From:	Brian Fadie
To:	UTC DL Records Center
Subject:	Comments on Docket UE-160918
Date:	Thursday, February 22, 2018 9:21:49 AM
Attachments:	PSE IRP Comments - MEIC - Brian Fadie.docx Energy Strategies - Montana Wind Competitiveness - 2016.pdf

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Please see the attached comments for Docket UE-160918 (Puget Sound Energy 2017 Integrated Resource Plan).

Thank you,

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February 21, 2018

Comments of Brian Fadie
Clean Energy Program Director
Montana Environmental Information Center

RE: Docket UE-160918. Puget Sound Energy 2017 Integrated Resource Plan.

Commissioners,

Thank you for the opportunity to comment on the Puget Sound Energy 2017 Integrated Resource Plan. After reviewing the IRP, the following comments are submitted for your consideration.

A winter peaking utility like PSE should fully and transparently evaluate Montana's winter peaking wind resource for potential value.

Puget Sound Energy is a winter peaking utility.[1] Customers of PSE can benefit from access to low cost, high capacity factor winter wind, which is precisely the type of wind Montana has in abundance. However, the IRP may not have fully considered this winter peaking characteristic of Montana wind.

In the IRP, page 6-22 as well as Figure D-25 on page D-50 straightforwardly states that Montana wind was assumed to have a capacity factor of 46 percent. But it is unclear what capacity factors were assumed for Montana wind during peak demand hours in order to generate the "peak capacity credit" found in Figure N-28. Page N-55 references DNV GL developing the wind distributions, however no numbers are given making review difficult. It is also unclear whether peak capacity credit was used to calculate the "capacity benefit" for wind projects as found in Figures 2-5, 6-24, 6-47, 6-48, and 6-49. While these terms sound similar, capacity benefit is not defined, creating uncertainty about whether it is the same as capacity value, peak capacity credit, both, or neither. In future IRPs, PSE should strive for consistency and clarity concerning terminology used in the plan.

Furthermore, due to these uncertainties it is difficult to determine whether the IRP accounted for the high winter peaking potential of Montana wind. In 2016 the consultant firm Energy Strategies LLC conducted an analysis of five Montana wind sites that found remarkably high capacity factors during winter peak hours.[2] For the month of January, the report found Montana wind sites to have an average capacity factor of 64 percent, well above the 46 percent assumed for the rest of the year.[3] Additionally, the report found that during morning and evening winter peak hours,

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[1] See IRP pages 2-8, 2-17, 3-8, 5-5, 6-5, and 6-7.
[2] "Assessment Of The Cost Competitiveness of Montana Wind Energy." Energy Strategies, 2016. Included as attachment to the electronic submission of these comments.
[3] Page 9, Id.

the highest demand hours of the day, some Montana wind sites reached as high as 70 percent.[4] The study concluded, "MT wind may be more valuable to PSE than [levelized cost of energy] alone suggests given that MT wind's profile aligns well with PSE's peak season (winter)."[5]

Montana's strong winter wind resource is well suited to help meet PSE's winter peak demand and in future IRPs PSE should strive to fully and transparently evaluate this potential and its value.

The benefits created by the geographic diversity of Montana wind should be evaluated.

Geographic diversity among wind facilities can help smooth out variability of their total output, decreasing the probability of exceptionally low or high output situations and reducing the need for integration services.[6] For example, in its 2017 IRP Avista Corp acknowledged that Montana wind could compliment its existing wind facilities well, noting, "Adding Montana wind will be less costly to integrate due to its different generation profile as compared to Palouse Wind, and it may add up to a 7.5 percent capacity contribution when combined with Palouse Wind's expected output on to meet the single-hour winter peak. For summer, the plan assumes the combined resources would add 3 percent of its capability."[7]

Given PSE currently lacks any Montana-based wind facilities, their addition would certainly create geographic diversity within the utility's renewable energy portfolio and potentially result in benefits. However, the IRP does not mention consideration of these benefits. Future PSE IRPs should explore these potential benefits and the scenarios in which they could be unlocked.

PSE should strive to accurately model the costs and benefits of Montana wind and energy storage projects, including transmission costs.

As multiple other commenters on the IRP have noted, there are concerns that the costs and benefits of Montana wind and energy storage projects were not accurately modeled.[8] Specifically, wind energy capital costs, operations and maintenance costs, and transmission cost assumptions appear to have been overstated. This unfortunately leads the IRP to draw questionable conclusions and make multiple statements that Montana wind is not cost effective, like one found on page 6-32, "Based on current assumptions, Montana wind is not expected to be cost effective

[4] Page 9, Id.
[5] Page 28, Id.
[6] "Wind Power Capacity Value Metrics and Variability: A Study in New England" Letson, Frederick.
[7] Page 9-6, Avista Corp 2017 Electric Integrated Resource Plan.
[8] See comments of Orion Renewable Energy Group, Absaroka Energy, and Synapse Energy Economics.

because of transmission cost."[9] The Commission and PSE customers should be aware that this conclusion is disputed.

It is expected that PSE will issue a Request for Proposals (RFP) later this year to explore the acquisition of a new resource. In order to ensure ratepayers are truly getting the best value resource, the Commission should give further guidance to PSE to fairly and transparently consider all resources not only in future IRPs but also in the upcoming RFP.

[9] Also see IRP pages 2-8, 2-20, 4-41, 6-31, and 6-76 for statements that Montana wind is not cost effective.

