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ARRA Performance Tracking Metrics

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Abstract

In 2010, the U.S. Department of Energy (DOE) provided \$60M in funding to five regional entities to conduct interregional transmission planning activities: the Eastern Interconnection Planning Collaborative (EIPC); the Eastern Interconnection States Planning Council (EISPC); the Transmission Expansion Planning and Policy Committee (TEPPC); the State Provincial Steering Committee (SPSC); and the Electricity Reliability Council of Texas (ERCOT). DOE also provided funding to the Lawrence Berkeley National Laboratory (LBNL) to support aspects of these interregional transmission planning activities. LBNL's support involved both technical assistance to DOE in its oversight of the activities conducted by the five regional entities and the preparation of six, standalone technical studies that were conducted in direct support for specific entities. This is the final report on LBNL's activities. It consists of summaries of each activity; references are provided to each of the stand-alone studies.

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1. Introduction and Overview

In 2010, the U.S. Department of Energy (DOE) provided \$60M in funding to five regional entities to conduct interregional transmission planning activities: the Eastern Interconnection Planning Collaborative (EIPC); the Eastern Interconnection States Planning Council (EISPC); the Transmission Expansion Planning and Policy Committee (TEPPC); the State Provincial Steering Committee (SPSC); and the Electricity Reliability Council of Texas (ERCOT).

The EIPC represents a first-of-its-kind effort to involve planning authorities in the Eastern Interconnection to model the impact on the grid of various policy options determined to be of interest by state, provincial and federal policy makers and other stakeholders.¹ The EIPC used DOE's funding to initiate a broad-based, transparent collaborative process to involve interested stakeholders in the development of policy futures for transmission analysis.²

The Eastern Interconnection States Planning Council is an historic endeavor initially funded by an award from DOE pursuant to a provision of the American Recovery and Reinvestment Act (ARRA). The goal of EISPC has been to encourage and support collaboration among states in the Eastern Interconnection on critical energy issues, including electric transmission, gas-electric infrastructure, resource diversity, and energy resiliency and reliability. EISPC members include public utility commissioners, Governors' representatives, state energy officials, and other key government representatives throughout the thirty-nine states, the City of New Orleans, and six Canadian Provinces that comprise the Eastern Interconnection.

The EISPC used DOE's funding to provide consistent and coordinated direction to the regional and interconnection-level analyses and planning undertaken by regional planning authorities and electric transmission companies. Significant state input and direction has increased the probability that these outputs have been useful to the state-level officials whose decisions may determine whether proposals that arise from such analyses become actual investments.

The Western Electricity Coordinating Council (WECC)'s Transmission Expansion Planning Policy Committee is designed to conduct and facilitate economic and reliable transmission planning in the Western Interconnection. The TEPPC used DOE's funding to oversee and maintain a public database for production cost and related analysis; develop and implement Interconnection-wide expansion planning processes in coordination with the Planning Coordination Committee (PCC), other WECC committees, Regional Planning Groups (RPG), and other stakeholders; guide and improve the economic analysis and modeling of the Western Interconnection and conduct transmission studies; and prepare Interconnection-wide transmission plans consistent with applicable NERC and WECC reliability standards and approved scenarios.

¹ See <http://www.eipconline.com/>

² See http://www.eipconline.com/Project_Overview.html

The Western Interstate Energy Board (WIEB)'s State-Provincial Steering Committee consists of appointees from each state and province in the Western Interconnection, and works to provide input on regional transmission planning and analysis in the Western Interconnection. The SPSC used DOE's funding to provide input into regional transmission planning; improve the efficient use of the existing grid; and enable the integrating of large amounts of variable generation.

The Electric Reliability Council of Texas manages the flow of electric power to 24 million Texas customers—representing about 90 percent of the state's electric load. As the independent system operator for the region, ERCOT schedules power on an electric grid that connects more than 43,000 miles of transmission lines and 550 generation units. ERCOT also performs financial settlement for the competitive wholesale bulk-power market and administers retail switching for seven million premises in competitive choice areas. ERCOT used DOE's funding to purchase new software tools to support aspects of their transmission planning processes.

DOE also provided funding to LBNL to support aspects of these interregional transmission planning activities, through three Inter-Entity Work Orders from the National Energy Technology Laboratory (Award Numbers M610000582; M610000585; and M610000708).

This is the final report on LBNL's activities conducted under these two contracts.

