



## **A Market Perspective on Forecast Value**

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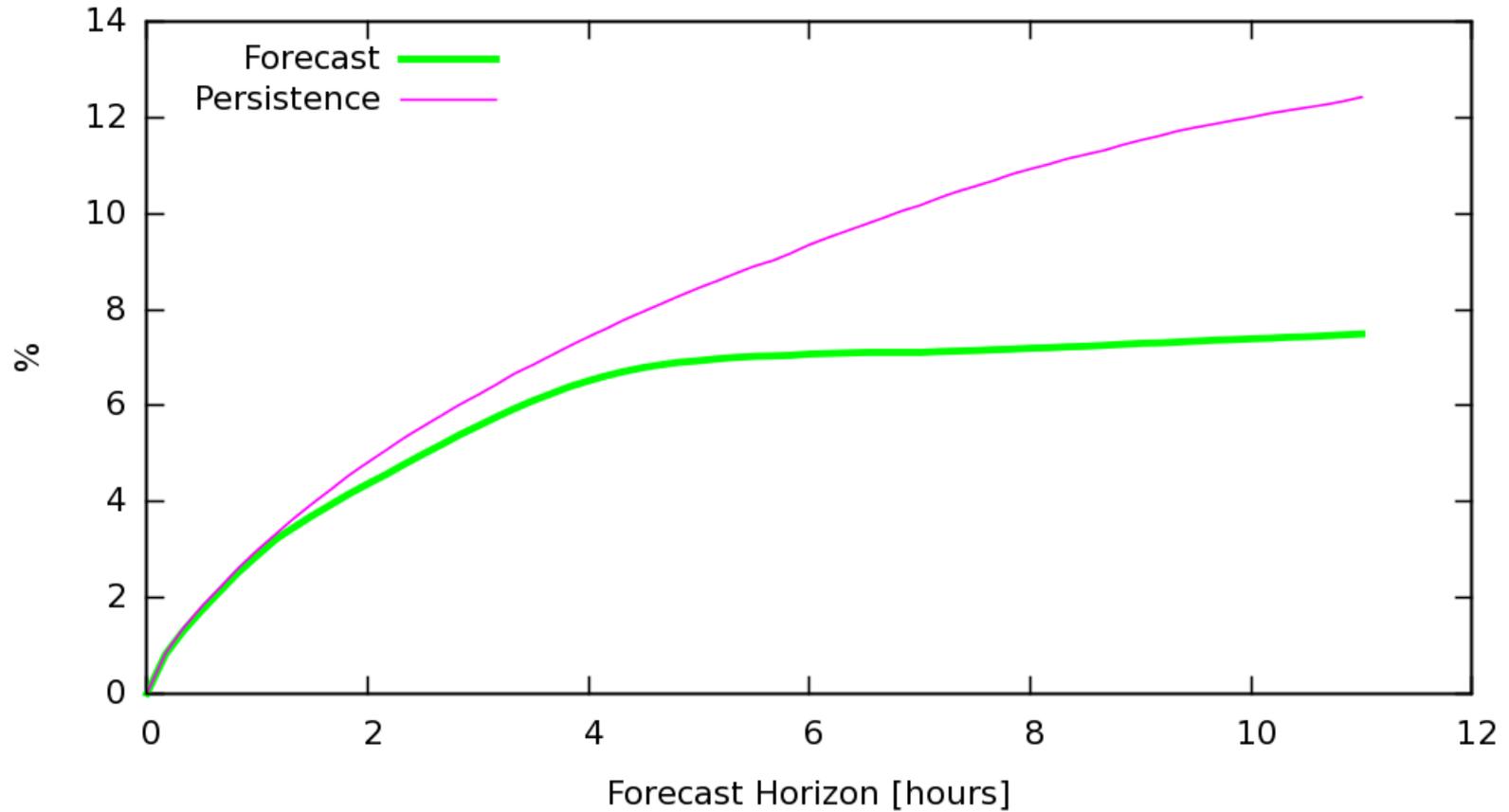
UVIG Workshop on Forecasting Applications

