MARKET SURVEILLANCE COMMITTEE

Day-ahead market enhancements discussion: Role of forecast uncertainty

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Shortening lead times reduces forecast errors: DA → hrs-ahead → RT

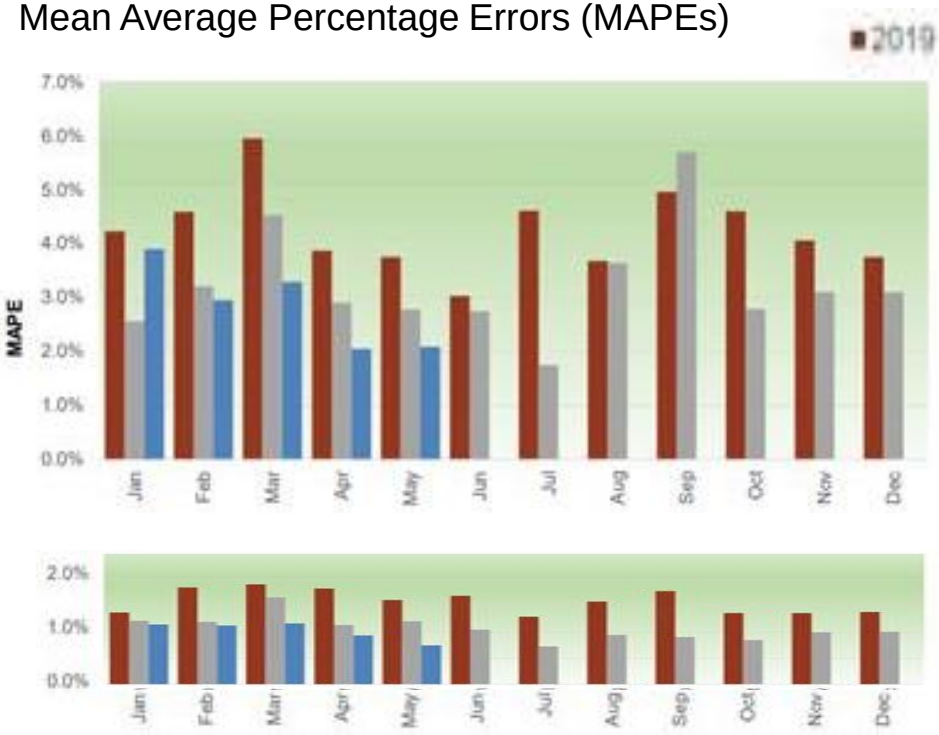
- This is the experience with solar, wind, and net load forecasts at the ISO and elsewhere (see appended slides)
  - Whether measured as reductions in :
    - RMSE/MAPE of forecast error or
    - Prediction width of probabilistic forecast
- The significant reduction in uncertainty from IFM → STUC → RTPD means that some of the IR procured could be from resources that require more than 15 minutes lead-time, which *might*:
  - save significant $, if IR from 15-minute capacity alone is costly
  - avoid skewing investment towards unneeded highly flexible capacity
- However, this would complicate the DAME proposal:
  - Multiple IR-Up and IR-Down products and prices
  - Complicated accounting of imbalances between IR and RT-Energy/FRP

