Southwest Power Pool

Frequently Constrained Areas- 2014 Study

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I. Introduction

Frequently Constrained Areas (FCAs) are areas of the Integrated Marketplace footprint that experience high levels of congestion and are associated with a dominant or pivotal supplier. Attachment AF, Section 3.1.1 of the SPP Open Access Transmission Tariff defines Frequently Constrained Areas as electrical areas with one or more binding transmission constraints or Reserve Zone constraints that are expected to be binding for at least five-hundred (500) hours during a given twelve (12)-month period and within which one or more suppliers are pivotal. Prior to the start of the Integrated Marketplace, Potomac Economics Ltd., under contract with the SPP Market Monitor, recommended the designation of three Frequently Constrained Areas: (1) the Kansas City area, (2) the Northwest Kansas area, and (3) the Texas Panhandle area.

The SPP Market Monitor, as required by Attachment AF, Section 3.1.1.3, has reexamined the FCA designations to determine if the current designations are still warranted and if any new areas need to be designated as an FCA. The contents of this report include an executive summary of the major findings and recommendations in Section II, a description of the study process in Section III, and a detailed description of the analysis in Section IV. Appendix A consists of the recommended changes to Addendum 1 of Attachment AF. Appendix B is a list of constraints with corresponding binding and pivotal supplier hours.

II. Executive Summary

Summary of Results

The initial phase of the study identified three candidates for the FCA designation; the identified candidates are the same areas that were designated to be Frequently Constrained Areas in the 2013 study. These areas are (1) the Kansas City area, (2) the Northwest Kansas area, and (3) the Texas Panhandle area. The identification of candidate areas and associated primary constraints is based on the number of hours the constraints are binding and the number of hours for which the constraints have a pivotal supplier. Table II.1 shows each area's primary constraint, and the shift-factor cut-off for each area. The primary constraint for each candidate area is the constraint with the most binding hours and the shift-factor cut-off is used to identify the candidate resources

associated with the candidate FCA. The Kansas City Area and Northwest Kansas areas have experienced significant changes to the transmission system since the period examined in the 2013 study. Additions to the transmission system open up load pockets to competition from a number of other resources in the market by providing SPP with more options to re-dispatch resources to relieve the constraints. The upgrades to the transmission system impacted the selection of a primary constraint in the Kansas City area and the number of candidate FCA resources. As noted in Table II.1, there is only one primary constraint associated with the Kansas City area whereas the 2013 study designated the Lake Road to Alabama constraint as a primary constraint in addition to the Iatan to Stranger Creek constraint. Lake Road to Alabama is no longer a significant constraint in the area due to the Eastowne transformer. The Eastowne transformer connects a 161 kV electrical system north of Kansas City to the 345 kV line from St. Joseph to Iatan.

Table II.1 - Primary Constraints and Shift-Factor Cut-Offs

Candidate Area	Primary Constraint	Shift-Factor Cut-Off
Kansas City Area	IATSTRSTJHAW	-6.8%
NW Kansas	REDWILLMINGO	-6.6%
Texas Panhandle	OSGCANBUSDEA	-5.3%

This upgrade to the transmission system, completed in the summer of 2013, relieved the congestion on the Lake Road to Alabama constraint and there were zero hours of congestion on the 161 kV system associated with the Lake Road to Alabama constraint during the study period for this analysis. The change in the primary constraint results in a smaller number of FCA resource candidates for the Kansas City area. The resource candidate group includes all resources with a shift-factor less than the shift-factor cut-off. Eighty-six resources were identified in the 2014 study compared with one hundred-twenty in the 2013 study.

The changes to the Kansas City area are also reflected in the determination of secondary constraints. Secondary constraints are constraints for which the candidate FCA resources provide at

least seventy percent (70%) of the congestion relief. No secondary constraints were identified for the Kansas City area. Table II.2 shows the defining constraints for each candidate FCA.

Table II.2 – Candidate FCA Defining Constraints

Candidate Area	Constraint Type	Constraint Name
Kansas City Area	Primary	IATSTRSTJHAW
NW Kansas	Primary	REDWILLMINGO
	Secondary	GENTLMREDWIL
	Secondary	TEMP02_18982 (Axtell to Post Rock)
Texas Panhandle	Primary	OSGCANBUSDEA
	Secondary	HARRANNICAMA
	Secondary	SPSNORTH_STH
	Secondary	Temp13_20278 (Bushland to Deaf Smith)

The shift-factor cut-off for the Northwest Kansas area changed from negative 12% in the 2013 Study to negative 6.6% in the current study. This change can be attributed to upgrades to the transmission system in the western part of the SPP footprint. Three upgrades that are impacting the area are the Hitchland to Woodward 345 kV double circuit line, the Axtell to Post Rock 345kV line, and the Post Rock to Spearville 345 kV line. Figure IV.2 in Section IV shows the transmission additions in the western part of the SPP footprint. These large volume lines reduce the ability of the pivotal suppliers to cause congestion. In the event a pivotal supplier is able to load a constraint, the smaller price impacts, as reflected by the lower shift-factors, significantly reduce the potential

benefits of such behavior. There are no significant changes in the defining constraints or resource candidate group for the Northwest Kansas area.

No significant changes from the 2013 study are found in the Texas Panhandle candidate FCA. The primary constraint is the same, the shift-factor cut-off has changed from -6% to -5.3%, and the defining constraint group has not changed substantially. There is a net change of three candidate resources due to new registrations and de-registrations.

