

Preliminary Assumptions for On-Shore Wind Technologies (Revisited)

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GRAC

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At the last meeting...

- Discussed trends in technology, cost, development
- Discussed capacity factors
 - Sixth Power Plan vs. actual generation
- Introduced preliminary generic reference plant, capital cost, and O&M
- Introduced preliminary levelized cost

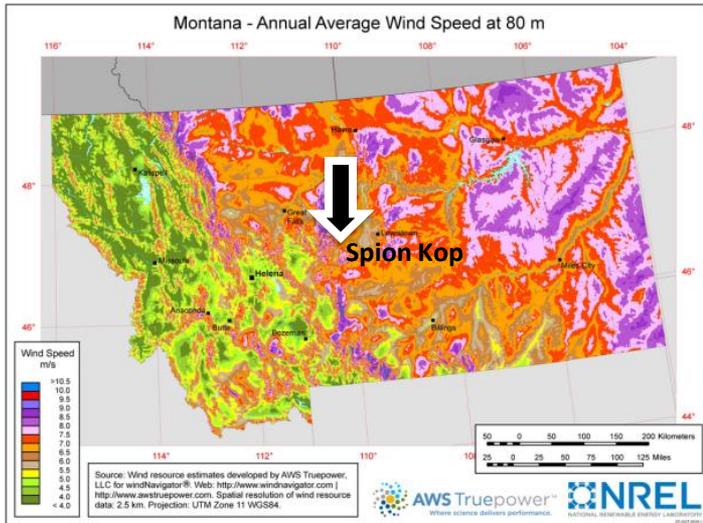
Today's Discussion

- Narrow down:
 - Capacity factors for regions in the PNW
 - Reference plant characteristics
- Discuss updated capital cost estimate
- Discuss updated levelized cost estimate
 - No PTC assumed
 - Transmission assumptions

Historical and Projected

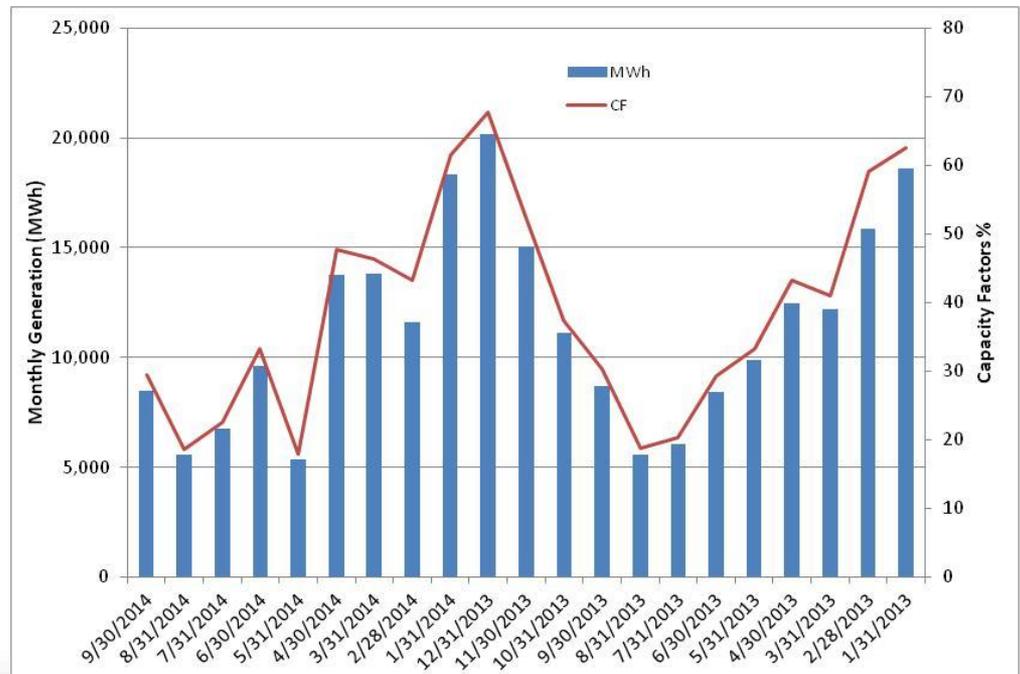
CAPACITY FACTORS

Spion Kop – Central MT



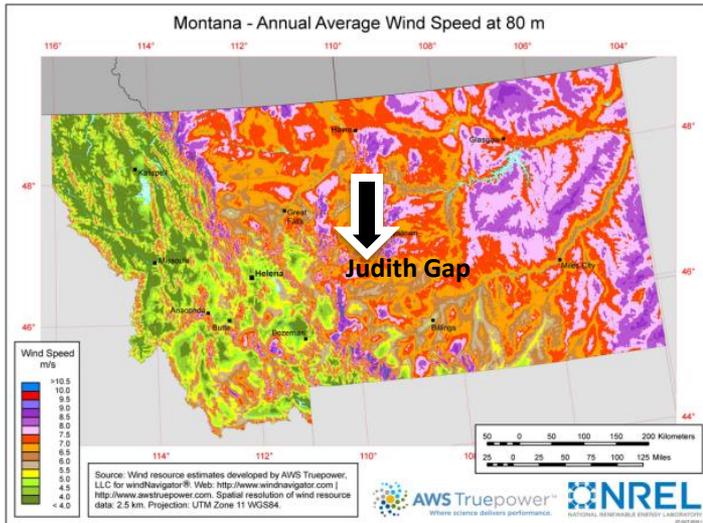
Duration	Capacity Factor
2013 Annual Average	41 %
Monthly Peak (Dec 2013)	68%
Monthly Min (May 2014)	18 %

