MEMORANDUM

TO: State-Provincial Steering Committee (SPSC)

FROM: Thomas Carr, Steve Ellenbecker, and Doug Larson

DATE: December 20, 2010

SUBJECT: Potential 2011 SPSC Study Requests to TEPPC

The State-Provincial Steering Committee (SPSC) will consider a new round of potential 2011 study requests to WECC's Transmission Expansion Planning Policy Committee (TEPPC) at the upcoming January 11-12 meeting in San Diego. The SPSC discussed some preliminary topic ideas at the SPSC meeting September 14-15 in Salt Lake City. Staff held a webinar on December 14 that identified nine candidate study requests. This memorandum summarizes the nine potential requests, elaborates on the strengths or weak points of requests, and solicits SPSC member feedback on the priority rankings of our list of candidates.

The December 14 webinar set forth the following schedule and process for SPSC consideration of the potential 2011 study requests.

- Jan. 3 SPSC member input due
- Jan. 6 staff distributes draft text of study requests
- Jan 11-12 SPSC meeting and approval of study requests (final topics and scope, draft text)
- Jan 31 deadline for submission to TEPPC

Background

In January 2010, the SPSC submitted a package of study requests for TEPPC's 2010 study cycle as summarized in the list below. The study requests included cases that were 10-years (2020) and 20-years (2030) in the future.

1. Reference case (2020)
    a. Adjusted 2020 BA loads for existing DSM policies
    b. Utility IRP/resource plans 2020 generation additions
2. High load sensitivity (2020)
    a. Sensitivity analysis: Loads 10% above Reference case
3. High DSM scenario (2020)
    a. Energy efficiency and demand response that is economically achievable
4. Carbon reduction scenario (2020)
    a. Waxman-Markey targets for reducing GHG (Targets 17%)
    b. California's AB 32 GHG policy/targets

5. Carbon reduction scenario (2030)
    a. Waxman-Markey targets for reducing GHG (Targets 42%)
    b. California's AB 32 GHG policy/targets
6. Breakthrough technology scenario (2030)
    a. Impacts from breakthroughs on storage, PV, nuclear, IGCC, DSM, transmission , and other

Work on the 2020 cases began in the spring with load input assumptions and generation assumptions later in the summer. WECC staff started preliminary model runs for validation purposes in the late fall of 2010. By December 2010, WECC staff is completing the official resource modeling runs for the four 2020 cases. In January, WECC staff will present modeling results from these cases at the SPSC meeting January 11-12 and at a meeting of the Technical Advisory Subcommittee (TAS) on January 25-26 in Salt Lake. If these results show significant congestion on specific transmission paths, follow up expansion cases may be performed that add transmission projects to reduce congestion on the grid.

The SPSC's 20-year or 2030 study requests were not modeled this study cycle because TEPPC chose to model 20-year cases with a new long-term planning tool. WECC is expected to announce very soon its selection of the long term modeling tool and vendor. We anticipate that the tool will be available in early 2011 and applied to the 20-year study requests.

In 2010, TEPPC received study requests from 19 other parties. In response to multiple requests to explore different generation and transmission assumptions, TEPPC created the geographic relocation cases. These cases assumed 12,000 GWh of renewable energy (about equal to 3000 MW of wind capacity) located in California was replaced by renewable generation in eight different locations across the West. The eight cases specified different portfolios of renewables consistent with the distinct characteristics in the following locations: Arizona and Southern Nevada, Northern Nevada, New Mexico and Colorado, Wyoming, Montana, Alberta, British Columbia, and the coastal Northwest. Two additional cases are being modeled known as the aggressive wind cases in which 24,000 GWh is shifted out of California to Wyoming in one case and Montana in the other case.

Potential 2011 Study Requests

WIEB staff initially drafted a list of potential study requests for discussion at the SPSC meeting September 14-15 in Salt Lake City. The current list presented below represents the combined input of the Scenario Work Group, the DSM Work Group, WGA staff and other interested parties recommending potential study requests.

