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BEFORE THE ARIZONA POWER PL

AND TRANSMISSION LINE SITING COMMITTEE

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IN THE MATTER OF THE APPLICATION OF NORTHEN ARIZONA ENERGY, LLC FOR A CERTIFICATE OF CONVENIENCE AND NECESSITY AUTHORIZING CONSTRUCTION OF A 175 MW NATURAL GAS-FIRED SIMPLE CYCLE GENERATING FACILITY AND ASSOCIATED TRANSMISSION LINE TO THE WESTERN AREA POWER ADMINISTRATION ("WAPA") GRIFFITH SWITCHYARD.	CASE NO. 133 DOCKET NO. L-00000FF-07-0134-00133 **NOTICE OF FILING STAFF'S REVISED SUMMARY OF SYSTEM IMPACT STUDY**

Staff of the Arizona Corporation Commission ("Staff") hereby files Prem K. Bahl's Revised Summary of System Impact Study ("SIS") in the above matter. The revised filing reflects recent conversations with the Western Area Power Administration ("WAPA") regarding the SIS and its findings and conclusions. Please substitute prior Staff filings regarding the SIS with this new revised filing.

RESPECTFULLY SUBMITTED this 17th of September 2007.

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Northern Arizona Energy Project

Summary of System Impact Study

Prem K. Bahl, ACC Staff

Presented to
The Power Plant & Line Siting Committee
September 17 & 18, 2007

Overview

- Project description
- System Impact Study Overview
- Components of System Impact Study
- Western Area Power Administration technical study criteria based on WECC Reliabilty criteria and NERC Planning Standards
- Power Flow Analysis
- Post-Transient Power Flow Analysis
- Transient Stability Analysis
- Short Circuit Analysis
- Summary of System Impact Study Results
- Commission Staff Conclusions & Recommendations

Project Description

- On March 2, 2007, Northern Arizona Energy, LLC ("NAE" or "Applicant"), applied to the Arizona Corporation Commission ("Commission") for a Certificate of Environmental Compatibility ("CEC") for the construction of the Northern Arizona Energy Project ("NAEP" or "Project").

- The Project consists of four simple cycle gas fired generating units, 45 MW each, with a total plant capacity of 175 MW.

Project Description (contd.)

- NAEP is proposed to be interconnected with the existing 230 kV Griffith Substation via a double circuit 230 kV transmission line.

- Pursuant to A.R.S. 40-360.02(B) and 40-360.02(C)(7), an applicant is required to file a Systems Impact Study ("SIS" or "Study") with the Commission. The Applicant received an extension of time to file the SIS. The Applicant docketed the SIS on July 26, 2007.

Components of System Impact Study

The Study simulated the following technical analyses as part of the SIS:

- Power flow analysis
- Post-transient power flow analysis
- Transient stability analysis
- Short circuit analysis

- Performance of the transmission system was measured against the WECC Reliability Criteria and NERC Planning Standards

WECC Reliability Criteria and NERC Planning Standards

- Western Area Power Administration ("Western" or "WAPA") technical study criteria was based on the following WECC Reliabilty criteria and NERC Planning Standards:
  - N-0 (Base Case – no contingency)
  - N-1 (Single contingency)
  - N-1-1 (Non-simultaneous double contingency)
  - N-2 (Double contingency)

- Comprehensive cases were developed to represent 2008 system peak load conditions, and the following simulations were conducted for each criteria listed above.

Power Flow Analysis

- Power Flow Analysis studied 2 alternatives of displacing NAEP generation: 1) Nevada generation reduced to accommodate NAEP generation and 2) NAEP generation serves regional load growth.

- In addition, the Liberty Phase Shifting Transformer ("Liberty PST") was modeled using 2 conditions: 1) in service with a south to north flow of 450 MW, and 2) bypassed.

Power Flow Analysis (contd.)

- Power Flow scenarios simulated these various potential transmission schedules. The following schedules refer to maximum plant export (175 MW) outside Arizona with minimum (off-peak) and maximum (on-peak) generation dispatch in the Western's area in Arizona:
  - NAEP displaces Nevada generation with minimum generation dispatch in Western's system
  - NAEP serves incremental load growth with minimum generation dispatch in Western's system
  - NAEP displaces Nevada generation with maximum generation dispatch in Western's system
  - NAEP serves incremental load growth with maximum generation dispatch in Western's system

Power Flow Analysis (contd.)

- NAEP Displacing Nevada Generation
  - NERC/WECC Category B contingency affected elements identified when Liberty PST was in service at 450 MW.
  - Loss of North Gila-Imperial Valley 500 kV line affects Blythe-Niland 161 kV line.
  - Loss of the Peacock-Mead 345 kV line or the Mead 345/230kV transformer overloads the Davis-McConnico 230 kV line by 21%.
  - Remaining thermal impacts on the transmission elements were observed under N-1-1 contingencies. The most severe is for loss of the Peacock 345/230 kV transformer, then loss of the Davis-McConnico 230kV line or vice versa with maximum NAEP and Griffith generation on line.
  - All Griffith and NAEP generation cannot be on line when the Peacock 345/230 kV transformer and Davis-McConnico 230 KV line are in operation. In addition, voltage violations were identified for all N-1-1 contingencies.

