



**NTTG Draft Study Report  
for the  
2018-2019 Public Policy Consideration Scenario**

DRAFT

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**Table of Contents**

Table of Contents..... 2

1. Background ..... 3

2. Study Assumptions..... 4

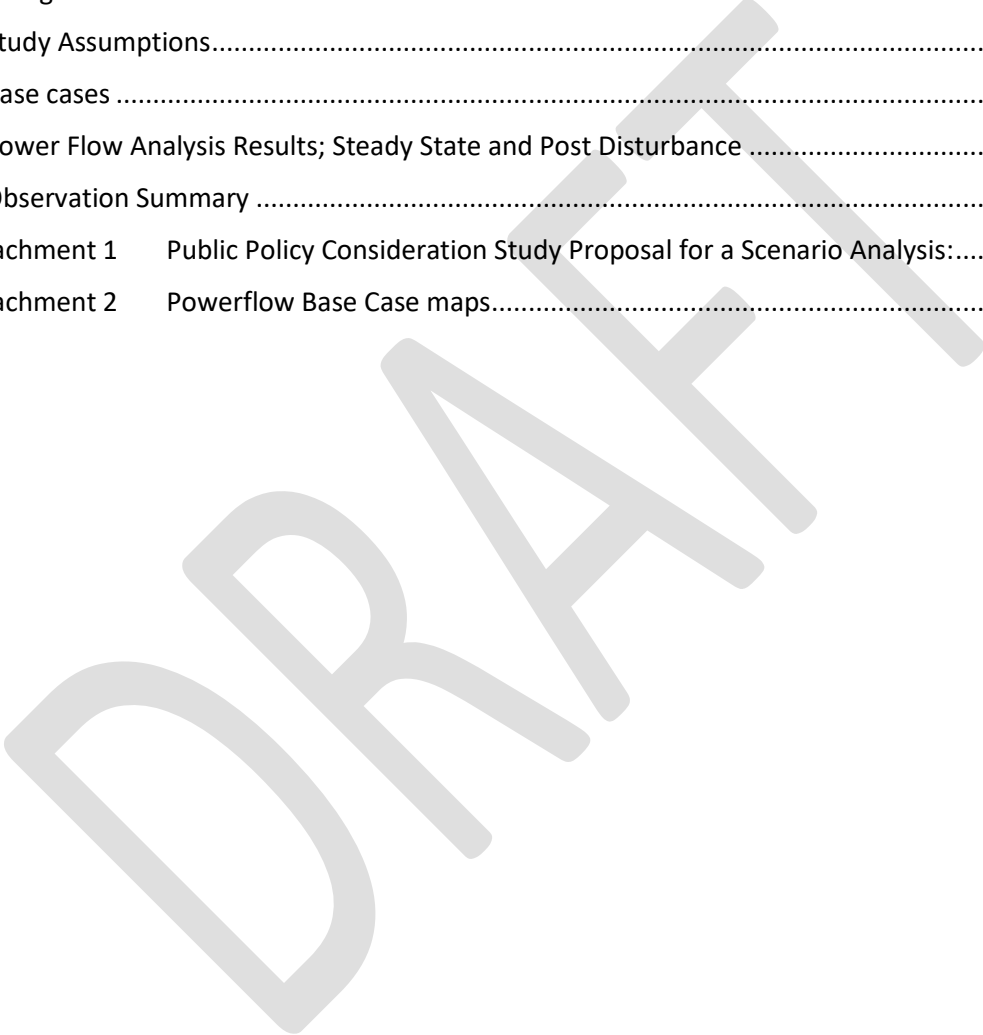
3. Base cases ..... 5

4. Power Flow Analysis Results; Steady State and Post Disturbance ..... 6

5. Observation Summary ..... 10

Attachment 1 Public Policy Consideration Study Proposal for a Scenario Analysis:..... 11

Attachment 2 Powerflow Base Case maps..... 13



1 **1. Background**

2 During Quarter 1 of the NTTG 2018-2019 Regional Planning Cycle, Deseret Power, Utah Association of  
 3 Energy Users, Utah Associated Municipal Power Systems, Utah Department of Commerce Office of  
 4 Consumer Services, Utah Municipal Power Agency, and Wyoming Industrial Energy Consumers jointly  
 5 submitted a Public Policy Consideration (“PPC”), defined in the NTTG Funders’ Attachment K, request for  
 6 a scenario analysis study. This request is to assess the transmission impacts and reliability implications  
 7 associated with the retirement of Jim Bridger Unit 1 (“Bridger”) and Naughton Units 1 and 2  
 8 (“Naughton”)<sup>1</sup> all three retirements are outside the 2028 study period and the integration of  
 9 replacement resources for Idaho Power and PacifiCorp. See PPC study plan in Attachment 1.

10  
 11 The PPC Study Plan, approved July 2018, assumed Idaho Power’s share of the jointly owned Jim Bridger  
 12 Unit 1 would be replaced with purchases from the Pacific Northwest<sup>2</sup> and the replacement energy for  
 13 PacifiCorp’s share of Jim Bridger Unit 1 and Naughton Units 1 and 2 was deferred. Since the PacifiCorp  
 14 2019 IRP update is underway and results are not expected until summer 2019. The NTTG Technical  
 15 Workgroup (“TWG”) reviewed the PPC request and identified three resource bracketing scenarios to test  
 16 the impact of likely PacifiCorp replacement resources; 1) wind resources in Wyoming, 2) wind resources  
 17 in Utah and 3) resources located in the Pacific Northwest.

18  
 19 The TWG reviewed the requested powerflow cases: High Wyoming Wind (Case F), High Southern Idaho  
 20 export (Case D), and High Southern Idaho import (Case C). However, upon further examination Case D  
 21 was dropped from further study because that case flows did not achieve the desired objectives; any  
 22 subsequent study of the that case would not have provided useful information. The Draft Regional  
 23 Transmission Plan (DRTP) replaced Case D with two other cases: the High Borah West (Case G), and the  
 24 High Aeolus South and West (Case I) cases.

25  
 26 For reference, the existing and planned 2028 Wyoming resources are listed in the following table. The  
 27 replacement resources being considered in this study are in addition to the 2028 Planned Resources and  
 28 vary in size and location:

29

	Thermal	Wind	Solar	Total
Existing (2018)	3155	1334	0	4489
Planned	-1042	1613	138	727
Total in 2028	2113	2949	138	5216
Beyond 2028	-913 <sup>3</sup>	Varies	0	Varies

30 Table 1 – Wyoming Resources, existing and future changes included in studies

<sup>1</sup> Units already modeled as retired in NTTG 2018-2019 studies include: Boardman, Cholla Unit 4, Colstrip units 1 and 2, Dave Johnson Units 1-4, Naughton Unit 3 and Valmy Units 1 & 2.

<sup>2</sup> In powerflow studies the removal of resources must be replaced in kind with output from other resources. If none are provided, the area swing generators will pick up the lost output potentially overloading those generators and likely not representing the appropriate new resource location.

<sup>3</sup> Jim Bridger Unit 1, Naughton Unit 1 and Unit 2.

