

NE Region System Operators' Wind Integration Seminar

Projet pilote AESO pour la prévision de l'énergie éolienne

11-12 février 2008

Reliable **Power**

Reliable **Markets**

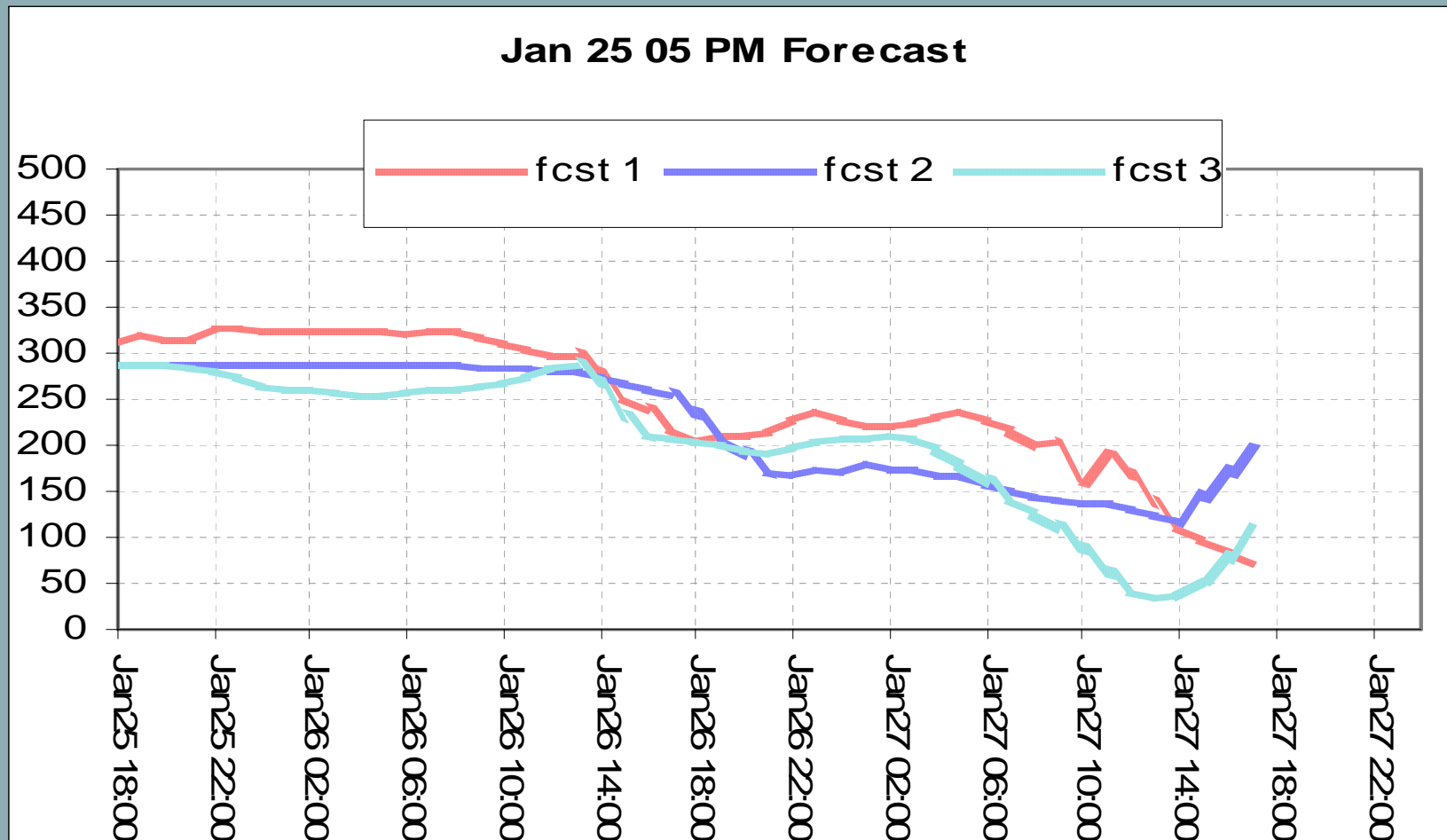
Reliable **People**



Darren McCrank, P. Eng.
Operations and Reliability



What is a wind power forecast? Is it a simple time series?



PLATON -

Presentation Form:

- Full EPS
- Mean/Min/Max
- Probabilities
- Map with fc&obs

Area:

- AESO
- CE
- EXIST
- FUTURE
- SC
- SE
- SW

Start of Forecast:

21/01/2008:
 00 06 12 18

22/01/2008:
 00 06 12 18

23/01/2008:
 00 06 12 18

24/01/2008:
 00 06 12 18

25/01/2008:
 00 06 12 18

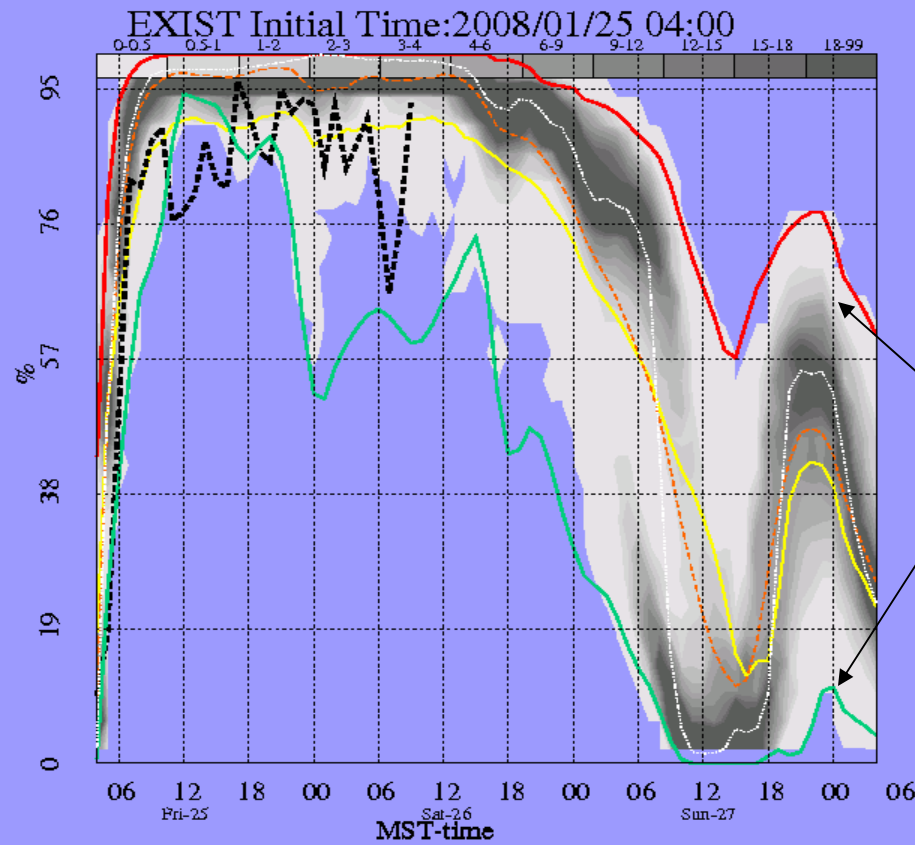
26/01/2008:
 00 06

Fields :