With the candidate FCAs fully defined by the candidate resource group and defining constraints, we conduct an impact analysis to determine the number of hours each candidate FCA is both binding and susceptible to the exercise of market power by a pivotal supplier. We record these results in Table II.3.

Table II.3 – Candidate FCA Binding & Pivotal Supplier Hours

Candidate Area	Binding Hours	Pivotal Supplier Hours $15 Impact Threshold
Kansas City Area	999	79
NW Kansas	678	219
Texas Panhandle	5,234	2,189

To determine the sensitivity of the results to the impact test threshold, we repeated the impact analysis at the $5/MWh and $25/MWh threshold levels. The results are shown in Table II.4. The sensitivity analysis indicates that the choice of impact threshold does not affect the FCA designation decision. Pivotal supplier impacts in the Kansas City and Northwest Kansas areas fall below the 500 hour level at the three threshold levels, and the impacts to the Texas Panhandle area exceed the 500 hour level at all three impact test threshold levels.

Table II.4 – Impact Analysis Sensitivity

Candidate Area	Total Hours at $5/MWH Threshold	Total Hours at $15/MWH Threshold	Total Hours at $25/MWH Threshold
Kansas City Area	175	79	58
NW Kansas	405	219	84
Texas Panhandle	3,619	2,189	1,258

Recommendations

The results of the analysis clearly indicate that the Texas Panhandle candidate FCA should remain a designated Frequently Constrained Area. The binding hours and pivotal supplier results in Table II.3 show that congestion and market power issues in the area have not been resolved. The pivotal supplier hours with price impacts easily exceed 500 hours. The Market Monitor recommends the Texas Panhandle area maintain the designation as an FCA and that the FCA defining constraints and FCA resource lists in Addendum 1 to Attachment AF be updated to reflect to the lists provided in Appendix A of this report.

The conclusions regarding the Kansas City candidate FCA are equally unambiguous; the Kansas City area does not warrant continued designation as a Frequently Constrained Area. Table II.3 shows that there is still significant congestion in the area with 999 binding hours. However, Table II.4 indicates that the price impacts are in excess of the $5/MWh threshold in 175 hours or 18% of the binding hours; and in excess of the $15/MWh threshold in 79 hours or 8% of the binding hours. This is in sharp contrast to the results of the 2013 study where a supplier was pivotal with price impacts in the Kansas City area in 94% of the binding hours.

The analysis also shows that the Northwest Kansas area does not warrant continued designation as a Frequently Constrained Area. Table II.3 shows significant congestion but the

number of hours with price impacts exceeding the impact test threshold does not reach the 500 hour threshold for designation as a Frequently Constrained Area. This differs greatly from the 2013 study where the number of hours in the Northwest Kansas area with price impacts exceeded 1,400 hours.

III. Methodology

Data and Study Period

The study period runs from September 1, 2013 through August 31, 2014, and therefore includes the last six months of the Energy Imbalance Service (EIS) Market and the first six months of the Integrated Marketplace. Congestion and dispatch data, and resource plans from the EIS Market are used in the analysis for the period from September 1, 2013 through February 28, 2014. Real-time Balancing Market (RTBM) congestion and dispatch data and resource parameter offers for online resource are used in the analysis for the period from March 1, 2014 through August 31, 2014.

Study Process

The study consists of the same six step process used in the 2013 study.

1. **Binding Hours Computation**: The number of binding hours is computed for each modeled transmission constraint. A constraint is counted as binding in a five minute interval if the loading on the constraint is within the greater of five megawatts (5 MW) or 2% of the effective constraint limit.
2. **Pivotal Supplier Analysis**: The number of pivotal supplier hours is computed for each modeled transmission constraint. A constraint is counted as having a pivotal supplier during a five minute interval if the supplier can cause a constraint to exceed the effective constraint limit by decreasing generation on resources that provide congestion relief and by increasing generation on resources that contribute to congestion. The re-dispatch of the potential pivotal supplier's resources is governed by the submitted ramp rates, and the economic minimum and maximum capabilities. A thirty minute re-dispatch period is considered. The ability of the market to react to the actions of the potential pivotal supplier is accounted for by allowing a similar re-dispatch of all resources not owned or controlled by the potential pivotal supplier.
3. **Selection of FCA candidates:** Candidates for designation as a Frequently Constrained Area are chosen based on the binding hours and pivotal supplier analyses. Constraints that are in the same electrical proximity and have the same pivotal suppliers are grouped together; if the aggregate number of binding and pivotal supplier hours is significant, then the area is

selected as a candidate FCA. A primary constraint for the candidate FCA is generally selected as the constraint with the highest number of binding hours.

