW of renewable wind and solar generation additions as listed on interconnection queues. The Parties' proposed system upgrades will increase system reliability for all participants' customers. Many of the proposed projects are "shovel ready" and can therefore be used to promote the objective(s) of the American Recovery and Reinvestment Act of 2009.

The Parties have enclosed detailed information on each of the proposed transmission projects. Should you have any questions or require additional information, the entity's contact information for each proposed transmission project is listed within the specific project proposal.

The Parties appreciate the opportunity to submit its proposal to Western.

Sincerely,

John R. Lucas

John R. Lucas
Manager, Transmission, Distribution Planning & Interconnection Development
Arizona Public Service Company

Robert E. Kondziolka

Robert E. Kondziolka
Manager of Transmission Planning
Salt River Project Agricultural Improvement and Power District

Jim Rein

Jim Rein
Manager of Transmission Planning
Southwest Transmission Cooperative, Inc.

W. B. Darmitzel

William Darmitzel
Manager of Planning & Technical Services
UniSource Energy Services

Enclosure

EXHIBIT

MM – 9

SWTC Substation ID Info

XFORMER ID	Name	Org	Loading Year	SWTC Flow Diagram		Right	Left
				MW	MVAR		
17005	Bicknell	SWTC	2007	359.8	1.034	Vail	Bicknell 04
17005	Bicknell	SWTC	2017	357.1	1.035	Vail	Bicknell 04
17004	Bicknell	SWTC	2007	231.2	1.005	Bicknell 04	Bicknell 06
17004	Bicknell	SWTC	2017	231.9	1.008	Bicknell 04	Bicknell 06
17006	Bicknell	SWTC	2007	114.8	0.998	Bicknell 05	Sahuarita 02
17006	Bicknell	SWTC	2017	115.8	1.007	Bicknell 05	Sahuarita 02
16105	Vail	TEP	2007	356.8	1.034	Winchester	Bicknell 05
16105	Vail	TEP	2017	356.9	1.034	Winchester	Bicknell 05
17105	Winchester	TEP	2007	358.1	1.038	Greenlee	Vail
17105	Winchester	TEP	2017	358.2	1.038	Greenlee	Vail
17102	Sahuarita	SWTC	2007	231.6	1.007	Bicknell 06	Pantano 16
17102	Sahuarita	SWTC	2017	232.4	1.009	Bicknell 06	NewTucson
17676	NewTucson	SWTC	2017	232.4	1.011	Sahuarita	Pantano 16
17016	Pantano 16	TEP	2007	232.8	1.102	Sahuarita	Pantano 15
17016	Pantano 16	TEP	2017	232.7	1.112	Sahuarita	Pantano 15
17015	Pantano 15	TEP	2007	116.3	1.011	Pantano 16	NGL-WALC
17015	Pantano 15	TEP	2017	116.1	1.009	Pantano 16	NGL-WALC
17015	Pantano 15	TEP	2007	116.3	1.011	Pantano 16	Adams 50
17015	Pantano 15	TEP	2017	116.1	1.009	Pantano 16	Adams 50
19221	NGL-WALC	UNSE	2007	112.5	0.978	Pantano 15	UNSE
19221	NGL-WALC	UNSE	2017	112.6	0.979	Pantano 15	UNSE

EXHIBIT
MM – 10

BEFORE THE ARIZONA POWER PLANT AND TRANSMISSION LINE SITING COMMITTEE

IN THE MATTER OF THE APPLICATION OF UNS ELECTRIC, INC. FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY FOR THE VAIL TO VALENCIA 115 KV TO 138 KV TRANSMISSION LINE UPGRADE PROJECT, ORIGINATING AT THE EXISTING VAIL SUBSTATION IN SEC. 4, T.16S., R.15E., PIMA COUNTY, TO THE EXISTING VALENCIA SUBSTATION IN SEC. 5, T.24S., R.14E., IN THE CITY OF NOGALES, SANTA CRUZ COUNTY, ARIZONA.	Docket No. L-00000F-09-0190-00144 Case No. 144

WITNESS SUMMARY

FOR MARSHALL MAGRUDER

29 May 2009

Submitted to the Arizona Power Plant and Transmission Line Siting Committee and parties in accordance with Procedural Orders of 27 April 2009 and 20 May 2009 for Line Siting Case No. 144.

