



# **SPP** *Southwest Power Pool*

***System Impact Study SPP-2001-310  
For Transmission Service  
Requested By  
Western Resources Generation  
Services***

***From Western Resources  
to Ameren***

***For a Reserved Amount Of 29MW  
From 3/1/02  
To 3/1/03***

***SPP Transmission Planning***

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## **1. Executive Summary**

Western Resources Generation Services has requested a system impact study for long-term Firm Point-to-Point transmission service from Western Resources to Ameren. The period of the transaction is from 3/1/02 to 3/1/03. The request is for OASIS reservation 306707 for 29MW.

The principal objective of this study is to identify system problems and potential system modifications necessary to facilitate the additional 29MW transfer while maintaining system reliability.

New overloads caused by the 29MW transfer were identified along with determining the impact of the transfer on any previously assigned and identified facilities.

The WR to AMRN transfer increases the loading on previously identified facilities, resulting in an ATC of 0MW. Redispatch was looked at as an option to relieving the additional loading on these facilities caused by the WR to AMRN 29MW transfer.

## **2. Introduction**

Western Resources Generation Services has requested an impact study for transmission service from WR to AMRN. The WR to AMRN transfer was originally requested to run from 1/1/2002 to 1/1/2003. Due to the inability to resolve higher priority requests in the time period needed, the WR to AMRN transfer was deferred to begin 3/1/2002 and end 3/1/2003.

The principal objective of this study is to identify the restraints on the SPP Regional Tariff System that may limit the transfer to less than 29MW. This study includes steady-state contingency analyses (PSS/E function ACCC) and Available Transfer Capability (ATC) analyses.

The steady-state analysis considers the impact of the 29MW transfer on transmission line loading and transmission bus voltages for outages of single and selected multiple transmission lines and transformers on the SPP system.

ATC analyses shows the amount of First Contingency Incremental Transfer Capabilities (FCITC) between the given study systems and what the limitations are, if any, for transferring up to 29MW.

### **3. Study Methodology**

#### **A. Description**

Two analyses were conducted to determine the impact of the 29MW transfer on the system. The first analysis was conducted to identify any new overloads caused by the 29MW transfer. The second analysis was done to ensure that available capacity exists on previously identified circuits.

The first analysis was to study the steady-state analysis impact of the 29MW transfer on the SPP system. The second step was to study Available Transfer Capability (ATC) of the facilities identified in the steady-state analysis impact. The steady-state analysis was done to ensure current SPP Criteria and NERC Planning Standards requirements are fulfilled. The Southwest Power Pool (SPP) conforms to the NERC Planning Standards, which provide the strictest requirements, related to thermal overloads with a contingency. It requires that all facilities be within emergency ratings after a contingency.

The second analysis was done to determine the impact of the transfer on previously assigned and identified facilities.

#### **B. Model Updates**

SPP used five seasonal models to study the 29MW request. The SPP 2001 Series Cases 2001/2002 Winter Peak, 2002 Spring, 2002 Summer Peak, 2002 Fall, and 2002/03 Winter Peak were used to study the impact of the 29MW transfer on the SPP system during the transaction period of 3/1/02 to 3/1/03.

The chosen base case models were modified to reflect the most current modeling information. The cases were modified to reflect future firm transfers during the request period that were not already included in the January 2001 base case series models.

#### **C. Transfer Analysis**

Using the created models and the ACCC function of PSS/E, single and select double contingency outages were analyzed. Then full AC solution was used to obtain the most accurate results possible. Any facility overloaded, using MVA ratings, in the transfer case and not overloaded in the base case was flagged. The PSS/E options chosen to conduct the Impact Study analysis can be found in Appendix A.

## **4. Study Results**

### **A. Study Analysis Results**

Tables 1, 2, and 3 contain the analysis results of the System Impact Study. The tables identify the seasonal case in which the event occurred; the emergency rating of the overloaded circuit (Rate B), the contingent loading percentage of circuit with and without the studied transfer, the estimated ATC value using interpolation if calculated, any SPP identification or assignment of the event, and any solutions received from the transmission owners.

Table 1 shows the new facility overloads caused by the 29MW transfer. Upgrades associated with these new overloads can be directly assigned to the WR to AMRN 29MW transfer.

Table 2 documents overloads on Non SPP Regional Tariff participants' transmission systems caused by the 29MW transfer.

Table 3 documents the 29MW transfer impact on previously assigned and identified facilities.

Table 4 documents possible pairs for redispatch that may be used to relieve the additional loading of the Hoyt to Circleville 115kV line for the 2002 Spring.