31 **2. Study Assumptions**

32 The following assumptions were applied to the scenarios to retire PacifiCorp resources.

- 33 • Solar resources were considered for the makeup of the PacifiCorp energy, but three of the four
- 34 PPC study cases were extracted from a night time hour. So, contribution to the capacity deficit
- 35 would be zero in those hours. As a result, the study’s focus was on replacement renewable
- 36 wind resources.
- 37 • The DRTP cases had the following dispatch of the Bridger and Naughton resources:

	Case C	Case F	Case G	Case I
<b>Bridger 1</b>	-212.3	-523.3	-523.0	-212.0
<b>Naughton 1</b>	-130.7	-141.6	-201.0	-200.0
<b>Naughton 2</b>	Off-line	-220.0	-201.0	-200.0
<b>Total dispatch change</b>	-343.0	-884.6	-830.0	-556.9
<b>Idaho Power’s Share</b>	70.8	174.3	174.3	70.7
<b>PacifiCorp Share</b>	272.2	710.3	655.7	486.2

38 Table 2 – PPC Study Retirements and Idaho Power’s and PacifiCorp’s  
 39 replacement energy requirements in Powerflow study

- 40 • For Idaho Power’s share of the retirements, the study plan indicated its replacement resource
- 41 would come from the Pacific Northwest via the proposed B2H project. For this study, the TWG
- 42 used the large resource at Coulee as a proxy for additional energy.
- 43 • For the wind scenarios #1 and #2, see Table 1 below, the wind capacity needed to be
- 44 determined with the tools available to the TWG. The TWG concluded that there is no industry
- 45 criteria that could be used for determining an appropriate capacity for this study. Subsequently,
- 46 the TWG, using the wind profiles in adjacent projects, adjusted the installed capacity levels until
- 47 two of the four cases had surplus wind energy and two required additional energy from other
- 48 available dispatchable resources.
  - 49 ○ For the Wyoming wind Scenario #1, 850 MW of installed capacity appeared to be
  - 50 reasonable.
  - 51 ○ In Scenario #2, the Utah wind profiles appeared to be of a lower capacity factor for the
  - 52 hours selected than the Wyoming wind profiles, so installed capacity was increased to
  - 53 1025 MW to compensate.

- 54 • In summary, for PacifiCorp share of the retirements the following adjustments were made:

	Case C	Case F	Case G	Case I	Capacity
<b>Scenario 1</b>					
Evanston	40.8	137.7	114.2	145.2	150
Rock Springs	68.1	229.5	190.3	242.0	250
Aeolus	122.5	413.1	342.6	435.7	450
Utah Coal	40.8	-70.0	8.6	-336.7	
<b>Scenario 2</b>					
Pinto	113.0	138.1	109.7	113.0	200
Blackrock	466.3	569.7	452.5	466.1	825
Utah Coal/Gas	-307.1	2.5	93.5	-92.8	
<b>Scenario 3</b>					
Coulee	272.2	710.3	655.7	486.2	

55 Table 3 – PacifiCorp’s replacement energy in bracketing scenarios

- 56 • It should be noted that this study has used the net flow as modeled in the typical PCM and  
 57 powerflow studies. The TWG did not perform an assessment to determine whether there would  
 58 be sufficient contract capacity in the B2H project to support the additional transfers  
 59 contemplated in Scenario #3 for PacifiCorp’s replacement energy from the Pacific Northwest.  
 60 • For each of the four selected cases, these three bracketing resource scenarios were applied,  
 61 totaling 12 separate base cases.  
 62 • To each of these base cases, the following Change Case configurations was tested:  
 63 Change Case Description  
 64 ○ Null: no future transmission facilities  
 65 ○ dRTP: Facilities included in the Draft Regional Transmission Plan  
 66 ○ CC4: included Gateway West without Gateway South  
 67 ○ CC5: included Gateway South without Gateway West  
 68 ○ CC31: dRTP without Populus-Cedar Hill-Hemingway 500 kV  
 69 ○ CC32: CC31 configuration adding Populus-Borah 500 kV  
 70 ○ CC33: CC31 configuration without Anticline-Populus 500 kV  
 71

72 **3. Base cases**

73 NTTG used the WECC ADS 2028 case in its 2018-2019 studies, edited the case to incorporate fixes to  
 74 load shapes, modified resource retirements/additions not included in the WECC 2028HS1a case, plus  
 75 other adjustments that improved the accuracy of the dataset. The production cost model simulating the  
 76 2028 load and resources forecast was used to identify stressed system conditions (i.e., load and  
 77 generation dispatch conditions) to study. A production cost model uses the costs of operating a fleet of  
 78 generators within the western interconnection to minimize costs for the 8760 hours of the year while  
 79 simultaneously adhering to a wide variety of operating constraints.  
 80

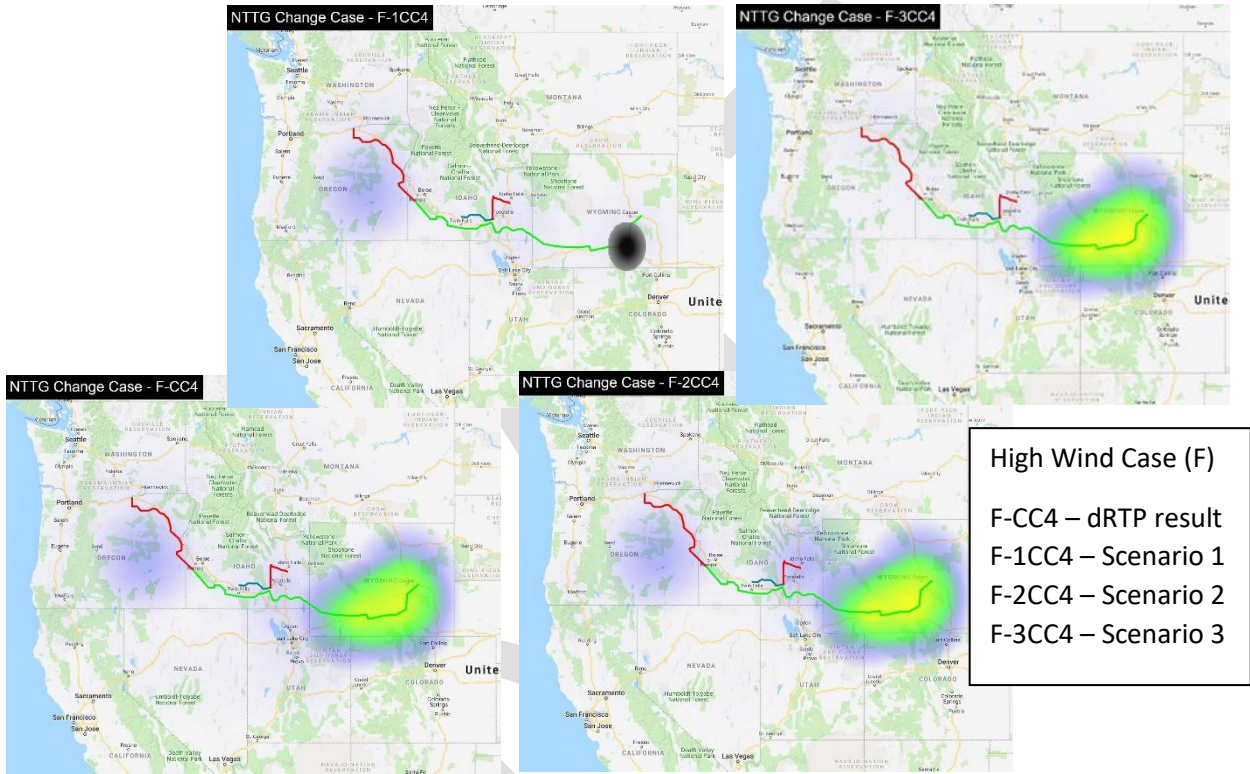
81 The production cost model data for the nine selected system conditions were then translated into  
 82 power flow base cases. A power flow model is a numerical analysis of a single condition flow (e.g., hour)

83 of electric power in an interconnected system. Of the nine selected cases, four were used as described  
 84 in section 1. See Attachment 2 for powerflow case flow detail.

85 **4. Power Flow Analysis Results; Steady State and Post Disturbance**

86 All analyses involved both steady state power flow and contingency runs. The contingencies include 36  
 87 credible double and 445 single contingencies in this analysis.

