



**Arizona
Corporation
Commission**

Docket No. L-00000HH-08-0422-00141

Coolidge Generating Station

Prem K. Bahl, ACC Staff

**Presented to
The Power Plant & Line Siting Committee
September 30 & October 1, 2008**



ACC Staff Witness

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Professional Background

- **M.S.E.E. – South Dakota State University (1972)**
- **Registered P.E. (Arizona) – Electrical (1978)**
- **Professional Experience:**
 - **16 Years as Staff Engineer with the Arizona Corporation Commission (since 1988); two years as Chief Engineer with RUCO; twenty years with Electric Utility industry in U.S. and India; and five years with Consulting Engineering firms**



Presentation Overview

- **Project Description**
- **Project Need and Benefits**
- **System Impact Study (“SIS” or “Study”)**
- **System Impact Study Results**
 - **Power Flow Study**
 - **Short Circuit Study**
 - **Transient Stability Study**
- **Conclusions & Recommendations**



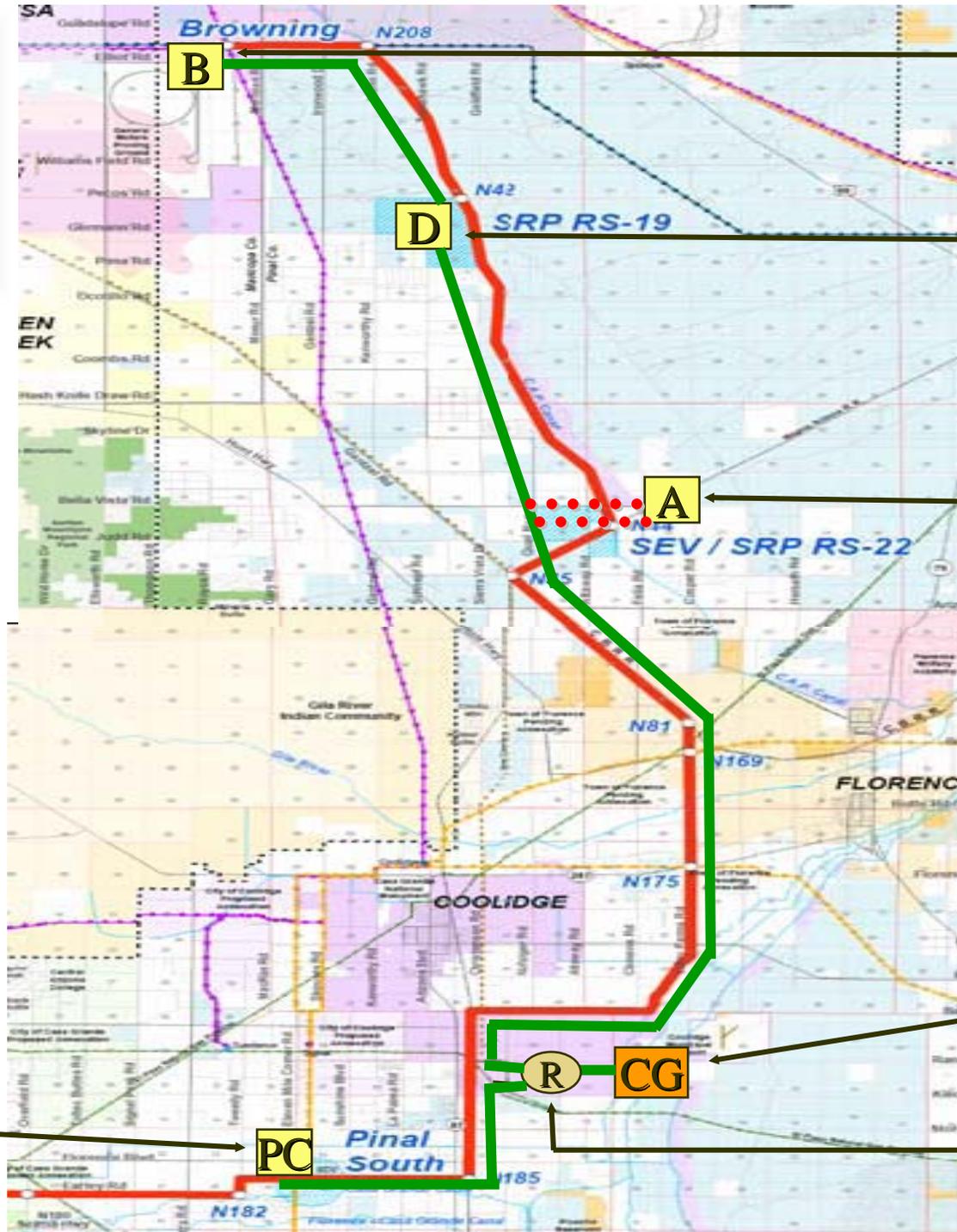
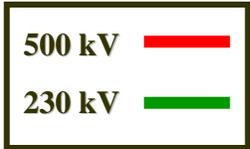
Project Description

