# *Southwest Power Pool (SPP)*

## Executive Summary

The SPP Regional Transmission Organization's (RTO) year- by-year demand forecast for the 2011-2021 assessment period is for the SPP RTO footprint, which now includes three Nebraska members and Arkansas Electric Cooperative Corporation's (AECC) Entergy footprint.[1] The SPP RTO's demand forecast for the 2011-2021 assessment period is projected to be approximately 18.5 percent higher than the 2010-2019 assessment period due to the inclusion of the Nebraska entities and AECC.[2] The SPP RTO's Total Internal Demand is projected to be 58,948 MW in 2021, with Total Internal Capacity of 82,038 MW. Approximately 14,908 MW of Existing, Certain resources were added since the last reporting year. The SPP RTO expects to add 5,437 MW of Future, Planned resources during the assessment period. Although no significant variable capacity additions or unit retirements were reported for the assessment period, SPP is evaluating the impacts of proposed federal environmental regulations on both coal and gas-fired generation in the long-term studies. The SPP RTO currently has 28,164 MW of generation (mostly wind) in the Generation Interconnection queue.

The SPP RTO's minimum capacity margin requirement is 12 percent, which translates to a reserve margin of 13.6 percent.[3] The 2011-2021 assessment periods' reserve margin for the SPP RTO Region based on Existing, Certain and Net Firm Transactions is 26.9 percent in 2011, and decreases to 14.3 percent in 2021. The Anticipated Capacity Resources reserve margin is 27.2 percent in 2011 and decreases to 23.6 percent in 2021. The Adjusted Potential Resources reserve margin is 35.5 percent in 2011 and decreases to 32.8 percent in 2021. No known resource reliability concerns are identified for the 2011-2021 assessment period, as the targeted reserve margin is above the required level.

Approximately 255 miles of new transmission facilities and three bulk system transformers were added to the SPP RTO since the previous reporting year. Approximately 2,995 miles of new transmission additions are expected to be in-service by the end of the assessment period.

The amount of in-service wind energy in the SPP Region is increasing, and the operational impacts of wind generation to regulation and control performance are still unknown. As additional wind generation is built in the western part of the SPP RTO grid, the organization will continue to implement operating procedures to address any reliability issues that arise. Due to its variable nature, increased wind generation could have a significant impact on operations. A number of avenues are being explored to provide transmission outlets for this wind energy during the next ten years. SPP's Wind Integration Task Force and other organizational groups work together on transmission expansion planning that will facilitate access to all types of generation, including wind energy.[4] As the variable generation penetration rate grows, further study will be required to mitigate any issues that arise. The SPP RTO is investigating mitigation measures for integrating more wind into

[1] Arkansas Electric Cooperative Corporation's Entergy footprint is included with SPP's assessment due NERC's restructuring of reporting responsibilities.
[2] The Nebraska utilities include Omaha Public Power District, Nebraska Public Power District and Lincoln Electric System. These utilities have a combined projected 2011 peak demand of 6,101 MWs. AECC's footprint has a projected 2011 peak demand of 1,740 MWs.
[3] The SPP Criteria are in the Governing Documents folder of the SPP.org *Documents and Filings* library. A link is at the top of the Org Groups page.
[4] Access the Wind Integration Study from the Org Groups page of SPP.org, Wind Integration Task Force section

the SPP RTO footprint, such as increasing operating reserves and implementing regional variable resource forecasting. Operating procedures, such as a unit curtailment plan specific to an individual variable resource, are developed when resulting transmission constraints are identified. .

To make the most efficient and effective use of these renewable resources, SPP's operations staff must predict how much wind generation will be available to reliably serve load over given time periods. The biggest obstacle to effectively integrating wind energy into SPP's generating mix has been its unpredictability. As wind speed changes, a utility relying on that output must switch instantaneously to and from other generating resources to compensate for these changes. The ability to more accurately predict when, where, and how hard the wind will blow will have a significant and positive impact on grid operations. In 2011 SPP implemented a new wind forecasting tool to generate five-minute, hourly, and day-ahead predictions.

## Introduction

The SPP RTO Region is a summer-peaking Region that operates and oversees the electric grid in the southwestern quadrant of the Eastern Interconnection. In addition to serving as a NERC Regional Entity (RE), SPP is a FERC approved RTO. The SPP RTO footprint includes all or part of nine states: Arkansas, Kansas, Louisiana, Mississippi, Missouri, Nebraska, New Mexico, Oklahoma, and Texas[5]. The Nebraska members belong to the Midwest Reliability Organization Regional Entity, but this year's assessment is being performed on the SPP RTO footprint, which includes the Nebraska members.

On behalf of the SPP RE, this assessment provides information on the Region's forecasted resource adequacy for the next 10 years. This report is created with data and information submitted by SPP Reporting Entities, which is validated and cross-checked to verify consistency. After this process is completed, SPP RE staff aggregate the information into one data set for the entire SPP RTO region. SPP RE staff use a peer review process to validate data and develop reliability assessments.

This report covers the following areas: reliability assessment, demand, generation, capacity, transactions, transmission, operational issues and standing and emerging reliability issues. The NERC Long Term Reliability Assessment identifies areas of concern regarding reliability for the SPP RTO Region.

## Reliability Assessment Analysis

For the 2011-2021 assessment period, the forecasted reserve margin based on Existing, Certain capacity for 2011 is 26.9 percent; it decreases to 14.3 percent in 2021. SPP Criteria requires SPP RTO members to meet a 12 percent capacity margin, which translates to a 13.6 percent reserve margin. These margins are also expected to cover a 90/10 weather scenario.

The SPP RTO completed the Loss-of-Load Expectation (LOLE) and Expected Unserved Energy Study for the 2016 time period.[6] The studies evaluated the need to adjust SPP's 12 percent capacity margin or 13.6 percent reserve margin, and estimated the reserve margin required to achieve an

[5] To read more about the differences between the SPP RE and SPP RTO footprints, open the Footprints document on the SPP.org Fast Facts page.
[6] SPP.org>Engineering>Loss-of-Load Expectation (LOLE) Report

LOLE of no more than 1 day in 10 years. Based on the LOLE study performed by SPP RTO staff in 2010 for the summer of 2016, the capacity or reserve margin requirement for the SPP RTO remained unchanged. The 12 percent capacity margin and 13.6 percent reserve margin requirements are also cross-checked annually in the EIA-411 reporting, as well as through supply adequacy audits the SPP RTO conducts every five years of Regional members. The last supply adequacy audit was conducted in 2007.