- day 1 - 3 ramp rate
- day 1 - 3 wind power

[HELP: Info about the EPS setup and how to use the menu](#)

MS-EPS-MEAN-Field: Wind Power - Forecast Start: 2008012512 +00H - Valid Date: 2008/01/25 05H MST



- EPS-Maximum
- EPS-Minimum
- EPS-Mean
- Best Guess 1
- Best Guess 2
- Online Measurement
- low probability
- high probability

Does it include Uncertainty?

Does it also contain information like this?



Situational Awareness

- An extreme cold front will move in from the NW sometime between 2-6pm MST
- This should cause a ramp down of wind starting with the most western facilities first
- However, a warm air mass with strong winds will move in on top of this cold air shortly thereafter setting up the conditions for strong vertical movement and a possible fast ramp up of wind power

Pourquoi un projet pilote en Alberta?



Load forecast vs Wind Forecast

- The AESO day ahead load forecast has a MAE of ~ 1.2% and a maximum error of ~7%
- The day ahead wind power forecasts in the pilot project have a MAE of ~ 15% and a maximum error of ~ 85%

What does this tell us?

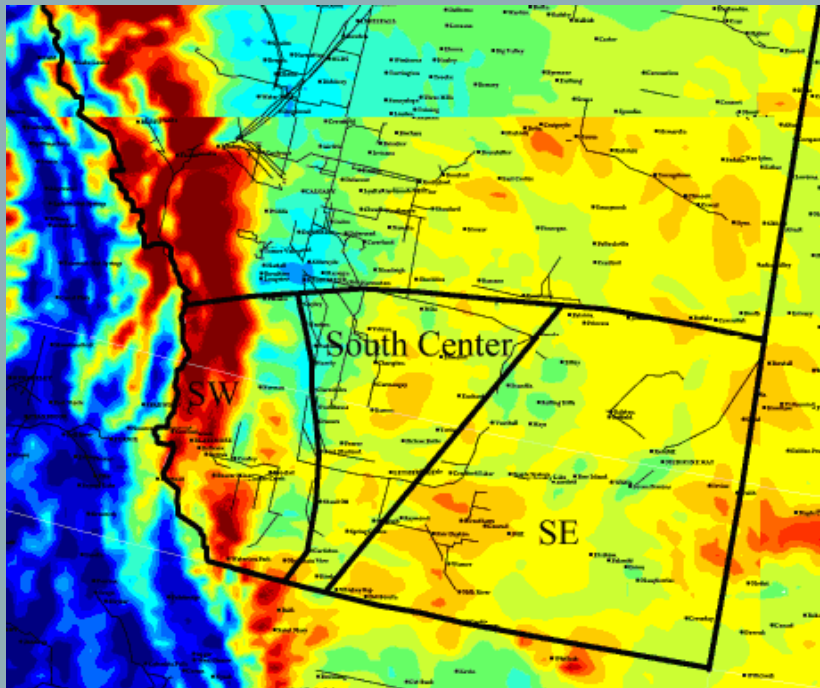
- The use of a wind power forecast will not give you the same certainty as will the use of a load forecast
- Should wind power forecasts be used differently than load forecasts?
- Should wind power forecasts be evaluated in the same fashion as load (MAE) due to the higher frequency of extreme events?
- We need to understand WHAT IS a wind power forecast?

La intention du projet



- To evaluate different forecasting methods in order to find the most effective means to forecast wind power in Alberta.
- To leverage the experience of other jurisdictions globally
- To educate Alberta's power industry on wind power forecasting techniques and capabilities
- To recommend wind power forecasting requirements to be implemented in Alberta

Projet pilote pour la prévision de l'énergie éolienne – le dessein



Funded by
AESO

*Alberta Energy Research Institute
Alberta Department Of Energy*

- Trial three very different forecasting methods over a one year period:
 - AWS Truewind (US)
 - WEProg (Denmark)
 - energy and meteo (Germany)
- 4 different geographic terrains / wind regimes in Alberta
- T-1 to T-48 hrs refreshed hourly (w/s, MWs, ramp rate)
- 7 existing and 5 future facilities to represent geographic diversity and future expansion
- Data Collection by Phoenix Eng. (Calgary) – 1 met tower/site
- Independent analytical analysis from ORTECH (Canada)

Projet pilote pour la prévision de l'énergie éolienne – le programme



- Feb 2007 - April 2007
 - Data Collection, model training (using historical information)
- May 2007
 - Forecast Delivery Begins
- Final Reports (ORTECH and Forecasters)
 - Draft Jun 08
 - Final Jul 08
- Work Group Recommendations
 - Sept 08

