SPP Southwest Power Pool

AGGREGATE STUDY MANUAL

By Transmission Services Department

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Version 1.0

REVISION HISTORY

DATE	AUTHOR	VERSION	COMMENTS
3/2020	SPP	1.0	Aggregate Study Manual

CONTENTS

OVERVIEW

The Aggregate Transmission Service Study (ATSS) provides results pursuant to Attachment Z1 of the SPP Open Access Transmission Tariff (OATT) for long-term transmission service requests. The principal objective of the ATSS is to identify system problems and potential modifications necessary to facilitate these transfers while maintaining or improving system reliability, as well as summarizing the operating limits and determination of the financial characteristics associated with facility upgrades. Facility upgrade costs are allocated on a prorated basis to all requests positively impacting any individual overloaded facility.

All requests for long-term transmission service with a completed application received before the closing of the open season will be included in this ATSS. See below for annual open season windows:

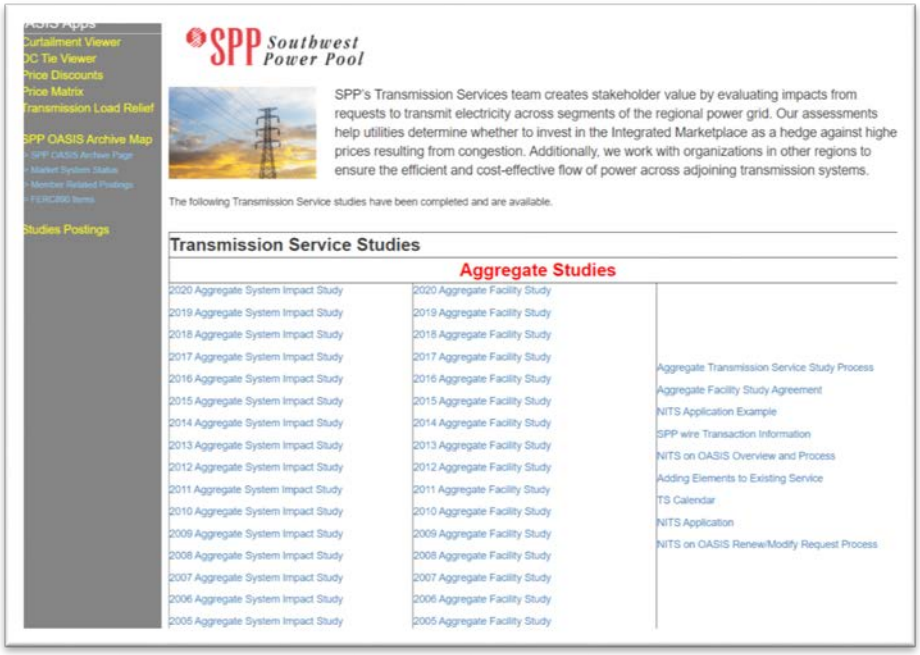
STUDY ID	OPEN SEASON
{Year}-AG1	December 1 – May 31
{Year}-AG2	June 1 – November 30

Transmission Customers (customers) requesting service in this study specified five parameters under which they agreed to confirm service:

1. Directly assigned upgrade cost ((engineering and construction (E&C and credit payment obligation))
2. Third-party upgrade cost
3. Latest deferred start date
4. Interim re-dispatch acceptance
5. Letter of credit amount

These parameters are studied for each request and are posted in at least two separate Aggregate Facility Studies (AFS) iterations.

This manual describes the ATSS process, which results in studies posted to SPP.org and distributed to customers included in the study. For specific study results, visit http://opsportal.spp.org/Studies/Trans (or use this path: SPP.org > Engineering > Tariff Studies >Transmission Service Studies).