4. **Identify the candidate FCA Resources:** A resource is a candidate FCA resource if its shift-factor relative to the candidate FCA primary constraint is less than or equal to the candidate FCA shift-factor cut-off. To determine the shift-factor cut-off we first compute the relief capability of the largest pivotal supplier relative to the primary constraint. The shift-factor cut-off is then set at the shift-factor corresponding to the ninetieth percentile of the relief capability. In other words, ninety percent (90%) of the largest pivotal supplier's relief capability has a shift-factor less than or equal to the candidate FCA shift-factor cut-off.
5. **Identify the candidate FCA secondary constraints:** A constraint is eligible to be defined as a secondary constraint for the candidate FCA if the candidate FCA resource group contributes at least seventy percent (70%) of the total relief capability on the constraint. Additional considerations for defining a constraint as a secondary constraint consist of (i) electrical proximity to the primary constraint, (ii) an expectation that the constraint is not a short-term or temporary constraint, and (iii) an expectation that the constraint will experience significant congestion in the upcoming year.
6. **Impact Analysis:** An impact analysis is employed to determine the number of hours for which the candidate FCA Resource group has significant impacts on prices in the candidate FCA. For each five minute interval in the study period, the resource price impacts on each defining constraint are calculated by multiplying the shadow price and the candidate resource's corresponding shift-factor. The resource price impacts are then summed over the candidate FCA defining constraints to obtain a five minute price impact for each candidate resource. This calculation is equivalent to finding the contribution from the candidate FCA defining constraints to the candidate resource's marginal congestion component of the LMP.

   Any interval for which a candidate resource's price impact exceeds the impact test threshold is counted as an interval that is susceptible to the exercise of market power by a pivotal supplier. The market impact test threshold used in the Marketplace mitigation system transitioned from $5/MWh to $15/MWh on September 1, 2014, and is expected to increase to $25/MWh on March 1, 2015. We computed the impact analysis in this study at

threshold levels ranging from $5/MWh to $25/MWh in order to test the sensitivity of the results to the various impact threshold levels.

As stated in Section 3.2 of SPP Tariff, Attachment AF, an area must have 500 hours with pivotal supplier impacts to be designated as a Frequently Constrained Area. The importance of employing a threshold value such as $15/MWh is to account for the times when there is low cost relief capability in the FCA. This low cost relief prohibits the pivotal supplier from accruing significant benefits by pursuing a withholding strategy in the FCA.

IV. Analysis

Binding Constraints and Pivotal Suppliers

The results of the binding hours and pivotal supplier computations as described in steps 1 and 2 in Section III are recorded in Appendix B. The Osage Switch to Canyon constraint in the Texas Panhandle area has the most binding hours; Temp56_19273, Harrington to Randall County, also experienced heavy congestion and is located in the Texas Panhandle area. These two constraints in the Texas Panhandle area also have significant levels of pivotal supplier hours.

Several constraints in the Kansas City area have high binding hour and pivotal supplier counts. There are three constraints with the Iatan to Stranger Creek 345 kV line as the monitored element; the Eastowne transformer is located north of Kansas City. The Pentagon to Mund line is southwest of Kansas City. The Redwillow to Mingo and Gentlemen to Redwillow constraints, located in the northwest Kansas area, each have approximately 300 binding hours.

FCA Candidate Areas

An analysis of the data in Appendix B led to the identification of three candidates for the FCA designation; the identified candidates being the currently designated areas (1) the Kansas City Area, (2) the Northwest Kansas Interface, and (3) the Texas Panhandle Area. The identifications of candidate areas and associated primary constraints are based on the number of hours the constraints are binding and the number of hours for which the constraints have a pivotal supplier. Table IV.1 shows the binding and pivotal supplier hours for the heavily congested constraints in the candidate areas. The primary constraint for each candidate area is the constraint with the most binding hours. Table IV.2 shows the primary constraint and the corresponding shift-factor cut-off. The shift-factor cut-off is set at the shift-factor corresponding to the ninetieth percentile of the largest supplier's relief capability. For example, Table IV.2 shows the shift-factor cut-off for the Kansas City Area is -6.8% on the primary constraint IATSTRSTJHAW. This indicates that 90% of the largest pivotal supplier's relief capability on IATSTRSTJHAW is from generators that have shift-factors less than or equal to -6.8%.

Table IV.1 – Binding and Pivotal Supplier Hours

Candidate Area	Constraint Name	Monitored Element	Binding Hours	Pivotal Supplier Hours
Kansas City Area	IATSTRSTJHAW	Iatan to Stranger Creek - 345 kV	999	348
	IATSTRIATEAT	Iatan to Stranger Creek - 345 kV	516	363
	PENMUN87TCRA	Pentagon to Mund – 115 kV	498	405
NW Kansas	REDWILLMINGO	Redwillow to Mingo – 345 kV	369	300
	GENTLREDWIL	Gentleman to Redwillow – 345 kV	302	283
Texas Panhandle	OSGCANBUSDEA	Osage Switch to Canyon - 115 kV	4,808	4,726
	HARRANNNICAMA	Harrington to Randall Co., 230 kV	675	646

In the initial FCA study completed in 2013, two primary constraints were identified for the Kansas City FCA, Iatan to Stranger Creek and Lake Road to Alabama, with corresponding cut-offs of -8% and -3%, respectively. The Lake Road to Alabama constraint does not appear in Table IV.1; indicating that there was no significant congestion on this constraint during the study period. This is due to the installation of the Eastowne Transformer which connects a 161 kV electrical system north of Kansas City to the 345 kV line from St. Joseph to Iatan. This upgrade to the transmission system, completed in the summer of 2013, resolved the congestion on the 161 kV transmission system and the Lake Road to Alabama constraint; and there is no expectation that significant congestion will occur in this area going forward. Also of note in Table IV.2 is that the shift-factor cut-off on the Iatan to Stranger Creek 345 kV line changed from -8% in the 2013 study to -6.8%. This indicates that the pivotal suppliers have lower impacts on the primary constraint. The change

in the primary constraint definition and the reduction in the shift-factor cut-off have led to substantial changes in the candidate resource group. Eighty-six resources were identified in the 2014 study compared to one hundred-twenty in the 2013 study.

