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Transmission Planning Process and Opportunities for Utility-Scale Solar Engagement within the Western Electricity Coordinating Council (WECC)

Jeff Hein, David Hurlbut, Michael Milligan, Lynn Coles, and Bruce Green

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Transmission Planning Process and Opportunities for Utility-Scale Solar Engagement within the Western Electricity Coordinating Council (WECC)

Introduction

Pre-emptive intervention by interested stakeholders is the easiest way to remove non-technical market barriers.

Market barriers unrelated to technology often limit the expansion of utility-scale solar power, even in areas with exceptional resource potential. Many of these non-technical barriers have to do with policy, regulation, and planning, and hardly ever do they resolve themselves in a timely fashion. In most cases, pre-emptive intervention by interested stakeholders is the easiest way to remove/address such barriers, but it requires knowing how to navigate the institutional waters of the relevant agencies and boards.

This report is a primer for solar developers who wish to engage directly in expediting the regulatory process and removing market barriers related to policy and planning. It focuses on the Western Interconnection (WI), primarily because the quality of solar resources in the Southwest makes utility-scale concentrating solar power (CSP) and photovoltaics (PV) economically feasible, and because the relevant institutions have evolved in a way that has opened up opportunities for removing non-technical market barriers. Developers will find in this report a high-level field manual to identify the venues for mitigating and possibly eliminating systemic market obstacles and ensuring that the economic playing field is reasonably level.

Project-specific issues such as siting for transmission and generation resources are beyond the scope of this report. Instead, the aim is to examine issues that pervasively affect all utility-scale PV and CSP in the region regardless of where the project may be. While the focus is on the WI, many of the institutions described here also have their counterparts in the Eastern and the Texas interconnections.

Specifically, this report suggests a number of critical engagement points relating to generation and transmission planning. Taking full advantage of these engagement points demands that solar developers and other interested parties understand:

- The importance of sharing appropriate solar resource cost and operational performance data for the modeling and planning efforts in order to ensure the resource is modeled accurately and therefore is not biased against, or handicapped, when compared to other generation resources[1];
- How the industry operates in the Western Interconnection when planning and studying regional generation resources and transmission systems;
- How the solar industry participates in WECC today, who represents the solar industry, and how to interact with WECC in order to maximize benefits given limited amounts of budget and time; and
- The positive role the industry could play in the legislative and regulatory arena to best advocate for the industry at the federal, regional, and local level.

[1] The wind industry's experience has highlighted the importance of sharing accurate, non-proprietary information with system planners to ensure generation costs and performance are modeled accurately in system studies.

In addition to this report, readers are encouraged to review the following fact sheets regarding solar resource integration:

- Electric Market and Utility Operation Terminology (Fact Sheet) - www.solar.energy.gov/pdfs/50169.pdf
- The Importance of Flexible Electricity Supply: Solar Integration Series. 1 of 3 (Brochure) - www.solar.energy.gov/pdfs/50060.pdf
- The Role of Electricity Markets and Market Design in Integrating Solar Generation: Solar Integration Series. 2 of 3 (Brochure)- www.solar.energy.gov/pdfs/50058.pdf
- The Role of Large Balancing Areas In Integrating Solar Generation: Solar Integration Series. 3 of 3 (Brochure)- www.solar.energy.gov/pdfs/50059.pdf

1.0 Today's Electric Power System

The power system comprises four basic components: generation, transmission, distribution, and load (see Figure 1).

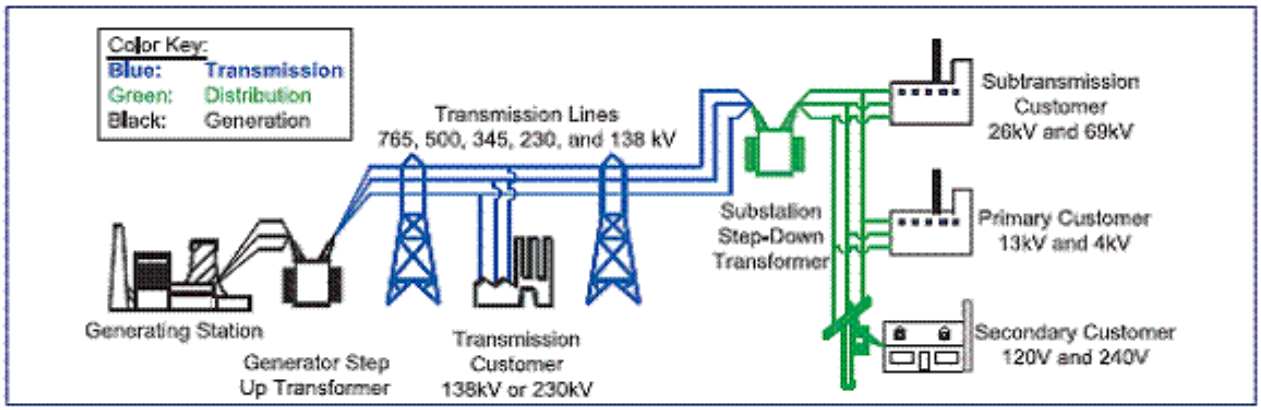

Figure 1 – Simple line drawing of the power system.

Source: North American Electric Reliability Corporation

Today, there are four large geographical areas or "interconnections" that operate as synchronous[2] interconnected systems in the lower 48 states of the United States, Canadian Provinces, and a small northern portion of Mexico (see Figure 2). The Eastern Interconnection, Western Interconnection, and Electric Reliability Council of Texas (ERCOT) are linked with high-voltage direct current (HVDC) back-to-back ties, rather than AC ties.[3] There is a fourth interconnection that links Québec to the Eastern Interconnection, but it's typically considered to be part of the Eastern Interconnection (see Figure 2).

[2] All generators are operating at the same synchronous frequency of 60 Hertz, producing alternating current (AC) electricity.
[3] The reason that back-to-back HVDC ties are used rather than simpler AC connections is a consequence of some rather technical aspects of the operation of large AC power systems, as well as certain aspects of transmission development history.

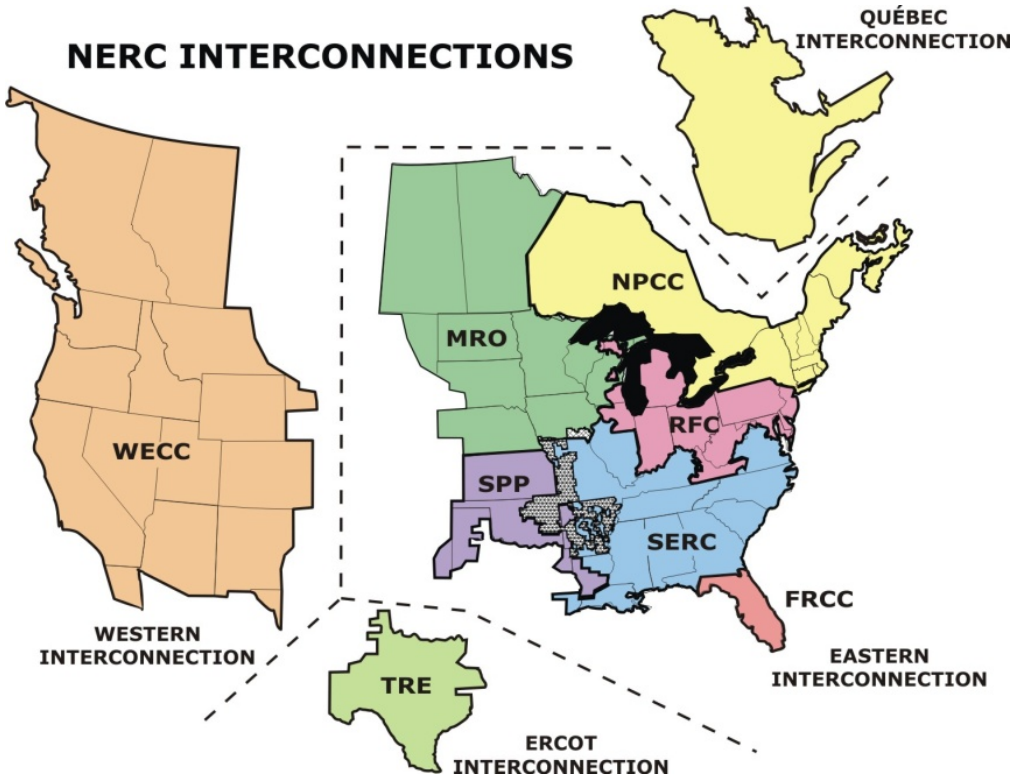

Figure 2 – NERC Interconnections

Source: North American Electric Reliability Corporation

At the national level, the Federal Energy Regulatory Commission (FERC) has regulatory authority over the interstate sale of electricity and operation of regional markets. The North American Electric Reliability Corporation (NERC) has the responsibility, under FERC authority, for more technical issues such as power system reliability, operating, and planning standards in the United States. Every transmission utility in the United States and Canada participates in the NERC reliability assessment process to assure that their transmission and generation systems meet industry standards and will perform reliably. Most of the criteria for transmission planning are based on NERC standards.

