NTTG 2016-2017

REGIONAL TRANSMISSION PLAN

December 28, 2017

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Executive Summary

Would it be more efficient or cost-effective to meet future transmission needs in the Northern Tier Transmission Group (NTTG) footprint through a regional planning framework rather than the aggregate of local planning processes[1]? The NTTG 2016-2017 Regional Transmission Plan (RTP) poses this question and seeks to answer it. Developed in accord with NTTG Transmission Providers' Attachment K, which includes FERC Order 1000 regional and interregional transmission planning requirements, the plan analyzes whether NTTG's transmission needs in 2026 could best be satisfied with projects of a regional or interregional scope.

To arrive at a conclusion, NTTG used a two-year process of identifying transmission requirements and performing reliability and economic analyses on several collections of transmission projects, or plans: the prior (2014-2015) RTP, an Initial RTP[2] made up of projects from the prior RTP and projects included in the Full Funders' Local Transmission Plans, and a number of Change Case plans. A null Change Case (null case), which tests the NTTG footprint's current transmission system stressed by the addition of loads and resources projected for 2026, showed that the NTTG system performed acceptably in only one of seven stressed conditions studied. All the other conditions suffered performance issues that required correction.

A technical study found that the 2014-2015 prior RTP, which included two Non-Committed Projects (Boardman to Hemingway and portions of Energy Gateway), was not fully reliable with the 2026 load and resource projections. The study then evaluated 23 Change Cases that explored ways to reliably meet the transmission system needs through various combinations of the Non-Committed Projects in the Initial RTP or three proposed Interregional Transmission Projects, or both. These Change Cases were created to explore the relationship of a build-out of wind generation in Wyoming to meet NTTG load with its impact on the transmission system west of Wyoming and a potential expansion of the transmission system (i.e., the Gateway West and Gateway South projects).

The study also examined three Interregional Transmission Projects as Alternative Projects to determine whether these projects would yield a more efficient or cost-effective regional transmission plan for NTTG and as a part of interregional coordination and planning. The analysis found, however, that none of the Interregional Transmission Projects could replace or enhance the Non-Committed Projects more efficiently or cost effectively to satisfy NTTG's regional transmission needs.

[1] NTTG's regional transmission planning process is not intended to be a replacement for local transmission or resource planning.

[2] Terms are capitalized to be consistent with Attachment K. All capitalized terms are defined in the glossary.

Reliability analyses narrowed the potentially acceptable solutions to the Initial RTP and two Change Cases. Subsequent economic analyses identified one of the Change Cases as the more-efficient or cost-effective case. Known in the study as Change Case 23, this case includes Boardman to Hemingway, Gateway South, portions of Gateway West, and the Antelope projects. See the figure below for a map of those projects.

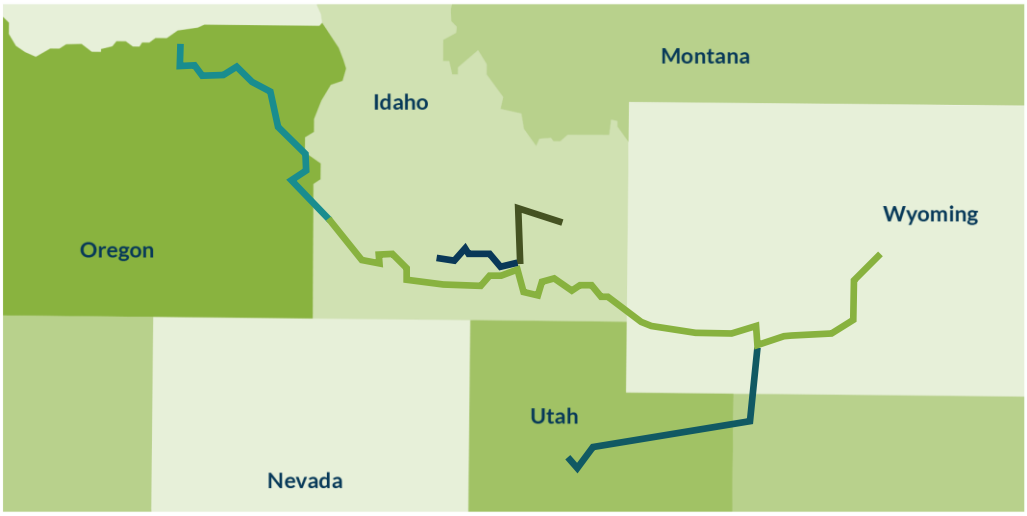

Figure 1. These projects comprise NTTG's 2016-2017 Regional Transmission Plan.

Stakeholder input on the RTP was accepted and evaluated throughout the biennial planning cycle. NTTG posted the Draft RTP in December 2016 (Quarter 4) for stakeholder comment and the Draft Final RTP in Quarter 6 for public comment. The revised Draft Final RTP was made available for public comment in Quarter 7. The Planning Committee recommended submittal of the RTP to the NTTG Steering Committee in Quarter 8. The Steering Committee approved the RTP in Quarter 8.

Plan Assumptions and Caveats

The NTTG 2016-2017 Regional Transmission Plan (RTP) is meant to inform local transmission planning processes and is not a construction plan. NTTG relies on the load and resource data submittals of its members and does not consider the re-dispatch or re-optimization of resource assumptions. The RTP studies are completed pursuant to the NTTG Transmission Providers' Attachment K.

NTTG's transmission plan assumes that its members' submissions are reasonable and cost-effective. The transmission plan is not an attempt to design an optimal portfolio of resources to meet the expected demand of the region's consumers. Instead, it is an attempt to design a reliable and cost-effective portfolio of transmission around the inputs of NTTG Members. The RTP is the result of the assumptions outlined in the report and solely represents a lower-cost

transmission plan than one represented by a rollup of the combined Transmission Provider's plans.

To the degree that those NTTG Transmission Providers' inputs are not realistic or cost-effective, the resulting NTTG Transmission Plan will likely be affected. However, NTTG regards correcting such potential errors as work to be undertaken in the context of integrated resource plans conducted by individual load-serving entities in their respective states.

The Northern Tier Transmission Group

The Northern Tier Transmission Group (NTTG) was formed in 2007 to provide a forum where all interested stakeholders, including Transmission Providers, customers and state regulators, can participate in an open, transparent, coordinated regional transmission planning process. The process is intended to promote effective planning and use of the multi-state electric transmission system within the NTTG footprint.

NTTG fulfills requirements of the Federal Energy Regulatory Commission (FERC) Order 1000 for each public utility transmission provider to participate in a regional transmission planning process that produces a regional transmission plan and, if appropriate, includes a regional cost-allocation method.

NTTG evaluates transmission projects that move power across the regional bulk electric transmission system, serving load in its footprint and delivering electricity to external markets. The transmission providers belonging to Northern Tier serve more than 4 million retail customers with more than 29,000 miles of high-voltage transmission lines. These members provide service across much of Utah, Wyoming, Montana, Idaho and Oregon, and parts of Washington and California.

NTTG works with other entities—the Western Electricity Coordinating Council (WECC) for reliability data and neighboring Planning Regions (e.g., ColumbiaGrid, WestConnect and California Independent System Operator (CAISO)) for interregional project coordination.

The NTTG footprint covers portions of seven Western states.

Northern Tier Members

Deseret Power Electric Cooperative
Idaho Power Company
Idaho Public Utilities Commission
MATL LLP
Montana Consumer Counsel
Montana Public Service Commission
NorthWestern Energy
Oregon Public Utility Commission
PacifiCorp
Portland General Electric
Utah Associated Municipal Power Systems (UAMPS)
Utah Office of Consumer Services
Utah Public Service Commission

Wyoming Office of Consumer Advocates
Wyoming Public Service Commission

Purpose of the Plan

The NTTG Regional Transmission Plan (RTP) aims to produce, if possible, a more efficient or cost-effective regional plan to transmit energy compared with a plan that rolls up the local Transmission Providers' transmission plans and other Change Case transmission plans studied. This study process complies with FERC Order No. 1000, Attachment K—Regional Planning Process. This planning cycle marks the first time that NTTG implemented FERC Order 1000 interregional project coordination with the other western regional transmission planning organizations.