The SPP RTO expects 60,500 MW of internal and external resources to meet the Region's targeted reserve margin during the assessment period

As part of the inter-Regional transmission transfer capability study, the SPP RTO participates in the Eastern Interconnection Reliability Assessment Group seasonal study group (comprised of MRO, RFC, SERC West, and SPP), which produces operating condition transfer limitation forecasts for an upcoming summer and winter assessment, as well as a long-term summer assessment for a NERC-determined future-year. Simultaneous transfers are performed as part of this study. Study results that were finalized May 9th, 2011 did not indicate any reliability issues for the SPP area.

SPP RTO members, along with neighboring Registered Entities such as Entergy from the SERC Region, have formed a Reserve Sharing Group. Members of this group receive contingency reserve assistance from other SPP Reserve Sharing Group members. SPP's Operating Reliability Working Group sets the minimum daily contingency reserve requirement for the SPP Reserve Sharing Group. The SPP Reserve Sharing Group maintains a Minimum Daily Contingency Reserve, over and above its Regulating Reserves, equal to the generating capacity of the largest unit scheduled to be on-line plus one-half of the capacity of the next largest generating unit scheduled to be on-line within the SPP Reserve Sharing Group each day.

The SPP RTO does not treat short term (1-5 year) and long term (6-10) reserve margin requirements differently. SPP has a single minimum capacity margin requirement for the entire 10-year assessment period of 12 percent or a 13.6 percent reserve margin. As mentioned above, the SPP RTO's reserve margin is above this threshold in 2011 (26.9 percent), but declines to 14.3% in 2021.

SPP defines firm deliverability as electric power intended to be continuously available to buyers even under adverse conditions; i.e., power for which the seller assumes the obligation to provide capacity (including SPP-defined capacity margin) and energy. Such power must meet the same standards of reliability and availability as that delivered to native load customers. Power purchased can be considered firm only if firm transmission service is in place to deliver the power to the load serving member. SPP does not include financial firm contracts in this category. Existing long-term firm delivery is ensured by provisions in the SPP Transmission Expansion Plan, while new long-term firm delivery is ensured by Aggregate Transmission Service Studies. These procedures are included in attachments O and Z1 in the SPP Open Access Transmission Tariff (OATT).[7]

Behind the meter generation is shown in this report as Existing, Certain capacity.

The SPP RTO reviews potential fuel supply limitations by consulting with its generation-owning and generation-controlling members via email. There are no known infrastructure issues which could impact fuel deliverability, as the SPP Region is blanketed by major pipelines and railroads that provide an adequate fuel supply. SPP RTP Criteria require coal and natural gas-fired power plants,

[7] SPP.org>Regulatory>Interactive Tariff page

which make up approximately 48 percent and 44 percent of total generation respectively, to maintain sufficient quantities of standby fuel on site in case of deliverability issues.[8] Because hydro capacity is a small fraction (approximately 1 percent) of capacity for the region, run–of–river hydro issues brought about by extreme weather are not expected to be critical.

Due to the diverse generation portfolio in the SPP RTO, there is no concern of the fuel supply being affected by summer weather extremes during peak conditions. If a fuel shortage is anticipated, SPP RTO members are to communicate to the RTO operations staff in advance so that appropriate measures can be taken. As it would in the case of insufficient capacity or reserves due to unavailable generation, the SPP RTO would declare either an Energy Emergency Alert (EEA) or Other Extreme Contingency (OEC) and post on the Reliability Coordinator Information System (RCIS).

SPP does not expect any immediate impact on the Regional reliability due to current economic conditions. The SPP RTO footprint continues to see a modest amount of load growth over the assessment period and capacity remains adequate. Transmission projects have not been negatively impacted due to economic conditions in the Region.

The SPP RTO is forecast to meet reserve margin requirements without reliance on energy-only and transmission limited resources. These resources are not used in calculating the net capacity margin.

States in the SPP RTO footprint that have a Renewable Portfolio Standard or Goal are Oklahoma, Kansas, Missouri, New Mexico, and Texas. The renewable energy targets were included in the Wind Integration Task Force Study and Priority Projects analysis.[9] Variable resources such as wind and solar are considered as Existing, Certain resources per the requirements of SPP Criteria 12.1.5.3. The Integrated Transmission Planning (ITP)[10] process evaluates high wind scenarios along with other environmental and regulatory factors such as a carbon tax. Demand response programs in the SPP RTO footprint are voluntary and because the amount is insignificant (approximately 1 percent) it is not included in the planning process.

There are no known unit retirements during the assessment timeframe which will impact reliability in the SPP RTO footprint. However, 2,500 MWs of generation could be retired if the proposed federal environmental regulations are passed within the next 10 years. These regulations could cause the retirement of both coal and gas units in the SPP RTO footprint. While no generators in the SPP RTO footprint have announced retirements as a result of these potential regulations, SPP is modeling the impacts in long-term studies. See the discussion in on "Emerging and Standing Reliability Issues" section below for additional information.

The SPP RTO has an undervoltage load shedding program in western Arkansas within the AEP-West footprint. This program targets about 186 MW of load shed during the peak summer conditions to protect the bulk power system against undervoltage events.

The SPP RTO has seven Special Protection Systems that are approved to be in place from 18 months to 5 years based on the reliability need. All Special Protection System requests are reviewed and

[8] SPP Criteria 2.4.2
[9] Oklahoma's renewable goal was established in May 2010, after the completion of the Wind Integration Task Force Study.
[10] SPP Criteria

approved by the SPP's System Protection and Control Working Group. The SPP RTO does not have any Special Protection Systems or Remedial Actions Schemes installed in place of planned bulk power transmission facilities.

