Reliability Must Run Study

For

Mohave County

Years 2005, 2008, 2012

DESERT SOUTHWEST REGION

Transmission Planning

January 2004

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1. Introduction and Purpose

In response to a request from the Arizona Corporation Commission's staff, the Desert Southwest Region (DSW) of Western Area Power conducted this Reliability Must Run (RMR) Study of the transmission system in Mohave County for projected years 2005, 2008 and 2012.

The Study System includes the portion of the DSW transmission network within Mohave County, Arizona. DSW owns and operates all the facilities of the transmission network within this Study System. Figure 1 shows the Study System for this RMR study. Because the years 2005, 2008, and 2012 each have the same transmission and generation units in its Study System base cases, only the year 2012 was evaluated. This is because it had the largest projected peak load for this Study System.

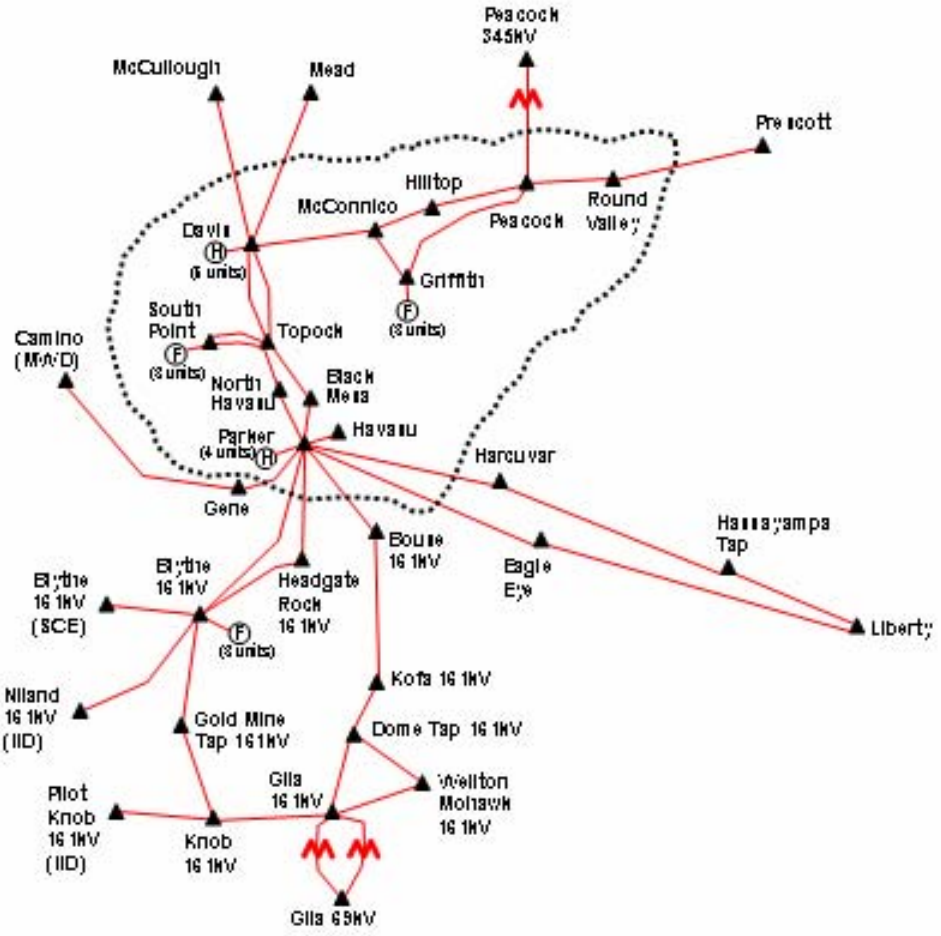
Distribution systems embedded on the DSW transmission network within the Study System include the following:

- Aha Macav (AMPS)
- Arizona Public Service (APS)
- Central Arizona Water Conservation District (CAWCD)
- Mohave Electric Cooperative (MEC)
- Southwest Transmission Cooperative (SWTC)
- Tucson Electric Power (TEP)

The purpose of this RMR Study is to determine the following six components as specified in the "Reliability Must-Run Generation (RMR) Requirements" by the Arizona Corporation Commission:

1. **System Import Limit (SIL)** – The maximum import level that the Study System can reliably support when none of its fossil generators are on-line.
2. **System Maximum Load Serving Capability (MLSC)** – The maximum load level that the Study System can reliably support when all of its generators are at maximum dispatch.
3. **System Generator List** – List includes generator ratings.
4. **Reliability Must Run (RMR) conditions** – RMR conditions exist only if the Study System cannot reliably support its projected peak load without dispatching some of its generators.
5. **Effectiveness of New Facilities** – A new facilities effectiveness evaluation is to be done only if new facilities (transmission or generation) are needed to mitigate RMR conditions in the Study System.
6. **Comparative Analysis of Alternatives** – Comparative analysis of alternatives is to be done only if such alternatives are needed to mitigate RMR conditions in the Study System.

