WESTCONNECT REGIONAL TRANSMISSION PLANNING

2022-23 PLANNING CYCLE

REGIONAL TRANSMISSION NEEDS ASSESSMENT REPORT

APPROVED BY WESTCONNECT PLANNING MANAGEMENT COMMITTEE ON

JANUARY 18, 2023

Contents

1.0 Introduction and Summary 3
1.1 WestConnect Regional Planning Process 3
1.2 WestConnect 2022-23 Regional Study Plan 4
1.3 WestConnect 2022-23 Regional Model Development 4
2.0 Regional Transmission Needs Assessment 5
2.1 Regional Reliability Needs Assessment 5
2.2 Regional Economic Needs Assessment 7
2.3 Public Policy Needs Assessment 8
3.0 Stakeholder Involvement 9
4.0 Conclusions and Next Steps 10
5.0 Information Confidentiality 11
6.0 Appendix A: Results of Reliability Needs Assessment 12
7.0 Appendix B: Results of Economic Needs Assessment 16
8.0 Appendix C: Economic Sensitivities 19

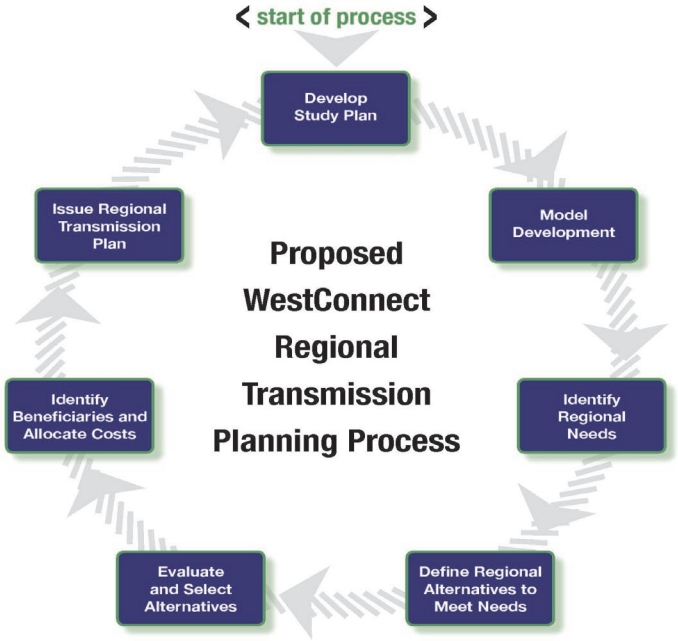
1.0 Introduction and Summary

The purpose of this report is to summarize the regional transmission need identification phase of the WestConnect 2022-23 Regional Transmission Planning Process ("Planning Process"). With stakeholder input, the Planning Subcommittee developed this report to document the regional transmission needs assessment and includes both minority and majority views on decisions and assumptions used in performing the assessment. The Planning Management Committee (PMC) has decision-making authority in the implementation of the Planning Process. On December 14, 2022, the PMC approved the recommendation by the Planning Subcommittee that no regional transmission needs were identified in the 2022-23 Regional Planning Process. This report provides documentation to the PMC in support of the Planning Subcommittee recommendation with regard to the regional transmission need identification phase of the Planning Process.

1.1 WestConnect Regional Planning Process

The identification of regional needs is the third step in the WestConnect Regional Planning Process. The planning process was developed for compliance with Federal Energy Regulatory Commission (FERC) *Order No. 1000, Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities* (Order No. 1000).[1] The Planning Process is performed biennially, beginning in even-numbered years, and consists of the seven primary steps outlined in **Figure 1**.

Figure 1 WestConnect Regional Transmission Planning



Additional details of the Planning Process can be reviewed in the WestConnect Regional Planning Process Business Practice Manual (BPM[2]), posted to the WestConnect website here. Readers can access

[1] *All references to Order No. 1000 include any subsequent orders.*

[2] *WestConnect Regional Planning Process Business Practice Manual, Version 2.0; Approved by the WestConnect Planning Management Committee on October 20, 2021*

the text of the FERC Order No. 1000 compliance documentation on the WestConnect website here and are encouraged to consult the compliance documentation and BPM for additional process information.

1.2 WestConnect 2022-23 Regional Study Plan

The first step in the Planning Process is the development of a Study Plan. 2022-23 WestConnect Study Plan ("Study Plan") was approved by the PMC on March 16, 2022. The Study Plan identifies the scope and schedule of planning activities to be conducted during the planning cycle. The Study Plan also describes the models and studies to be developed in the model development portion of the Planning Process.

1.3 WestConnect 2022-23 Regional Model Development

The second step in the Planning Process is the development of regional models. Two types of studies are needed for the Planning Process: reliability (power flow and stability) and economic (production cost model or PCM). During the second, third, and fourth quarters of 2022, the Planning Subcommittee developed regional models that were used in the identification of regional transmission needs for the 2022-23 Planning Process. WestConnect conducted an assessment of the region's transmission needs using models developed for the 2032 timeframe, approximately 10 years into the future. WestConnect will also perform information-only scenario studies, as outlined in the Study Plan, which are designed to evaluate alternate but plausible futures. As stated in the Study Plan, WestConnect regional assessments are centered on Base Cases and Scenarios, which when taken together, provide a robust platform that is used to identify the potential for regional transmission needs and emerging regional opportunities. Base Cases are intended to represent "business as usual," "current trends," or the "expected future." They are based on TO-supplied forecasts for load, generation, public policy resources, and transmission plans. Scenarios are intended to complement Base Cases by looking at alternate but plausible futures. They represent futures with resource, load, and public policy assumptions that are different in one or more ways than what is assumed in the Base Cases. The scenario assessment will be performed in 2023 and the results of the scenario assessments will be documented in a separate report. **Table 1** lists the reliability and economic models developed for the 2022-23 cycle.

Table 1 WestConnect Planning Models

Case Name	Case Description and Scope
2032 Heavy Summer Base Case	Summer peak load conditions during 1500 to 1700 MDT, with typical flows throughout the Western Interconnection.
2032 Light Spring Base Case	Light load conditions during 1200 to 1400 MDT in spring months of March, April, and May with solar and wind serving a significant but realistic portion of the Western Interconnection total load. Case includes renewable resource capacity consistent with any applicable and enacted public policy requirements.
2032 Base Case PCM	Business-as-usual, expected-future case with (1) median load, (2) median hydro conditions and (3) representation of resources consistent with TOLSO-approved resource plans as of March 2022.

For the 2022-23 cycle, the Base Case models were approved by the PMC on September 21, 2022, and the documentation of the Base Case model development was finalized on December 14, 2022, with the PMC's approval of the 2022-23 Model Development Report (MDR). The MDR describes the development process of the regional base models created with assistance from WestConnect members and other stakeholders. The report details key model assumptions and parameters such as study timeframe, horizon, area, the Base Transmission Plan, and how public policy requirements were considered. Along with the MDR, the PMC approved the regional base models for use in assessments.

2.0 Regional Transmission Needs Assessment

The third step in the WestConnect regional Planning Process is the regional transmission needs assessment and identification of regional needs. The following sections outline the methods, assumptions, and results of the three types of regional need assessments: reliability, economic, and public policy.

2.1 Regional Reliability Needs Assessment

WestConnect conducted the 2022-23 regional reliability assessment on two base cases: the 2032 Heavy Summer Base Case and the 2032 Light Spring Base Case. These models originated from cases developed and approved by the Western Electricity Coordinating Council (WECC). The assessment for regional needs was based on reliability standards adopted by the North American Electric Reliability Corporation (NERC) TPL-001-4 Table 1 (page 8, P0 and P1) and TPL-001-WECC-CRT-3.2 (Transmission System Planning Performance WECC Regional Criterion), and supplemented with any more stringent Transmission Owner with Load Serving Obligations (TOLSO) planning criteria based on TOLSO member feedback. Initial identification of regional issues for further review was defined as system performance issues impacting or between more than one TO Member system.