Personal Background.

I am Marshall Magruder, from Tubac, Arizona, UNS Electric ratepayer. Having served on the Santa Cruz County/City of Nogales Joint Energy Commission, I have gained a detailed understanding of our county's electricity utilities. My resume is an Attachment, but my "Large systems" systems engineering experience, gives a unique perspective. Many consider system engineers as best of breed. We usually are the first to really look at the "need" for a system. I've lead many requirements analysis teams to determine what is necessary to solve somebody's problem. Finding the "best" solution is what systems engineers do for a living. It takes several approaches before the "best" is found. We say it's really not designed until Rev C, the fourth revision. We "bracket and half", overshoot, and then undershoot, decreasing error each time. No one knows the "best" solution in isolation. Only when teams, an integrated product team (IPT), with all disciplines represented, such as your committee, can all the necessary environmental factors are put on the table. Reviewed and analyzed, then synthesized into a Product or Project. The "total environmental" requirements for this committee are about a broad a term as possible.

Background of a Project Review.

All factors need review. This Committee would not exist if human judgments were not required to assess the many unknown impacts. The A.R.S. 40-360 statutes specify a committee from various backgrounds. Some factors aren't included; others may not be key players in every decision. For years, I had psychologists on my projects, because they come from a different discipline, with different

and diverse points of view, and usually are the best at understanding how "people" will change or should use the "system." In fact, many systems are redesigned if this discipline is not property employed at the "needs assessment" phase of requirements analysis. Another key discipline is reliability engineering, the engineering specialist critical to "keep it operating". Through simple, well sometimes rather complex, through probability analysis, failures are predicted and sequenced, as they cascade through a system. We do this over and over again, changing the design, so that high failure items always have redundancy designed into the system. Use of mean time between failure and mean time to repair permits one to estimate rather closely when a system will fail and usually what component will fail first. Usually, that "first to fail" component is redesigned so a new "first to fail" component emerges. And we repeat that process again. Reliability engineering is not used in the electric utility industry, other than at nuclear power plants, probably because of the heavy influence of Admiral Rickover trained nuclear engineers who are top-notch professionals.

Issues Related to the Project.

For the "Vail-Valencia 138 kV upgrade", I am not yet convinced a "need" really exists, nor if the WAPA to TEP transmission services change is "best" for Santa Cruz County ratepayers.

The major concern is changing the northern terminal for the transmission line from the WAPA Nogales Tap to the TEP Vail Substation. DOES this really benefit for Cruz County ratepayers in terms of economic, energy (electricity) and total environmental factors.

At this stage, with discovery questions not been fully answered, I'm unsure about the "need" and cost-benefit for customers this project.

Some questions I plan to explore during witness cross-examination include:

1. The Application seems to indicate that WAPA has a 50.9 MW "constraint" on providing electricity to the Nogales Tap. In response to my Data Request 1.1, the Company's report stated that after December 2008, an upgrade in the WAPA transmission line would add a tap at the Pantano substation that increases this "constraint" to 65.8 MW. (Exhibit MM-1, DR 1.1 response)
   a. What is the WAPA constraint?
   b. How does this constraint change?
   c. What is the impact of EPA of 2005, section 1221, which provided up to $500 million annually for 5 years to remove WAPA transmission constraints?
   d. What is WAPA's future plans for the Sahuaro-Pantano 115 kV line?
   e. When has 50.9 MW actually been the maximum power delivered by WAPA?
   f. How much does WAPA charge to use its transmission system, e.g., the wheeling charges in $ per kW-month?