Assessment Of The Cost Competitiveness of Montana Wind Energy

A Webinar From

Renewable Northwest

Conducted By

Energy Strategies LLC

September 14, 2016

Revised From July 27, 2016

Project Purpose

To develop an independent assessment of the relative costs to produce and deliver wind energy generated in Montana, Oregon, and Washington to Puget Sound Energy's system

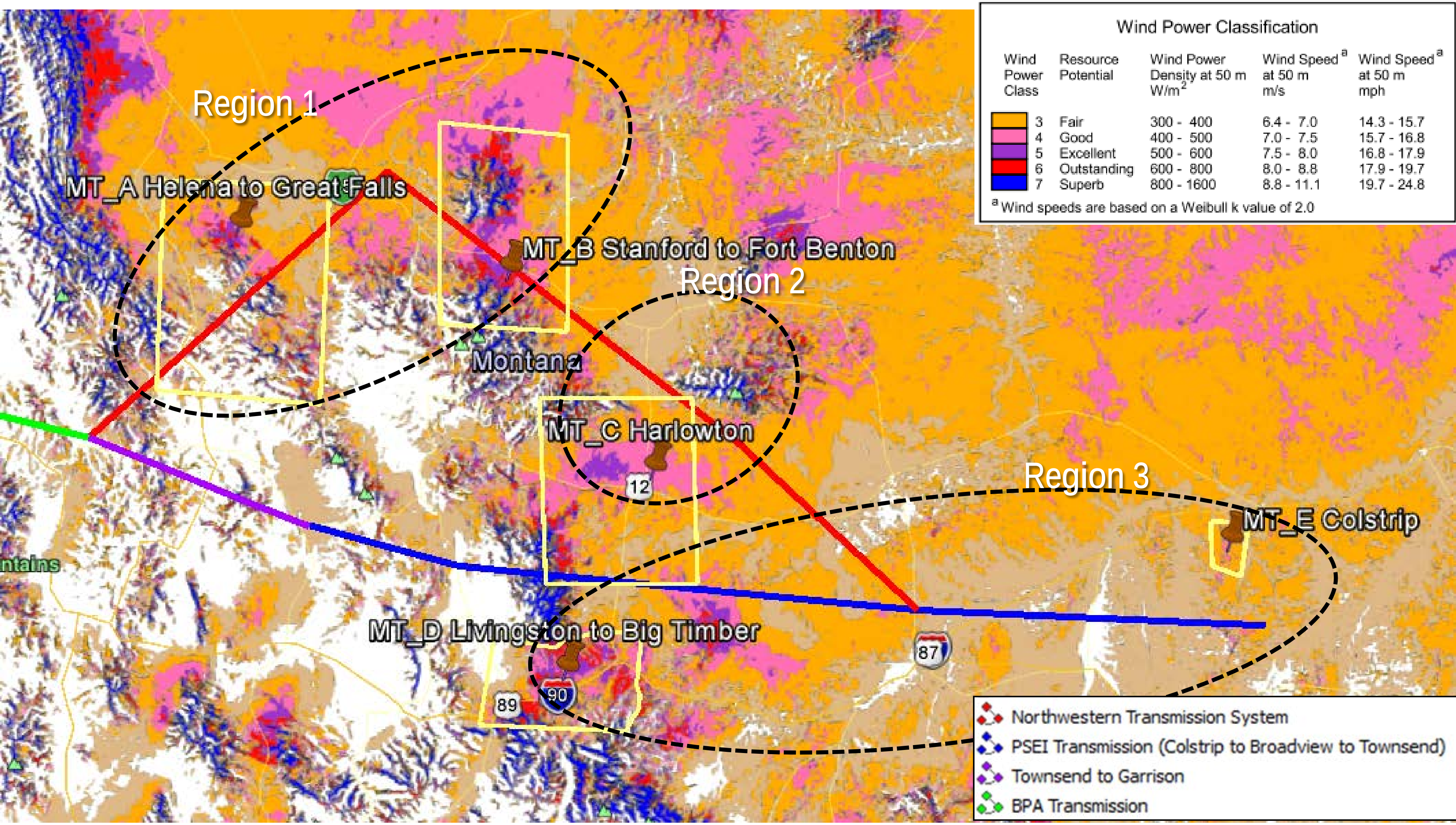
Site Selection

Selected Wind Locations in Each State

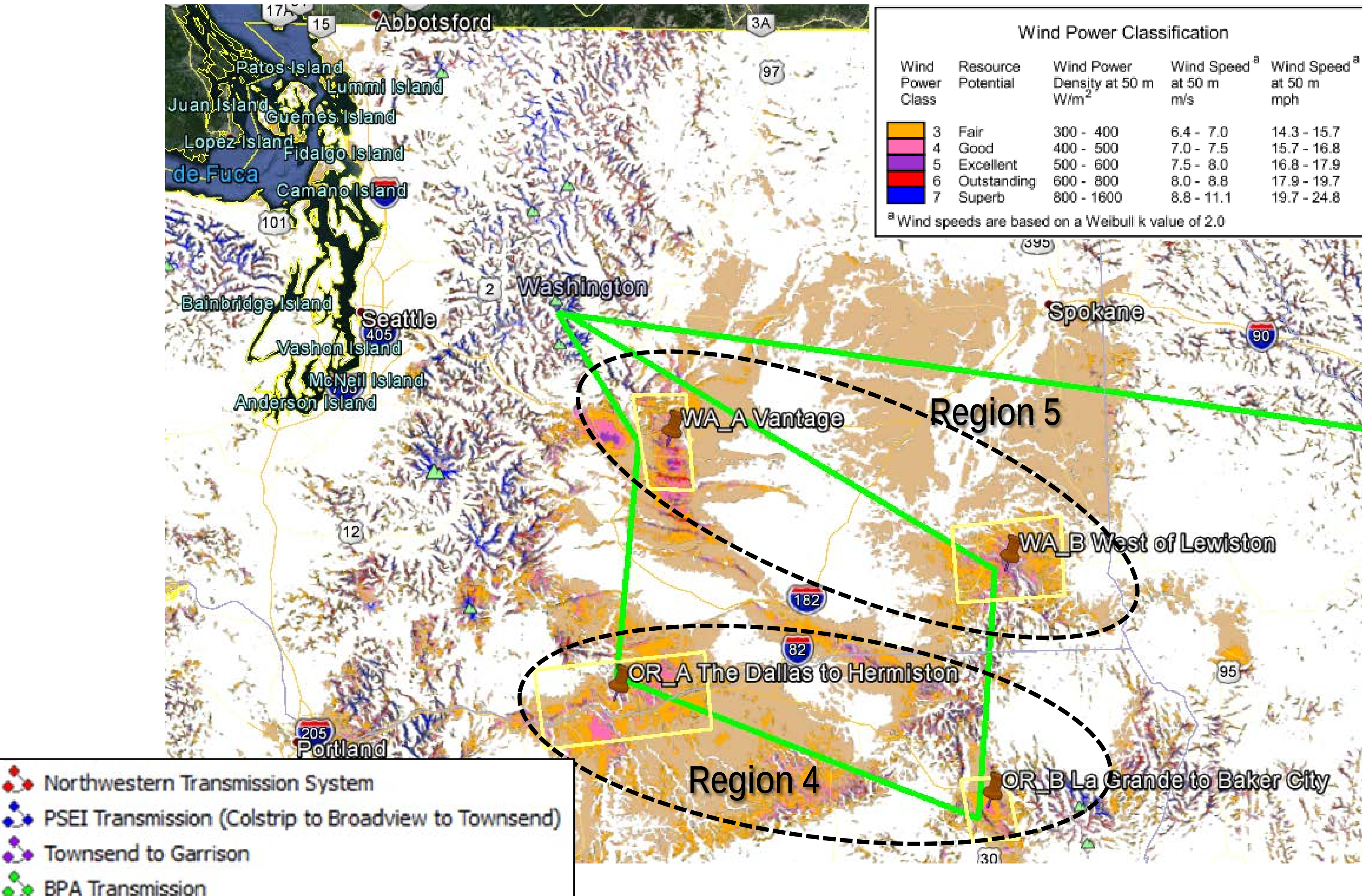
Montana	Oregon	Washington
Region 1	Region 4	Region 5
MT "A" Helena - Great Falls MT "B" Stanford - Fort Benton	OR "A" Dalles - Hermiston OR "B" LaGrande - Baker	WA "A" Vantage WA "B" West of Lewiston
Region 2		
MT "C" Harlowton		
Region 3		
MT "D" Livingston – Big Timber MT "E" Near Colstrip		