Progress Update

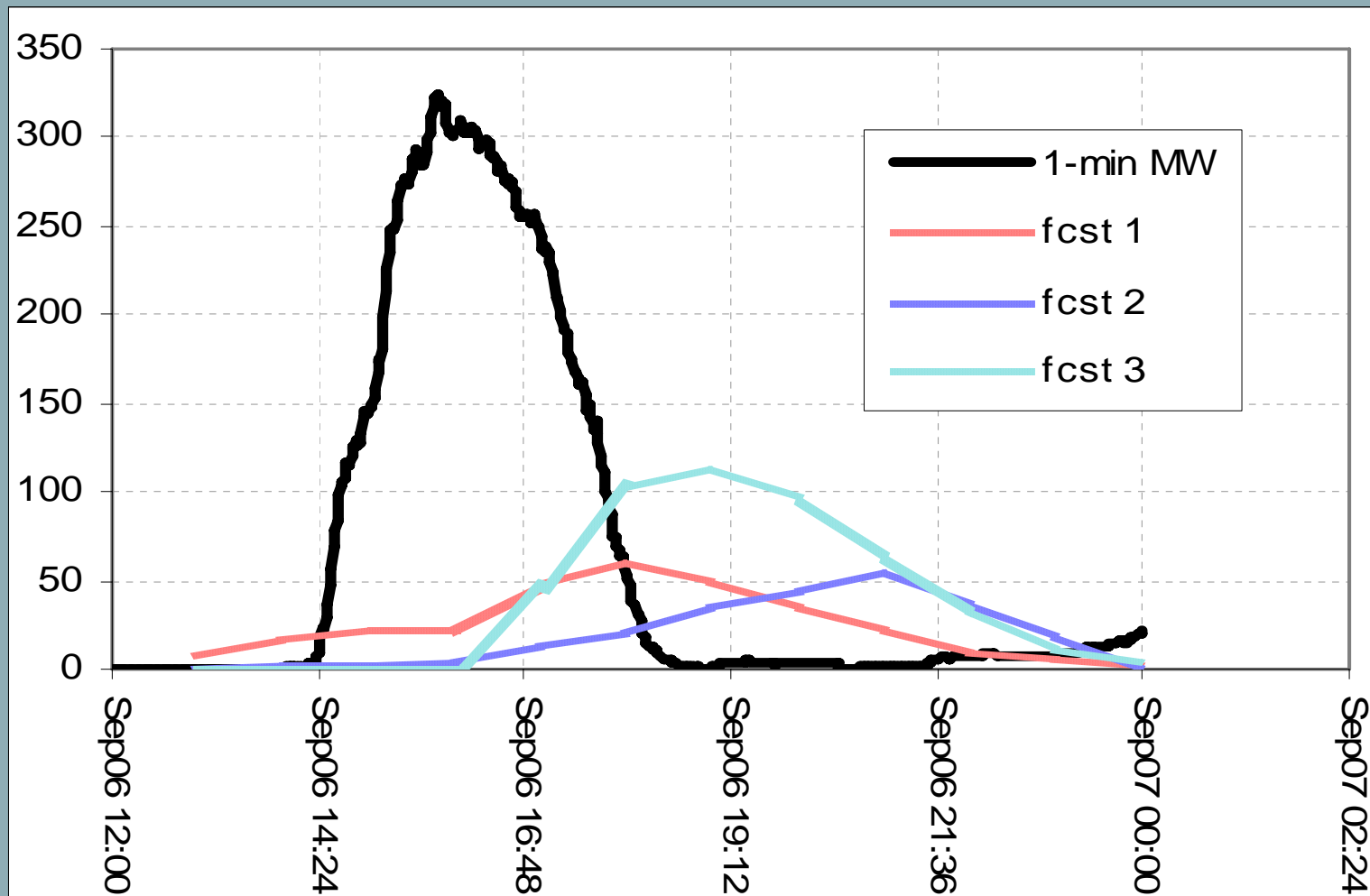
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Reliable **Markets**