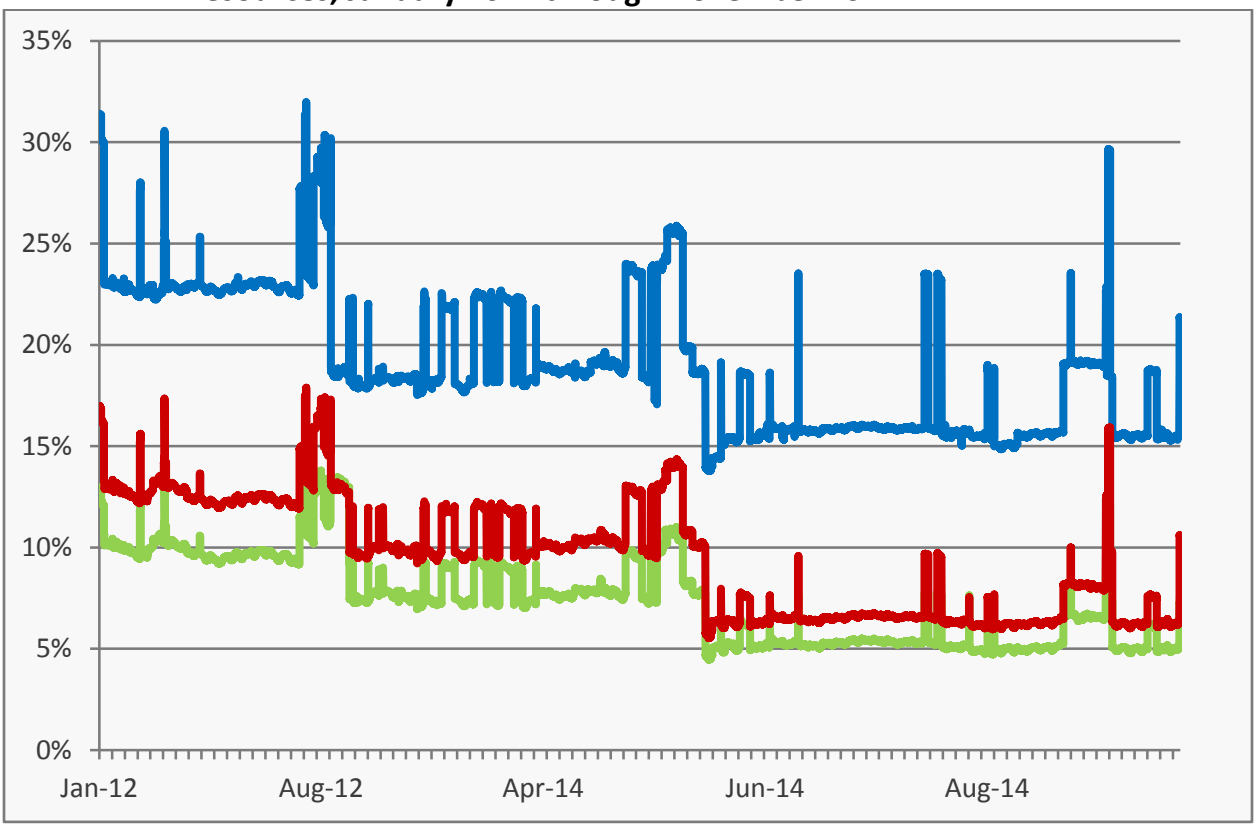
Table IV.2 - Primary Constraints and Shift-Factor Cut-Offs

Candidate Area	Primary Constraint	Shift-Factor Cut-Off
Kansas City Area	IATSTRSTJHAW	-6.8%
NW Kansas	REDWILLMINGO	-6.6%
Texas Panhandle	OSGCANBUSDEA	-5.3%

In the NW Kansas area, the cut-off changed from -12% to -6.6%, indicating that the price impacts from the FCA candidate resources will be substantially reduced. The reduction in the shift-factor cut-off had essentially no impact on the resource candidate group. There is a net gain of 16 resources but these can be attributed to new registrations and de-registrations. Figure IV.1 shows shift-factor data for three resources that are in the NW Kansas FCA. The data begins on the left with January 2012 values. Although there is considerable volatility in the shift-factor values, there is a distinct and recognizable shift downward in the magnitudes of each resource's shift-factor as the lines on the chart move from the left to right. This shows that the ability of the pivotal suppliers to create congestion on the NW Kansas constraints has been significantly reduced since 2012. Additionally, in the event a pivotal supplier is able to load a constraint, the smaller price impacts will significantly reduce the benefits from such behavior. Transmission expansion in the western part of the SPP footprint likely contributed to the systematic changes in the shift-factors of the resources in the NW Kansas FCA.

The shift-factor cut-off for the Texas Panhandle changed from -6% to -5.3% and there was a net change of three candidate resources due to new registrations and de-registrations.