Table 5 documents possible pairs for redispatch that may be used to relieve the additional loading of the Hoyt to Circleville 115kV line for the 2002 Summer.

Table 6 documents possible pairs for redispatch that may be used to relieve the additional loading of the Midland 230/115kV transformer for the 2002 Summer.

**Table 1** – SPP Facility Overloads caused by the WR to AMRN 29MW Transfer

Study Year	From Area - To Area	Branch Over 100% Rate B	Rate B	BC % Loading	TC % Loading	Outaged Branch Causing Overload	ATC	Assignment
01WP		NONE				NONE	29	
02G		NONE				NONE	29	
02SP	WERE-WERE	<b>HOYT HTI SWITCHING JUNCTION TO CIRCLEVILLE, 115KV</b> 57165 HTI JCT3 115 to 57152 CIRCLVL3 115 CKT 1	92	99.6	100.5	<b>KNOB HILL TO GREENLEAF, 115KV</b> 57332 KNOB HL3 115 to 58765 GRNLEAF3 115 CKT1	29	Assigned to SPP-2001-227, Estimated In-Service Date 6/1/02
02SP	WERE-WERE	<b>HOYT TO HOYT HTI SWITCHING JUNCTION, 115KV</b> 57163 HOYT 3 115 to 57165 HTI JCT3 115 CKT 1	92	99.5	100.1	<b>BONDRNT TO MNTZUMA, 345KV</b> 62412 BONDRNT3 345 to 62455 MNTZUMA3 345 CKT1	29	Assigned to SPP-2001-211, Estimated In-Service Date 6/1/02
02FA		NONE				NONE	29	
02WP		NONE				NONE	29	

**Table 2** – Non - SPP Facility Overloads caused by the WR to AMRN 29MW Transfer

Study Year	From Area - To Area	Branch Over 100% Rate B	Rate B	BC % Loading	TC % Loading	Outaged Branch Causing Overload	ATC (MW)
01WP		NONE				NONE	29
02G		NONE				NONE	29
02SP		NONE				NONE	29
02FA		NONE				NONE	29
02WP		NONE				NONE	29

**Table 3** – Previously Assigned and Identified SPP Facilities Impacted by the WR to AMRN 29MW Transfer.

Study Year	From Area - To Area	Branch Over 100% Rate B	Rate B	BC % Loading	TC % Loading	Outaged Branch Causing Overload	ATC (MW)	Assignment
01WP		NONE				NONE	29	
02G	WERE-WERE	<b>HOYT HTI SWITCHING JUNCTION TO CIRCLEVILLE, 115KV</b> 57165 HTI JCT3 115 to 57152 CIRCLVL3 115 CKT 1	92	106.2	106.6	<b>IATAN TO ST. JOE, 345KV</b> 57982 IATAN 7 345 to 69702 ST JOE 3 345 CKT1	0	Assigned to SPP-2001-227, Estimated In-Service Date 6/1/02
02SP	WERE-WERE	<b>HOYT TO HOYT HTI SWITCHING JUNCTION, 115KV</b> 57163 HOYT 3 115 to 57165 HTI JCT3 115 CKT 1	92	100.4	100.8	<b>JEFFERY ENERGY CENTER TO SUMMIT, 345KV</b> 56766 JEC N 7 345 to 56773 SUMMIT 7 345 CKT1	29	Assigned to SPP-2001-211, Estimated In-Service Date 6/1/02
02SP	WERE-WERE	<b>HOYT HTI SWITCHING JUNCTION TO CIRCLEVILLE, 115KV</b> 57165 HTI JCT3 115 to 57152 CIRCLVL3 115 CKT 1	92	107.0	107.5	<b>JEFFERY ENERGY CENTER TO EAST MANHATTAN, 230KV</b> 56852 JEC 6 230 to 56861 EMANHAT6 230 CKT1	0	Assigned to SPP-2001-227, Estimated In-Service Date 6/1/02
02SP	WERE-WERE	<b>MIDLAND JUNCTION 230/115KV TR</b> 56855 MIDLAND6 230 to 57252 MIDLAND3 115 CKT 1	308	101.2	101.8	<b>LAWRENCE HILL 230/115KV TR</b> 56853 LAWHILL6 230 to 57250 LWRNCHL3 115 CKT1	0	Previously Identified
02FA	WERE-WERE	<b>HOYT TO HOYT HTI SWITCHING JUNCTION, 115KV</b> 57163 HOYT 3 115 to 57165 HTI JCT3 115 CKT 1	92	104.1	104.3	<b>CLIFTON TO CONCORDIA, 115KV</b> 58756 CLIFTON3 115 to 58757 CONCORD3 115 CKT1	29	Assigned to SPP-2001-211, Estimated In-Service Date 6/1/02
02WP	WERE-WERE	<b>HOYT HTI SWITCHING JUNCTION TO CIRCLEVILLE, 115KV</b> 57165 HTI JCT3 115 to 57152 CIRCLVL3 115 CKT 1	92	104.0	104.3	<b>CONCORDIA 230/115KV TR</b> 58757 CONCORD3 115 to 58758 CONCORD6 230 CKT1	29	Assigned to SPP-2001-227, Estimated In-Service Date 6/1/02