Capacity	40 MW
Location	Judith Basin, MT
Technology	(25) 1.6MW, 82.5m GE WTG
Service Date	November 2012



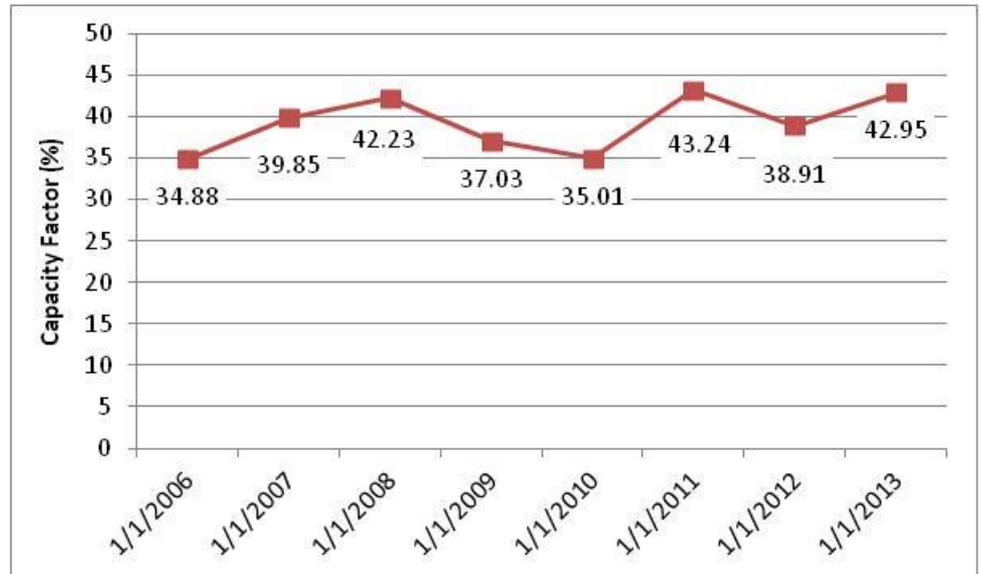
Data from SNL

Judith Gap – Central MT



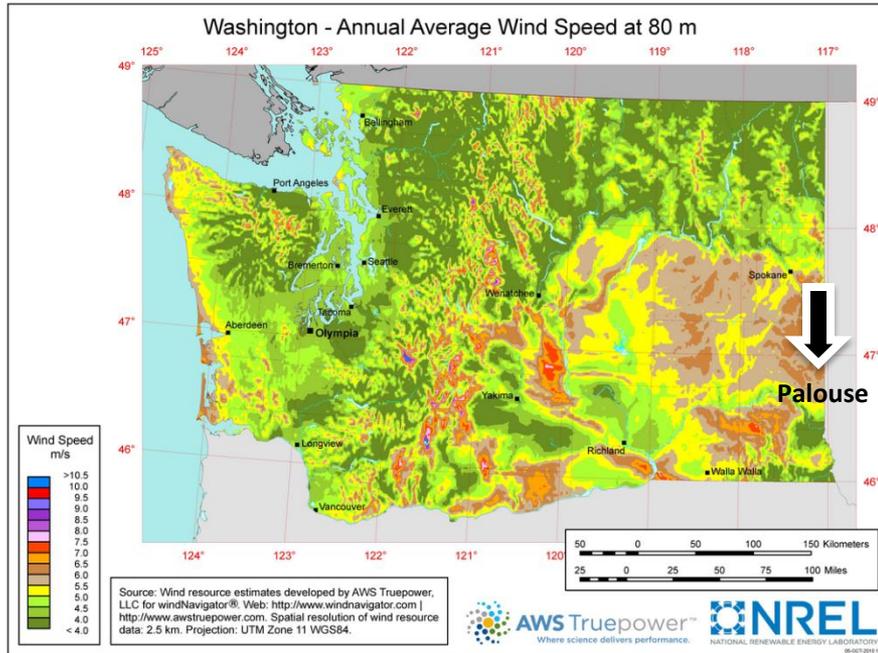
Capacity	135 MW
Location	Wheatland, MT
Technology	(90) 1.5MW, GE WTG
Service Date	December 2005

Duration	Capacity Factor
2013 Annual Average	43 %
Monthly Peak (Jan 2014)	73.6 %
Monthly Min (July 2009)	21 %