1. Updated 10-year and 20-year Reference case
2. Prolonged Drought Scenario
3. High DSM and Distributed Generation Scenarios
    a. Updated west-wide High DSM/DG scenario
    b. Geographically-targeted High DSM/DG case
4. Alternative California Import Scenarios
5. Lower Renewable Generation Scenario
6. Alternative Southwest Solar Development Scenarios
7. Plant Retirements and Capacity Reductions in High DSM and Low Carbon Cases

8. Increased Utilization of Existing Grid Scenario
9. Variable Generation Integration Analysis

Each proposed study request is discussed in more detail below.

1. Updated Reference Case

In 2010, SPSC submitted a request for a Reference Case that would be based on current utility integrated resource plans (IRPs) or related utility plans. The DSM Work Group's review of 2020 load forecasts from Balancing Areas (BAs) did not incorporate all federal and state DSM policies. As a result, the DSM Work Group developed state-adjusted loads and these load forecasts were applied in the 2020 Reference Case, as distinguished from the original BA load forecasts used in the 2020 Base Case. The SPSC request for a 2020 state-adjusted load analysis did not incorporate distributed generation.

This proposed 10-year Updated Reference Case would add new information from the most recent IPR or other resource plans, and updated load forecasts for BAs that fully accounts for demand-side policies of energy efficiency, demand response, and distributed generation. A new element to this request would be the addition of distributed generation policies. Based on the experience last year, it would be important to verify that future BA load forecasts incorporate current DSM policies. The update would also serve to capture any new DSM policy developments.

One important caveat to this request is that TEPPC has contemplated shifting to a biennial study cycle in which the reference or base case would be updated every two years. The reason for shifting to a two cycle is to reduce the large amount of time and effort needed to revise the reference case. For example, work on developing the Base and Reference cases over this past year occurred from April to September. The actual model runs occurs in late fall and into December. It is possible to pursue a more modest update of the reference case that does not involve new BA load forecasts and revised generation assumptions. If we did not create a new reference case, or pursued only minor updates, TEPPC would be in a position to begin running new studies (submitted by January 2011) during the spring and summer. The decision on whether to pursue a new or updated reference case depends on the relative benefits of having a refreshed reference case versus the benefits of evaluating a greater number of alternative study questions.

The request for a 20-year Reference case is a different issue since TEPPC will likely need to develop this case for the first time. In the upcoming 2011 study cycle, TEPPC plans to model a series of 20-year studies using a new long-term modeling tool. Although we do not know how the long-term model works at this time, a 20-year Reference case will likely need to be built based on numerous input assumptions that SPSC could provide to TEPPC.

2. Prolonged Drought Scenario

Under the Topic B proposal to DOE, WGA drew upon the expertise of the Western States Water Council and collaborated with national labs to create a water-energy nexus in WECC's Regional Transmission Expansion Planning (RTEP) process. WGA staff has coordinated with Sandia National Laboratory to develop a water decision calculator that will identify water use in the electric sector based on calculations at the individual generator level. This tool will enable us to evaluate how different electricity generation scenarios impact water resources in the West. Recognizing the importance of the water-energy nexus, SPSC made a representative of the Western States Water Council an *ex officio* member of SPSC.

This Prolonged Drought study request was drafted by WGA staff in collaboration with WIEB staff, and Sandia National Laboratory. WGA staff requests that that SPSC endorse this study request in its January 2011 submittal to WECC. Key elements of the 2011 prolonged drought study request are to evaluate the: (1) direct impacts to energy generation from a prolonged drought (e.g. hydro resources in the face of low water periods, thermal generation impacts in the face of diminished water availability); (2) impacts to water availability for other users of water resources; and (3) impacts to energy demands associated with potentially higher temperatures (e.g., higher peak loads from air conditioning). Sandia National Laboratory will provide technical support to implement this study request.

We anticipate that the study will provide important information to policy makers, water resource planners, and the electric industry. The study may identify areas where water may constrain new power plant development. For example, new solar thermal plants that use wet cooling may have a difficult time obtaining sufficient water to operate in desert areas. Alternative solar technologies such as solar thermal with dry cooling or photovoltaic solar may be preferable in the face of severe water constraints. The study may also identify areas where existing power plants face operational limitations if their water supplies for cooling are reduced by a prolonged drought. The electric sector's water use has repercussions in other sectors that use water. Policy makers will want to know the potential effects of water availability for agriculture and municipal uses.