Study Procedure and Assumptions

The reliability assessment included extensive testing and multiple iterations of model refinements, simulations, participant review of results, and incorporation of modifications and comments into the subsequent round of simulations. The base case contingency and transient stability analysis became the final system assessment.

According to the BPM, "In the event a simulated outage produces NERC TPL violations in more than one TOLSO Member's system, that violation may result in the identification of a regional reliability-driven transmission need. Some reliability studies that show potential reliability issues may not result in the identification of regional reliability needs based on the review and consideration of those issues by the PMC."

The final evaluation of the base reliability assessment was limited to contingencies meeting specific voltage and generation criteria, as described below.

Steady State Contingency Analysis

Contingency definitions for the steady-state contingency analysis were limited to N-1 contingencies for elements 230-kV and above, generator step-up transformers for generation with at least 200 MW capacity, and member-requested N-2 contingencies. All bulk electric system (BES) branches and buses – i.e., elements above 90-kV – in the reliability models were monitored.

Transient Stability Analysis

The PMC agreed that the transient stability simulations studied in the 2020-21 study cycle would be repeated for this cycle.

Study Results

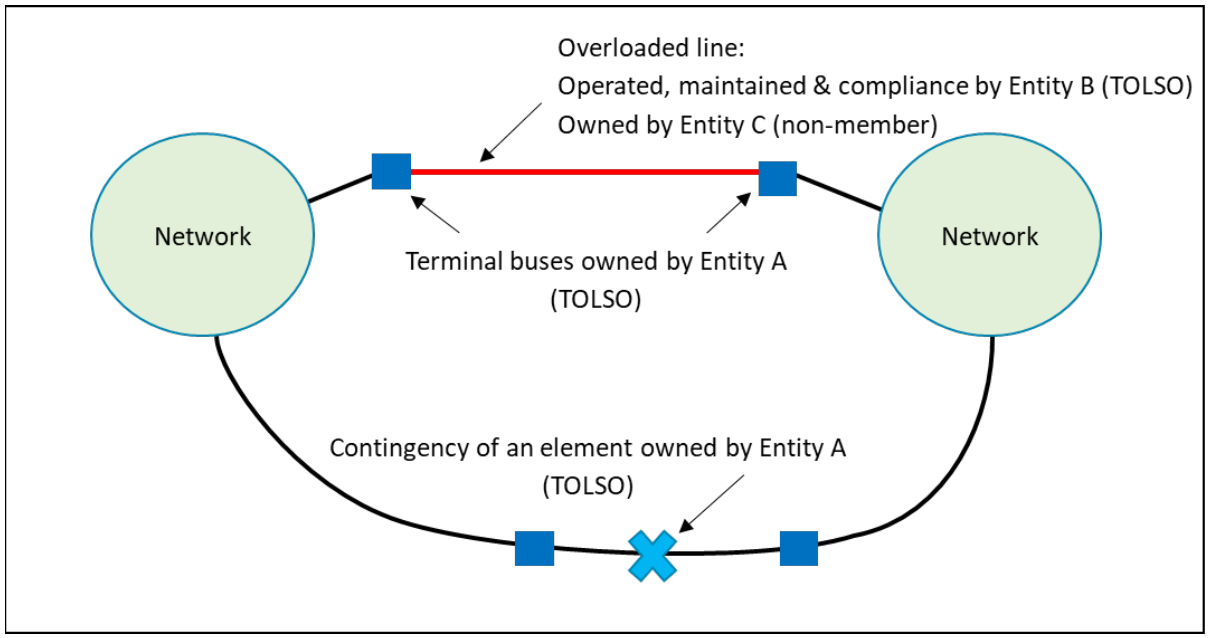
The 2022-23 WestConnect Model Development effort and preliminary Regional Needs Assessment indicated the potential for a single regional reliability issue resulting from the reliability assessment test. The issue was flagged for further discussion because of the involvement of multiple entities.

A summary of the issue follows:

- A single contingency was found to result in an overload on a transmission element.
- The contingency is a transmission element owned by one entity (Entity A).
- The overloaded transmission line is operated and maintained by another entity (Entity B).
- The overloaded transmission line is owned by a third entity (Entity C).
- The substations at both ends of the overloaded transmission line are owned by Entity A.
- Entities A and B are TOLSO members of WestConnect.
- Entity C, the owner of the overloaded line, is not a member of WestConnect.

The figure below shows a basic description of the issue.

Figure 2; Simple drawing of potential regional reliability issue



Upon a comprehensive review of the regional reliability assessment results, the PS concluded that even though the issue involved multiple entities in that a contingency on one entity's system caused an overload on another entity's transmission facility, the overloaded facility is owned by a single entity, and therefore should be considered a single-entity (local) issue. As a result, they recommended to the PMC at the November 16, 2022, meeting that the single reliability issue not be considered a regional reliability need. This conclusion was reached because neither the Heavy Summer nor Light Spring assessments identified reliability issues that were between two or more WestConnect members or

impacted two or more WestConnect members. The reliability issues were presented to the PMC on October 12, 2022 (link) and November 16, 2022 (link). The reliability results for the base case are provided in Appendix A.

2.2 Regional Economic Needs Assessment

WestConnect performed the 2022-23 regional economic assessment by conducting a PCM study on the 2032 Base Case along with four sensitivity case. The goal of the assessment was to test the base case and the Base Transmission Plan for economic congestion that impacts more than one TOLSO Member. The WestConnect 2030 PCM from the 2020-21 planning cycle served as the seed case for the WestConnect economic model 2032 Base Case. The PCM was reviewed and updated by WestConnect members during Quarters 2 and 3 of the 2022-23 planning cycle, and the Quarter 3 updates included assumptions pulled from the WECC 2032 Anchor Dataset (ADS) interconnection-wide 10-year PCM (WECC 2032 ADS PCM V2.0). The model was reviewed and updated by WestConnect members to maintain consistent electric topologies with the reliability base cases within the WestConnect footprint. Detailed model and data assumptions are described in Section 4 of the MDR.

WestConnect also evaluated four sensitivity cases that are described below.

Study Procedure and Assumptions

The Planning Subcommittee conducted the study and reviewed the 2032 Base Case PCM results for regional congestion (i.e., number of hours) and congestion cost (i.e., the cost to re-dispatch more expensive generation because of transmission constraints). As with the reliability assessment, the economic assessment included extensive testing and multiple iterations of model refinements, simulations, participant review of results, and incorporation of modifications and comments into the subsequent round of simulations. Wheeling charge assumptions were further vetted through a sensitivity analysis described below.

Given the regional focus of the WestConnect process, the Planning Subcommittee limited its congestion analysis to:

- Transmission elements (or paths/interfaces) between multiple WestConnect member TOs;
- Transmission elements (or paths/interfaces) owned by multiple WestConnect member TOs; and
- Congestion occurring within the footprints of multiple TOs that has potential to be addressed by a regional transmission project or non-transmission alternative.[3]

Study Results

The objective of the economic needs assessment was to arrive at a set of congested elements that warranted testing for the economic potential for a regional project solution, recognizing that the presence of congestion does not always equate to a regional need for congestion relief at a particular location.

The base economic regional Needs Assessments revealed five instances of congestion. Members that were affected by the economic issues were requested to assist the PS by providing narrative

[3] Congestion within a single TO footprint (and not reasonably related or tied to other TO footprints) is out of scope of the regional planning effort and is alternatively subject to Order 890 economic planning requirements.

perspectives on the specific issues that affected them. Every affected member provided a narrative response to the PS.

The economic issues were presented to the PMC on October 12, 2022 (link) and November 16, 2022 (link).