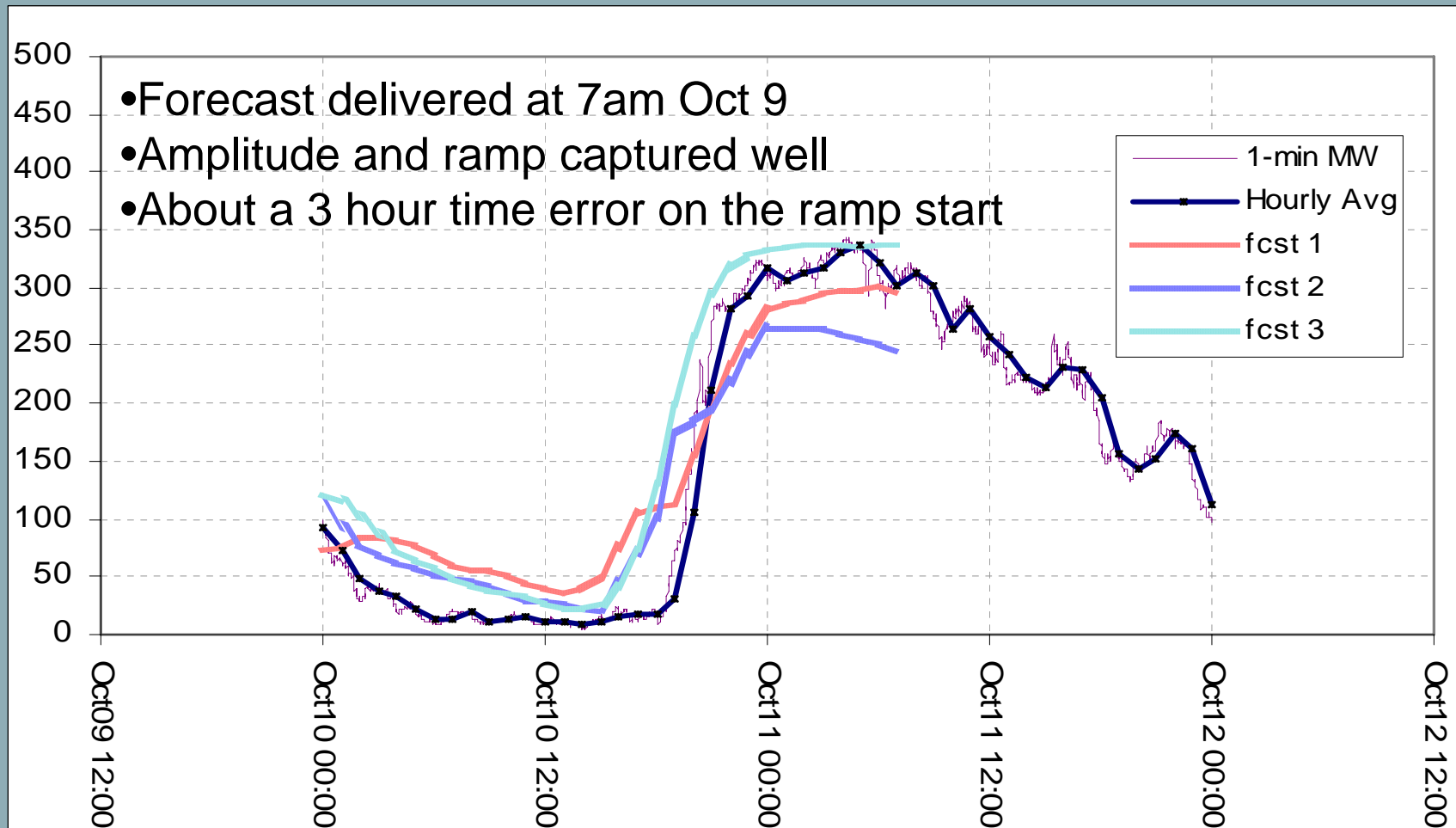
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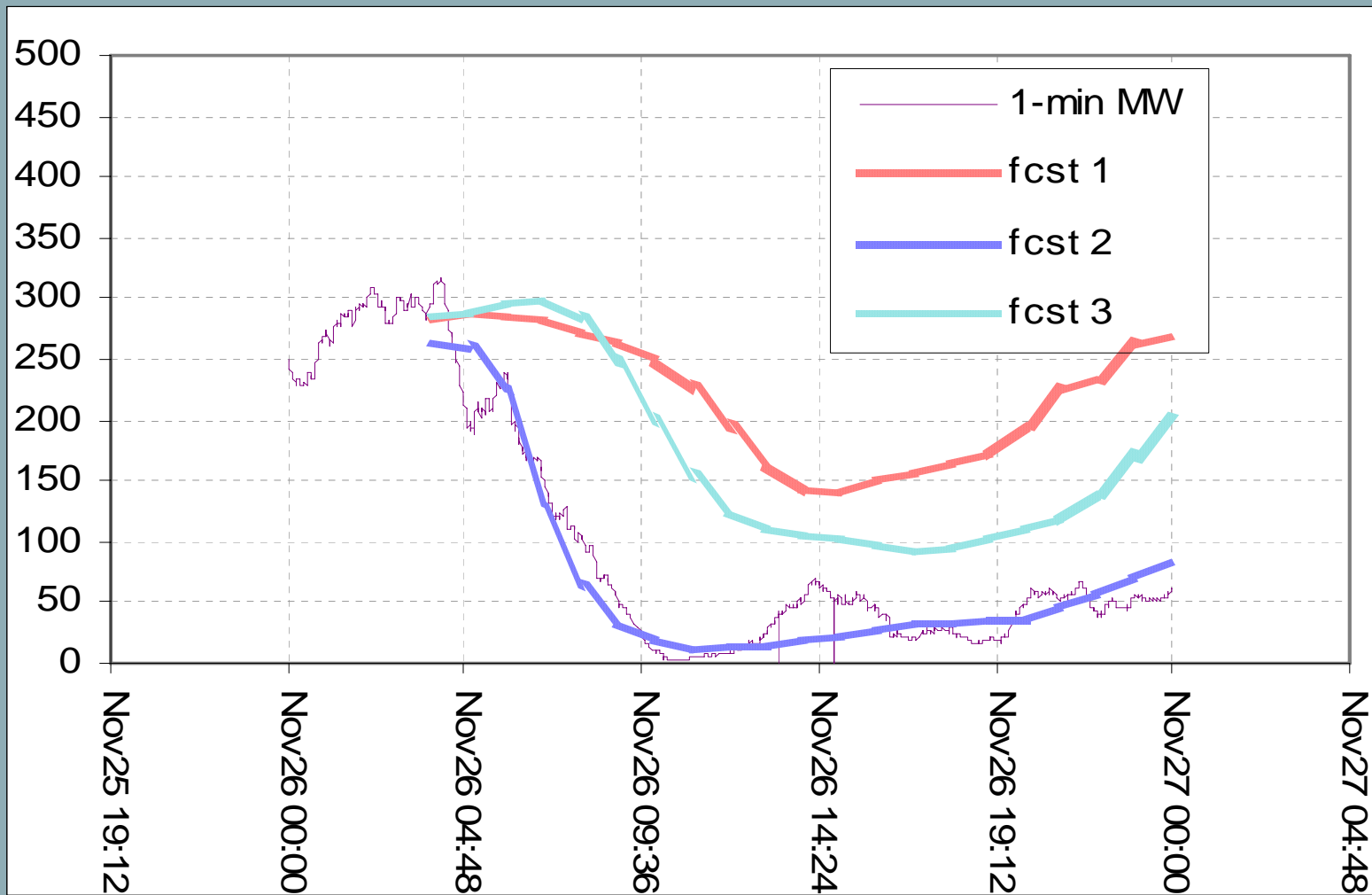
Special Event Analysis



Day-Ahead Forecasts for Oct 10 (delivered Oct 9 at 7am)



