Transmission Expansion Planning Policy Committee

2010 TEPPC Study Program

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1 Introduction

The Transmission Expansion Planning Policy Committee's (TEPPC) 2010 Study Program has been prepared under the provisions of the TEPPC Regional Transmission Expansion Planning Protocol[1] (TEPPC Protocol). The goal of the Study Program is to produce study results reports in early 2011 that can be used in the preparation of a 10-year Regional Transmission Plan to be submitted to the U.S. Department of Energy (DOE) in September 2011. The 2010 Study Program will evaluate the transmission system of the Western Interconnection in four horizon years:

1. Horizon Year 2029 – A 2029 production cost study of transmission overlay options under a 33% WECC-wide Renewable Portfolio Standard will be completed early in 2010. These are studies carried over from the 2009 Study Program.
2. Horizon Year 2019 – The 2019 base case used in the 2009 Study Program, with the implementation of minimal updates, will be used for production cost simulations that will investigate the effect of moving a large block of renewable energy production to different locations across the system.
3. Horizon Year 2020 – A new 2020 production cost simulation base case will be developed and used to evaluate a number of policy driven variables – energy efficiency, demand side management, carbon control regulations, technology changes, etc.
4. Horizon Year 2030 – A 2030 study will be initiated, using a new set of long range planning tools, to evaluate a wide range of possible conditions that will affect future transmission needs.

The 2010 Study Program was developed to (1) respond to requests received under the provisions of the TEPPC Protocol, (2) incorporate relevant study needs of the subregional planning groups, state authorities, transmission providers and generators, (3) develop needed models for congestion simulation studies, and (4) support the objectives of the WECC Strategic Plan by providing useful transmission insights into the implications of major policy and technology changes for the future of the western power system.

TEPPC met on March 18, 2010 to evaluate and prioritize a consolidated list of proposed studies. This list of proposed studies was prepared by the Technical Advisory Subcommittee (TAS) from an initial clustering and consolidation of the study requests prepared by the Studies Work Group (SWG). The list included both follow-up to studies performed in 2009 and the study requests submitted under the provisions of the TEPPC Protocol during the request window period that ended January 31, 2010. The result of this process is the proposed 2010 Study Program described herein.

[1] TEPPC Planning Protocol, Hhttp://www.wecc.biz/committees/BOD/TEPPC/Shared%20Documents/TEPPC%20Planning%20Protocol.pdfH

This document has three major sections and an appendix.

- Section 1 is this Introduction.
- Section 2 summarizes the TEPPC transmission planning process, the study program development, and other study activities.
- Section 3 describes the elements of the Study Program, specifically, the sets of cases proposed and their priority within the Study Program.
- Appendix A is a glossary of TEPPC terminology.

2 Transmission Planning and the Study Program

The goal of TEPPC's transmission expansion screening studies is to provide economic expansion information useful for understanding future transmission needs and developing projects to meet those needs within the Western Interconnection. This information is useful to transmission project developers, energy service providers, regulators, and other parties involved in making public policy and investment decisions that are affected by expansion of the transmission system. Since TEPPC's work is one component of the many activities involved in the planning, building, and operating of the transmission system, this section first covers the WECC planning activities. Following this, there is a brief description of the adaptive planning cycle of the TEPPC Protocol. Finally, the specific study methodology that will be used for this year's TEPPC Study Program is described.

The importance of transmission planning is well recognized by stakeholders – transmission providers, generating companies, load serving entities, regulatory agencies, energy offices, environmental interests, investors, and others. The DOE's triennial Congestion Study and FERC's Order No. 890 both require consideration of future transmission needs. In addition, under the provisions of the American Reinvestment and Recovery Act of 2009 (ARRA), WECC received a grant from DOE to develop a 10-year Regional Transmission Plan for submission to DOE in September 2011.

TEPPC's work compliments and coordinates with other transmission planning related activities. These include state and provincial integrated resource planning (IRP), the western states' climate initiatives, state and provincial renewable portfolio standards (RPS), analyses of renewables integration by the National Renewable Energy Laboratory, the Western Electricity Industry Leaders (WEIL) studies, and the Western Renewable Energy Zone (WREZ) initiative of the Western Governors Association (WGA). Transmission planning is no longer the exclusive preserve of a few engineers, but has come to the forefront of electric energy policy decision making.

2.1 Purpose of Transmission Planning

Electric power networks are a unique part of our national infrastructure. With current technology, long distance high voltage lines are not buried, so they become a visible part of the landscape through which they pass. Transmission facilities also have very long lives, so decisions made today have long-lasting effects. Therefore, the objective of long-term transmission planning is to make the best network design decisions today after considering possible future needs and expansion options. Few, if any, ten or twenty year transmission plans will come to fruition as originally conceived. However, by

planning for possible future needs, flexibility is built into the network's design that allows options to be exercised and adaptation to occur as future conditions are revealed.

TEPPC's activities are an integral part of the Western Interconnection's overall approach to regional planning of the transmission system, which has two major aspects to be considered. The first is *system reliability*, which can be characterized as "keeping the lights on" while responding in a predictable fashion to both planned and unplanned outages in generation and transmission. The second aspect is *system congestion*, which is a measure of the economic performance of the transmission system. System congestion studies provide answers to the question, "While operating within the bounds of reliable operation, how well does the transmission system perform to deliver electricity services to consumers at a reasonable cost?"

2.2 Regional Transmission Expansion Planning

The WECC Regional Transmission Expansion Planning (RTEP) Process is described in the TEPPC Protocol. The TEPPC Protocol governs the transmission planning process used by the TEPPC to (1) Produce regional transmission plans consistent with agreements between WECC and the United States Department of Energy (DOE)[2] and (2) Support Transmission Providers in meeting the transmission planning obligations of Attachment K to the Transmission Providers' Open Access Transmission Tariffs (OATT).