The PS addressed the congestion issues individually. Upon a comprehensive review of the regional reliability assessment results, the PS determined the base economic congestion results did not result in the identification of any regional economic needs. The PS recommended to the PMC at the November 16, 2022, PMC meeting that the five economic congestion issues not be considered as regional economic needs. The congestion results for the base case PCM and detailed explanations are provided in Appendix B.

Sensitivity Studies

Economic models were also developed for sensitivity studies on the 2032 Base Case economic model to better understand whether regional transmission congestion may be impacted by adjusting certain input assumptions subject to significant uncertainty. The sensitivity analysis is intended to make relatively minor adjustments that would still remain within the expected future framework of the base models. The Planning Subcommittee determined four sensitivities of interest, and their assumptions are summarized below. The detailed assumptions are provided in Section 4.1 of the MDR.

1. **2032 High Load Sensitivity Case**: The hourly load shapes of the Balancing Authority Areas (BAAs) within WestConnect were scaled up so their annual peak and energy was beyond their values in the 2032 Base Case.
   - TEPC: 105% of both peak and energy
   - All other WestConnect Areas: 120% of both peak and energy
2. **2032 Low Hydro Sensitivity Case**: The hydro modeling was replaced with WECC's 2001-based hydro modeling developed by WECC in conjunction with their 2024 Common Case PCM dataset.
3. **2032 High Gas Price Sensitivity Case**: All the natural gas prices were increased to 140% of their value in the 2032 Base Case.
4. **2032 System-Wide Carbon Emission Cost Sensitivity Case**: Applied CO2 emission charges to all generators in WECC via the below updates to the 2032 Base Case:
   - Applied California Carbon Price Assumption as the carbon emission price for all generation in California, Oregon, and Washington
   - Kept the Alberta and British Columbia carbon emission prices unchanged
   - Removed the carbon emission wheeling charges from all California borders except with Baja California (CFE)
   - Applied a carbon emission price of $44/metric ton CO2e (2020 dollars) for all other generation in the WECC system

The congestion results for the sensitivity cases and detailed explanations are provided in Appendix C.

2.3 Public Policy Needs Assessment

The WestConnect Regional Planning Process is intended to identify regional needs and the more efficient or cost-effective solutions to satisfy those needs. Enacted public policy was considered in the Planning Process as a part of the base case development. Non-enacted or proposed public policies were considered as part of the scenario planning process. In this context, enacted public policies are 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, whether within a state or at the

federal level. Enacted public policies were incorporated into the base models through the roll-up of local TO plans and their associated load, resource, and transmission assumptions. Given this, regional public policy needs can be identified one of two ways:

1) New regional economic or reliability needs driven by enacted Public Policy Requirements; or

2) Stakeholder review of local TO Public Policy Requirements-driven transmission projects and associated suggestions as to whether one or more TO projects may constitute a public policy-driven regional transmission need.

Study Procedure and Assumptions

WestConnect began the evaluation of regional transmission needs driven by public policy requirements by identifying a list of enacted public policies that impact local TO plans in the WestConnect planning region. This list was developed by the Planning Subcommittee in public meetings and posted in meeting materials. It was agreed that enacted public policies driving local TO transmission including, but not limited to, state RPS and distributed generation goals/set-asides would be represented in the base cases. Stakeholders were invited to suggest possible regional public policy-driven transmission needs based on the enacted public policies driving local transmission needs and the associated list of local public policy-driven transmission projects, presented via the November 17, 2022, meeting slides (link).

Study Results

In conducting the regional reliability and economic assessments (see above) the Planning Subcommittee did not find any regional issues driven by enacted public policy requirements. Furthermore, stakeholders did not suggest or recommend the identification of a regional public policy-driven transmission need based on this information. Based on these two findings, there are no identified public policy needs in the WestConnect 2022-23 regional Planning Process.

The economic sensitivities were presented to the PMC on October 12, 2022, (link).

3.0 Stakeholder Involvement

The Planning Process is performed in an open and transparent manner. The Planning Subcommittee and PMC meetings held in support of the regional transmission needs assessment were open to the public, and each meeting provided an opportunity for stakeholder comment. Notice of all stakeholder meetings and stakeholder comment periods were posted to the WestConnect website[4] and distributed via email.

An open stakeholder meeting to discuss the WestConnect regional transmission needs assessment was conducted on November 17, 2022. The meeting was announced through the WestConnect stakeholder distribution lists, and all stakeholders were invited to attend.

There was an open stakeholder comment window between November 17, 2022, and December 2, 2022, for stakeholders to comment on the Draft 2022-23 Regional Needs Assessment, as presented via the November 17, 2022 Stakeholder Meeting slides. No stakeholder comments were received with regard to the regional assessment determination.

[4] *WestConnect Regional Planning meeting calendar: http://regplanning.westconnect.com/calendar_rp.htm*
Stakeholder Comments webpage: http://regplanning.westconnect.com/stakeholder_comments.htm

4.0 Conclusions and Next Steps

Based on the findings from the 2022-23 cycle analysis performed for reliability, economic, and public policy transmission needs as described in this Regional Needs Assessment Report, no regional transmission needs were identified in the 2022-23 needs assessment.

Since no regional transmission needs were identified, the PMC will not collect transmission or non-transmission alternatives for evaluation as there are no regional transmission needs to evaluate the alternatives against.

5.0 Information Confidentiality

The Planning Subcommittee handled confidential information in accordance with the protocols outlined in the BPM. Although the Regional Planning Process is open to all stakeholders, stakeholders are required to comply at all times with certain applicable confidentiality measures necessary to protect confidential information, proprietary information, or Critical Energy Infrastructure Information (CEII).

As it related to the model development portion of the process, confidentiality protections were accorded for the following:

- WestConnect power flow models are considered CEII. Based on this, during the case development process, only those entities having signed the appropriate Non-Disclosure Agreement (NDA) with WECC were granted access to the model. This iteration does not contain any information that is different from what would be typically contained in the original WECC base case.
- Certain generator procurement and contract information gathered during the RPS evaluation was considered commercially sensitive. Based on this assessment, that data was considered confidential and was not shared.
- WestConnect PCM and power flow models are subject to the WestConnect Confidentiality Agreement and their distribution was limited to signatories of that agreement.