The electrical grid was designed to provide reliable power at minimum costs to customers, and this purpose changed very little from the approval of the Federal Power Act in 1935 to the start of power industry restructuring following enactment of the Energy Policy Act of 1992. The standard for approving costs was to ensure "just and reasonable" rates. The dominant business model for the U.S. electric power industry was that of a vertically integrated, investor-owned, and state-regulated local utility monopoly. In addition to the investor-owned utilities, there were (and still are) federal, state, and municipal utilities, and rural cooperatives in operation. Local utility companies and their customers benefited by the economic exchange of electric energy in power pools across regional networks. In a few regions—PJM (Pennsylvania, New Jersey and Maryland), the Midwest (Midwest ISO), New England, and New York—utilities organized into power pools to share savings through cooperation with neighbors. In general, utilities that controlled generation also owned and operated the transmission systems.

The Energy Policy Act of 1992 mandated that transmission owners allow open access to their transmission system. Independent System Operators (ISOs) [4] (Figure 3) grew out of FERC's 1996 Order Nos. 888/889, in which FERC suggested the ISO structure for existing tight power pools[5] to satisfy the requirement of providing non-discriminatory open access to the transmission system. Subsequently, in Order No. 2000, FERC encouraged the voluntary formation of Regional Transmission Organizations (RTOs)[6] to operate the transmission grid on a regional basis throughout North America, (see Figure 3). Order No. 2000 delineated twelve characteristics and functions that an entity must satisfy to become an RTO. In the Eastern Interconnection, the development of RTOs and organized wholesale power markets has transferred a large part of the resource procurement function from state regulation to FERC jurisdiction. Resource use within an RTO is based on regional economic selection using locational marginal pricing (LMP), which is often accompanied by bilateral agreements and special contracts that cover any differences between real-time LMP[7] and long-term contract prices. A state renewable portfolio standard (RPS) can still affect the amount of renewable resources required, but specific resources and the new transmission to connect them to the system are subject to the RTO's FERC-approved tariff.

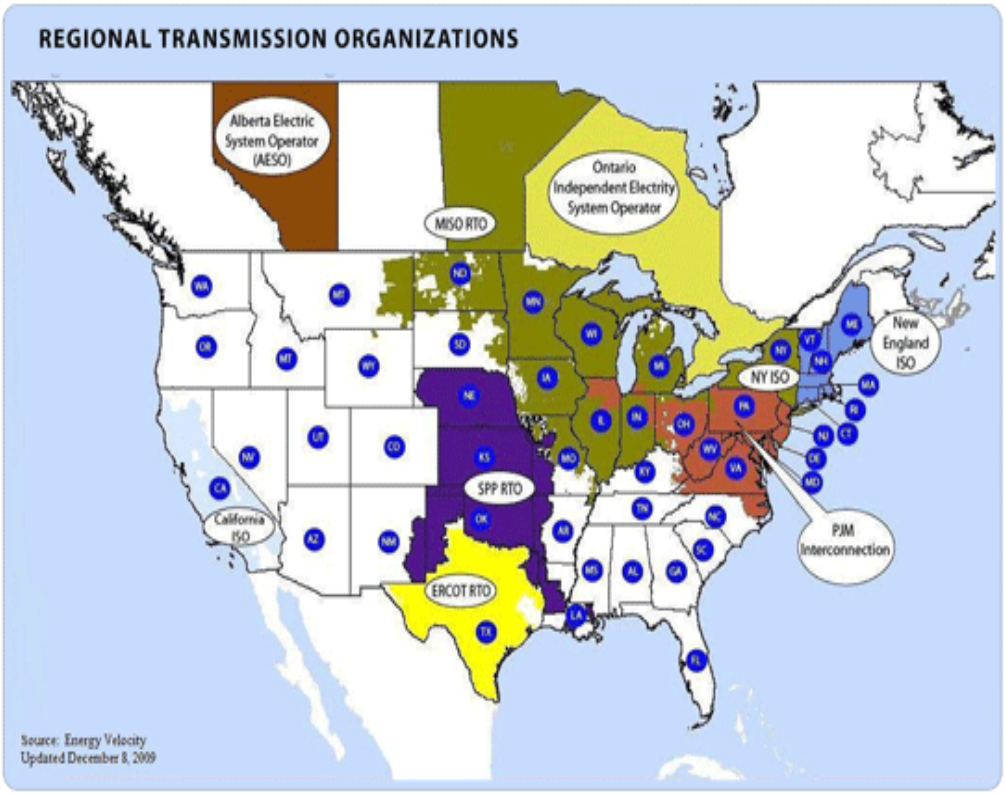

Figure 3 – RTOs and ISOs in North America

[4] Source: http://www.ferc.gov/legal/maj-ord-reg/land-docs/order888.asp.
[5] Tight power pools can be defined as systems with generation resources less than or equal to load.
[6] Source: http://www.ferc.gov/legal/maj-ord-reg/land-docs/RM99-2A.pdf.
[7] Locational marginal pricing (LMP) is a mechanism for using market-based prices for managing transmission congestion. Source: http://www.caiso.com/docs/2004/02/13/2004021316073586 43ex.html

In the WI, two ISOs exist – one each in California and Alberta Province. In states and provinces without these organizations, transmission utilities still operate their own systems within their balancing authority area (BAA) as shown below (see Figure 4)[8].

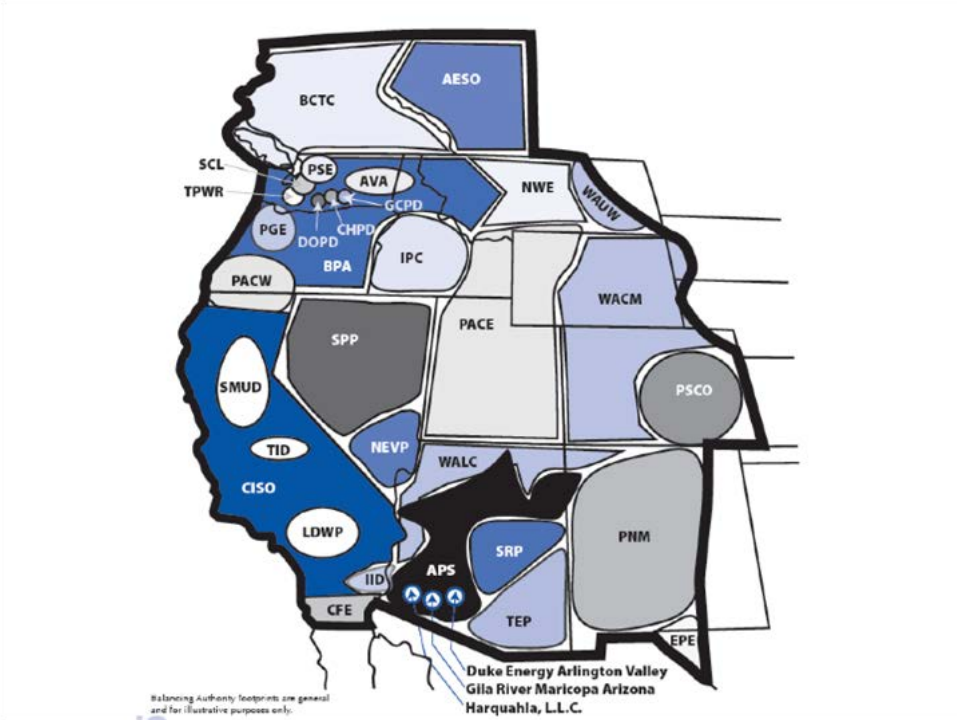

Figure 4 – Balancing Authorities in WECC

Additional efforts are underway in the WI, which attempt to develop collaborative informal institutional arrangements that would support interstate coordination on renewable resource development. The West has a history of informal coordination on multistate transmission planning. An example of this is the Western Renewable Energy Zone (WREZ) initiative of the Western Governors' Association WGA). This initiative is an effort to maximize usage of renewable resources to serve the energy needs of the West. The WREZ allows for a high-level economic analysis of renewable resource development and transmission costs to serve western loads[9]. Not yet tested is whether current informal cooperation will be capable of supporting regional reforms for power system operations or market development.