2.3 TEPPC Study Program Development

A key component of RTEP is TEPPC's biennial study program. Given the start up of RTEP in 2010 with a report due in 2011, the 2010 Study Program is effectively the second year of a biennial RTEP study program. Figure 2.1 below is taken from the TEPPC Protocol[3] and it shows the process for developing a TEPPC study program. The process begins with input from four sources:

1. Study scenarios developed by the Scenario Planning Steering Group (SPSG), which includes load and resource assumptions for reference cases.
2. Study requests from stakeholders under provisions of FERC Order No. 890.
3. Feedback from previous TEPPC studies.
4. The Foundational Transmission Projects List from the SPG Coordination Group (SCG), which provides the transmission assumptions for reference cases.

The development of the annual study program is an adaptive process that uses previous experience to not only improve the quality of the cases, but to add new models or modify study methodology to continually improve the results produced by the study program. The 2010 Study Program is more extensive than programs of previous years.

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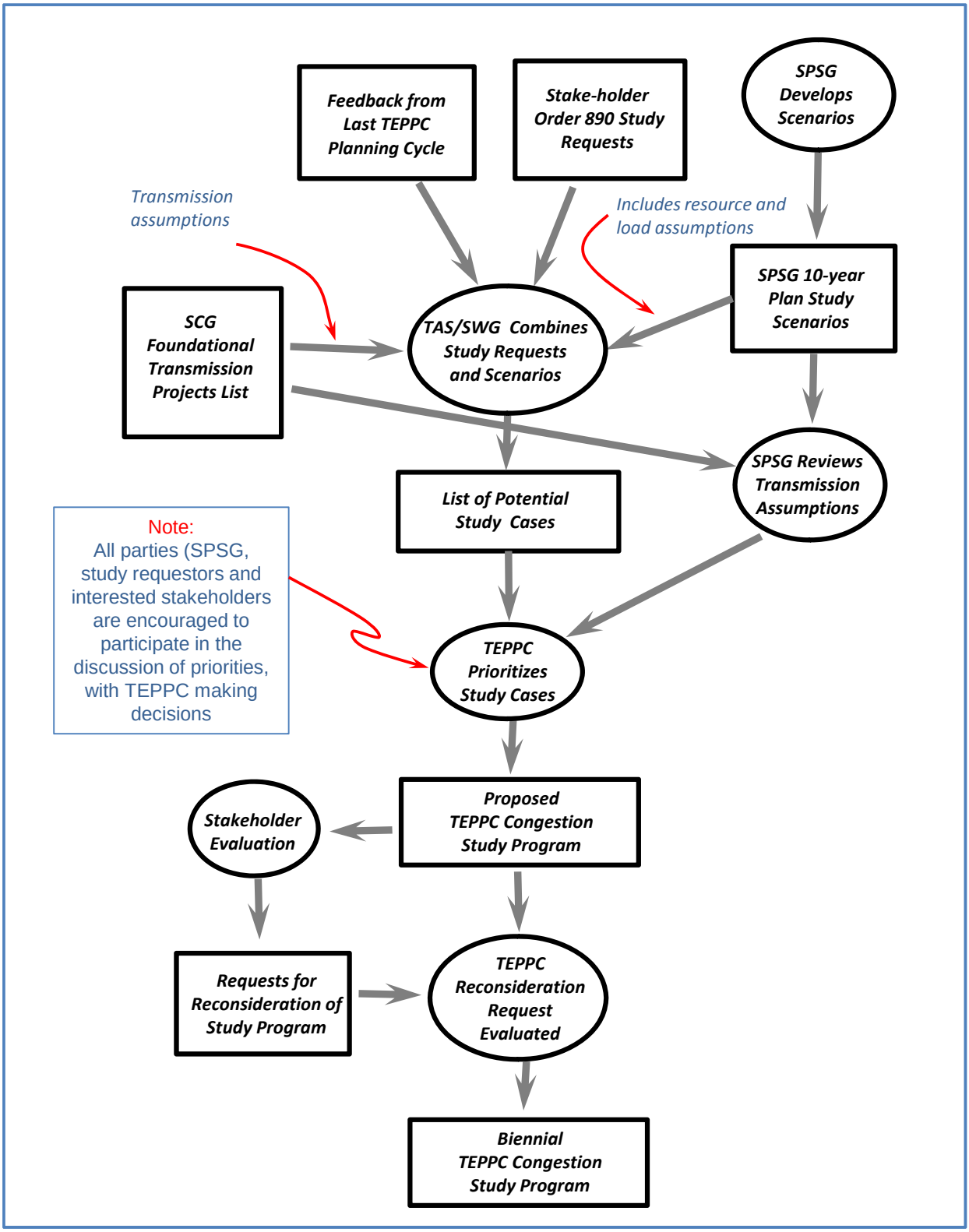
[2] These agreements resulted from WECC's proposal to the DOE's Funding Opportunity Announcement (FOA) DE-FOA0000068 to implement provisions in Title IV of the American Recovery and Reinvestment Act of 2009 (ARRA).

[3] TEPPC Regional Transmission Expansion Planning Protocol, Figure 5.3, p. 26

This expansion of planning activity was made possible, in part, by lessons learned in previous years.

Figure 2.1, Study Program Development Process



From the four inputs shown in Figure 2.1, the SWG develops a consolidated list of studies. In preparing the consolidated list, SWG looks for opportunities to consolidate requests to meet multiple requests with a reduced number of studies. The consolidated list is reviewed by the TAS and forwarded to TEPPC for its consideration. All stakeholders, including the parties who submitted study requests, are invited to attend the TEPPC meeting and participate in the prioritization discussion. The consolidated list of studies is adjusted based on the TEPPC discussion and posted for review. Stakeholders are given an opportunity to request reconsideration of TEPPC's proposed study program before it is finalized.

2.4 Other Study Activities

In addition to the studies described in Section 3, TEPPC has ongoing activities that support the Study Program effort. First, TEPPC conducts historical analysis of congestion through the TAS Historical Analysis Work Group (HAWG).[4] Second, the Data Work Group (DWG) builds the study databases needed for simulation studies. Third, the Modeling Work Group (MWG) develops improved simulation models based on needs identified in past studies. Each of these activities is an important element of TEPPC's adaptive approach to transmission planning studies.