Figure IV.1 Shift-Factors relative to the NW Kansas Primary Constraint for three FCA Resources, January 2012 through November 2014



The next step in the process is to identify the secondary constraints for each FCA candidate. The secondary constraints for each candidate FCA are shown in Table IV.3. The identification of secondary constraints is necessary because congestion in tightly constrained areas generally impacts a group of constraints. Operators may choose to activate a constraint in close proximity to the designated primary constraint while not activating the primary constraint. Without the designation of the secondary constraints the market power mitigation logic will not recognize that the FCA is binding and may not adequately protect against market power abuse. For a constraint to be defined as a secondary constraint it must be determined that the FCA candidate resource group makes up more than seventy percent (70%) of the total relief capability on the constraint. For example, if the total relief capability on constraint XYZ is 1,000 megawatts and the resource candidate group corresponding to the Kansas City area contributes 725 relief megawatts, then the 70% threshold is exceeded and constraint XYZ may be included as a secondary constraint for the Kansas City Area.

Additional considerations for including a constraint as a secondary constraint include (i) electrical proximity to the primary constraint, (ii) the expectation that the constraint is not a short-term or temporary constraint, and (iii) the constraint experienced significant congestion in the previous twelve months. Application of the seventy percent (70%) test produced seven potential secondary constraints for the Kansas City Area. However, all seven of these constraints were temporary constraints in the Wichita area which experienced several construction related outages during the study period. The congestion on these temporary constraints is not expected to be an issue going forward. As a result, the Kansas City Area does not have any secondary constraints.

Thirty-one constraints were identified as potential secondary constraints to the Northwest Kansas area. Twelve of the identified constraints are temporary constraints that were either created to address short-term issues or are no longer monitored constraints. Fourteen of the identified constraints are also identified as potential defining constraints for the Texas Panhandle candidate FCA. This is because the candidate resource group for the Texas Panhandle is a proper subset of the candidate resource group for the Northwest Kansas area, meaning that every resource in the Texas Panhandle candidate FCA is also in the Northwest Kansas candidate FCA but the reverse is not true. If we were to include the fourteen potential constraints as defining constraints for the Northwest Kansas area, the result would be one very large FCA covering the entire western area of the footprint from the Kansas-Nebraska border to the most southwestern point of the footprint. Clearly this is not a desired outcome since resources that do not contribute to congestion relief on OSGCANBUSDEA will be subject to mitigation anytime the OSGCANBUSDEA constraint is binding. This will lead to the over application of mitigation since resources that may not have local market power will be subject to mitigation anytime the Texas Panhandle FCA is binding. Therefore, we do not include the fourteen constraints in Texas Panhandle area as defining constraints for the NW Kansas FCA. Two additional constraints (NPLSTOGTLRED, REDMINAXTPOS) were not included because there has not been significant congestion on these constraints in the past and there is no expectation of increased congestion on these constraints going forward. This leaves two secondary constraints for the NW Kansas candidate FCA, GENTLMREDWILL (Gentleman to Red Willow) and Temp02_18982 (Axtel to Post Rock).

Table IV.3 – Candidate FCA Defining Constraints

Candidate Area	Constraint Type	Constraint Name
Kansas City Area	Primary	IATSTRSTJHAW
NW Kansas	Primary	REDWILLMINGO
	Secondary	GENTLMREDWIL
	Secondary	TEMP02_18982 (Axtell to Post Rock)
Texas Panhandle	Primary	OSGCANBUSDEA
	Secondary	HARRANNICAMA
	Secondary	SPSNORTH_STH
	Secondary	Temp13_20278 (Bushland to Deaf Smith)

The application of the seventy percent relief capability test to the Texas Panhandle candidate resource group yielded fifteen secondary constraints. Ten of the fifteen are temporary constraints that are not expected to experience heavy congestion levels going forward. Two permanent constraints were identified and not included because they have not experienced significant congestion in the past; the two constraints are ROOXFRROOOAS (Roosevelt transformer) and SUNAMOTOLYOA (Sundown to Amoco). Three secondary constraints for the Texas Panhandle area are included in Table IV.3.

Impact Analysis

As in the 2013 study the final step is to determine the number of hours each candidate FCA was both binding and susceptible to the exercise of market power. This is done by applying a price

impact test; the price impact is calculated by multiplying the constraint shadow price and the candidate resource's shift-factor relative to the defining constraints for each FCA. The price impacts were computed for each five minute interval in the study period and if the price impact on a single candidate resource exceeds the price impact threshold, then the candidate FCA is susceptible to the exercise of market power. The results of this final test are displayed in Table IV.4. The results in Table IV.4 indicate that the impacts of the pivotal suppliers in the Kansas City area and the Northwest Kansas area do not meet the 500 hour threshold; however, the impacts in the Texas Panhandle are significant with the total hours exceeding 2000 hours. The comparison with the 2013 study in Table IV.5 shows substantial differences in all three areas. The Kansas City area experienced almost the same amount of congestion but the pivotal supplier impacts are drastically reduced. As noted previously, this appears to be due the installation of the Eastowne Transformer.

Table IV.4 – Candidate FCA Binding & Pivotal Supplier Hours

Candidate Area	Binding Hours	Pivotal Supplier Hours $15 Impact Threshold
Kansas City Area	999	79
NW Kansas	678	219
Texas Panhandle	5,234	2,189

Binding hours and pivotal supplier impacts are down in the Northwest Kansas area due to the transmission expansion in the western part of the footprint. Finally we note the increases in binding hours and pivotal supplier impacts in the Texas Panhandle area. The increases may in part be due to construction related outages; additionally, the changes in commitment since the start of the Integrated Marketplace may be impacting the congestion in this area.