Plan Development Process

The Regional Transmission Plan is developed through a two-year process:

1) Identification of the transmission requirement for the NTTG footprint, derived from the data submissions

2) Reliability analysis and evaluation of the Initial RTP and Alternative Projects (including interregional projects) through Change Cases

3) Economic analysis and evaluation comparing the annualized incremental costs of the Initial RTP and the Change Cases that perform acceptably (two cases this study cycle)

4) Selection of the project or projects that yield a regional transmission plan that is more efficient or cost-effective than the other regional transmission plans studied

5) Any projects that were submitted for the purposes of cost allocation and selected into the RTP will go through the cost allocation process if they are deemed to be eligible for cost allocation.

Biennial Cycle

NTTG follows a two-year, eight-quarter planning cycle to produce the 10-year Regional Transmission Plan. In the first step, the Planning and Cost Allocation Committees pre-qualify[3] Transmission Developers who properly submit their transmission project to be considered for regional cost allocation (should the sponsor's project be selected in the Regional Transmission Plan for cost allocation). The biennial cycle includes steps to collect, evaluate and analyze transmission and non-transmission data, produce and publish a draft plan, gather stakeholder and public input, update the plan and complete the cycle with the publishing of a RTP.

[3] Pursuant to Attachment K, Section Pre-qualify for Cost Allocation, a Project Sponsor that intends to submit a project for cost allocation must be pre-qualified before the beginning of the 2016-2017 biennial planning cycle (i.e., the last quarter of the prior planning cycle).

Figure 2. NTTG uses an eight-quarter biennial planning cycle.

Biennial Study Plan

The biennial study plan outlines the process that NTTG follows to develop its 10-year RTP. It provides the framework to guide plan development. It also describes NTTG's process to determine if a properly submitted Interregional Transmission Project (ITP) would yield a transmission plan that is a more cost-effective or efficient solution to NTTG's regional transmission needs.

The NTTG Planning Committee manages the study plan. The Planning Committee establishes the Technical Work Group (TWG) subcommittee to develop the study plan. The TWG also performs the necessary technical evaluations for the RTP and assesses any projects, including ITPs, submitted to NTTG. TWG members are NTTG Planning Committee members or their designated technical representatives. They have access to and expertise in power-flow analysis for power systems or production-cost modeling, or both.

Developed during Quarter 2 of the biennial planning cycle, the study plan establishes the:

- Study methodology and criteria
- Study assumptions based on the loads, resources, point-to-point transmission requests, desired flows, constraints and other technical data submitted in Quarter 1 and updated in Quarter 5 of the regional planning cycle
- Software analysis tools
- 2026 production-cost-model database and hours to be selected for reliability analysis
- Evaluation criteria for reliability and transmission service obligations
- Capital cost, energy losses and reserve-sharing metric calculations
- Public Policy Requirements and Public Policy Considerations

The study plan was posted for stakeholder comment, recommended for approval by the Planning Committee and approved by the Steering Committee during Quarter 2 of the biennial

cycle. Due to data submission updates provided in Quarter 5, the study plan was revised in Quarter 6. Any differences between what is stated in the study plan and the process stated in the NTTG Transmission Providers' FERC Order 1000 Attachment K, defer to Attachment K.

Study Methodology

To determine the more efficient or cost-effective transmission plan, the TWG subcommittee conducted reliability and economic studies in accordance with the 2016-2017 Study Plan. The Study Plan and ultimately the RTP reflect the NTTG Transmission Providers' Attachment K requirements to satisfy its transmission needs. NTTG's regional transmission planning does not investigate local transmission planning or generation decisions related to integrated resource planning. Rather, NTTG's methodology uses a regional perspective to question the Initial RTP's roll-up of Non-Committed regional transmission project(s) to identify, if possible, a regional transmission plan that is more efficient or cost effective than the aggregated Full Funder's transmission plans. In conducting its regional studies, NTTG uses regional transmission and non-transmission alternatives (if any) to honor the local transmission needs. As part of the study, NTTG assumed that the local existing and new generation additions have (or will have) firm transmission rights to move their power from the generator to load. NTTG's reliability studies did not re-dispatch existing generation down to relieve congestion such that the new generation additions could move their power to load without potentially creating congestion.

The reliability studies used production-cost modeling and power-flow studies. The production-cost and power-flow models represent data for the western interconnection load, resource and transmission topology. In developing the data for these two models, NTTG started with a WECC production cost model (version TEPPC CC1.3) and WECC power-flow model (version 25hs1a) and modified the modeling data in NTTG's footprint for its regional studies. For the studies including one or more interregional transmission projects that relied on increased wind generation within NTTG's footprint (e.g., adding new wind resource in Wyoming), NTTG adjusted generation levels down in the region receiving the power. The goal of the adjustments was to ensure western interconnection load and resource balance. NTTG consulted with the planning region receiving the power (i.e., California ISO) for their generation reductions.

The results of the production-cost modeling were used to identify seven hours of high stress on the transmission system. These seven hours were then subjected to reliability analysis using a power-flow model. The input and output data for these selected hours were transferred from the production-cost model (i.e., GridView) to a power-flow model (i.e., PowerWorld) to perform the technical reliability analysis. By taking these steps, a consistent set of analysis tools and data can be engaged to evaluate the reliability performance.

Next, economic studies employed the Attachment K's three metrics—capital-related costs, energy losses, and reserves—to analyze Change Case plans that were deemed reliable to further determine the cost effectiveness of the NTTG transmission plan.

Production-Cost Modeling

The TWG examined 8,760 hours of data using GridView[4] production-cost software to establish stressed conditions within the NTTG footprint. To set the stressed conditions, the TWG used and modified a dataset from the Transmission Expansion Planning Policy Committee (TEPPC) of the WECC. The TEPPC case included a representation of the load, generation and transmission topology of the WECC interconnection-wide transmission system 10 years into the future.

The study plan identified seven stressed conditions that affect the NTTG area for study. After all hours of data were run through the GridView production-cost program, the results were analyzed and the hours representative of the seven stressed conditions were identified. For a more detailed discussion of the conditions and hours, see the section on stress-conditioned case study results.

Power-Flow Cases

For the next step in the process, the TWG used PowerWorld[5] simulation software to convert the production-cost model for the seven stressed hours into power-flow cases. Each of the stressed cases was then reviewed by the TWG to ensure that the case met steady-state system performance criteria (no voltage issues or thermal overloads). Bubble diagrams showing the inter-area flows for each of the stressed cases are included in the Draft Final RTP, available on the NTTG website.

Data Submission

Information flows into NTTG during Quarter 1 and Quarter 5 of the biennial cycle. Transmission Providers and stakeholders may supply data on forecasted firm energy obligations and commitments required to support the transmission system within the NTTG footprint. The data may include load forecasts, resources, transmission topology, transmission service and Public Policy Requirements submissions. Regional transmission projects submitted in Quarter 1 are shown in Table 1 and include those from the prior Regional Transmission Plan, Transmission Provider Local Transmission Plans (LTP), Sponsored Projects, unsponsored projects and Merchant Transmission Developer projects. No projects that were eligible for cost allocation were submitted into NTTG's 2016-17 regional planning process.

[4] GridView is a registered ABB product

[5] PowerWorld is a registered trademark of PowerWorld Corp.