For purposes of transmission cost estimation, locations with relatively close proximity were grouped into these five transmission "regions"

Montana Wind Resource & Site Locations



Washington and Oregon
Wind Resource & Site Locations



Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m^2	Wind Speed[a] at 50 m m/s	Wind Speed[a] at 50 m mph
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

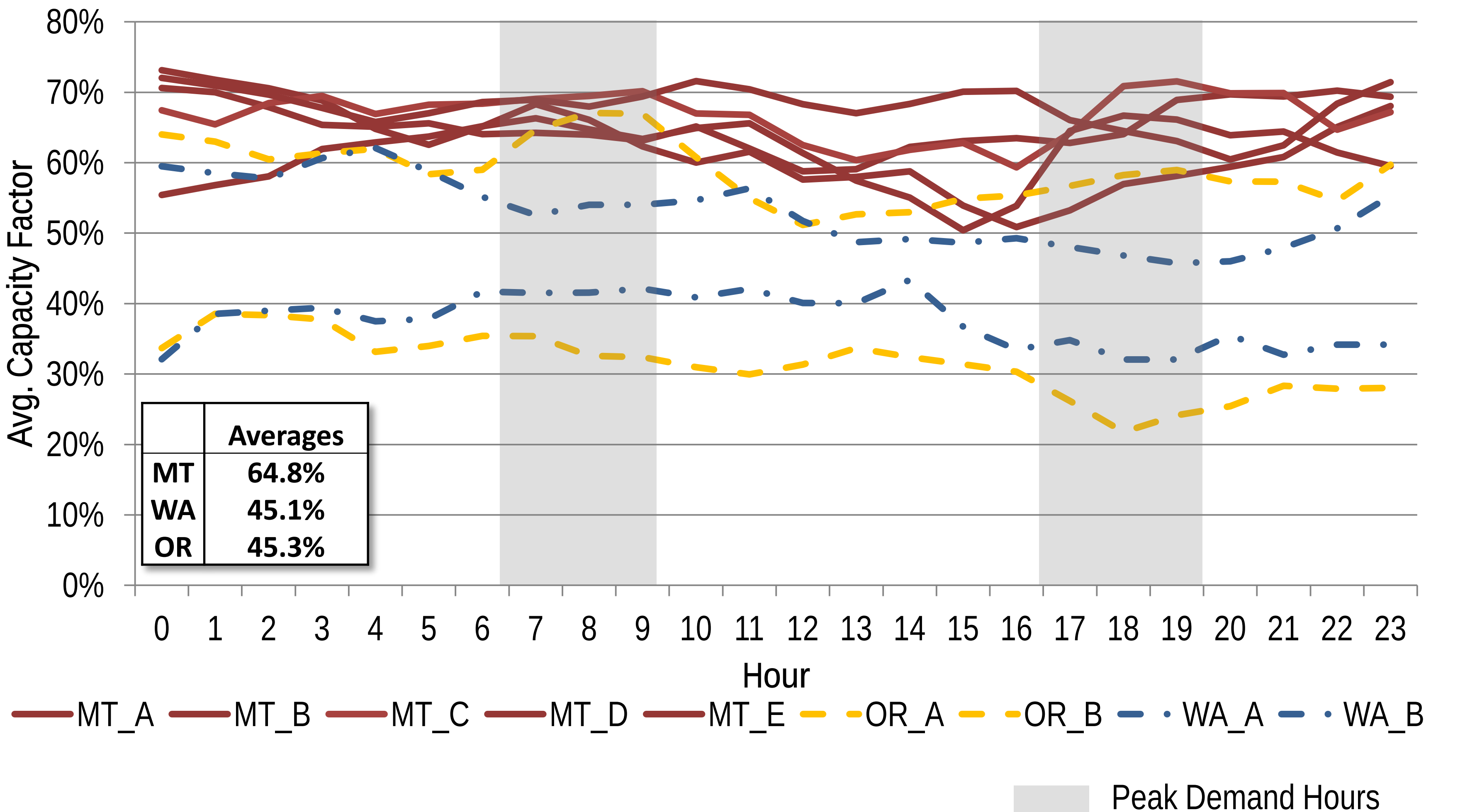
[a] Wind speeds are based on a Weibull k value of 2.0

