2010 Network Open Season Cluster Study Results

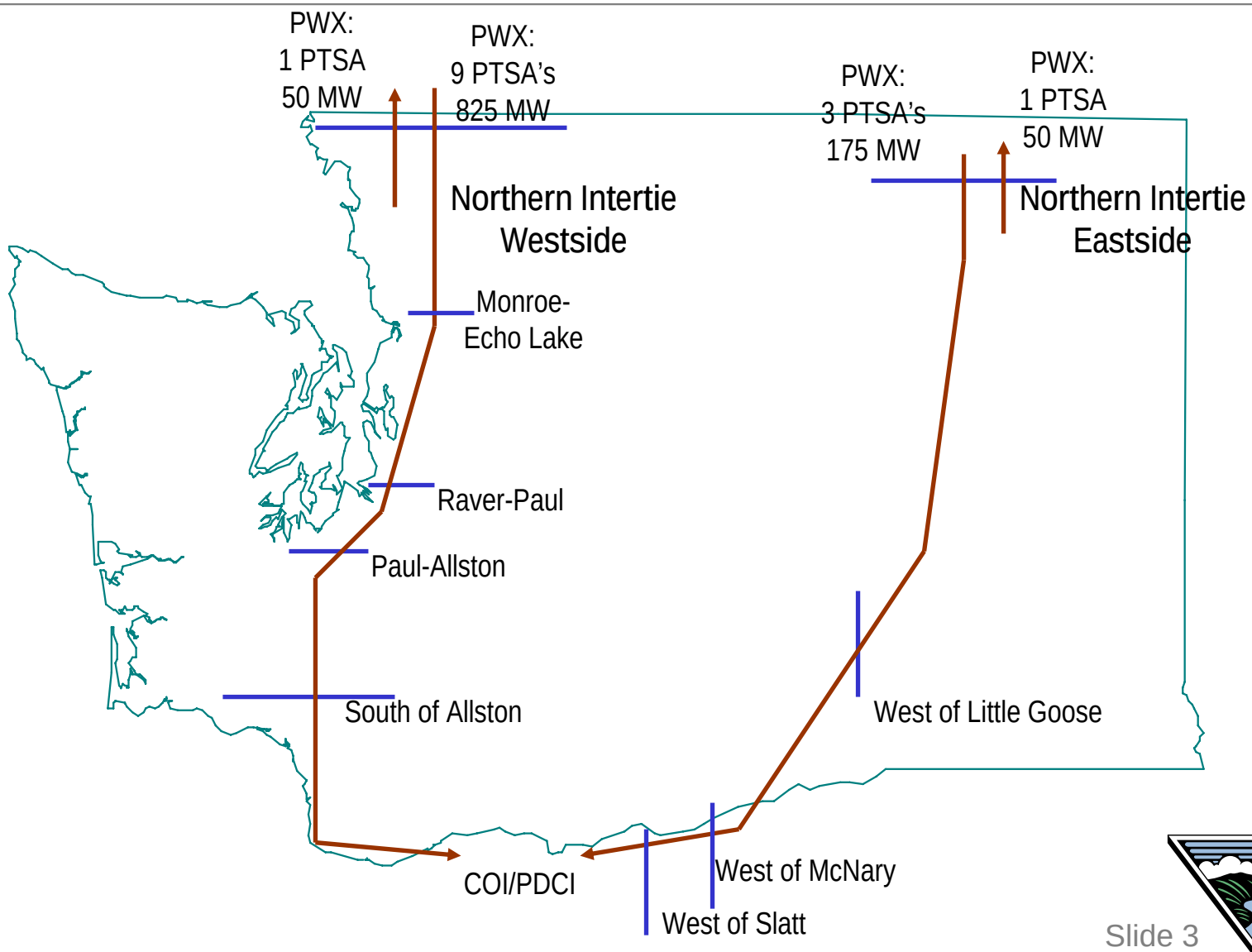
Customer Briefing

January 27, 2011

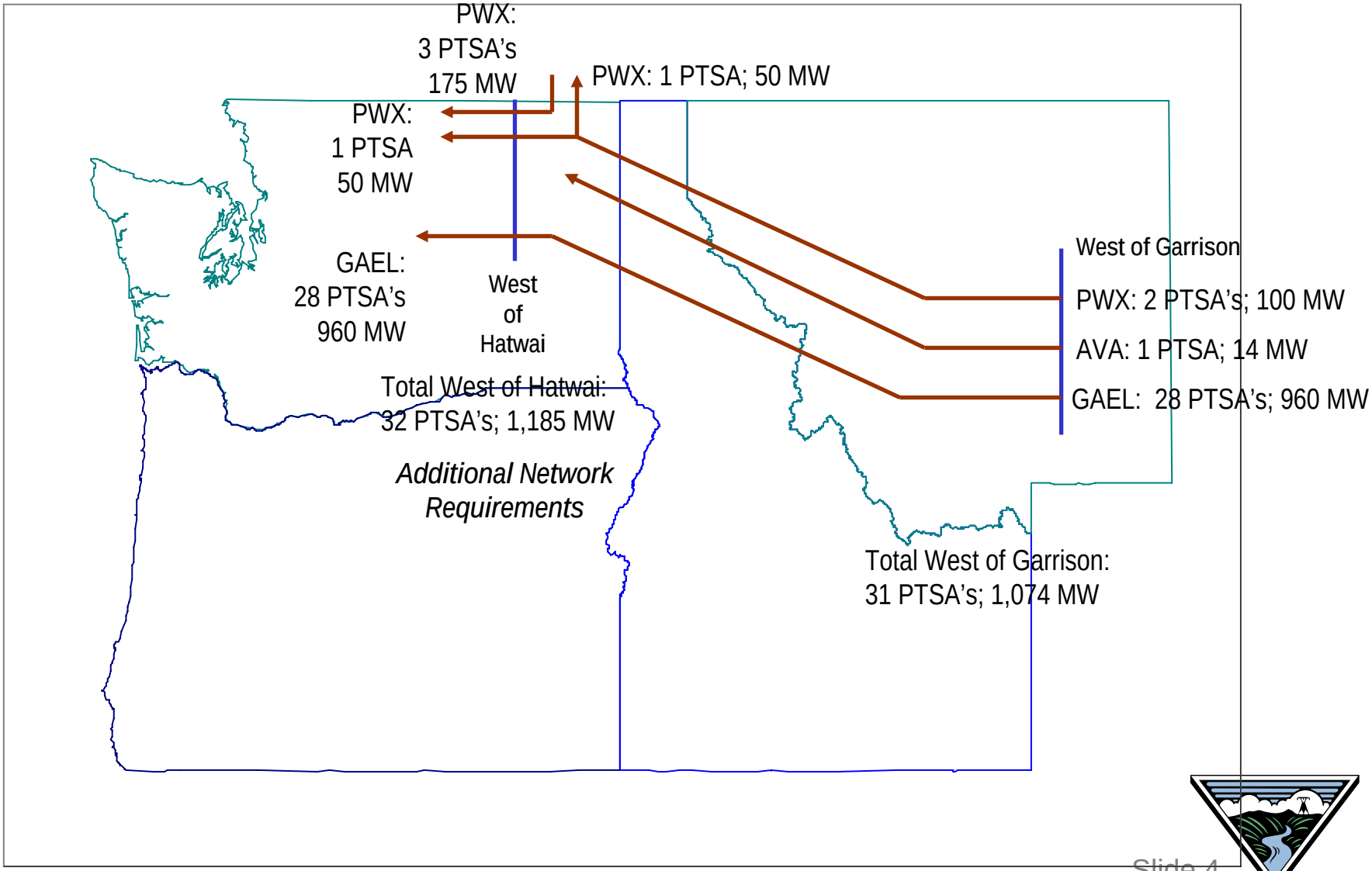
2010 NOS Cluster Study Participation

- 76 PTSA's for 3,759 MW (52 PTSA's for 2,493 MW wind)
- 3 Major Concentrations of PTSA's
  - 14 PTSA's on Northern Intertie
    - 9 PTSA's for 825 MW are on the Westside N>S
    - 1 PTSA for 50 MW is on the Westside S>N
    - 3 PTSA's for 175 MW are on the Eastside N>S *(included in West of Hatwai impact)*
    - 1 PTSA for 50 MW is on the Eastside S>N *(included in West of Garrison impact)*
  - 34 PTSA's for 1,074 MW Impacting West of Garrison/West of Hatwai
    - Of the 34 PTSA's, 28 PTSA's for 960 MW wind in Montana
  - 32 PTSA's for 1,635 MW on the network (23 PTSA's for 1,483 MW wind)