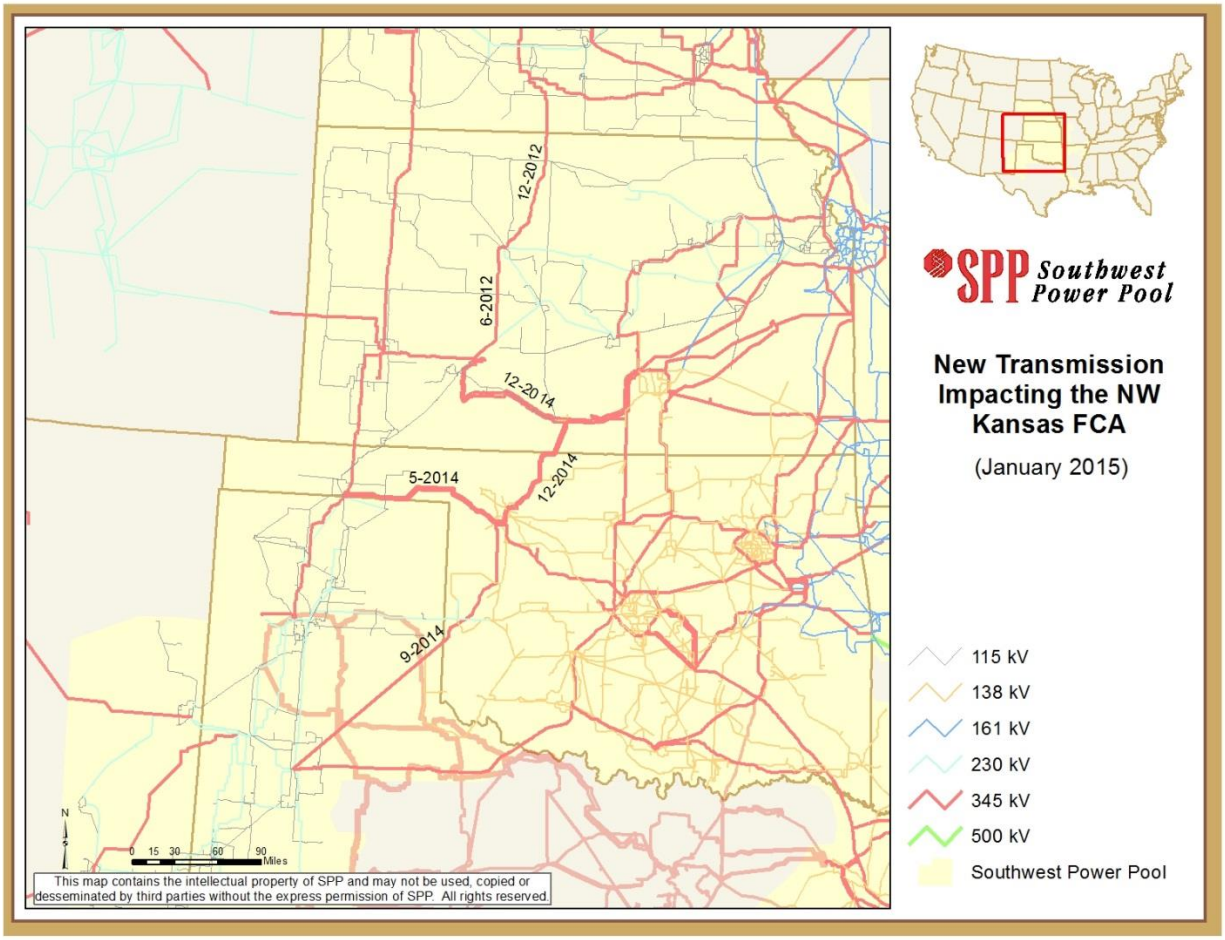
Table IV.5 – Impact Analysis Comparison with 2013 Study

	2013 FCA Study		2014 FCA Study	
Candidate Area	Binding Hours	Total Hours at $5/MWH Threshold	Binding Hours	Total Hours at $5/MWH Threshold
Kansas City	1,105	751	999	175
NW Kansas	1,556	1,463	678	405
Texas Panhandle	2,514	2,489	5,234	3,619

Figure IV.2 shows the transmission expansion in the western part of the SPP footprint since 2012. The map shows six lines that have gone into service since 2012. The Post Rock to Spearville 345 kV line in central Kansas went into service in June 2012, followed in December 2012 by the Axtel to Post Rock 345 kV from Nebraska into central Kansas. The impacts of the these lines are fully captured in the 2014 study; however given the 2011-2012 study period, only partial impacts of these lines were captured in the 2013 study. The 345kV double circuit from Hitchland to Woodward went into service in May 2014 and likely contributed to the reduction in pivotal supplier impacts in the Northwest Kansas area. The systematic drop in shift-factor impacts noted in Figure IV.1 correlates with the service start date for the Hitchland to Woodward line.

The results reported in Table IV.4 correspond to an impact analysis threshold level of $15/MWh. This is the current threshold for the Market Impact Test specified in the SPP mitigation plan. At market start in March 2014, the threshold was $5/MWh and this level was used in the 2013 FCA Study. The threshold was increased to $15/MWh on September 1, 2014 and it is expected to increase to $25/MWh on March 1, 2015.