2.5 Types of Study Cases

Prior to the formation of TEPPC, a number of Western Interconnection congestion studies were done using production cost simulation. These studies stimulated interest in economic evaluation of transmission expansion and led to the formation of TEPPC. These studies were also influential in triggering interest in a number of major transmission projects now being developed across the Interconnection. However, one of the concerns expressed regarding the early studies was the inclusion of potentially redundant generation and transmission expansion proposals. The presence of surplus generation and transmission tended to mask possible congestion – eliminating it before it could be identified. To avoid this problem, the SWG has developed a study methodology that uses two types of study cases: (1) Portfolio Cases, and (2) Expansion Cases. The relationship between the two types of study cases is shown in Figure 2.2 for a set of illustrative, hypothetical cases.

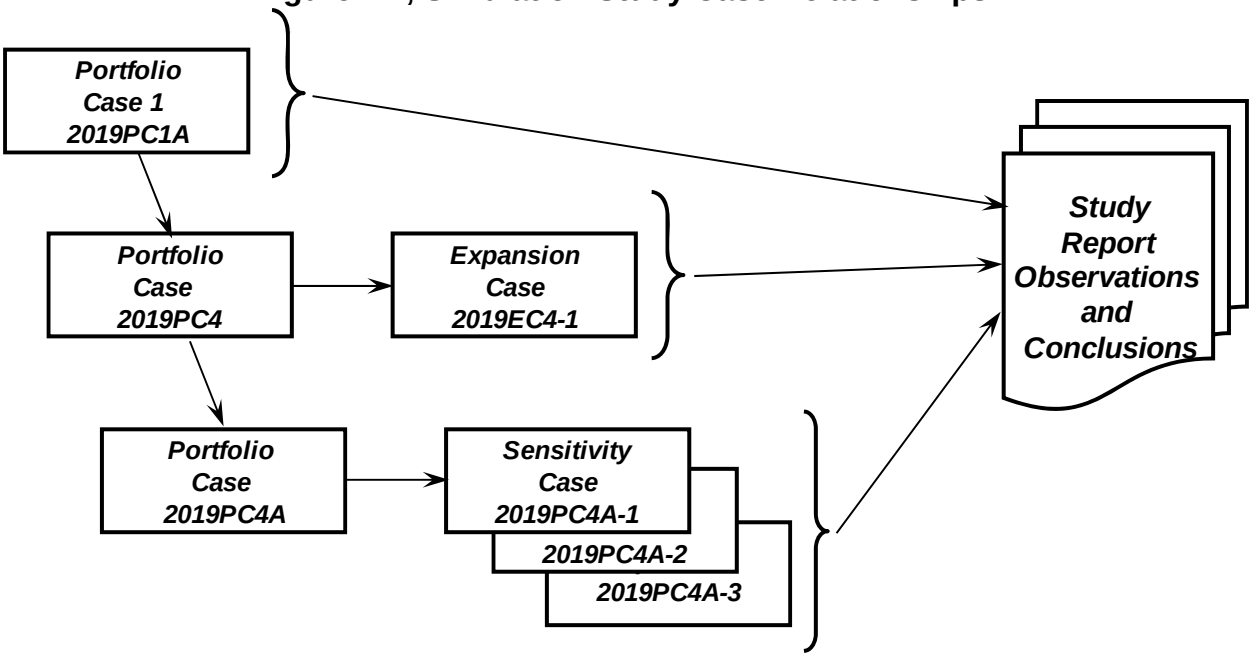
2.5.1 Portfolio Cases

The resource mix for a Portfolio Case is developed to represent a possible pattern of future resource and load development. The type and location of incremental resources will be different among portfolio cases. The foundation of each resource portfolio is the set of resources currently in-service and those deemed probable, based on the analysis of the Load and Resources Subcommittee. The next step in the Portfolio Case development is adding a hypothetical portfolio of incremental resources. For the network topology, Portfolio Cases use a representation of the existing transmission plus new transmission whose construction is sufficiently certain to be deemed foundational for studies in a given horizon year. The first base case for a given horizon year has been called a reference case, from which additional Portfolio Cases are developed that

[4] Historical analysis of actual flows has been conducted by WECC for the past 10 years.

represent other possible patterns of resource and load developments to evaluate the impact of different future market, regulatory, and policy conditions on the need for transmission network expansion.[5]

Figure 2.2, Simulation Study Case Relationships



2.5.2 Expansion Cases

Expansion Cases are developed from Portfolio Cases by adding incremental transmission. This is the second step in congestion study analysis to investigate the effect that various transmission expansion options may have on reducing network congestion. By reporting the congestion reduction effects produced by different transmission alternatives, stakeholders will be better able to judge their interest in various projects and provide a basis for further project studies. For a given study year, there will be a few Portfolio Cases and possibly many Expansion Cases – a few for each of the Portfolio Cases, as shown in Figure 2.2. For the 2010 Study Program, expansion cases will be prepared that add specific proposed projects to Portfolio Cases to observe their impact on system congestion.

[5] The Portfolio Cases provide a hypothetical portfolio of resources that balance load and generation. In past TEPPC studies, the incremental resources are added in three groups: (1) Renewable resources needed to meet the study target, (2) more likely planned resources listed in LRS reports, and (3) enough conventional generation to achieve load-resource balance. Evaluation of a Portfolio Case is used to identify binding constraints, which may suggest what additional transmission is needed to alleviate congestion.