- **On August 8, 2008, Coolidge Power Corporation (“Coolidge Power” or “Applicant”), applied to the Arizona Corporation Commission (“Commission”) for a Certificate of Environmental Compatibility (“CEC”) for the construction of the Coolidge Generating Station (“CSG,” “Plant” or “Project”).**
- **The Project consists of twelve simple cycle gas fired GE LM6000 combustion turbine generators (“CTs”), with a total plant capacity ranging from a minimum of 25 MW to a maximum of 575 MW (495 MW in summer).**
- **SRP has entered into a long-term (20-year) contract with Coolidge Power to receive the full output of the Plant, and to act as Control Area Operator for the Plant.**



Project Description

- **The CGS will be interconnected with the 230 kV line between Pinal Central (“PC”) and Dinosaur (“DIN”) Substations through a 230 kV Randolph (“RAN”) Substation.**
- **PC-RAN-DIN 230 kV line will be constructed in two phases:**
 - **Phase I ~ RAN-DIN 230 kV (will be energized on September 1, 2010)**
 - **Phase II ~ RAN-PC 230 kV (will be energized on May 1, 2011)**



Browning Substation 230 kV

Dinosaur Substation 230 kV

Abel Substation 500 kV

Coolidge Generating Station

Randolph Switchyard

Pinal Central Substation 500 kV (2011)

9/30 & 10/1/2008



Project Need and Benefits

- **Coolidge Power proposed the Project in response to a request for proposal (“RFP”) from Salt River Project (“SRP”).**
- **SRP’s rapidly growing load in the Pinal County needs a generation resource under peak load conditions.**
- **The 230 kV transmission line from Pinal Central to Abel to Dinosaur, which will receive output from CGS, was included in the Central Arizona Transmission System High Voltage (“CATS-HV”) Saturated Load and Transmission Study Final Report issued on September 21, 2006, and later in SRP’s 10-year Plan 2007-2016, filed with the Commission in January 2007.**



Project Need and Benefits

- **The benefit of the Project is that it is a peaking plant that provides not only load serving requirement but also spinning reserve requirement, as it can be brought on line at full capacity within ten minutes.**



System Impact Study

- Pursuant to the Arizona State statute 40-360.02(B), Coolidge Power filed the Interconnection System Impact Study (“SIS”) in Docket Control on March 20, 2008.



Components of System Impact Study

- **Power flow analysis**
- **Short circuit analysis**
- **Transient stability analysis**



WECC Reliability Criteria and NERC Planning Standards

- **SRP technical study criteria was based on WECC¹ Reliability criteria and NERC² Planning Standards:**
 - **N-0** (Base Case – no contingency)
 - **N-1** (Single contingency)
 - **N-1-1** (Non-simultaneous double contingency)
 - **N-2** (Simultaneous double contingency)