**Table 4** – Possible Pairs Available for Redispatch to Relieve Hoyt to Circleville 115kV line - 2002 Spring

Sources		Sinks		% Response	Maximum Available for Transfer (MW)	Amount Needed for Hoyt to Circleville 115kV Line 2002G SPP-2001-309	Amount Needed for Hoyt to Circleville 115kV Line 2002G SPP-2001-310
Bus #	Bus Name	Bus #	Bus Name				
56711	NEC U3	56671	TEC U7	-4.14	40.0	14.0	10.0
56711	NEC U3	56651	JEC U1	-3.12	67.0	19.0	13.0
56711	NEC U3	56652	JEC U2	-3.45	67.0	17.0	12.0
56711	NEC U3	56661	LEC U3	-2.67	25.0	22.0	15.0
56731	GEC U1	56671	TEC U7	-4.14	40.0	14.0	10.0
56731	GEC U1	56651	JEC U1	-3.12	44.0	19.0	13.0
56731	GEC U1	56653	JEC U3	-3.45	44.0	17.0	12.0
56731	GEC U1	56661	LEC U3	-2.67	25.0	22.0	15.0
56734	GEC U4	56671	TEC U7	-4.14	40.0	14.0	10.0
57072	WACO 4	56672	TEC U8	-4.14	30.0	14.0	10.0
57072	WACO 4	56651	JEC U1	-3.12	30.0	19.0	13.0
57072	WACO 4	56652	JEC U2	-3.45	30.0	17.0	12.0
57072	WACO 4	56661	LEC U3	-2.67	25.0	22.0	15.0
56721	EEC U1	56671	TEC U7	-3.94	26.0	15.0	10.0
56721	EEC U1	56651	JEC U1	-3.01	26.0	20.0	13.0
56721	EEC U1	56652	JEC U2	-3.31	26.0	18.0	12.0
56722	EEC U2	56663	LEC U5	-2.55	41.0	24.0	16.0
56725	EEC GT3	56672	TEC U8	-3.94	68.0	15.0	10.0

**Table 5** – Possible Pairs Available for Redispatch to Relieve Hoyt to Circleville 115kV line - 2002 Summer

Sources		Sinks		% Response	Maximum Available for Transfer (MW)	Amount Needed for Hoyt to Circleville 115kV Line 2002SP SPP-2001-309	Amount Needed for Hoyt to Circleville 115kV Line 2002SP SPP-2001-310
Bus #	Bus Name	Bus #	Bus Name				
56711	NEC U3	56671	TEC U7	-4.1	17.0	17.0	12.0
56711	NEC U3	56672	TEC U8	-4.1	17.0	17.0	12.0
56722	EEC U2	56671	TEC U7	-3.9	16.0	15.0	13.0
56722	EEC U2	56672	TEC U8	-3.9	16.0	15.0	13.0
56723	EEC GT1	56671	TEC U7	-3.9	23.3	15.0	13.0
56723	EEC GT1	56672	TEC U8	-3.9	23.3	15.0	13.0
56724	EEC GT2	56671	TEC U7	-3.9	23.3	15.0	13.0
56724	EEC GT2	56672	TEC U8	-3.9	23.3	15.0	13.0
56723	EEC GT1	56652	JEC U2	-3.3	23.3	18.0	15.0
56723	EEC GT1	56653	JEC U3	-3.3	23.3	18.0	15.0
56724	EEC GT2	56652	JEC U2	-3.3	23.3	18.0	15.0
56724	EEC GT2	56653	JEC U3	-3.3	23.3	18.0	15.0
56723	EEC GT1	56651	JEC U1	-3.0	23.3	20.0	17.0
56724	EEC GT2	56651	JEC U1	-3.0	23.3	20.0	17.0

