

Topic B Requests of National Laboratories

To help inform and supplement the work to be done by WGA in its proposal to enhance transmission planning and development in the Western Interconnection, we are requesting technical assistance from the national laboratories.

To ensure coordination of these activities, we would like to request that a representative from the Department of Energy be appointed to serve as a liaison between WGA and the national labs. The liaison would be tasked with reviewing proposals for lab requests and ensuring that project objectives and deadlines are met. WGA will appoint a representative to serve in the same capacity.

The following requests represent key input that will be needed to successfully complete the scope of work in WGA's proposal. Each request is accompanied by a recommendation for the lead lab for the project. Requests that are denoted with an asterisk indicate an area where the input of multiple labs may be needed.

1. Lawrence Berkeley National Laboratory - Provide ongoing support for all users of the WREZ model. States and provinces will use the WREZ model to engage resource planners and transmission planners for developing input to Topic A. The WREZ model can be used to develop sensitivity and scenario analysis for a variety of representative case studies. The WREZ model needs to be updated over time, adapted and customized to answer user-specific questions, and improved with new assumptions and validation.
2. National Renewable Energy Laboratory - Support GIS mapping of information relevant to development of resource areas identified in the WREZ project Phase 1. The GIS mapping would build upon the existing WREZ GIS data base and incorporate information on Section 368 corridors, wildlife information, military flight restricted areas, and other relevant information.
3. Los Alamos National Laboratory - Analysis of feasible locations for electricity storage in the Western Interconnection. This information would inform state and provinces on input to Topic A analyses and transmission planning. LANL completed a scoping study for the Four Corners area which included large-scale development of renewable resources in New Mexico and placement of energy storage resources. The Four Corners study could be expanded across the Western Interconnection. This analysis can be conducted as a top-level screening assessment for input to Topic A. Cases analyzed could be constrained by environmental resources that could impact the expansion of the grid.
4. Idaho National Laboratory - Analysis of feasible locations where carbon sequestration can help to firm the variability of renewable resources. This will include engaging state/provincial geologic surveys to develop more accurate site capacity assessment for targeted areas. The desired end product will be a map that identifies the carbon and compressed air storage potential for these areas and the existing infrastructure needed to support these activities.

5. * Lawrence Berkeley National Laboratory - Analyze utility integrated resource plans (IRPs) in the Western Interconnection to provide input into Topic A analyses and transmission planning, and to identify best practices and facilitate coordination and consistency among resource planners in the Western Interconnection Resource Planner Forum.

Review of recent IRPs filed by utilities in the Western Interconnection may include: comparing and analyzing IRP assumptions and methods used to assess and manage carbon regulatory risk; comparing and assessing IRP natural gas price forecast assumptions and scenarios; evaluating the manner and degree to which IRPs consider resource options made available by additional transmission; evaluating the levels of renewables, CCS, nuclear, energy efficiency, demand response, and fossil generation evaluated within IRPs and the manner in which candidate resource portfolios are constructed and selected, including how risk is considered in portfolio selection; compiling information on the composition of the preferred resource portfolios identified in IRPs, in terms of capacity and energy additions by technology type (including both supply- and demand-side resources); compiling information on other IRP assumptions that could be used to benchmark assumptions used in transmission planning, including plug-in hybrid vehicle market penetration, generation and transmission technology costs, and economic growth; compiling IRP load forecasts and documenting underlying assumptions and methods used to generate base case and alternate IRP load forecasts.

6. National Renewable Energy Laboratory - Analyze existing and/or potential methods used in IRPs to determine the market and capacity value of wind and solar technologies at increasing penetrations of renewables. This information will guide state and province input to Topic A analysis and transmission planning regarding scenarios with increasing levels of variable generation renewables.

This analysis will include an evaluation of methods used to calculate the capacity value, time-of-delivery energy value, and integration costs associated with wind and solar. Where IRPs do not adequately address these issues, the analysis will evaluate or develop methods to estimate capacity value, time-of-delivery energy value, and integration costs. Since these values and costs change with penetration, the analysis will evaluate if and how methods accommodate or reflect these changes. The analysis will provide guidance on methods for evaluating the portfolio impacts of increased demand for resource flexibility with increased penetration of variable generation. Methods will include valuing the flexibility of conventional resources, demand response, and storage technologies to manage variability. The analysis will then identify best practices within existing IRPs, and develop recommendations for consideration in the Western Interconnection Resource Planners Forum, transmission planning, and future IRPs.

7. * Lawrence Berkeley National Laboratory - Assist states and provinces in incorporating demand-side resources (energy efficiency and demand response) into the Topic A modeling and studies, including the construction of a high demand-side resource case.