**Notes: 1) Western Electricity Coordinating Council
2) North American Reliability Corporation**



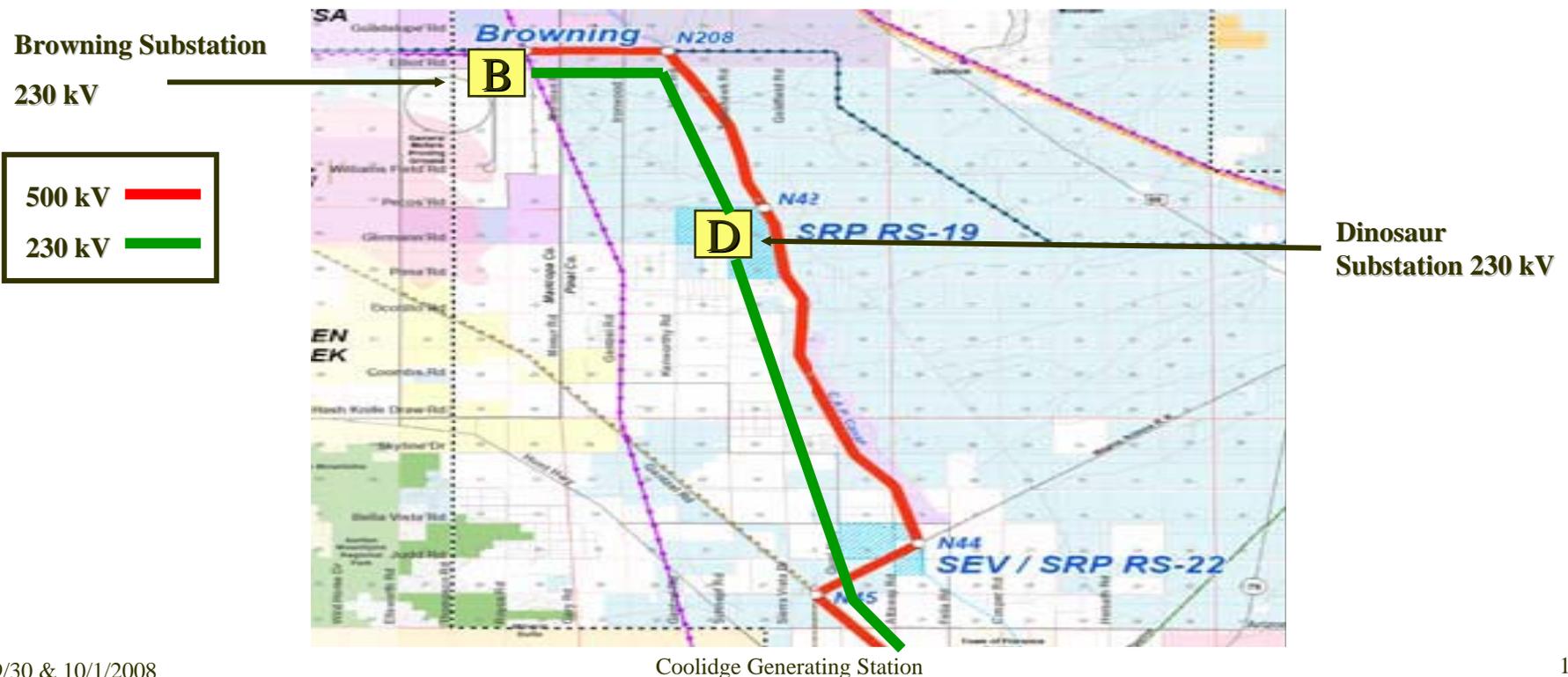
Power Flow Study Results

- **Several Power Flow scenarios were developed to simulate various potential transmission schedules with the following results. Temporary Remedial Action Scheme (“RAS”) for N-1 contingencies will be implemented until 4-30-11. Permanent RAS will be employed for N-2 or N-1-1 contingencies after May 1, 2011.**
 - **2011 Summer peak load conditions were studied**
 - **Plant output 100 MW from 9-1-10 to 9-30-10**
 - **N-1 Contingency (before 10-1-10) ~ Browning to Dinosaur 230 kV outage → Reduce Plant output to 95 MW ~ temporary RAS**