In 2009, the Southwest Power Pool Board of Directors approved a new Integrated Transmission Planning (ITP) process that will determine the transmission needed to maintain electric reliability and provide near-term and long-term economic benefits to the SPP RTO Region.[11] Successful implementation of the ITP will result in a list of transmission expansion projects and completion dates that facilitate the creation of a reliable, robust, flexible, and cost-effective transmission network that improves access to the Region's diverse resources, including its vast potential for renewable energy. Significant wind energy development is taking place in parts of Oklahoma, Kansas, Nebraska, and Texas.

The ITP is an iterative three-year process that includes 20-Year, 10-Year, and Near-Term Assessments. The 20 Year Assessment evaluates high voltage transmission (above 345 kV) needs over a 20 year period to meet load growth and other future scenarios and potential developments.[12] The first iteration of the 20 Year Assessment,[13] conducted and concluded in 2010, included an examination of high voltage transmission needs while taking into account state renewable energy targets. Transmission needs were studied both with and without a potential 20 percent federal RES and a potential carbon tax. The renewable energy generation in a 20-year future without a federal RES was 10.6 GW, and the renewable energy generation in a future with a federal RES was 16.5 GW.

The 10-Year Assessment is a value-based planning approach that analyzes the transmission system over a 10-year horizon. Economic and reliability analyses are utilized to identify 100 kV and above solutions for issues identified on the 69 kV and above system, as well as issues identified by the 20-Year Assessment appropriate for the 10-Year Assessment. The first iteration of the 10-Year Assessment is ongoing throughout 2011. This study, like the 20-Year Assessment, examines transmission needs while considering state renewable energy targets and a potential 20 percent federal RES. The renewable energy generation in a 10-year future without a federal RES is 10.0 GW, and the renewable energy generation in a 10-year future with a federal RES is 14.0 GW. The study is also examining the effects of proposed EPA coal regulations on transmission needs.

The ITP Near-Term Assessment evaluates transmission system reliability in the near-term planning horizon. The Assessment will identify potential problems using NERC Reliability Standards, SPP Criteria, and local planning criteria. Mitigation plans are developed to meet Regional reliability needs and identify necessary reliability upgrades for all voltage levels for approval and construction. The first iteration of the Near-Term Assessment is being conducted in 2011.

The ITP process, through its 20-Year, 10-Year, and Near-Term Assessments, seeks to target a reasonable balance between long-term transmission investment and congestion costs to customers. While SPP RTO does not have a planning process in place at this time for catastrophic events it does assess and study all events as required by TPL-003 and TPL-004.

The objective of the 2010 Transient Stability Compliance Assessment was to report findings that support compliance with NERC TPL- 001, TPL- 002, TPL-003 and TPL-004 Reliability Standards.

---

[11] SPP.org>Engineering> Transmission Planning>Integrated Transmission Planning
[12] SPP uses a stakeholder process to determine what futures are studied during each ITP cycle.
[13] SPP.org>Engineering>Integrated Transmission Planning>2010 ITP 20 Year Assessment

The goals of the Transient Stability Assessment were:

1. Perform a stability screening using 3-phase fault for the SPP system operated above 100 kV
2. Perform a detailed stability assessment for those events identified as unstable in the screening analysis
3. Perform a detailed stability analysis for member submitted events (Category B, C and D)
4. Identify a mitigation plan for those events that indicate potential stability violations

The initial unstable NERC Category B and Category C Events were mitigated by applying either the proper clearing time or system generation re-dispatch to maintain system stability. The unstable NERC Category D Events were made stable by tripping the unit made unstable by the event offline and applying more realistic clearing times. This mitigation technique for NERC Category D was chosen due to the severity of the events that were being modeled. The clearing times used for the system scan were generic based on the KV of the line segment. If an unstable event was found, the SPP RTO contacted the member and replaced the generic clearing time with actual clearing times, which were faster. The closing times were chosen based on the average clearing time for a breaker at a certain KV level.

The SPP RTO is in the early stages of documenting and implementing a reactive planning process and expects to have this process completed by the end of 2012.

The SPP RTO does not have criteria for voltage stability margins in the reporting area, but is in the process of determining what the voltage stability margins should be for each member area in the Region.

The SPP RTO is looking into several new smart grid systems/tools but no decisions have been made on their deployment timeframe.

Based on these studies, the SPP RTO does not anticipate any near-term or long-term reliability issues that have not been addressed by mitigation plans or with local operating guides. There are no known project slow-downs, deferrals, cancellations, or other issues at this time that will impact the SPP RTO footprint's reliability.

SPP RTO conducted a Power-Voltage (P-V) analysis study for nine potential load pockets within the SPP RTO footprint based on a 2014 summer peak load condition. The study found that the Midland, TX area within the Southwest Public Service (SPS) footprint may face voltage issues during the 2014 summer peak if planned projects are not built on time. However, the Midland load pocket may be significantly reduced by a load transfer to ERCOT, invalidating the need for any projects. The SPP RTO Project Tracking process will continue to track these projects and monitor any additional load transfer developments with ERCOT. SPP RTO staff will coordinate any potential reactive reserve issues and associated mitigation plans during their annual reliability assessment effort.

## Demand

According to the most recent forecasted data, the projected compound annual rate of growth for peak demand in the SPP RTO Region over the next ten years is 1.0 percent. In the 2010 LTRA report, the projected annual growth rate for the SPP RTO Region over the ten year period was 1.3 percent. The

SPP RTO has 21 reporting members who annually provide a ten–year forecast of peak demand and net energy requirements. These forecasts are used to develop an overall non-coincident SPP RTO forecast. The forecasts are developed in accordance with the following principles:

- Each member selects its own demand forecasting methodology and establishes its own forecast.
- Each member forecasts demand based on expected weather conditions.
- Each member submits to the SPP RTO the methods used, factors considered, and assumptions made, along with the annual forecast.
- When producing the forecast, the SPP RTO considers economic, technological, sociological, demographic, and any other significant factors

The SPP RTO's peak demand is the non-coincident peak for the entire Region. The Resource evaluations made by the SPP RTO and the members are based on summer peaking conditions.

Energy efficiency programs in the SPP RTO area are approximately 153 MW in 2011 increasing to around 300 MW in 2021. The capacity and reserve margin projections include the effects of demand-side response programs, such as direct-control load management and interruptible demand. The SPP RTO does not have an organized demand response program at this time, but it is expected that over the next ten years, interruptible demand will increase from 1,300 MW to 1,421 MW. These demand response values are based on predictions using historical data and trends; they do not reflect increased demand response as directed by FERC in the evolution of SPP's market design.