[8] For more information on BAAs, please refer to (http://www1.eere.energy.gov/solar/pdfs/50059.pdf)
[9] Source: http://www.westgov.org/index.php?option=com_content&view=article&id=219:western-renewable-energy-zones&catid=102&Itemid=81.

2.0 Purpose and Importance of System Planning

Electric power systems are an essential and unique infrastructure upon which our society and our nation's way of life depend. Components of the bulk electric system — which comprises generating stations (i.e., power plants) and high- and extra-high voltage transmission lines — have a typical life span averaging 40-60 years. Today, long distance high-voltage lines are not buried, and are a visible part of the landscape through which they pass. Decisions made today have long-term effects, which is why system planning is so important in maintaining the necessary flexibility required for a reliable and robust transmission system. Therefore, the objective of long-term transmission planning is to make the best network design decisions today after considering possible future needs and generation resource expansion options or scenarios. Few, if any, ten- or twenty-year transmission plans will come to fruition as originally conceived. However, by planning for possible future needs for loads and generation, flexibility is built into the network's design that allows options to be exercised and adaptation to occur as future conditions necessitate.

Transmission planning decisions made today have long-term effects for maintaining the necessary flexibility required for a reliable and robust transmission system.

The importance of transmission planning is well-recognized by industry stakeholders including, but not limited to the U.S. Department of Energy (DOE), FERC, NERC, and the regional entities, transmission providers, generating companies, load serving entities/LSEs (i.e., 'utilities'), regulatory agencies, energy offices, environmental interests, and investors. This is why it is important for the solar industry to engage in this process.

3.0 System Planning in the Western Interconnection

WECC[10] is the regional entity[11] responsible for developing and enforcing transmission reliability standards across the WI, and also oversees the interconnection planning processes[12]. In this role, WECC coordinates and promotes a reliable bulk electric power system within the WI. WECC serves as a regional planning and policy facilitator, and operates using a transparent, stakeholder-driven process to address resource and transmission adequacy, as well as operational and performance issues to ensure reliability.

System planning is no longer exclusively or solely technically driven and performed strictly by utilities.

System planning activities in the WI serve to address the varied needs of stakeholders at all levels regarding the future needs of the transmission system through the Regional Transmission Expansion Planning (RTEP) process and the Transmission Expansion Planning Policy Committee (TEPPC)[13]. The geographic scale of the WI, with its wide diversity in climate,

[10] WECC is comprised of a diverse set of electric industry stakeholders from across the West, including all or parts of 14 U.S. states, Alberta and British Columbia in Canada, and Mexico's Northern Baja. WECC is governed by an independent and balanced stakeholder Board of Directors consisting of 32 directors with representation from seven membership classes. WECC has seven, non-affiliated board members with a variety of skills and backgrounds. http://www.wecc.biz/About/Pages/default.aspx.

[11] Source: WECC Governance Document, Delegation Agreement http://www.wecc.biz/library/WECC%20Documents/Business%20and%20Governance%20Documents/Delegation%20Agreement%20-%20Filing%203.pdf

[12] The WECC Board provides the approval authority for the TEPPC Study Program.

[13] The TEPPC oversees the planning process in the WI, and the RTEP process expands the TEPPC planning process to include interconnection-wide studies.

consumer demographics, and resource concentration requires a division of planning duties. These activities are divided by geographic reach and by planning time horizons, as discussed in greater detail in Section 3.2.2

Additionally, performance of and engagement in these WI transmission planning efforts involve many key entities and stakeholders, organized within technical workgroups and policy workgroups. The technically driven entities include individual transmission owners, Subregional Planning Groups (SPG), and the SPG Coordination Group (SCG). The policy-driven entities include the Scenario Planning Steering Group (SPSG) and the State/Provincial Steering Committee (SPSC). These entities coordinate with WECC to ensure coordination at both the sub-regional and interconnection-wide levels. Each group or entity, shown in table 1 below, is discussed in more detail in Section 3.1. Each of these entities serves a specific purpose, with some addressing technical issues and others addressing policy issues.

WECC-TEPPC
Planning, Policy, and Advisory Groups
Subregional Planning Groups (SPG),
SPG Coordination Group (SCG).
Scenario Planning Steering Group (SPSG)
State/Provincial Steering Committee (SPSC)
Technical Advisory Subcommittee (TAS)

Table 1 – WECC planning, policy and advisory groups.

System planning is no longer exclusively or solely technically driven and performed strictly by utilities. Rather, it has developed into a planning process that includes, to some extent, all industry stakeholders, including, but not limited to, electric energy policy makers, resource developers, transmission developers, environmentalists, and numerous others.

3.1 Stakeholder Process

For more than a decade, the WI has fostered and institutionalized stakeholder-driven initiatives for undertaking transmission expansion planning. The myriad collaborative processes and regional stakeholder groups provide a transparent and sound foundation for the 10- and 20-Year Plans. Although no entity in the WI has the sole authority or responsibility to implement the plans, this does not inhibit the plan's development as a consensus-based, valuable, regional reference document for policymakers, stakeholders, and implementers. The plan accommodates the evolution of new ideas, while still forecasting a reasonable expectation of the future transmission system. Developers may find it beneficial to engage in this process to ensure accurate data is included, including modeling data, planning assumptions, etc.

Load Serving Entities (Local) Planning

LSEs[14] provide local planning activities to ensure reliable service and address stakeholder concerns, and study interconnection requests in accordance with policy/legislative directives, such as RPS statutes. Activities must be compliant with FERC Order 890[15] and Attachment K where applicable. This is another forum for solar developer engagement in the planning process.

Additionally, DOE has two Power Marketing Administrations in the WI; the Western Area Power Administration[16] and the Bonneville Power Administration[17]. These two entities deliver hydro-power to mainly public power customers across the interconnection.

Construction of transmission facilities are introduced into the regulatory review and approval process by each local utility or independent transmission company after the system planning process is complete. When approved, these transmission plans enter the construction phase followed by placing the facility into service – energization.

Subregional Planning Activities - Subregional Planning Groups

Subregional planning groups develop subregional transmission plans for the geographic area they represent as shown in Figure 5 below. These groups consist of Load Serving Entities, transmission owners, rural utility service providers, and industry stakeholders. Each SPG operates under its own charter, covers a geographical region (see Figure 5) within the WECC to address transmission issues and develop transmission plans within the region for inclusion into the planning process. The SPGs provide a forum for input to the transmission planning process for all stakeholders.

[14] Load serving entities secure energy and transmission services (and related interconnected operations services) to serve the electrical demand and energy requirements of its customers. http://www.nerc.com/files/Glossary_12Feb08.pdf.

[15] Source: FERC Order 890, Assuring Open Access to Transmission Tariff (OATT) and Transparent Planning, http://www.ferc.gov/industries/electric/indus-act/oatt-reform.asp