Wind Location Hourly Profiles

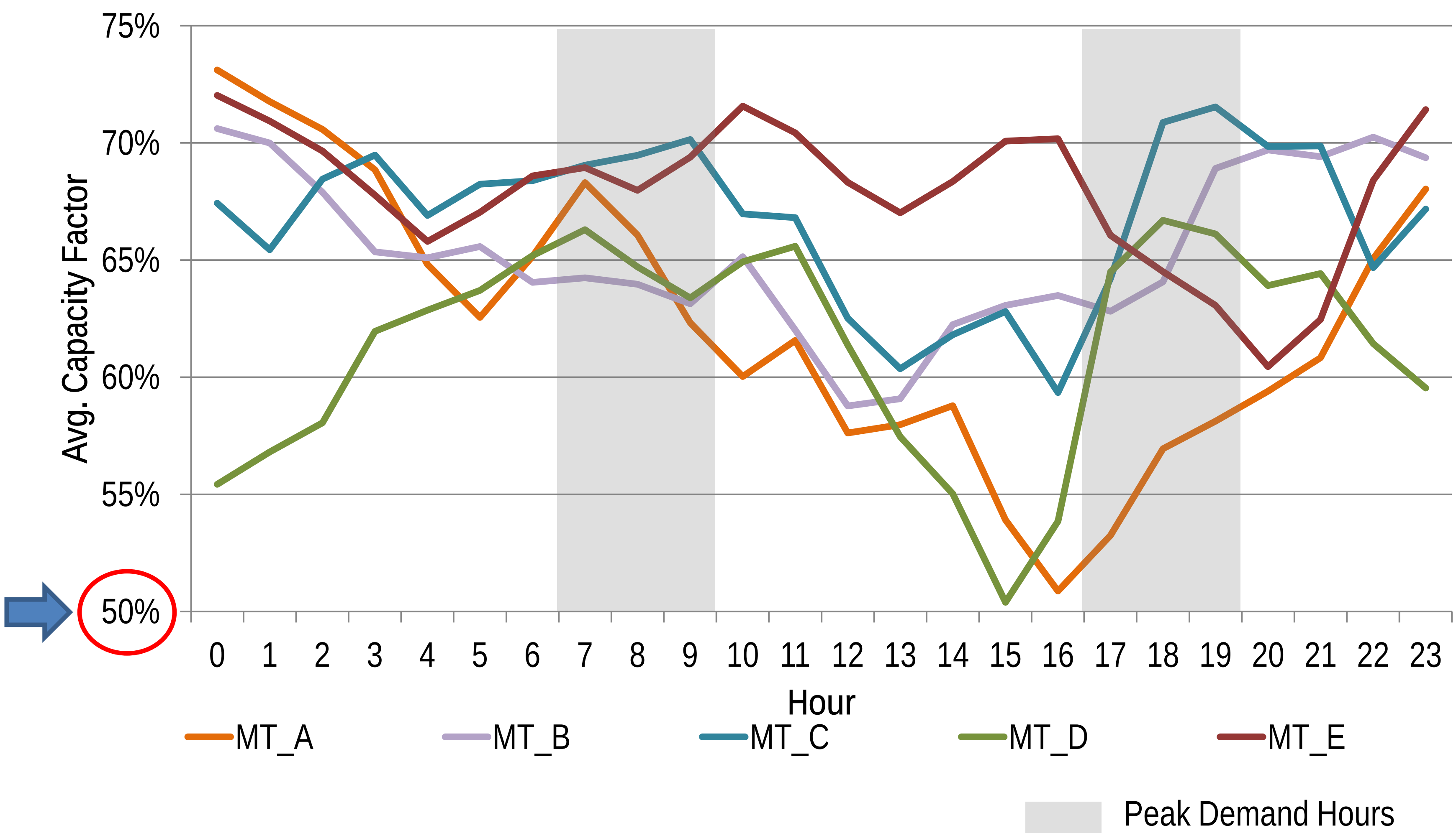
Average Capacity Factors by Transmission Region; Jan & July 2012

	Region	Average	January	July
MT	1	45.0%	63.8%	23.5%
	2	39.9%	66.7%	16.3%
	3	40.0%	49.7%	22.5%
	Average	42.0%	64.8%	21.7%
OR	4	38.8%	45.1%	39.3%
WA	5	35.7%	45.3%	30.2%