→ Could implement 15-min requirement only and then elaborate in future

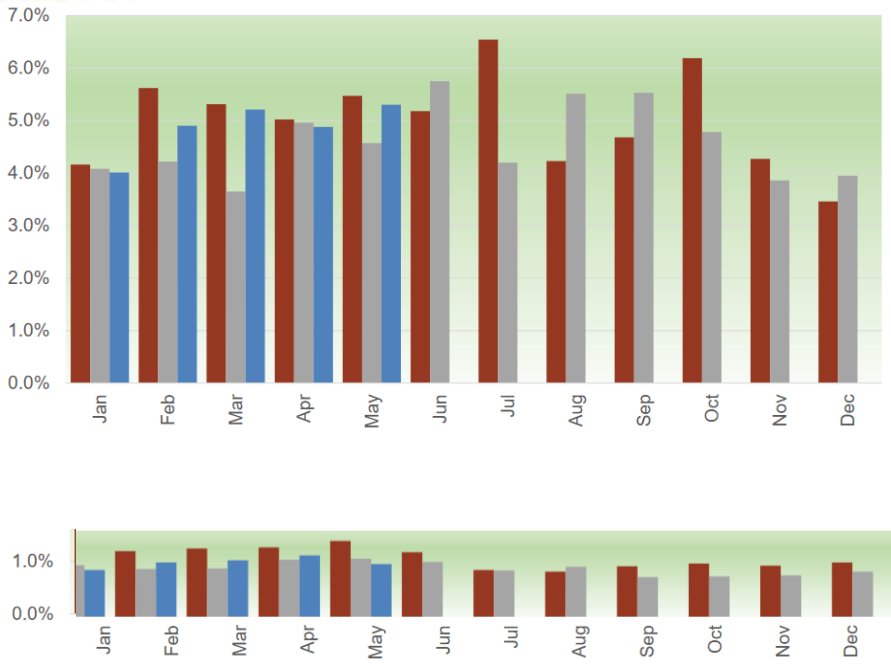
Addendum: Examples of Forecast Errors

- CAISO (adapted from G. Bautista-Alderete, R. Kalaskar, A. Javanbakht, MPPF, June 2021, www.caiso.com/Documents/Presentation-MarketPerformance-PlanningForum-Jun222021.pdf)

DA and RT Solar Forecast
Mean Average Percentage Errors (MAPEs)

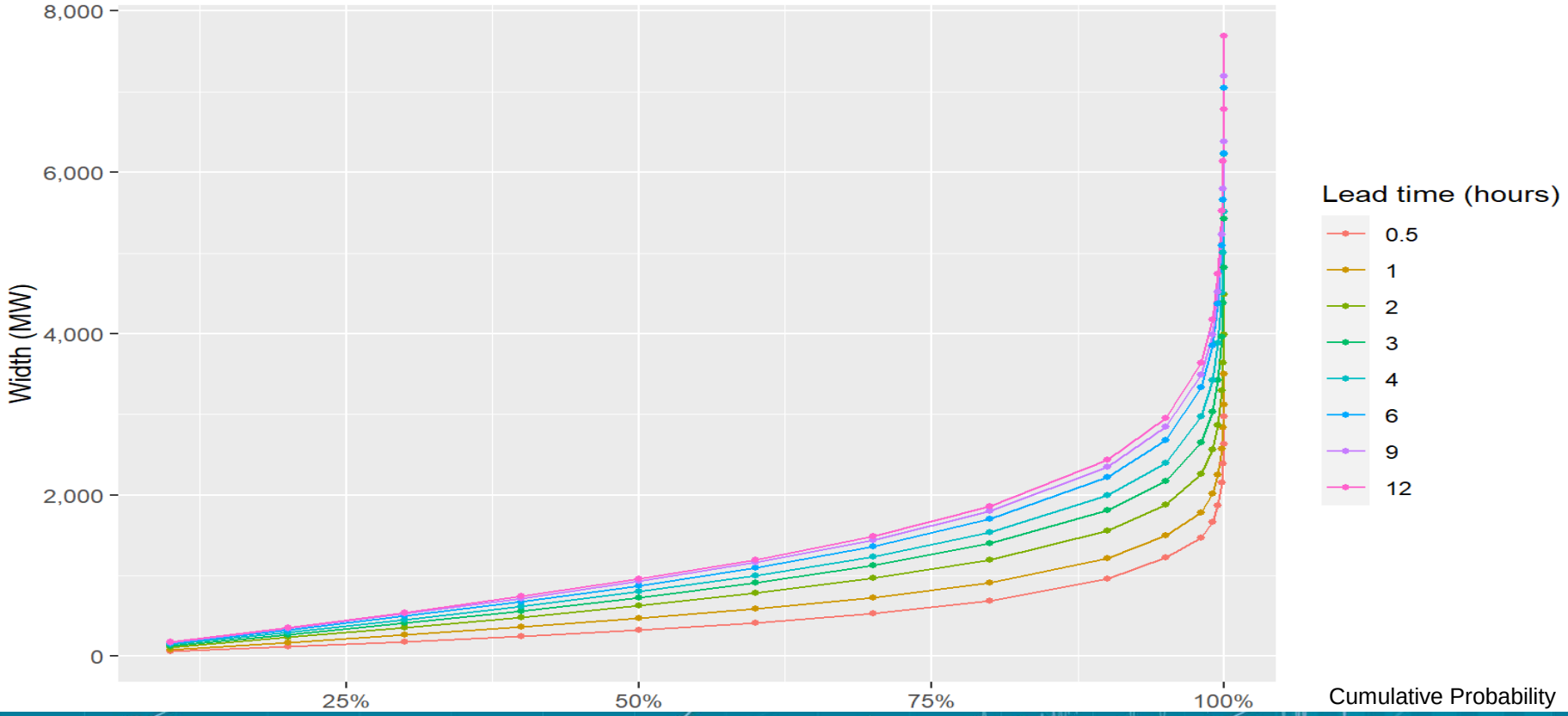


DA, RT Wind Forecast MAPEs



A European country's probabilistic net load forecasts

- ~1/4 reduction in forecast uncertainty ("prediction width") 12 hr ahead → 3 hr ahead (Source: Jethro Browell, Glasgow University, UK, and Gordon McFadzean, TNEI, personal communication)