2010 NOS Cluster Study – Northern Intertie Requests



2010 NOS Cluster Study – Montana Requests



Thermal Generation Dispatch Sequence Used to Balance Requests for Incremental Transmission Service

Tier	Generation
I	Cherry Point Refinery
I	Beaver Gen.
I	Whitehorn Power Station
I	Avista Rathdrum CT
I	Frederickson Gen. Station
I	Fredonia
I	Klamath Expansion (Peaking)
I	Northeast Comb. Turbine
I	Kettle Falls Gen. Station
I	Big Hanaford Centralia

Tier	Generation
II	Klamath Cogeneration Project
II	Tenaska Ferndale Cogen Station
II	Encogen Gen. Station
II	Sumas Cogeneration
II	River Road Gen. Plant
II	March Point Cogen
II	Hermiston Gen. Plant
II	Hermiston Energy Center Cogen
II	Frederickson I
II	Lancaster (Rathdrum Gen. Station)
II	Coyote Springs Power Station
II	Coyote Springs II
II	Goldendale Energy Center
II	Port Westward Gen. Station
II	Chehalis Gen. Facility
II	Mint Farm Energy Center

Tier	Generation
III	Centralia G2 Centralia
III	Boardman
IV	Centralia G1 Centralia
IV	Jim Bridger
IV	Colstrip
V	CGS

The Tiers indicate generation groups that, for study purposes will be assumed to be re-dispatched to balance NW area generation and load. The Tier sequence was based on age of the plant, heat rate, and past operation. The sequence within a Tier may change for seasonal power flow studies.

Cluster Study Generation Scenarios

- Base Case: 95th Percentile FCRPS Hydro Gen., 60% Wind Generation in the NW, 100% of the Montana and Northern Intertie requests.
  - Reduced thermal generation based on thermal generation dispatch sequence
- Generation Scenario 1: 95th Percentile FCRPS Hydro Gen., *100% Wind Generation in the NW*, 100% of the Montana and Northern Intertie requests.
  - Further reduced thermal generation based on thermal generation dispatch sequence
- Generation Scenario 2: *FCRPS Hydro Gen. High Upper Columbia and Low Lower Columbia, No Wind Generation in the NW*, 100% of the Northern Intertie requests.
  - Increased thermal generation

2010 NOS Study Assumptions -- The Journey Begins

Item	Previous NOS	2010 NOS	Comment
Outyear base case	2014 Summer Case: BPA A14CY07 Winter Case: BPA J14CY07	2016 Summer Case: WECC 16HS1 Winter Case: WECC 15HW2A	Topology updates submitted through WECC Annual Study Program
Load	Expected 1-in-2 peak	Expected 1-in-2 peak	
Hydro	90th percentile dispatch FCRPS/Mid-C assumed to be backed down in order to accommodate new TSRs	95th percentile dispatch Mid-C remained at assumed contract level Thermal turned down to accommodate requests for service	
Thermal	100% of contracted demand	Based upon Thermal Generation Dispatch Sequence	
Wind	80% of contract/requested demand for pre-2008 NOS; 100% for NT 100% of requested demand for all 2008 & 2009 NOS requests	Base scenario: All wind in Northwest set to 60% of contracted/requested demand Wind in Montana set to 100% of requested demand	
COI/PDCI	4,800/3,100 Summer	4,800/3,100 Summer	
Northern Intertie	Contracted demand in N>S direction for summer; Canadian Entitlement Return for Winter	Contracted demand in N>S direction for summer; Canadian Entitlement Return for Winter	
Montana>NW; Idaho > NW	Set at agreed to levels from ATC Methodology	Set at agreed to levels from ATC Methodology	