SPONSOR	FROM	TO	VOLTAGE	CIRCUIT	TYPE	REGIONALLY SIGNIFICANT [6]	COMMITTED	PROJECTS
DESERET G&T	Bonanza	Upalco	138 kV	2	LTP	No	No	New Line
IDAHO POWER	Longhorn	Hemingway	500 kV	1	LTP & pRTP[7]	Yes	No	Boardman to Hemingway (B2H) Project
	Hemingway	Bowmont	230 kV	2	LTP	Yes	No	New Line (associated with Boardman to Hemingway)
	Bowmont	Hubbard	230 kV	1	LTP	Yes	No	New Line (associated with Boardman to Hemingway)
	Cedar Hill	Hemingway	500 kV	1	LTP	Yes	No	Gateway West Segment #9 (joint with PacifiCorp East)
	Cedar Hill	Midpoint	500 kV	1	LTP	Yes	No	Gateway West Segment #10
	Midpoint	Borah	500 kV	1	LTP	Yes	No	(convert existing from 345 kV operation)
	King	Wood River	138 kV	1	LTP	No	No	Line Reconductor
	Willis	Star	138 kV	1	LTP	No	No	New Line
MATL	SE Alberta		DC	1	LTP	Yes	No	MATL 600 MW Back to Back DC Converter
PACIFICORP EAST	Aeolus	Clover	500 kV	1	LTP & pRTP	Yes	No	Gateway South Project – Segment #2
	Aeolus	Anticline	500 kV	1	LTP & pRTP	Yes	No	Gateway West Segments 2&3
	Anticline	Jim Bridger	500 kV	1	LTP & pRTP	Yes	No	345/500 kV Tie
	Anticline	Populus	500 kV	1	LTP & pRTP	Yes	No	Gateway West Segment #4
	Populus	Borah	500 kV	1	LTP	Yes	No	Gateway West Segment #5
	Populus	Cedar Hill	500 kV	1	LTP	Yes	No	Gateway West Segment #7
	Antelope	Goshen	345 kV	1	LTP	Yes	No	Nuclear Resource Integration
	Antelope	Borah	345 kV	1	LTP	Yes	No	Nuclear Resource Integration
	Windstar	Aeolus	230 kV	1	LTP & pRTP	Yes	No	Gateway West Segment #1W
	Oquirrh	Terminal	345 kV	2	LTP	Yes	Yes	Gateway Central
	Cedar Hill	Hemingway	500 kV	1	LTP	Yes	No	Gateway West Segment #9 (joint with Idaho Power)
PACIFICORP WEST	Wallula	McNary	230 kV	1	LTP	Yes	Yes	Gateway West Segment A
PORTLAND GENERAL	Blue Lake	Gresham	230 kV	1	LTP	No	No	New Line
	Blue Lake	Troutdale	230 kV	1	LTP	No	No	Rebuild
	Blue Lake	Troutdale	230 kV	2	LTP	No	No	New Line
	Horizon	Springville Jct	230 kV	1	LTP	No	No	New Line (Trojan-St Marys-Horizon)
	Horizon	Harborton	230 kV	1	LTP	No	No	New Line (re-terminates Horizon Line)
	Trojan	Harborton	230 kV	1	LTP	No	No	Re-termination to Harborton
	St Marys	Harborton	230 kV	1	LTP	No	No	Re-termination to Harborton
	Rivergate	Harborton	230 kV	1	LTP	No	No	Re-termination to Harborton
	Trojan	Harborton	230 kV	2	LTP	No	No	Re-termination to Harborton

Table 1. January 2016 data submittal—transmission additions by 2026.

[6] Regionally significant transmission projects are generally those that effect transfer capability between areas of NTTG. Projects that are mainly for local load service are not regionally significant. Projects that are not regionally significant will be placed into all change cases and not tested for impact on the Regional Transmission Plan. The future facilities submitted in the LTP's will be removed in the null case.
[7] Prior RTP

Forecasted Loads

Participating load-serving entities provide forecasts of loads for balancing authority areas internal to the NTTG footprint. These loads are generally the same as those found in the participants' official load forecasts (such as those in integrated resource plans) and are similar to those provided to the Load and Resource Subcommittee of the WECC Planning Coordination Committee. Figure 3 summarizes the load forecast used in the 2016-2017 planning cycle.

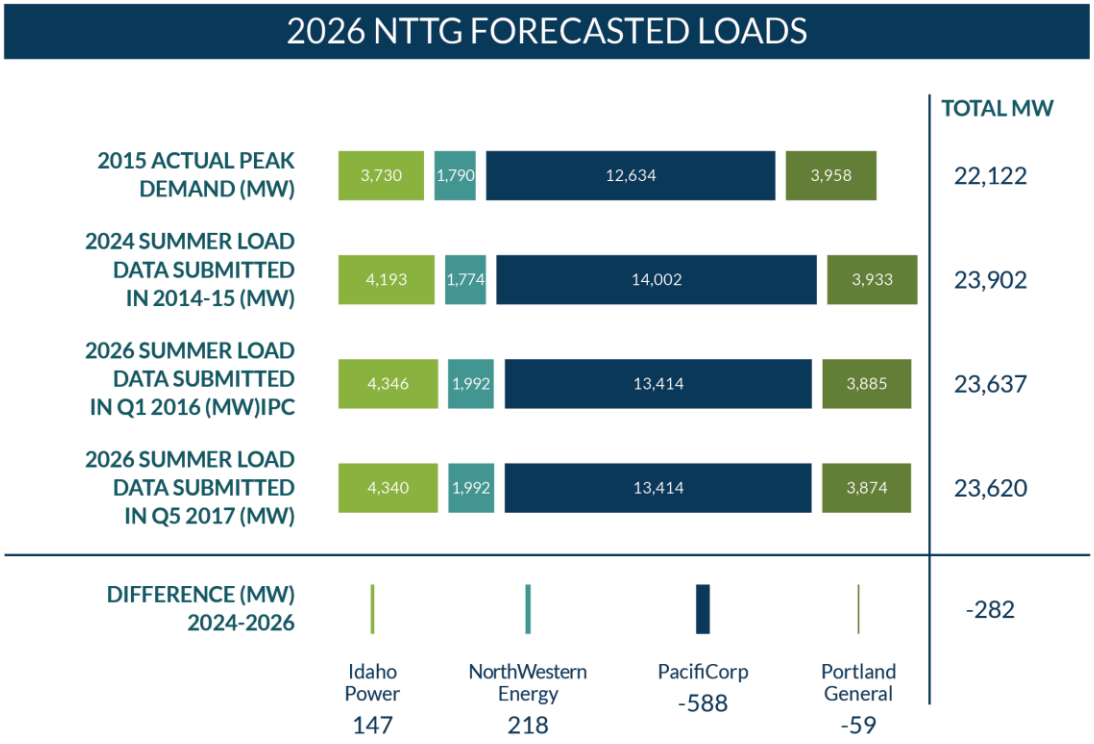

Figure 3. 2026 NTTG forecasted loads

NTTG received 3,200 MW of proposed new generation resources from its funding Transmission Providers for consideration in the RTP. Figure 4 displays these incremental resources within the NTTG footprint and compares submissions from the prior RTP with submissions for Quarter 1 and Quarter 5 of the current cycle.