48 Hr Forecast delivered at 3am on Nov. 26

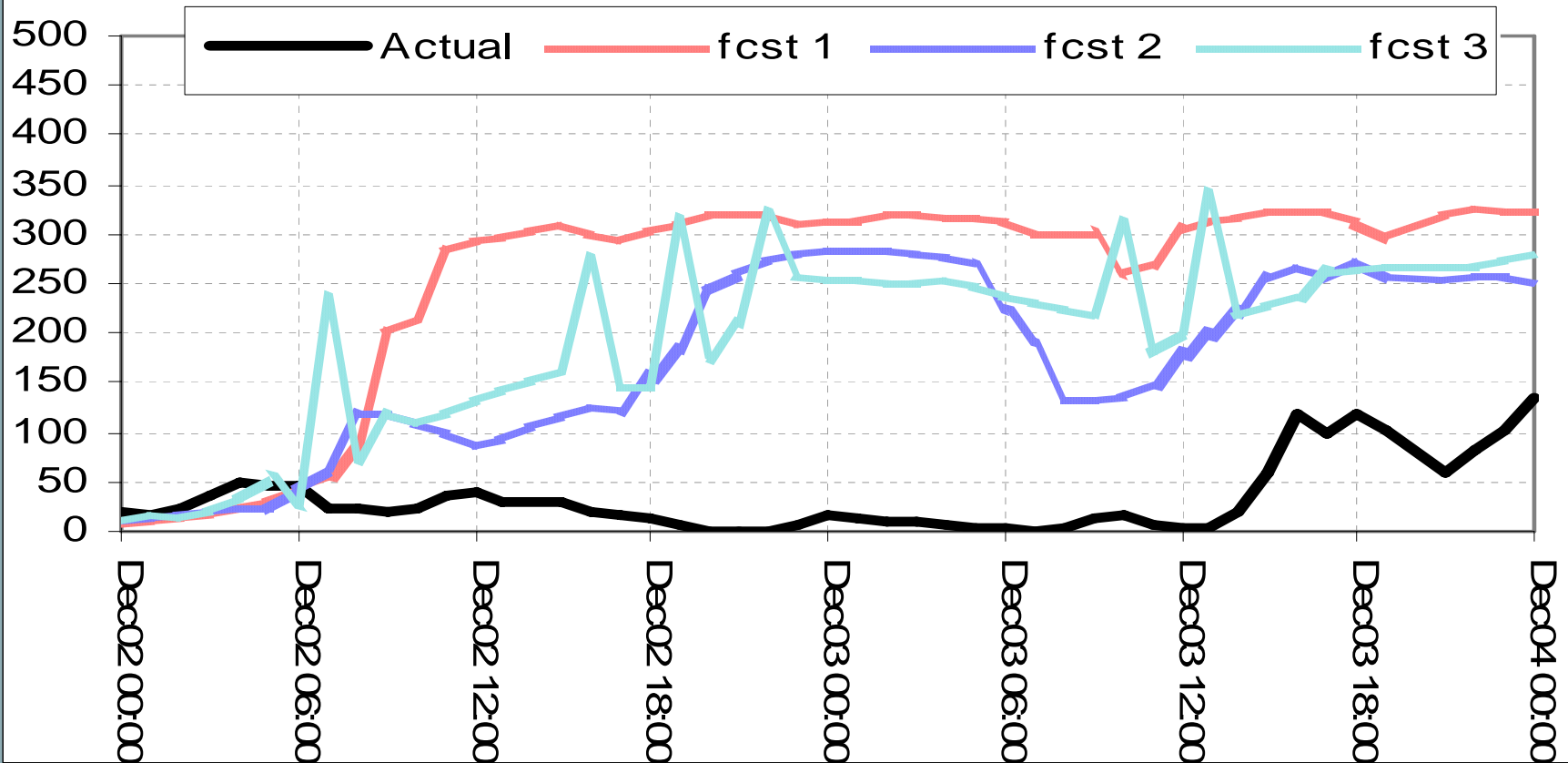


Extracted 6 hour timeframes

T-6 hr timeframe from every 48 hour forecast dataset plotted



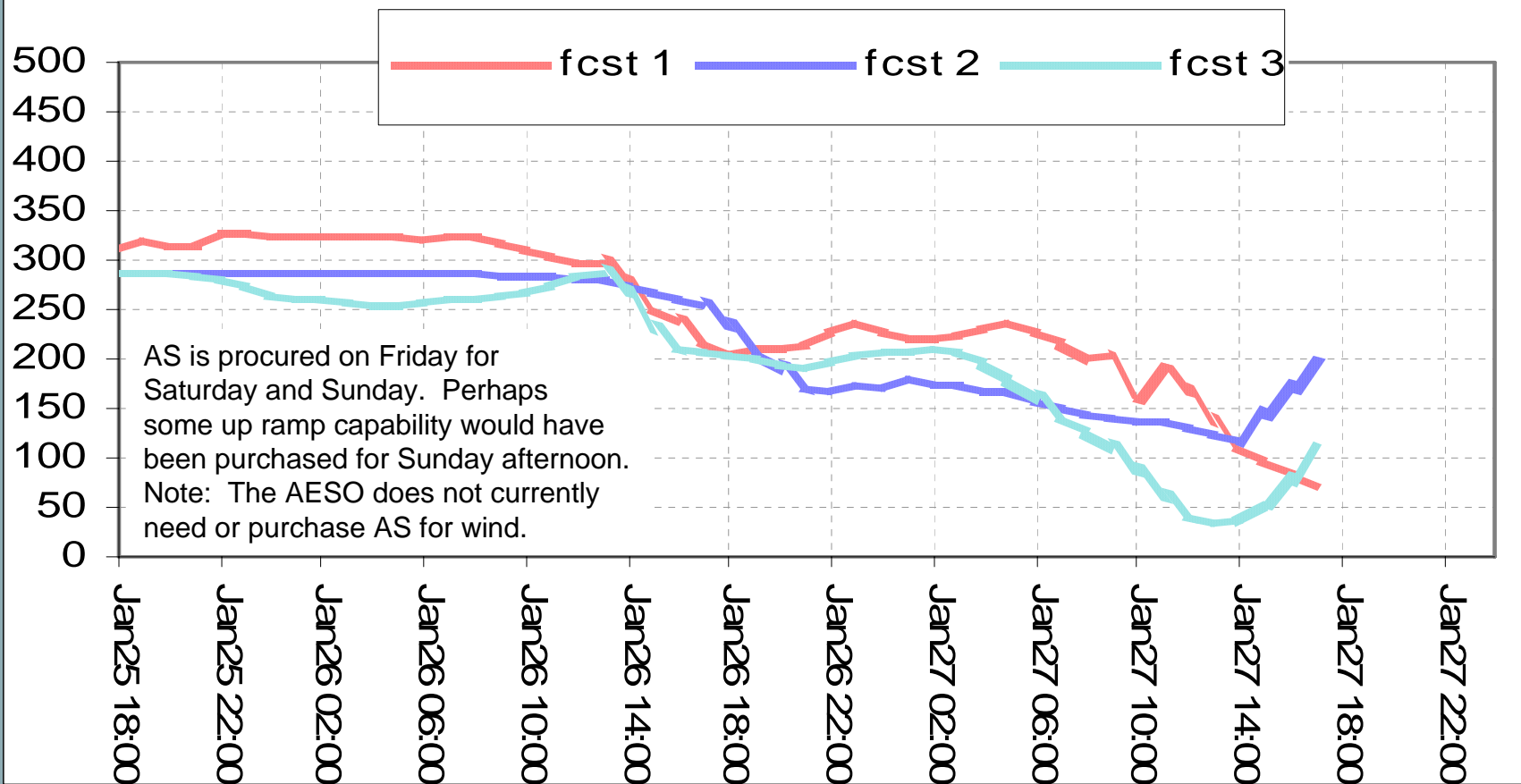
Actual vs Extracted6HrAheadFcst hourly average wind power output [2007/12/02 - 2007/12/04]