3 Elements of the 2010 Study Program

The consolidated list of cases reviewed by TEPPC at its March 25, 2010 meeting is provided below in six tables. Each table represents a major element of the study program. The order of the tables indicates the general order in which the elements of the study program will be executed. A primary consideration in ordering of the study elements was to make best use of study resources. Because of the large number of studies requested, TEPPC decided to proceed with some study elements using available databases while a new base case is being built and new study tools are being acquired to address later study elements. An explanation of each study element and general study approach precedes each of the six tables. As the studies progress, SWG will send out timely requests for data for (1) rating changes needed for the N-2 study and (2) for transmission project data. In addition, cost estimates will be developed for all projects using generic cost estimates.[6]

In order to manage the study effort and get results of greatest value, the priority of issues will be revisited during the year to measure progress and make possible modifications to the 2010 Study Program. The priority of 2019 cases will be revisited around July 1, and the priority order of 2020 cases reconsidered around November 1.

3.1 Studies Using the 2029 Base case

During 2009, work began on a 2029 base case that was developed for evaluating long-term transmission overlay options. These studies were not completed in 2009 and work continued during the early months of 2010. For the 2010 Study Program, a limited amount of work will continue on the 2029 cases until the updated 2019 case is ready for use. This work includes:

1. The modeling of two study cases to represent the form of long-term transmission overlay options, including:
    a. An incremental approach using currently proposed 500 kV and HVDC projects, and
    b. A new 765 kV overlay alternative.
2. Adjustments (additions or removal of transmission segments) to the two transmission alternatives to improve the design of each of the alternatives.

Work on these cases will end in April so that the 2019 studies may proceed after modifications to the 2019 base case have been completed.

[6] The termination costs to be used in the capital cost estimating tool will need to be revisited.

Table 3.1, 2029 Carryover Studies from 2009 Study Program

Study Requests for 2029 Studies – Long-term
2029 Strategy: Continue work on the 2029 cases from the 2009 Study Program while the 2019 basecase is being revised and the 2020 basecase is being developed.

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2029 PC1	WREZ	Renewables additions to meet 33% renewables WECC-wide in 2029 (from WREZ information - significant renewables added in MT, WY, BC and AZ)		Completed	Dec - 09	Discontinue model enhancements and accept case as is to run expansion cases.
2029 EC1	WREZ		Add robust transmission plan of incremental transmission additions from Toolbox (proposed projects; 500 and 345 kV). Optimize additions if time permits.	High	April – 2010	Continue work on case until end of April when 2019 case update is available.
2029 EC2	WREZ		Add robust transmission plan of a 765 kV Overlay. Optimize additions if time permits.	High	April – 2010	Continue work on case until end of April when 2019 case update is available.

3.2 Resource Relocation Studies Using the 2019 Base case

A number of the study requests received in 2010 requested the insertion of a large block of new resources at given locations in the system to study their incremental effect on system congestion and transmission needs. These types of resource relocation cases serve two functions.

1. They provide a comparison of congestion effects of injection of resources at various locations.
2. They provide a basis for studying the congestion relief effects of the projects proposed for delivery of locational resources modeled in a given case.

TEPPC decided to use the existing 2019 base case to respond to the majority of these resource relocation study requests in order to work through the summer of 2010 while a new 2020 basecase was being prepared.

Based on the results of previous studies, SWG recommended that a limited set of changes be made to the 2019 base case while the 2029 work was being completed. These changes include updating and refining thermal plant parameters, implementing additional Hydro Thermal Coordination (HTC) modeling, making model improvements to improve the performance of the Alberta to British Columbia (AB/BC) tie line, and fixing some other known problems. Only changes that can be implemented by May 1 will be incorporated into the 2019 dataset update to maximize study time. The new 2019 study work includes:

- The evaluation of eight new generation scenarios, which will be run in this priority order: Southern Nevada/Arizona, Wyoming, British Columbia, Northern Nevada, Alberta, Montana, New Mexico and NW Coastal.
    - In each resource relocation case, 12,000 GWh of new renewable resources will be added in one of the eight designated locations and 12,000 GWH will be removed from the California in-state RPS resources modeled in the 2019 base case. The 12,000 GWh block of energy is roughly 20% of the new RPS resources added in California in the 2019 base case, and roughly 3,200 MW nameplate in the better remote wind areas. The new resources added in each area of study will be renewables that are appropriate for that area.
- Associated transmission expansion cases will be created for each resource scenario at the time the scenario is analyzed. Transmission projects to be studied will be selected from specific study requests made in either 2009 or 2010 and from among projects identified in the TEPPC Transmission Information Portal.
- Output for these expansion studies will be standardized and limited to maximize the number of study cases that can be run.

Work on the new 2019 studies will continue until a new 2020 basecase is available.

Table 3.2, 2019 Resource Location Studies

Study Requests for New 2019 Studies – Medium-term
2019 Strategy: Update the 2019 basecase with refined thermal plant parameters, additional HTC modeling, AB/BC model improvements, and other quick known fixes. New resource and transmission expansion scenarios (from 2009 and 2010 study requests) will be run while the new 2020 case is being developed. Only fixes that can be implemented by May 1 will be incorporated into the 2019 dataset update to maximize the resource scenarios and expansion cases that can be run.

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2019 PC1A	PG&E, NTTG	Minor update to 2019 base case.		High	May-Aug 2010	
2019 EC1A-1	PG&E		Central CA Clean Energy Transmission Project (Midway-Gregg 500 line)	High	May-Aug 2010	
2019 EC1A-2	PPL Energy and NTTG		Determine economic effects of the WECC N-2 Common Corridor outage	Med	May-Aug 2010	Run study to test impact of increased ratings throughout WECC. Need to circulate request for information regarding how path ratings might change under this scenario
2019 EC1A-3	Startrans IO, LLC		Analyze the congestion in the SF Bay area and evaluate potential solutions	Low	May-Aug 2010	Study is more appropriate at subregional level