ATSS posting notifications are sent to the SPP aggregate studies "exploder" email list. Instructions for joining the email list are located at: https://www.spp.org/stakeholder-center/exploder-lists/

If you have questions regarding the ATSS process or a specific ATSS report, please contact the Transmission Services team via TS@spp.org or submit an SPP Request Management System (RMS) ticket (https://spprms.issuetrak.com/login.asp). Information about setting up an RMS account is available on SPP.org. (http://www.spp.org/stakeholder-center/customer-relations/request-management-system/).

AFS-1

AFS-1 is posted midway through the 165-day study window. SPP will tender an AFS – Appendix 1 – Update form to customers with a request(s) that have one or more study parameters that were not met. This will open a five-business-day window for customer responses. To remain in the ATSS, SPP must receive from the customer the AFS – Appendix 1 – Update form with the adjusted parameters that were not met.

The AFS Appendix 1 – Update will indicate the parameters that were not met and need to be adjusted by the customer. If the customer does not increase the exceeded parameters or does not respond within five business days, the request will be removed from study and the request(s) will be refused in Open Access Same Time Information Systems (OASIS). The customer is not required to take action in OASIS.

Following the end of the response period, SPP will conclude the study using the revised parameters. Any requests that do not meet the specified parameters will be removed from the study. The customer may re-submit the request during the next open season.

FINAL AFS ITERATION

SPP will post a final study report within 165 days of the close of the open season. The report will detail the results for all requests including those that are removed from study. This final study report provides details and indicates for each request whether any of the five parameters were exceeded. The specific parameters defined by the customer are confidential and will not be included in this report. At the conclusion of the ATSS, SPP will accept the requests in which the specified study parameters were met. SPP will tender a service agreement for each request for service identifying the terms and conditions of the confirmed service.

All allocated revenue requirements for facility upgrades are assigned to the customer in the AFS data tables. Potential base plan funding allowable is contingent upon validation of designated resources meeting Attachment J, Section III B criteria.

For upgrades requiring issuance of a Notification to Construct, within 30 days of the confirmation of the customer's OASIS request the customer must provide financial security in an amount equal to the full amount of the upgrade cost allocated to the customer for recovery. The amount of the security may increase or decrease each year thereafter based on the total amount of financial obligation, plus an estimate of the increase or decrease in financial obligations that will be incurred in the next 12 months.

SPP ATSS RESULTS

The results of the AFS are detailed in Tables 1 through 7 in the study results spreadsheet. Detailed results depict individual upgrade costs by study and potential base plan allowances determined by Attachments J and Z1 of the SPP OATT.

To understand the extent to which base plan upgrades may be applied to both point-to-point (PTP) and network integration transmission services (NITS), it is necessary to highlight the definition of a designated resource. Per Section 1 of the SPP OATT, a designated resource is:

> "Any designated generation resource owned, purchased or leased by a Transmission Customer to serve load in the SPP Region. Designated Resources do not include any resource, or any portion thereof, that is committed for sale to third parties or otherwise cannot be called upon to meet the Transmission Customer's load on a non-interruptible basis."

Both NITS and PTP service have potential for base plan funding if the conditions for classifying upgrades associated with designated resources as base plan upgrades as defined in Section III.B of Attachment J are met.

Pursuant to Attachment J, Section III.B of the SPP OATT, the customer must provide SPP information necessary to verify that the new or changed designated resource meets the following conditions:

1. Customer's commitment to the requested new or changed designated resource must have duration of at least five years.
2. During the first year the customer plans to use the designated resource, the accredited capacity of the customer's existing designated resources plus the lesser of:
    a. The planned maximum net dependable capacity applicable to the customer, or
    b. The requested capacity; shall not exceed 125% of the customer's projected system peak responsibility determined pursuant to SPP Criteria 2.

According to Attachment Z1 Section V.A, PTP customers pay the higher of the monthly transmission access charge (base rate) or the monthly revenue requirement associated with the directly assigned portion of the service upgrade, if any.

NITS customers pay the total monthly transmission access charges and the monthly revenue requirement associated with the directly assigned portion of the service upgrade, if any.

Customers paying for a directly assigned network upgrade shall receive credits for new transmission service using the facility as specified in Attachment Z2.