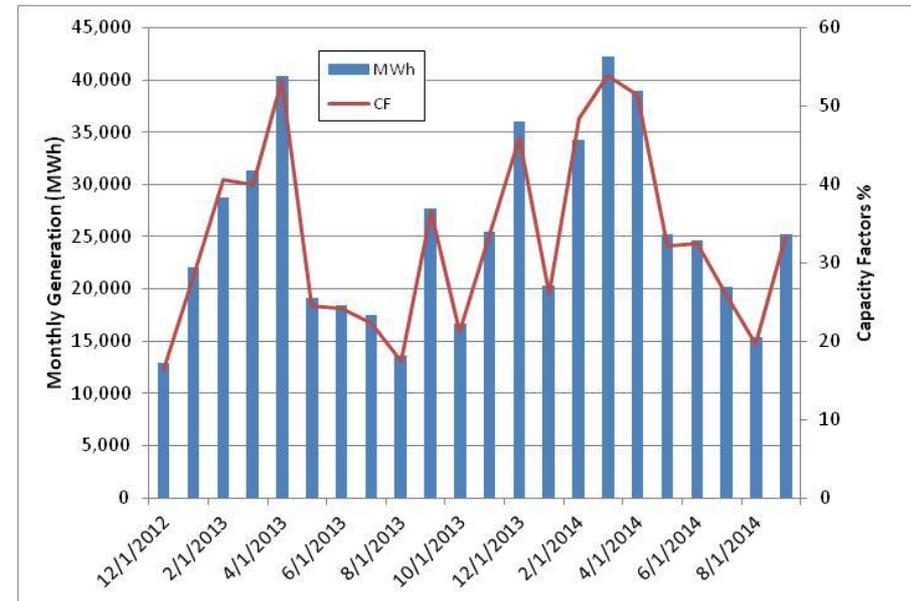
Data from SNL

Palouse – Eastern WA



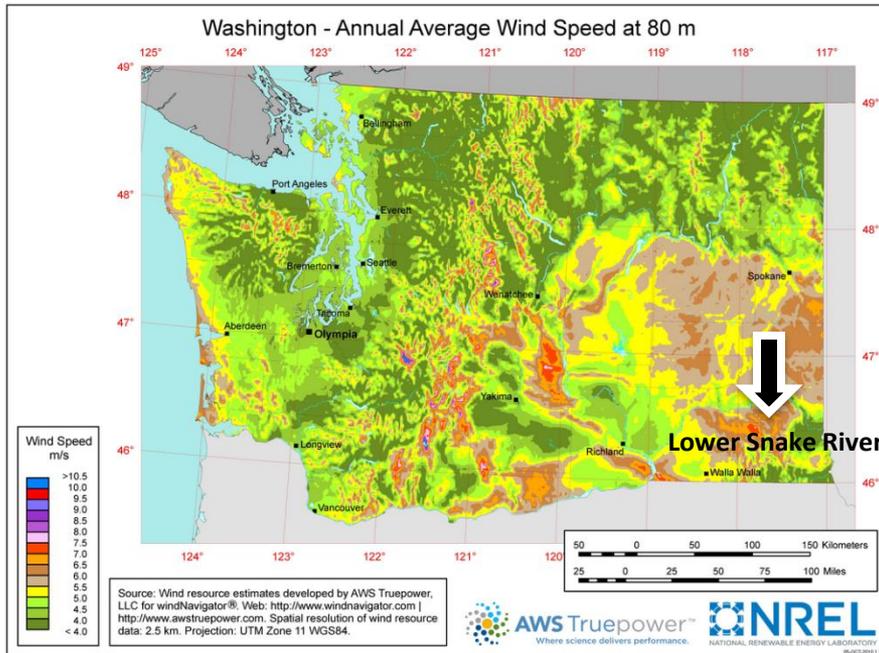
Duration	Capacity Factor
2013 Annual Average	32.3 %
Monthly Peak (April 2013)	53.3 %
Monthly Min (Aug 2014)	17.4 %

Capacity	104 MW
Location	Whitman, WA
Technology	(58) 1.8MW, Vestas V100 WTG
Service Date	December 2012