Salt Lake City, Utah

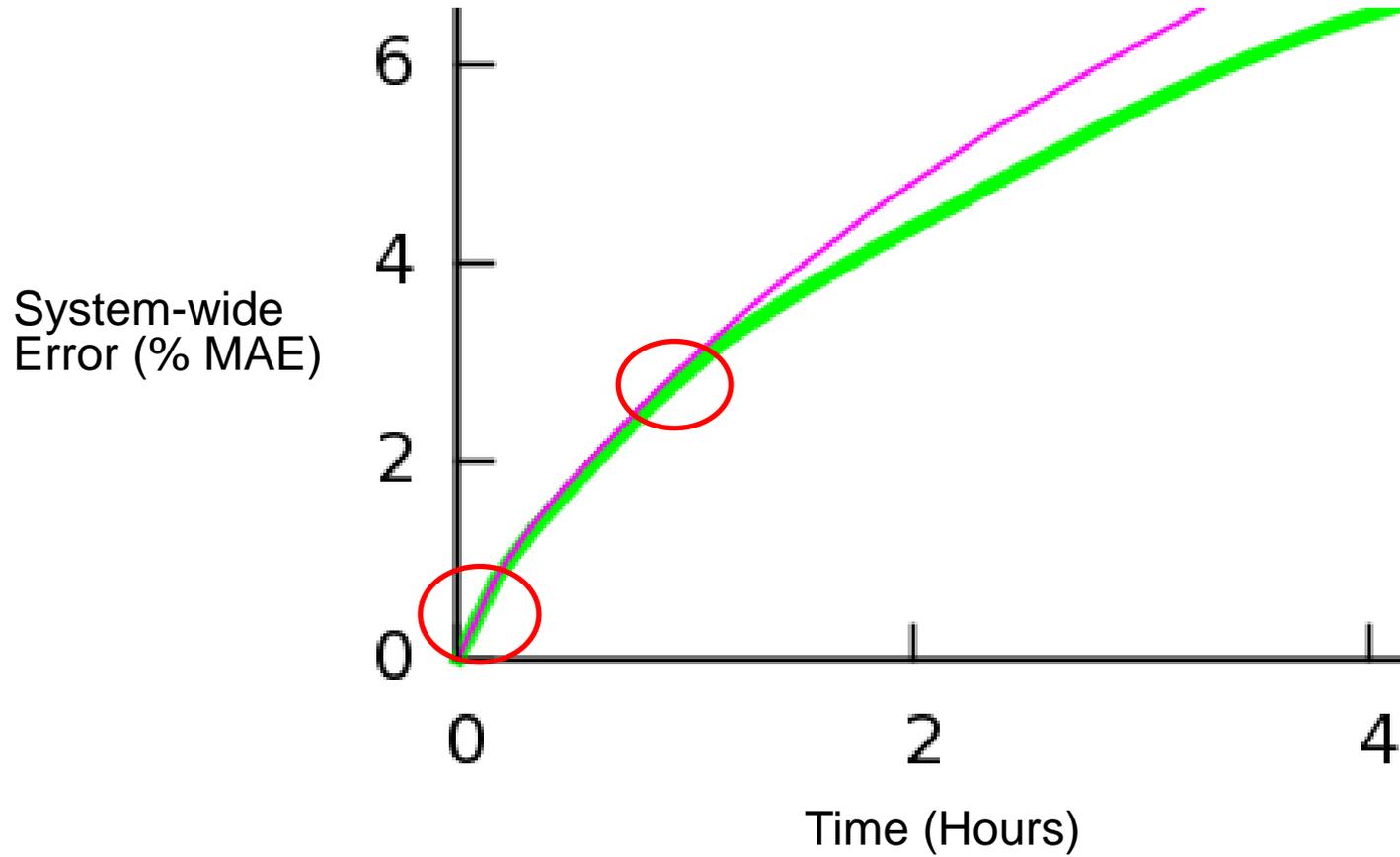
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# The Short Term Wind Forecast Error Curve