Facilities identified as limiting the requested transmission service are reviewed to determine the required in-service date of each network upgrade. Both previously assigned facilities and the facilities assigned to this request for transmission service are evaluated.

In some instances, due to lead times for engineering and construction, network upgrades may not be available when required to accommodate a request for transmission service. When this occurs, the ATC with available network upgrades will be less than the capacity requested during either a portion of or all of the requested reservation period. The ATC may be limited by expansion plan projects or customer-assigned upgrades.

Some constraints identified in the AFS are not assigned to the customer. SPP may determine that upgrades are not required or the transmission owner may have construction plans pending for these upgrades. These facilities are listed by reservation in Table 3. Table 7 lists the costs allocated per request for each service upgrade assigned in this AFS.

By taking the transmission service subject to interim redispatch, the customer agrees to any limitations to auction revenue rights that may result. In the absence of implementing interim redispatch as requested by SPP for Customer transactions resulting in overloads on limiting facilities, SPP may curtail the Customer's schedule.

SPP ATSS RESULTS WORKBOOK TABS

The ATSS study results workbooks contain worksheets providing the necessary data to analyze transmission service requests presented within the specific parameters as defined by the customer.

Tables 1 through 7 contain the AFS steady-state analysis results:

EXECUTIVE SUMMARY

A summary of total MW amount, models used, and closing date for the study.

REVISION HISTORY

Contains description of each report revision.

TABLE 1

Table 1 identifies the participating long-term transmission service requests included in the AFS. This table lists: deferred start and stop dates with and without redispatch (based on customer selection of redispatch if available), minimum annual allocated ATC without upgrades, season of first impact, and requests with parameters that were exceeded.

TABLE 2

Table 2 identifies total E&C cost allocated to each customer, letter of credit requirements, third party E&C cost assignments, potential base plan E&C funding (lower of allocated E&C or Attachment J Section III B criteria), PTP base rate charge, total revenue requirements for assigned upgrades with consideration of potential base plan funding, final total cost allocation to the customer, and directly assigned upgrade cost to the customer. Table 2 identifies any Southwestern Power Administration upgrade costs that require prepayment in addition to other allocated costs.

TABLE 3

Table 3 provides additional details for each request including all assigned facility upgrades required, allocated E&C costs, allocated revenue requirements for upgrades, upgrades not assigned to the customer but required for service to be confirmed, credits to be paid for previously assigned AFS or generation interconnection network upgrades, and any required third-party upgrades.

TABLE 4

Table 4 lists all upgrade requirements with associated solutions needed to provide transmission service for the AFS, earliest date upgrade is needed (DUN), estimated date the upgrade will be completed and in-service (end of construction, or "EOC"), and estimated E&C cost.

TABLE 5

Table 5 lists identified third-party constrained facilities.

TABLE 6

Reserved

TABLE 7

Table 7 lists costs allocated per request for service upgrades assigned in this AFS.

DEFINITIONS

Date Upgrade Needed (DUN) – The earliest date the upgrade is required to alleviate a constraint considering all requests.

End of Construction (EOC) – The estimated date the upgrade will be completed and in service.

Total Engineering and Construction Cost (E&C) – The upgrade solution cost as determined by the transmission owner. Based on the request having an impact of at least 3% on the limiting element, and having a positive impact on the upgraded facility.

Minimum Available Transfer Capability (ATC) – The portion of the request capacity that can be accommodated without upgrading facilities.

Annual Available Transfer Capability (ATC) – The ATC allocated to the transmission customer is determined by the least amount of allocated seasonal ATC within each year of a reservation period.

ATSS METHODOLOGY

The facility study analysis is conducted to determine the steady-state impact of the requested service on SPP and first-tier non-SPP control area systems. The steady-state analysis is performed consistent with SPP Criteria and NERC Reliability Standards requirements. SPP conforms to NERC Reliability Standards, which provide strict requirements related to voltage violations and thermal overloads during normal conditions and during a contingency. NERC Reliability Standards require all facilities to be within normal operating ratings for normal system conditions and within emergency ratings after a contingency.