2. What are the differences between using the Nogales Tap and Vail substations?
   a. What are the respective transmission line charges, and the differences impact on ratepayers? [TEP was $2.33/kW-month in 2001]
   b. What are the transmission (energy) losses differences on each transmission system? [WAPA was approximately 4.95% in 2001, Nogales Tap to delivery was approximately 10.45%]

c. What equipment owed by UNS Electric at the Nogales Tap will not be used after a potential transfer to Vail and what is its cost? [$2.1M switch Exhibit MM-2]
d. How much new equipment will be required at Vail to support UNS Electric and what is its cost?
e. Can the Citizens' installed three-ring bus switch be used by changing from Apache to Vail, with an inline 115:138 kV transformer, so that both the Nogales Tap and Vail substations can provide two different power sources to support UNS Electric? (Exhibit MM-2)

3. Do these poles really require replacement? (Exhibit MM-3)

a. Has the company tested these poles to determine if they require replacement?
b. What do the UNSE statistics on pole failure on this line indicate? (DR refused)
c. What are the reliability statistics on this transmission line? (DR refused)
d. What are the new objective reliability measures that show the improvement before and after pole replacement? (DR refused)
e. What will be the change in total capacity of the 138 kV compared to the existing 115 kV? [Present line thermal limit is 132 MW except at southern end, new 138kV has 120 MW capacity => no change] (Exhibit MM-4)
f. Validation of Peak Demand forecasts for SCC. (Exhibits MM-5, MM-6, and MM-7)
g. What and where will the conductor be replaced?
h. Where will the existing poles and acquired right-of-way not be adequate for pole replacement?
i. Where will cor-ten poles and dulled galvanized steel poles be sited?

4. What are the UNS Electric Renewable Energy Transmission Project's impact on the WAPA 115 kV line to Nogales Tap? (Exhibit MM-8)

a. How will UNS Electric perform on this contract if there is no Nogales Tap?
b. How will the two 230 kV new WAPA lines plus the 230 kV line to Pantano impact Santa Cruz County?
c. If WAPA has adequate future supply adequate to meet the load demands, other than changing poles, is there any other reason for this project (other than TEP receiving wheeling charges)?

5. What are the plans for archeological and biologic professionals to survey for unexpected disturbance of archeological sites and plant life?

a. How will OHV traffic on maintenance roads be curtailed?
b. How will construction and restoration be performed to return the disturbed lands back to its original conditions?

6. Will there be any public process or dialog occurring after the CEC is granted?
a. Will there be different groups for the UNSE and TEP customers?
b. Where and how frequent will these briefing and discussion sessions occur?
c. Will they be open, advertized, and make public?
d. Does the company see that such meetings can improve its image?
e. Will a website and any newsletter be used after CEC approval?

7. How much will this project really cost?
a. What are the component costs for each segment?
b. Where will you deviate from the existing 100-foot wide ROW, when replacing poles?
c. On new ROW, how close will your 100-foot wide ROW be with respect to the UPRR ROW, in other words, is your ROW directly adjacent to the RR?

Prefiled Testimony.

My Prefiled Direct Testimony is planned to provide the background and discuss these and related issues but, in general, most of these questions are planned for cross-examination. It will not be ready until AM Monday and will be put into the "box" for each Committee person staying at the Rio Rico Esplendor Hotel by noon and available by 0800 on 2 June for others.

Exhibits.

Exhibits in this Summary are to be provided before the hearing to the Committee and parties.

Pre-Filed Exhibits (all have been provided to the Applicant)

MM-1 UniSource Energy Services – UNS Electric (Santa Cruz) System Conversion from Point-to-Point to Network Integrated Transmission Service, 22 May 2008 (in DR 1-1 response)
MM-2 Citizens Plan of Action Excerpt (sent to UNSE via email)
MM-3 Article from T&D on Pole Replacement practices (provided as a handout 26 May)
MM-4 Excerpt from Magruder Testimony 8 July 2005 (conductor capacities)
MM-5 Peak Demand Forecasts for Santa Cruz County (various sources since 2000)
MM-6 UES Loads and Resources Peak Demand Forecast (UES website)
MM-7 Santa Cruz Generation Forecasts 2008-2028 (UES website)
MM-8 UES Letter to WAPA Transmission Infrastructure Program (p. 30-36) (in DR 1-3 response)
MM-9 SWTC Substation ID Info
MM-10 Magruder Witness Summary (this document less other exhibits)

Mailed to all parties and DATED this 29th day of May 2009.