6.0 Appendix A: Results of Reliability Needs Assessment

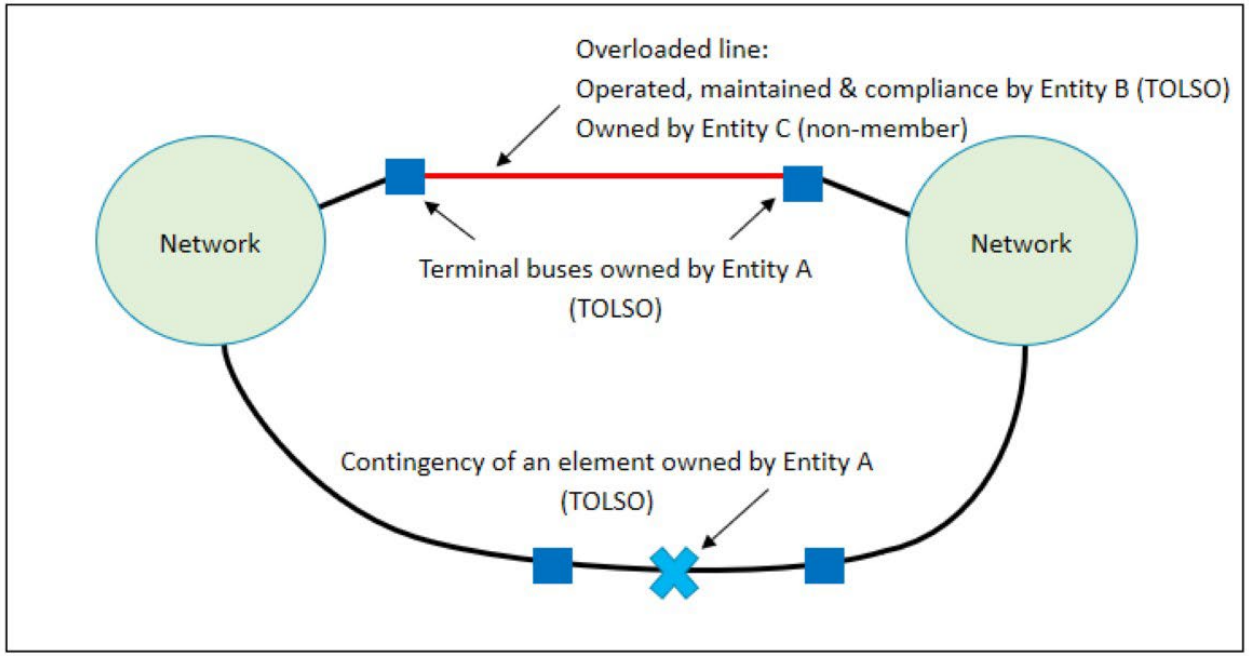
Base PF Results

- HS case
  - No Contingency (P-0)
    - **0** branch flagged above Rating A
    - **1** flagged bus voltage issues (PNM **1**)
  - Contingencies (**3** flagged issues)
    - **0** failed solutions
    - **1** flagged loadings above Rating B (APS & WAPA-DSW **1**)
    - **1** flagged low bus voltages (PNM **1**)
    - **1** flagged voltage deviations (PNM **1**)
    - **0** flagged high voltages
- LSP Case
  - No Contingency (P-0)
    - **0** branch loading issues above Rating G
    - **1** flagged bus voltage issues (PNM **1**)
  - Contingencies (**1** flagged issue)
    - **0** failed solutions
    - **0** flagged loadings above Rating H
    - **0** flagged low bus voltages
    - **1** flagged voltage deviations (PNM **1**)
    - **0** flagged high voltages

REGIONAL PLANNING WestConnect 41

Reliability Issue

Simple Drawing



REGIONAL PLANNING

WestConnect

35

264
265

Reliability Issue

Summary

- A single contingency was found to result in an overload on a transmission element.
- The contingency is a transmission element owned by Entity A.
- The overloaded transmission line is operated, maintained & compliance performed by Entity B.
- The overloaded transmission line is owned by Entity C.
- The substations at both ends of the overloaded transmission line are owned by Entity A.
- Entities A and B are TOLSO members of WestConnect.
- Entity C, the owner of the overloaded line, is not a member of WestConnect.

WestConnect 36

Reliability Issue

PS Recommendation

- The reliability issue involves multiple entities in that a contingency on one entity's system causes an overload on another entity's transmission facility.
- However, the overloaded facility is owned by a single entity.
- The PS consensus is that it is a single-entity (local) issue.

The PS recommends that the reliability issue not be considered a regional reliability need and should be referred to the involved entities for resolution.

REGIONAL PLANNING

WestConnect

37

7.0 Appendix B: Results of Economic Needs Assessment

Branch & Path Congestion

Assumed Grouping	Entities Involved	Branch PF Owner(s)	Bus PF Owner(s)	Branch or Path Name	All Year: Avg Flow (MW)	All Year: Congestion Hours (% Hrs) / Cost (K$)	All Year: Penalty Cost Cost (K$) / % of Congestion
Multiple WC Entities	|PNM|TSGT|		PN1 New Mexico|TSGT New Mexico|EPE El Paso Electric Company|Tucson Electric Power|PN2 New Mexico|Arizona Public Service|Tri-State G&T	P48 Northern New Mexico (NM2) Interface	112	61 (0.70%) / 1,102	
	TSGT|WAPA-RMR		WAPA L.M.|DG&T|Tri-State G&T	P30 TOT 1A Interface	113	20 (0.23%) / 913	
	TSGT|PSCO|WAPA-RMR|BEPC		Tri-State G&T|WAPA L.M.|PSColorado|Basin Electric Power Coop.	P36 TOT 3 Interface	464	1 (0.01%) / 16	
	PSCO|TSGT	PSColorado		STORY - PAWNEE 230kV Line #1 (73192_70311_1)	-196	1 (0.01%) / 7	
	BEPC|TSGT|	Basin Electric Power Coop.		DAVEJOHN - LAR.RIVR 230kV Line #1 (65420_73107_1)	-125	2 (0.02%) / 0.57	
Possibly Multiple WC Entities	PSCO|TSGT	PSColorado		STORY - PAWNEE 230kV Line #1 (73192_70311_1)	-196	1 (0.01%) / 7	

Branch & Path Congestion

Assumed Grouping	Entities Involved	Branch PF Owner(s)	Bus PF Owner(s)	Branch or Path Name	All Year: Avg Flow (MW)	All Year: Congestion Hours (% Hrs) / Cost (K$)	All Year: Penalty Cost Cost (K$) / % of Congestion
Single WC Entity, Multi-Regional	LADWP|IPA		Intermountain Power Agency	P27 Intermountain Power Project DC Line Interface*	1,128	1,243 (14%) / 5,132	2,772 / 54%
	LADWP|NorthernGrid|IPA	Intermountain Power Agency		INTERMT-MONA 345kV Line Ckt 1&2 (26043_65995_1&2)	-4	63 (0.72%) / 3,434	
	LADWP|CAISO		Southern California Edison|City of Los Angeles	P61 Lugo-Victorville 500 kV Line Interface	667	56 (0.64%) / 2,080	
	LADWP|IPA|NorthernGrid		Intermountain Power Agency|Sierra Pacific Power Co.	P32 Pavant-Gonder InterMtn-Gonder 230 kV Interface	55	3 (0.03%) / 204	
	LADWP|CAISO		City of Los Angeles|Southern California Edison	P41 Sylmar to SCE Interface	-371	8 (0.09%) / 35	
	DG&T|NorthernGrid		PacifiCorp - East|DG&T	P33 Bonanza West Interface	-289	2 (0.02%) / 2	

Member Responses:

Branch or Path Name	Entities Involved	Member Response
P48 Northern New Mexico (NM2) Interface	|PNM|TSGT	The limited number of hours of congestion seen for these interfaces do not indicate a regional need.
P30 TOT 1A Interface	TSGT|WAPA-RMR	This result does not warrant establishing a regional need. The 20 hours or .23% of congestion for TOT1A can be considered noise and is less than previous study cycle results.
P36 TOT 3 Interface	TSGT|PSCO|WAPA-RMR|BEPC	This result does not warrant establishing a regional need. The 1 hour of congestion for TOT3 can be considered noise and is less than previous study cycle results.
STORY - PAWNEE 230kV	PSCO|TSGT	The limited number of hours of congestion seen for these interfaces do not indicate a regional need.
DAVEJOHN - LAR.RIVR 230kV	BEPC|TSGT	The 2 hours of congestion on the LRS-DJ 230kV line does not warrant establishing a regional need

277

Potential Economic Issues

PS Recommendation

- A response for each issue was provided by affected entities.
- No responses indicated a regional need.
- The PS concurred with the responses provided.

The PS recommends that the economic issues not be considered regional economic needs.

