Northwest Power and Conservation Council

July 2, 2008

MEMORANDUM

TO: Council Members

FROM: Terry Morlan

SUBJECT: Presentation on Northwestern Energy Wind Integration Experience

Integration of increasing amounts of variable wind generation into the electrical system is providing experience to help understand wind integration requirements and their costs.

Northwestern Energy, an investor owned utility providing electricity and natural gas services in Montana, South Dakota, and Nebraska, has been integrating new wind resources into their system. It provides an example of a power system facing integration challenges without large amounts of hydroelectricity or other flexible resources.

John Hines, Chief Supply Officer for Northwestern Energy, and a former Council member from Montana, along with Dave Fine, Director of Energy Supply Planning, will brief the Council on their experiences incorporating wind into Northwestern's system.

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NorthWestern Energy

Wind Integration Discussion
Northwest Power & Conservation Council
Kalispell, Montana
July 15, 2008

Wind on NWE's System

- 9 projects,
  - 149 MW
  - About 9% of NWE's Energy Requirement

Judith Gap Overview

- Commercial Operation Date: February 2006
- 90 GE 1.5 MW Turbines (135 MW installed capacity)
- 20-Year Purchase Power Agreement between Invenergy & NorthWestern Energy
- 38-40% Expected Annual Average Capacity Factor (450,000 - 475,000 MWH/yr)

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Project Performance:

- Annual & monthly energy production and capacity factor are as expected for a “typical year”
- Wind forecasting system is operational and providing valuable data for pre-schedule and real-time activities.
- TEA (NWE realtime agent) using the 3Tier wind energy forecasts for purchase & sales decisions to balance load and resources
- NWE anticipates Judith Gap will continue to exceed >94% mechanical availabilty from the state-of-the-art facility

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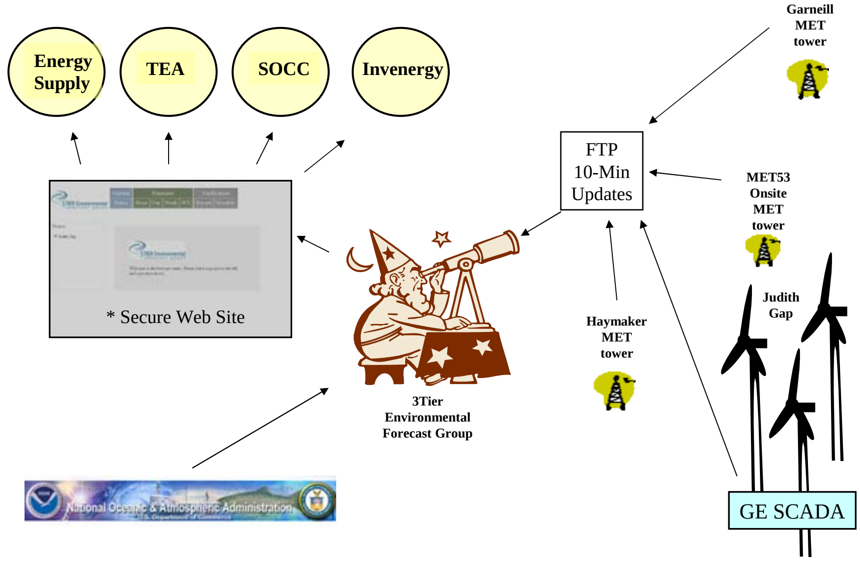
Judith Gap Wind Project: Wind & Wind Energy Forecast System



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Judith Gap Wind Energy Production Summary

2007	Total MWH	HL[1] MWH	LL[2] MWH	Peak MW	Maximum 15-Minute Change MW	Average MW	Standard Deviation MW	Capacity Factor[3]
January	68,740	40,077	28,663	135.8	-91.8	92.4	43.3	0.68
February	41,435	23,751	17,684	135.4	-90.0	61.7	56.0	0.46
March	50,775	29,323	21,452	139.0	130.8	68.2	50.8	0.51
April	34,006	21,438	12,568	137.0	82.9	47.2	48.2	0.35
May	32,957	19,657	13,300	133.7	90.2	44.3	44.5	0.33
June	23,234	11,937	11,297	134.0	95.9	32.3	42.1	0.24
July	18,059	11,283	6,776	131.5	88.8	24.3	34.2	0.18
August	26,397	14,079	12,318	135.7	75.2	35.5	41.2	0.26
September	33,106	20,162	12,943	136.9	85.6	46.0	48.4	0.34
October	44,892	26,778	18,115	137.6	85.3	60.3	50.9	0.45
November	50,432	29,727	20,705	138.7	-85.7	70.0	53.9	0.52
December	62,814	34,917	27,896	138.8	-64.7	84.4	49.8	0.63
	========	========	========	========	========	========	========	========
Total YTD	486,847	283,129	203,717	139.0	130.8	55.6	51.3	0.41
		58%	42%					

1 - Heavy load hours Monday - Saturday HE 7 - 22
2 - Light load hours Monday - Saturday HE 1 - 6, 23, 24; all day Sunday
3 - Calculated capacity factor based on 135 MW installed capacity

Wind energy production values are expected to vary from year-to-year.