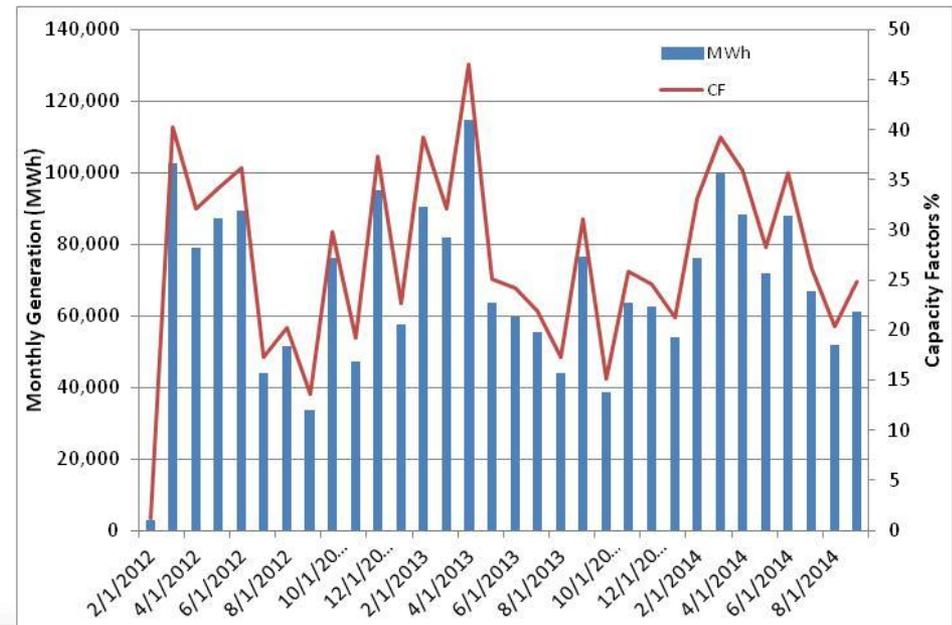
Data from SNL

Lower Snake River – E. WA



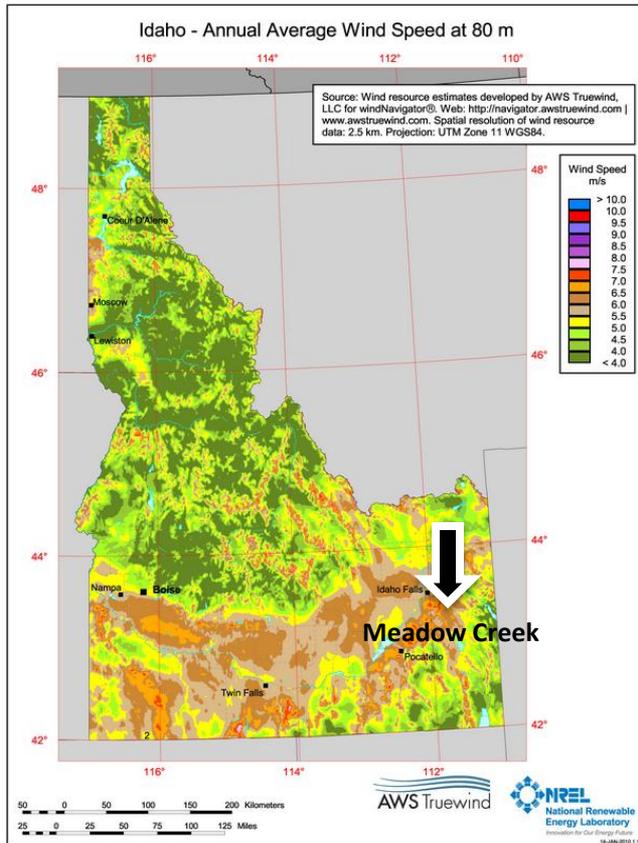
Duration	Capacity Factor
2013 Annual Average	27.2 %
Monthly Peak (April 2013)	46.6 %
Monthly Min (Oct 2014)	15.2 %

Capacity	343 MW
Location	Garfield, WA
Technology	(149) 2.3MW, Siemens 101 WTG
Service Date	March 2012



Data from SNL

Meadow Creek – Southern ID



Duration

Capacity Factor

2013 Annual Average

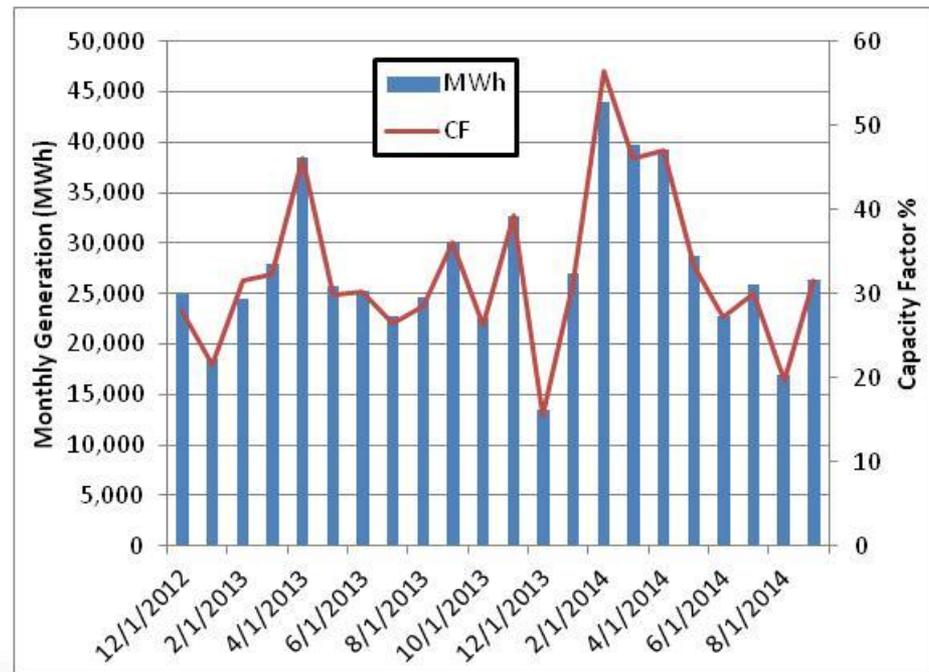
30.3 %

Monthly Peak (Feb 2014)

56.5 %

Monthly Min (Dec 2013)