Figure 1: Study System for Mohave County



Notes:
1. All facilities are 230kV unless otherwise noted.
2. Line or transformer flows that cross the boundary are measured at the station inside the Study System.
3. Encircled F denotes fossil generation; encircled H denotes hydro generation.
4. Number of generating units are shown in parentheses. Refer to Table 1 for Generator List.

Table 1 – Study System Generator List

Description	Rating [MW]
--- FOSSIL GENERATION ---	
GRIFFITH	
Combustion Turbine #1	170
Combustion Turbine #2	170
Steam Turbine #1	300
Griffith Total	640
SOUTH POINT	
Combustion Turbine #1	180
Combustion Turbine #2	180
Steam Turbine #1	180
South Point Total	540
Total Fossil Generation	1180
--- HYDRO GENERATION ---	
DAVIS	
Unit #1	52
Unit #2	52
Unit #3	52
Unit #4	52
Unit #5	52
Davis Total	260
PARKER	
Unit #1	26
Unit #2	26
Unit #3	26
Unit #4	26
Parker Total	104
Total Hydro Generation	364
Total STUDY SYSTEM Generation	1544

2. Conclusions

For the six components that are described in section 1 and that are to be determined by this RMR Study, these conclusions follow from this Study.

1. **System Import Limit (SIL)** – At Study System Import Limit (SIL) conditions, in which no Study System fossil generation is on-line, the Study System could support its year 2012 projected peak load of 588.2 MW. This projected peak load includes minimal generating station auxiliary loads (about 2 MW total) with all Study System fossil generators off-line and with 250 MW of Study System normally operated hydro generators dispatched. When all Study System loads except generating station auxiliary loads are increased by the same percentage and the load power factors are held constant, then under these SIL conditions, the Study System supports about 862 MW of load with about 647 MW flowing into the Study System from the external system. This SIL is limited by a WECC 5% post-transient voltage deviation at the Black Mesa 230kV station for the single contingency outage of the Parker-Black Mesa 230kV line. The Study System loads and generation for SIL conditions are listed in Table 3 on page 7.

2. **System Maximum Load Serving Capability (MLSC)** – The Maximum Load Serving Capability (MLSC), in which all Study System generation is dispatched at maximum, is limited to about 1265 MW. The MLSC is limited by a WECC 5% post-transient voltage deviation at the Black Mesa 230kV station for the single contingency outage of the Parker-Black Mesa 230kV line. This maximum Study System load includes a total of 38 MW of auxiliary loads at Study System generating stations. The Study System loads and generation for MLSC conditions are listed in Table 4 on page 8.

3. **Study System Generator List** – The Study System generators with ratings are listed in Table 1 on page 3.

4. **Reliability Must Run (RMR) conditions** – RMR conditions do not exist for the Study System because it can reliably support its projected peak load without dispatching any of its fossil generators.

5. **Effectiveness of New Facilities** – No RMR conditions exist for the Study System. Therefore, an effectiveness evaluation for new facilities (transmission or generation), that mitigate RMR conditions in the Study System, is not needed.

6. **Comparative Analysis of Alternatives** – No RMR conditions exist for the Study System. Therefore, no comparative analysis of alternatives that mitigate RMR conditions in the Study System is needed.

3. Study Methodology and Assumptions

The following summarizes the study methodology and assumptions used to determine the System Import Limit (SIL) and the Maximum Load Serving Capability (MLSC).