EIM Area Solar Forecasts

- Reductions in solar insolation forecast error of >50% (DA vs. 75-min forecasts) and ~25% (75-min vs. 15-min forecasts) (Source: Reproduced from A. Kaur, L. Nonnenmacher, H. Pedro, C.F.M. Coimbra, "Benefits of solar forecasting for energy imbalance markets" Renewable Energy, Vol. 86, 2016, 819-830)

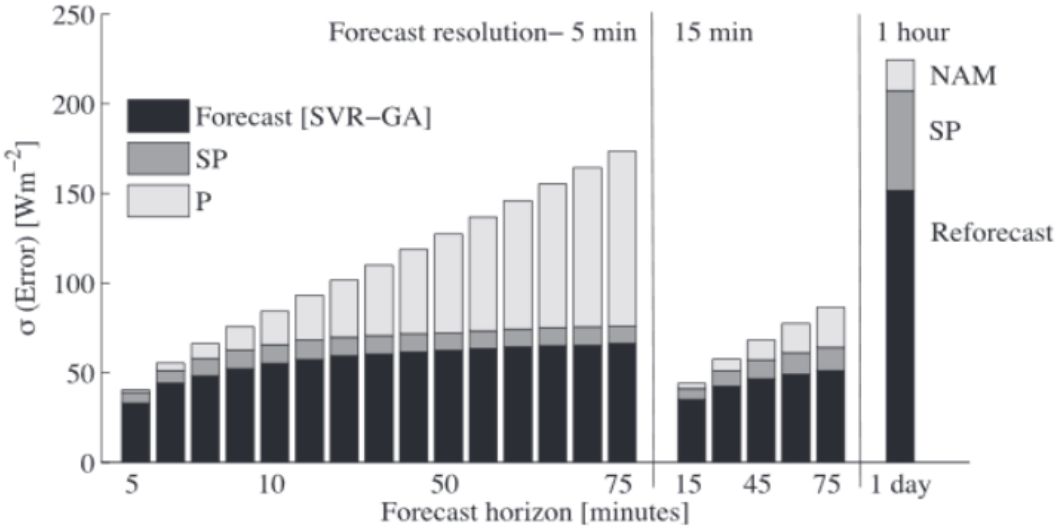
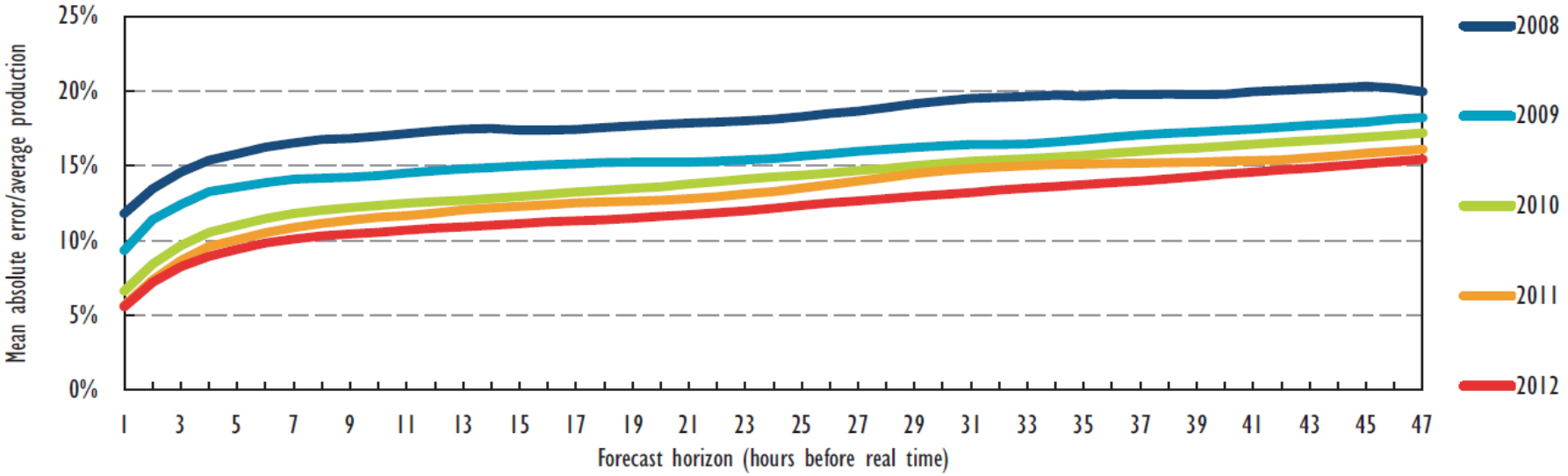