Normal operating ratings and emergency operating ratings monitored are Rate A and B in the SPP Model Development Working Group (MDWG) models, respectively. The upper bound and lower bound of the normal voltage range monitored is 105% and 95%. The upper bound and lower bound of the emergency voltage range monitored is 105% and 90%. Transmission Owner voltage monitoring criteria is used if more restrictive. The Southwestern Public Service Company Tuco 230 kV bus voltage is monitored at 92.5% due to pre-determined system stability limitations. The Evergy Kansas Central Wolf Creek 345 kV bus voltage is monitored at 103.5% and 98.5% due to transmission operating procedure.

The contingency set includes: all SPP control area branches and ties 69 kV and above; first tier non-SPP control area branches and ties 115 kV and above; any defined contingencies for these control areas; and generation unit outages for the control areas with SPP reserve share program redispatch. The monitored elements include: all SPP control area branches, ties, and buses 69 kV and above and all first-tier non-SPP control area branches and ties 115 kV and above. Voltage monitoring is performed for SPP control area buses 69 kV and above.

A 3% transfer distribution factor (TDF) cutoff is applied to all SPP control area facilities. For first-tier non-SPP control area facilities, a 3% TDF cutoff is applied to Associated Electric Cooperative, Ameren, and Entergy control areas. For voltage monitoring, a 0.02 per unit change in voltage must occur due to the transfer or modeling upgrades to be considered a valid limit to the transfer.

POWER FLOW MODEL SET

The SPP Integrated Transmission Plan (ITP) power flow models serve as the starting point for all Aggregate Studies requiring steady-state power flow analysis. These models typically include, but are not limited to:

- (Current Year) Summer and Winter
- (Current Year +2) Light Load, Summer, and Winter
- (Current Year +5) Light Load, Summer, and Winter

- (Current Year +10) Light Load, Summer, and Winter

The ITP Assessment analyzes the year 2, year 5, and year 10 models. In addition to these models, the ATSS uses the current year Summer Peak and Winter Peak ITP models in order to assess the impacts of service beginning at that time. The ATSS may potentially use year 1 ITP models as well, as applicable.

The Summer Peak models apply to June through September, the Winter Peak models apply to December through March, and the Light Load models apply to April and May.

The chosen base case models are modified to reflect the current modeling information. One group of requests is developed from the aggregate to model the requested service. Base Reliability model scenarios are utilized. Base Reliability includes projected usage of transmission included in the SPP (Current Year) ITP Cases.

BASE CASE SETTINGS

Solutions	Fixed slope decoupled Newton-Rhapson solution (FDNS)
Tap Adjustment	Stepping
Var Interchange Control	Tie lines and loads
Var Limits	Apply immediately
Solution Options	Phase shift adjustment

ACCC CASE SETTINGS

Solutions	AC contingency checking (ACCC)
MW Mismatch Tolerance	.5
System Intact Rating	Rate A
Contingency Case Rating	Rate B
Percent of Rating	100
Output Code	Summary
Min Flow Change in Overload Report	3 MW
Exclude Cases w/ No Overloads from Report	YES
Exclude Interfaces from Report	NO
Perform Voltage Limit Check	YES
Elements in Available Capacity Table	60000

Cutoff Threshold for Available Capacity Table	99999.0
Min. Contingency Case Voltage Change for Report	.02
Sorted Output	None
Tap Adjustment	Stepping
Area Interchange Control	Tie lines and loads (Disabled for generator outages)
Solution Options	Phase shift adjustment

TRANSMISSION REQUEST MODELING

NITS requests are modeled as generation-to-load transfers in addition to generation-to-generation transfers. The requested NITS is a request to serve network load with the new designated network resource, and the impacts on the transmission system are determined accordingly. PTP Transmission Service requests are modeled as generation-to-generation transfers. Generation-to-generation transfers are accomplished by developing a post-transfer case for comparison by dispatching the requested source and redispatching the requested sink.