Figure IV.2 New Transmission



In Table IV.6, we report the results of a sensitivity analysis where we reran the impact analysis at the $5/MWh and $25/MWh threshold levels. The results in Table IV.6 show that the choice of the impact analysis threshold does not alter the outcome of the test since Kansas City and NW Kansas are below the 500 hours FCA designation threshold for all three levels and the Texas Panhandle exceeds 500 hours for all three impact test threshold levels.

Table IV.6 – Threshold Sensitivity Analysis

Candidate Area	Total Hours at $5/MWH Threshold	Total Hours at $15/MWH Threshold	Total Hours at $25/MWH Threshold
Kansas City Area	175	79	58
NW Kansas	405	219	84
Texas Panhandle	3,619	2,189	1,258

Forward Looking Analysis

The SPP footprint is still undergoing transmission expansion with several lines going into service since September 2014. Three of these lines are shown Figure IV.2. The Tuco to Woodward 345 kV line went into service in late September. The Woodward to Thistle 345 kV double circuit and the Clark County to Thistle 345 kV double circuit were energized in the latter part of 2014. Table IV.7 reports the impact analysis for the final four months of 2014. The results in Table IV.7 for the four month period do not vary significantly, on an annualized basis, from the results in Table IV.6 and we conclude that the expansion has not resolved the congestion and pivotal supplier issues in the Texas Panhandle area. The SPP Market Monitor will continue to monitor the impacts of transmission expansion on the FCA designation and will initiate a new study if the forward looking impact analysis indicates a need.

Table IV.7 – Impact Analysis for September 2014 through December 2014

Candidate Area	Total Hours at $5/MWH Threshold	Total Hours at $15/MWH Threshold	Total Hours at $25/MWH Threshold
Kansas City Area	56	25	18
NW Kansas	86	35	19
Texas Panhandle	844	512	323

Appendix A – FCA Constraints and Resources

Table 1 – Defining Constraints for the Texas Panhandle Frequently Constrained Area	
Line #	**Constraint Name**
1	HARRANNICAMA
2	OSGCANBUSDEA
3	SPSNORTH_STH
4	TEMP13_20178

Table 2 – Units in the Texas Panhandle Frequently Constrained Area	
Line #	**Resource Name**
1	SPSCAPROCKUNWINDFARM
2	SPSCARLSBADUN5
3	SPSCIRRUSUNCIRRUS_WIND
4	SPSCUNNSUBUN1
5	SPSCUNNSUBUN2
6	SPSCUNNSUBUN3
7	SPSCUNNSUBUN4
8	SPSDOLLARHIUNSUNE_SPS1
9	SPSHOBBSPLT1
10	SPSHOBBSPLT2
11	SPSHOPI_SUBUNSUNE_SPS5
12	SPSJONESSUBUN1
13	SPSJONESSUBUN2
14	SPSJONESSUBUN3
15	SPSJONESSUBUN4
16	SPSLEA_ROADUNSUNE_SPS3
17	SPSLOVINGTOPLT1
18	SPSLOVINGTOUNWILDCATWIND
19	SPSLP-COOP2UNLUBBOCK_WIND
20	SPSLP-HOLL2UNCOOKE_GT2
21	SPSLP-HOLL2UNCOOKE_GT3
22	SPSLP-HOLL2UNCOOKE_ST1
23	SPSLP-HOLL2UNCOOKE_ST2
24	SPSMADDOXSUUN1
25	SPSMADDOXSUUN2

Table 2 – Units in the Texas Panhandle Frequently Constrained Area	
Line #	**PNODE NAME**
26	SPSMONUMENTUNSUNE_SPS4
27	SPSMSTNGPLT1
28	SPSMSTNGUN4
29	SPSMSTNGUN5
30	SPSMSTNGUN6_GSEC
31	SPSPLXSUBUN1
32	SPSPLXSUBUN2
33	SPSPLXSUBUN3
34	SPSPLXSUBUN4
35	SPSQUAYCNTYUNQUAYCOUNTY1
36	SPSSAN_JUANUNWINDFARM
37	SPSS_JALUNSUNE_SPS2
38	SPSTOLKSUBUN1
39	SPSTOLKSUBUN2