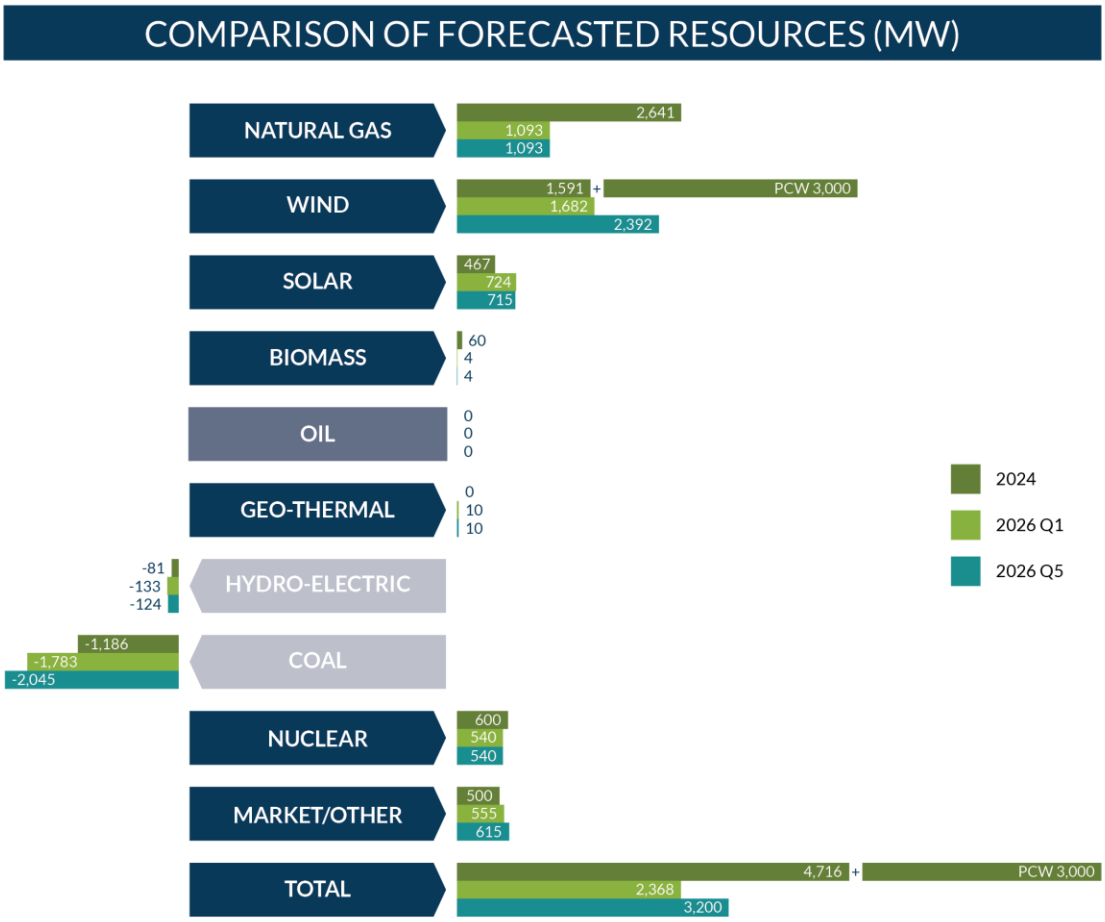

Figure 4. Comparison of forecasted resources.

In the 2014-15 study cycle, Power Company of Wyoming (PCW) submitted 3,000 MW of wind resources associated with the TransWest Express project. PCW asked that those resources not be included in the NTTG 2014-15 Regional Plan, and those resources have been shown separately in Figure 4. For the 2016-17 study cycle, the 3,000 MW has been excluded from the NTTG totals. Those resources, to serve loads outside the NTTG footprint in California, have been submitted with an Interregional Transmission Project in the 2016-17 study cycle.

In Quarter 5, NorthWestern submitted 550 MW of new Montana wind generation. Also PacifiCorp indicated that its recently submitted integrated resource plan increased the amount of Wyoming wind power from 887 MW to 1,100 MW. As shown in Figure 4, the total resource forecast of 3,200 MW submitted this cycle was reduced by 1,516 MW, or 32.1 percent, from the 4,716 MW forecast in 2024. Following the Quarter 1 data submittal, the owners of the Colstrip 1 and 2 coal-fired plants announced a plan to retire the units before 2026. The owners of the Valmy 1 and 2 coal plants in Nevada also plan to decommission the plants by 2025, a

decade earlier than originally planned. Both sets of retirements were assumed in the 2016-2017 studies and are reflected in Quarter 5 values shown in Figure 4.

In support of the proposed transmission additions or upgrades, NTTG received four firm transmission-service-obligation submissions (contractual requirements to provide service)—two each from Idaho Power and PacifiCorp. These are shown in the following map.

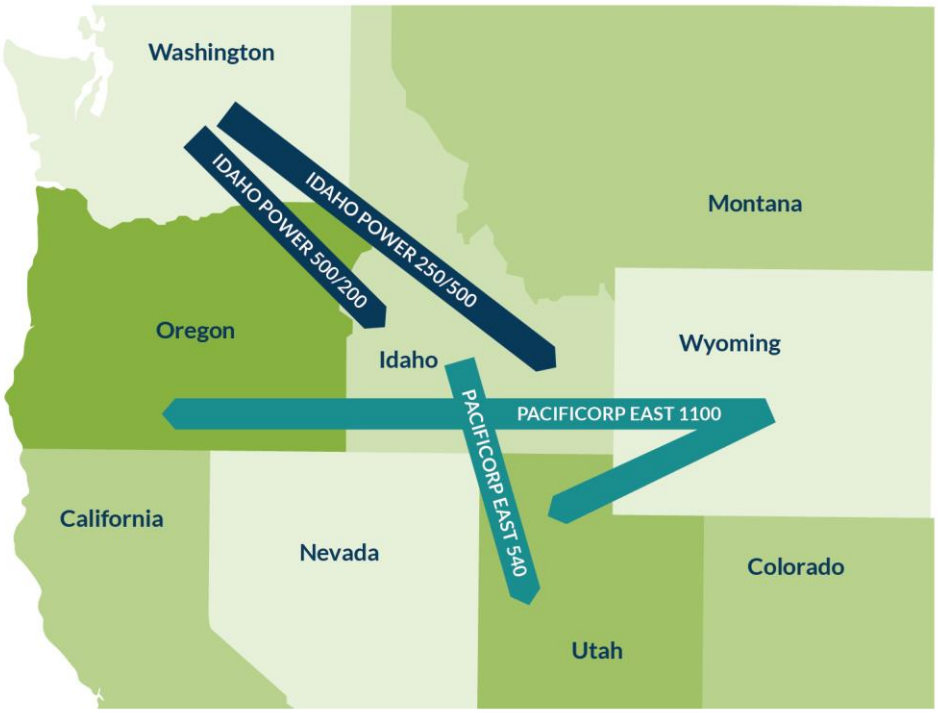

Figure 5. Transmission Service Obligations.

Public Policy Consideration Scenario Requests

In Quarter 1, Renewable Northwest (RNW) and the Northwest Energy Coalition (NWEC) jointly submitted a Public Policy Consideration request for a scenario analysis study. The group asked NTTG to study a faster phase-out of coal plants while developing utility-scale renewable resources and replacing Colstrip units 1, 2 and 3 with either wind only or a combination of wind and natural gas simple/combined cycle resource.

Members of the TWG and representatives from RNW and NWEC reviewed the request and agreed to some modifications. These modifications, and the associated study assumptions, are documented in the NTTG 2016-2017 Study Plan, Attachment 3 of the Draft Final RTP.

The study results suggested that a replacement of wind or a combination of wind and gas for coal may be feasible. This study, however, neither constituted a path study nor conveyed or implied transmission rights. Additional analysis would be required to understand the full impacts of coal plant decommissioning.

Public Policy Considerations are considered to be relevant factors not established by local, state or federal laws or regulations. The results of PPC analysis may inform the RTP but do not result in the inclusion of additional projects in the RTP.

A full report of the study can be found in Appendix D of the NTTG 2016-2017 Draft Final RTP.

Regional Economic Study Requests

NTTG received no regional economic study requests.

Initial Regional Transmission Plan Development

The starting point for the biennial planning process was development of the Initial RTP. This exercise used a bottom-up approach to merge the projects in the prior RTP (2014-2015) and the NTTG Transmission Providers' local transmission plans into a single regional transmission plan. Next, the TWG analyzed the Initial RTP through Change Case plans, which included or excluded Non-Committed regional projects and Interregional Transmission Projects. These Change Case plans helped to determine whether Alternative Projects could be added or substituted, or if one or more Non-Committed Projects could be deferred, or both, to yield a regional transmission plan more efficient or cost effective than the Initial RTP. The results of this analysis led to the formation of the Draft RTP.

Figure 6. The turquoise and green lines represent the projects comprising the prior RTP from 2014-2015. These include Boardman to Hemingway, in the northwest sector of the above map, and an Alternative Project with four transmission elements across four states.