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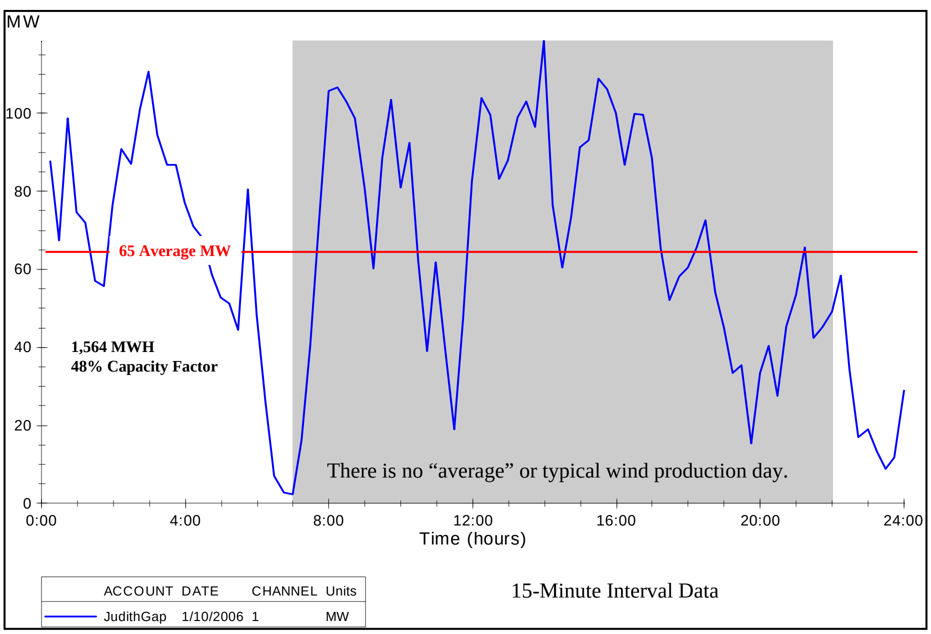

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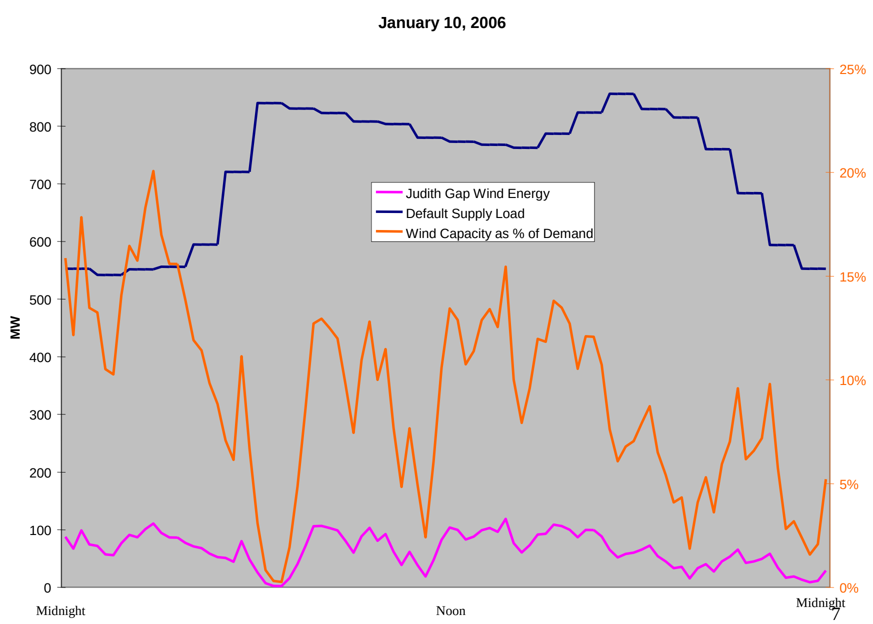