15.6 %



Data from SNL

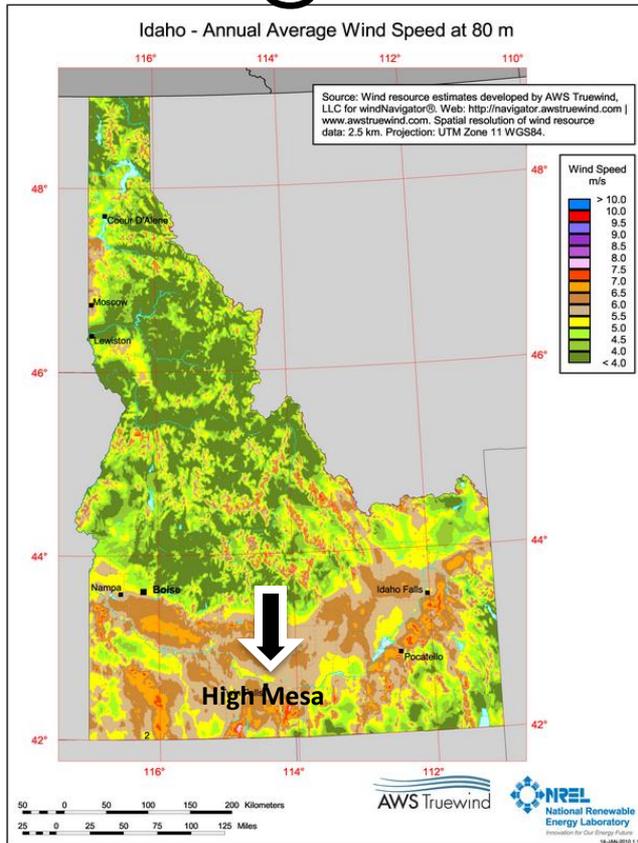
Capacity 116 MW

Location Bonneville Cty, ID

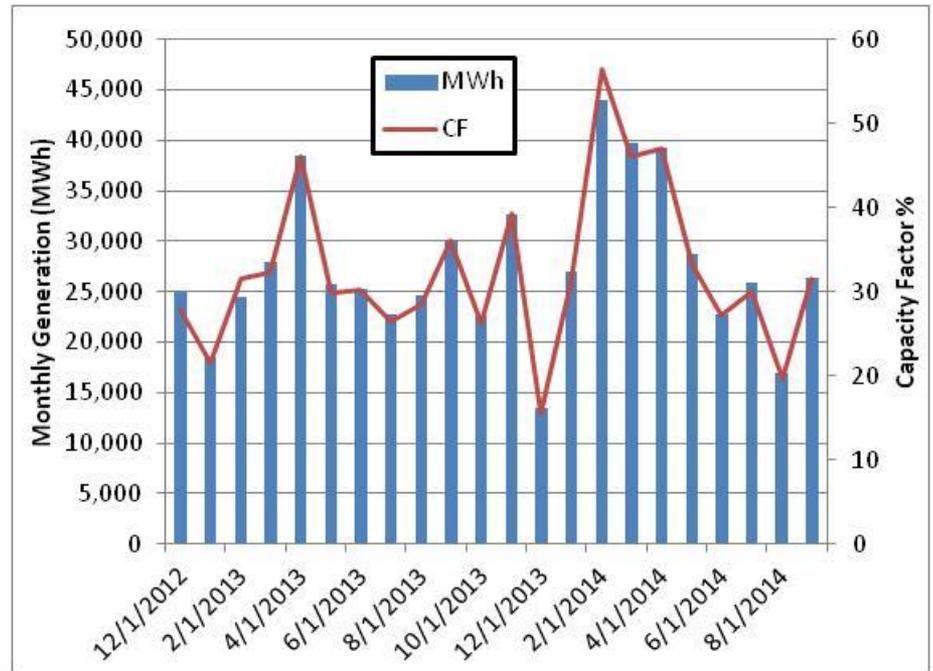
Technology (57) 2.1MW Suzlon S97 WTG

Service Date December 2012

High Mesa – Southern ID



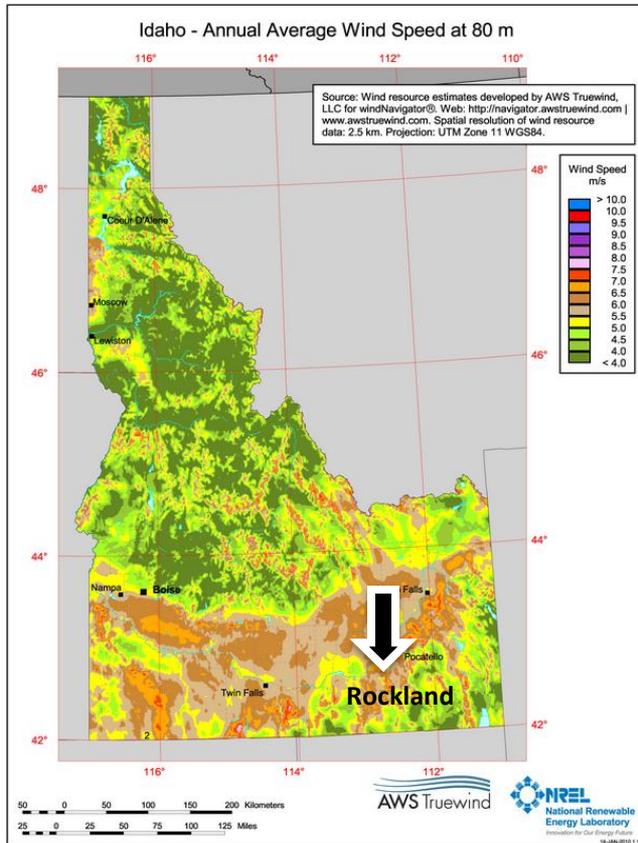
Duration	Capacity Factor
2013 Annual Average	25.6 %
Monthly Peak (Feb 2013)	37.7 %
Monthly Min (Aug 2013)	11.8 %