Cluster Study Generation Scenarios

- Base Case: 95th Percentile FCRPS Hydro Gen., 60% Wind Generation in the NW, 100% of the Montana and Northern Intertie requests.
  - Modeled requests for service from 2010 NOS
  - Reduced thermal generation based on thermal generation dispatch sequence

			Summer			Winter		
	TTC with 2008 NOS Projects	Preliminary TTC after 2010 NOS	2010 NOS Starting Point	Base Scenario	Impact from 2010 NOS Requests	2010 NOS Starting Point	Base Scenario	Impact from 2010 NOS Requests
Flowgate	MW	MW	Flow MW	Flow MW	Delta	Flow MW	Flow MW	Delta
SOUTH OF ALLSTON	3,890	3,890	3,244	3,389	146	1,959	1,575	-384
CROSS CASCADES NORTH	9,900	10,350	4,643	4,838	194	8,638	9,210	572
CROSS CASCADES SOUTH	7,700	7,700	4,352	4,572	219	6,268	6,595	327
MONROE-ECHO LAKE	1,500	1,900	1,265	1,412	147	-304	-489	-185
NORTH OF HANFORD	4,400	4,400	2,791	2,949	158	-140	-424	-284
NORTH OF JOHN DAY	8,400	8,400	6,753	7,331	579	3,673	3,616	-56
PAUL TO ALLSTON	2,990	2,990	2,276	2,373	98	806	875	70
RAVER TO PAUL	1,450	1,700	1,105	1,197	92	434	511	77
WEST OF MCNARY	4,500	4,500	2,878	2,792	-86	3,310	3,857	547
WEST OF SLATT	7,500	7,500	5,730	5,970	239	5,097	5,585	488
COI			4,783	4,783	0	3,252	3,233	-18
PDCI			3,101	3,101	0	1,500	2,001	500
NORTHERN INTERTIE WESTSIDE N>S			1,231	2,006	775	-1,260	-1,309	-49
NORTHERN INTERTIE EASTSIDE N>S			0	125	125	-319	-370	-51
Plant		Gen MW Max	Gen MW	Gen MW	Delta	Gen MW	Gen MW	Delta
FCRPS -- Big 15		22,559	12,187	12,187	0	15,824	15,827	3
FCRPS -- Lower Columbia Hydro Gen		6,880	2,447	2,447	0	4,795	4,795	0
FCRPS -- Lower Snake Gen		3,483	595	595	0	1,782	1,782	0
FCRPS -- Upper Columbia (Total) Gen		9,455	6,775	6,775	0	6,888	6,891	3
Mid-Columbia (Total) Gen		4,943	3,882	3,882	0	4,616	4,616	0
Northwest Wind		11,121	4,382	5,344	962	4,382	5,302	920
NW Thermal Total		16,636	12,550	9,856	-2,694	14,279	13,252	-1,027

Cluster Study Generation Scenarios

- Generation Scenario 1: 95th Percentile FCRPS Hydro Gen., *100% Wind Generation in the NW*, 100% of the Montana and Northern Intertie requests.
  - Modeled requests for service from 2010 NOS
  - Further reduced thermal generation based on thermal generation dispatch sequence