TRANSFER ANALYSIS

Using the selected cases both with and without the requested transfers modeled, the Power System Simulator for Engineering (PSS/E) Activity ACCC is run on the cases and compared to determine the facility overloads caused or impacted by the transfer. TDF cutoffs (SPP and first-tier) and voltage threshold (0.02 change) are applied to determine the impacted facilities. The PSS/E options chosen to conduct the analysis can be found in Appendix A.

CURTAILMENT AND REDISPATCH EVALUATION

During any period in which SPP determines that a transmission constraint exists on and may impair transmission system reliability, SPP will take whatever actions are reasonably necessary to maintain reliability. If SPP determines transmission system reliability can be maintained by redispatching resources, it will evaluate the interim redispatch of units to provide service prior to completion of any assigned network upgrades. Any redispatch may not unduly discriminate between the transmission owners' use of the transmission system on behalf of their native load customers and any customer's use of the transmission system to serve its designated load. Redispatch is evaluated to provide only interim service during the time frame prior to completion of any assigned network upgrades.

SPP determines potential relief pairs to relieve the incremental MW impact on limiting facilities. Using the selected cases in which the limiting facilities are identified, potential incremental and decremental units are identified by determining the generation amount available for increasing

and decreasing from the units' generation amount, maximum generation amount, and minimum generation amount. If the incremental or decremental amount is greater than 1 MW, the unit is considered as a potential incremental or decremental unit.

Generation shift factors are calculated for the potential incremental and decremental units using the Siemens power flow analysis tool, Managing and Utilizing System Transmission (MUST). Relief pairs from the generation shift factors for the incremental and decremental units with a TDF greater than 3% on the limiting constraint are determined from the incremental units with the lowest generation shift factors and decremental units with highest generation shift factors. If the aggregate redispatch amount for the potential relief pair is determined to be three times greater than the lower of the increment or decrement, then the pair is determined not to be feasible and is not included. The potential relief pairs are not evaluated to determine impacts on limiting facilities in the SPP and first tier systems.

The AFS analyzes the most probable contingencies and does not account for every situation that may be encountered in real-time operation. Because of this, it is possible the customer may be curtailed under certain system conditions to allow system operators to maintain the reliability of the transmission network.

FINANCIAL ANALYSIS

The AFS utilizes the allocated customer's E&C cost in a present-worth analysis to determine the monthly levelized revenue requirement of each facility upgrade over the term of the reservation. In some cases, network upgrades cannot be completed within the requested reservation period, thus deferred reservation periods will be utilized in the present worth analysis. If the customer chose Option 5, use of interim redispatch, in Appendix 1 of the AFS agreement, the present-worth analysis of revenue requirements will be based on the deferred term with redispatch in the subsequent AFS. The upgrade levelized revenue requirement includes interest, depreciation, and carrying costs.

Each request for transmission service is evaluated independently as the cost associated with each network upgrade is assigned to a request. When facilities are upgraded throughout the reservation period, the customer will pay the total E&C costs and other annual operating costs associated with the new facilities.

If E&C of a previously assigned network upgrade may be accelerated with no additional upgrades to accommodate a new request for transmission service, the levelized present worth of only the incremental expenses through the reservation period of the new request, excluding depreciation, shall be assigned to the new request. These incremental expenses, excluding depreciation, include:

1. The levelized difference in present worth of the E&C expenses given the change in date to complete construction to account for additional interest expense and reduced E&C expense due to inflation,
2. The levelized present worth of all expediting fees, and
3. The levelized present worth of the incremental annual carrying charges, excluding depreciation and interest, during the new reservation period taking into account both:
    a. The reservation in which the project was originally assigned, and
    b. A reservation, if any, in which the project was previously accelerated.