Figure 7. Map showing Non-Committed regional projects comprising the 2016-2017 Initial RTP.

Interregional Project Coordination

As part of interregional coordination, NTTG and the other regional entities in the Western Interconnection collaborate during their transmission planning processes to coordinate their interregional transmission planning data. These coordination efforts inform each planning region's transmission plans. A properly submitted Interregional Transmission Project is evaluated as an Alternative Project in NTTG's regional planning process. The set of uncommitted projects (regional, interregional or both) that result in the more efficient or cost-effective plan forms the Regional Transmission Plan.

SUMMARY OF Q1-2016 INTERREGIONAL PROJECTS SUBMITTED TO NTTG

PROJECT NAME	COMPANY	RELEVANT PLANNING REGION(S)	TERMINATION FROM	TERMINATION TO	STATUS	IN SERVICE DATE
CROSS-TIE TRANSMISSION PROJECT	TransCanyon, LLC	NTTG, WestConnect	Clover, UT	Robinson Summit, NV	Conceptual	2024
SWIP-NORTH	Great Basin Transmission LLC	NTTG, WestConnect	Midpoint, ID	Robinson Summit, NV	Permitted	2021
TRANSWEST EXPRESS TRANSMISSION PROJECT	TransWest Express, LLC	NTTG, WestConnect and CAISO	Sinclair, WY	Boulder City, NV	Conceptual	2020

Table 2. Three Interregional Transmission Projects were submitted for consideration during formation of the Initial RTP in Quarter 1 of the biennial cycle.

Figure 8. Three Interregional Transmission Projects were evaluated during the planning cycle.

Southwest Intertie Project (SWIP). Great Basin Transmission, LLC (GBT), an affiliate of LS Power, submitted the 275-mile northern portion of the Southwest Intertie Project (SWIP) as an ITP. SWIP-North would connect the Midpoint 500-kV substation in NTTG's planning area to the Robinson Summit 500-kV substation in the WestConnect area with a 500-kV single-circuit AC transmission line. The SWIP is expected to have a bi-directional WECC-approved path rating of approximately 2,000 MW. If GBT is selected to build SWIP-North, development, final design and construction activities could be completed to support energizing the project within an estimated 36-42 months.

Cross-Tie Transmission Line. TransCanyon submitted the 213-mile Cross-Tie Transmission Line for consideration as an ITP. TransCanyon proposes to build a 1500-MW, 500-kV high-voltage alternating current (HVAC) line between central Utah and east-central Nevada. The line would connect PacifiCorp's proposed 500-kV Clover substation with the existing 500-kV Robinson Summit substation. TransCanyon expects the project to be in-service by the end of 2024.

TransWest Express Transmission Project. TransWest proposed a 730-mile, phased 1,500/3,000 MW, ±600 kV, high-voltage direct current (HVDC) transmission system with terminals in south-central Wyoming and southeastern Nevada. The federal Bureau of Land Management and Western Area Power Administration published the Final Environmental Impact Statement (FEIS) for the TWE Project in May 2015.

Stress-conditioned Case Study Results

Stressed Hours for Study with Production-Cost Modeling

The TWG used GridView production-cost software to review 8,760 hours of data to identify stressed conditions within the NTTG footprint. A case representing the year 2026 was obtained from the WECC TEPPC. This case included a representation of the load, generation and transmission topology of the WECC interconnection-wide transmission system 10 years in the future. The TWG identified corrections to the data needed to align with data submitted in the first quarter of the biennial planning cycle. The TWG shared these changes with the other regional planning entities and WECC to include in their future studies. The TWG then agreed to use this modified TEPPC case in creating the stressed cases discussed below.

After processing all 8,760 hours through the production-cost program, the TWG analyzed the data and identified seven stressed conditions to study, as shown in Table 3.

STRESSED CONDITION	DATE	HOUR	TWG LABEL
Max. NTTG Summer Peak	July 22, 2026	16:00	A
Max. NTTG Winter Peak	December 8, 2026	19:00	B
Max. MT to NW	September 10, 2026	Midnight	C
High Southern Idaho Import	June 11,2026	14:00	D1
High Southern Idaho Export	September 17, 2026	2:00	D2
High Tot2 Flows	November 11, 2026	17:00	E
High Wyoming Wind	September 17, 2026	2:00	F

Table 3. Hours selected from 2026 WECC TEPPC case to represent different NTTG system stresses.

High Summer Peak (NTTG Case A)

- 24,100 MW load
- 17,851 MW resources
- 6,250 MW import
- 4 p.m., July 22, 2026

This case showed a need to import energy during high summer air-conditioning loads. The transmission projects in the Initial RTP performed reasonably well; however, system performance proved inadequate without transmission system additions by 2026 to meet NTTG's summer peak load. This case accounted for wind resources of 2,175 MW to check the performance of the set of projects comprising the Draft RTP.

High Winter Peak (NTTG Case B)

- 22,468 MW load
- 19,261 MW resources
- 3,208 MW import
- 7 p.m., Dec. 8, 2026

A few local system violations occurred when tested against the transmission projects comprising the Initial RTP. This case puts less stress on the NTTG system than did the summer peak. This case also accounted for wind resources of 2,175 MW to check the performance of the Draft RTP projects.

High Montana-NW (Path 8) Flows (NTTG Case C)

- 13,097 MW load
- 12,138 MW resources
- 959 MW import
- 12:00 midnight, Sept. 10, 2026

This case tested transmission system capabilities with high electricity flows from Montana to the Northwest. This scenario was used for the Public Policy Consideration study, which analyzed the impact of an accelerated phase-out of Colstrip units 1, 2 and 3 with either wind only or a combination of wind and gas. See the Public Policy Consideration Scenario Requests section for results of the study.

High Southern Idaho Import (NTTG Case D1)

- 16,382 MW load
- 9,159 MW resources
- 7,223 MW import
- 2 p.m., June 11, 2026

Under conditions with the eastbound path from the Northwest to Idaho operating at a 2,244 MW deficit, and the NTTG system importing 7,223 MW, the NTTG transmission topology could not import enough power to support load service obligations in southern Idaho. With the addition of transmission projects comprising the Initial RTP, however, the NTTG system would perform well, with a few local violations.

High Southern Idaho Export (NTTG Case D2)

- 11,935 MW load
- 14,683 MW resources
- 2,748 MW export
- 2 a.m., Sept 17, 2026

In this export scenario, with the Idaho to Northwest Path 8 flow at 3,391 MW, the existing NTTG system would be incapable of supporting expected transfers and meeting transmission requirements in 2026. Adding in the projects from the Initial RTP, the system performed well, with one contingency that caused a series capacitor bank to overload. That bank, however, has reached the end of its useful life and is likely to be replaced before 2026.

High NE-SE (Path Tot2) flows (NTTG Case E)

- 16,625 MW load
- 16,620 MW resources
- 5 MW export
- 5 p.m., Nov. 11, 2026

This case evaluated the performance of the Interregional Transmission Projects in supporting transfers between regions. These additional interregional transfers were not identified in Q1 to meet or defer NTTG's 2026 footprint resource requirements. The case showed near balance in the NTTG footprint between loads and resources, with a small 5 MW import, along with a Tot2 flow of 1,566 MW. This case accounted for wind resources of 2,175 MW to check the performance of the Draft RTP.

High Wyoming wind production (NTTG Case F)

- 11,935 MW load
- 15,015 MW resources
- 3,081 MW export
- 2 a.m., Sept. 17, 2026

This case, as others, was studied at the 2,175-MW wind level, which includes the addition of 1,100 MW of wind capacity. The thermal dispatch in this case was at a typical high level of 3,580 MW. The added wind generation in the Wyoming area worsened reliability issues observed in Wyoming and confirmed the need for additional transmission to use these resources to their fullest extent. The RTP addresses these reliability concerns and relieves the transmission constraints.