			Summer			Winter		
	TTC with 2008 NOS Projects	Preliminary TTC after 2010 NOS	Base Scenario	High Wind Scenario	Additional Impact from High Wind	Base Scenario	High Wind Scenario	Additional Impact from High Wind
Flowgate	MW	MW	Flow MW	Flow MW	Delta	Flow MW	Flow MW	Delta
SOUTH OF ALLSTON	3,890	3,890	3,389	2,113	-1,277	1,575	1,300	-275
CROSS CASCADES NORTH	9,900	10,350	4,838	5,765	928	9,210	10,308	1,098
CROSS CASCADES SOUTH	7,700	7,700	4,572	5,733	1,162	6,595	7,221	626
MONROE-ECHO LAKE	1,500	1,900	1,412	1,488	76	-489	-920	-431
NORTH OF HANFORD	4,400	4,400	2,949	2,398	-551	-424	-1,144	-721
NORTH OF JOHN DAY	8,400	8,400	7,331	7,804	473	3,616	3,166	-451
PAUL TO ALLSTON	2,990	2,990	2,373	1,720	-654	875	646	-229
RAVER TO PAUL	1,450	1,700	1,197	1,844	646	511	369	-142
WEST OF MCNARY	4,500	4,500	2,792	2,960	168	3,857	3,589	-268
WEST OF SLATT	7,500	7,500	5,970	6,224	254	5,585	5,702	117
COI			4,783	4,781	-2	3,233	3,234	0
PDCI			3,101	3,101	0	2,001	2,001	0
NORTHERN INTERTIE WESTSIDE N>S			2,006	2,005	-1	-1,309	-1,308	0
NORTHERN INTERTIE EASTSIDE N>S			125	126	1	-370	-369	0
Plant		GenMW Max	Gen MW	Gen MW	Delta	Gen MW	Gen MW	Delta
FCRPS -- Big 15		22,559	12,187	12,182	-5	15,827	15,824	-3
FCRPS -- Lower Columbia Hydro Gen		6,880	2,447	2,447	0	4,795	4,795	0
FCRPS -- Lower Snake Gen		3,483	595	595	0	1,782	1,782	0
FCRPS -- Upper Columbia (Total) Gen		9,455	6,775	6,770	-5	6,891	6,888	-3
Mid-Columbia (Total) Gen		4,943	3,882	3,882	0	4,616	4,616	0
Northwest Wind		11,121	5,344	8,873	3,529	5,302	8,736	3,434
NW Thermal Total		16,636	9,856	6,356	-3,500	13,252	9,571	-3,681

Cluster Study Generation Scenarios

- Generation Scenario 2: *FCRPS Hydro Gen. High Upper Columbia and Low Lower Columbia, No Wind Generation*, 100% of the Northern Intertie requests.
  - Wind reduced to zero output
  - Increased thermal generation

			Summer			Winter		
	TTC with 2008 NOS Projects	Preliminary TTC after 2010 NOS	Base Scenario	No Wind Scenario	Additional Impact from No Wind	Base Scenario	No Wind Scenario	Additional Impact from No Wind
Flowgate	MW	MW	Flow MW	Flow MW	Delta	Flow MW	Flow MW	Delta
SOUTH OF ALLSTON	3,890	3,890	3,389	3,500	111	1,575	1,679	104
CROSS CASCADES NORTH	9,900	10,350	4,838	4,094	-744	9,210	8,580	-630
CROSS CASCADES SOUTH	7,700	7,700	4,572	3,900	-672	6,595	5,916	-679
MONROE-ECHO LAKE	1,500	1,900	1,412	1,729	318	-489	-464	24
NORTH OF HANFORD	4,400	4,400	2,949	3,899	950	-424	-385	39
NORTH OF JOHN DAY	8,400	8,400	7,331	7,319	-13	3,616	2,579	-1,037
PAUL TO ALLSTON	2,990	2,990	2,373	2,465	91	875	542	-333
RAVER TO PAUL	1,450	1,700	1,197	1,250	53	511	227	-284
WEST OF MCNARY	4,500	4,500	2,792	1,980	-812	3,857	2,356	-1,502
WEST OF SLATT	7,500	7,500	5,970	4,411	-1,559	5,585	3,190	-2,395
COI			4,783	2,834	-1,949	3,233	307	-2,926
PDCI			3,101	1,270	-1,831	2,001	0	-2,000
NORTHERN INTERTIE WESTSIDE N>S			2,006	2,004	-2	-1,309	-1,309	-1
NORTHERN INTERTIE EASTSIDE N>S			125	126	2	-370	-369	1
Plant		GenMW Max	Gen MW	Gen MW	Delta	Gen MW	Gen MW	Delta
FCRPS -- Big 15		22,559	12,187	11,813	-375	15,827	15,827	0
FCRPS -- Lower Columbia Hydro Gen		6,880	2,447	1,117	-1,330	4,795	4,795	0
FCRPS -- Lower Snake Gen		3,483	595	310	-285	1,782	1,782	0
FCRPS -- Upper Columbia (Total) Gen		9,455	6,775	8,016	1,241	6,891	6,891	0
Mid-Columbia (Total) Gen		4,943	3,882	3,882	0	4,616	4,616	0
Northwest Wind		11,121	5,344	0	-5,344	5,302	0	-5,302
NW Thermal Total		16,636	9,856	12,550	2,695	13,252	13,882	630