Next 48 hour forecast as seen at 5pm Friday Jan 25



Jan 25 05 PM Forecast



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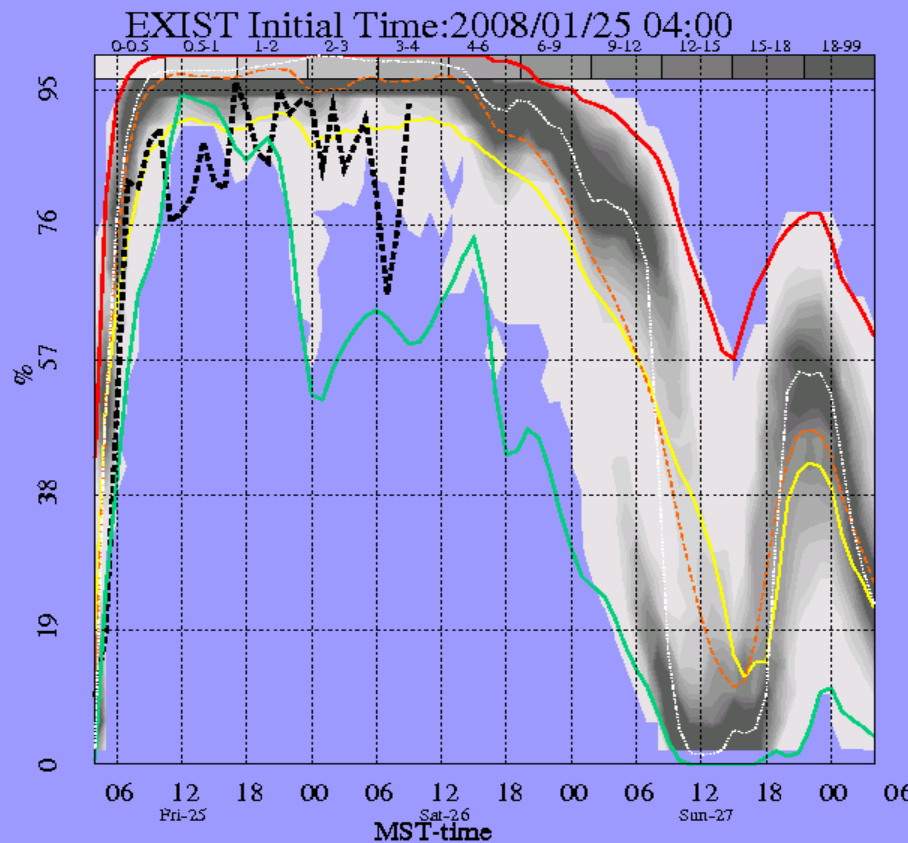
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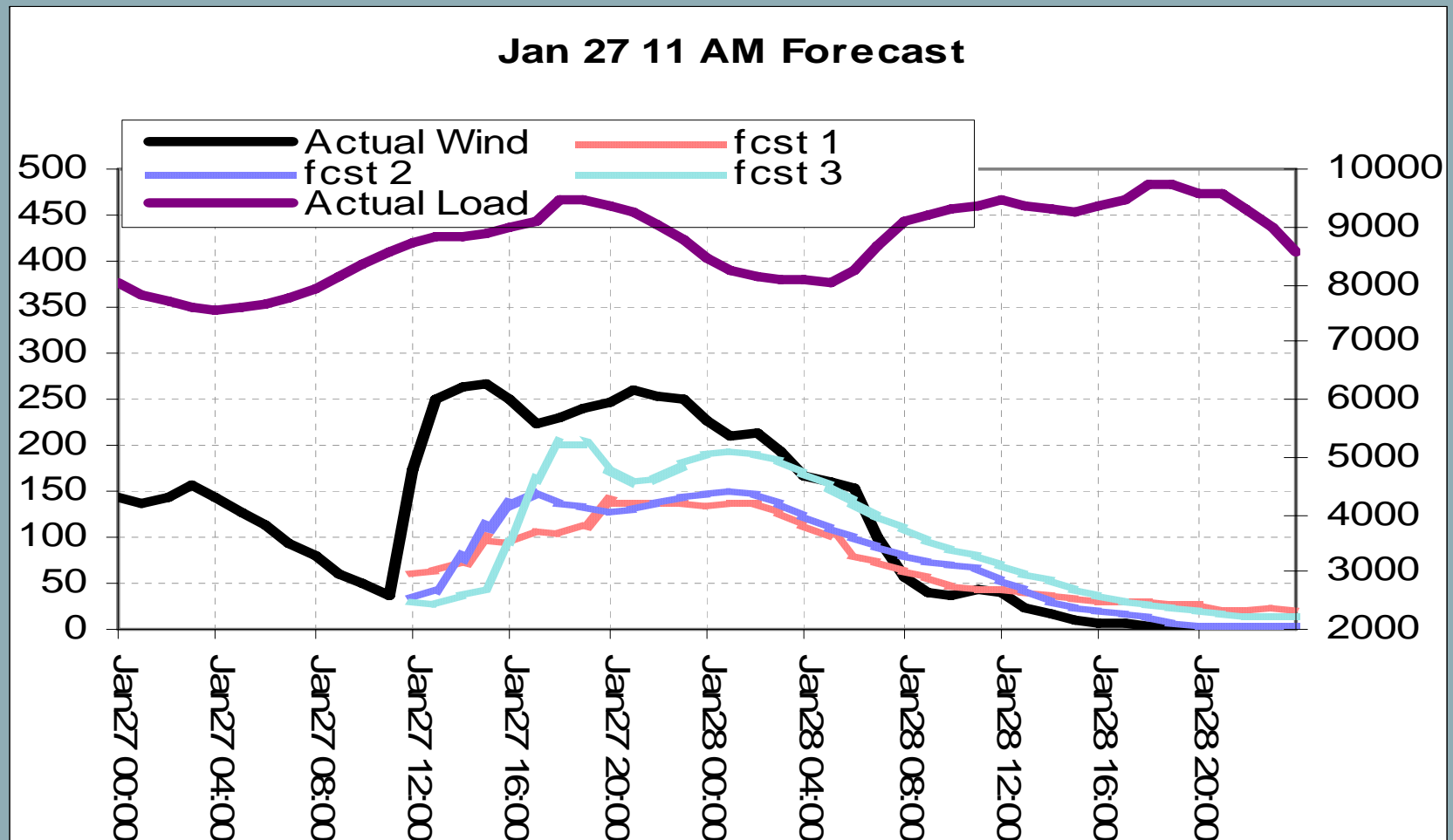
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-----	EPS-Minimum
-----	EPS-Mean
-----	Best Guess 1
-----	Best Guess 2
-----	Online Measurement
-----	low probability
-----	high probability

WEPROG Forecast delivered at 1200 Fri 25 Jan.

(Captured at 0900 Sat 26 Jan which is why You see the actual online measurement.)

Aggregate of 7 existing Facilities. Demonstrates the uncertainty in the forecast on Sunday.