88 For the transmission configuration with Gateway West without Gateway South (Change Case CC4):



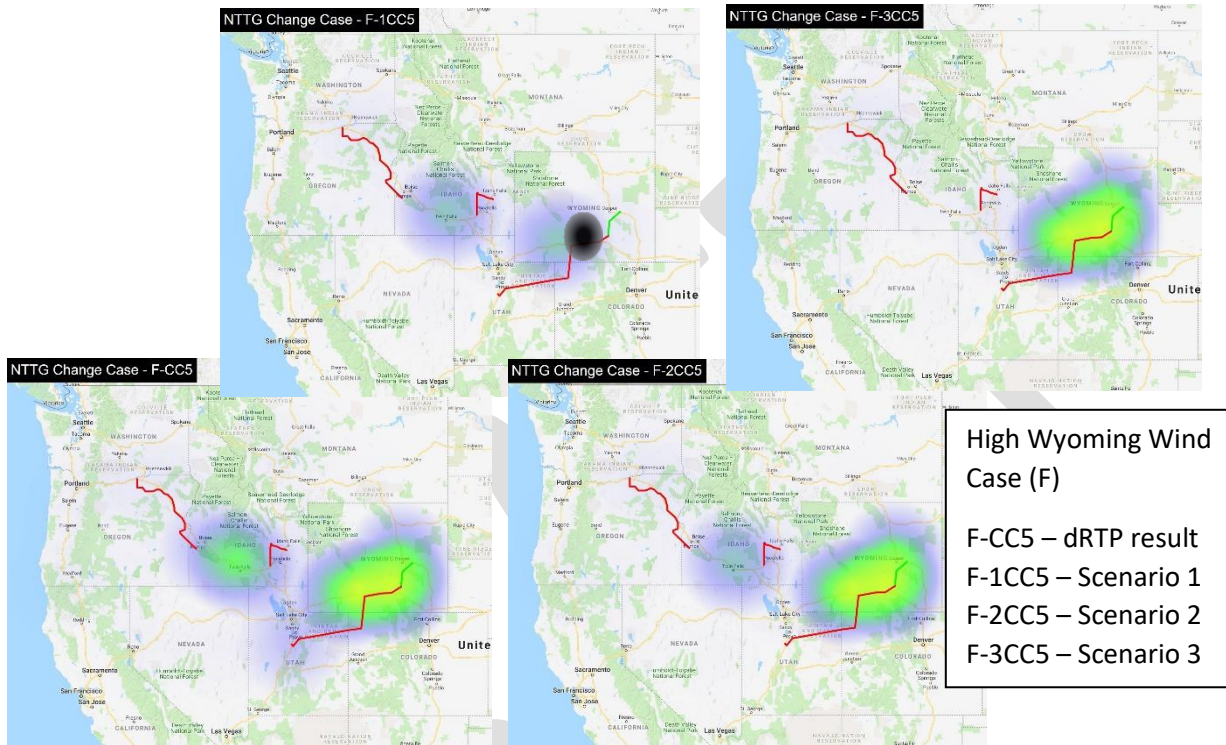
89 Figures 1 through 4 – Heatmap results for Change Case CC4

90 Observations

91 The performance issues illustrated in these heatmaps are the result of overloads due to the loss of the  
 92 Gateway West project in Wyoming causing overloads of the existing transmission system. These  
 93 overloads are mitigated in the DRTP by the inclusion of Gateway South.

94

95 For the transmission configuration with Gateway South without Gateway West (Change Case CC5), both  
 96 projects are necessary to move the wind energy out of Wyoming. The retired resources are in the  
 97 southwestern portion of Wyoming with over half of the retired resource at Bridger. These retired  
 98 Bridger resources are more tightly associated with the Southern Idaho system than Wyoming. The  
 99 contemplated wind resource additions in eastern Wyoming exceed the retired capacity because of the  
 100 lower capacity factor renewable resource:



101 Figures 5 through 8 – Heatmap results for Change Case CC5

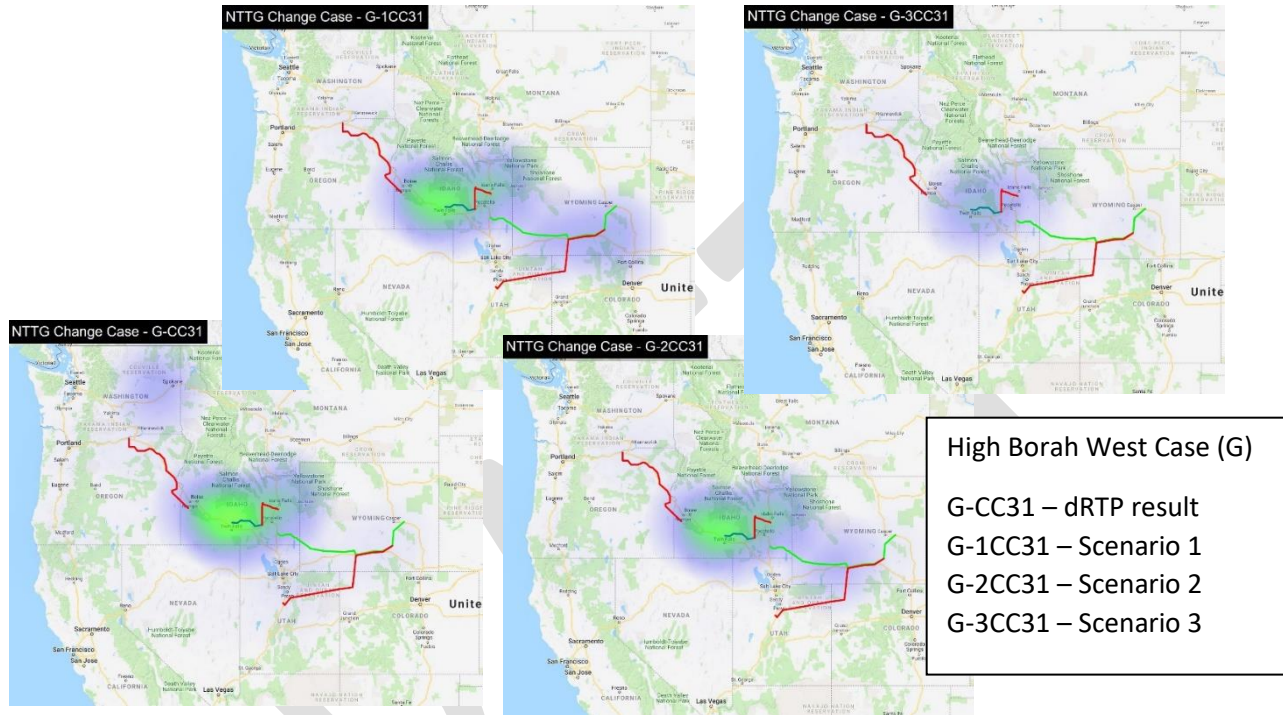
102 Observations

103 The performance issues illustrated in these heatmaps are the result of overloads due to the loss of the  
 104 Gateway South project in Wyoming causing overloads of the existing transmission system. These  
 105 overloads are mitigated in the DRTP by the inclusion of Gateway West.

106

107 The dRTP report found that the Populus-Hemingway segment was needed to mitigate transmission  
 108 overloads in the southern Idaho system. The following heat maps show the result of the dRTP result  
 109 versus the three scenarios used in this study.

110 Figures 9 through 12 – Heatmap results for Change Case CC31



111 Observations

112 The performance issues illustrated in these heatmaps are the result of overloads due to the loss of the  
 113 Gateway West project in Idaho causing overloads of the existing transmission system. These overloads  
 114 are mitigated in the DRTP by the inclusion of some segments of Gateway West in Idaho (Populus-Cedar  
 115 Hill-Hemingway). Conversion of the Borah-Midpoint section of the Kinport-Midpoint 345 kV line does  
 116 not materially resolve these performance issues as the issues are west of Midpoint in these cases.

117 Having the replacement energy located in the Pacific Northwest (Scenario 3) could potentially defer the  
 118 need the Populus-Cedar Hill-Hemingway segment, as shown in case G-3CC31 (Figure 12).