In March 2010, SPP RTO member Oklahoma Gas and Electric (OG&E) installed approximately 42,000 smart meters on customer homes in Norman, Oklahoma, along with the information delivery infrastructure to carry the information between OG&E and its customers. An estimated 3,000 Norman customers are expected to continue participating in the study during the summer of 2011 using the in-home devices and/or Internet portals as a means to get electricity pricing and usage information. Program results will not be available until after the two-year study period concludes.

Although actual demand is very dependent on weather conditions and typically includes interruptible loads, forecasted Net Internal Demands are based on 10-year average summer weather, or 50/50 weather. Some SPP RTO members determine peak forecast based on a 50 percent confidence level, as approved by their respective state commission(s). This means the actual weather on the peak summer day is expected to have a 50 percent likelihood of being hotter or a 50 percent likelihood of being cooler than the weather assumed in deriving the load forecast. The SPP RTO does not develop load forecasts based on a 90/10 weather scenario, but has a 13.6 percent reserve margin requirement to address this uncertainty.

To quantify peak demand uncertainty and variability due to extreme weather, economic conditions, and other variables, the SPP RTO formed a Bandwidth Working Group. This group produced the Demand and Energy Bandwidth Report,[14] which supports the current predicted growth rates and allows for up to a 1.2 percent variation from the base demand forecast in current and future predictions through the year 2012. The report also determined the 13.6 percent reserve margin is adequate to cover any extreme load for the SPP RTO footprint. The SPP RTO anticipates this trend will continue for the remaining assessment period. SPP is currently seeking a load forecasting tool that will have the capability to forecast both demand and energy.

[14] SPP.org>Demand and Energy Bandwidth Forecast 2003-2012

## Generation

For the 2011-2021 assessment period, the SPP RTO projects to have 65,090 MW Existing, Certain Capacity; 4,417 MW Existing, Other Capacity; 364 MW Existing, Inoperable; 5,437 MW Future Capacity; and 9,786 MW Conceptual resources in service or forecasted to be in service during the assessment period. The Existing, Certain Capacity amount from renewable plants is 259 MW (wind), 2,649 MW (hydro), and 11 MW (biomass). Existing, Other Capacity from renewable plants (mostly wind) is 3,135 MW.

Planned Capacity for 2021 from renewable plants is 246 MW. These reported renewable resource additions in the SPP RTO do not reflect merchant wind farm development in process, incremental needs which may result from RES mandates/goals within the SPP RTO Region, or public announcements for additional renewable expansion by SPP RTO members. The SPP RTO has requests to connect approximately 28,164 MW of generation (mostly wind) to the SPP RTO grid via the Generation Interconnection queue.

Conceptual capacity resources forecasted for 2011-2021 are projected to be 28,164 MW. Variable generation of 20,049 MW nameplate capacity composes the majority of the Conceptual resources. SPP Criteria Section 12.0 discusses capacity values and how they are calculated for the Region based on a wind farm's historical performance. The SPP RTO applies a 10 percent confidence level to all conceptual capacity unless otherwise reported by SPP RTO members.

For the reporting of Future and Conceptual capacity resources, the SPP RTO uses the Generation Interconnection and Transmission Service Request study processes as defined in the SPP OATT. According to the OATT, when the interconnection request is submitted, the interconnection customer must request either energy resource interconnection service or Network Resource interconnection service. Any interconnection customer requesting Network Resource interconnection service may also request that it be concurrently studied for energy resource interconnection service, up to the point when an interconnection facility study agreement is executed. Interconnection customers may then elect to proceed with Network Resource interconnection service or to proceed under a lower level of interconnection service to the extent that only certain upgrades will be completed. SPP RTO includes active requests that are currently in the generation queue to be studied, in addition to the member-reported Future, Planned, and Conceptual resources.

There has been no significant increase in the distributed or behind the meter generation for the assessment period.

## Capacity Transactions on Peak

A small portion of SPP RTO capacity or reserve margin depends on purchases external to the SPP RTO Region as shown in Table SPP-1. SPP RTO firm sales are depicted below in Table SPP-1. The sales and firm contracts are backed by firm generation and transmission, and are based on partial path reservations.

| Table SPP-1: SPP Imports/Exports | | |
|---|---|---|
| Transaction type | 2011 Summer (MW) | 2021Summer (MW) |
| Firm Imports | 5,021 | 4,452 |
| Firm Exports | 4,044 | 3,559 |
| Non-Firm Imports | 0 | 0 |
| Non-Firm Exports | 0 | 0 |
| Expected Imports | 134.6 | 60 |
| Expected | 0 | 0 |

## Transmission

Table SPP-2 lists bulk power system transmission projects the SPP RTO has defined as Under Construction, Planned, or Conceptual that are projected to be in service during the assessment timeframe.

| Table SPP-2: SPP Expected Transmission | | | |
|---|---|---|---|
| Transmission project name | Transmission type | In-service Date(s) | Operating Voltage (kV) |
| Sub A to Sub M | Under Construction | Jun-12 | 161 |
| Sherman-Dallam Project | Planned | Jun-12 | 115 |
| ALP | Under Construction | Aug-11 | 230 |
| SW Lincoln Plan | Planned | Sep-11 | 115 |
| WFEC Snyder to AEP Snyder 138kV | Planned | Sep-11 | 138 |
| Turk – Okay | Planned | Nov-11 | 138 |
| Piper to Wolcott Transmission Line | Planned | Dec-11 | 161 |
| East-Fairfax to Fairfax Transmission Line | Planned | Dec-11 | 161 |
| East-Fairfax to GM Transmission Line | Planned | Dec-11 | 161 |
| Quindaro to Nearman Transmission Line | Planned | Dec-11 | 161 |
| Siloam Springs Tap-Siloam Springs | Planned | Dec-11 | 161 |
| Hitchland - Ochiltree Project | Planned | Dec-11 | 230 |
| Channing Project | Planned | Dec-11 | 230 |
| Johnson Draw | Planned | Dec-11 | 115 |
| Carlsbad Ocotillo | Planned | Dec-11 | 115 |
| Anadarko SW 138 kV | Planned | Dec-11 | 138 |
| Anadarko SW to Washita | Planned | Dec-11 | 138 |
| Hugo to Valliant | Planned | Apr-12 | 345 |
| Mcnab to Turk | Planned | Apr-12 | 138 |