Forecasts delivered at 11am on Sunday Jan 27



Proposed Controlled Experiment within the project



- Trial the assessment of a local meteorologist of the submitted forecasts
 - Provide a brief of the unfolding situation
 - Provide an assessment of the uncertainty
 - Provide an assessment of the phase or timing of a forecasted ramp

Quantitative Event Analysis

Reliable **Power**

Reliable **Markets**

Reliable **People**

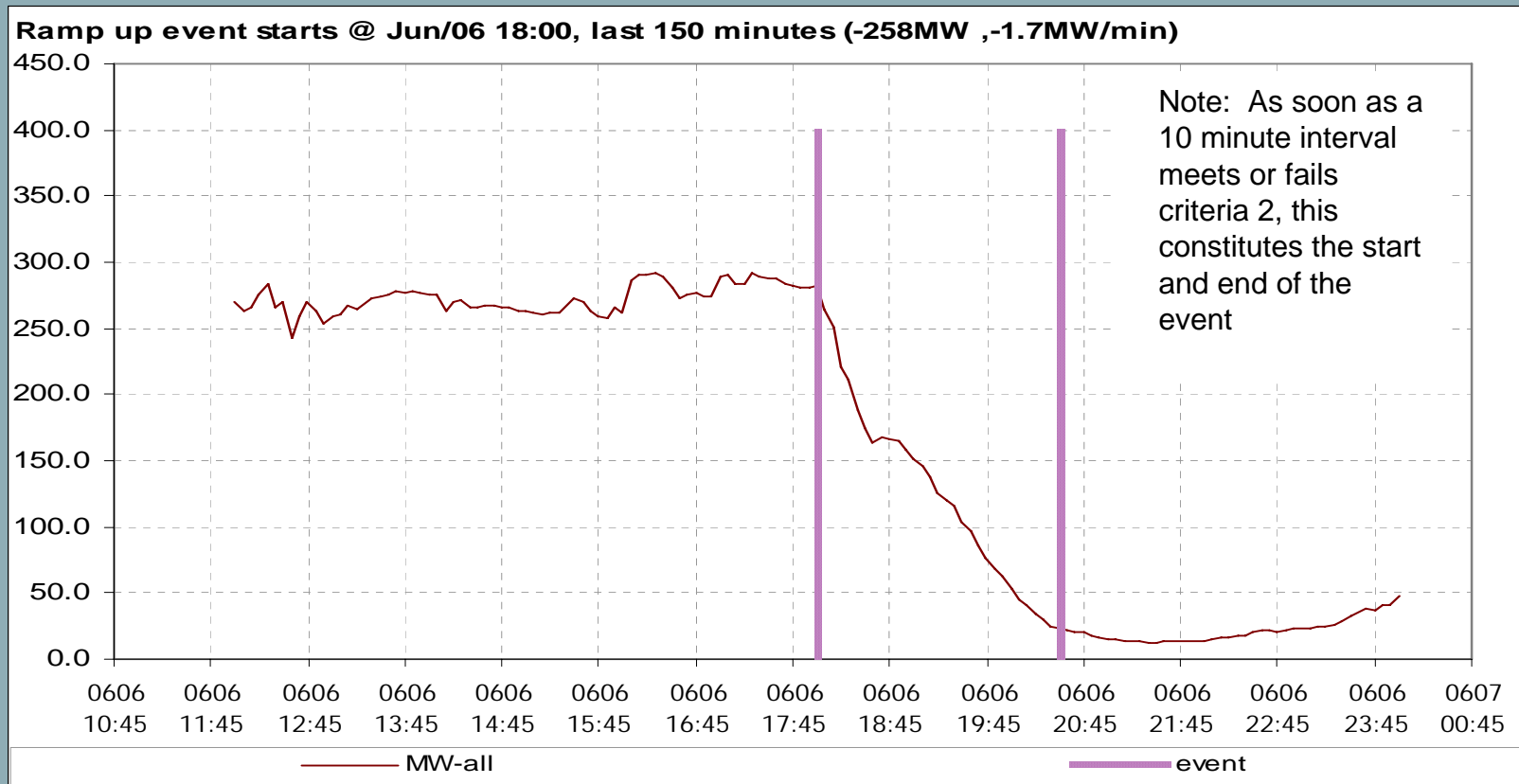


AESO Event Analysis Methodology

Step 1



- Isolate all ramping events in the measured aggregate wind power data by finding times where the following criteria is met
 1. Any continuous + or - change in wind power greater than 100 MWs &
 2. The rate of change is more than 1.33 MW/minute (80MW/hr)