119

120 The bracketing scenarios provided an opportunity to test the robustness of the dRTP configuration. This  
 121 PPC study found that the dRTP configuration accommodates all three resource bracketing scenarios. For  
 122 example, in Case F, shown below, there isn't a practical difference between the original study resource  
 123 scenario and this studies' three alternative scenarios:



124 Figures 13 through 16 – Heatmap results for the DRTP

125

126 **5. Observation Summary**

127 The Study Plan requested a review of the following DRTP segments:

- 128 • Anticline – Populus 500 kV & Aeolus – Clover 500 kV
  - 129 ▪ Necessary to integrate the projected Wind capacity in Wyoming
  - 130 ▪ Anticline – Populus 500 kV necessary to support outage of Aeolus-Clover (see results from
  - 131 CC5)
  - 132 ▪ Aeolus – Clover 500 kV necessary to support outage of Aeolus-Anticline (see results from
  - 133 CC4)
- 134 • Populus – Cedar Hill 500 kV & Cedar Hill – Hemingway 500 kV (see results from CC31)
  - 135 ▪ Necessary to avoid overloads in Southern Idaho
- 136 • Populus – Borah 500 kV
  - 137 ▪ Not part of dRTP but would partially mitigate a Populus-Hemingway removal
- 138 • Borah – Midpoint 500 kV & Borah 500/345 kV transformer (uprating the Borah-Midpoint section
- 139 of the existing Kinport-Midpoint 345 kV)
  - 140 ▪ Upgrade necessary to support increased westbound transfers with Populus-Cedar Hill-
  - 141 Hemingway
- 142 • Midpoint – Hemingway #2 500 kV
  - 143 ▪ Not part of dRTP. Needed at higher Borah West transfers than modeled in 2028
- 144 • Midpoint – Cedar Hill 500 kV
  - 145 ▪ Not part of dRTP. Needed at higher Borah West transfers than modeled in 2028
  - 146

## Attachment 1

### Public Policy Consideration Study Proposal for a Scenario Analysis:

147  
148  
149  
150

#### **Objective**

151 On May 9, 2018, the NTTG Planning Committee approved studying a Public Policy Consideration (PPC)  
152 request submitted by Deseret Power, Utah Associate of Energy Users, Utah Associated Municipal Power  
153 Systems, Utah Office of Consumer Services, Utah Municipal Power Agency, and Wyoming Industrial  
154 Energy Consumers.

155 These Joint Submitters requested NTTG study the retirement of additional coal fired generation not  
156 being considered in the 2018-2028 NTTG 10-year planning window. These coal retirements have been  
157 identified in NTTG members' Integrated Resource Plans (IRPs). NTTG will remove this additional coal  
158 generation and perform a power flow transmission reliability assessment utilizing base cases that will be  
159 developed as part of the 2018-2019 planning cycle.

#### **Base Case Building Process and Assumptions**

161 As part of the NTTG 2018-2019 cycle, NTTG will undertake the development and study of several power  
162 flow base cases. This PPC study will utilize the base cases that are developed to be studied in the 2018-  
163 2019 cycle representing stressed conditions on the system such as:

- 164 1) High Wyoming Wind  
165 2) High Southern Idaho Export  
166 3) High Southern Idaho Import

167 For each of the relevant cases, the following coal generation should be modeled as off-line:

- 168 • Boardman  
169 • Jim Bridger 1  
170 • Cholla 4  
171 • Colstrip 1 & 2  
172 • Dave Johnston 1, 2, 3 & 4  
173 • Naughton 1 & 2  
174 • Naughton 3  
175 • Valmy 1 & 2

176 *Note:* The units underlined above will be modeled as off-line in all 2018-2019 NTTG studies.

177 Make-up power for the units taken off-line should attempt to be consistent with the planned resource  
178 additions of the respective company's most recent IRPs and consider individual company's available  
179 transmission capacity.

180 For Idaho Power, make-up power for Jim Bridger 1 should be dispatched from either (1) internal  
181 Idaho Power resources, or (2) the Pacific Northwest across the Boardman to Hemingway 500 kV  
182 transmission line.

183 PacifiCorp’s make-up power for Jim Bridger 1, and Naughton 1 & 2, will be developed using  
 184 available 2019 IRP information in consultation with the PPC submitters and Planning Committee.

185 **Study Process**

186 The NTTG TWG will ultimately create and run powerflow contingency analysis on the relevant cases,  
 187 such as:

- 188 1) High Wyoming Wind \_ PPC
- 189 2) High Southern Idaho Export \_ PPC
- 190 3) High Southern Idaho Import \_ PPC

191 Given all previous assumptions, the NTTG Technical Working Group, through contingency analysis on the  
 192 cases, will determine if any of the following Energy Gateway segments are superfluous to the specific  
 193 power flow case:

- 194 • Anticline – Populus 500 kV
- 195 • Aeolus – Clover 500 kV
- 196 • Populus – Cedar Hill 500 kV
- 197 • Cedar Hill – Hemingway 500 kV
- 198 • Populus – Borah 500 kV
- 199 • Borah – Midpoint 500 kV & Borah 500/345 kV Transformer (uprating Kinport-Midpoint 345 kV)
- 200 • Midpoint – Hemingway #2 500 kV
- 201 • Midpoint – Cedar Hill 500 kV

202 *Note:* It is unknown which facilities will be included into the Draft Regional Transmission Plan. Those  
 203 lines not included in the Draft Regional Transmission Plan will be removed from this PPC analysis.

204 **Study Schedule**

205 This analysis is scheduled to be completed in Quarter 6 of the 2018-2019 Biennial Planning Cycle.

206 **Deliverable**

207 A final PPC Study Report will document the results and will be incorporated, as an attachment, into the  
 208 final NTTG 2018-2019 Biennial Transmission Plan. The results of this additional analysis are  
 209 informational only and may inform the 2018-2019 Regional Transmission Plan, but will not result in the  
 210 inclusion of additional projects or exclusion of projects in the Regional Transmission Plan.

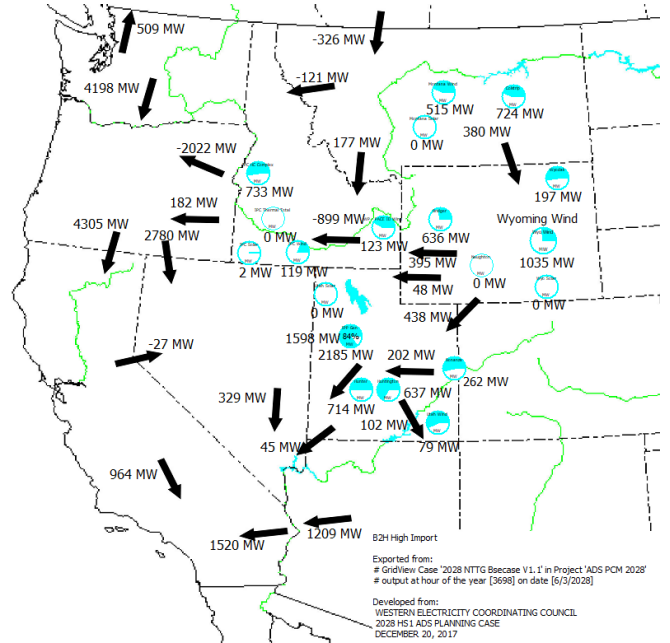
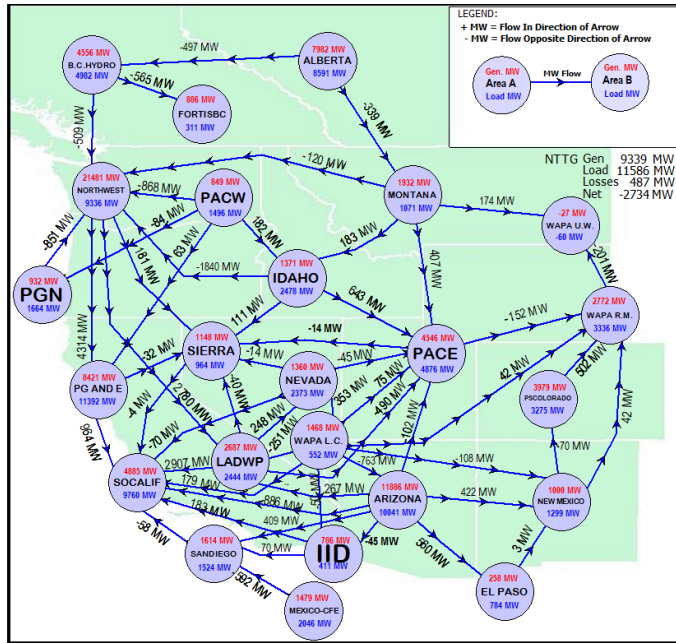
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**Attachment 2**  
**Powerflow Base Case maps**