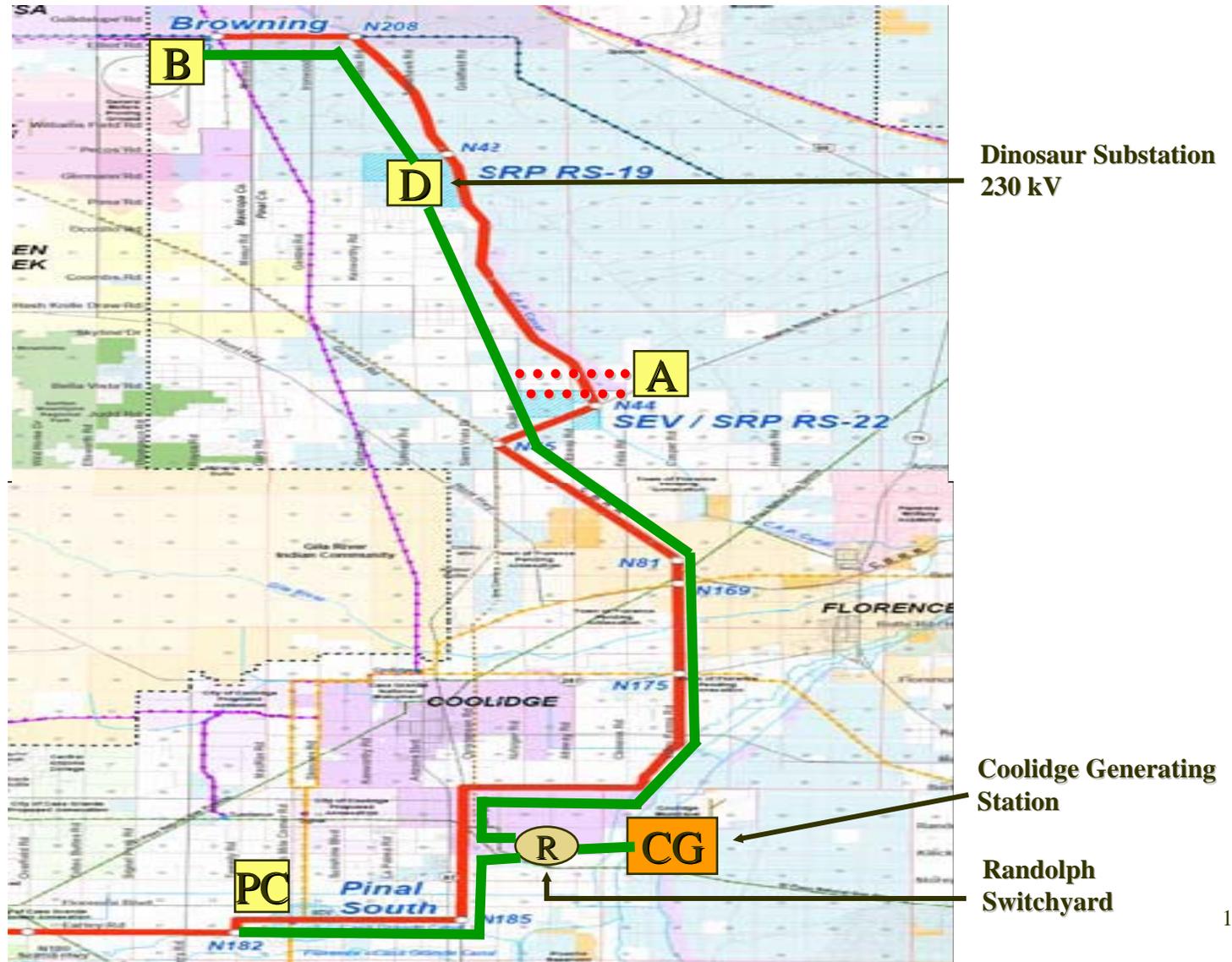
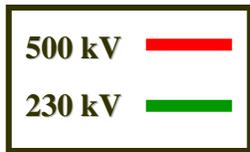
Power Flow Study Results

N-1 Contingency (10-1-10 to 4-30-11) ~ Browning to Dinosaur 230 kV outage → Reduce Plant output to 360 MW (emergency rating of the Dinosaur 230/69 kV transformer), and, within half hour to 280 MW (Dinosaur 230/69 kV transformer normal rating) ~ temporary RAS