Fig. 7. Standard deviation in forecast error for forecast horizons ranging from 1 day to 5 min ahead forecast horizons in 1 h, 15 min and 5 min resolution. The total height of the bar represents the standard deviation in the P forecast errors and then the stacks within a bar shows the reduction in σ by the SP and SVR-GA model. For the one day-ahead forecast, the standard deviation is the highest for the plain NAM forecast, followed by P model. The best performance is achieved by the reforecast model. This chart can be used for any solar forecast application study to design the modeling parameters for the uncertainty at various time-horizons.

Spain: ~40% reduction in wind forecast errors if lead time reduced from 24 hrs → 3 hrs

- (Source: courtesy of Bri-Mathias Hodge, U. Colorado)

Figure 2.9 • Improvement in wind power forecasts in Spain, 2008-12



Source: based on data from Red Eléctrica de España.

Key point • Wind power forecasts have improved over recent years. Forecasts looking ahead only a few hours are more accurate than day-ahead forecasts.

Belgium: ~1/3 reduction in wind errors when lead time reduced from 24 hrs → 3 hrs

- (Source: M. Hermans, K. Bruninx, E. Delarue, "Impact of generator start-up lead times on short-term scheduling with high shares of renewables," Applied Energy, Vol. 268, 2020, 114935)

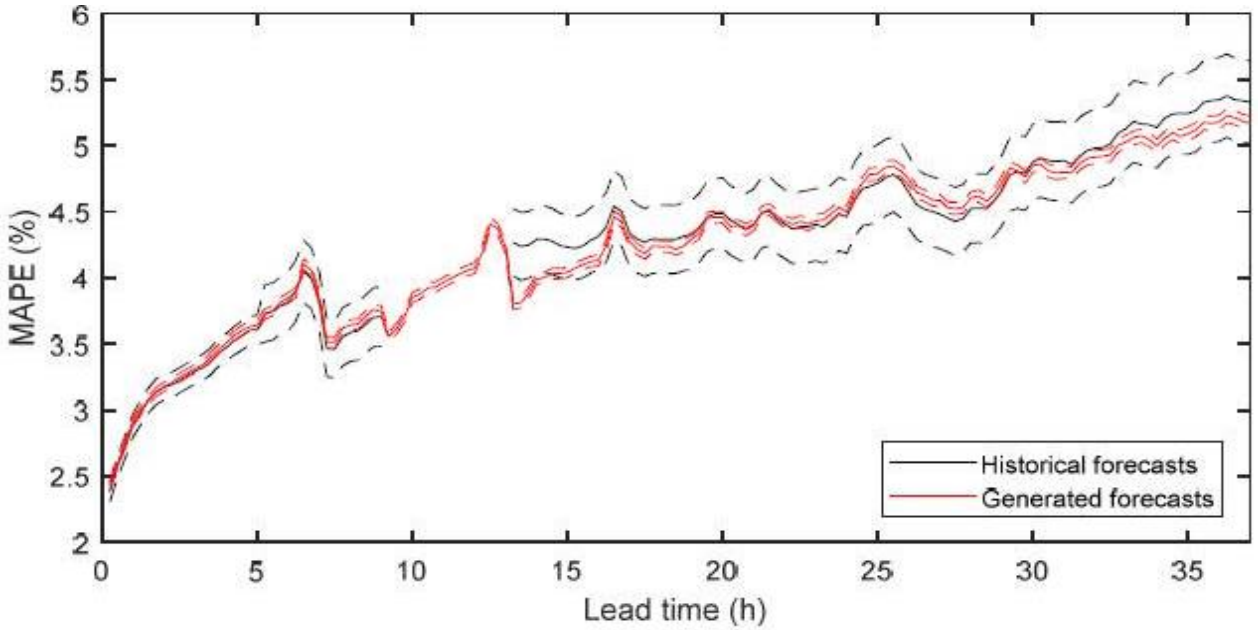


Fig. 3. The MAPE of generated forecasts (10 years) lies within the 95% confidence intervals of the MAPE of historical forecast data (3 years). Prior to analysis, the time series and forecast errors were normalized with respect to the available wind power capacity. Forecasts with lead times from 1 to 9 h and 13.25 to 37 h were available in the historical data. For the missing lead times 9.25-13 h, data was copied from the closest range of day ahead lead times.