LBNL's activities involved, on the one hand, technical assistance to DOE in its oversight of the activities conducted by the five entities and, on the other hand, standalone technical studies that were conducted in direct support for specific entities. Six, standalone studies were prepared:

1. Open Access Technology International, Inc. (2015). *Assessment of Historical Transmission Schedules and Flows in the Eastern Interconnection*, v 1.0. **(See section 3.1)**
2. Whitely, Eric, Alan G. Isenmonger, and Joseph H. Eto. (2013). *Perspectives on Real-Time Grid Operating Technologies to Manage Reliability in the Western Interconnection*. **(See section 3.2)**
3. Jonathan L. Ho, Benjamin F. Hobbs, Pearl Donohoo-Vallett, Qingyu Xu, Saamrat Kasina, SangWoo Park, and Yueying Ouyang. (2015). *Planning Transmission for Uncertainty: Applications and Lessons with the Western Interconnection*. **(See section 3.3)**
4. Sullivan, Michael J., Josh A. Schellenberg, and Marshall Blundell. (2015). *Updated Value of Service Reliability Estimates for Electric Utility Customers in the United States*. **(See section 3.4)**
5. Hadley, Stanton W., Douglas J. Gotham, and Ralph Luciani. (2014). *Additional EIPC Study Analysis: Final Report*. Oak Ridge National Laboratory, November 2014. **(See section 3.5)**

Each activity (and each stand-alone study) is described separately in the remainder of this report.

2. Technical support to DOE in its oversight of awards for interregional transmission planning activities

LBNL's technical support to DOE in its oversight of awards for interregional transmission planning activities consisted of three activities:

1. Participation in planning and coordination discussions with staff from DOE's Office of Electricity Delivery and Energy Reliability (OE)
2. Participation as observers at interregional transmission planning meetings of EIPC, EISPC, TEPPC, SPSC, and ERCOT
3. Technical support to OE staff for preparation of summary assessment of interregional transmission planning grants, including development of metrics

The LBNL team was joined by Alison Silverstein, whose involvement was supported through a subcontract managed by LBNL.

2.1. Participation in planning and coordination activities with DOE staff

The LBNL team met regularly with a core group of DOE staff involved in oversight of one or more the awards for interregional transmission planning. The meetings consisted of either conference calls or face-to-face meetings, both at DOE as well as before and after public meetings of the awardees. The team also supported core DOE staff in drafting and revising internal and external memos on aspects of the planning activities and through participation in meetings with other staff within DOE.

2.2. Participation as observers at interregional transmission planning meetings of EIPC, EISPC, TEPPC, SPSC, and ERCOT

Members of the LBNL team were designated by DOE staff to participate as observers at most of the public meetings and webinars hosted by the awardees. Team members generally accompanied DOE staff at these meetings, but in some cases participated alone when DOE staff were unavailable. In these latter instances, team members de-briefed DOE staff afterwards. Member of the teams sometimes joined DOE staff in side meetings with one or more meeting participants. In some instances, especially during working technical sessions, team members were invited by meeting participants to provide technical information on selected topics.

2.3. Technical support to DOE staff for preparation of summary assessment of interregional transmission planning grants, including development of metrics

Members of the LBNL team provided direct technical assistance to core DOE staff leading preparation of a summary report on the activities conducted by interregional planning activities. LBNL team members conducted analysis, including development of metrics, and drafted sections of the final report. As of the time this report was prepared (June 2015), DOE has not released its summary report.

3. Technical studies directed to specific interregional transmission planning activities

In addition, to providing technical assistance to DOE in its oversight of the five awardees, LBNL directed or participated in the preparation of six, standalone technical studies, which were conducted in direct support for specific entities.

3.1. Analysis of historic utilization of transmission in the Eastern Interconnection

LBNL contracted with Open Access Technologies Inc. (OATI) to prepare an analysis of historic utilization of transmission in the eastern interconnection. OATI obtained both scheduled and actually hourly transmission flows for 2011 through 2013. It aggregated this information according to the boundaries between balancing authorities in the eastern interconnection. These boundaries corresponded roughly to boundaries among the 26 planning regions used in the transmission modeling studies prepared by the EPIC. Thus, the historical information can be used to further calibrate future modeling studies of the eastern interconnection conducted by EIPC and others.