| | | | |
|---|---|---|---|
| Sunnyside to Hugo | Planned | Apr-12 | 345* |
| Turk to Sugar Hill | Planned | May-12 | 138 |
| Acadiana Load Pocket Upgrade | Planned | Jun-12 | 230 |
| Twin Church to South Sioux City | Planned | Jun-12 | 115 |
| Heizer - Mullegren | Planned | Jun-12 | 115 |
| Spearville to Post Rock | Planned | Jun-12 | 345 |
| Massard - Oak Park | Planned | Jun-12 | 138 |
| Turk to NW Tex. | Planned | Jul-12 | 345* |
| Turk to SE Tex. | Planned | Jul-12 | 138 |
| Broken Bow to Broken Bow Wind | Planned | Sep-12 | 115 |
| Clay Center to Riley Pump | Planned | Oct-12 | 115 |
| O'Neill to Stuart South | Planned | Nov-12 | 115 |
| Petersburg to Ericson | Planned | Nov-12 | 115 |
| Clarks to Central City North | Planned | Nov-12 | 115 |
| GI L1369 | Planned | Dec-12 | 115 |
| Sooner to Cleveland | Planned | Dec-12 | 345* |
| East Clovis Conversion | Planned | Dec-12 | 115 |
| Roswell-Capitan | Planned | Dec-12 | 115 |
| ALP | Planned | Jan-13 | 230 |
| Cherry St. Intg. | Planned | Apr-13 | 230 |
| Randall County Intg. | Planned | Apr-13 | 230 |
| Cherry St. Intg. | Planned | Apr-13 | 115 |
| Osbourne to Osbourne Tap | Planned | Jun-13 | 161 |
| Axtell to Post Rock | Planned | Jun-13 | 345* |
| Sooner to Rose Hill | Planned | Jun-13 | 345* |
| Pleasant Hill | Planned | Jun-13 | 115 |
| Central Reliab. Proj. | Planned | Nov-13 | 115 |
| Muncie to Center City Transmission Line | Planned | Dec-13 | 161 |
| Muncie to Armourdale Transmission Line | Planned | Dec-13 | 161 |
| Seminole to Muskogee | Planned | Dec-13 | 345* |
| Cherry St. Intg. | Planned | Dec-13 | 115 |
| Newhart Intg. | Planned | Dec-13 | 115 |
| Plainview City | Planned | Feb-14 | 115 |
| SW 7th & Bennet to 40th & Rokeby | Planned | May-14 | 115 |
| Woodward EHV to Border | Planned | May-14 | 345* |
| Flint Creek to Shipe Road | Planned | Jun-14 | 345* |
| Shipe Road to E. Centerton | Planned | Jun-14 | 161 |
| Woodward EHV to Hitchland | Planned | Jun-14 | 345* |
| Border to Hitchland | Conceptual | Jun-14 | 345* |
| Hitchland-Woodward | Planned | Jun-14 | 345* |
| TUCO-Woodward | Planned | Jun-14 | 345* |
| Newhart Intg. | Planned | Jun-14 | 115 |
| Pleasant Hill | Planned | Sep-14 | 230 |

| | | | |
|---|---|---|---|
| Valiant 345kV to NW Tex | Planned | Oct-14 | 345* |
| TransCanda Pump - Knipe | Planned | Oct-14 | 138 |
| Stillwater - Knipe | Planned | Oct-14 | 138 |
| Wolcott to Nearman Transmission Line | Planned | Dec-14 | 161 |
| Woodward EHV to Medicine Lodge | Planned | Dec-14 | 345* |
| Newhart Intg. | Planned | Dec-14 | 230 |
| Pleasant Hill | Planned | Dec-14 | 230 |
| Spearville to Clark County to Thistle | Planned | Dec-14 | 345 |
| Plainview City | Planned | Dec-14 | 115 |
| Greenwood-Lonejack | Planned | Jun-15 | 161 |
| Iatan-Nashua | Planned | Jun-15 | 345* |
| Cedarniles-Clare | Planned | Jun-15 | 161 |
| Kinsley | Conceptual | Jun-15 | 115 |
| Newhart Intg. | Planned | Jun-15 | 115 |
| Shipe Road to E. Rogers | Planned | Jun-16 | 345* |
| E. Rogers to Osage | Planned | Jun-16 | 345* |
| Fisher to Barber Substation | Conceptual | Dec-16 | 161 |
| Kaw-West to Speaker Transmission Line | Conceptual | Dec-16 | 161 |
| Speaker to Kaw Transmission Line | Conceptual | Dec-16 | 161 |
| Kaw to Barber Transmission Line | Conceptual | Dec-16 | 161 |
| Sibley-Maryville | Planned | Jun-17 | 345* |
| Maryville-Nebraska | Planned | Jun-17 | 345* |
| Speaker to Everett Transmission Line | Conceptual | Dec-17 | 161 |
| Everett to Quindaro Transmission Line | Conceptual | Dec-17 | 161 |

***Identifies critical projects needed to enhance reliability**

The SPP RTO identified several projects in the list above as critical projects needed to maintain/enhance reliability within the Region. These critical projects were determined by a Region wide study looking at N-1 contingencies based on TPL-002. These high voltage lines solved overload and voltage issues within the SPP RTO Region. If for some reason the in-service dates are not met mitigation plans are identified for each project. Mitigation plans could include area specific operational measures or a temporary reconfiguration of the transmission system in the area, among other measures.