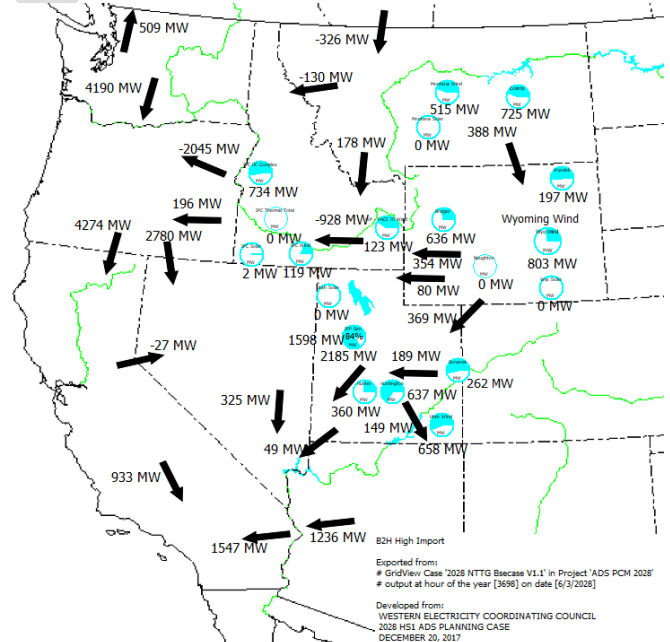
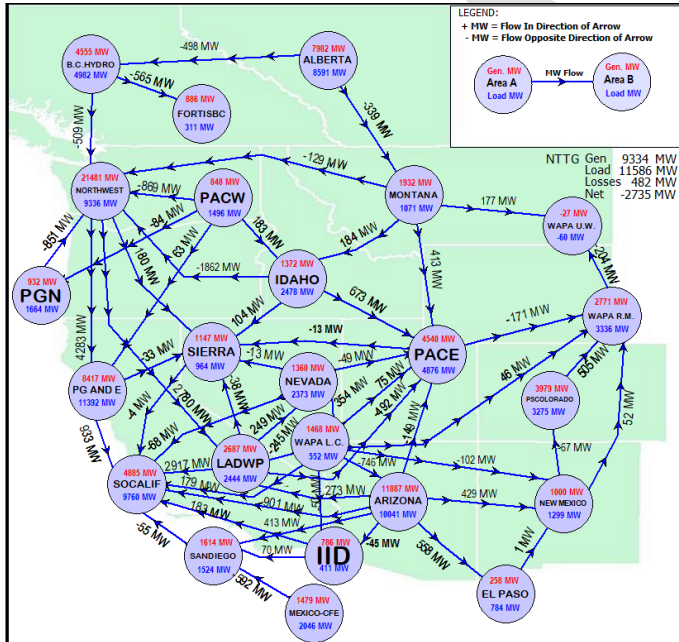
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- Table of cases:
- Case C Scenario 1 - High Idaho-Northwest Import case with Wyoming Wind Replacement Energy
  - Case C Scenario 2 - High Idaho-Northwest Import case with Utah Wind Replacement Energy
  - Case C Scenario 3 - High Idaho-Northwest Import case with Pacific Northwest Replacement Energy
  
  - Case F Scenario 1 - High Wyoming Wind case with Wyoming Wind Replacement Energy
  - Case F Scenario 2 - High Wyoming Wind case with Utah Wind Replacement Energy
  - Case F Scenario 3 - High Wyoming Wind case with Pacific Northwest Replacement Energy
  
  - Case G Scenario 1 - High Borah West case with Wyoming Wind Replacement Energy
  - Case G Scenario 2 - High Borah West case with Utah Wind Replacement Energy
  - Case G Scenario 3 - High Borah West case with Pacific Northwest Replacement Energy
  
  - Case I Scenario 1 - High Aeolus West and South case with Wyoming Wind Replacement Energy
  - Case I Scenario 2 - High Aeolus West and South case with Utah Wind Replacement Energy
  - Case I Scenario 3 - High Aeolus West and South case with Pacific Northwest Replacement Energy

231 Case C Scenario 1 – High Idaho-Northwest Import Case with Wyoming Wind Replacement Energy

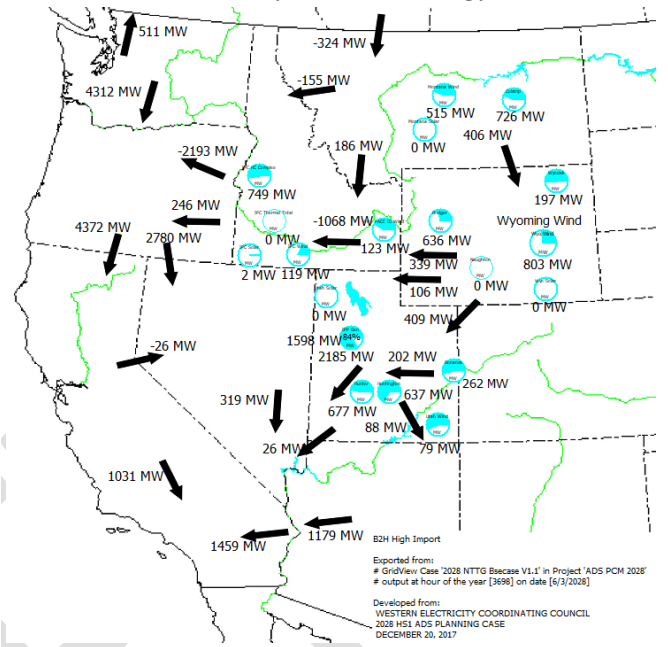
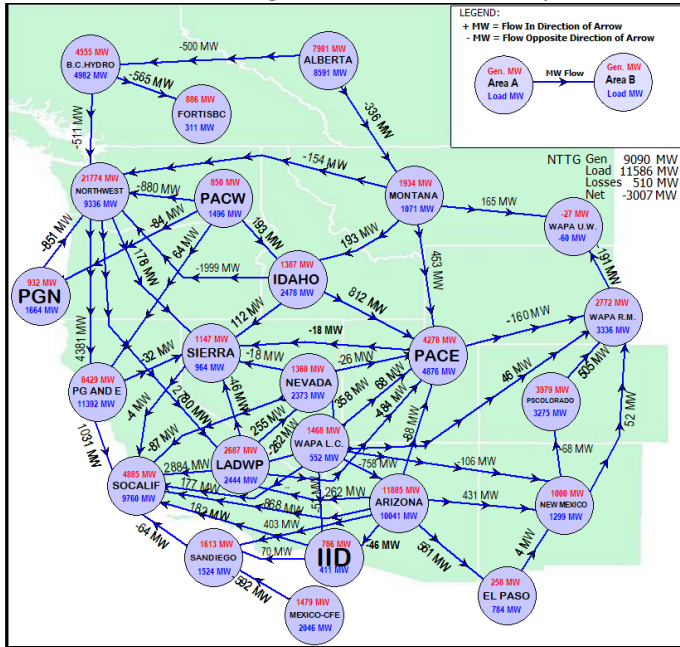