Technical assistance and analysis may include: developing projections of energy efficiency savings that accurately reflect recent policy developments, including state energy efficiency resources standards, and recently-approved utility DSM or IRP plans; helping to specify high efficiency, high demand response cases that go well beyond the levels expected under existing policies and avoided costs and which may reduce supply-side (and hence transmission needs); identifying the demand-side resource potential under alternative technology and economic assumptions by sub-region, drawing upon the recent FERC National Assessment of Demand Response Potential (June 2009) study and recent energy efficiency potential studies; quantifying the load profile impacts of demand-side resources on a daily and seasonal basis; identifying the costs of implementing a range of demand-side investments; and assessing issues associated with accurately accounting for the impacts of appliance efficiency standards, building codes, ratepayer-funded energy efficiency programs, and naturally-occurring energy efficiency improvements when developing load forecasts for use in Topic A modeling.

8. Lawrence Berkeley National Laboratory - Provide assistance to states and provinces in developing input to Topic A regarding assumptions on the type, size, and timing of renewable energy capacity additions in the Western Interconnect needed to meet state and, potentially, federal renewable portfolio standards.
9. Pacific Northwest National Laboratory - Consider the effects of plug-in electric (PHEV) and electric vehicles (EV) on the grid:
 - a. Examine the estimated infrastructure, reliability, and environmental impacts associated with small, mid and large-scale deployment of EVs and PHEVs. This would include:
 - b. Examining load variability impacts associated with various charging behaviors
 - c. Examine the potential for market penetration given projected infrastructure and vehicle availability
 - d. Determine the net greenhouse gas and environmental impacts that would result from displacing liquid transportation fuels.
 - e. Examine what potential vehicle to grid charging impacts may be and recommend policies to optimize consumer behavior.
10. * Lawrence Livermore National Laboratory - Evaluate assumptions used to determine GHG emission impacts of plans and planning scenarios. As Topic A transmission scenarios and plans are developed and modeled assist states and provinces in the interpretation of model results regarding GHG emissions and develop recommendations for further analysis and policy options.
11. National Renewable Energy Laboratory - Conduct a wind integration study covering the entire Western Interconnection that builds upon the existing work of the Western Wind and Solar Study (WWSIS). The new Western Interconnection study would expand the footprint studied from the WestConnect subregion to include California, the Northwest, and the provinces of British Columbia and Alberta. An interconnection-wide analysis is needed to better understand the operational interdependencies across the entire Western

Interconnection. This study would make other important improvements such as incorporating the Northwest hydro system, improving data on PV solar generation, adding mesoscale wind and solar data for the years 2007- 2009, and adding mesoscale wind data covering the Canadian provinces. The technical feasibility and economic implications of higher penetration of variable generation are critical parameters in state and province input to Topic A analyses and transmission planning.

12. National Renewable Energy Laboratory - Analyze and assess the operational flexibility of the generation fleet in the Western Interconnection and subregions. This information will inform state and province input to Topic A analyses and transmission planning.
 - a. The analysis would assess the capability of subregions to ramp up and ramp down generation.
 - b. Estimate the incremental new generation needed to complement higher levels of variable generation to ensure reliable operations. This work would build upon the Renewable Integration Calculator model developed by resource planners at PG&E.
 - c. Inform state and province recommendations for incremental generation in the modeling of the Western Interconnection 10 years and 20 years in the future with higher levels of variable generation.
 - d. Inform state and province input to Topic A regarding new modeling and analysis methods for variable generation.
13. * National Renewable Energy Laboratory - Evaluate the benefits of changes to market operations, new practices, or institutional reforms that improve the ability of the electrical system to integrate higher levels of variable generation. For example, this analysis would inform state and provincial representatives on the impact of:
 - a. consolidating balancing areas or creating larger virtual balancing areas through improvements in communication, scheduling and coordination;
 - b. market design changes such as changing market scheduling from 1 hour to 10 minute intervals;
 - c. greater use of the federal hydro system to integrate variable generation across the Western Interconnection;
 - d. implementing wind forecasting to operations rooms;
 - e. improving the market for ancillary services;
 - f. evaluating alternative wind development scenarios to determine the impact on ancillary service needs; and
 - g. expanding storage resources in the system.
14. * Sandia National Laboratory - Update the existing decision support framework for integrated energy-water planning. This model includes data on the lifecycle water requirements of various energy resources and technologies and allows stakeholders to interactively investigate alternative energy development scenarios and their impacts on water supply. The model will need to be updated with the most recent and geographically specific data from the states on water supply, as developed in Task 1. We would request the Sandia National Laboratory serve as the technical lead for WGA's

proposed work on the energy-water nexus and also be encouraged to work with other laboratories.

15. * Lawrence Livermore National Laboratory - Use high-resolution climate model outputs to examine the affect of climate change on average annual precipitation, seasonal variations, and year-to-year variations to assess changes in hydro resources as well as changes in operation and investments in variable renewables resulting from climate change.
16. WGA reserves the right to make future requests of the labs as the project progresses and technical issues present themselves.