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2019 EC1A-4	Green Energy Express LLC		Study impact of Green Energy Express Transmission Project Phase 1 on congestion	Low	May-Aug 2010	Project will be added to toolbox but study is more appropriate at subregional level
2019 PC7	WestConnect, PG&E	Based on 2019 PC1A - Arizona/Southern Nevada: re-locate capacity equivalent of 12,000 GWh energy from California		High	May-Aug 2010	
2019 EC7-1	Startrans IO, LLC		Phoenix-Mead-Adelanto line converted to HVDC	High	May-Aug 2010	
2019 EC7-2	Green Energy Express LLC		Green Energy Express Transmission Project Phases 2&3	High	May-Aug 2010	
2019 EC7-3	SCE		Palo Verde-Colorado River 500 kV line	High	May-Aug 2010	
2019 EC7-4	LADWP, IID, SCPPA		Green Path North Project (Indian Hills-Upland)	Low	May-Aug 2010	Project dropped by LADWP
2019 EC7-5	Central AZ Water Conservation District		Harcuvar Transmission Project	Low	May-Aug 2010	Local project, Collector system

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2019 PC8	NTTG	Based on 2019 PC1A - Wyoming: re-locate capacity equivalent of 12,000 GWh energy from California		High	May-Aug 2010	
2019 EC8-1	TransCanada		Zephyr Project (Wyoming-Las Vegas HVDC)	High	May-Aug 2010	
2019 EC8-2	TransWest Express and NTTG		600 kV HVDC from Central Wyoming to Las Vegas	High	May-Aug 2010	
2019 EC8-3	PacifiCorp		Hemingway-Captain Jack 500 kV Transmission Line and Gateway West #2	High	May-Aug 2010	
2019 EC8-4	Black Hills et al, Sunzia Project Participants		High Plains Express Transmission Project and SunZia Project	High	May-Aug 2010	
2019 EC8-5	Portland General Electric, PacifiCorp		Cascade Crossing (Boardman-Bethell 500 kV line) and Gateway West #2	High	May-Aug 2010	
2019 EC8-6	TransElect, Wyoming Infrastructure Authority		Wyoming-Colorado Intertie Project (345 kV lines)	High	May-Aug 2010	

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2019 EC8-7	PacifiCorp		Gateway South #2	High	May-Aug 2010	
2019 EC8-8	NTTG, PPL Energy		Determine impact of new energy market hub in eastern Wyoming	Low	May-Aug 2010	Studies already model collector system as single delivery point, appropriate study for subregions
2019 PC9	NTTG, PG&E, BCTC, SeaBreeze	Based on 2019 PC1A - British Columbia : re-locate capacity equivalent of 12,000 GWh energy from California, add reshaping using existing storage capability		High	May-Aug 2010	BC to provide generation changes due to the reshaping
2019 EC9-1	PG&E		Canada-PNW-Northern California Project	High	May-Aug 2010	
2019 EC9-2	SeaBreeze and NTTG		Test impact of Juan de Fuca cable project in alleviating congestion	Low	May-Aug 2010	Project will be added to toolbox but study is more appropriate at subregional level
2019 EC9-3	SeaBreeze		Juan de Fuca Cable Project II	Low	May-Aug 2010	Project will be added to toolbox but study is more appropriate at subregional level

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2019 PC10	Sierra SPG	Based on 2019 PC1A - Northern Nevada: re-locate capacity equivalent of 12,000 GWh energy from California		High	May-Aug 2010	
2019 EC10-1	NV Energy		Reno to Las Vegas 500 kV line (Blackhawk to Amargosa/Northwest) and 2 Blackhawk to Tracy/Tesla 500 kV lines	High	May-Aug 2010	
	Sierra SPG	Evaluate the congestion that results from the development of 1000 MW of wind in northern CA and northern NV at 230 kV		Low		Subregional Study
2019 PC11	NTTG	Based on 2019 PC1A - Alberta: re-locate capacity equivalent of 12,000 GWh energy from California		High	May-Aug 2010	
2019 EC11-1	TransCanada		Northern Lights Project	High	May-Aug 2010	
2019 EC11-2	MATL		Montana-Alberta Transmission Line (MATL)	HighHigh	May-Aug 2010	

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2019 PC12	PG&E, Grasslands Renewable Energy LLC and NTTG	Based on 2019 PC1A - Montana: re-locate capacity equivalent of 12,000 GWh energy from California		High	May-Aug 2010	
2019 EC12-1	TransCanada		Chinook Project (Colstrip-Las Vegas HVDC)	High	May-Aug 2010	
2019 EC12-2	NWE		Mountain States Intertie Project and SWIP (Midpoint-Robinson Summit-Las Vegas 500 kV line)	High	May-Aug 2010	Combined two requests that are complementary projects
2019 EC12-3	NWE		MT-NW Path 8 Upgrades (500-700 MW increase)	High	May-Aug 2010	Study 700 MW increase
2019 EC12-4	Grasslands Renewable Energy LLC, NTTG, PPL Energy		Add 400 MW Pump Storage between Garrison and Broadview	High	May-Aug 2010	Correct and expand on 2009 study
2019 EC12-5	PPL Energy and NTTG		Colstrip-Zephyr AC transmission line with Zephyr and Chinook projects	Low	May-Aug 2010	Need WY and MT resources to load both projects. This requests is being addressed by 2029 Incremental Transmission Study

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2019 EC12-6	PPL Energy and NTTG		Colstrip-Zephyr AC transmission line with Zephyr project upgraded to 800 kV and no Chinook project	Low	May-Aug 2010	Results would be similar to Chinook project
2019 EC12-7	PPL Energy and NTTG		Test impact on congestion of two 345 kV DCTL to tie Great Falls to both Broadview and to Garrison over the existing 230 kV ROW's.	Low	May-Aug 2010	Project will be added to toolbox but study is more appropriate at subregional level
2019 EC12-8	PPL Energy and NTTG		Test impact on congestion of a 345 kV uprate to the existing 100 kV lines from Great Falls to Helena. Continue past Helena to the Townsend 500 kV substation.	Low	May-Aug 2010	Project will be added to toolbox but study is more appropriate at subregional level
2019 EC12-9	NTTG-PPL Energy		Test impact on congestion of project from EC12-7 but instead of a double 345 kV lines from Ovando to Garrison, convert North Amps to 500 kV (Garrison to Ovando to Hot Springs (a BPA 500 kV site)) and meet the GF 345 at Ovando.	Low	May-Aug 2010	Project will be added to toolbox but study is more appropriate at subregional level