Appendix B – Binding and Pivotal Supplier Data

Constraint	Monitored Element	Binding Hours	Pivotal Supplier Hours
OSGCANBUSDEA	Osage Switch to Canyon, 115kV	4808	4726
IATSTRSTJHAW	Iatan to Stranger Creek, 345 kV	999	348
ELKXFRTUCOKU	Elk City Xfr, 230/138	795	77
WDWFPLWDWTAT	Woodward to FPL, 138 kV	793	111
TEMP56_19273	Harrington to Randall, 230kV	675	646
EASXFREASSTJ	Eastowne Xfr, 345/161	628	617
IATSTRIATEAT	Iatan to Stranger Creek, 345 kV	516	363
PENMUN87TCRA	Pentagon to Mund, 115kV	498	405
NEORIVNEOBLC	Neosho to Riverton, 161kV	489	235
TEMP06_18995	Smokey Hills to Summit, 230kV	455	106
IATSTRIATSTJ	Iatan to Stranger Creek, 345 kV	408	251
REDWILLMINGO	Redwillow to Mingo, 345kV	369	300
VICXFRWAYSTE	Victory Hill Xfr, 230/115	304	0
GENTLMREDWIL	Gentlemen to Redwillow, 345 kV	302	283
TEMP47_20353	Montrose to Archie, 161kV	241	2
TEMP28_20001	Sundown Xfr, 230/115	216	199
SHAHAYKNOXFR	South Hays to Hays, 115 kV	214	94
TEMP49_19494	Hale County to Tuco, 113kV	210	210
GGS	Gentleman to N. Platte, 230kV	209	101
SHAXFRELKXFR	Shamrock Xfr, 115/69	201	0
SPPSPSTIES	(1) Oklaunion to Tuco, 345 kV; (2) Wheeler to Sweetwater, 230 kV; (3) Finney to Hitchland, 345 kV; (4) Shamrock to McClean, 115 kV; (5) Liberal to Texas Co., 115 kV; (6) Beaver County to Hitchland, 345 kV; (7) Border to Hitchland 345 kV	197	171
HAYVINPOSKNO	Hays to Vine St	181	37
GRAXFRSWEELK	Grapevine Xfr, 230/115	156	0
TEMP45_19952	Hobbs to Cunningham, 115kV	153	153
POTXFRHITXFR	Potter Co. Xfr, 345/230	145	105
TEMP14_20121	Gordon Evans to Maize, 138kV	145	109
TEMP38_20360	Sun City to Medicine Lodge, 115kV	142	3
REDARCREDARC	Redbud to Acadia, 345kV	135	118
TEMP67_20472	Renfrow7-Renfrow WF	133	17
TEMP22_20292	Creswell to Rome, 69kV	127	15
TEMP35_19020	Circ Xfr, AR, 230/115	125	24
HARRANNICAMA	Harrington to Randall, 230kV	119	119
TEMP17_19635	Sweetwater to Grand Island, 345kV	118	6

Constraint	Monitored Element	Binding Hours	Pivotal Supplier Hours
TEMP47_19592	Grapevine Xfr - Reversed direction,115/230	114	31
TEMP03_19960	Knoll to North Hays, 115kV	110	26
HOBXFRHOBLEA	Hobbs Xfr, 230/115	106	5
TEMP80_19668	Clearwater to Milan	104	1
SHAXFRTUCOKU	Shamrock Xfr, 115/69	102	13
TEMP72_20480	SW Lawrence to Waka, 115kV	99	0
TEMP38_19908	Cunningham Xfr	98	98
TEMP33_19963	Woodring Xfr, 345/138	98	74
TEMP28_19744	Brook LN, XFT2	95	62
SUBTEKFTCRAU	Substation 1226 to Tekamah, 161kV	87	0
TEMP15_20172	Snake Creek to Alliance, AR, 115kV	83	0
HOBCARHOBALT	Hobart to Carnigie, 138kV	81	10
CBLS56ROLMAD	Council Bluffs, 345kV	77	15
TEMP65_20468	Montrose to Archie , 161kV	69	0
TEMP94_20182	Cannaday to Elm Creek, 115kV	63	0
TEMP48_20358	Longwood to Oak PH, 138kV	63	62
TEMP72_19639	Kelly to Tecumseh, AR, 161kV	61	14
TEMP44_20033	Woodring 345 kV - Woodring 138 kV	59	21
TEMP38_19163	Muskogee to Pecan1, 345kV	58	44
IATXFRIATSTR	Iatan Xfr, 345/161	58	48
TEMP62_19792	Sub 1211 to Sub 1250, AR, 161kV	58	42
TEMP26_19708	SPERVI2 to Mulgre2, AR, 230kV	58	5
ELKXFRSWEWHE	Elk City Xfr ftlo Sweetwater to Wheeler, 230/138	57	0
CATXFRCATXFR	Catoosa Xfr 161/138	55	49
TEMP16_19634	Cooper to Fairport, 345kV	52	4
TEMP04_19602	Gracmont to Anadarko, 138kV	50	19
SHAHAYPOSKNO	South Hays to Hays, 115 kV	50	9
TEMP09_20424	Gordan Evans Xfr, 345/138	49	30
TEMP13_20278	Bushland to Deafsmith, 230 kV	48	39
ASHCRALYDVAL	Ashdown West to Craig Junction, 138kV	48	43
ONEBANNESTUL	Oneta to Broken Arrow North, 138kV	46	43
MILCLEBARSAW	Milan Tab to Clearwater, 138kV	46	0
TEMP73_20364	Wolf Creek to Bent, 345kV	45	34
SPSNORTH_STH	(1) Bushland to Deafsmith, 230 kV; (2) Potter Co to Newhart 230kV; (3) Osage Switch to Canyon 115kV; (4) Randall Co. to Paloduro 115kV; (5) Amarillo So. To Swisher 230kV	44	36
TEMP37_20355	WR Smokey Hill to Summit, 230kV	44	29
TEMP79_19669	Beverly Tag to Fort Smith, 161kV	42	0
TEMP23_19876	Tulsa North to PP Tap, 138kV	41	26

Constraint	Monitored Element	Binding Hours	Pivotal Supplier Hours
STR87TSTJHAW	Stranger Creek to 87th Street, 345kV	41	30
TEMP50_20450	Ogalala to Brule 115kV	40	0
TEMP18_20151	Yoakum Xfr, 230/115	40	38