See: Open Access Technology International, Inc. (2015). *Assessment of Historical Transmission Schedules and Flows in the Eastern Interconnection, v 1.0*. Available from: <http://eetd.lbl.gov/publications/assessment-of-historical-transmission>

3.2. Review of grid reliability management procedures in the Western Interconnection

LBNL contracted with Grid Subject Matter Experts to co-author a review of grid reliability management procedures in the western interconnection. The review focused on five real-time practices, tools, and technologies: (1) Network models; (2) Outage management coordination; (3) Next-day studies; (4) Real-time situational awareness tools; and (5) Advance grid monitoring technologies. The review involved interviews with operating entities within the western interconnection to identify both current and best practices.

The study is intended to support the review of current practices by state utility regulators, the governing boards of consumer-owned utilities, and the leadership of Power Marketing Administrators, and to provide guidance and support for improvements where they are deemed appropriate. These bodies play an irreplaceable role in communicating expectations for the reliable operation of the grid to the firms they regulate or oversee as well as in enforcing these expectations; thus, they have unique influence over firms' priorities with regard to reliability.

See: Whitely, Eric, Alan G. Isenmonger, and Joseph H. Eto. (2013) *Perspectives on Real-Time Grid Operating Technologies to Manage Reliability in the Western Interconnection*. Available from: <http://eetd.lbl.gov/publications/perspectives-on-real-time-grid-operat>

3.3. Application of stochastic optimization to transmission expansion planning in the Western Interconnection

LBNL contracted with Johns Hopkins University to co-sponsor, with WECC, a study that applied stochastic optimization techniques to transmission expansion plans for the western interconnection. The study was based on the 2014 transmission plan developed by TEPPC. The study examined aspects of five major transmission lines that are included in the common case transmission assumptions used in TEPPC's 2014 study. Specifically, the study considered, under different scenarios, which additional transmission lines would be warranted, if one or more of the five major transmission lines in the common case transmission assumptions did not get built.

See: Jonathan L. Ho, Benjamin F. Hobbs, Pearl Donohoo-Vallett, Qingyu Xu, Saamrat Kasina, SangWoo Park, and Yueying Ouyang. (2015). *Planning Transmission for Uncertainty: Applications and Lessons with the Western Interconnection*.

3.4. Update of integrated analysis of utility studies of the costs of power interruptions to customers

LBNL contracted with Nexant to update an earlier study to include new information from recent surveys conducted by electric utilities to estimate the cost of power interruptions to customers. With the addition of these more recent surveys, the meta-dataset includes 34 different datasets from surveys fielded by 10 different utility companies between 1989 and 2012. Because these studies used nearly identical interruption cost estimation or willingness-to-pay/accept methods, it was possible to integrate their results into a single meta-dataset describing the value of electric service reliability observed in all of them. Once the datasets from the various studies were combined, a two-part regression model was used to estimate customer damage functions that can be generally applied to calculate customer interruption costs per event by season, time of day, day of week, and geographical regions within the United States for industrial, commercial, and residential customers. The results of the study were incorporated in a publicly available, on-line interruption cost estimation tool, called the Interruption Cost Estimate (ICE) Calculator. (See <http://icecalculator.com>.)

See: Sullivan, Michael J., Josh A. Schellenberg, and Marshall Blundell. (2015) *Updated Value of Service Reliability Estimates for Electric Utility Customers in the United States*. Available from: <http://eetd.lbl.gov/publications/updated-value-of-service-reliability->

3.5. Extended analysis of EIPC Phase-1 study results

LBNL contracted with Oak Ridge National Laboratory (ORNL) to prepare a study that extended analysis of the results from EIPC's transmission planning studies. ORNL examined 14 topics: (1) How do Phase 2 results compare to Phase 1; (2) Were there significant changes in earlier years within various regions; (3) When all costs are integrated, how do results compare between scenarios; (4) Do some regions face overreliance on certain fuels or technologies; (5) What are the gas sector interrelationships in the different regions; (6) How did regional operating and planning reserves definitions affect the results; (7)

Why was there so much wind curtailment in the RPS/R and CO₂+ scenarios; (8) How much did Demand Response as defined in the models affect results; (9) What transmission lines were of value in all scenarios; (10) Regional vs. national implementation of policies; (11) Load growth sensitivities on resource mix and cost; (12) Environmental policy sensitivity impacts; (13) Technology sensitivity impacts; and (14) Changes in key assumptions since 2010 (capital cost, distributed solar, load).

See: Hadley, Stanton W., Douglas J. Gotham, and Ralph Luciani. (2014). *Additional EIPC Study Analysis: Final Report*. Oak Ridge National Laboratory, November 2014.