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2019 EC12-10	NTTG-NWE		Test impact on congestion of the Collector system to move generation from Cutbank, Judith Gap, Belt, Broadview and Ennis areas into Townsend	Low	May-Aug 2010	Project will be added to toolbox but study is more appropriate at subregional level
2019 EC12-11	NTTG-NWE		Test impact on congestion of upgrading Path 18 to 401 MW	Low	May-Aug 2010	Study is more appropriate at subregional level
2019 PC13		Based on 2019 PC1A – New Mexico: re-locate capacity equivalent of 12,000 GWh energy from California	Include Tres Amigas for part of the resource development	High	May-Aug 2010	Zglobal will provide generator model information that can simulate import of energy from the other two interconnections as part of the Tres Amigas project.
2019 EC13-1	Integrated Transmission Solutions		Santa Fe Project	High	May-Aug 2010	
2019 EC13-2	SunZia SW Project Participants		SunZia Project, High Plains Express, Tres Amigas	High	May-Aug 2010	

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2019 EC13-3	Dine Power Authority		Navajo Transmission Project (Four Corners-Marketplace 500 kV)	High	May-Aug 2010	
2019 PC14	NTTG	Based on 2019 PC1A - Oregon-Washington-BC coastal: re-locate capacity equivalent of 12,000 GWh energy from California		High	May-Aug 2010	NTTG to provide locations of generation, interconnection points and hourly data.
2019 EC14-1	SeaBreeze		West Coast Cable and I-5 Corridor Projects	High	May-Aug 2010	
2019 EC14-2	SeaBreeze		Project Triton	High	May-Aug 2010	
2019 EC14-3	TANC		COI Uprate Project (to 5100 MW)	High	May-Aug 2010	

3.3 Studies Using a New 2020 Base case

The 2010 study requests submitted to TEPPC by the State-Provincial Steering Committee (SPSC) asked for the preparation of a new reference case for a 2020 horizon year. The preparation of a new base case takes several months. Updated load and resource data is not available until May each year and it takes about 4 months to develop, check, and test the additional data needed to create a new simulation base case. As noted above, TEPPC decided to use the 2019 base case developed in 2009 to proceed with a large block of studies as soon as possible while the new 2020 base case is being prepared.

The 2020 base case will be used to study the transmission effects of a number of strategic and policy related issues, i.e., carbon reduction, demand side management, and energy efficiency implementation. The 2020 base case will also be used to study requests for larger resource locations studies (6,000 MW nameplate) and the Tres Amigas studies that are not addressed by the 2019 studies described above.

It is anticipated that the 2020 base case will be available in early fall 2010 and will includ:

- A refresh of resource locations and quantities using the data collected in 2010 by the Loads and Resources Subcommittee (LRS).
- A review of sub-region target planning reserve margins and LRS resource class additions.
- The SCG Foundational Transmission Projects.
- The modeling updates applied to the 2019 basecase.

Table 3.3, Studies Using New 2020 Base case

Study Requests for 2020 Studies – Medium-term
2020 Strategy: Create a new 2020 basecase and run carbon reduction, DSM, and efficiency scenarios as requested. These will be high priority cases when the new 2020 dataset is available in the fall.

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2020 PC1	SPSC	Develop base case guided by utility IRPs with specified assumptions with appropriate review from state regulators, medium load forecast		High	Aug-Dec 2010	Perform when 2020 base case ready in fall
2020 PC2	SPSC	From 2020 PC1, run high load case		High	Aug-Dec 2010	
2020 PC3	SPSC	From 2020 PC1, develop high DSM case per Table 1 in SPSC study request and evaluate transmission needs		High	Aug-Dec 2010	

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2020 PC4	SPSC	To achieve carbon reduction targets of the Waxman/Markley benchmarks of 17% by 2020 and consistent with California AB32, add to 2020 PC1 combinations of (i) aggressive EE, conservation, DSM additions, (ii) increased interior wind, (iii) increased SW solar, (iv) combinations of interior wind and SW solar, (v) carbon adder/tax, and (vi) coal fired generation shutdown.		High	Aug-Dec 2010	
2020 PC5	SPSC	Scenario 3: From 2020 PC1, evaluate impacts of breakthrough technologies on transmission congestion; include storage, central and distributed photovoltaics, modular nuclear, IGCC and Carbon Capture and Sequestration, Super conducting lines, DSM (EE and DR)		High	Aug-Dec 2010	
2020 PC6	Grasslands Renewable Energy LLC, NTTG	Aggressive interior wind in MT, approx 25,000 GWh total over today	Study appropriate transmission projects	Med	Aug-Dec 2010	Equivalent to 6000 MW study requests for MT
2020 PC7	TransWest Express, NTTG	Aggressive interior wind in WY, approx 25,000 GWh total over today	Study appropriate transmission projects	Med	Aug-Dec 2010	Equivalent to 6000 MW study requests for WY

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2020 PC8	Western Grid Group	Using 2020 PC1, apply carbon constraints by utility or region to meet goal of 30% reduction by 2020. Optimize resource mix outside of ProMod with 10% coal retirements, 20% EE, 20% renewable energy		Med	Aug-Dec 2010	
2020 PC9	Zglobal	Evaluate benefits of full operation of Tres Amigas project	SunZia Project, High Plains Express, Tres Amigas	Med	Aug-Dec 2010	Zglobal to provide reasonable generator model that can simulate import and export capability with the other two interconnections using the Tres Amigas project

3.4 Twenty Year Studies Using New Long-Range Planning Tools

The 2010 study requests included several requests for studies with a 20-year horizon. These included high wind penetration studies (12,000 MW), carbon reductions studies, new generation “game changing” technologies, etc. TEPPC’s experience with the 2029 studies suggests that using production cost simulation is not the best tool for addressing such long-term policy investigations. In 2009, TAS set up a task force to look for tools that could be used for long-term studies. In particular, the task force is seeking tools that would permit the evaluation of a wide range of possible futures scenarios and that would synthesize transmission network additions needed for these scenarios. After determining that stakeholders wished to address the long-term issues sooner rather than later, TEPPC determined that it should accelerate the acquisition of new long-range planning tools during 2010 in order to assess the wide range of policy options raised by requests for long-term studies twenty years into the future. TEPPC’s intention is to begin the 20-year studies when the long-term planning tools become available. Although the full 20-year plan development may carry into 2011 and 2012, the initial results could be used in preparing the 2011 submission to DOE of the 10-year Regional Transmission Plan.