January 2012
Average Hourly Capacity Factors

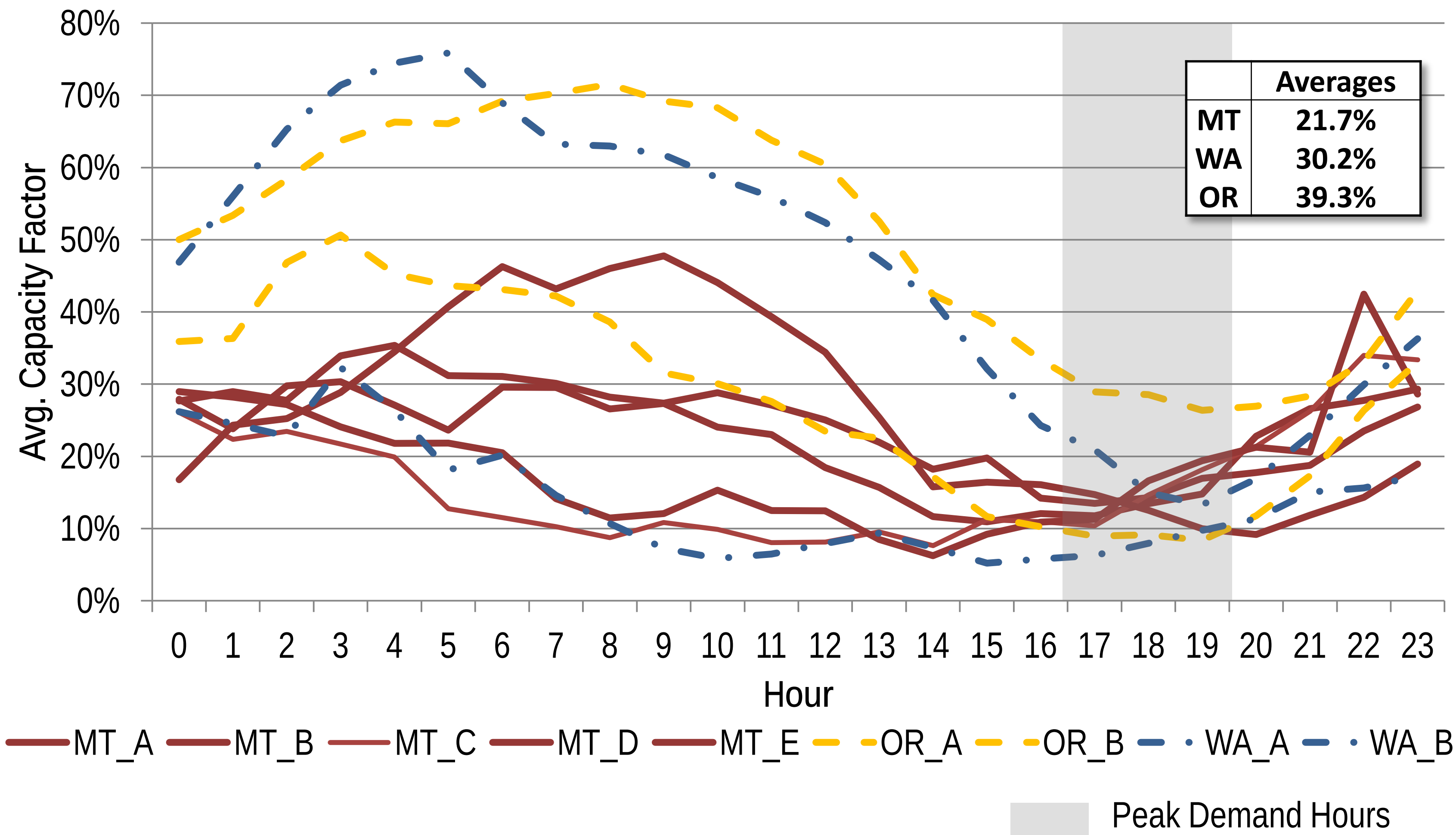


January 2012 Montana
Average Hourly Capacity Factors



Energy Strategies LLC

July 2012
Average Hourly Capacity Factors



Observations

- PSE is a winter-peaking electric utility whose peak load matches well with Montana wind sites' production profiles
- The NREL visualization tool, and the underlying data, indicate that across the three states, generally:
  - MT has substantially more wind resource than OR & WA
  - MT wind is higher quality on the basis of potential wind generation capacity factor
- For the average hourly 2012 Winter (January) & Summer (July) capacity factors for each wind site
  - Montana wind sites have consistently & substantially higher Winter capacity factors than the four OR & WA sites
  - One OR & one WA site have higher Summer capacity factors than the highest capacity factor Montana site

Estimated Delivery Costs

Estimated Delivery Cost

- Refers to transmission-related fees charged by each Transmission Provider (TP) across whose system the identified wind resource would pass in route to PSE
- Delivery costs were applied based on current rates in each TP's FERC-approved Open Access Transmission Tariff (OATT), and in dialog with the TPs and experienced Montana wind developers
- Transmission losses were assumed to be self-supplied
- The study did not include estimated interconnection costs
- The study assumes BPA will provide all necessary operating reserves and wind balancing services

Open Access Transmission Tariff Rates

	NorthWestern		Bonneville Power Administration					
			Point to Point		Montana Intertie Townsend to Garrison		PSE Colstrip Line Colstrip to Townsend	
Service	Fixed Cost ($/KW-yr)	Variable Cost ($/MWh)	Fixed Cost ($/KW-yr)	Variable Cost ($/MWh)	Fixed Cost ($/KW-yr)	Variable Cost ($/MWh)	Fixed Cost ($/KW-yr)	Variable Cost ($/MWh)
Yearly firm point-to-point	$37.92		$17.87		$7.18		$31.83	
Scheduling, system control & dispatch	$2.00		$3.61		$3.61			
Reactive supply & voltage control								
Regulation & frequency response								
Energy imbalance service		Various		Various				
Operating reserves: Spinning*				$0.34				
Operating reserves: Supplemental*				$0.31				
Wind balancing schedules								
Regulating Reserves			$0.96					
Following Reserves			$3.84					
Imbalance reserves			$3.96					
Opt out fee			$0.24					
Totals	**$39.92**	**$0.00**	**$30.48**	**$0.66**	**$10.79**		**$31.83**	
Transmission losses	**4%**		**1.9%**		**5%**		**2.7%**	

* Applied according to BPA's published Billing Factors for Operating Reserves

Transmission Costs by Site & Region Applied in Cost Modeling

Study Region		Project ID	Transmission Losses Applied	Total	
				Fixed Cost ($/KW-yr)	Variable Cost ($/MWh)
1		MT – A	5.9%	$70.40	$0.66
		MT – B	5.9%	$70.40	$0.66
2		MT – C	4.6%	$73.10	$0.66
3		MT – D	4.6%	$73.10	$0.66
		MT – E	4.6%	$73.10	$0.66
4/5		WA – A	1.9%	$30.48	$0.66
		WA – B	1.9%	$30.48	$0.66
		OR – A	1.9%	$30.48	$0.66
		OR – B	1.9%	$30.48	$0.66
No MT Intertie Costs	2	MT –C	4.6%	$62.31	$0.66
	3	MT– D	4.6%	$62.31	$0.66
		MT– E	4.6%	$62.31	$0.66

Rate application is based on the following assumptions:

Montana regions 2 & 3 and 4 & 5 have the same transmission costs. Projects in MT regions 2 & 3 build generator interconnection lines to the Colstrip Line. Projects will use PSE's Colstrip Line ownership, thereby incurring the PSE Colstrip Line loss of 2.7%, not the MT Intertie loss of 5%. Projects will pay fixed transmission costs for both PSE's Colstrip Line and BPA 's Montana Intertie.