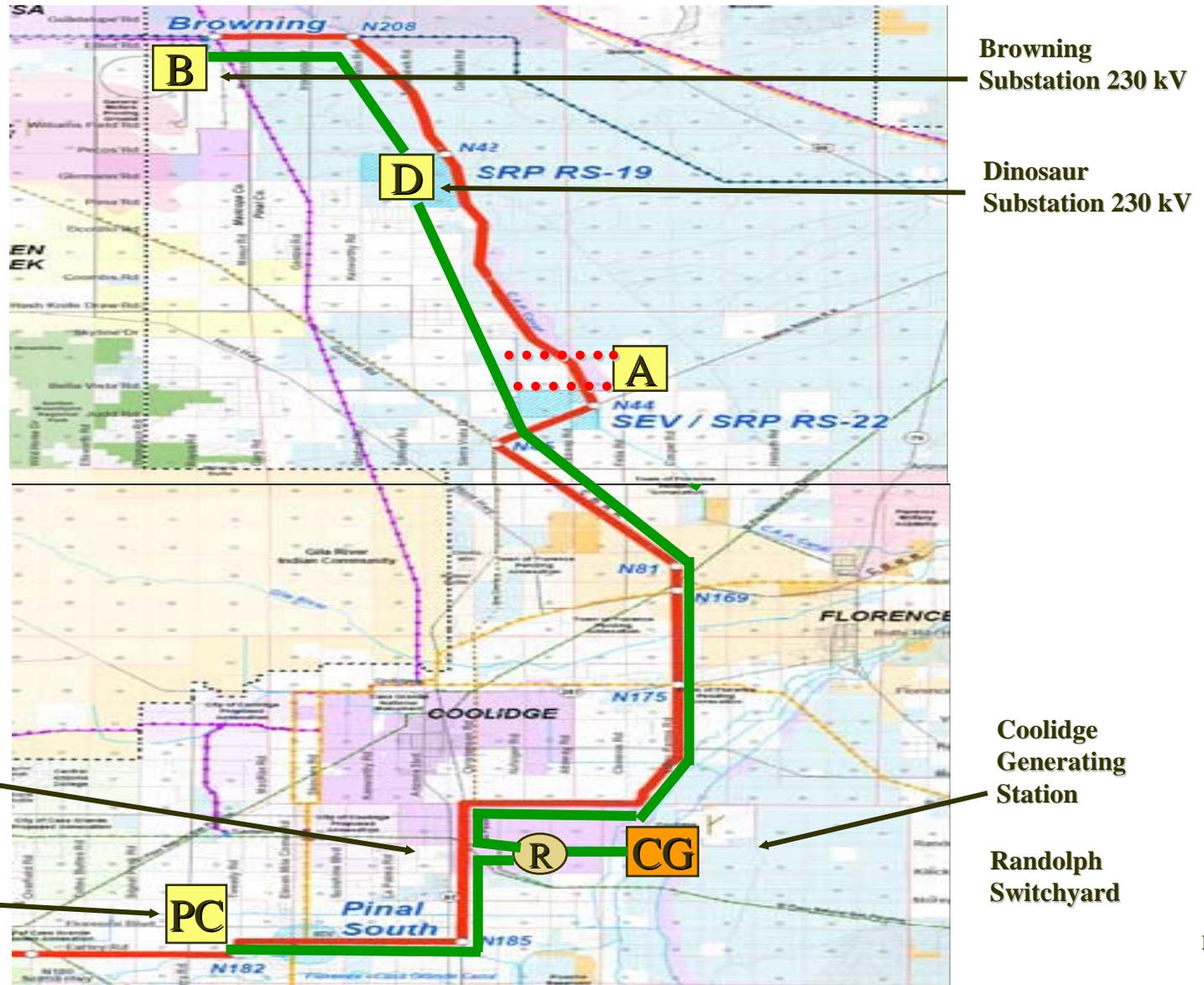
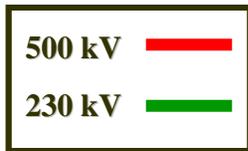


- N-1 (10-1-10 to 4-30-11) ~ Randolph to Dinosaur 230 kV (radial line) outage → temporary RAS shuts down the Plant (power nowhere to go)





N-2 or N-1-1 ~ Randolph to Pinal Central 230 kV and Browning to Dinosaur 230 kV outages → RAS will bring the Plant generation down to 280 MW (Dinosaur 230/69 kV transformer normal rating)