[16] http://www.wapa.gov/about/default.htm

[17] http://www.bpa.gov/corporate/

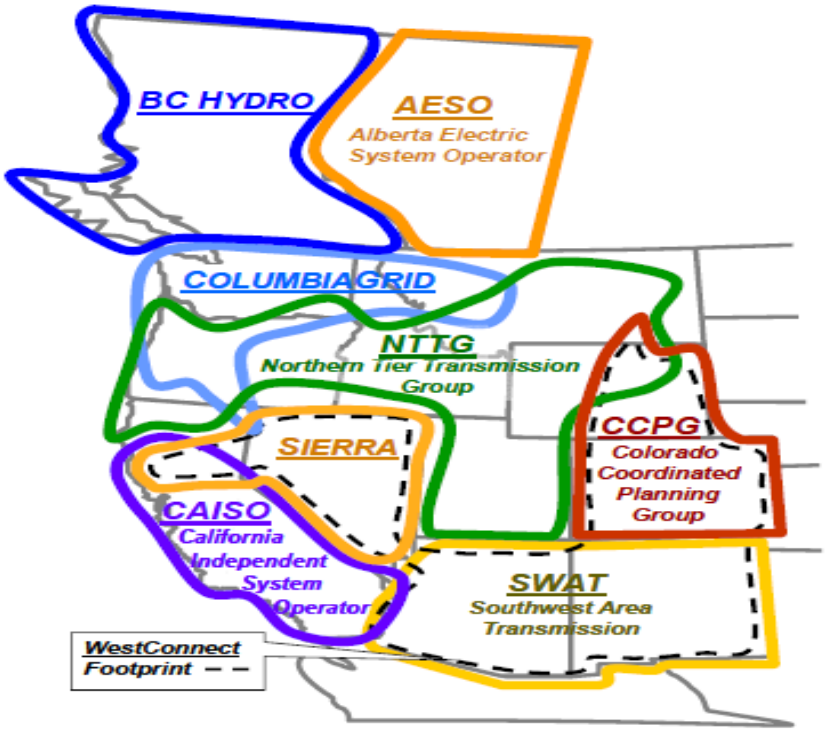

Figure 5 – Geographic Footprint of SPGs

The Subregional Coordination Group is made up of a member from each Subregional Planning Group. The purpose of the group is to coordinate planning activities between each other and TEPPC[18]. This group develops the foundational transmission plan, with stakeholder input, which serves as the starting point showing minimum additional transmission additions within the western interconnection for analyzing future 10-year study cases. This process organizes and coordinates issues that reach across the regional boundaries to cover the entire interconnection.[19]

Scenario Planning Steering Group (SPSG)

The SPSG provides guidance to TEPPC on (1) scenarios to be modeled in planning studies, (2) the modeling tools to be used, (3) key assumptions and processes to be used in creating the scenarios, and (4) review of study results. The SPSG consists of typical representation from across the industry, but also non-typical stakeholders such as non-governmental organizations (NGOs)[20].

This group will have a key role in developing screening methods and data for evaluation of transmission projects and solutions. It will actively develop the framework for the TEPPC 10-year Plan ("the Plan"), described later in this document, and provide comment/input on the Plan contents. This group's activities are part of the DOE-funded Regional Transmission Expansion Planning (RTEP) project.

[18] Source: http://www.wecc.biz/committees/BOD/TEPPC/SCG/default.aspx.
[19] The DOE grant supports state participation in the activities of the SPGs through the SPSC.
[20] For more information on SPSG members and role(s) please see: http://www.wecc.biz/committees/BOD/TEPPC/SPSG/default.aspx.

State-Provincial Steering Committee (SPSC)

This group was created to assure communication of state and provincial governments' input into (1) the Plan, (2) efficient utilization of the existing grid, and (3) integration of variable, renewable resources. This group consists of appointees from each state and province in the interconnection, and one-third of the membership[21] is comprised of various advocacy groups (e.g., solar community) whom directly participate in the organization and its work groups.

Western Interstate Energy Board (WIEB)

The WIEB has a similar role to the planning process as the SPSC, while also serving as the energy arm of the Western Governors' Association. This organization is comprised of representation from 12 western states and three western Canadian provinces. The purpose of this body is to provide the instruments and framework for cooperative state efforts to "enhance the economy of the West and contribute to the well-being of the region's people." WIEB seeks to achieve this through cooperative efforts among member states/provinces, and with the federal government[22].

Federal Agencies

There is significant engagement by DOE (Office of Electricity and Energy Reliability, and Energy Efficiency and Renewable Energy), FERC, the U.S. Department of the Interior (DOI), and the U.S. Department of Agriculture (USDA) participation in planning activities through *ex officio* positions on the Scenario Planning Steering Group. The EERE Wind and Solar Programs have a critical stake in transmission planning activities, as exemplified by the 20% wind scenario and Sunshot initiative. DOE funds a significant portion of the planning activities in the West through a grant to the Western Electricity Coordinating Council. Accordingly, the 10-year plan will be filed with DOE to meet the terms of the grant which requires biennial plan submittals.

Transmission Expansion Planning Policy Committee (TEPPC)

The goal of TEPPC's transmission expansion and utilization studies is to provide economic expansion and utilization information vital to understanding future transmission needs and to meet the needs of the WI[23]. This information is useful to transmission project developers, energy resource developers, energy service providers, regulators, and other parties involved in making public policy and investment decisions that are affected by transmission system expansion.

TEPPC comprises 18 members selected for expertise, geographic diversity, and stakeholder representation; as well as a Technical Advisory Subcommittee (TAS), workgroups, and designated WECC staff. These units work in concert to perform analysis and to help stakeholders to engage in planning processes.

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[21] For a complete member list, please see: http://www.westgov.org/sptsc/site/members.htm.

[22] Much of WIEB's work is conducted through committees. Its Committee on Regional Electric Power Cooperation (CREPC) consists of the public utility commissions, energy agencies, and facility siting agencies in the western electricity grid's western states and Canadian provinces. WIEB staff and CREPC members participate actively in TEPPC activities.

[23] According to WECC, "TEPPC's work compliments and coordinates with other transmission planning-related activities. These include state and provincial integrated resource planning (IRP), the western state's climate initiatives, state and provincial renewable portfolio standards (RPS), analyses of renewables integration by the National Renewable Energy Laboratory (NREL), the Western Electricity Industry Leaders (WEIL) studies, the WREZ initiative of the WGA, and involvement of industry stakeholders such as resource developers and others."

TEPPC's activities are vital to WECC's overall approach of addressing two issues: *system reliability* and *system congestion.* The first, system reliability, is "characterized as keeping the lights on while responding in a predictable fashion to both planned and unplanned outages in generation and transmission," according to WECC's TEPPC Study Program document[24]. The second, system congestion, is "a measure of the economic performance of the transmission system."[25] 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?" Also included within the TEPPC process is a third consideration including assessment of state, regional, and federal energy policy impact(s) to the bulk electric system when analyzing the transmission system plan for proposed expansion.[26]

TEPPC is responsible for system planning in the WI in accordance with FERC Order 890.[27] TEPPC membership includes representatives from WECC. Additionally, in accordance with the terms of the DOE grant, the TEPPC 10-Year Regional Transmission Plan will be delivered to DOE in September 2011 and updated in September 2013. The 20-year plan is due December 2013. TEPPC's role is to ensure the creation of the 10-Year Regional Transmission Plan and to recommend that 10-Year Plan ('the Plan') to the WECC Board for approval. The Plan will not make recommendations for specific transmission or generation projects and industry energy policy.[28]

As stated before, the TEPPC planning process' objective is a reliable bulk-power system serving needs 10 and 20 years into the future. This task is a daunting analytical approach, requiring extensive study of load growth, generation, transmission, and industry regulations and policies. This process is complex, and consists of high-level studies based on detailed modeling assumptions and data.

This study process includes acquiring system data, making modeling and study assumptions, and presenting results. TEPPC identifies nine steps[29] that "constitute the analytic approach:

1. Acquire data, tools, and abilities;
2. Determine the overarching goal(s) of the Plan;
3. Develop Plan assumptions;
4. Characterize issues and key questions;
5. Conduct analytic work;
6. Organize results, determine relationships, and identify problems;
7. Determine potential solutions to identified problems;

[24] Interconnection reliability studies on transmission plans are performed consistent with NERC and WECC reliability standards.
[25] System congestion results when transmission service is oversubscribed – design MW capacity fully subscribed – which results in higher energy prices. Congestion studies are performed to determine economic impacts on energy costs resulting from planned transmission additions.
[26] Energy policy is considered primarily during the long-term scenario planning process addressed in the 20-year time frame studies activities for the WI.
[27] Transmission owners and/or operators meet their Order 890 planning requirements with respect to their SPGs and TEPPC through their Attachment Ks to their OATTs. SPGs interact with TEPPC according to their charters. Source: http://www.ferc.gov/industries/electric/indus-act/oatt-reform.asp.
[28] The Plan may provide insight as to how energy policies may shape the Plan.
[29] Please see TEPPC 10-Year Plan Whitepaper for a detailed discussion.

8. Evaluate proposed solutions for possible reliability implications, environmental attributes, cost impacts, and policy achievement; and
9. Craft a set of recommendations."

Regional Transmission Expansion Planning

Regional transmission expansion planning is managed by TEPPC and addresses three time horizons: "the **near-term** and historical evaluation of congestion; **medium-term** congestion studies with development of a 10-year plan; and **long-term** studies with development of a 20-year plan."[30]

In recent years, TEPPC planning processes have expanded to satisfy the terms of a 2009 grant[31] to WECC from DOE. Specifically, WECC studies now include the development of 10-year and 20-year interconnection-wide transmission plans, with input from a multi-constituency steering group.