**Table SPP-3: SPP Transformer Additions**

| Transformer project name | High-side voltage (kV) | Low-side voltage (kV) | In-service date(s) | Description/Status |
|---|---|---|---|---|
| Eagle Creek | 115 | 69 | Mar-2012 | Project in final design |
| Segura Auto | 230 | 138 | Aug-2011 | Autotransformer at Segura substation |
| Rork Auto | 500 | 230 | Aug-2011 | Autotransformer at Richard substation |

| | | | | |
|---|---|---|---|---|
| Cocodrie Auto #2 | 230 | 138 | Aug-2011 | Second Autotransformer at Cocodrie Substation |
| Johnston County | 345 | 138 | Oct-2011 | Install New |
| Tonnece Substation | 345 | 161 | Dec-2011 | Planned Installation - Transformer enroute from factory |
| Hitchland Project | 230 | 115 | Dec-2011 | Project in final design |
| Gracemont | 345 | 138 | May-2012 | Install New |
| Acadiana Load Pocket Upgrade | 230 | 138 | Jun-2012 | 180 MVA base rating, Auto transformer |
| Arcadia | 345 | 138 | Jun-2012 | Install New |
| TUCO | 345 | 230 | Jun-2012 | 2nd autotransformer |
| Post Rock | 345 | 230 | Jun-2012 | Install New |
| Hitchland-Woodward Project | 345 | 230 | Jun-2012 | 2nd autotransformer |
| N Manhattan | 230 | 115 | Jun-2012 | Install New |
| Turk | 345 | 138 | Jul-2012 | Install New |
| Wells Auto #2 | 500 | 230 | Aug-2012 | Second Autotransformer at Wells Substation |
| Ochiltree | 230 | 115 | Dec-2012 | Install New |
| 87th Street | 345 | 115 | Dec-2012 | Install New |
| Randall County | 230 | 115 | Apr-2013 | 2nd autotransformer |
| Canadian River | 345 | 138 | Jun-2013 | Install New |
| Cherry St. Intg. | 230 | 115 | Jun-2013 | Install New |
| Medicine Lodge 138/115kV Transformer | 138 | 115 | Jun-2013 | Required by SPP for reliability |
| Rose Hill | 345 | 138 | Jun-2013 | Install New |
| Newhart | 230 | 115 | Dec-2013 | Install New |
| Plainview City | 115 | 69 | Feb-2014 | Install New |
| Hitchland Project | 345 | 230 | Dec-2014 | Project in final design |
| Shipe Road | 345 | 161 | Jun-2014 | Install New |
| Ogallala T-1 Relacement | 230 | 115 | Jun-2014 | Replaces existing 187 MVA T-1 with 336 MVA |
| Greenwood | 138 | 69 | Jun-2014 | Install New |

| | | | | |
|---|---|---|---|---|
| Woodward District EHV | 345 | 138 | Jun-2014 | Install New |
| Pleasant Hill | 230 | 115 | Jun-2014 | Install New |
| Auburn | 230 | 115 | Jun-2014 | Install New |
| Summit | 345 | 115 | Jun-2014 | Install New |
| Baldwin Creek | 230 | 115 | Jun-2014 | Install New |
| NASHUA | 345 | 161 | Jun-2015 | Install New |
| Stegall T-2 Addition | 345 | 230 | Jun-2015 | Addition of second 400 MVA transformer at Stegall |
| Osage Creek | 345 | 161 | Jun-2016 | Install New |
| Ft. Smith | 500 | 161 | Jun-2017 | Install New |
| NW 68th & Holdrege | 345 | 115 | Jun-2020 | Provide Additional Inlet Capacity For Reliability Purposes |

There are no known concerns about meeting target in-service dates for reliability projects that have been approved by the SPP RTO Board. Assuming these projects come on line as scheduled, there are no known transmission constraints that could impact the reliability of the SPP RTO transmission grid. The SPP RTO relies heavily on its Project Tracking process to track projects and ensure they meet their issued timelines. [15] If a project's timeline is extended, the SPP RTO will conduct a study to address any reliability issues associated the extension. There is no significant substation equipment identified at this time.

### Operational Issues

The SPP RTO operations group does not expect any systemic outages that will impact Regional reliability.

The SPP RTO participates in the SPP Reserve Sharing Group which provides assistance during Energy Emergencies. Demand response and curtailable contract sales may also be implemented during appropriate emergency levels.

In the long-term, there are no expected restrictions that will impact reliability. The generation fleet within the SPP RTO remains diverse in terms of location, fuel type, and capability. Depending on the long-term penetration of wind generation in the footprint, the SPP RTO could experience some operational issues. The impact of wind generation in the SPP RTO footprint is discussed in the "Emerging and Standing Reliability Issues" section.

Integrating variable resources provides some challenges for SPP in managing grid congestion in an equitable manner. SPP continues to pursue incentives and requirements for variable resources to be

[15] The Engineering section of SPP.org has a page on Project Tracking

controllable and responsive in a manner similar to other non-variable resources. This is in the system's best interest in terms of reliability and equity.

Distributed generation consisting of non-controllable variable energy resources could lead to increased challenges in load forecasting because most of the distributed generation resources are located behind the meter. In the long-term, the volume of distributed generation is not forecast to have an impact in the SPP RTO. According to SPP RTO operational staff, there are no known operational changes/concerns resulting from distributed resource integration, and SPP does not anticipate any reliability concerns as a result of demand response resources.

The SPP RTO reviews, on a quarterly basis, several years of SPP RTO Protection System mis-operations data looking for trends that could be used to help reduce the number of mis-operations in the future. The current mis-operations data is not sufficient to begin trend analysis.