Development of Change Cases

For each of the seven stress-conditioned cases, the TWG prepared a null Change Case and analyzed reliability results. The null case represents roughly today's transmission topology made to serve loads and resource requirements in 2026. Only the Heavy Winter case performed acceptably. All the other conditions revealed performance issues that required varying degrees of correction, with the heavy summer case needing the least correction and the high Wyoming wind case needing the most. In instances where the transmission system was not adequately stressed to historical norms, the TWG slightly modified system conditions to ensure that the transmission system was studied under reasonably stressed conditions.

Change Case Results

To efficiently study the wide range of potential combinations of Non-Committed Projects, the TWG proposed a Change Case matrix in the study plan. Once the stressed power-flow cases had been selected and developed, the TWG modified the matrix to better reflect the recommended analysis. The TWG provided stakeholders with the opportunity for input on whether a particular combination of uncommitted regional or interregional projects should be analyzed. No comments were received. The matrix was subsequently vetted through the Planning Committee and the Steering Committee.

Figure 9 is the Change Case matrix used by the TWG.

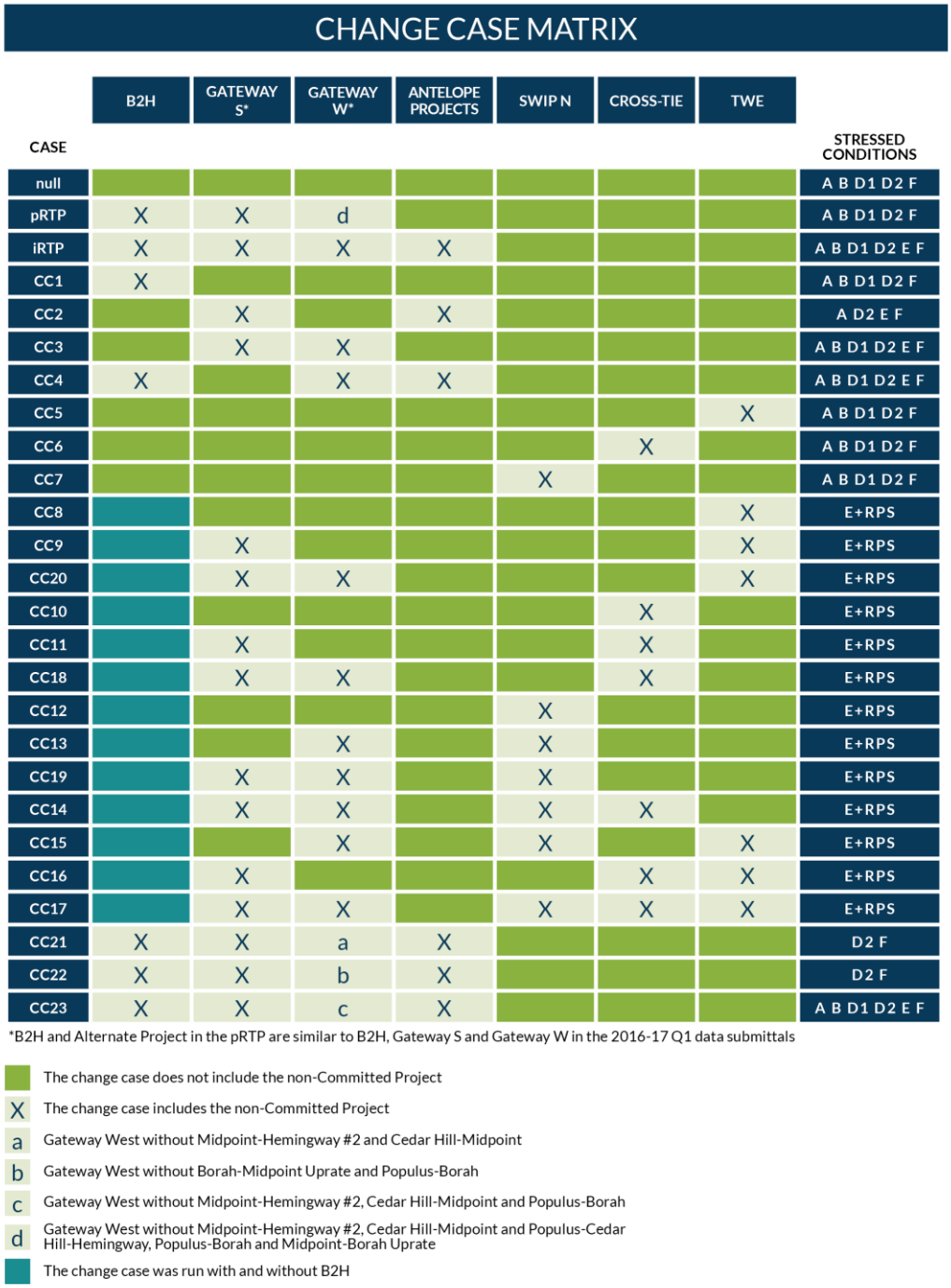

Figure 9. Change Case matrix used in the development of the RTP.

In all, the TWG performed more than 100 reliability studies with more than 410 contingencies in each study. To better communicate the results of these studies, the TWG created heat maps,

which present a weighted[8] graphical performance of a Change Case on a specific flow condition. A full heat map analysis of the Change Cases is included in the final Draft RTP.

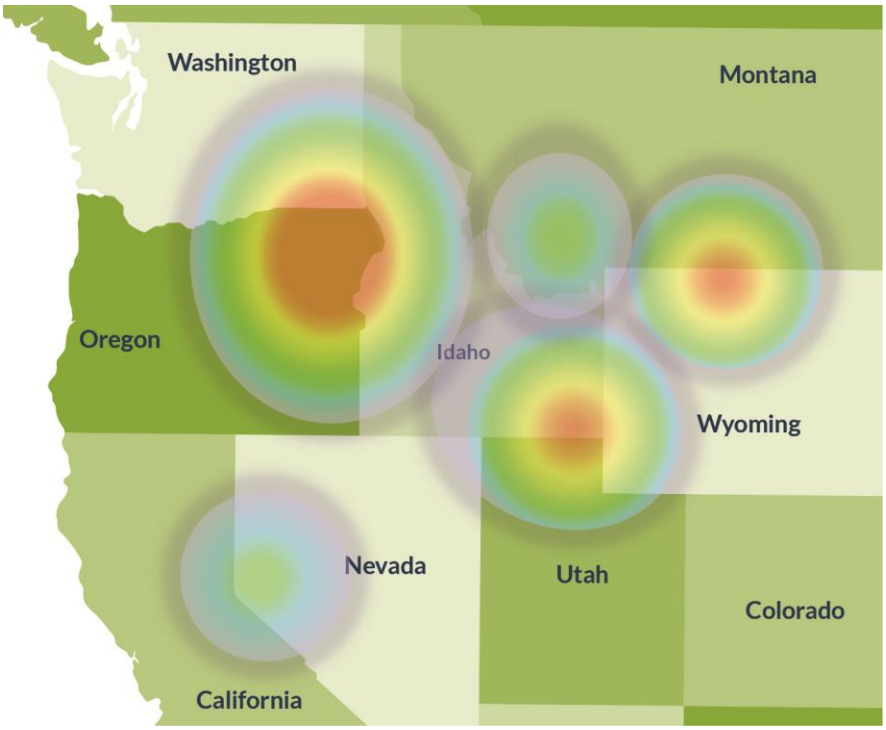

Figure 10. Heat map of the D2-Null Case.

Figure 10, for example, shows the general location where performance issues (e.g., an overloaded transmission line) occurred for a contingency. The accumulation of overloads and voltage issues are represented by the color spectrum from blue to red, or "cooler" to "hotter." These violations occur when transmission systems cannot handle anticipated transfers across that area's transmission lines. In particular, this heat map, using existing Wyoming wind resources dispatched at about 600 MW, indicates that transmission additions are necessary to integrate the projected wind resources.