Given the long lead time to plan and energize a transmission line (7–9 years), the 10-year and 20-year studies and plans address different issues. The 10-year plan, typically a 'bottom-up' approach, studies capacity additions of planned projects and those under construction. The 20-year studies are typically top-down in nature and analyze long-term capacity requirements under various scenarios, which inform decisions needed today that address the future scenarios studied. These two studies are not independent of each other because the 20-year plan includes the contents of the 10-year plan, the 20-year plan then informs subsequent 10-year plans, and this 10-year plan then 'fine tunes' the subsequent 20-year plan, adjusting for corrections to study assumptions based on reality.

In addition to the activities conducted by TEPPC, other regional planning activities are performed by the WECC Planning Coordination Committee (PCC), Loads and Resources Subcommittee (LRS), and Variable Generation Subcommittee (VGS). These planning activities include resource adequacy forecasts, project coordination and path rating reviews, and variable generation integration analysis[32].

3.2 WECC 10-Year Regional Transmission Plan

The creation of the Plan is a bottom-up process that incorporates coordinated input assumptions from other "layers" of planning, flowing up from the LSEs (transmission providers/operators) and their customers, to the SPG, then on to TEPPC as shown below (see Figure 6).

[30] Source: http://www.wecc.biz/committees/BOD/TEPPC/Shared%20Documents/Annual%20Study%20Programs/2010/2010%20TEPPC%20Study%20Program.pdf.

[31] This grant resulted from Funding Opportunity Announcement (FOA) DE-FOA0000068 to implement provisions in Title IV of the American Recovery and Reinvestment Act of 2009 (ARRA). Source: http://www.wecc.biz/Planning/stimulus/default.aspx.

[32] Source: http://www.wecc.biz/committees/BOD/TEPPC/default.aspx.

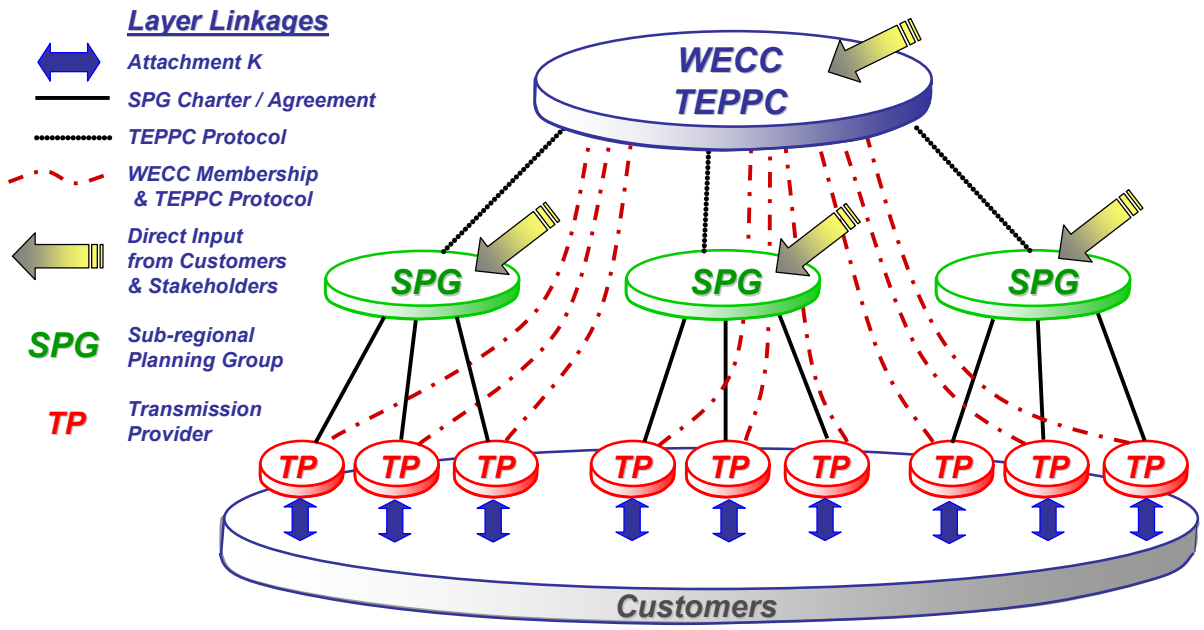

Figure 6 – WECC/TEPPC Study Layers

TEPPC has four main functions[33]:

- *Oversee and maintain a public database for production cost and related analysis;*
- *Develop and implement interconnection-wide expansion planning processes in coordination with the PCC, other WECC committees, SPGs, and other stakeholders;*
- *Guide and improve the economic analysis and modeling of the WI and conduct transmission studies; and*
- *Prepare interconnection-wide transmission plans consistent with applicable NERC and WECC reliability standards.*

TEPPC comprises 18 members selected for expertise, geographic diversity, and stakeholder representation; as well as a Technical Advisory Subcommittee (TAS), workgroups, and designated WECC staff. These units work in concert to perform analysis and to help stakeholders to engage in planning processes.

The TEPPC 10-Year Plan will have the following components: (1) a year 2020 bulk power-system model, (2) analyses of stakeholder-provided scenarios, (3) a feasibility assessment of a future system model and scenarios[34], and (4) recommendations based on study results and stakeholder discussion[35].

[33] Source: WECC 10-Year Regional Transmission Plan Whitepaper http://www.wecc.biz/committees/BOD/TEPPC/Shared%20Documents/10-year%20transmission%20plan%20whitepaper%20-%20final%20(4.1).pdf

[34] Scenarios may address issues such as impact of industry policies, and environmental issues.

[35] For more detailed information regarding the Plan, please reference the TEPPC Whitepaper December 21, 2010.

The TEPPC 10-Year Plan is developed biennially, starting in 2011. The study program's development process includes input from stakeholders and may seem complex in writing, but is clarified when presented graphically (see Figure 7)[36]. This graphic highlights where industry stakeholders give input to the study program planning process – of specific interest to solar developers.