Levelized Cost of Energy (LCOE) Comparisons

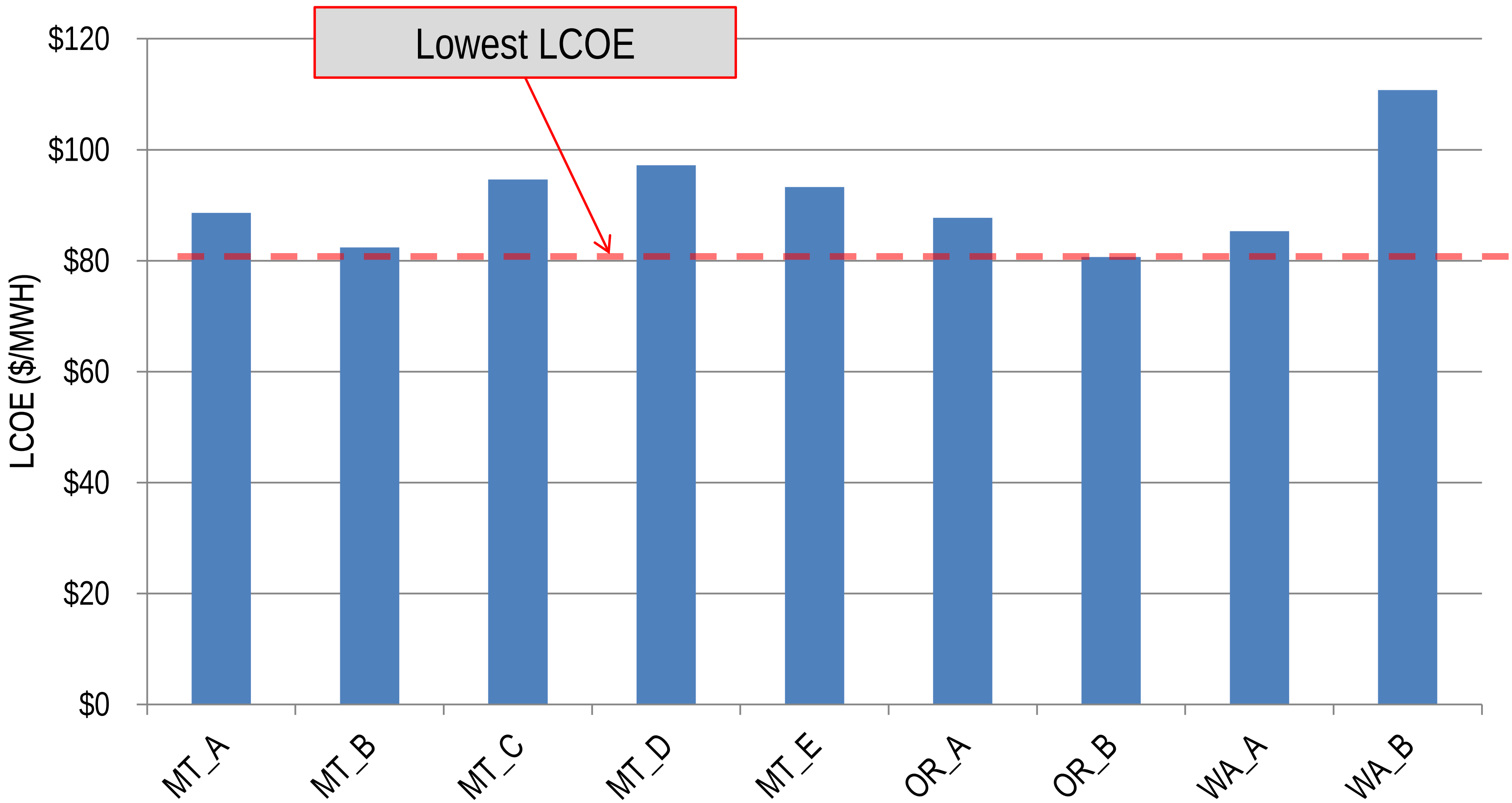
LCOE: Tools & Assumptions

- LCOE for each site was calculated using the WECC TEPPC cost calculator
  - Modified for losses, fixed and variable costs over a 20-year term
- Assumed a 265 MW project at each site*
- Assumed wind projects at each site reach COD in 2020
- Projects do not receive production tax credit (PTC)
- Capital costs for all projects was set at $1,703/kW*
- Projects in WA included additional $123/kW sales tax*
- Generation interconnection costs were not modeled
- LCOE run for independent power producer (IPP) financing scenarios