Data from SNL

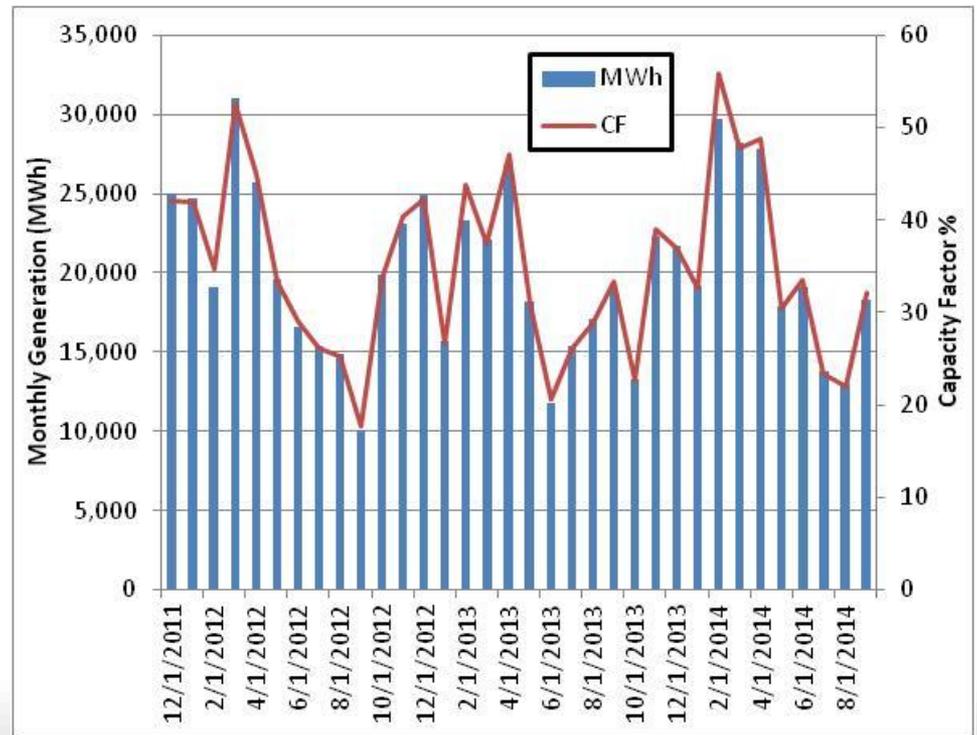
Capacity	40 MW
Location	Elmore, ID
Technology	(19) 2.1MW Suzlon S97 WTG
Service Date	December 2012

Rockland – Southern ID

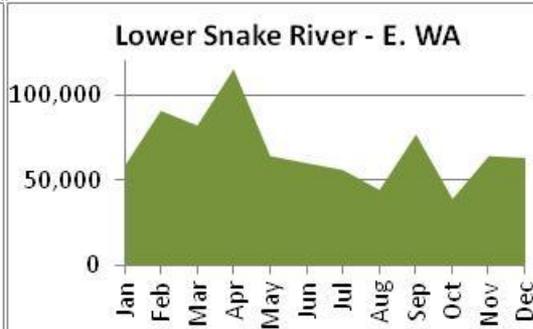
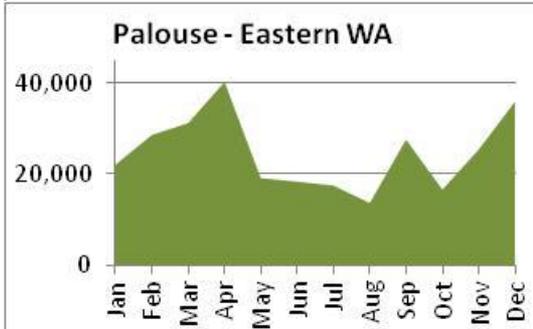
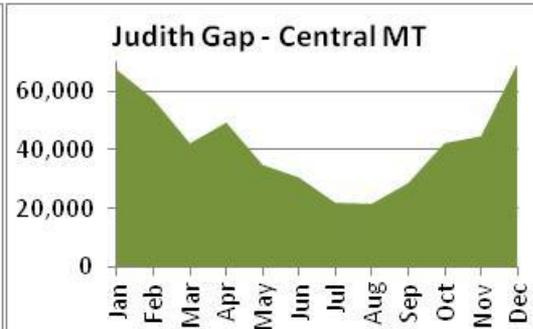


Capacity	80 MW
Location	Power Cty, ID
Technology	(44) 1.8MW V100 Vestas
Service Date	December 2011

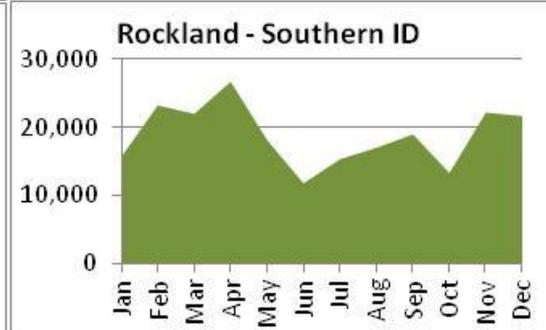
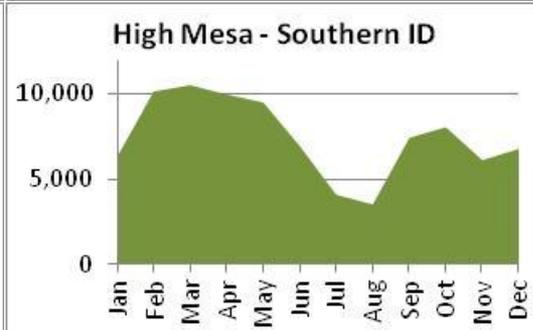
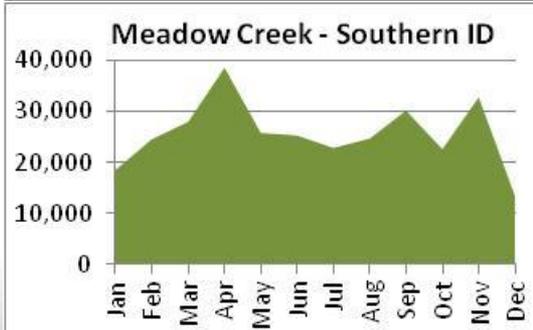
Duration	Capacity Factor
2013/2012 Annual Average	32.8 % / 35.2%
Monthly Peak (Feb 2014)	55.8 %
Monthly Min (Sep 2012)	17.7 %



Comparison of Regional 2013 Generation Shapes (MWh)