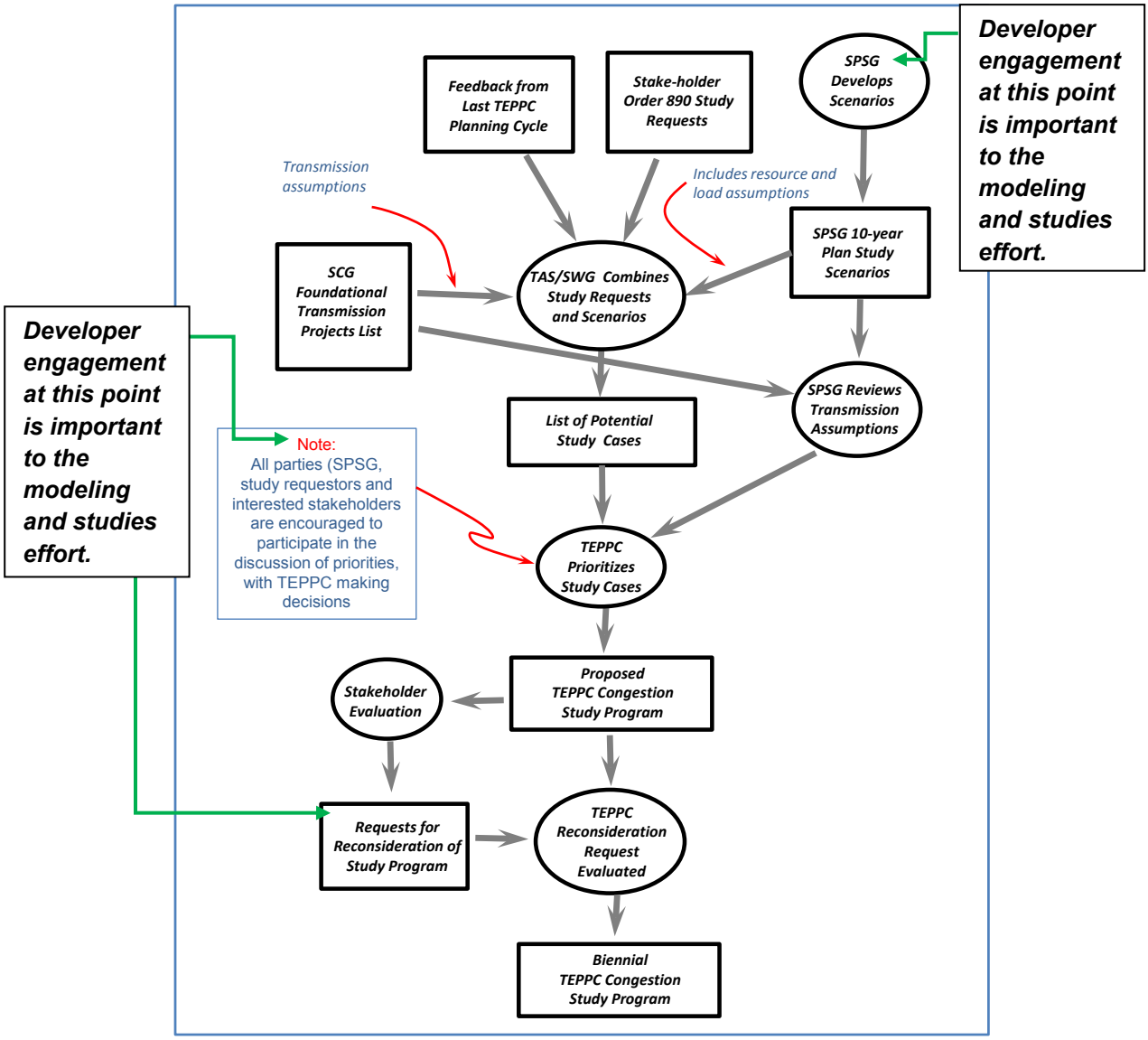

Figure 7 – Biennial TEPPC Congestion Study Program Planning Process

This process provides an opportunity for solar resource developers, and/or industry representatives, to engage in this process to ensure that proper resource data (cost, capacity factor, operational characteristics, etc.) are represented in the model. If this foundational modeling data is incorrect, results of the analysis will be incorrect and could be misinterpreted and misapplied when key resource planning decisions and selections are made.

[36] Source: 2010 TEPPC Study Program, April 26, 2010.

As would be expected, significant amounts of stakeholder information is exchanged in this process. This information is used to model, initiate, conduct, analyze, and make presentations of the TEPPC 10-Year Plan study results. This flow of information follows the process shown in Figure 8[37].

The Plan includes a system congestion analysis of transmission projects to assess the economic benefits of system expansion using production-cost modeling. The production cost modeling is performed with reliability criteria in place in order to model real system operational economic benefits and potential impacts of energy policy driven system expansion. The Technical Studies Subcommittee perform the traditional reliability studies such as load flow, stability, transients, and short circuit. There is some coordination between these two activities with more coordination occurring on a going-forward basis.

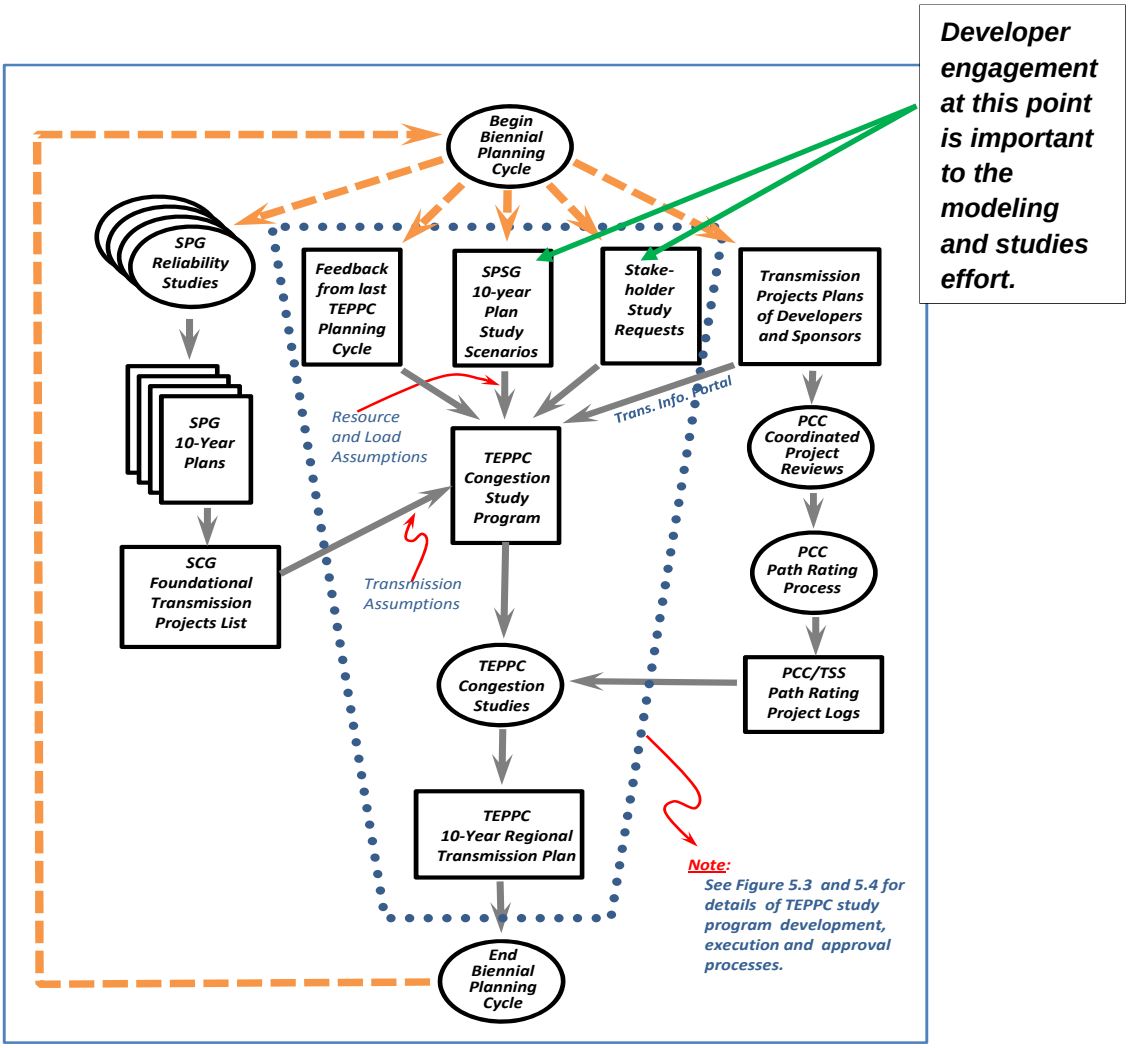

Figure 8 – Information Flow and Development Diagram for 10-year Plan

[37] Source: 2010 TEPPC Study Program, April 26, 2010.

Solar resource stakeholder engagement is necessary to ensure proper resource characterization data (i.e., cost, capacity factor, operational characteristics, etc.) are represented in the model. If this foundational modeling data is incorrect, results of the analysis will be incorrect and could be misinterpreted and misapplied when key resource planning decisions and selections are made.

The Plan is designed specifically to provide high-quality, stakeholder-driven integrated analyses that are internally consistent and reflect statutory requirements. It also provides information on the expected future state of the WI, and what interconnection-wide transmission capacity or other transmission solutions may be needed under a variety of future scenarios. The plan will help guide decision-makers on whether and when to build a transmission line or take other related actions.

Each of the organizations previously mentioned in section 3.1 has unique responsibilities, but share a duty to ensure robust stakeholder input for the plan. Figure 9 below[38] describes the processes and roles of the individual organizations.