AESO Shortterm Forecast Mean Absolute Error August 2012



# The Short Term Wind Forecast Error Curve



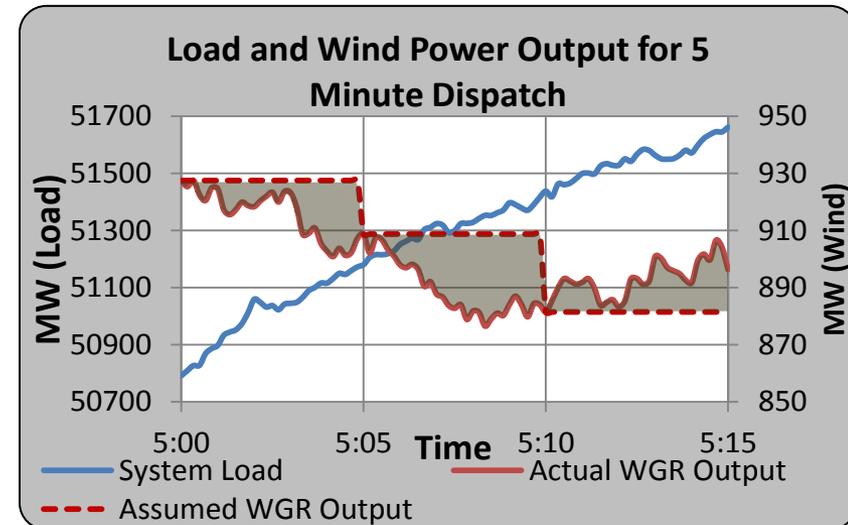
# Wind Variability in ERCOT

ERCOT uses the output at the start of the dispatch period as the dispatch value for the wind plant (unless curtailed)

Under this approach, wind variability is the change within the five-minute period

Within the five-minute period, regulation must cover the difference

How much extra regulation is needed and what does it cost?



# What does this wind variability cost?

For ~10,000 MW of wind (11% of ERCOT energy):

Typical months:

- Regulation up: \$300k
- Regulation down: \$88k
- **Total: \$388k/month**

Including July/August period with record prices:

- Regulation up: \$937k
- Regulation down: \$92k
- **Total: \$1 million/month**

Month	Avg. Actual RGSU Requirement	Avg. Estimated RGSU Requirement w/ No Wind	Difference in Avg. Requirement	Estimated Cost of Additional RGSU (MCPC x Difference in Requirement)
Dec. '10	436.2	433.3	3.0	\$26,702.60
Jan. '11	499.2	477.9	21.3	\$170,595.76
Feb. '11	491.3	471.3	19.9	\$547,294.91
Mar. '11	569.0	513.6	55.4	\$569,037.53
Apr. '11	570.5	526.6	43.9	\$285,647.14
May '11	589.7	539.0	50.7	\$350,156.82
Jun. '11	587.2	516.8	70.4	\$551,253.78
Jul. '11	585.4	505.0	80.4	\$1,262,316.69
Aug. '11	618.5	536.7	81.8	\$6,264,574.40
Sep. '11	559.9	535.4	24.5	\$142,691.87
Oct. '11	543.1	531.5	11.6	\$136,646.20

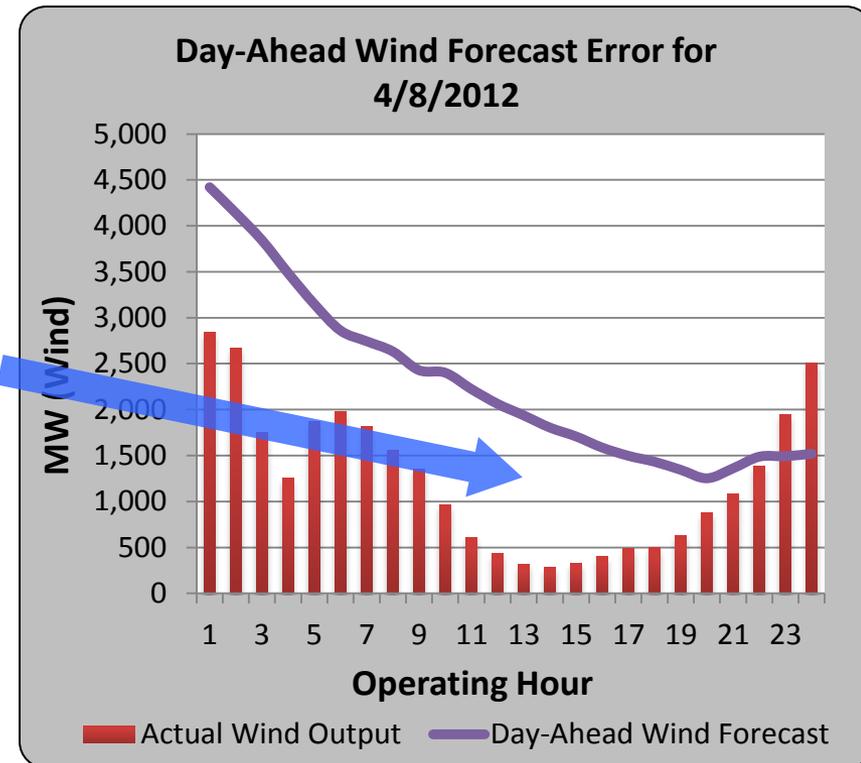
Month	Avg. Actual RGSU Requirement	Avg. Estimated RGSU Requirement w/ No Wind	Difference in Avg. Requirement	Estimated Cost of Additional RGSU (MCPC x Difference in Requirement)
Dec. '10	433.3	424.2	9.1	\$34,983.70
Jan. '11	455.7	453.5	2.2	\$8,316.57
Feb. '11	483.4	476.5	6.8	\$65,193.45
Mar. '11	488.8	483.6	5.2	\$30,389.07
Apr. '11	488.9	467.9	21.0	\$235,523.99
May '11	505.2	491.2	14.0	\$100,224.09
Jun. '11	514.0	483.3	30.7	\$206,474.94
Jul. '11	536.9	499.0	37.8	\$186,529.72
Aug. '11	479.7	473.2	6.5	\$34,765.55
Sep. '11	476.2	467.6	8.5	\$56,459.89
Oct. '11	522.0	513.6	8.5	\$63,267.33