Thermal Generation Dispatch Sequence Summary

		Summer			Winter		
Winter		Base Scenario	High Wind Scenario	No Wind Scenario	Base Scenario	High Wind Scenario	No Wind Scenario
Plant	Gen MW Max	Gen MW	Gen MW	Gen MW	Gen MW	Gen MW	Gen MW
NW Thermal Total	16,693	9,856	6,356	12,550	13,252	9,571	13,882
Cherry Point	666	0	0	0	0	0	0
Beaver Generation	519	0	0	0	0	0	531
Whitehorn Power Station	162	0	0	0	0	0	162
Avista Rathdrum CT	210	0	0	0	0	0	182
Frederickson Generating Station	162	0	0	0	113	0	162
Fredonia	341	0	0	83	341	0	341
Klamath Expansion (Peaking)	100	0	0	85	90	0	90
Northeast Combustion Turbine	68	0	0	0	0	0	0
Kettle Falls Generating Station	53	0	0	43	42	0	42
Big Hanaford Centralia	260	0	0	0	0	0	0
Klamath Cogeneration Project	540	0	0	400	395	0	395
Tenaska Ferndale Cogen Station	282	0	0	246	267	0	267
Encogen Generating Station	185	0	0	156	177	0	177
Sumas Cogeneration	140	0	0	116	130	0	130
River Road Generating Plant	260	0	0	235	240	0	240
March Point Cogen	152	0	0	138	149	0	149
Hermiston Generating Plant	532	0	0	490	490	0	490
Hermiston Energy Center Cogen	623	0	0	536	536	0	536
Frederickson I	270	0	0	150	150	0	150
Lancaster (Rathdrum Generating Station)	270	0	0	250	250	0	250
Coyote Springs Power Station	250	240	0	248	240	0	240
Coyote Springs II	290	251	0	251	282	147	282
Goldendale Energy Center	303	277	0	277	277	277	277
Port Westward Generating Station	430	388	0	388	430	430	430
Chehalis Generating Facility	640	520	0	520	520	520	520
Mint Farm Energy Center	320	305	0	305	305	305	305
Centralia G2 Centralia	764	757	0	757	757	757	757
Boardman	620	540	0	540	578	578	578
Centralia G1 Centralia	764	756	537	756	756	756	756
Jim Bridger	2,248	2,160	2,160	2,160	2,210	2,210	2,210
Colstrip	2,306	2,432	2,430	2,191	2,308	2,372	2,013
Columbia Generating Station	1,200	1,184	1,184	1,184	1,184	1,184	1,184
Kimberly Clark Gen	47	45	45	45	35	35	35
Grays Harbor Gen	715	0	0	0	0	0	0

Cluster Study Results

- Total 2010 NOS Requests = 77 TSRs 3,759 MW (1 partial TSR)
- Long-term Firm Queue Restack
  - Planning recommends authorization of six (6) PTSA's for 53 MW without system reinforcements.
- 2008 NOS Projects
  - 1,522 MW only require WOMR & the I-5 Project
  - Most remaining TSRs require some combination of WOMR, the I-5 Project, or Central Ferry – Lower Monumental to address requirements for service with the following 2010 NOS Projects

Cluster Study Results

- Northern Intertie Westside
  - Westside Fixes North→South – (825 MW)
    - NI Eastside Scheduling
    - Portal Way 230/115-kV Transformer (*PSE Load-Service Project*)
    - Monroe-Novelty 230-kV - Resag to 70 Deg C
    - Raver-Paul (1) - Rebuild Tacoma-Cowlitz 230-kV #1 and #2 and Cowlitz 230-kV Strain Bus (*TCL coordination required)*
    - Monroe-Snohomish #1 and #2 230-kV - Resag to 100 Deg C (Gen scen. 2)
    - Raver-Paul (2) - Reconductor Olympia-S. Tacoma 230-kV (Gen scen. 2)
  - Westside Fixes South→North – (50 MW)
    - NI Eastside Scheduling
    - PSAST (S-N) Reinforcements
- Northern Intertie Eastside
  - Eastside Fixes North→South – (175 MW)
    - NI Eastside Scheduling
    - Boundary-Nelway RAS
    - Addy-Devil's Gap 115-kV - Reconductor (*AVA coordination required*)
  - Eastside Fixes South→North – (50 MW)
    - NI Eastside Scheduling
    - PSAST (S-N) Reinforcements