Pinal Central Substation 500 kV (2011)

9/30 & 10/1/2008



Power Flow Study Results

- **Micromill One to Germann 69 kV line (approximately one mile long) gets overloaded for the Browning 230/69 kV transformer outage to 102% of its emergency rating. SRP will upgrade this line to mitigate this overloading at an estimated cost of \$350,000.**
- **SRP's Santan to Thunderstone 230 kV line will be upgraded prior to 2010 to mitigate overloading of this line to 114% of its emergency rating for the Silver King 500/230 kV transformer outage.**



Power Flow Study Results

- **APS Casa Grande 230/69 kV transformer was overloaded to 112.5% of its emergency limit as a result of Milligan 230/69 kV transformer outage. This transformer had a pre-TransCanada loading of 109.3% of its emergency limit.**

(According to APS' Jason Spitzkoff, 230/69 kV transformers are designed for overloading up to 120% of their emergency limit.)



Short Circuit Study Results

- **SRP conducted the short circuit analysis using the ASPEN OneLiner program employing an SRP 2011 planning model.**
- **Post-Plant fault current level increases (a difference greater than 500 A) at the busses close to the CGS are below the breaker interrupting limits.**



Transient Analysis Results

- **The transient stability analysis was performed by selecting contingencies involving fault locations having the largest impact on the transmission system surrounding the Plant.**
- **Modified 2011 Heavy Summer WECC base case and a sensitivity base case were selected. The sensitivity base case included the 230 kV Pinal Central to Sundance and 500 kV Pinal Central to Tortolita lines.**



Transient Analysis Results

- **An additional base case scenario was considered when the Plant may be radially connected to Dinosaur Substation. An assumption of in-service date for the Abel 230/69 kV transformer prior to May 1, 2011, with the contingencies of Browning to Dinosaur and Dinosaur to Abel 230 kV lines would have the most severe impact on the system.**
- **For the above worst-case scenario, as with the other cases, no transient stability violations were noted.**



Conclusions

- **Based on the analysis of the Application and results of SIS, Staff concludes as follows:**
 - **The Applicant has established need and benefits of the Project.**
 - **Power flow analysis indicates that certain SRP facilities that were overloaded as a result of certain contingencies would be upgraded prior to May 1, 2011, when the Plant would be interconnected to the Pinal Central to Dinosaur 230 kV line.**
 - **There is no negative reliability impact to non-SRP facilities.**



Conclusions

- **Temporary RAS required for N-1 contingencies from September 1, 2010, to April 30, 2011, is acceptable since it is not cost effective to upgrade the system, such as adding the second Dinosaur 230/69 kV transformer, for less than one year of operation until Randolph to Pinal Central 230 kV line is completed by May 1, 2011.**
- **The cost to implement temporary RAS is \$75,000. The Project will pay for it.**
- **The cost of putting in a second transformer at Dinosaur would be \$5 million, which is not cost effective.**



Conclusions

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

- **The Study indicates no system stability violations under all contingency scenarios.**



Recommendations

- **Based on Staff's review of the Applicant's request to receive CEC for the Plant, and on the analysis of the SIS, Staff makes the following recommendations.**
 - **The Applicant shall file with ACC Docket Control confirmation of the completion of the required upgrades to the Micromill One-Germann 69 kV line and the Santan to Thunderstone 230 kV line at least thirty days before commercial operation of the Plant.**



Recommendations

- **The Applicant shall file with the Docket Control a letter indicating that it has filed with the ACC Director of the Utilities Division a copy of the executed PPA with SRP reflecting its 20-year agreement to receive the full output of the Plant, and for SRP to act as Control Area Operator for the Plant.**



Recommendations

- **Approval of Applicant’s plan to employ temporary RAS for the period between September 1, 2010, and April 30, 2011, be granted because the mitigation measures for such a short period of time are not cost effective.**
- **No RAS should be employed for any N-1 contingencies after April 30, 2011, for either load dropping or generation tripping. Permanent RAS may be employed for N-2 or N-1-1 contingencies.**



Questions ?