In the case of a base plan upgrade being deferred or displaced by an earlier in-service date for a requested upgrade, the methodology for achievable base plan avoided revenue requirements shall be determined per Attachment J, Section VII.A or Section VII.B, respectively. A deferred base plan upgrade is defined as a different requested network upgrade needed at an earlier date that negates the need for the initial base plan upgrade within the planning horizon. A displaced base plan upgrade is defined as the same network upgrade being displaced by a requested upgrade needed at an earlier date.

A 40-year service life assumption is utilized for base plan funded projects, unless the transmission owner provides another assumption. A present worth analysis of revenue requirements on a common year basis between the base plan and requested upgrades is performed. This analysis determines avoided base plan revenue requirements due to the

displacement or deferral of the base plan upgrade by the requested upgrade. The difference in present worth between the base plan and requested upgrades is assigned to the transmission requests impacting this upgrade based on the displacement or deferral.

MAKE-WHOLE PAYMENT

Make-whole payment (MWP) is a potential cost that may be allocated to a request in a completed AFS that meets the study completion conditions but has unresolved third-party impacts. If there is a request with identified third-party impact(s) and the customer has not notified SPP of a successful conclusion to the third-party negotiation by the deadline described in Section III.D.2 of Attachment Z1 in the OATT, SPP will deem the request to be terminated and withdrawn. The customer may be subject to a MWP in accordance with Section III.D.4 of Attachment Z1 in the OATT. The calculation of the customer's MWP shall include any impacts to subsequent completed AFS(s).

The MWP assigned to a withdrawn request will be any reallocated upgrade costs that are in excess of the sum of (i) the DAUC and (ii) the amounts included in rates, for any remaining confirmed request(s).

If there is more than one withdrawn request, the MWP, if any, shall be assigned to the withdrawn customers based on the withdrawal(s)' impact on each withdrawn customer's request on those upgrades for which the DAUC increased for the confirmed requests, thereby resulting in the MWP. Upgrade costs for facilities only required by the withdrawn customer's request(s) shall not be included as part of the calculation of the MWP. A customer required to pay a MWP will enter into a sponsored upgrade agreement with SPP in accordance with Attachment J of the OATT and will be eligible for revenue credits in accordance with Attachment Z2 of the OATT.

THIRD-PARTY FACILITIES

For third-party facilities listed in Table 3 and Table 5, the customer is responsible for funding the necessary upgrades of these facilities per Section 21.1 of SPP's OATT.

All modeled facilities within the SPP system are monitored during study development, as well as certain facilities in first-tier neighboring systems. Third-party facilities must be upgraded when it is determined they are overloaded while accommodating the requested transmission service. An agreement between the customer and third-party owner detailing mitigation of the third-party impact must be provided to SPP prior to tendering a transmission service agreement. These facilities include those owned by SPP members who have not placed their facilities under SPP's OATT. Upgrades on the Southwestern Power Administration (SWPA) network requires prepayment of the upgrade cost prior to construction of the upgrade.

Third-party facilities are evaluated for only those requests whose load sinks within the SPP footprint. The customer must arrange with the applicable transmission providers for studying third-party facilities for service that sinks outside the SPP footprint.

BASE PLAN UPGRADES

The potential allowable base plan funding is contingent on meeting each of the conditions for classifying upgrades associated with designated resources as base plan upgrades as defined in Section III.B of Attachment J. If the additional capacity of the new or changed designated resource exceeds the 125% resource-to-load forecast for the year service starts, the requested resource is not eligible for base plan funding of required network upgrades. The full cost of the upgrades is assignable to the customer.

If the request is for wind generation, the total requested capacity of wind generation plus existing wind generation capacity shall not exceed 20% of the customer's projected system peak responsibility in the first year the designated resource is planned to be used by the customer. If the five-year term and 125% resource-to-load criteria are met, (as well as the 20% wind resource-to-load criteria for wind generation requests) the requested capacity is multiplied by $180,000 to determine the potential base plan funding allowable.