Cluster Study Results

- West of Garrison/West of Hatwai
  - Colstrip Upgrade Project (CUP West) – upgraded and new reactive compensation among Garrison, Hatwai and Bell Substations. - (480 MW)
    - West of Hatwai TTC: Assumed increase from 4,250 MW to 4,800 MW
    - West of Garrison TTC: Assumed increase from 2,200 MW to 2,800 MW
  - Approx. 420 miles of 500 kV line including series compensation between Garrison and Central Washington (Ashe Sub.). - (544 MW)
- Other Network Projects – (60 MW)
  - Redmond 230/115-kV #2 Transformer
  - Ponderosa #2 500/230-kV transformer

Projects Required by Generation Scenarios

- <u>Generation Scenario 1</u>: (100% NW wind/100% MT/NI/95% Hydro/Thermal Displaced)
- Monroe 500-kV Shunt Caps
- McNary 230-KV Caps

- <u>Generation Scenario 2</u>: (0% NW wind/100% NI/Hi U.C./Low L.C.)
- Monroe-Snohomish #1 and #2 230-kV – Resag to 100 Deg C
- Raver-Paul (2) – Reconductor Olympia-S. Tacoma 230-kV

PTSA grouping and project requirements

	Requests	77 TSRs
	Demand	**3,759 MW**
Grouping	**PTSAs**	**Demand**
Authorize	6 TSRs	53 MW
CFRY-LOMO, CUP (West)	13 TSRs	480 MW
CFRY-LOMO, GASH	16 TSRs	530 MW
GASH	1 TSRs	14 MW
I-5 Project, WOMR	1 TSRs	33 MW
I-5 Project, WOMR, CFRY-LOMO, NI (East): North-South	2 TSRs	100 MW
I-5 Project, WOMR, CFRY-LOMO, NI (East): North-South, CUP (West)	1 TSRs	75 MW
I-5 Project, WOMR, NI (West): North-South	9 TSRs	825 MW
NI (East): South-North, CUP (West)	1 TSRs	50 MW
Redmond 230/115-kV Transformer	1 TSRs	20 MW
Redmond 230/115-kV Transformer, Ponderosa 500/230-kV Transformer	1 TSRs	40 MW
WOMR	24 TSRs	1,489 MW
WOMR, NI (West): South-North	1 TSRs	50 MW
Total	77 TSRs	3,759 MW