Table 3.4, Twenty Year Studies

Study Requests for 2030 Studies – Long-term
2030 Strategy: The difficulty with the 2029 studies suggests that Promod is not the best tool for addressing long term policy investigations, so the better option is to accelerate acquisition of new long-range tools that can address a wide range of policy options. WECC will accelerate acquisition of this new tool. If the tool and studies are not possible this year, we will revisit the priority of the twenty year studies with the 2011 Study Program.

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
2030 PC1	SPSC	Like 2020 PC4: evaluate impacts of carbon reduction using Waxman/Markley benchmarks of 42% by 2030 and California AB32		High	Nov/ Dec 2010	Procure Long Range Tool to run this study later in year
2030 PC2	Western Grid Group	Apply carbon constraints by utility or region to meet goal of 40% reduction by 2030. Optimize resource mix outside of ProMod with 20% coal retirements, 30% EE, 33% renewable energy.		High	Nov/ Dec 2010	Procure Long Range Tool to run this study later in year
2030 PC3	TransWest Express, NTTG	Determine congestion impact of additional 12,000 MW of wind in Wyoming		Med	Nov/ Dec 2010	Procure Long Range Tool to run this study later in year

3.5 Studies of Interconnecting the Eastern and Western Interconnections

Early attempts to close AC lines between the Eastern Interconnection and Western Interconnection – synchronize the two grids – were unsuccessful because not enough power could be moved over low capacity ties to keep the two systems continuously synchronized. As a result, these low capacity lines at the fringe between the two interconnections would trip open as the frequency of the two systems drifted apart. For this reason, all of the existing ties between the Eastern and Western Interconnections are relatively small back-to-back DC ties. The capacity of these existing ties is based on local needs, not on major movement of energy between the interconnections. With the growing interest in the wind resources of the Great Plains has come a growing interest in increased capacity for energy transactions across the boundaries between the Eastern, Western, and Texas Interconnections. Several study requests were submitted to TEPPC for investigating the increased DC ties or a set of high capacity AC ties to synchronize the two largest systems in North America.

While these are very interesting and appropriate questions for transmission planning, TEPPC felt that they could not be directly accommodated within the 2010 Study Program. Using the existing production cost simulation tools would involve a very large model effort to study a need that has not yet been fully defined. As a result, TEPPC recommended that WECC initiate a scoping study with appropriate Eastern Interconnection parties to evaluate the technical and economic feasibly of increasing DC tie capacity or of implementing high capacity AC ties among the interconnections.

Table 3.5, Eastern to Western Interconnection Studies

Study Requests for Interconnection Studies
Analysis is needed to determine feasible technical options to close the interconnections with AC. Promod studies including the Eastern Interconnection and ERCOT would be premature at this time, not to mention the significant additional modeling such studies would require. The recommendation is for WECC to instigate a scoping study with the other interconnections to determine the technical and economic feasibility, if any, of such studies.

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
N/A	Keres Consulting	AC closure of Eastern and Western Grids		N/A		Multi-Interconnection Scoping Study is recommended - TEPPC and other WECC groups
N/A	SIRPP/Energy Consulting Group LLC	Study the benefits and costs of enhanced ties with the EI for the purpose of exchanging wind resources		N/A		Multi-Interconnection Scoping Study is recommended - TEPPC and other WECC groups
N/A	SPP	Demonstrate benefits of increased capabilities by sharing resources, capturing the diversity benefits of load profiles, effective aggregation and delivery of premium renewable resources to markets by increasing connections between interconnections. Also demonstrate reliability benefits of HVDC facility additions and comparison of wind profiles for the plains with SW solar.		N/A		Multi-Interconnection Scoping Study is recommended - TEPPC and other WECC groups

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
N/A	Keres Consulting	Maximization of the benefit to cost ratio of EHV projects now under consideration as ties between interconnections		N/A		Multi-Interconnection Scoping Study is recommended - TEPPC and other WECC groups
N/A	Keres Consulting	Coordinated development of EHV projects now contemplated to move renewable energy from high plains states to major mid-west and east coast markets		N/A		Multi-Interconnection Scoping Study is recommended - TEPPC and other WECC groups
N/A	Keres Consulting	Consideration of 765 kV as the standard voltage class in lieu of 500 kV for backbone projects between interconnections		N/A		Multi-Interconnection Scoping Study is recommended - TEPPC and other WECC groups

3.6 Other Study Requests

TEPPC received other study requests that did not fit into the 2010 Study Program. These requests are described in Table **3**.**6**. The first two requests on this table ask for studies of 20% and 30% penetration of wind, particularly for identifying resource locations consistent with such a high penetration of renewables. Work done in preparation of the 2029 base case satisfies these needs, so TEPPC will provide the information associated with these studies for use by the requestor.

The third request was for sub-hourly production cost simulation to evaluate load following, balancing, and reserve issues that are associated with the integration of renewable and other intermittent generation. Specifically, the request proposed using a 10-minute time step for simulation of system dispatch. TEPPC's role is focused on transmission expansion issues, while the Variable Generation Subcommittee (VGS) was organized to address these sub-hourly integration issues. TEPPC recommends that the requestors work with the VGS to address these issues.