**Table 6** – Possible Pairs Available for Redispatch to Relieve Midland 230/115kV Transformer - 2002 Summer

Sources		Sinks		Redispatch Response	Maximum Available for Transfer (MW)	Amount Needed to Relieve Midland 230/115kV TR for SPP-2001-309	Amount Needed to Relieve Midland 230/115kV TR for SPP-2001-310
Bus #	Bus Name	Bus #	Bus Name				
56661	LEC U3 14.4	56652	JEC U2 26.0	-32.1%	9.0	8.0	6.0
56661	LEC U3 14.4	56653	JEC U3 26.0	-32.1%	9.0	8.0	6.0
56661	LEC U3 14.4	56701	MCPH PLT12.5	-32.9%	9.0	8.0	5.0
56661	LEC U3 14.4	56651	JEC U1 26.0	-33.0%	9.0	8.0	5.0
56661	LEC U3 14.4	56663	LEC U5 24.0	-67.2%	9.0	4.0	3.0
56662	LEC U4 14.4	56652	JEC U2 26.0	-31.1%	19.0	8.0	6.0
56662	LEC U4 14.4	56653	JEC U3 26.0	-31.1%	19.0	8.0	6.0
56662	LEC U4 14.4	56701	MCPH PLT12.5	-31.9%	19.0	8.0	6.0
56662	LEC U4 14.4	56651	JEC U1 26.0	-32.0%	19.0	8.0	6.0
56662	LEC U4 14.4	56663	LEC U5 24.0	-66.2%	19.0	4.0	3.0
57637	IOLA 269.0	56663	LEC U5 24.0	-37.2%	13.5	7.0	5.0
56711	NEC U3 12.0	56663	LEC U5 24.0	-37.2%	17.0	7.0	5.0
57710	SUB A 269.0	56663	LEC U5 24.0	-37.1%	8.0	7.0	5.0

## **5. Conclusion**

The WR to AMRN transfer increases the loading on previously identified facilities. The acceptance of the WR to AMRN request is dependant on the following:

- 2002 Spring (4/1/2002 – 6/1/2002) – The WR to AMRN 29MW transfer increases the loading on the previously overloaded Hoyt to Circleville 115kV line. To provide the needed capacity on this facility, Western Resources must agree to redispatch generation as needed to relieve the additional loading caused by the transfer. Any generation provided for redispatch to relieve the loading on this facility caused by the 29MW from WR to AMRN must be in addition to the redispatch provided for the previously confirmed WR to AMRN 61MW transfer (SPP-2001-248) and the WR to AECI 40MW transfer (SPP-2001-309).
- 2002 Summer Peak (6/1/2002 – 10/1/2002) – The WR to AMRN 29MW transfer increases the loading on the previously overloaded Hoyt to Circleville 115kV line and Midland 230/115kV transformer. To provide the needed capacity on these facilities, Western Resources must agree to redispatch generation as needed to relieve the additional loading caused by the transfer. Any generation provided for redispatch to relieve the loading on these facilities caused by the 29MW from WR to AMRN must be in addition to the redispatch provided for the previously confirmed WR to AMRN 61MW transfer (SPP-2001-248) and the WR to AECI 40MW transfer (SPP-2001-309).
- 2002 Fall (10/1/2002 – 12/1/2002) - Upgrades must be completed for the Hoyt to Hoyt Hti Switching Junction 115kV line assigned to the previously studied WR to EES 100MW transfer (SPP-2001-211).
- 2002/2003 Winter (12/1/2002 – 4/1/2003) - Upgrades must be completed for the Hoyt Hti Switching Junction to Circleville 115kV line assigned to the previously studied WR to AMRN 100MW transfer (SPP-2001-227).

## **Appendix A**

### PSS/E CHOICES IN RUNNING LOAD FLOW PROGRAM AND ACCC

#### BASE CASES:

Solutions - Fixed slope decoupled Newton-Raphson solution (FDNS)

1. Tap adjustment – Stepping
2. Area interchange control – Tie lines only
3. Var limits – Apply automatically
4. Solution options -  Phase shift adjustment
  - Flat start
  - Lock DC taps
  - Lock switched shunts

#### ACCC CASES:

Solutions – AC contingency checking (ACCC)

1. MW mismatch tolerance –0.5
2. Contingency case rating – Rate B
3. Percent of rating – 100
4. Output code – Summary
5. Min flow change in overload report – 1mw
6. Excl'd cases w/ no overloads form report – YES
7. Exclude interfaces from report – NO
8. Perform voltage limit check – YES
9. Elements in available capacity table – 60000
10. Cutoff threshold for available capacity table – 99999.0
11. Min. contng. case Vltg chng for report – 0.02
12. Sorted output – None

#### Newton Solution:

1. Tap adjustment – Stepping
2. Area interchange control – Tie lines only
3. Var limits - Apply automatically
4. Solution options -  Phase shift adjustment
  - Flat start
  - Lock DC taps
  - Lock switched shunts