3. High DSM and Distributed Generation Scenarios

In 2010, SPSC submitted a High DSM study request. This request postulated the implementation of all economically achievable energy efficiency and demand response policies. The High DSM case reduced loads across WECC about 10% below loads in the 2020 Reference case.

The DSM Work Group drafted two distinct proposals for a new High DSM case. These two proposals can also be viewed as complementary with the second building upon the first.

3(a). Updated West-wide High DSM/DG case

The Updated West-wide High DSM/DG case would develop a new refined, expanded and updated 10-year analysis of DSM and incorporate new information on distributed generation. The DSM Work Group made tremendous strides in implementing the 2010 High

DSM case, and learned important lessons on how to improve the analysis for modeling such a case next year. At the recent SPSC meeting in Salt Lake City, some SPSC members commented that they observed increased activity of distributed generation in their state. This case would explore potential high levels of further expansion of distributed generation.

The Updated West-wide High DSM/DG 10-year analysis would also serve as a foundation for building loads in a 20-year timeframe. DSM and distributed generation should be integrated into the 20-year load forecast in constructing the future 20-year cases.

3(b) Geographically-targeted High DSM/DG case

The Geographically-targeted High DSM/DG study request asks whether a strategic application of DSM/DG resources in a targeted geographic area will serve to alleviate transmission congestion and thereby avoid the need for building new transmission.

The study would use information from the 2020 study results and identify specific paths where there was significant transmission congestion in the Reference case. These paths may have been identified and evaluated with new transmission projects. Under this study request, the relevant load areas connected to the congested transmission paths would be considered for a targeted analysis of high DSM/DG assumptions. The study would examine whether the geographically targeted DSM/DG resources serve to relieve congestion to such an extent that new transmission expansion was no longer necessary 10-years in the future. This study could potentially evaluate 3-5 different geographically targeted area and a specific congested transmission path.

4. Alternative California Import Scenarios

TEPPC modeling of California renewable development has been guided by the California PUC's modeling efforts, the California Energy Commission, the California ISO, California's Renewable Energy Transmission Initiative (RETI), and other informed California stakeholders. TEPPC's 2020 Reference case assumes California imports at a level of 25% of state loads. The 2019 Base case assumed a lower level of imports in the 20% range. The California Transmission Planning Group is a new industry based subregional planning group that is pursuing new modeling scenarios.

Under current policies, California's 33% RPS requirement accounts for about two-thirds of the incremental renewable generation expected to be needed to meet all RPS requirements across the Western Interconnection by 2020. California policy decisions on its RPS statute and its policy on renewable energy credits (RECs) could have a profound impact on future imports or delivery of power into California, and the corresponding demand for new transmission.

This study request would explore the implications of different policies that could alter the level of renewable energy imports delivered into California. Recent policy questions debated within the state have been whether the RPS statute should be increased to 33% to match the Governor's executive order, whether the RPS statute should limit qualifying renewables to instate resources, and whether unbundled RECs should qualify for the RPS. If the state statute was revised to limit RPS compliance to instate renewable energy resources, then there would be

less development of out-of-state resources for imports to California and less need for the associated transmission to deliver that power. If California policy approved unbundled RECs for RPS compliance, California utilities could purchase RECs from out-of-state resource rich areas without the need for new transmission to deliver the power. This could promote increased development in areas with high quality renewable resources and low loads, further complicating the operational challenges of integrating variable generation.

The Northwest Power and Conservation Council is studying the impact of RECs and wind development in the Northwest that serves to fulfill California RPS requirements. This study is not complete or available at this time. The NWPCC study was motivated by concern in the region on how it was going to integrate a high level of wind development within its footprint. The Northwest's concerns could be a precursor to a wider issue across the Western Interconnection if the demand for renewable energy continues to rise from other high load areas and the pressure to develop new renewables is concentrated in areas that face the greatest challenges to integrate variable generation. In this context, the issue is not solely a California policy question but an issue about the implications of expanded unbundled REC trading with future renewable development.