REGIONAL PLANNING

WestConnect

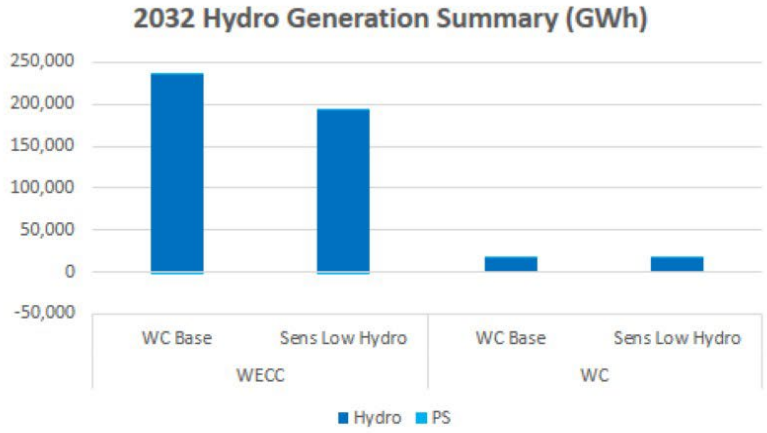
41

278

8.0 Appendix C: Economic Sensitivities

Low Hydro

- The 2032 WCPCM Base Case uses a median year hydro condition. Hydro conditions from 2001 provide the best representation of hydro operations for a low water year
- WECC developed the associated PCM inputs, which reflect the appropriate energy targets in addition to the hydro system's reactivity to price and load movement when the water supply is lower than normal



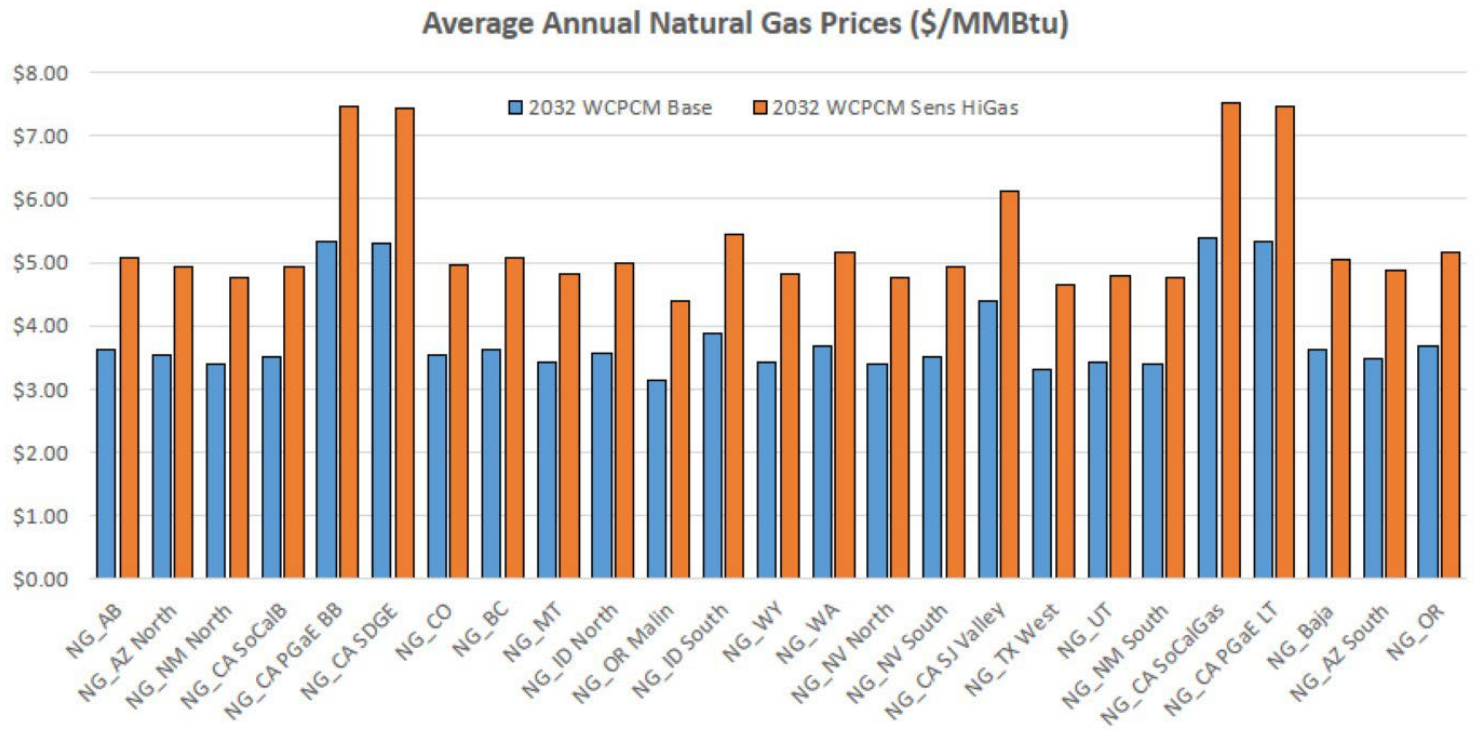
Metric	Fleet	Case	Hydro	PS	PS Pump
Generation (GWh)	WECC	WC Base	234,508	1,666	-3,098
		Sens Low Hydro	193,625	1,698	-3,110
	WC	WC Base	16,009	985	-1,516
		Sens Low Hydro	16,298	1,034	-1,551
Capacity (MW)	WECC	WC Base	63,433	4,054	
		Sens Low Hydro	63,433	4,054	
	WC	WC Base	4,991	2,311	
		Sens Low Hydro	4,991	2,311	
Capacity Factor	WECC	WC Base	42.1%	4.7%	-8.7%
		Sens Low Hydro	34.8%	4.8%	-8.7%
	WC	WC Base	36.5%	4.9%	-7.5%
		Sens Low Hydro	37.2%	5.1%	-7.6%

REGIONAL PLANNING

WestConnect

29

High Gas Prices



- Assumed natural gas prices 40% higher than the base case
  - Base Case annual average gas price: $3.84/MMBtu
  - Sensitivity Case annual average gas price: $5.37/MMBtu

REGIONAL PLANNING

WestConnect

30

281
282

High Load Forecast

		2032 WCPCM Base		2032 WCPCM sens High Load Forecast			
LoadAreaName	RegionName	Peak (MW)	Energy (GWh)	Peak Inc %	Energy Inc %	Peak (MW)	Energy (GWh)
AZPS	SW_AZPS	8,991	42,945	120%	120%	10,789	51,534
BANC	CA_BANC	5,491	21,074	120%	120%	6,589	25,289
EPE	SW_EPE	2,651	12,240	100%	100%	2,651	12,240
IID	CA_IID	1,319	4,600	120%	120%	1,583	5,520
LDWP	CA_LDWP	10,313	45,250	120%	120%	12,376	54,300
PNM	SW_PNM	3,053	16,860	120%	120%	3,664	20,232
PSCO	RM_PSCO	11,702	54,608	120%	120%	14,042	65,530
SRP	SW_SRP	10,543	46,969	120%	120%	12,652	56,363
TEPC	SW_TEPC	4,136	19,190	105%	105%	4,343	20,149
WACM	RM_WACM	4,794	27,762	120%	120%	5,753	33,314
WALC	SW_WALC	1,863	9,738	120%	120%	2,236	11,686