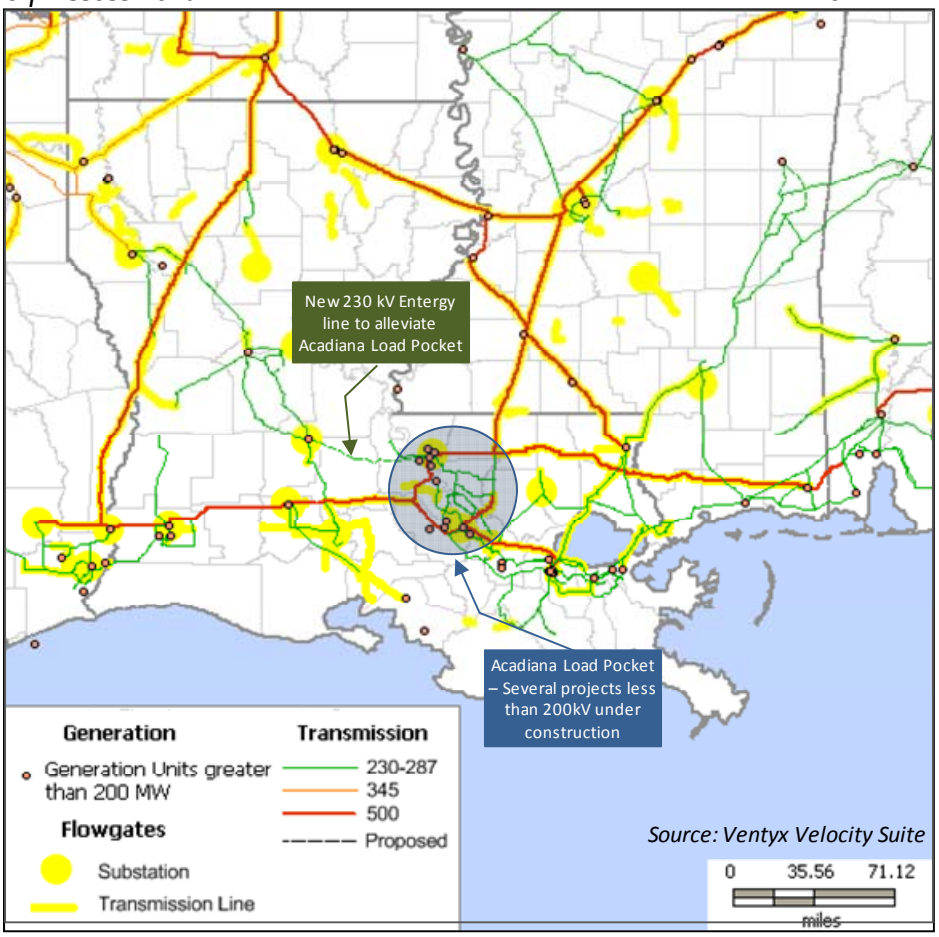
### Emerging and Standing Reliability Issues

#### Risk Assessment

| Identified Reliability Issues | Likelihood | | | | | | Consequence | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-5 Years | | | 6-10 Years | | | 1-5 Years | | | 6-10 Years | | |
| | H | M | L | H | M | L | H | M | L | H | M | L |
| 1.Acadiana Load Pocket | | X | | | | X | | | X | | | X |
| 2.Variable Energy Integration | | X | | | X | | | X | | | X | |
| 3. HVDC Line Proposals | | | X | | | X | | | X | | | X |
| 4. Potential U.S. Environmental Regulations | | | X | | X | | | X | | | X | |

## Acadiana Load Pocket

The Acadiana Load Pocket (ALP) located in southern Louisiana, with a 2010 summer peak demand of 1,723 MWs, spans both the SPP RE and SERC reliability areas and continues to be constrained as transmission improvements are being constructed. The SPP RTO has been aware of congestion issues in this area since 2006 due to the lack of efficient generation and transmission capacity that limit the amount of import capability. The City of Lafayette, CLECO, and Entergy are in the process of constructing reliability additions and upgrades in the Region. The first phase of the project, which includes a 230 kV line from Roark to Sellers Rd., was energized on May 3, 2011. This line has already alleviated some of the most limiting elements in the ALP by as much as 10 percent. Completion of the entire project in 2012 should further alleviate some of the transmission congestion in this area.




The SPP Reliability Coordinator (RC) continues to aggressively address the system characteristics listed above by coordinating with all of the impacted entities. The SPP RC and ALP entities' operational Planning Engineering staffs developed operating guides and ALP entities are sharing generation cost of legacy generation required to dispatch during system events. This coordinated effort on the part of all ALP parties has limited the load at risk. There has been an increase in the ALP load over the last few years due to catastrophic weather events on the Louisiana gulf coast that redistributed the population from larger load centers near the coast to Acadiana. ALP Transmission System events in the ALP do not pose a significant threat to the Eastern Interconnection as these events are restricted to the boundaries of the ALP.

Once the transmission projects are complete, older ALP generation may retire and the area will change from being generation dependent to transmission dependent

## Variable Energy Integration

The SPP RTO has been aware of potential variable energy integration issues since the 2003-2004 timeframe. The SPP RTO recently worked with AMEC Earth and Environmental and Southwestern Public Service (SPS)/Xcel Energy staff to investigate the operational impacts of increased wind penetration to secure reliable operations within the SPS area. SPS serves a 52,000 square mile area in southeastern New Mexico, the Texas Panhandle, portions of Oklahoma, and a small part of Kansas. Due to significant existing, approved, and requested wind farm development, constraints must be resolved

in the near-term before major transmission capability is installed to improve internal and interface capabilities.

The recently completed AMEC study for spring 2010 conditions focused on operations and reliability, and did not investigate the economics associated with planned and potential wind development within and surrounding the SPS Balancing Authority. The study leveraged the National Renewable Energy Lab's wind data for 2004-2006 to simulate future scenarios for 2010. Without considering proactive wind curtailments as an option, the study concluded that operating margins[16] during low load periods within SPS would be jeopardized as wind farm development approached 1,100 to 1,200 MW– only slightly above existing wind capacity levels, without curtailments. SPS is working with the SPP RTO to finalize operating procedures for curtailment of generation resources based on transmission priority and communicate them to generation developers as a near-term solution. SPS has a posted curtailment policy for curtailment of resources if necessary.[17]

In anticipation of a surge in renewable resources on the western part of its grid, the SPP RTO completed the Wind Integration Task Force (WITF) Study in January 2010.[18] This study reinforced the criticality of coordinating transmission expansion plans with wind generation construction plans. The study recommended significant bulk EHV transmission additions (230 kV, 345 kV and/or 765 kV) for a high wind scenario. If the needed transmission upgrades were completed, there would be no significant technical barriers or reliability impacts to integrating wind energy levels up to 20 percent of total capacity in the SPP RTO.