Other recent TEPPC studies have explored the shifting of renewable development outside of California, effectively increasing California imports. In 2010, TEPPC modeled geographic relocation cases off the 2019 Base case by shifting 12,000 GWh of renewable energy (about equal to 3000 MW of wind capacity) out of California into 8 different locations across the West. Additionally, two aggressive wind cases to be run this year shift 24,000 GWh of energy out of California to Wyoming and Montana.

The study request on alternative California imports also raises issues regarding the affect the location of resources will have on the integration issue. This issue is related to the proposed request item nine below.

5. Lower Renewable Generation Scenario

TEPPC studies to date have generally specified renewable generation levels needed to meet RPS targets consistent with current policies or specified some benchmark penetration level above the RPS targets. What has not been studied is a case where future renewable development is less than the RPS targets anticipated from today's perspective.

One potential reason that future renewable development may fall short of current RPS targets is that cost cap provisions in many state RPS statutes become binding over the next 10-years. At least four states have cost caps in their RPS statute (Colorado, New Mexico, Oregon and Utah). This study request could take different approaches in modeling binding cost caps. We could postulate some benchmark increases in renewable costs (e.g., 25% or 50%) and evaluate the potential cost cap constraints in state RPS provisions. Other factors could also make the relative cost of renewables increase for cost cap purposes. Natural gas prices could drop to such a low level that the relative cost of renewable energy becomes significantly more expensive and triggers cost cap constraints. Federal tax incentives (production tax credit or investment tax credit) could expire in the future, thereby making it more expensive for utilities to purchase

renewable energy and pushing up the cost to consumers. An alternative approach would be to simply specify a benchmark percentage reduction (e.g., 10%, 25% or 50%) in meeting RPS requirements in states with cost caps.

There may be drivers other than price caps that hinder the ultimate development of renewables below state RPS targets. State legislatures or regulatory commissions could reverse or eliminate the current RPS provisions. Such a political shift could occur in a subset of states or across all states. The range of potential backsliding on RPS targets is quite large and there is no clear or obvious benchmark. A small reversal on RPS targets may seem more probable but would not be very interesting in terms of modeling for TEPPC purposes. A large reversal on RPS targets would be less probable but potentially more significant in yielding significant changes relative to the Reference case.

6. Alternative Southwest Solar Development Scenarios

Solar generation is potentially the biggest wildcard in the future build out of renewable resources and the corresponding demand for new transmission. Wind generation has experienced declining costs over the past two decades and is currently a cheaper option to solar. The cost of solar resources could drop in the future with technological innovation and economies of scale.

The Southwest's solar resources are geographically closer to large load areas relative to the abundant wind resources in the eastern part of the interconnection. Concentrated solar power technologies (i.e., thermal and/or PV) would have a transmission cost advantage to serve the southwestern loads relative to eastern and northern wind resources. If solar technology costs drop in the future, southwestern loads could rely heavily on its local solar resources to meet RPS targets or even higher levels of renewables. If solar resources became very cost competitive, or highly valued to meet peak loads, southwestern solar energy could be exported to other parts of the interconnection. At high levels of renewable penetration, the complementary profiles of wind and solar could mutually share new transmission for flows of energy in both directions.

On the other hand, if solar technologies become less competitive with wind over time, solar may not significantly develop in the Southwest to levels currently being planned. If the solar option diminishes while the demand for renewables continues, then wind energy expands including the best eastern wind resources. New transmission would be needed to deliver a large wind build out.

An important take away from the last Resource Planners Forum meeting last June was that utility resource planners are looking in their own backyard for renewables to meet their RPS requirements. Many of the large utilities do not intend to look for remote renewables in the near term. California appears to be in a position to develop a substantial amount of solar in the southern part of the state. A large amount of solar projects are planned for Arizona and southern Nevada which could meet local loads and more if there are willing buyers for this solar power.

7. Plant Retirements and Capacity Reductions in High DSM and Low Carbon Cases

In recent weeks, questions arose about how to model the High DSM case in the face of reduced loads and high reserve margins in 2020. There was an initial desire to reduce generation capacity to bring down the reserve margins to a more reasonable level. But the only way to reduce capacity was to retire existing conventional generation or under construction generation. The 2020 Reference case generation fleet consists of existing generation in 2010, additional renewables to meet RPS requirements by 2020, conventional generation which is under construction, and new conventional generation to offset retirements under California's once-through-cooling (OTC) policy. Concerns were raised about the methodology to specify retirements as an input assumption to the model, and whether it was appropriate for the SPSC to be making such assumptions in its study cases.