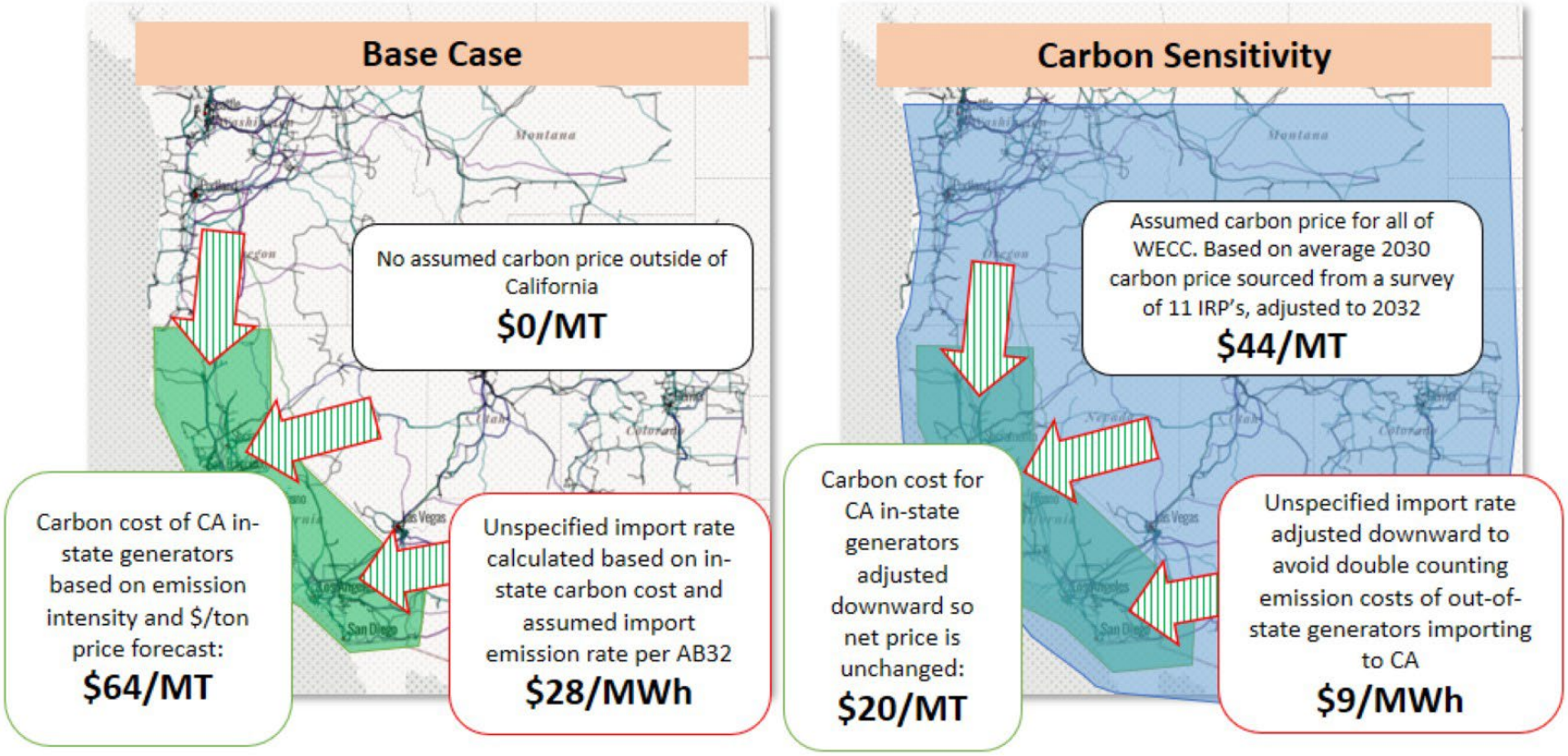
- Sensitivity case assumed peak loads and annual energy 20% higher than the base case unless member feedback stated otherwise

REGIONAL PLANNING

WestConnect

31

System Carbon Price



CA In-state/Specified Resources:	**$64/MT**	$20/MT + $44/MT = **$64/MT**
CA Imports:	**$64/MT** ($28/MWh)	$20/MT ($9/MWh) + $44/MT = **$64/MT**
WECC System adder:	**$0/MT**	**$44/MT**

REGIONAL PLANNING

WestConnect

32

285
286

Economic Sensitivities - Congestion

		Congestion Hours (% Hrs) / Cost (K$)				
Assumed Grouping	Branch or Path Name	Base	Low Hydro	High Gas	High Load	System Carbon Price
Multiple WC Entities	P48 Northern New Mexico (NM2) Interface	61 (0.70%) / 1,102	60 (0.68%) / 1,041	53 (0.61%) / 987	8 (0.09%) / 45	58 (0.66%) / 1,387
	P30 TOT 1A Interface	20 (0.23%) / 913	19 (0.22%) / 788	12 (0.14%) / 1,344	248 (3%) / 123,357	5 (0.06%) / 626
	P36 TOT 3 Interface	1 (0.01%) / 16		1 (0.01%) / 32	96 (1%) / 159,513	1 (0.01%) / 68
	DAVEJOHN - LAR.RIVR 230kV Line #1 (65420_73107_1)	2 (0.02%) / 0.57	3 (0.03%) / 4	1 (0.01%) / 8	3 (0.03%) / 1,390	
	P39 TOT 5 Interface				13 (0.15%) / 12,675	
	TRCY PMP-HURLEY S 230kV Line Ckt 1&2 (37585_37010_1&2)		3 (0.03%) / 1,088		25 (0.29%) / 7,170	
	W.RV.CTY - CALAMRDG 138kV Line #1 (79264_79265_1)				1 (0.01%) / 71	
	WESTWNGW - PINPK 230kV Line #1 (14231_19062_1)				7 (0.08%) / 3,736	
Possibly Multiple WC Entities	STORY - PAWNEE 230kV Line #1 (73192_70311_1)	1 (0.01%) / 7	3 (0.03%) / 7	1 (0.01%) / 31		
	DEERVALY - WESTWNGE 230kV Line #1 (14207_14259_1)				14 (0.16%) / 3,255	
	HESPERUS - WATRFLW 345kV Line #1 (79072_79990_1)				11 (0.13%) / 4,420	
	MIDWAYBR - RD_NIXON 230kV Line #1 (73413_78857_1)				4 (0.05%) / 55	
	SAN_JUAN - SANJN PS 345kV Line #1 (10292_79060_1)				12 (0.14%) / 4,396	
	ST.VRAIN - LONGPEAK 230kV Line #1 (70410_78105_1)				2 (0.02%) / 25	
	TRCY PMP-HURLEY S 230kV Line Ckt 1&2 (37585_37010_1&2)		3 (0.03%) / 1,088		25 (0.29%) / 7,170	
Single WC Entity, Multi-Regional	P27 Intermountain Power Project DC Line Interface	1,243 (14%) / 5,132	2,239 (26%) / 7,896	847 (10%) / 3,786	317 (4%) / 1,542	1,520 (17%) / 8,173
	INTERMT-MONA 345kV Line Ckt 1&2 (26043_65995_1&2)	63 (0.72%) / 3,434	290 (3%) / 17,638	75 (0.86%) / 3,511	207 (2%) / 31,930	496 (6%) / 8,465
	P61 Lugo-Victorville 500 kV Line Interface	56 (0.64%) / 2,080	32 (0.37%) / 1,498	42 (0.48%) / 2,311	143 (2%) / 13,286	51 (0.58%) / 2,832
	P32 Pavant-Gonder InterMtn-Gonder 230 kV Interface	3 (0.03%) / 204	5 (0.06%) / 825	2 (0.02%) / 82	20 (0.23%) / 3,366	3 (0.03%) / 273
	P33 Bonanza West Interface	2 (0.02%) / 2	1 (0.01%) / 0.57		3 (0.03%) / 116	
	P41 Sylmar to SCE Interface	8 (0.09%) / 35	6 (0.07%) / 28	10 (0.11%) / 50	267 (3%) / 19,532	21 (0.24%) / 81
	P28 Intermountain-Mona 345 kV Interface				8 (0.09%) / 5,733	
	P29 Intermountain-Gonder 230 kV Interface				10 (0.11%) / 526	
	PHSHFT XOVER - YELLOWTL WST 230kV Line #1 (630041_73632_1)				9 (0.10%) / 2,727	
	Total Multi-TO Congestion ($):	**2,031,988**	**2,921,181**	**2,369,840**	**300,787,318**	**2,080,823**
	Total Single-TO Congestion ($):	**197,607,522**	**336,882,640**	**203,202,098**	**2,289,773,193**	**229,468,694**
	Total Non-WestConnect Congestion ($):	**1,182,675,221**	**1,253,269,842**	**1,302,681,380**	**1,819,432,129**	**1,102,098,354**
	Total Multi-TO Congestion (% Change):		**44%**	**17%**	**14703%**	**2%**
	Total Single-TO Congestion (% Change)):		**70%**	**3%**	**1059%**	**16%**
	Total Non-WestConnect Congestion (% Change)):		**6%**	**10%**	**54%**	**-7%**