**Aligns with the value used by PSE in their 2015 IRP*

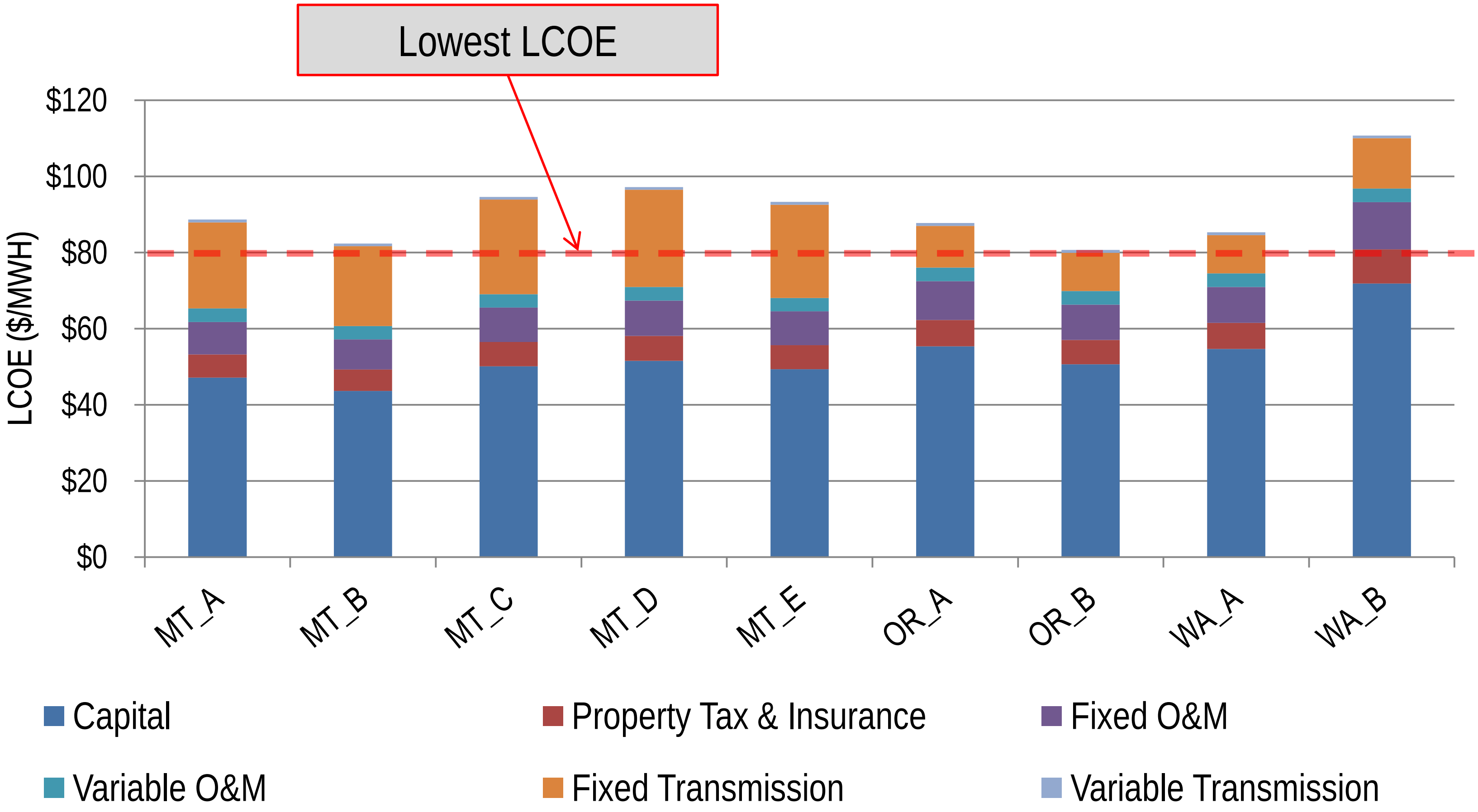
LCOE Comparison by Wind Site

IPP Financing



LCOE by Cost Component

IPP Financing



LCOE($/MWh) by Capacity Factor and Transmission Region

Values in red represent the approximate LCOE based on average capacity factor for that transmission region

IPP Financing

State	Region	Avg. Cap. Factor	25%	30%	35%	40%	45%	50%
MT	1	45.0%	$148	$124	$107	$94	$84	$76
	2	39.9%	$148	$124	$107	$94	$84	$76
	3	40.0%	$148	$124	$107	$94	$84	$76
OR	4	38.8%	$127	$106	$92	$81	$72	$66
WA	5	35.7%	$133	$112	$96	$85	$76	$69

Similar LCOE's across transmission regions result depending on higher or lower relative capacity factors

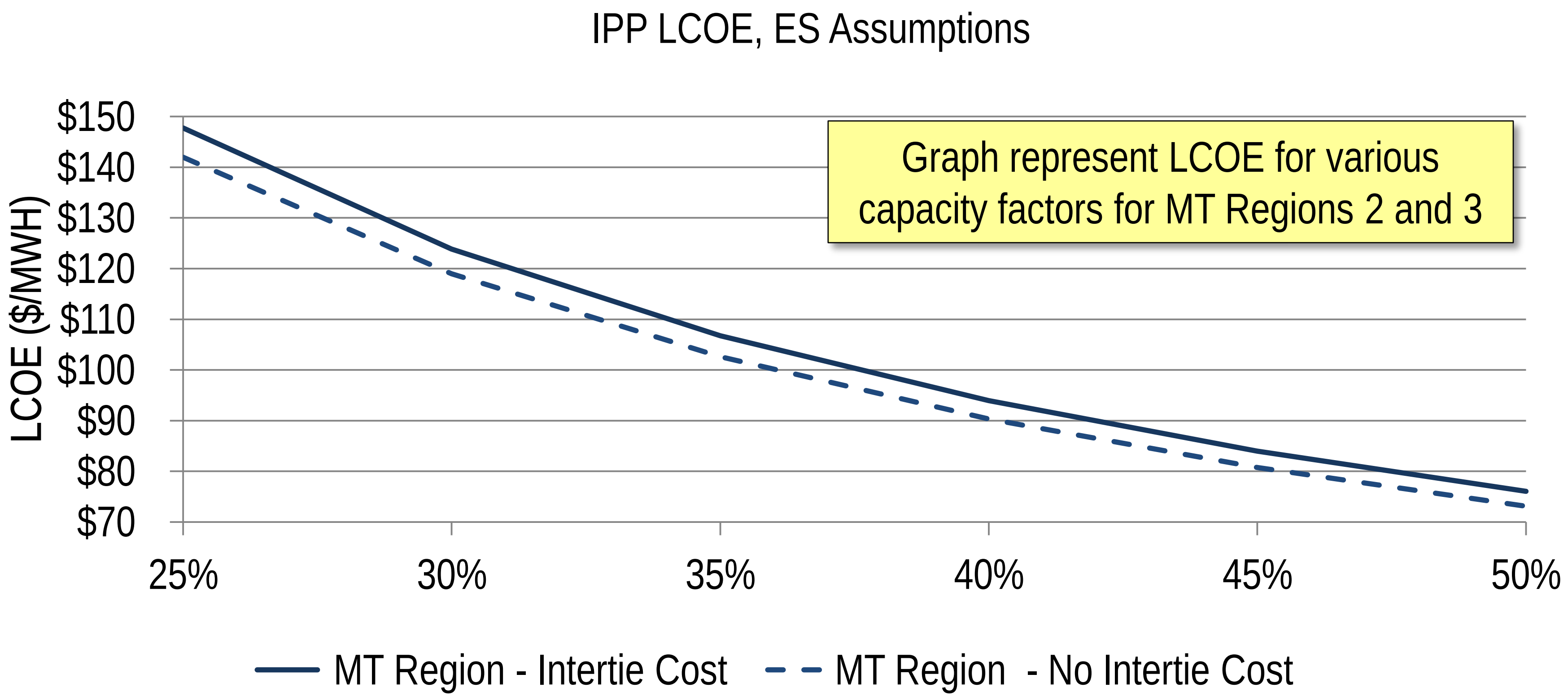
LCOE ($/MWh) After Removal of Montana Intertie Rate Component (MT Regions 2 and 3)

Values in red represent the approximate LCOE based on average capacity factor for that transmission region

State	Region	25%	30%	35%	40%	45%	50%
MT	1	$148	$124	$107	$94	$84	$76
	2 – w/Intertie Cost	$148	$124	$107	$94	$84	$76
	2 - no Intertie Cost	$142	$119	$103	$90	$81	$73
	3 – w/Intertie Cost	$148	$124	$107	$94	$84	$76
	3 - no Intertie Cost	$142	$119	$103	$90	$81	$73
OR	OR Region 4	$127	$106	$92	$81	$72	$66
WA	WA Region 5	$133	$112	$96	$85	$76	$69