Central MT – Peak in Dec/Jan
 Southern ID and Columbia Basin
 – Peak in Mar/April, Sept/Oct
 Summer months – low in all areas



Capacity Factors

Sixth Power Plan

Wind Resource Area	Columbia Basin	S. Idaho	Central Montana
Avg annual capacity factor	32%	30%	38%

Proposed Draft Seventh Power Plan

Wind Resource Area	Columbia Basin	S. Idaho	Central Montana
Avg annual capacity factor	32%	32% ↑	40% ↑

Updated

REFERENCE PLANT

Preliminary Reference Plant

Year Dollars

2012 \$

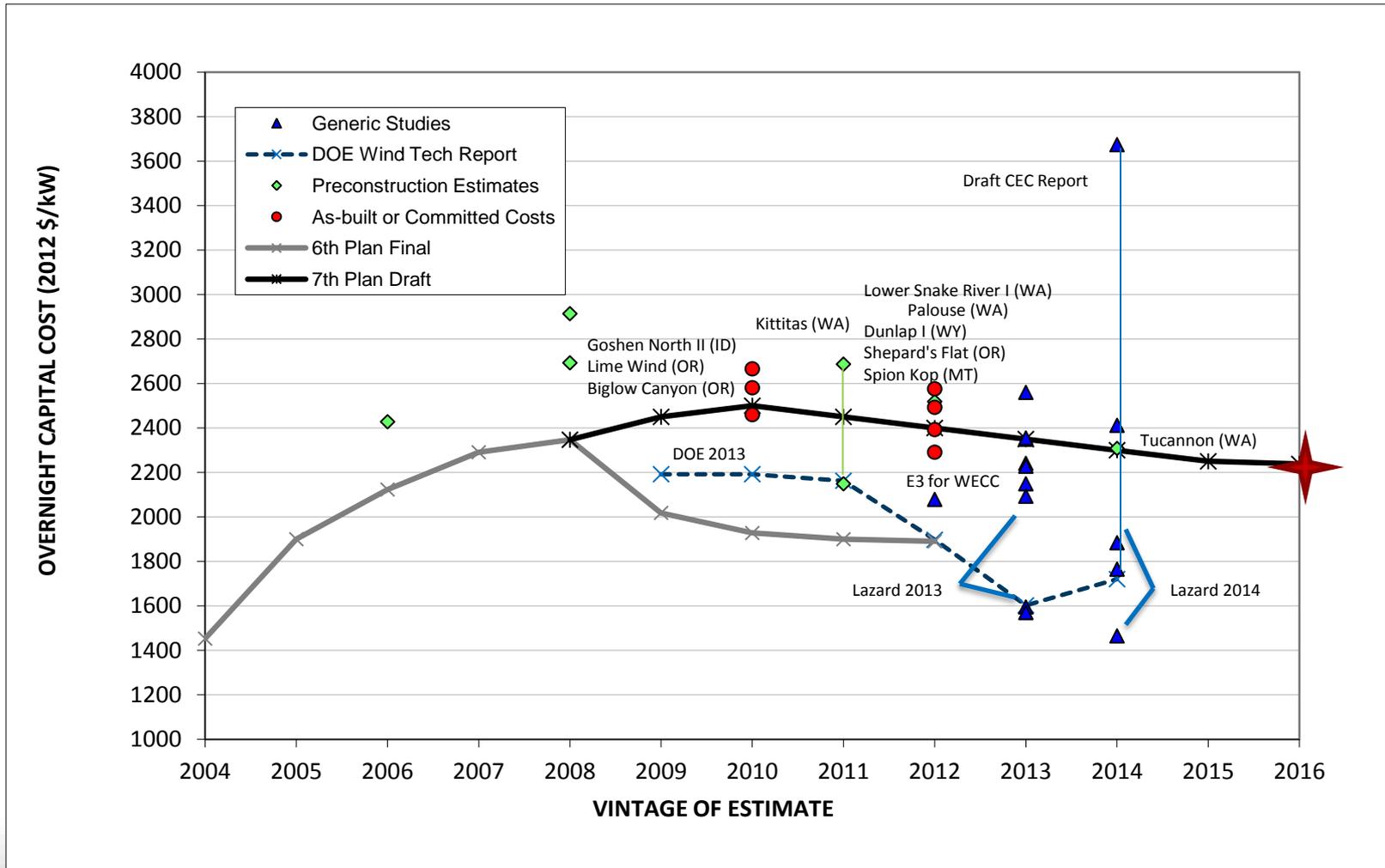
Technology & Configuration base	(40) 2.5MW Wind Turbine Generators
Output Total (MW)	100 lifecycle avg*
Capacity Factor	Based on location
Economic Life (Years)	25 years (↑ 20 years)
Construction Lead Time (Months)	24 planning & development 24 construction (↓ 30 months) 48 months total, ~4 years (↓ 4.5 yrs)

* Assuming 0% derate over lifetime of plant, based on insufficient information. GRAC agreed this was OK at last October 2 meeting.

Capital, O&M

COST ASSUMPTIONS

Preliminary Capital Cost of Wind



Preliminary Capital and O&M Estimates for Wind Reference Plant

Year Dollars

2012 \$

Capital Cost (MM)	\$225MM (lifecycle)
Capital Cost (\$/kW)	\$2,240 (lifecycle)
Capital Cost Escalation	-0.5% annual after 2016*

* We discussed possibly changing this to 0% at the last GRAC meeting – not sure it had enough traction to warrant a change. Still ok?