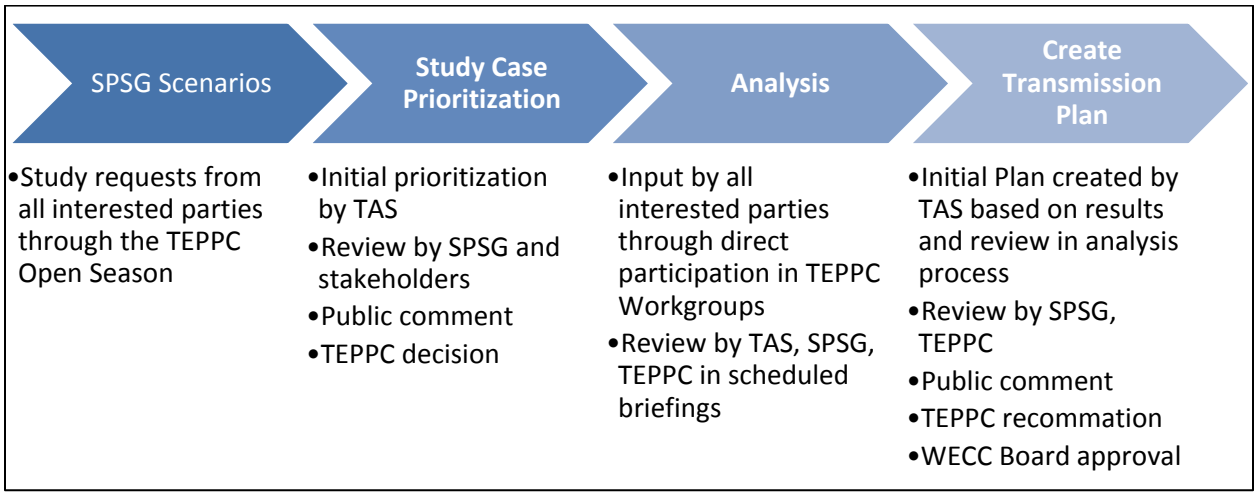

Figure 9 – Stakeholder Roles in Developing and Approving the Plan

3.3 WECC 20-Year Regional Transmission Plan

In accordance with the terms of the DOE grant, the 20-Year Regional Transmission Plan ("20-Year Plan") will be delivered in December 2013. The 20-Year Plan builds on the 10-Year Plan and will be based on a broad set of realistic scenarios developed by the SPSG. Development of the scenarios began in December 2010 and will be based on multiple societal, technical, and political drivers regarding electricity generation and usage, as shown in Figure 10[39].

[38] Source: WECC 10-Year Regional Plan Whitepaper, December 21, 2010.
[39] Source: http://www.wecc.biz/committees/BOD/TEPPC/04262010/default.aspx?InstanceID=1.

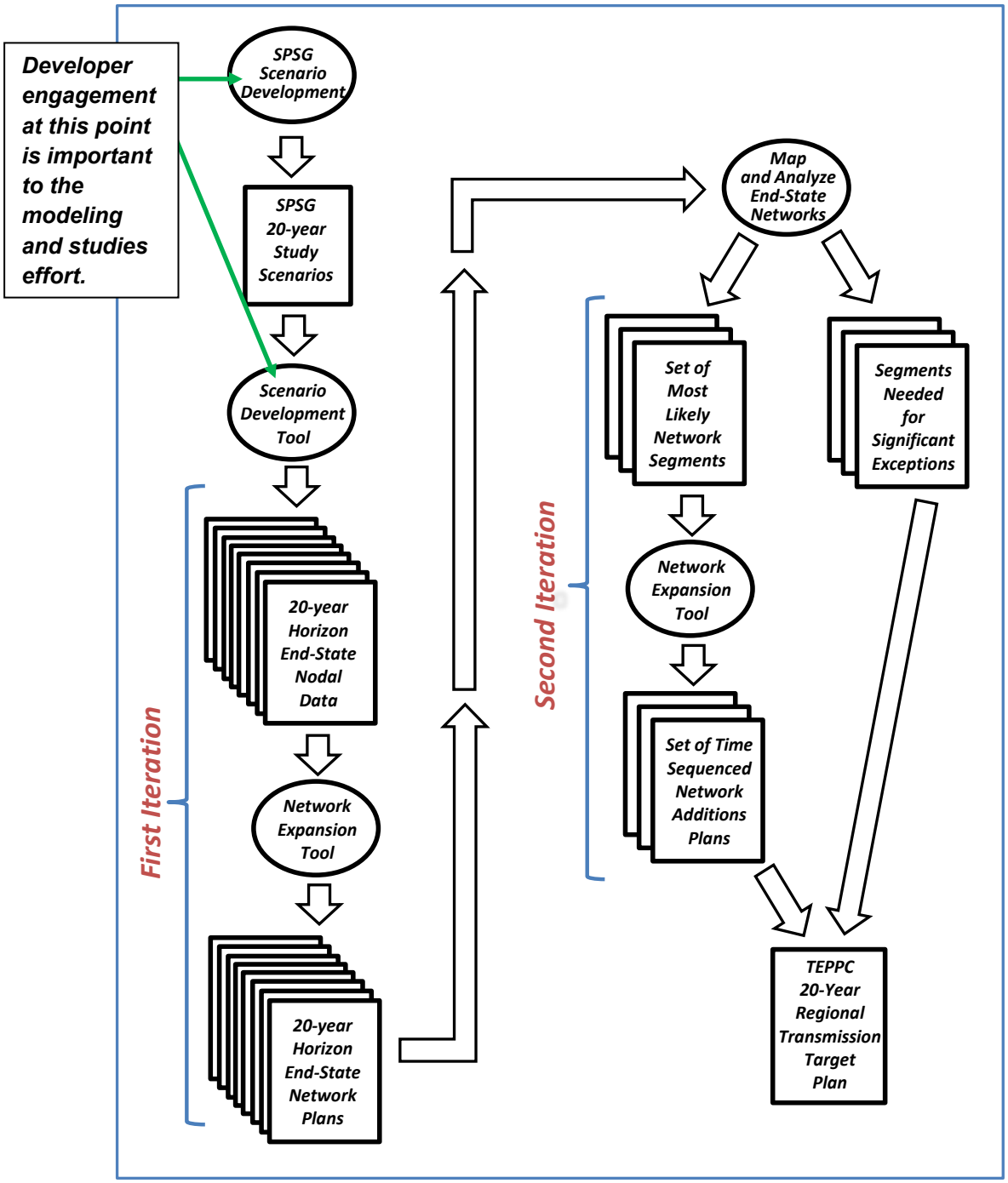

Figure 10 – 20-Year Plan Development Process

3.4 Transmission Project Funding and Construction

WECC does not have the authority to order that transmission lines be constructed. Nor does it have any siting, permitting, or cost allocation authority. It is up to decision-makers at all levels (i.e., utilities, developers, state regulators, siting agencies, and financiers) to determine what and where transmission is built. Funding mechanisms for transmission projects vary and consist of the following:

1. Traditional utility rate-base,
2. Anchor-Tenant utilizing open-season auctions for line capacity (Zephyr Transmission Project),
3. Broad system improvements (Tehachapi in California, and Highway/Byway in the Southwest Power Pool)
4. Real Estate Investment Trust (Sharyland Utilities in Texas)

The actual construction of transmission facilities is the responsibility of the utilities and transmission developers. Projects are introduced into the regulatory review and approval process by each local utility or independent transmission company after the system planning process is complete. When approved, these transmission plans enter the construction phase followed by placing the transmission facility into service by energizing the line.

4.0 Legislative and Regulatory Oversight and Approval

This section informs the reader about how industry oversight is performed and how to actively participate in this process.

Once the transmission plans are developed, the approval and siting process for commercial transmission assets begins. Many entities may be engaged in this process including resource developers, transmission owners/operators, federal regulators, state regulators, state county commissions, federal and state land agencies, environmental advocates, consumer advocates, and health agencies, among others. This process entails significant jurisdictional challenges, which can often lead to federal or state judicial review of planned transmission assets.

This section reviews the legislative and regulatory oversight of the electric utility industry, including a description of the roles of DOE, FERC, NERC, and state public utilities commissions (PUCs). The intent of this section is to inform the reader about how industry oversight is performed and how to actively participate in certain venues where specific solar resources and transmission projects are introduced and approved.

Today, the industry operates under a myriad of statutes[40] which include the system reliability oversight provisions of the Energy Policy Act of 2005 (EPAct 2005). For the purposes of this paper, electric utility industry regulatory oversight can be separated into three main categories: interstate electricity sales, bulk electric system reliability, and physical construction of facilities. FERC oversees interstate electricity sales, NERC oversees bulk electric system reliability, and state PUCs oversee physical construction of facilities.

4.1 Role of FERC and DOE

FERC is an independent regulatory agency within DOE, charged with regulating interstate electricity sales and wholesale electricity rates, as well as for other energy-related issues outside the scope of this document. EPAct 2005 significantly expanded FERC's authority to include:

- Imposing mandatory reliability standards on the bulk electric system and penalties for violations;

[40] Other statutes include Federal Power Act, Public Utility Regulatory Policies Act, Public Utility Holding Company Act, to name several.

- Monitoring, investigating, and imposing penalties on entities that manipulate the electricity markets; and
- Regulating the transmission and wholesale sale of electricity in interstate commerce.