REGIONAL PLANNING

WestConnect

33

287
288

Economic Sensitivities - Congestion

Assumed Grouping	Branch or Path Name	Avg Flow (MW)				
		Base	Low Hydro	High Gas	High Load	System Carbon Price
Multiple WC Entities	P48 Northern New Mexico (NM2) Interface	112	115	123	396	117
	P30 TOT 1A Interface	113	108	96	-29	39
	P36 TOT 3 Interface	464		475	569	303
	DAVEJOHN - LAR.RIVR 230kV Line #1 (65420_73107_1)	-125	-152	-122	-76	
	P39 TOT 5 Interface				221	
	TRCY PMP-HURLEY S 230kV Line Ckt 1&2 (37585_37010_1&2)		141		181	
	W.RV.CTY - CALAMRDG 138kV Line #1 (79264_79265_1)				-16	
	WESTWNGW - PINPK 230kV Line #1 (14231_19062_1)				205	
Possibly Multiple WC Entities	STORY - PAWNEE 230kV Line #1 (73192_70311_1)	-196	-220	-194		
	DEERVALY - WESTWNGE 230kV Line #1 (14207_14259_1)				-195	
	HESPERUS - WATRFLW 345kV Line #1 (79072_79990_1)				-94	
	MIDWAYBR - RD_NIXON 230kV Line #1 (73413_78857_1)				24	
	SAN_JUAN - SANJN PS 345kV Line #1 (10292_79060_1)				94	
	ST.VRAIN - LONGPEAK 230kV Line #1 (70410_78105_1)				265	
	TRCY PMP-HURLEY S 230kV Line Ckt 1&2 (37585_37010_1&2)		141		181	
Single WC Entity, Multi-Regional	P27 Intermountain Power Project DC Line Interface	1,128	847	1,304	1,619	819
	INTERMT-MONA 345kV Line Ckt 1&2 (26043_65995_1&2)	-4	50	-110	-73	601
	P61 Lugo-Victorville 500 kV Line Interface	667	573	749	588	423
	P32 Pavant-Gonder InterMtn-Gonder 230 kV Interface	55	77	55	36	50
	P33 Bonanza West Interface	-289	-262		-207	
	P41 Sylmar to SCE Interface	-371	-310	-393	-600	-402
	P28 Intermountain-Mona 345 kV Interface				-73	
	P29 Intermountain-Gonder 230 kV Interface				8	
	PHSHFT XOVER - YELLOWTL WST 230kV Line #1 (630041_73632_1)				102	

WestConnect

34

289
290

Economic Sensitivities – Area Summary

Metric	Region	Base	Low Hydro	High Gas	High Load	SysCarb Price	% Change from Base Case: Low Hydro	High Gas	High Load	SysCarb Price
LMP ($/MWh)	AZPS	29.04	29.47	41.00	52.49	52.06	1%	41%	81%	79%
	BANC	64.47	81.58	78.67	120.77	76.92	27%	22%	87%	19%
	EPE	31.00	32.08	43.47	53.22	56.37	3%	40%	72%	82%
	IID	55.79	56.38	67.81	74.84	60.07	1%	22%	34%	8%
	LDWP	64.07	66.87	76.75	108.41	73.35	4%	20%	69%	14%
	PNM	29.81	31.06	41.74	55.37	55.00	4%	40%	86%	84%
	PSCO	34.50	37.09	46.43	93.14	61.05	8%	35%	170%	77%
	SRP	29.54	30.00	41.56	54.81	52.86	2%	41%	86%	79%
	TEPC	29.84	30.50	41.76	52.77	54.44	2%	40%	77%	82%
	WALC	24.99	25.46	36.35	46.13	49.00	2%	45%	85%	96%
	WACM	35.06	38.25	46.89	73.23	63.20	9%	34%	109%	80%
MCC ($/MWh)	AZPS	-16.44	-19.54	-16.65	-15.46	-8.81	19%	1%	-6%	-46%
	BANC	17.45	30.78	18.92	51.14	14.62	76%	8%	193%	-16%
	EPE	-17.26	-19.96	-17.71	-18.20	-8.57	16%	3%	5%	-50%
	IID	10.45	7.51	10.33	7.64	-0.54	-28%	-1%	-27%	-105%
	LDWP	16.34	15.23	16.14	36.86	9.35	-7%	-1%	126%	-43%
	PNM	-17.56	-20.12	-18.35	-16.91	-9.00	15%	4%	-4%	-49%
	PSCO	-10.81	-11.95	-10.90	24.26	-0.70	11%	1%	-325%	-94%
	SRP	-16.14	-19.25	-16.35	-13.36	-8.28	19%	1%	-17%	-49%
	TEPC	-17.05	-20.04	-17.60	-16.81	-8.82	18%	3%	-1%	-48%
	WALC	-20.56	-23.63	-21.34	-21.50	-12.24	15%	4%	5%	-40%
	WACM	-9.45	-10.16	-9.44	5.93	2.34	7%	0%	-163%	-125%
MCE ($/MWh)	WECC	45.08	49.25	57.24	66.70	60.34	9%	27%	48%	34%

Total Unserved Load (MWh)

	Base	Low Hydro	High Gas	High Load	SysCarb Price
AZPS	0	0	0	3,446	0
BANC	0	0	0	2,157	0
EPE	0	0	0	310	0
IID	0	0	0	38	0
LDWP	0	0	0	0	0
PNM	0	0	0	7,334	0
PSCO	0	0	0	52,932	0
SRP	0	0	0	12,376	0
TEPC	0	0	0	1,169	0
WALC	0	0	0	53	0
WACM	0	0	0	9,907	0

- Congestion results in High Load scenario are primarily driven by a lack of generation to meet load in the Rocky Mountain region, not by any direct transmission constraints