Respectfully submitted,

Marshall Magruder
PO Box 1267
Tubac, AZ 85646
marshall@magruder.org
520.398.8587

Attachments

A. Resume of Marshall Magruder

Service List

Docket Control (Original and 25 copies)
Arizona Corporation Commission
1200 West Washington Street
Phoenix, Arizona 85007

Charles Hains, Janice Alward, Chief Counsel
Arizona Corporation Commission
1200 West Washington Street
Phoenix, Arizona 85007

Jason D. Gellman, J. Matthew Derstine
Roshka DeWulf & Patten, PLC
One Arizona Center
400 East Van Buren Street, Suite 800
Phoenix, Arizona 85004

Marc Jerden
Tucson Electric Power Company, Legal Department
One South Church Avenue, Suite 200
PO Box 711
Tucson, Arizona 85702-0711

Elizabeth Buchroeder-Webb
17451 East Hilton Ranch Road
Vail, Arizona 85641

Attachment A

RESUME OF MARSHALL MAGRUDER

EDUCATION

MS in Systems Management, University of Southern California (1981); MS in Physical Oceanography, Naval Postgraduate School (1970); BS, US Naval Academy (1962)

EXPERIENCE

Over 25 years as Systems Engineer associated contractor, consultant, Raytheon-Hughes in systems engineering, training and naval systems, C4I simulation and modeling; over 40 years experience with 25 years US Navy

- **Large-system development** at all levels
  From pursuit, analysis, winning strategy, Request for Proposal evaluation, proposal management, system requirements analysis, architectures, specifications, design synthesis, trade-off studies, requirements allocation tracking,
  To system, level test planning, deployment, implementation, through sign-off,
  For technical systems of all complexities.
- **Developed** Antisubmarine Warfare, Electronic Warfare, Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance operational concepts, procedures, and tactical employment.
- **Used, operated, and planned** Navy, Army, Air Force, Coast Guard, Joint systems, world-wide.
- **Coordinated multi-platform employment** from sensor to tactical platform to Battle Force to Theater levels.
- **Qualified systems engineer-manager** for trainers, artillery, Command & Control, countermeasures, any platform.
- **Specialties:** environmental analysis, documentation, sensor/weapon predictions, C4ISR, Electromagnetic and Emission Control (EMCON) decision criteria.
- **Battle Force/Group Tactical Action Officer** on 8 aircraft carriers, TAO Instructor, 20 months combat.

RECENT POSITIONS

Commissioner, Santa Cruz County/City of Nogales Joint Energy Commission (2001-2008), intervened in Line Siting Case No. 111 and 144; Rate Cases (two Natural Gas, one Electric, one Water), Renewable Energy Standard participation, and various other ACC issues.

C4I Architect and **C4I Support Plan Lead** for the Carrier for the 21st Century (CVX) Delivery Task.

- Completed *CVX C4I Support Plan, v1.0,* Joint Operational Architecture development for Joint and Naval staff space allocations for CVX (1999) and Joint Command and Control ship (2002).
- Drafted *CVN 77 Electronics System Integrator Statement of Work* for WBS Group 400 tasks and IPTs (1999), *Integrated Management Plan*;
- **Royal Navy Future Aircraft Carrier** WBS proposal (2002)

Lead Systems Engineer, Operations Analyst and **Site Survey Leader** for Saudi Arabian Minister of Defense National Operational Command Centers and C4I System (completed August 1997).