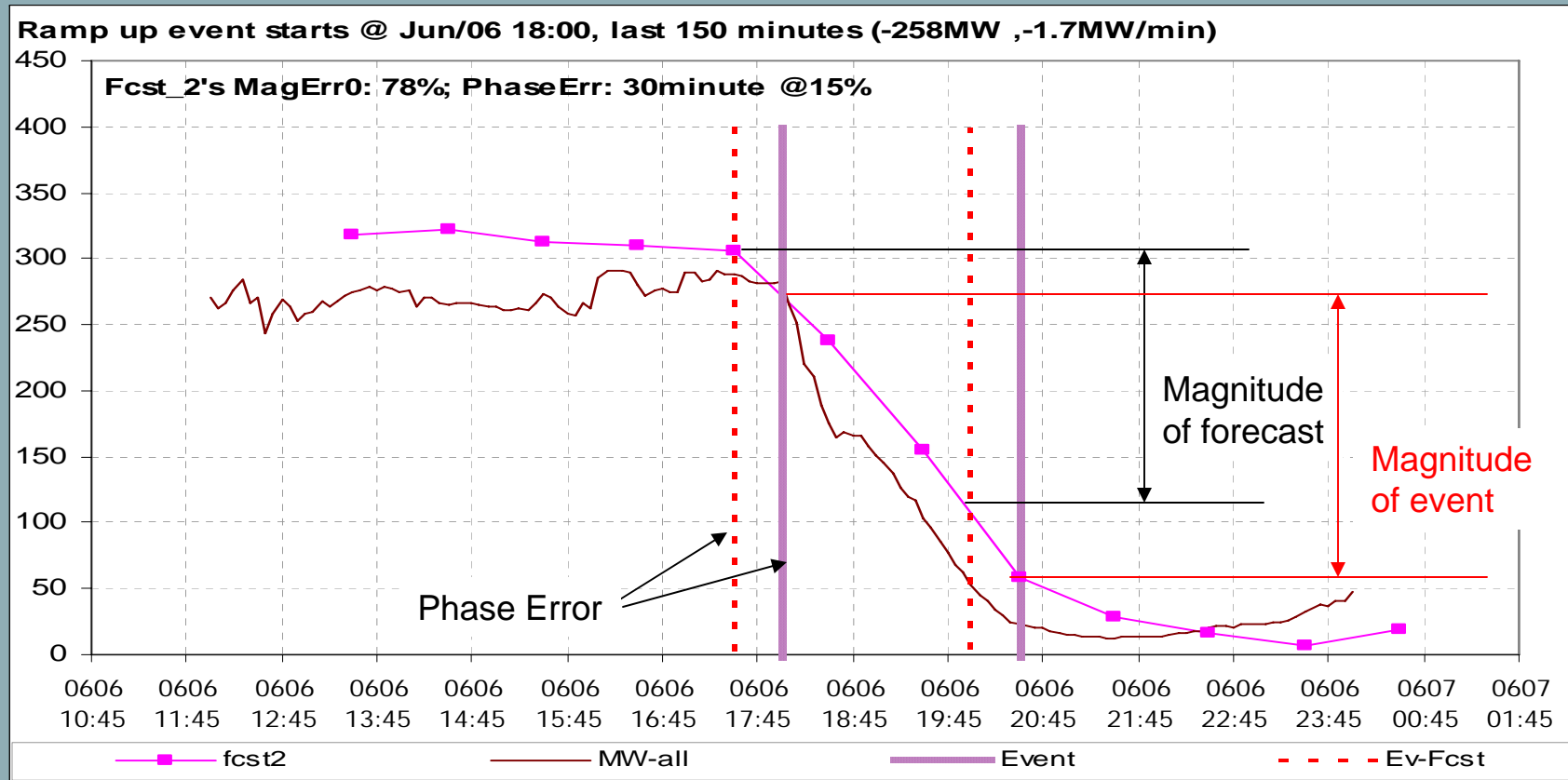


Event Analysis Methodology

Step 2

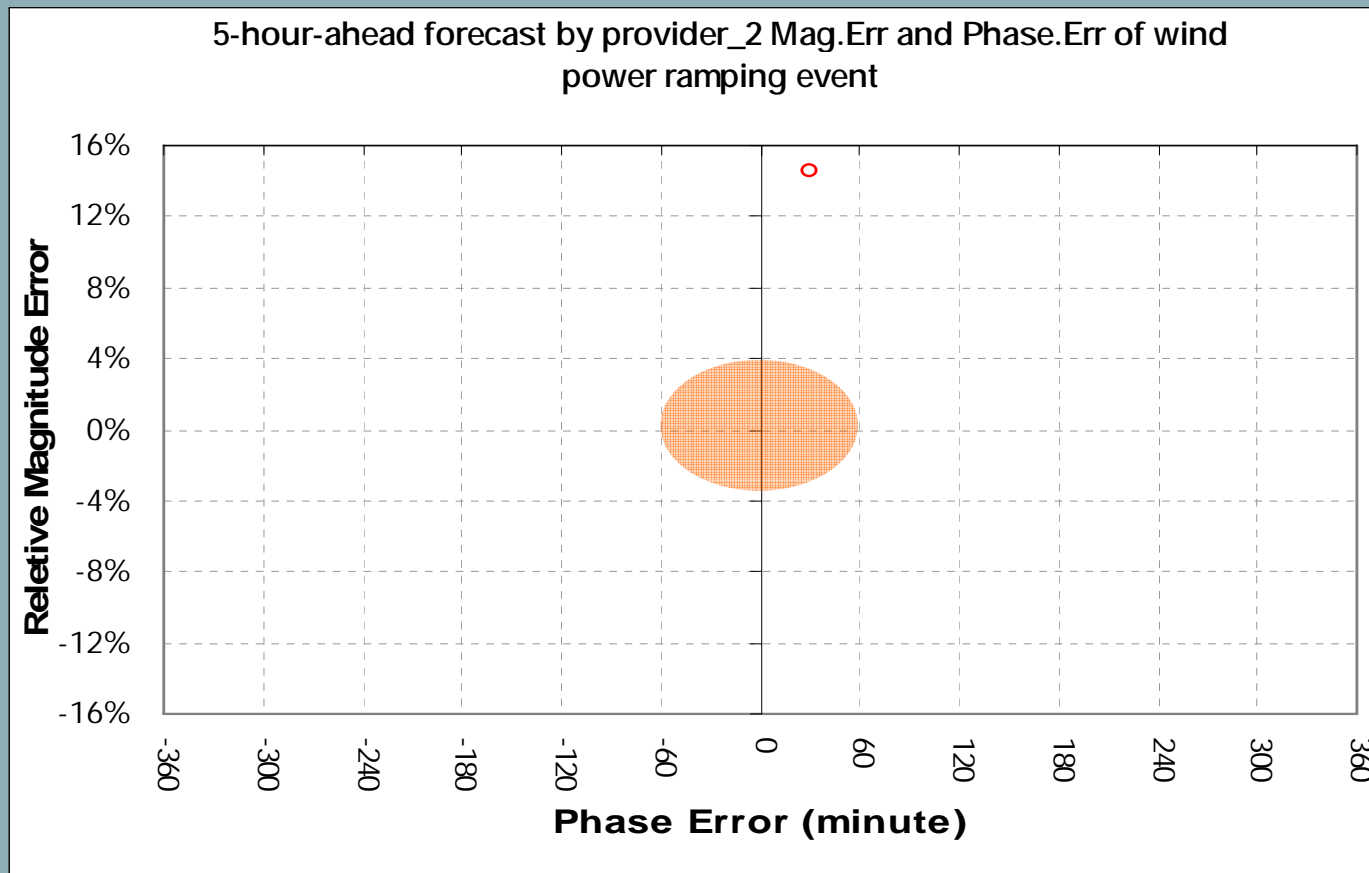


- Find the “best fit” for each forecast to the isolated event
 - Scan the forecasts from the start of the event back 6 hours and forward 6 hours to find the closest forecasted ramp in magnitude



Example Result Plot

- Shaded area is the sample target
- Negative magnitude error indicates an over forecast



Purpose of Event Analysis

- Provide a feel for how well the forecasts capture ramping events
- Provide a means to identify trends to event forecast error
 - By hour or month
 - By ramping direction up or down
 - By weather pattern (westerly or northerly winds, cold or warm front,...)
- Possibly provide a means to define a target or requirement in the future for event forecast error
- Once we understand what this error looks like, we can start to visualize how we might account for this error in operations

Des questions

- Darren McCrank, darren.mccrank@aeso.ca, 403-539-2623
- www.aeso.ca
- Wind Power Forecasting Pilot Project Site
 - <http://www.aeso.ca/gridoperations/13825.html>
- Special Event Analysis Site
 - <http://www.aeso.ca/gridoperations/13870.html>
- Project Updates Site
 - <http://www.aeso.ca/gridoperations/13867.html>
- Weekly Report
 - <http://www.aeso.ca/gridoperations/14246.html>