[8] High voltage conditions had a weighting of 1; low-voltage conditions had a weighting of 3; and overloads of branches had a weighting of 5. For example, a zone in which 10 contingencies caused an overload of one branch in that zone would receive a total weight of 50 (i.e., 10 x 5), which would then be translated into a color on the map. A blue color represents a weighted total of about 10, green is a count up to 30, yellow is a count up to 50 and red is for a weighted count exceeding about 70.

Figure 11. Heat map of the High Southern Idaho export case with the Initial RTP facilities included.

The heat map in Figure 11 shows how the addition of the Initial RTP projects produced a dramatic improvement of transmission performance when compared with the null case.

High Southern Idaho Import Case

Combining the Boardman to Hemingway project with the Gateway West and Gateway South Non-Committed Projects eliminated violations in flow conditions visible in the null case. Change Case 3 tested whether Gateway West or Gateway South, or both, could replace or compare with the Boardman to Hemingway line. They couldn't. The projects contained in the prior RTP also failed to alleviate the violations.

High Southern Idaho Export Case

Adding the Boardman to Hemingway project relieved stress across the Idaho-Northwest cutplane, but significant issues remained east of Hemingway. Adding the eastern portion of Gateway West and Gateway South outlined in the prior RTP eliminated the performance issues in Wyoming and between Idaho and Montana, but those additions increased the stress across southern Idaho. The Initial RTP and Change Cases 21 and 23 resolved these issues.

High Wyoming Wind Case

Without significant reinforcements, the transmission system in Wyoming could not handle both existing and future planned wind resources while maintaining all other Wyoming area generating resources at their typical high capability in an export scenario.

With wind production at the 1,300-MW level in the null case (no new transmission supporting 2026 loads), the system performed poorly. Nor did the projects in the prior RTP solve problems. Adding the Initial RTP projects resolved all violations except for a series capacitor bank. That bank has reached the end of its useful life, however, and is due for replacement.

In Quarter 6, the case was tested to see if Change Cases 1 through 4 would support the increased level of Wyoming wind. The null case (no new transmission) was unable to be solved with wind above 1,800 MW. Testing Change Case 4 required adding the Aeolus-Anticline 500-kV line (Case 4a) to eliminate a number of contingencies that failed to solve in Wyoming. Change Case 23, which is essentially Change Case 4a with Gateway South added, performed well with Wyoming wind modeled at 2,175 MW.

Interregional Transmission Projects

Change Cases 5 through 20 tested whether the three Interregional Transmission Projects (ITP)—alone, in combination with other ITPs or in combination with the Non-Committed Projects—could satisfy NTTG's transmission needs on a regional or interregional basis more efficiently or cost effectively than through local planning processes. The ITPs were added to the null cases without any additional resources to serve NTTG load beyond those resources identified in the Quarter 1 and Quarter 5 data submittals. Testing showed the ITPs did not provide the NTTG footprint with regional benefits, either by significantly reducing performance issues or by displacing NTTG Non-Committed Projects.

The Initial RTP also was analyzed to determine whether it would be capable of supporting the interregional resource transfers proposed by the ITPs. Given the relatively long distances of the ITPs, the local integration performance issues identified in Wyoming were solvable.

Reliability Conclusions

Based on the above study results, the TWG concluded that the Initial RTP shown in Figure 7 and two variants, Change Cases 21 and 23, satisfy NTTG reliability criteria. In Quarter 5, the TWG tested Change Case 23 and the wind resource additions at various load and flow levels on the Heavy Summer, Heavy Winter, High Tot2 and High Wyoming wind cases. The TWG study found the NTTG area would be reliably served in the year 2026 only by including the following Non-Committed regional projects:

- Boardman to Hemingway
- The Energy Gateway projects including segments:
    - Windstar-Aeolus 230 kV
    - Aeolus-Clover 500 kV
    - Aeolus-Anticline 500 kV
    - Anticline-Populus 500 kV
    - Populus-Cedar Hill-Hemingway 500 kV

        - Borah-Midpoint 345 kV uprate to 500 kV
    - Antelope Transmission Project including:
        - Antelope-Borah 345 kV
        - Antelope-Goshen 345 kV
        - Antelope 345/230 kV transformers and interconnection facilities

The ITPs were evaluated to determine whether one or more of them could defer or replace NTTG's Non-Committed Projects. The TWG concluded that none of the ITPs solved NTTG's reliability performance issues and, thus, were not included in the Draft Final NTTG RTP.

Economic Evaluations

To determine whether the Initial RTP or a Change Case transmission plan was more cost effective, the TWG used three economic metrics, as determined in the biennial study plan. The three metrics—capital-related costs, power flow losses and reserves—and results are discussed below.

Capital-related Cost Metric

Development of the capital-related cost metric required three steps. The first step validated the capital cost of the Project Sponsor's Q1 submitted project. The second step used those results to estimate the annual capital-related costs. The third step levelized the net present value annual capital-related costs for the Initial RTP and the Change Case plans.

Energy-loss Metric

The energy-loss metric captures the change in energy generated, based on system topology, to serve a given amount of load. A reduction in losses for a Change Case would represent a benefit, since less energy would be required to serve the same load. The two Change Cases with fewer Gateway West transmission segments—Change Cases 21 and 23—had losses higher than, or in some cases equal to, the Initial RTP. Losses were higher in the two Change Cases because the electrical flows in the Initial RTP were redistributed to fewer lines. From a loss perspective alone, the Initial RTP case had fewer losses and as such was the more efficient case.

Reserve Metric

The reserve metric evaluates the opportunities for two or more parties to save money by sharing a generating resource that would be enabled by transmission. The metric is a 10-year look at the increased load and generation additions in the NTTG footprint and the incremental transmission additions that may be included in the RTP.

In the study cycle, the TWG analyzed Gateway West, Gateway South, Boardman to Hemingway, SWIP North and the Cross-Tie projects. To evaluate these projects, the NTTG footprint was segmented into five zones, and a sixth external zone was included to study the SWIP North and the Cross-Tie projects. The six zones produced 122 viable sharing combinations. Of those, the

analysis of the annual net savings over each theoretical participant's standalone alternative suggested that only 34 viable combinations were economic.

Note that this metric includes generation capital costs in its evaluation and, as such, may only be appropriate for cost allocation purposes. It should not drive the selection of a RTP. Whether these cost savings warrant jointly sharing the costs of reserve capacity is up to the parties to decide.

For the NTTG metric analysis, the Initial RTP and the two alternative Change Cases each supported viable economic combinations. Since these Change Cases could contain the same benefit value, the Change in Reserve metric did not factor into the RTP selection decision.

Economic Metric Analysis Conclusion

The sum of the annual capital-related cost metric, loss metric (monetized) and reserve metric (monetized) yielded an incremental cost for the Initial RTP and the Change Case plans. The set of projects with the lowest incremental cost, after adjustment by the plan's effects on neighboring regions—Change Case 23 (see Figure 10, below)—was then incorporated into the RTP. Note that the incremental cost was computed as the levelized annual capital-related cost, minus NTTG loss benefit, minus monetized reserve benefit.

Figure 12. Change Case 23, comprising Boardman to Hemingway, Gateway South, portions of Gateway West, and the Antelope projects, produced the lowest incremental cost.

Final Regional Transmission Plan

Based on the study assumptions and reliability and economic conclusions discussed above, the more efficient or cost-effective plan is Change Case 23. Change Case 23 is a staged variant of the Initial RTP. For the transfers submitted in Quarter 1 and Quarter 5, the facility segments

shown in Figure 13, below, were not necessary for the transfers studied in the Change Cases. These segments would likely be necessary at higher transfer levels.