The Scenario Work Group formed a special task force to consider options and methodologies for retirements or capacity reductions in the High DSM case and the Low Carbon case. The task force will report to the full SPSC at the upcoming meeting January 11-12. The SPSC will need to decide how to proceed in subsequent modeling of the High DSM case, the Low Carbon case, and other potential 2011 study requests.

The 2020 Low Carbon case will be run using the High DSM load assumptions. A second step is to run the model with a carbon adder that puts a price on carbon dioxide emissions. The carbon adder will start at $10 and increase incrementally until emissions reach the 17% reduction target relative to 2005 emissions and compliance with California AB 32 requirements. Promod model results will be reviewed to see how the coal plant fleet is backed down with higher carbon adders. A third step considers specifying coal plant retirements that are driven by proposed EPA regulations to meet a number of non-carbon air quality objectives (e.g., ozone, mercury)

8. Increased Utilization of Existing Grid Scenario

TEPPC relies on a production cost model to evaluate 10-year cases. Under current practices, the production cost model assumes a perfect dispatch in a frictionless world. There are no institutional barriers, bilateral contracts, or imperfect information to inhibit the selection of the least cost solution to meet loads for every hour over an entire year.

If we want to use the production cost model to evaluate the gains from innovations that improve the operation of the system, we need to model the system with its current institutional rigidities or friction. This type of work is currently being pursued to evaluate the benefits of an energy imbalance market, balancing area consolidation, and other changes.

This proposed study request would ask WECC to model the deployment of new transmission technologies such as synchrophasers, volt-var optimization/conservation voltage that serve to reduce loads and line losses. Additionally, the study could ask to model the impact of institutional reforms that reduce friction in the system through an energy imbalance market or the proposals of the Joint Initiatives.

This study request could be very difficult to implement. Current efforts are underway at WECC to model institutional rigidities and derive the benefits of certain reforms. The current modeling tools are not easily adapted to address these questions.

9. Variable Generation Integration Analysis

The validity of TEPPC's current modeling efforts can be grounded with good data on loads and generation assumptions, checked with historical indicators, validated by a load and resource balance, as well as reliability checks. However, we currently do not have a tool to cross check the capability of the system to to integrate high levels variable generation.

This request would ask WECC to develop a screening tool to evaluate cases with substantial variable generation (wind and solar) and determine the technical feasibility and cost of integration. The screen should identify measures to mitigate technical and cost hurdles. This integration screen would be analogous to the reliability analysis that subregional planning groups will be doing on current case studies.

Currently there is not such tool or screening mechanism. NREL has been evaluating how to measure the flexibility of the power system and has begun to identify parameters or potential criteria for such a screening device. SPSC can look to NREL for guidance on how to develop such a screening tool. If such a screen is successfully developed by NREL, it could be adopted by WECC. Depending on how long it takes to develop the screening tool, it could be tested against some 2010 study cases as well as 2011 study requests that include large amounts of variable generation.

Prioritization of potential 2011 study request

In addition to commenting on the nine proposed study requests, you are asked to identify your initial thoughts on the relative priority of these proposed studies.

Please identify your top five study requests. Email your responses to tcarr@westgov.org. This information will help guide the discussion in San Diego.

Potential Study Request	**Rank (your top 5 priorities from 1 (highest priority) to 5**
1. Updated Reference Case	
2. Prolonged Drought Scenario	
3(a) Updated West-wide High DSM/DG case	
3(b) Geographically-targeted High DSM/DG case	
4. Alternative California Import Scenarios	
5. Lower Renewable Generation Scenario	

6. Alternative Southwest Solar Development Scenarios	
7. Plant Retirements and Capacity Reductions in High DSM and Low Carbon Cases	
8. Increased Utilization of Existing Grid Scenario	
9. Variable Generation Integration Analysis	