Power Flow Analysis (contd.)

- NAEP Generation Serving Regional Load Growth:

  - Only 1 NERC/WECC Category B contingency affected element triggered when the Liberty PST was in service at 450 MW. Loss of the Peacock-Whitehill 345 KV line increases power flow to the Davis-McConnico 230 kV line by 16.7%. Also, loss of the Whitehill-Mead 345 kV line or Mead 345/230 kV transformer increases power flow to the Davis-McConnico 230 kV line by 9.3%.

  - Remainder of the thermal overloads on the transmission system were observed under N-1-1 contingency conditions. Similar to study case where NAEP generation was displaced by Nevada generation, the most severe is for loss of the McConnico 230 kV line or vice versa with maximum NAEP and Griffith generation on line.

  - Power flow to Round Valley-Peacock 230 kV and Prescott-Yavapai 230 kV lines significantly increased as a result of NAEP. This indicates that all Griffith and NAEP generation cannot be on line when the Peacock 345/230 kV transformer and Davis-McConnico 230 kV line are open.

  - In addition, voltage violations were identified for all N-1-1 contingencies.

Power Flow Analysis (contd.)

- **Power Flow Mitigation**

  - The NAEP will be subject to generation curtailment based on flow limits during N-1 conditions for the following contingencies:

  1) **Mead 345/230 kV transformer**
  2) **Peacock-Mead 345 kV line**

  - In addition, the project is subject to generation curtailment for any of the identified N-1-1 contingencies. The mitigation method involves generation curtailment or generation run back to be designed in accordance with WECC/NERC design, operations and reliability criteria.

Post-Transient Power Flow Analysis

- Two post-project contingencies yielded voltage deviations greater than WECC Performance of 5%.
- Post transient voltage deviations will be corrected with use of the flow-limit mitigation.
- Results between the Project displacing Nevada generation and the Project serving regional load were similar in voltage deviations.
- Liberty PST did not significantly skew the post-transient voltage results.
- Loss of the Peacock 345/230 kV transformer and Davis-McConnico 230 kV line results in no numerical solution.
- With use of flow limits, the post-transient voltage deviations from the NAEP does not have a negative impact.

Transient Stability Analysis

- Completed for all post-project conditions, including Project generation being displaced by Nevada generation and Project generation serving regional load. In addition, the Liberty PST was modeled in-service at 450 MW (south-to-north) and by-passed.
- All N-1 contingencies in the WAPA-DSW system showed sufficient damping with no WECC performance criteria violations.

Transient Stability Analysis (contd.)

- However, there were WECC performance criteria violations for 2 N-1-1 contingencies.
  - Power flow results identified that with the Griffith-Peacock 230 kV line out-of-service and loss of the Davis-McConnico 230 kV line, the Hilltop-McConnico 230 kV and Hilltop-Peacock 230 kV lines will thermally overload with maximum NAEP and Griffith generation on-line.
  - Transient stability results also identified that maximum NAEP and Griffith generation will result in the WECC Performance criteria standards to be violated. The Hilltop 230 kV bus would experience a 31.1% voltage dip and the Griffith 230 kV bus would experience a frequency dip of 59.5 Hz.

Transient Stability Analysis (contd.)

- Power flow results identified that a flow limit will be required to ensure that the affected elements are not thermally overloaded under these conditions.
- Power flow results also identified that with the Peacock 345/230 kV transformer out-of-service and loss of the Davis-McConnico 230 kV line, the Round Valley –Peacock 230 kV, Round Valley-Prescott 230 kV and Prescott-Yavapai 230 kV lines will thermally overload with maximum NAEP and Griffith generation online. The sum of Griffith and NAEP generation with the Peacock 345/230 kV transformer OR the Davis-McConnico 230 kV line open must remain at or below 520 MW to prevent system instability.

Short-Circuit Duty Analysis

- Only 3-phase fault analysis was completed since the negative sequence data was not available
- Single-phase-to-ground short-circuit duties will be provided in the completed Facilities Study.
- Results identified that the NAEP did not trigger any circuit breaker rating violations.

Summary of System Impact Study Results

- There is not a significant difference between the Northern Arizona Energy Project generation being displaced by generation outside the WAPA-DSW system and the NAEP serving regional load growth – results of the two scenarios were very similar. However, operation of the Liberty phase-shifting transformer did result in affecting the power flow results.

- With inclusion of the Project, the post-transient power flow analysis and short-circuit analysis did not identify any negative effects to the system.