232 Case C Scenario 2 – High Idaho-Northwest Import Case with Utah Wind Replacement Energy

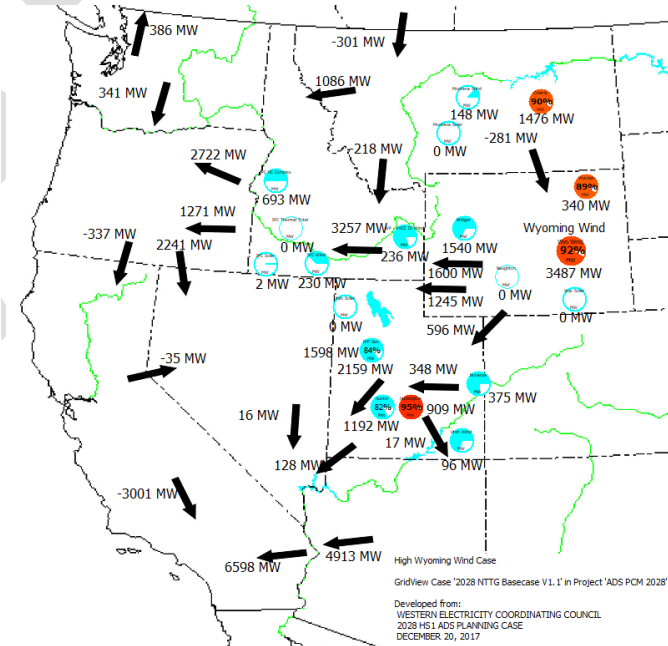
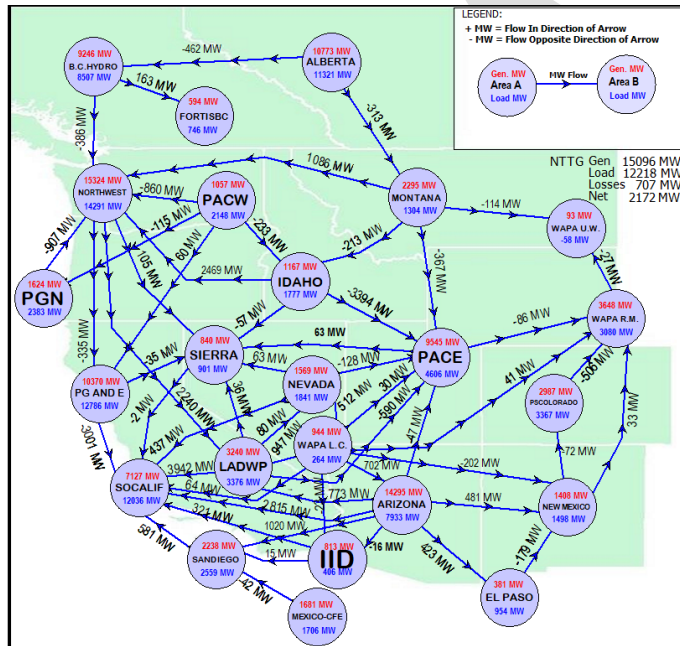


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234 Case C Scenario 3 – High Idaho-Northwest Import Case with Pacific Northwest Replacement Energy

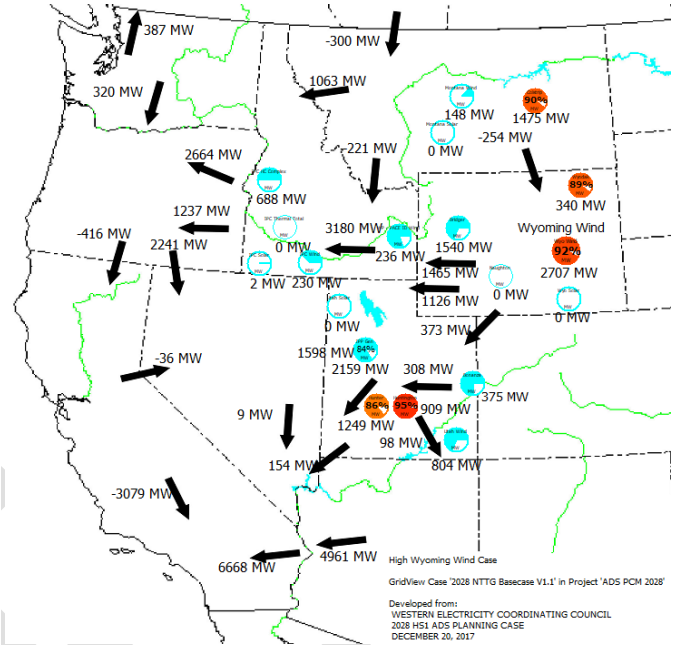
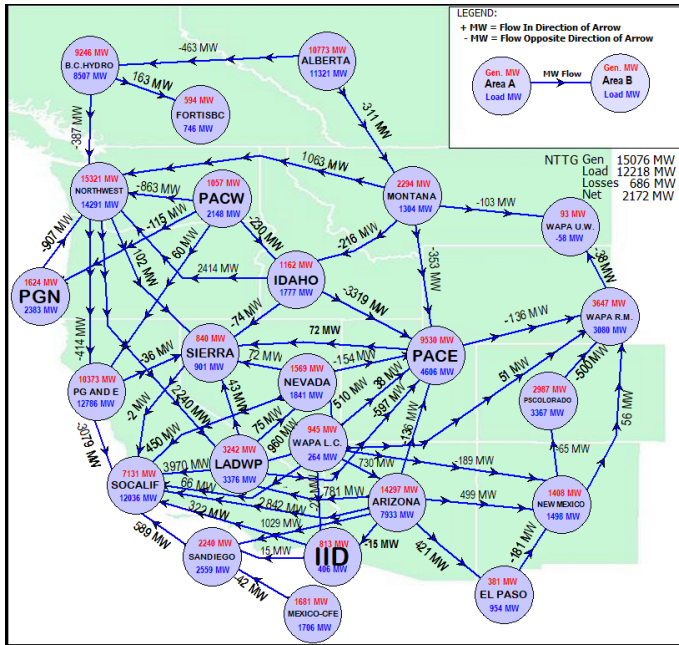


235 Case F Scenario 1 – High Wyoming Wind Case with Wyoming Wind Replacement Energy

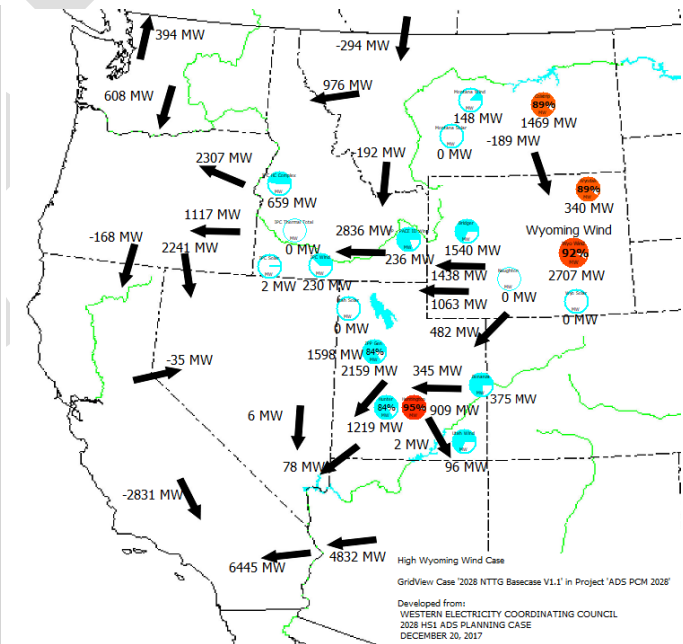
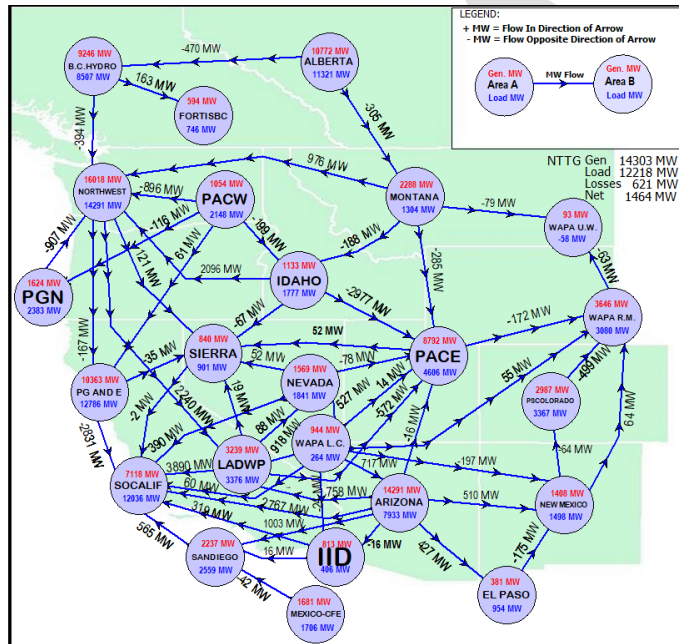


