Wind Power Forecasting

MSWG

September 12, 2005

Draft – For Discussion Only

Need for Forecasting

- Day-ahead mean absolute error (MAE)
  - 25.2% using persistence
    - Assume tomorrow will be the same as today
  - 13.6% using a wind forecast
    - MAE can be greatly reduced with accurate knowledge of wind turbine outages
- Real-time (1-hour) mean absolute error (MAE)
  - 10.1% using persistence
    - Assume next hour will be the same as this hour
  - 5.1% using a wind forecast
    - Forecast benefits become important at about 1 hour out. Persistence is probably adequate to predict wind power output 15-30 minutes out.

Day-Ahead Forecast Overall Performance Annual Statistics and Error Distribution
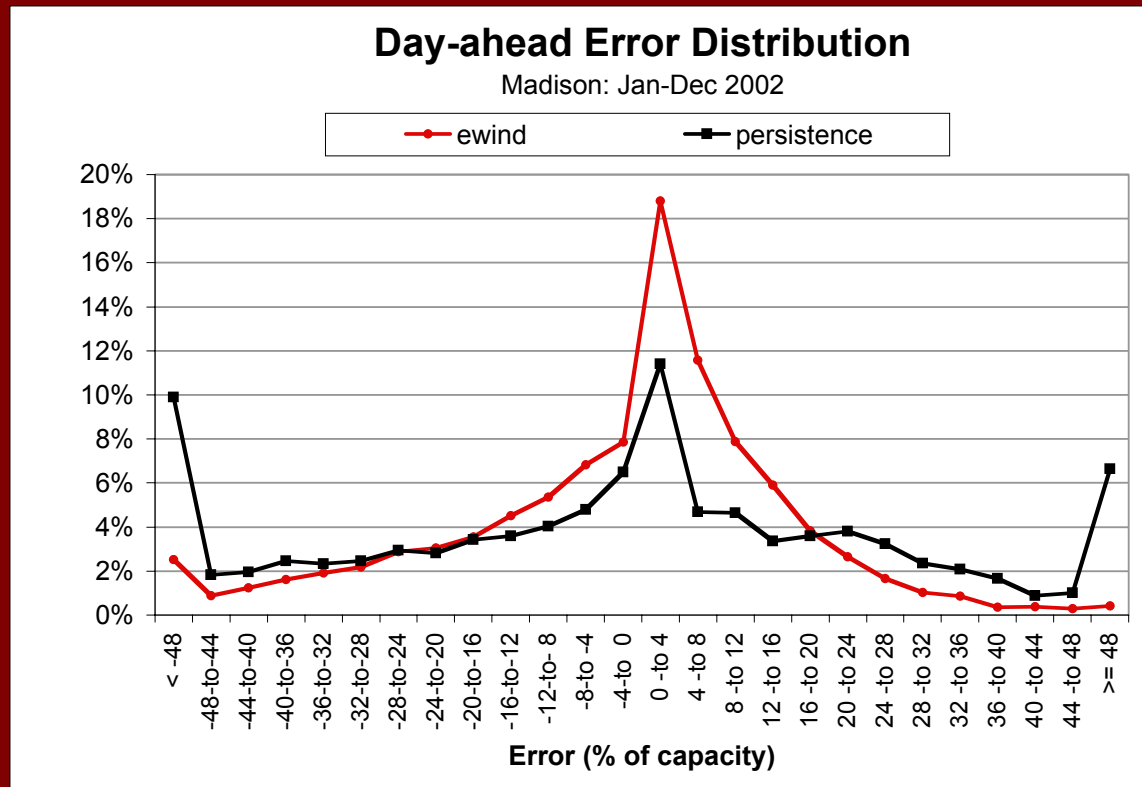
Annual Performance Statistics

Median Error
9.7%
Mean Absolute Error
13.6%
Persistence MAE
25.2%
Skill vs. Persistence
46.1%

Day-ahead Error Distribution
Madison: Jan-Dec 2002

— ewind — persistence

Error (% of capacity)

Hour-Ahead Forecast Overall Performance
Annual Performance Statistics

Hour 1 (0-60 min)

(four 15-min intervals)

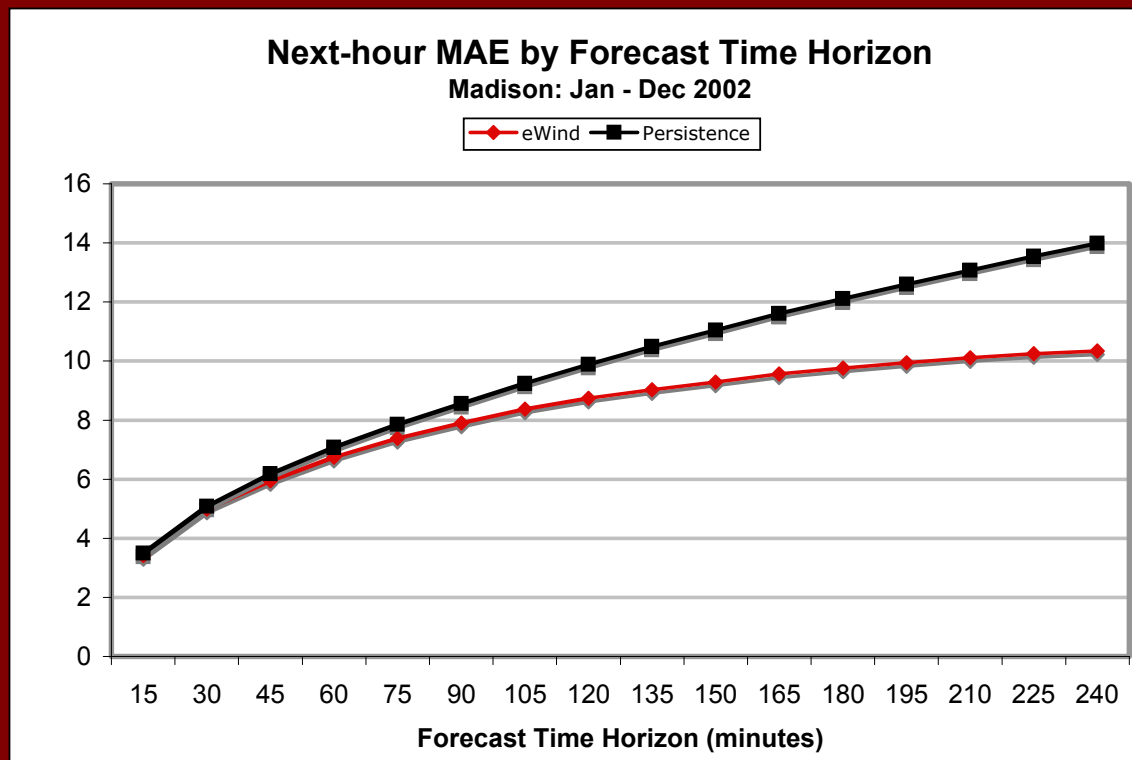MAE
5.7%

Skill (vs. Persistence)
5.1%

Hour 4 (180-240 min)

(four 15-min intervals)

MAE
10.1%

Skill (vs. Persistence)
22.3%

Next-hour MAE by Forecast Time Horizon
Madison: Jan - Dec 2002

eWind ◆ Persistence ■

Forecast Time Horizon (minutes)

Accurate Forecast Requires

- Meteorological instrumentation at each wind farm (important for real-time forecasts).

- Proper maintenance (periodic calibration) of meteorological instrumentation.

- Accurate reporting of wind turbine outages.

Probable Architecture