1. Because no transmission or generation changes were projected for the Study System between the year 2005 and 2012, only the year 2012 was evaluated because it had the highest projected peak load for the Study System.
2. To develop a Starting Case for the Study System, the WECC base case 2007HS1A was modified according to the utilities within Arizona. Incorporated into the Starting Case were the year 2012 projected peak loads within the Study System. Table 2 on page 7 summarizes these year 2012 peak load projections for the Study System.
3. To develop a System Import Limit (SIL) case, the Starting Case described in item 2 above was modified so that all fossil generators within the Study System were taken off-line. Replacement generation was scheduled from southern California generation. Study System loads except generating station auxiliary loads were increased by the same percentage with the load power factors held constant. The increased Study System loads were sourced from increased generation in the external system (Mead and Palo Verde hubs). Under these SIL conditions, the load was continually increased in the Study System until it became constrained either by a NERC Category A (i.e. no contingency outage) or by a NERC Category B (i.e. single contingency outage) condition in the Study System.
4. To verify post-transient voltage stability in the SIL case, the "Voltage Support and Reactive Power" section of the NERC/WECC Planning Standards (section I.D.WECC-S2) was applied so that total Study System load in the SIL case was increased 5%. Then this SIL margin case was evaluated for NERC Category A (i.e. no contingency outage) and NERC Category B (i.e. single contingency outage) conditions in the Study System.
5. To develop a Maximum Load Serving Capability (MLSC) case, the Starting Case described in item 2 above was modified so that all generators within the Study System were on-line at maximum dispatch. The increased Study System generation was scheduled to displace an equal amount of generation in southern California. Study System loads except generating station auxiliary loads were increased by the same percentage with the load power factors held constant. The increased Study System loads were sourced from increased generation in the external system (Mead and Palo Verde hubs). Under these MLSC conditions, the load was continually increased in the Study System until it became constrained either by a NERC Category A (i.e. no contingency outage) or by a NERC Category B (i.e. single contingency outage) condition in the Study System.
6. To verify post-transient voltage stability in the MLSC case, the "Voltage Support and Reactive Power" section of the NERC/WECC Planning Standards (section I.D.WECC-S2) was applied so that total Study System load in the MLSC case was increased 5%. Then this MLSC margin case was evaluated for NERC Category A (i.e. no contingency outage) and NERC Category B (i.e. single contingency outage) conditions in the Study System.

4. Study Criteria

NERC/WECC Planning Standards were applied. The following summarizes the technical criteria used to determine whether the Study System performance is acceptable.

NERC Category A (i.e. no contingency outage)

- Pre-outage flow on each transmission line or transformer is within its continuous rating, which has been specified by its owner or operator.
- Pre-outage voltage at each station is within its continuous high and low ratings, which have been specified by its owner or operator.
- With the SIL or MLSC case adjusted so that its Study System load level is 5% greater than the SIL or MLSC case, the adjusted SIL or MLSC pre-outage case has a power flow solution.

NERC Category B (i.e. single contingency outage)

- Post-outage flow on each transmission line or transformer is within its emergency rating, which has been specified by its owner or operator.
- Post-outage voltage at each station is within its emergency high and low ratings, which have been specified by its owner or operator.
- Post-outage post-transient voltage at each station is within 5% of its pre-outage station voltage.
- With the SIL or MLSC case adjusted so that its Study System load level is 5% greater than the SIL or MLSC case, the adjusted SIL or MLSC post-outage case has a power flow solution.

Table 2 – Study System Projected Peak Loads for Year 2012

Description	MW
Aha Macav (AMPS @ Davis)	9.8
Arizona Public Service (APS @ Parker, Round Valley)	18.6
Central AZ Water Conservation District (CAWCD @ CAP's Havasu)	0.0
Southwest Transmission Cooperative (includes Mohave Electric Cooperative) (SWTC @ Davis, Parker, Riviera, Round Valley, Topock)	174.2
Tucson Electric Power (TEP @ Black Mesa, Davis, Hilltop, North Havasu)	383.6
TOTAL <Note 1>	**586.2**

Notes:

1. This total projected peak load does not include auxiliary loads for the Griffith and South Point generating stations, which ranges from a combined total of 2 MW under SIL conditions to 38 MW under MLSC conditions.

Table 3 – Study System Loads & Generation for SIL

SIL = 647 MW for Study System Years 2005, 2008, 2012						
Study System Load (MW)				Study System Generation (MW)		
	@ SIL	Year 2012 @ Peak Load			@ SIL	Year 2012 @ Peak Load
TEP	562.5	383.6				
SWTC & MEC	255.4	174.2		Davis	210	210
APS	27.3	18.6		Parker	40	80
AMPS	14.4	9.8		Griffith	0	559
IPP (aux load)	2.0	38.0		South Point	0	539
Total	861.6	624.2		Total	250	1308

Table 4 – Study System Loads & Generation for MLSC

MLSC = 1265 MW for Study System Years 2005, 2008, 2012						
Study System Load (MW)				Study System Generation (MW)		
	@ MLSC	Year 2012 @ Peak Load			@ MLSC	Year 2012 @ Peak Load
TEP	802.1	383.6				
SWTC & MEC	364.5	174.2		Davis	260	210
APS	39.6	18.6		Parker	104	80
AMPS	20.3	9.8		Griffith	640	559
IPP (aux load)	38.0	38.0		South Point	540	539
Total	1264.5	624.2		Total	1544	1308