The maximum potential base plan funding allowable may be less than the potential base plan funding allowable, due to the E&C cost allocated to the customer being lower than the potential amount allowable to the customer. The customer is responsible for any assigned upgrade costs in excess of potential base plan E&C funding allowable. Network upgrades required for wind generation requests located in a zone other than the customer's point of delivery (POD) shall be allocated as 67% base plan region-wide charge and 33% directly assigned to the customer.

Regarding application of base plan funding for PTP requests: if PTP base rate exceeds upgrade revenue requirements without taking into effect the reduction of revenue requirements by potential base plan funding, then the base rate revenue pays back the transmission owner for upgrades. No base plan funding is applicable, as the access charge must be paid as it is the higher of "OR" pricing.

However, if initially the upgrade revenue requirements exceed the PTP base rate, then potential base plan funding would be applicable. The test of the higher of "OR" pricing would then be made against the remaining assignable revenue requirements versus PTP base rate. Examples are as follows:

EXAMPLE A:

E&C allocated for upgrades is $74 million with revenue requirements of $140 million and PTP base rate of $101 million. Potential base plan funding is $47 million, with the difference of $27 million E&C assignable to the customer. If the revenue requirements for the assignable portion is $54 million and the PTP base rate is $101 million, the customer will pay the higher amount (so-called "or pricing") of $101 million base rate. Out of the $101 million, $54 million in revenue requirements will be paid back to the transmission owners for the upgrades. The remaining revenue requirements of $86 million ($140 million less $54 million) will be paid by base plan funding.

EXAMPLE B:

E&C allocated for upgrades is $74 million with revenue requirements of $140 million and PTP base rate of $101 million. Potential base plan funding is $10 million with the difference of $64 million E&C assignable to the customer. If the revenue requirements for this assignable portion is $128 million and the PTP base rate is $101 million, the customer will pay the higher amount of $128 million revenue requirements to be paid back to the transmission owners. The remaining revenue requirements of $12 million ($140 million less $128 million) will be paid by base plan funding.

EXAMPLE C:

E&C allocated for upgrades is $25 million with revenue requirements of $50 million and PTP base rate of $101 million. Potential base plan funding is $10 million. Base plan funding is not applicable, as the higher amount of PTP base rate of $101 million must be paid and the $50 million revenue requirements will be paid from this.

NEXT STEPS

SPP will accept the requests in which the specified study parameters are met in the final iteration and will tender a service agreement for each of these requests identifying the terms and conditions of the confirmed service. SPP will refuse all requests in which the parameters are exceeded.

GLOSSARY OF TERMS

Term	Definition
ACCC	Alternating current contingency check
AFS	Aggregate Facility Study
ATC	Available transfer capability
ATSS	Aggregate Transmission Service Study
DAUC	Directly assigned upgrade cost
DUN	Date upgrade needed
E&C	Engineering and construction
EOC	End of construction
ITP	Integrated Transmission Plan
MDWG	Model Development Working Group
MUST	Managing and Utilizing System Transmission
MWP	Make whole payment
NITS	Network integrated transmission service
OATT	Open Access Transmission Tariff
POD	Point of delivery
PTP	Point-to-point
RMS	Request Management System
SPP	Southwest Power Pool
SWPA	Southwestern Power Administration
TC	Transmission customer
TDF	Transfer distribution factor
TO	Transmission owner
TP	Transmission provider

REFERENCE DOCUMENTS

The following reference materials are available at: www.spp.org

SPP Open Access Transmission Tariff
- Aggregate Transmission Service Study Procedures and Cost Allocation and Recovery for Service Upgrades (Attachment Z1)
- The contents of this document are intended to be consistent with the tariff. If there is any conflicting information, the tariff supersedes this document.

SPP Business Practices
- 7500 Aggregate Study Procedures

SPP Planning Criteria

SEAMS Agreements
- AECI
- ERCOT
- MISO
- Peak
- Saskatchewan Power
- SWPA
- TVA