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237 Case F Scenario 2 – High Wyoming Wind Case with Utah Wind Replacement Energy

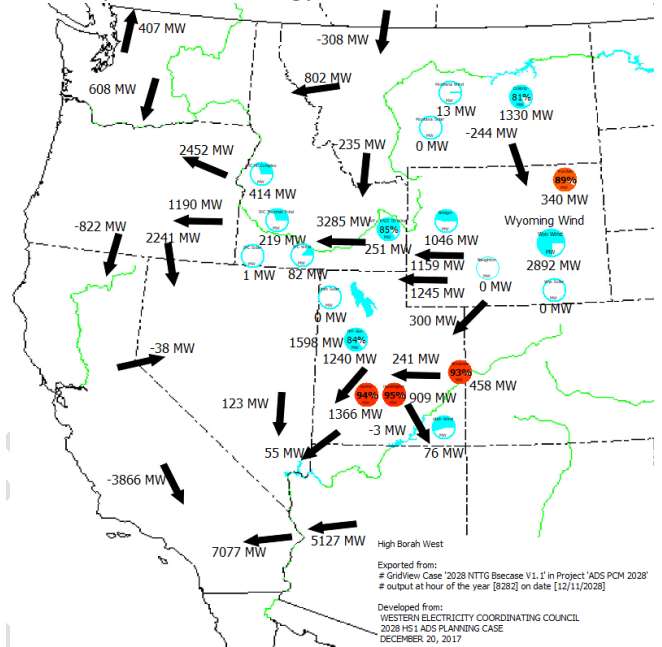
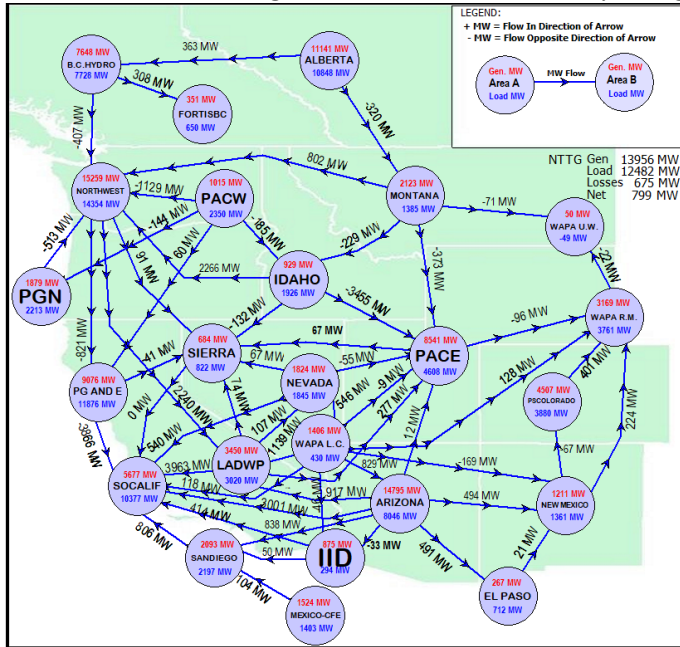


238 Case F Scenario 3 – High Wyoming Wind Case with Pacific Northwest Replacement Energy

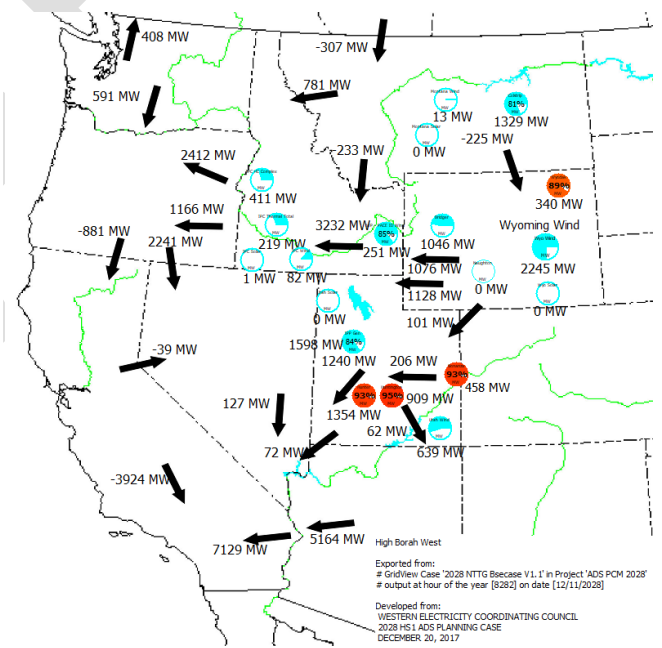
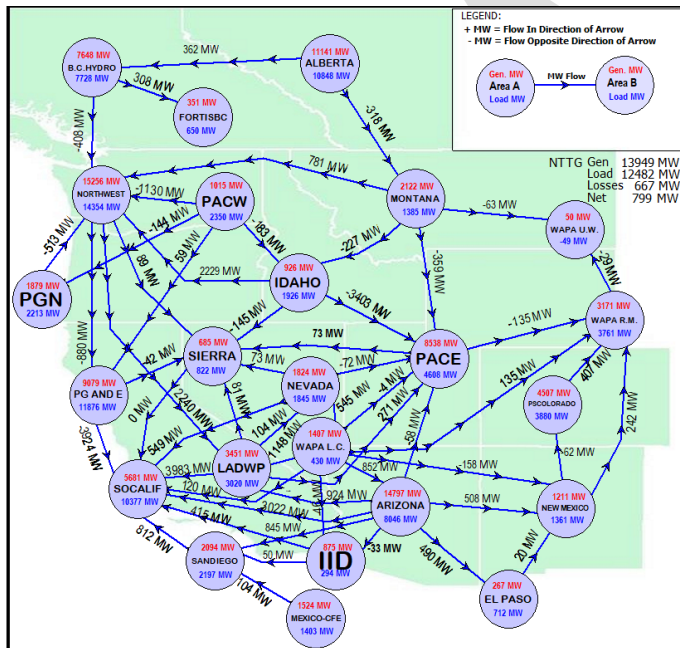


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240 Case G Scenario 1 – High Borah West Case with Wyoming Wind Replacement Energy