# Wind Uncertainty in ERCOT

Forecast error creates additional uncertainty that must be covered by reserves

- For ERCOT, this reserve is non-spin
- Real-time dispatch is used for most forecast error, non-spin reserves cover risk of insufficient dispatch resources

How much extra non-spin reserves are needed and what does it cost?



# What does this wind uncertainty cost?

For ~10,000 MW of wind (11% of ERCOT energy):

Typical month:

- **\$1 million/month**

Including August 2011 with record prices:

- **\$2 million/month**

Month	Avg. Actual NSRS Requirement	Avg. Estimated NSRS Requirement w/ No Wind Forecast Error	Difference in Avg. Requirement	Estimated Cost of Additional NSRS (MCPC x Difference in Requirement)
Dec. '10	1875.8	1548.2	327.7	\$779,529.45
Jan. '11	1982.8	1801.8	181.0	\$665,367.18
Feb. '11	2000.0	1908.2	91.8	\$1,337,097.78
Mar. '11	1946.0	1624.2	321.8	\$1,082,611.93
Apr. '11	1757.3	1004.2	753.2	\$2,902,156.00
May '11	1760.2	1284.3	475.8	\$1,359,895.04
Jun. '11	1903.5	1680.0	223.5	\$539,952.74
Jul. '11	1815.7	1410.5	405.2	\$636,768.72
Aug. '11	1539.8	1320.0	219.8	\$11,481,080.26
Sep. '11	1649.2	1356.0	293.2	\$794,453.54
Oct. '11	1595.7	1276.0	319.7	\$875,603.52

# What does this mean to us?

Approximate ERCOT annualized “typical” numbers:

– Variability cost:	\$4.6 million	\$0.14/MWh
– Uncertainty cost:	\$12 million	\$0.36/MWh
– Value of energy provided by wind:	<u>\$1.3 Billion</u>	

*For a system like ERCOT that efficiently dispatches wind and uses energy dispatch and non-spin for wind uncertainty, the cost of wind variability and uncertainty is very modest (~1.3% of the energy value)*

For a 100 MW wind plant, this implies annual values of \$46k for variability and \$120k for uncertainty

– Implied value of self-supplying regulation (storage?):	\$46k/year
– Implied value of perfect forecasting:	\$120k/year

# Implications for Market Participants & Forecasting Value

1. Market participants prefer to control their own offers and schedules, but they care the most about getting maximum energy dispatched.
2. In markets with a good wind and solar dispatch method, the value for improving very short term (intra-hour) forecasts is very small.
3. An inefficient dispatch method increases the value proposition for very short term forecasting, but it is an artifact of the rules and not based on a physical reality for running a power system.
4. Efficient dispatch encourages participation in day ahead and intraday financial markets, thereby **increasing** the value of day ahead and hours ahead forecasts (more than is shown by their impact on reserves, due to nodal versus system issues).
5. It's a "MWh x price" world! Compare forecasts against the annual revenue of a perfect forecast under the actual market rules.



## **Discussion**

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