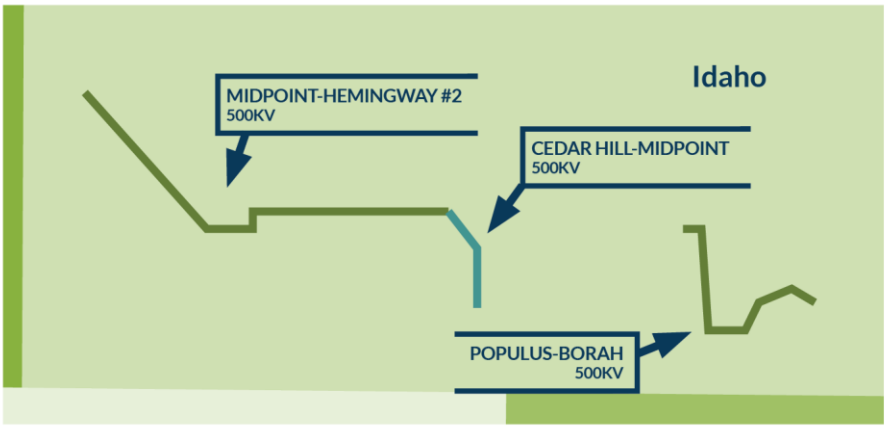

Figure 13. These transmission line segments from the Initial RTP were not included in the final RTP.

NTTG's final RTP emerged after a rigorous reliability analysis of the NTTG Transmission Providers' rollup of their local area plans and assumption of Non-Committed regional transmission projects, augmented with stakeholder Interregional Transmission Projects. This technical analysis was followed by an economic metric analysis that selected NTTG's more efficient and cost-effective regional transmission plan, shown below in Figure 14.

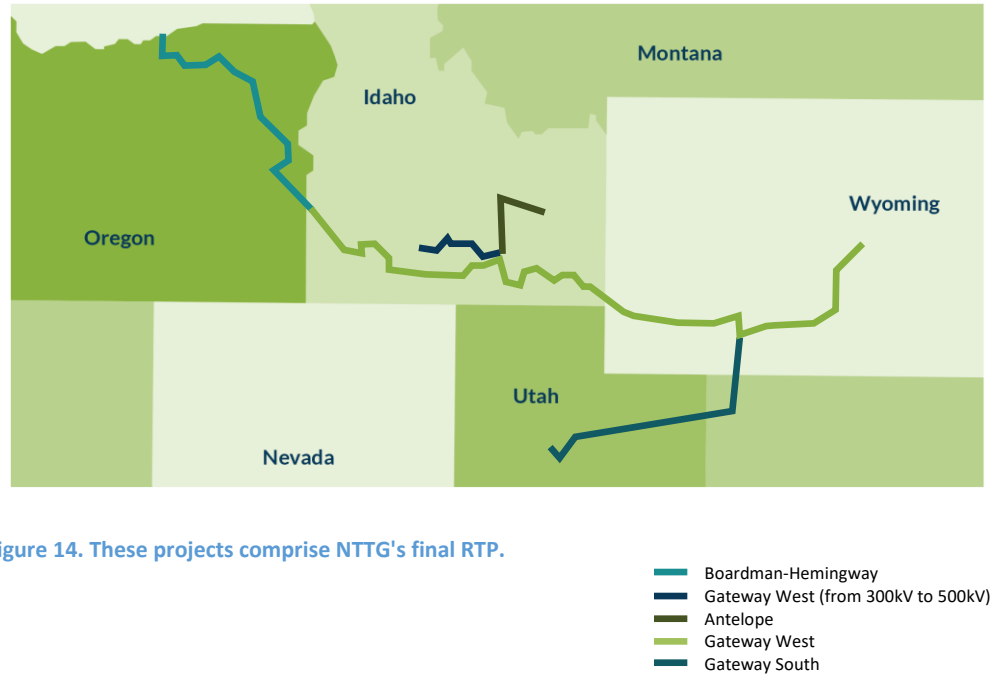

Figure 14. These projects comprise NTTG's final RTP.

Cost Allocation

The SWIP-North Project Sponsors were the only Project Sponsors to request cost allocation; however, they failed to comply with the requirement to submit pre-qualification data by Oct. 31, 2015. As a result, no projects that were eligible for cost allocation were submitted into NTTG's 2016-17 regional planning process.

Next Steps

Publication of the NTTG Regional Transmission Plan completes the two-year planning process begun with pre-qualification of Project Sponsors in Quarter 8 2015 and continued with project data submittal in Quarter 1 of 2016. The NTTG 2016-2017 RTP identified a need for new transmission capacity to serve forecasted load in 10 years. The plan also identified a set of transmission projects known in this report as Change Case 23 as the more efficient or cost-effective transmission plan to meet that need. While the RTP is not a construction plan, it provides valuable regional insight and information for all stakeholders (including developers) to consider and use in their respective decision-making processes.

The next biennial regional transmission planning cycle for NTTG started Oct. 1, 2017 with Project Sponsor pre-qualification and will culminate with the publication of the 2018-2019 RTP in December 2019.

NTTG 2016-2017 Regional Transmission Plan Supporting Materials

The supporting materials referenced in this report have been posted on the NTTG website and can be found using the following link:

https://www.nttg.biz/site/index.php?option=com_docman&view=list&slug=supporting-documents-regional-transmission-plan&Itemid=31

A list and link to each of the individual supporting documents is also provided below:

1. Amended Quarter 6 NTTG 2016-17 Biennial Study Plan Approved 08-02-2017
2. NTTG 2016-2017 Draft Final Regional Transmission Plan - 06-30-2017
3. NTTG 2016-2017 Public Policy Consideration Scenario Report

Glossary

Note: This Glossary is for the benefit of readers and neither supplements nor modifies any defined terms contained in any entity's filed Open Access Transmission Tariff (OATT), including the Attachment K to that tariff. To the extent that a term diverges from any entity's OATT, the OATT takes precedence.

Alternative Project Alternative Project refers to Sponsored Projects, projects submitted by stakeholders, projects submitted by Merchant Transmission Developers and unsponsored projects identified by the Planning Committee (if any).

Change Case A Change Case is a scenario where one or more of the Alternative Projects is added to or replaces one or more Non-Committed projects in the Initial RTP. The deletion or deferral of a Non-Committed Project in the Initial RTP without including an Alternative Project can also be a Change Case.

Committed Project A Committed Project is a project that has all permits and rights of way required for construction, as identified in the submitted development schedule, by the end of Quarter 1 of the current regional planning cycle.

Draft Regional Transmission Plan Draft Regional Transmission Plan refers to the version of the Regional Transmission Plan that is produced by the end of Quarter 4 and presented to stakeholders for comment in Quarter 5.

Draft Final Regional Transmission Plan Draft Final Regional Transmission Plan refers to the version of the Regional Transmission Plan that is produced by the end of Quarter 6, presented to stakeholders for comment in Quarter 7 and presented, with any necessary modifications, to the Steering Committee for adoption in Quarter 8.

Initial Regional Transmission Plan Initial Regional Transmission Plan comprises projects included in the prior Regional Transmission Plan and projects included in the Full Funders Local Transmission Plans and accounts for future generation additions and deletions (e.g., announced coal retirements).

Interregional Transmission Project An Interregional Transmission Project is a proposed new transmission project that would directly interconnect electrically to existing or planned transmission facilities in two or more planning regions and that is submitted into the regional transmission planning processes of all such planning regions.

Merchant Transmission Developer Merchant Transmission Developer refers to an entity that assumes all financial risk for developing and constructing its transmission project. A Merchant Transmission Developer recovers the costs of constructing the proposed transmission project through negotiated rates instead of cost-based rates.

Non-Committed Project A project that is not a Committed Project

Project Sponsor A Project Sponsor is a Non-incumbent Transmission Provider or Incumbent Transmission Provider intending to develop the project that is submitted into the planning process.

Public Policy Consideration Those public policy considerations that are not established by local, state, or federal laws or regulations.

Public Policy Requirements Those public policy requirements that are established by local, state or federal laws or regulations, meaning enacted statutes (i.e., passed by the legislature and signed by the executive) and regulations promulgated by a relevant jurisdiction.

Sponsored Project A Sponsored Project is a project proposed by a Project Sponsor.