Finally, there were some study requests that did not involve issues of regional significance, but were either subregional or local in character. These have been referred back to the sub-regions for their consideration.

Table 3.6, Other Study Requests

Portfolio Case Number	Requested By	Resources to be Added	Transmission to be Added	Priority	Est. Sched.	Comments
N/A	NREL/PNNL	Study high wind scenario with 20% penetration by energy to determine impact of increased variability and uncertainty of high penetration wind level.		High	May/ June 2010	Study request is looking for resource locations, not prod/cost modeling. SWG to provide resource locations from 2029 study
N/A	NREL/PNNL	Study high wind scenario with 30% penetration by energy to determine impact of increased variability and uncertainty of high penetration wind level.		High	May/ June 2010	Study request is looking for resource locations, not prod/cost modeling. SWG to provide resource locations from 2029 study
N/A	NTTG PC	Evaluate sub hourly (10 minute)Prod/Cost Model of Spring season with high hydro to evaluate the load following, balancing and reserve issues surrounding integration of renewable and intermittent generation and to improve modeling techniques.		Low		VGS is dealing with subhourly issues. Outside the purview of TEPPC (system congestion and expansion alternatives). Policy Issue for TEPPC.

Appendix – Glossary of TEPPC Terminology

Acronym	Description
AESO	Alberta Electric System Operator
ARRA	American Recovery and Reinvestment Act of 2009
ATC	Available Transmission Capacity or Available Transfer Capability
Bubbles	A set of transmission busses located in a given area and represented in production cost simulation using common load profile characteristics
Buckets	A set of generators represented in production cost simulations with common heat-rate characteristics
CCPG	Colorado Coordinated Planning Group, a subregional transmission planning area within WestConnect
CDEAC	Clean and Diversified Energy Advisory Committee
ColumbiaGrid	A subregional transmission planning group within the Western Interconnection
CSP	Concentrating solar power facilities
DOE	United States Department of Energy
DWG	Data Work Group formed by the TAS
EIA	Energy Information Agency
EPACT	Energy Policy Act of 2005
FERC	Federal Energy Regulatory Commission
GridView	Production cost simulation software provided by ABB
HAWG	Historical Analysis Work Group formed by TAS
Heat Rate	The measure of the thermal efficiency of a generator's ability to convert fuel to electrical energy. The heat rate is equal to the heat value of the fuel measured in BTU required to produce a kilowatt-hour of electric energy.
LBL	Lawrence Berkeley Laboratory
LRS	Loads and Resources Subcommittee of PCC
LSE	Load serving entity
Mesoscale	A classification of meteorological systems with approximate horizontal dimensions for TEPPC purposes from 2 to 10 kilometers.

Acronym	Description
MWG	Modeling Work Group formed by TAS
NEA	New Energy Associates, now called Ventyx
NREL	National Renewable Energy Laboratory of the U. S. Department of Energy
NTTG	Northern Tier Transmission Group, a subregional transmission planning group within the Western Interconnection
OASIS	Open Access Same-time Information System
OATI	Open Access Technology International, Inc.
PCC	Planning Coordination Committee of WECC
PowerBase	A data management tool developed by NEA for use with Promod IV
Portable Data Format	A public format for simulation data using Microsoft Access which was developed to enable use of the TEPPC database by multiple vendors' software products.
PROMOD	Production cost simulation software provided by Ventyx
RMATS	Rocky Mountain Area Transmission Study
Coordinated Project Review Group	A group formed by a project sponsor by inviting participation by any interested WECC member. The group's purpose is to identify opportunities to incorporate multiple interests and needs into a single project.
Coordinated Project Review Report	A report prepared by a project sponsor and submitted to PPC to demonstrate compliance with WECC Regional Planning Guidelines contained in WECC's "Overview of Policies and Procedures for Regional Planning Project Review, Project Rating Review and Progress Reports", as revised April 2005.
RPS	Renewable Portfolio Standard
Sierra Area	A subregional transmission planning area within WestConnect
SCG	SPG Coordination Group
SPG	Subregional Planning Group
SPSC	State-Provincial Steering Committee
SPSG	Scenario Planning Steering Group, a multi-constituency drawn from TEPPC members, governmental representatives, and non-governmental organizations to provide guidance to TEPPC particularly with regard to environmental and policy perspectives.
Synchronized Study	A proposed series of studies jointly developed under the provisions of the TEPPC Transmission Planning Protocol based

Acronym	Description
Program	on consideration and prioritization of all study requests received by transmission providers in a given year, with portions of the study work being designated for completion by TEPPC, subregional planning groups and transmission providers. The Study Program is called a Study Plan in the TEPPC Protocol; the title has been changed here to avoid confusion with transmission plans made up of a series of proposed projects.
SWAT	Southwest Area Transmission, a subregional transmission planning area within WestConnect
SWG	Studies Work Group formed by TAS
SSG-WI	Seams Steering Group-Western Interconnection
TAS	Technical Advisory Subcommittee of TEPPC
TEPPC	Transmission Expansion Planning and Policy Committee of WECC
TEPPC Protocol	The TEPPC Transmission Planning Protocol, a document that describes the transmission planning services to be provided by TEPPC to assist transmission providers in meeting their regional planning obligations under FERC Order No. 890.
TSS	Technical Studies Subcommittee of WECC Planning Coordination Committee
VGS	Variable Generation Subcommittee of WECC
WECC	Western Electricity Coordinating Council
WEIL	Western Electricity Industry Leaders
WREZ	Western Renewable Energy Zone Project of WGA
WestConnect	An organization of utility companies providing transmission service in southwestern United States, which has three subregional planning areas
WestTrans	An OASIS system provided by OATI
WGA	Western Governors Association
WSCC	Western Systems Coordinating Council, 1967-2002 merged with Western Regional Transmission Association and Southwest Regional Transmission Association to form WECC.
WWSIS	Western Wind and Solar Integration Study