- Operational flow limits will be required to mitigate power flow and transient stability issues during N-1 and N-1-1 conditions.

Summary of System Impact Study Results (contd.)

- No system impacts under normal Base Case conditions (N-0) cases and NAEP Generation curtailment is not required.

- No system impacts under N-1 contingencies, with the Liberty Phase Shifter (PST) by-passed. Thus NAEP Generation curtailment is not required.

- Only with Liberty PST operating, with 450 MW (max) - south to north - two (2) N-1 cases yield system impacts as follows:
  - Contingency 1: Loss of Mead 345/230 kV transformer overloads WAPA's Davis-McConnico 230kv line
  - Contingency 2: Loss of Peacock-Mead 345kV line overloads Davis-McConnico 230kv line

Summary of System Impact Study Results (contd.)

- These two N-1 contingencies would require NAEP generation curtailments of approximately 75 MW, which depends on system conditions.
  - According to Western Operations, the Liberty PST operated between 8 and 10 times per year for the last 10 years.
  - Operation of the Liberty PST is according to a contract between Western and the Operator of the WECC accepted East of River ("EOR") marketing path. The Liberty PST holding 450 MW is a critical component in maintaining the EOR path rating.

Summary of System Impact Study Results (contd.)

- Three N-1-1 contingencies were identified which would require all of the NAEP generation to be tripped and several other N-1-1 contingencies will require generation curtailments.
- Impact of the following two N-1-1cases:

  A1. Davis – McConnico 230 kV line

  A2. Griffith – Peacock 230 kV line

  - Overload on Hilltop – Peacock 230 kV line

  B2. Peacock 345/230 kV transformer

  B3. Davis – McConnico 230 kV line

  - Overload on Prescott – Yavapai 230 kV line
  - The Study indicates that WAPA will have operational solutions for the above outages.

Summary of System Impact Study Results (contd.)

- Study indicates that reliable operating procedures and a Remedial Action Scheme ("RAS") is required for the NAEP interconnection.
- Study indicates that Western would modify existing Liberty PST operating procedures and design appropriate RAS for specified N-1-1 contingencies concurrent with Liberty PST operation.

System Impact Study Results (contd.)

- The Study indicates that Western will perform detailed operating study and define solutions to mitigate any potential unreliable system conditions.
- Western will enter into a Facility Study ("FS") Agreement with the Applicant after the release of the SIS. The FS will include the identification of equipment additions and modifications required for the NAEP interconnection.
- According to Western, the presently established procedures for the Liberty PST operation will continue to be followed after the commercial operation of NAEP.

Conclusions & Recommendatios

- Based on Staff's review of WAPA's technical studies and Staff's discussions with WAPA officials and with the USE Consultant who performed the studies for Western, and with NAEP Consultant, Staff concludes as follows:

- Western's Liberty PST Operation
  - Required to preserve East of River contract path
  - Operation of Liberty PST is very infrequent:
  - Operated approximately 10 times per year for the past ten years
  - Rarely operates at or near maximum of 450 MW, and only 450 MW northbound impacts NAEP operation
  - Probability of Liberty PST in operation at 450 MW flows northbound <u>and</u> simultaneous N-1 contingencies is extremely low
  - <u>Maximum</u> NAEP generation curtailment for low probability N-1 Contingencies is 75 MW (2 units) if Liberty PST is operating at maximum 450 MW northbound.

Conclusions & Recommendations (contd.)

- The Study indicates system stability under all post-transient power flow scenarios.

- The study indicates no change in the short circuit duty of equipment in the interconnected transmission grid under all contingency scenarios.

- Operating Studies will be performed if Southwest Power Partners, LLC ("SWPP") chooses to proceed with the interconnection process. The Operating Studies will analyze additional system conditions and define overloaded elements and/or voltage violations as a result of the NAEP. In addition, extreme WECC Category D contingencies will be studied. Additional flow limits and corresponding generation reductions may be identified during the operation studies as well.

Conclusions & Recommendations (contd.)

- Staff recommends that the Applicant comply with requirements of the Facility Studies by making equipment additions and modifications, and implement WAPA's solutions resulting from operational studies. However Applicant shall do so without the need to implement a RAS for the NAEP interconnection for N-1 contingencies.

- Staff further recommends that the Applicant file with the Commission the Facility Study Agreement with Western as soon as available, but no later than 90 days before commercial operation of the plant. The FS Agreement should include details of equipment additions and modifications required for NAEP interconnection.

- Staff further recommends that the CEC for the NAEP be granted subject to the Applicant's commitment to all mitigation measures indicated per the FS Agreement, and its agreement to take whatever measures may be necessary to ensure compliance with all WECC/NERC standards without the implementation of a RAS for the NAEP interconnection for N-1 contingencies. To the extent that any mitigation measures involve a substantial change to the existing infrastructure, Applicant shall seek authority from the Commission to amend its CEC.

Questions ?