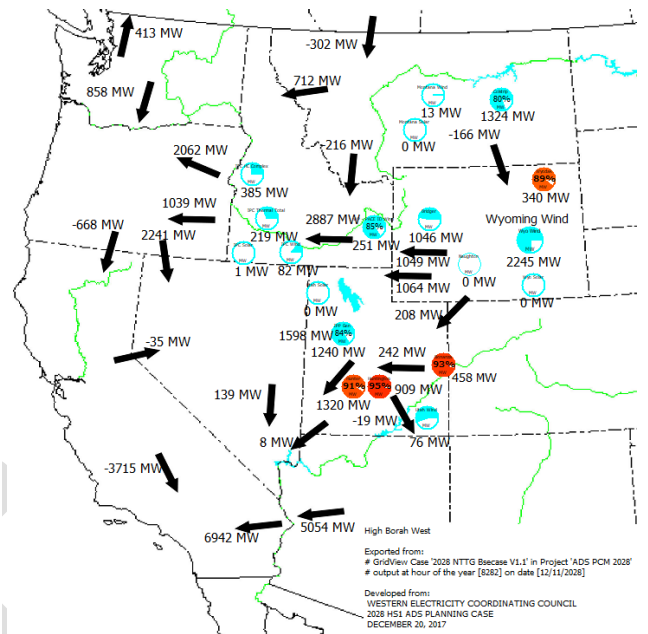
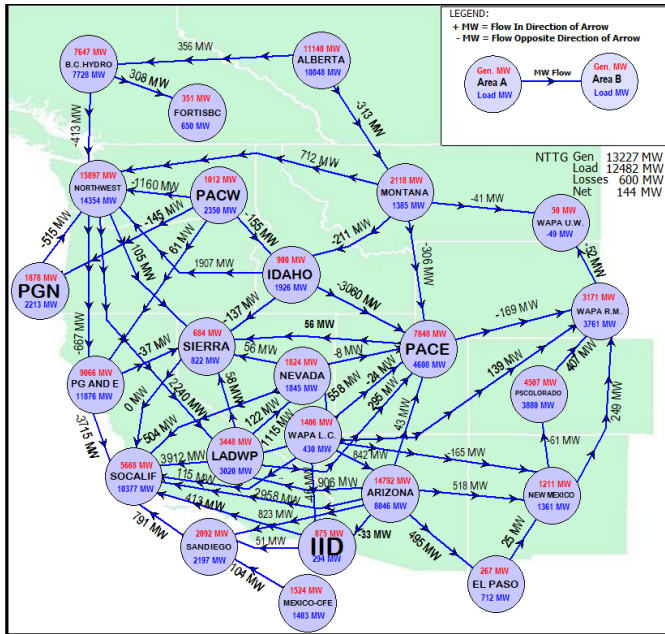


241 Case G Scenario 2 – High Borah West Case with Utah Wind Replacement Energy

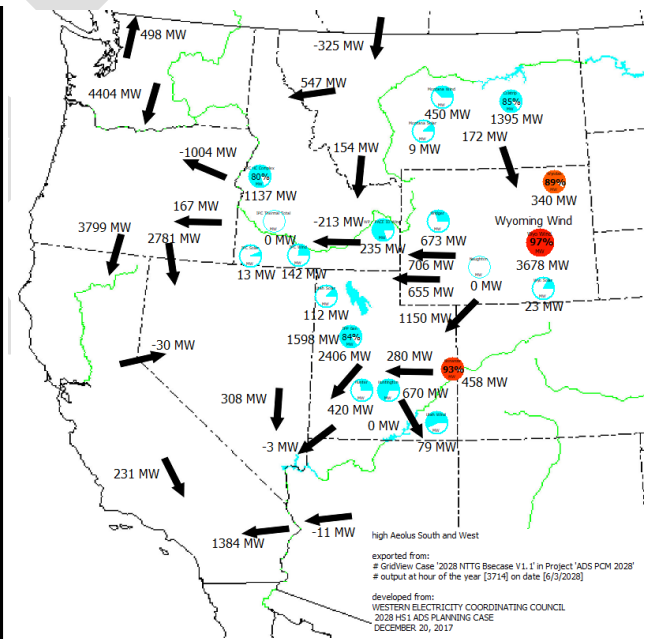
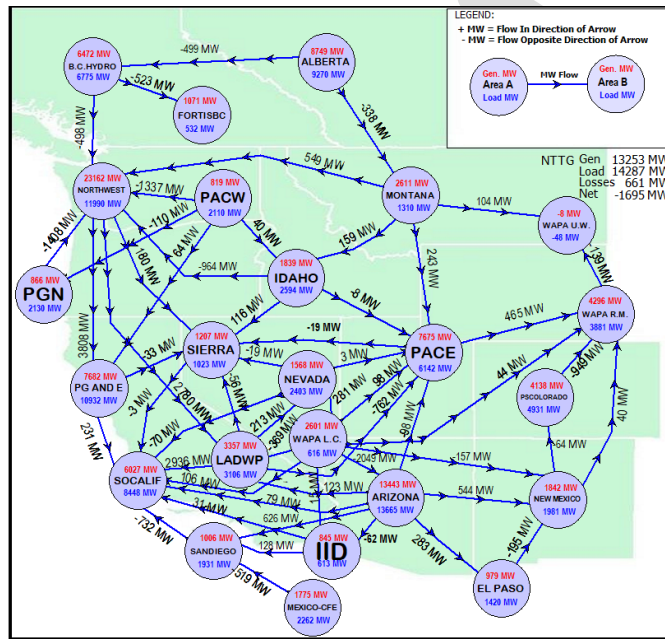


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243 Case G Scenario 3 – High Borah West Case with Pacific Northwest Replacement Energy

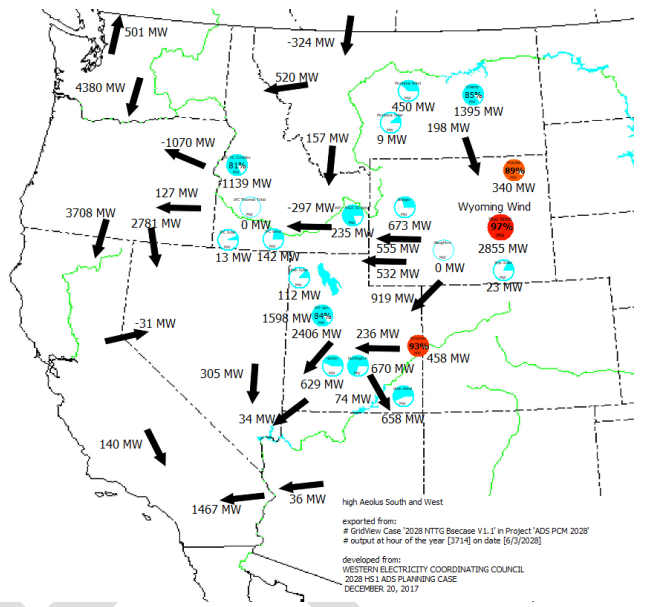
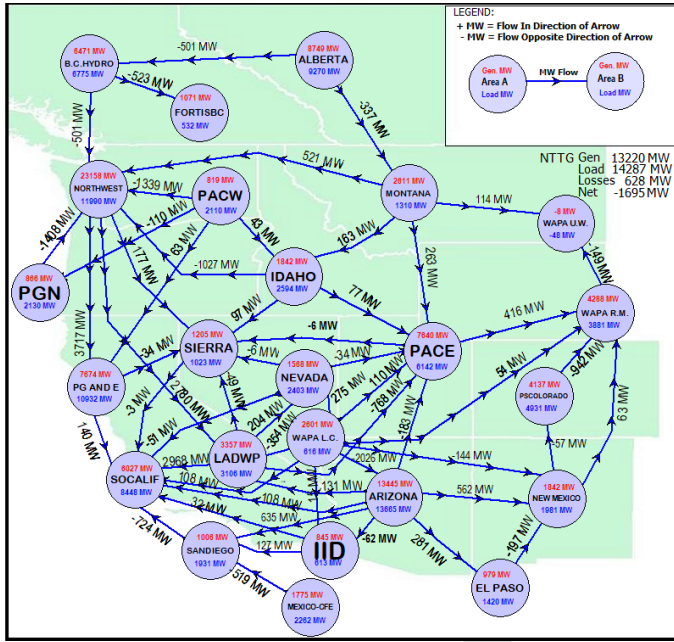


244 Case I Scenario 1 – High Aeolus West and South Case with Wyoming Wind Replacement Energy



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246 Case I Scenario 2 – High Aeolus West and South Case with Utah Wind Replacement Energy



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248 Case I Scenario 3 – High Aeolus West and South Case with Pacific Northwest Replacement Energy