Removing BPA Intertie costs from those MT sites that would use the Intertie system (Colstrip to Garrison) decreases those projects' LCOE by ~4%

MT Transmission Regions, with and w/out Montana Intertie costs



Removing the BPA intertie charge increases MT wind's competitiveness with OR and WA wind resources

Potential Transmission Constraints

Coal PPA Expirations & Coal Unit Retirements in Montana

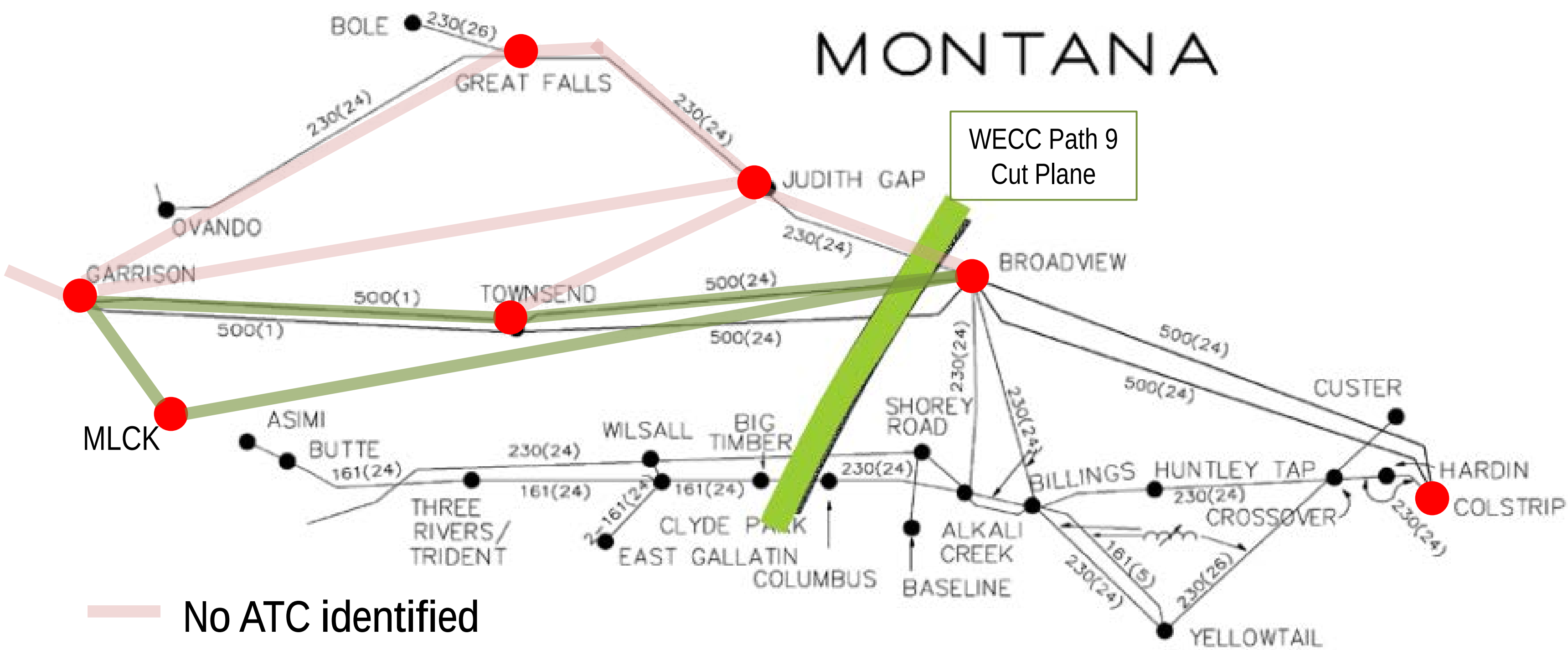
Two events will impact transmission availability between Colstrip and PSE:

- Retirement or turndown of one or more coal units using the transmission contract paths from Montana to PSE
- Expansion of transmission facilities (none planned as of today)

These coal retirements or contract expirations may result in increased Available Transfer Capability (ATC) from Montana to PSE

Power Plant Name	Operating Capacity-MW	PPA Entity/Owner	End of PPA / Unit Shutdown
Colstrip Energy LP	40.5	NorthWestern	2024
Colstrip Unit 1	358	PSE/Talen	2022
Colstrip Unit 2	358	PSE/Talen	2022

Transmission Paths: MT to PSE



No ATC identified

Available Transfer Capability; ATC (part of Colstrip Transmission)

Northwestern-BPA: 2016-2017

- POD BPAT - 158MW
- POD MLCK -176 MW

Broadview to Townsend

- PSE: 95-98 MW
- PGE: - 5 MW
- \- 312 MW available in 2022

Currently, contract paths between Colstrip & PSE's system are heavily subscribed. Little to no available long-term firm ATC west of the Garrison substation

Conclusions

Conclusions

1. Montana wind is more plentiful and generally of higher quality than Washington or Oregon wind
2. MT wind may be more valuable to PSE than LCOE alone suggests given that MT wind's profile aligns well with PSE's peak season (winter)
3. MT wind's summer peak capacity factor is comparable to that of OR and WA wind
4. The addition of MT wind to a portfolio of WA wind will provide resource diversity and security
5. MT wind is cost competitive with OR and WA wind even though the cost of transmitting MT wind to PSE's system erodes some of MT wind's LCOE advantage driven by higher capacity factor
6. Any reduction in MT wind transmission cost improves MT wind's cost competitiveness with WA and OR wind
7. With the planned closure of Colstrip 1 and 2, large quantities of ATC will become available from MT to PSE

Conclusions (p.2)

8. MT wind as a replacement for the Colstrip 1 and 2 will facilitate continued use of the “Colstrip line” which would benefit the transmission owners and their customers
9. Higher capacity factors in MT can overcome higher relative transmission costs.
10. High capacity factor sites, like MT’s, will be less impacted on an LCOE basis by the costs of generator interconnection
11. Similarly, self-supplied losses from a higher capacity factor wind site would be less costly than from a lower capacity factor site
12. MT wind appears to be a viable and economic alternative to additional WA and/or OR wind in PSE’s supply balance
13. When considering MT wind sites, PSE should seek locations that minimize transmission costs