Fixed O&M (\$/kw-yr)	\$35.00 (<i>Sixth Plan \$35.80</i>)
Variable O&M (\$/MWh)	\$2.00 (<i>Sixth Plan \$2.20</i>)

Financial Incentives

- Production Tax Credit (PTC) expired in 2013, was just renewed by Congress through 2014
 - Projects that began construction before end of 2014 eligible
 - Extension doesn't do much for wind development – too late and not long enough (there was a possibility of extending through 2015)
- Investment Tax Credit (ITC)
 - Ability to take 30% ITC in lieu of PTC now expired

Draft Seventh Plan Proposal:

- No financial incentives included in levelized costs for wind power

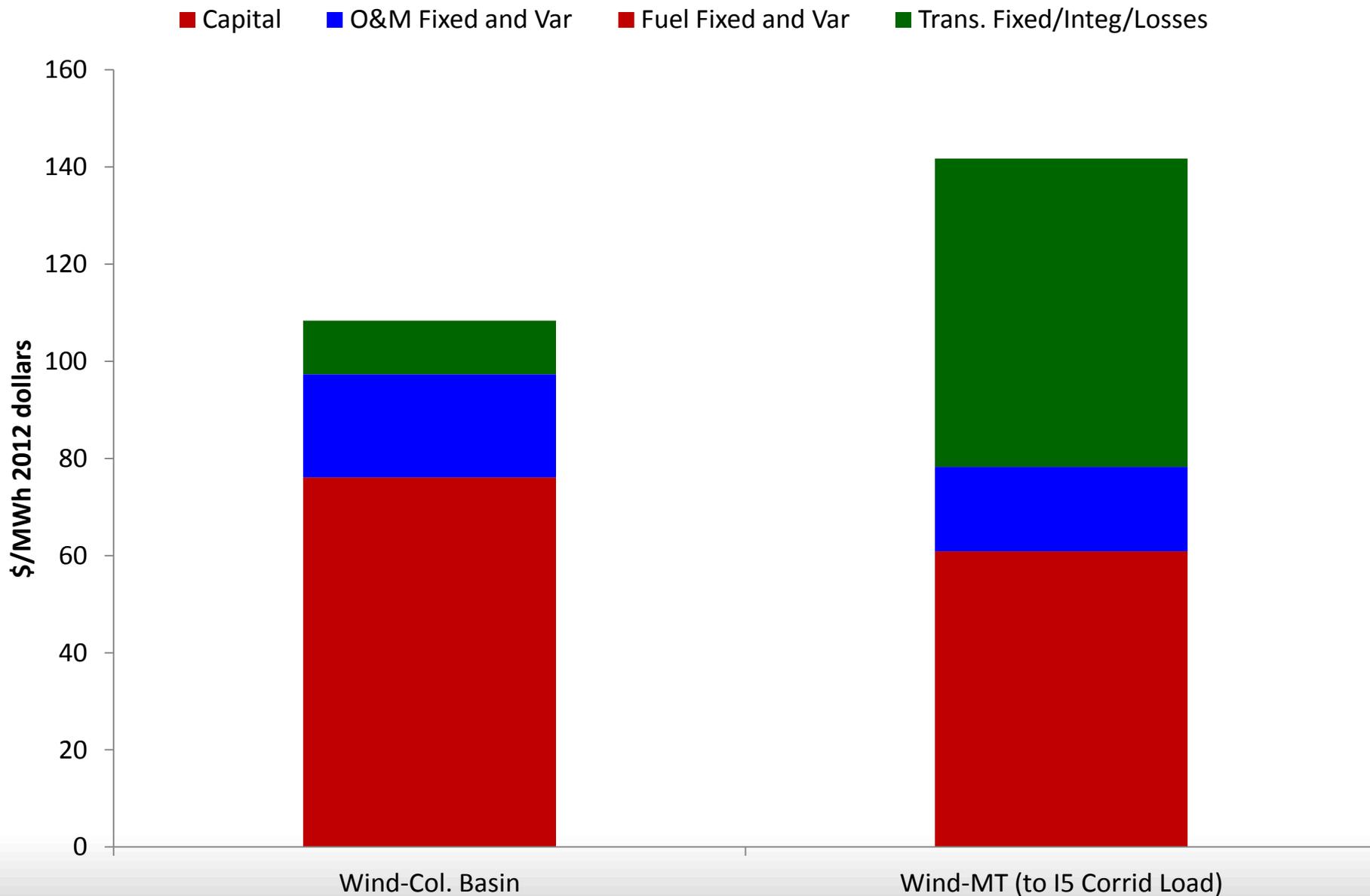
Levelized Cost

COST ASSUMPTIONS

Remote Wind Transmission Cases

1. Wind: MT>OR/WA via Colstrip Transmission System Upgrade
 - Judith Gap MT to I5 corridor
 - Fixed transmission cost \$134/kW-year
 - Losses 10.0%
2. Wind: MT>S. ID
 - Proposed Mountain States Transmission Intertie - Townsend MT to Midpoint ID
 - Fixed transmission cost \$34.62/kW-year
 - Losses 4.2%
3. Wind: MT>OR/WA via S. ID
 - MSTI & Hemingway-Boardman projects
 - Fixed transmission cost \$65.54/kW-year
 - Losses 6.4 %

Wind - Levelized Cost of Energy



Modeling Wind in the RPM

- What should we limit Columbia Gorge wind development to?
 - 3,000 MW limit? 5,000 MW? 1,000 MW?
What is realistic development potential for next 20 years?