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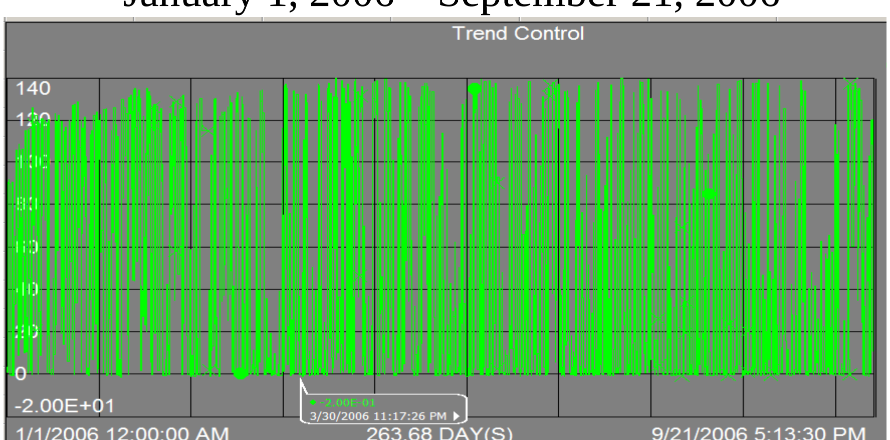
Wind Integration Experience

Hourly Wind Production

January 1, 2006 – September 21, 2006



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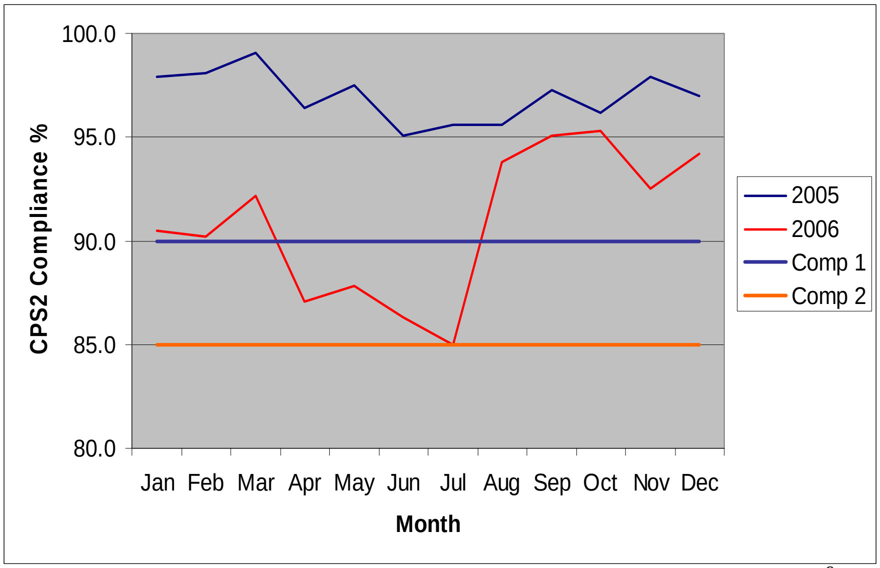
NWE CPS2 Compliance Data



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Wind Integration Costs

- NWE must continually balance resources with demand.
- NWE contracts with 3rd party for Regulation Reserves
  - NWE owns no regulating resources – and hasn't since the mid-80s
- We regulate by sending a signal from our Automatic Generation Control system every 4 seconds to our regulation services providers.
  - If supply > demand we send a signal to back down generation
  - If demand > supply we send a signal to pick up generation
- Historical need for 60 MW of regulating capacity (± 30 MW)
  - Very illiquid market

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What does the future hold?

Historical Regulation Requirements

- Transmission Customer Resource
  - 60 MW (± 30 MW)
  - Base price $2.7 million / year
- Liquidity of the regulating reserves market
  - It is getting worse not better – Availability Issues
- NWE has issued 2 recent RFPs for Regulating Reserves
  - Verified that market is very illiquid for this product.
  - No long term proposals received, other than new-build, green-field projects
  - Prices are going up

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Now With Wind Integration Requirements

- Supply acquiring regulation necessary for intermittent resources and makes available to the transmission operator
- Reglation Purchased at the beginning of 2006
  - 15 MW (± 7.5 MW): ~11% of default supply wind resource
  - Base price: $1.1 million / year:
- Second Purchase Added in June 2006 to correct CPS2 performance
  - 10 MW (± 5 MW)
  - Base price: $740,000 / year
- Total regulating reserves to support wind generation
  - 25 MW ~18% of default supply wind resource
  - Nearly $1.8 million/year
- Costs for regulation reserves have doubled for this upcoming year

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Looking Forward….

- Finite and possibly diminishing capability to effectively integrate intermittent resources with low capacity value
- NWE may build regulating resource
- Renewable Portfolio Standards should be based on economic or utility operational criteria - not "hard targets"
- Need Additional Analyses For Policy Makers – "Apples to Apples" Comparisons

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