- Completed *System Specification, System Description Document, Site Survey, Interface Requirements Documents*

Proposal Technical Volume Manager for the following **winning proposals**:

- **Vessel Traffic Service 2000 system**, US Coast Guard command center for surface surveillance using radar, visual, communications links. (evaluated A++, won Phase I, Phase II delayed then restructured)
- **Anti-submarine Warfare Team Trainer** (Device 20A66), an integrated, multi-ship, submarine and aircraft training system for Naval Task Groups. ($56M contract, best technical, lowest cost)
- **Electronic Warfare Coordination Module**, an Intelligence/EW spectrum planning and management system for Task Force Command Centers. (won Phase I, best technical)

Program Manager for the Border Patrol Strategic Border Initiative and National Training Center (2008)

- Training Standards for Border Patrol personnel performing maintenance on Virtual Fence equipment, establish a National Border Patrol Training Center with interactive and life-time Performance Measurement

Subsystem, for maintenance and operational personnel.

Assistant Program Manager for the Training Effectiveness Subsystem, Device 20A66

- Performance Measurement Subsystem, observed real-time performance of operators, teams, multi-ship and aircraft units during exercises and compared to the standard

Senior Systems Engineer responsible for writing **specifications** in following **proposals**:

- **Fire Support Combined Arms Team Trainer** *System Specification*, a US Army field artillery multiple cannon and battery training system. (awarded $118M contract, still under contract)
- **Warfighter's Simulation 2000** (WARSIM 2000) *System Specification*, a US Army Force XXI Century battalion to theater levels, training system with actual C4I systems. (won Phase I)
- **US Navy Tactical Combat Training System**, *Exercise Execution Software Requirements Specification* for simulation and computer models to run real-time, driving sensors, weapons and links on 35 ships, 100 aircraft and submarines (won Phase I contract, wrote SRS in Phase 2 proposal)
- **US Army Virtual Proving Ground (VPG)** - Performed *C4ISR Architecture Framework* development, implementation and documentation using the DoD *Architecture Framework,* for Operational, Technical and Systems architecture products. (2001-2002).
- **MBA Instructor, University of Phoenix,** for "Operations Management for Total Quality" and "Managing R&D and Innovation Processes" courses.

January 1998 to present – H&R Block, Senior Tax Advisor Level III, seasonal tax preparer (January to April 15), part time, **AARP Tax Consulting for the Elderly** (pro bono) tax preparer, IRS qualified.

Networthiness Certification (Jan. 2005-2007), prepared proposal for the Army Network Command (NETCOM), for this several million-dollar program involving over 3,200 Army computer programs at all Army installations, worldwide. Prepared Quality Control and Risk Management Plan.

Cryptologic Support and Logistic Analysis (Oct. 2004-2006), prepared proposal for Army Communications-Electronics Command, Ft. Huachuca, Arizona.

Proposal Manager, Law Enforcement Driver Trainer System for California.
Led pre-proposal and proposal team to develop a design for high-technology driver trainer systems for the Peace Officers and Safety Training (POST) Commission. (Hughes won)

AWARDS

Arizona Golden Rule Citizen Award, by Arizona Secretary of State Janice K. Brewer for exemplifying the spirit of the Golden Rule daily: "treat others the way you would like to be treated", nomination made by Santa Cruz County Supervisor Ron Morris, of August 2004 for accomplishments on the Santa Cruz County/City of Nogales Joint Energy Commission.

Merit Award, Raytheon and Hughes, four times, for achievement and excellence in performance.

National Security Industrial Association (NSIA) Anti-Submarine Warfare Committee, Meritorious Award from the NSIA President, Admiral Hogg USN (ret), for leading ASW training industry and government studies. (1992)

Military Awards include Meritorious Service Medal, Naval Commendation Medal with Combat "V" and Gold Star, Navy Unit Commendation, Navy Meritorious Unit Commendation, National Defense Medal, Armed Forces Expeditionary Medal (Dominican Republic), Vietnam Service Medal with three Bronze Stars, Vietnam Campaign Medal with "1960-", Overseas Service Ribbon (Italy).