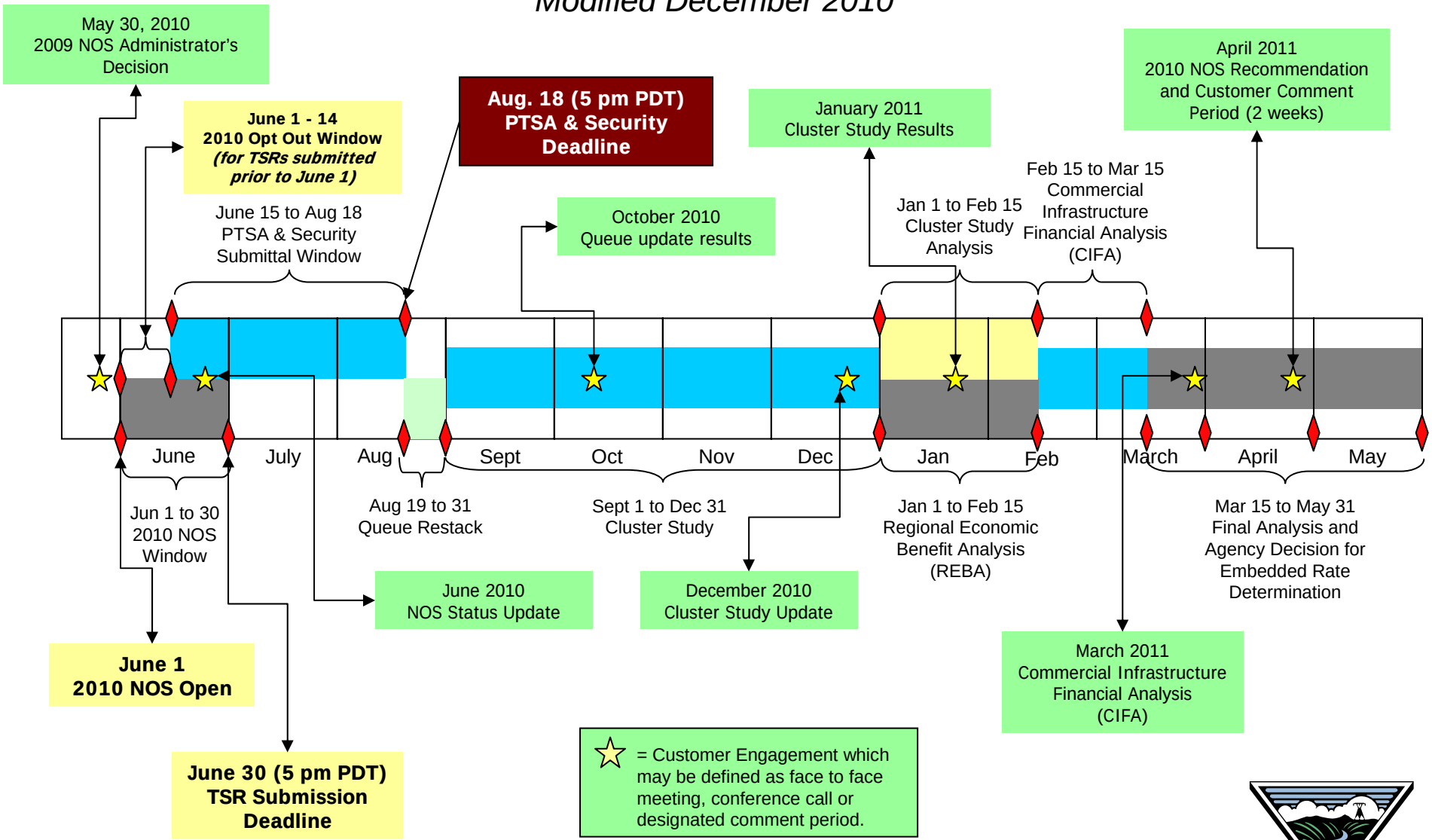
2010 NOS Project Estimated Cost & Schedule
Estimated Direct Costs Only (no overheads)

Project[4]	**Estimated Direct Cost ($K)[1] / Confidence Level**	**Energization Date[2]**
CUP (West)	$115,464/LOW	2015
GASH	$943,477/LOW	2018
NI (East): North-South	$1,625/LOW	2015
NI (East): South-North	$500/LOW	2013
NI (West): North-South	$25,156/LOW	2014
NI (West): South-North	$500/LOW	2013
Total[3]	$1,085,222	

Note 1. Estimated costs in FY10 dollars.
Note 2. Energization dates assume embedded cost rate determination is made in May 2011.
Note 3. Total estimated direct cost excludes cost for Eastside Scheduling included in multiple projects.
Note 4. The proposed projects do not defer or otherwise change any planned reliability projects

Next Steps

- ✓ Cluster Study results provided to BPA Marketing on December 29, 2010
  - ✓ Detailed PTSA grouping and project requirements
  - ✓ Plan of Service
  - ✓ Cost estimates
- ✓ Customer meeting to share results – scheduled for January 27, 2011
- Begin Regional Economic Benefits Analysis – January 2011
- Begin Commercial Infrastructure Financial Analysis – January 2011
- Complete Cluster Study Report – February 2011

2010 Network Open Season Roadmap & Timeline

Modified December 2010