FERC hears cases related to these issues and renders decisions, which often have implications for future cases. FERC decisions are only subject to federal judicial review, not executive or legislative review. However, DOE may intervene in cases before FERC just like any other party to these proceedings.

FERC also issues orders dictating industry policy through rules that impact how the industry is organized and operated. In general, orders are initiated through the issuance of Notice of Proposed Rulemaking (NOPR), followed by comments submitted to FERC by parties to the proceeding, and finalized by FERC after reviewing comments. Landmark FERC orders address issues such as:

- Open access to transmission, creation of RTOs, ISOs, and transparency to stakeholders;
- Large and small generator interconnection standards;
- Standards of conduct, which allow for true 20 to 40-year Integrated Resource Plans, which coordinate planning activities between transmission and generation functions; and
- Cost allocation and integration of variable energy resources and sub-hourly transmission scheduling.

4.2 Role of NERC and Reliability Entities

NERC is a non-profit corporation, formed in 2006 as the successor to the North American Electric Reliability Council, which seeks to "ensure that the bulk power system in North America is reliable." NERC's major responsibilities include, among others, working with electric industry stakeholders to develop standards for power system planning and operation, monitoring and enforcing compliance with reliability standards, assessing resource adequacy, and educational and training resources.

NERC is organized in a complex committee structure that brings together hundreds of industry expert volunteers in nearly 50 committees, sub-committees, task forces, and working groups, all of which consider issues such as renewable power integration, education, demand-side management, and energy efficiency. Pursuant to EPAct 2005, FERC designated NERC as the entity responsible for developing and enforcing compliance with mandatory reliability standards in the United States.[41]

As illustrated and listed below, NERC oversees and works with eight regional entities to improve the reliability of the bulk power system. The members of these regional entities come from all segments of the electric industry: investor-owned utilities, federal power agencies, rural electric cooperatives, state, municipal, and provincial utilities, independent power producers, power marketers, and end-use customers. These entities ensure the reliability of virtually all the electricity supplied in the United States, Canada, and a portion of Baja California in Mexico.

[41] Previous reliability standards were voluntary and NERC had no fining authority to enforce compliance.

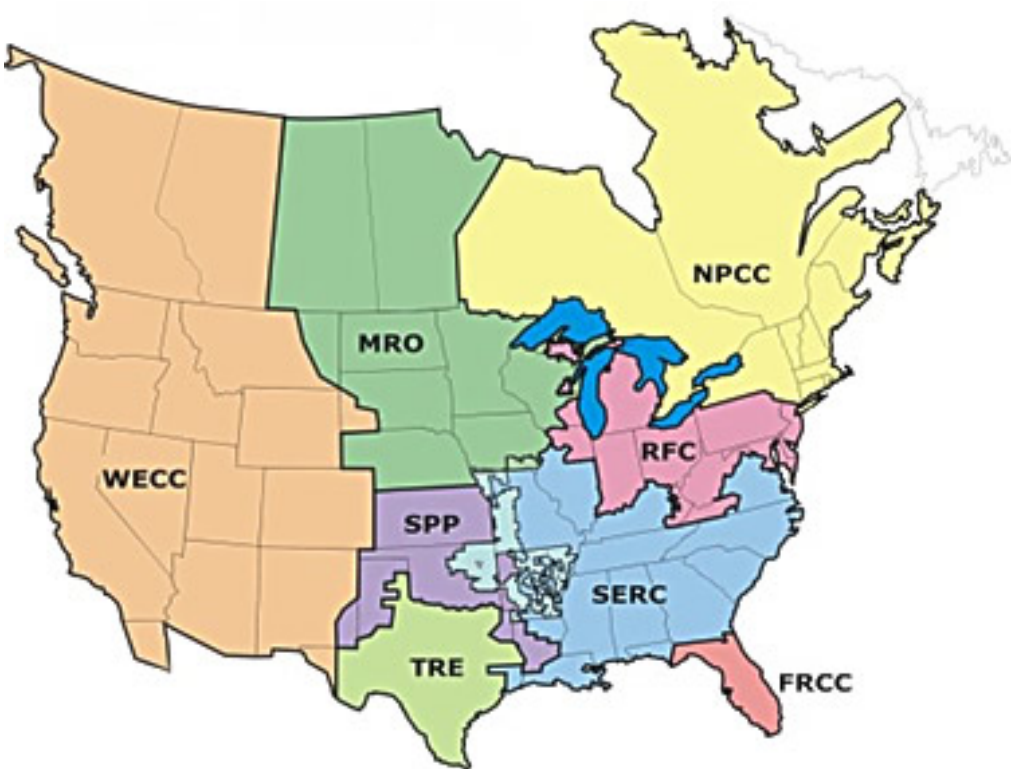

Figure 11- NERC and Regional Entities

Source: North American Electric Reliability Corporation

The regional entities are:

- Florida Reliability Coordinating Council (FRCC)
- Midwest Reliability Organization (MRO)
- Northeast Power Coordinating Council (NPCC)
- Reliability*First* Corporation (RFC)
- SERC Reliability Corporation (SERC)
- Southwest Power Pool, RE (SPP)
- Texas Reliability Entity (TRE)
- Western Electricity Coordinating Council (WECC)

4.3 Role of State Legislatures and Public Utilities Commissions

Each state has a PUC charged with regulating in-state investor-owned electric utilities, and depending on jurisdiction, municipal utilities, rural electric cooperatives, and other electricity generators.[42] Each state has unique statutes and PUC rules, many of which cover various aspects of the electric system, including integrated resource planning, determination of need, siting, construction, and operation of generation and transmission assets, and rates, among others[43].

[42] Not all utilities are regulated by PUCs — depending on state jurisdiction, municipally-owned utilities, rural electric cooperatives, and other generators may not be subject to regulation. Additionally, the federal government's power marketing administrations are exempt from state regulation.

[43] Siting methods and responsibility vary by state. This is a significant problem when trying to site interstate transmission projects.

State legislatures may also pass legislation mandating a RPS, addressing transmission expansion issues by enabling additional PUC oversight, or addressing other pressing issues.

PUCs review and address issues within their purview through dockets brought before the commission. Similar to FERC, parties may intervene in a docket or proceeding and provide input to the commission in an attempt to persuade decision making in their favor.

5.0 Conclusions and Recommendations

The purpose of this report was to inform solar resource developers of the mechanisms for engaging in energy resource development discussions nationally, with a particular emphasis on the West. This report has sought to inform the reader, at a high level, on the various transmission planning processes and efforts underway and the legislative and regulatory oversight in the WI to allow for an optimized integration of utility-scale concentrating solar power (CSP) and photovoltaic (PV) power plants in the West[44].

Specifically, this report encourages the following:

- Improved sharing of appropriate solar resource cost and operational performance data for the modeling and planning efforts to ensure that the resource is modeled accurately and therefore is not biased against, or handicapped, when compared to other generation resources[45].

- Continued and expanded engagement in the WI regarding planning and studying regional generation resources and transmission systems.

- A continued and expanded role in engaging with legislators and regulators at the federal, state, and local levels to best inform policy and program decisions as they pertain to the development of solar energy resources in the West.

[44] Although this report concentrates on the western United States, utility-scale PV is planned for the Eastern Interconnection in Florida and Ohio as two examples elsewhere.
[45] The wind industry experienced this at first and then realized they must share more accurate, non-business sensitive information was provide to system planners in order to ensure wind generation costs and performance were modeled accurately.

Appendix A - Industry References

This section includes a list of references that should prove useful to the solar resource development community.

http://www.wecc.biz/Pages/Default.aspx

http://www.nerc.com/

http://www.ferc.gov/

http://www.energy.gov/

http://www.eere.energy.gov/

http://www.eia.doe.gov/

http://www.westgov.org/

http://www.westgov.org/wieb/

http://www.westgov.org/initiatives/energy

http://www.westgov.org/index.php?option=com_content&view=article&id=219:western-renewable-energy-zones&catid=102&Itemid=81

http://www.westgov.org/sptsc/index.htm

http://www.westconnect.com/

http://www.dsireusa.org/summarymaps/index.cfm?ee=1&RE=1

http://www.interwest.org/

http://www.ncsl.org/

http://www.naruc.org/

http://votesolar.org/ (present industry representative participating in WECC planning)

http://www.largescalesolar.org/

Appendix B – Glossary of WECC TEPPC Terminology

(from TEPPC 2010 Study Plan)

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.
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
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