REGIONAL PLANNING

WestConnect

35

Economic Sensitivities – Gen Fleet

Metric	Case	Nuclear	Coal	Gas	Hydro	PS	Geothermal	Biomass	Other	BESS	Solar	Wind
Capacity (MW)	Base	3,436	6,434	29,064	4,880	1,887	830	0	1,037	6,964	12,700	11,733
	LowHydro	3,436	6,434	29,064	4,880	1,887	830	0	1,037	6,964	12,700	11,733
	HiGas	3,436	6,434	29,064	4,880	1,887	830	0	1,037	6,964	12,700	11,733
	HiLoad	3,436	6,434	29,064	4,880	1,887	830	0	1,037	6,964	12,700	11,733
	SysCarbPrice	3,436	6,434	29,064	4,880	1,887	830	0	1,037	6,964	12,700	11,733
Generation (GWh)	Base	28,450	47,466	122,622	15,565	743	4,037	0	154	7,875	29,083	37,220
	LowHydro	28,450	46,333	127,023	15,980	791	4,037	0	248	8,110	29,084	37,223
	HiGas	28,450	49,657	120,220	15,565	729	4,037	0	147	8,180	29,058	37,219
	HiLoad	28,450	49,361	161,288	15,565	1,283	4,038	0	481	8,438	29,068	37,208
	SysCarbPrice	28,450	25,272	142,167	15,565	554	4,038	0	176	6,730	29,091	37,226
Spillage (MWh)	Base	0	0	0	0	0	1,944	0	0	0	44,081	255,079
	LowHydro	0	0	0	0	0	1,310	0	0	0	43,213	251,521
	HiGas	0	0	0	0	0	1,966	0	0	0	68,414	256,022
	HiLoad	0	0	0	0	0	519	0	0	0	58,709	266,849
	SysCarbPrice	0	0	0	0	0	661	0	0	0	35,410	249,073
CO2e (Short Tons)	Base	0	49,925,067	56,954,857	0	0	0	0	65,837	0	0	0
	LowHydro	0	48,685,159	59,169,161	0	0	0	0	154,880	0	0	0
	HiGas	0	52,319,971	55,481,345	0	0	0	0	66,480	0	0	0
	HiLoad	0	52,009,708	77,097,213	0	0	0	0	391,405	0	0	0
	SysCarbPrice	0	26,729,792	66,115,238	0	0	0	0	71,611	0	0	0
CO2e Cost (M$)	Base	0	0	682	0	0	0	0	3	0	0	0
	LowHydro	0	0	784	0	0	0	0	7	0	0	0
	HiGas	0	0	658	0	0	0	0	3	0	0	0
	HiLoad	0	0	927	0	0	0	0	10	0	0	0
	SysCarbPrice	0	1,055	2,737	0	0	0	0	4	0	0	0
LMP ($/MWh)	Base	29.15	31.16	37.93	35.74	45.08	47.49		43.26	32.80	36.79	33.21
	LowHydro	29.61	33.43	40.76	37.67	47.02	48.09		45.60	33.63	38.15	36.49
	HiGas	40.86	42.36	49.94	47.86	57.26	58.94		55.29	44.48	48.51	44.34
	HiLoad	49.79	65.35	74.66	62.45	69.28	64.83		73.44	57.11	63.92	64.71
	SysCarbPrice	52.50	58.34	59.39	57.48	61.36	56.41		60.31	53.87	56.17	54.90
MCC ($/MWh)	Base	-15.17	-12.31	-7.43	-9.18	-0.89	4.82		-2.45	-12.20	-8.33	-9.49
	LowHydro	-18.14	-13.73	-8.23	-10.84	-2.59	2.09		-3.72	-14.88	-10.53	-10.20
	HiGas	-15.32	-12.60	-7.55	-9.10	-1.05	4.87		-2.62	-12.55	-8.68	-9.80
	HiLoad	-15.97	0.23	7.09	-4.34	0.83	1.66		5.30	-9.92	-3.59	0.22
	SysCarbPrice	-6.77	-1.66	-1.69	-2.84	-0.36	-0.70		-1.26	-6.52	-4.56	-2.84

REGIONAL PLANNING

WestConnect

36

293
294

Economic Sensitivities – Generation (GWh)

Region	Case	Nuclear	Coal	Gas	Hydro	PS	Geothermal	Biomass	Other	BESS	Solar	Wind
AZPS	Base	9,957	0	17,425	20	0	0	0	0	4,400	4,611	4,985
	LowHydro	9,957	0	17,230	24	0	0	0	0	4,560	4,614	4,986
	HiGas	9,957	0	17,307	20	0	0	0	0	4,590	4,612	4,985
	HiLoad	9,957	0	22,866	20	0	0	0	7	4,718	4,618	4,989
	SysCarbPrice	9,957	0	18,744	20	0	0	0	0	3,606	4,618	4,988
BANC	Base	0	0	8,397	5,240	0	0	0	36	0	448	1,164
	LowHydro	0	0	10,963	4,526	0	0	0	96	0	448	1,164
	HiGas	0	0	8,109	5,240	0	0	0	37	0	448	1,164
	HiLoad	0	0	10,727	5,240	0	0	0	134	0	448	1,164
	SysCarbPrice	0	0	9,759	5,240	0	0	0	37	0	448	1,164
EPE	Base	5,406	0	6,231	0	0	587	0	0	44	1,474	0
	LowHydro	5,406	0	6,291	0	0	587	0	0	46	1,474	0
	HiGas	5,406	0	5,941	0	0	587	0	0	46	1,474	0
	HiLoad	5,406	0	6,929	0	0	588	0	0	45	1,474	0
	SysCarbPrice	5,406	0	6,460	0	0	588	0	0	40	1,474	0
IID	Base	130	0	1,484	239	0	2,202	0	0	725	1,996	0
	LowHydro	130	0	1,472	274	0	2,202	0	2	734	1,997	0
	HiGas	130	0	1,367	239	0	2,202	0	0	759	1,997	0
	HiLoad	130	0	1,917	239	0	2,202	0	18	755	1,997	0
	SysCarbPrice	130	0	1,252	239	0	2,202	0	0	780	1,997	0
LDWP	Base	3,483	0	21,221	1,474	309	563	0	99	195	3,989	3,783
	LowHydro	3,483	0	22,116	1,387	316	563	0	120	199	3,989	3,783
	HiGas	3,483	0	20,594	1,474	311	563	0	91	205	3,989	3,783
	HiLoad	3,483	0	27,206	1,474	561	563	0	110	280	3,989	3,765
	SysCarbPrice	3,483	0	24,326	1,474	345	563	0	114	280	3,989	3,783
PNM	Base	3,490	978	3,421	56	0	0	0	2	645	4,810	8,573
	LowHydro	3,490	919	3,281	92	0	0	0	4	658	4,804	8,575
	HiGas	3,490	1,013	3,271	56	0	0	0	2	652	4,787	8,572
	HiLoad	3,490	1,017	4,048	56	0	0	0	34	674	4,784	8,574
	SysCarbPrice	3,490	330	3,707	56	0	0	0	4	554	4,808	8,575

WestConnect

37

295
296

Economic Sensitivities – Generation (GWh)

Region	Case	Nuclear	Coal	Gas	Hydro	PS	Geothermal	Biomass	Other	BESS	Solar	Wind
PSCO	Base	0	10,573	23,763	58	210	0	0	12	601	4,195	15,033
	LowHydro	0	10,588	24,520	68	219	0	0	14	582	4,195	15,033
	HiGas	0	10,639	23,574	58	208	0	0	12	590	4,195	15,033
	HiLoad	0	10,658	34,001	58	331	0	0	88	611	4,195	15,034
	SysCarbPrice	0	5,455	30,864	58	85	0	0	13	354	4,195	15,034
SRP	Base	5,984	10,313	23,510	445	65	685	0	0	679	4,392	350
	LowHydro	5,984	10,035	23,992	517	65	685	0	0	718	4,395	350
	HiGas	5,984	11,966	22,584	445	62	685	0	0	725	4,389	350
	HiLoad	5,984	11,621	31,156	445	147	685	0	0	716	4,395	350
	SysCarbPrice	5,984	2,875	26,164	445	30	685	0	0	603	4,395	350
TEPC	Base	0	3,085	9,731	3	0	0	0	0	492	1,503	567
	LowHydro	0	3,085	10,002	4	0	0	0	0	510	1,503	567
	HiGas	0	3,128	9,875	3	0	0	0	0	512	1,503	567
	HiLoad	0	3,048	12,313	3	0	0	0	0	532	1,503	567
	SysCarbPrice	0	1,583	11,048	3	0	0	0	0	460	1,503	567
WACM	Base	0	19,692	1,386	2,992	100	0	0	5	0	1,252	2,765
	LowHydro	0	18,911	1,218	3,147	133	0	0	12	0	1,252	2,765
	HiGas	0	19,859	1,292	2,992	89	0	0	5	0	1,252	2,765
	HiLoad	0	20,072	2,156	2,992	185	0	0	90	0	1,252	2,765
	SysCarbPrice	0	14,683	2,541	2,992	35	0	0	7	0	1,252	2,765
WALC	Base	0	2,825	6,053	5,039	59	0	0	0	94	412	0
	LowHydro	0	2,794	5,939	5,942	59	0	0	0	103	412	0
	HiGas	0	3,052	6,306	5,039	59	0	0	0	99	412	0
	HiLoad	0	2,946	7,968	5,039	59	0	0	0	108	412	0
	SysCarbPrice	0	347	7,301	5,039	59	0	0	0	54	412	0