For the near-term, the study identified the need to develop a process for determining what generating units are utilized throughout the region, explicitly addressing the uncertainty associated with wind forecast errors. Recommendations resulting from the WITF study were assigned to the Markets and Operations Policy Committee, and implementation of the recommendations has been integrated into the stakeholder process. The implementation of a centralized wind energy forecasting system was also recommended. The SPP RTO evaluated two wind forecasting systems and selected one that became operational in January 2011. The new forecasting tool relies on historic and real-time wind speed and direction, air temperature, barometric pressure, and other factors such as turbines' manufacturer, location, availability, and metered output to generate five-minute, hourly, and day-ahead predictions. SPP operators previously predicted wind power availability by reviewing current power output and assuming the same circumstances would be true ten minutes into the future.

Additional data collection and situational awareness has been implemented to begin assessing regulation and spinning reserve needs. The Wind Integration Task Force Study also indicated that the SPP RTO would need significant transmission additions to accommodate wind capacity of 10 percent or more of total capacity in the SPP RTO. For the assessment period, approximately four percent of installed wind capacity is counted towards the reserve margin even though a large percentage of wind generation is available in the SPP wholesale energy market for energy-only purchase.

Reliability concerns associated with the continued influx of wind generation will consist of regulating the large percentage of variable energy resources and curtailments of the variable resources during times of transmission congestion. Consolidating the Balancing Authorities in the SPP RTO's Integrated Marketplace will help facilitate wind integration in the region, but additional

[16] An operating margins is the amount of backup generation available to handle load as wind generation reduces.
[17] SPS Schedule Curtailment Policy Version 1
[18] Access the Wind Integration Study from the Org Groups page of SPP.org, Wind Integration Task Force section.

changes to the SPP OATT, interconnection agreements, operating procedures, and market design may be required to maintain adequate operating margins within portions of SPP as wind development continues. [19]

## New HVDC Lines Proposals

SPP became aware in mid-2010 of two HVDC lines that may be constructed in the Southwest part of the SPP system by Clean Line Energy. The first project, the Plain & Eastern line, is a 7,000 MW capacity, 800-mile long facility that is planned to begin in western Oklahoma and end in western Tennessee.[20] The second Clean Line Energy project, the Grain Belt Express Line,[21] will deliver 3,500 MWs of renewable energy from western Kansas to communities in southeastern Missouri. The clean energy will be transported via an approximately 550 mile overhead, HVDC transmission line.

SPP became aware of another DC project in early 2011. Tres Amigas proposes constructing a "super grid" to link America's three primary electric transmission grids – the Eastern Interconnection (SPP), the Western Interconnection (WECC) and Texas (ERCOT).[22]

The Clean Line Energy projects and Tres Amigas project are in the planning stages with projected in-service dates of 2014/2015. However, these projects are not firm, nor are the in-service dates. SPP has just begun the technical evaluation of these projects. Should the proposed facilities be constructed and placed in service, SPP may be faced with a large number of transmission requests. SPP may not be able to approve all of the requests until additional transmission facilities are built. However, SPP's current processes should prevent any reliability impacts to the Bulk Electric System.

## Potential U.S. Environmental Regulations

In October 2010 NERC released a study on four potential U.S. regulations that could impact the reliability of the Bulk Electric System across the United States and Canada.[23] The four regulations include:

1. The Clean Water Act – Section 316(b) Cooling Water Intake Structures [24]
2. Title 1 of the Clean Air Act – National Emission Standards for Hazardous Air Pollutants (NESHAP) or Maximum Achievable Control Technology Standards (MACT)
3. Clean Air Transportation Rule (CATR)
4. Coal Combustion Residuals (CCR)

---

[19] Consolidating Balancing Authorities was recommended in the NERC Report *Accommodating High-Levels of Variable Generation, 2009*. A follow-up report was also published titled *Ancillary Service and Balancing Authority Area Solutions to Integrate Variable Generation, 2011*

[20] plainsandeasterncleanline.com

[21] grainbeltexpresscleanline.com

[22] tresamigasllc.com

[23] North American Electric Reliability Corporation, 2010 Special Reliability Scenario Assessment: Resource Adequacy Impacts of Potential U.S. Environmental Regulations, October 2010.

[24] The EPA published the proposed Clean Water Act – 316(b), Cooling Water Intake Structures regulations for public comment in March 2011.

NERC estimates that full compliance with the air and solid waste regulations will be in the 2015-2016 timeframe.[25] While NERC did not identify the SPP Region as having significant impacts to planning reserve margins in this timeframe, SPP has begun to include the possible impacts of these regulations in the 10-year planning studies. The EPA regulations will likely cause unit retirements throughout the SPP footprint . SPP estimates that 2,500 MWs of generating capacity will be needed to satisfy a 12 percent planning reserve margin in 2022 given these retirements.

## Other Region-specific issues that were not mentioned above

SPP knows of no other Region-specific issues that could impact reliability besides those mentioned earlier in this report. The SPP RTO continues to perform real-time, current day, next day, and seasonal Reliability assessments for the SPP RTO footprint. The results of these studies are shared with SPP RTO members and coordination occurs using these studies to prepare to operate the system reliably.

## Region Description

*The Southwest Power Pool, Inc. Regional Transmission Organization (SPP RTO) Region covers a geographic area of 370,000 square miles and has members in nine states: Arkansas, Kansas, Louisiana, Missouri, Mississippi, Nebraska, New Mexico, Oklahoma, and Texas. SPP's Reliability Coordinator footprint includes 29 balancing authorities and the RTO has over 48,000 miles of transmission lines. SPP typically experiences peak demand in the summer months.*

*SPP has 64 members that serve over 15 million people. SPP's membership consists of 14 investor-owned utilities, 11 municipal systems, 12 generation and transmission cooperatives, 4 state agencies, 7 independent power producers, 10 power marketers, and 6 independent transmission companies. SPP was a founding member of the North American Electric Reliability Corporation in 1968, and was designated by the Federal Energy Regulatory Commission as an RTO in 2004 and a Regional Entity (RE) in 2007. As an RTO, SPP ensures reliable supplies of power, adequate transmission infrastructure, and competitive wholesale prices of electricity. The SPP RE oversees compliance enforcement and reliability standards development. Additional information can be found on* SPP.org.

[25] "2010 Special Reliability Scenario Assessment: Resource Adequacy Impacts of Potential U.S. Environmental Regulations" Page 4 NERC EPA Scenario