

Wind Park Valuation and Risk Management in Germany

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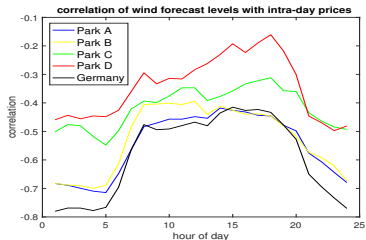
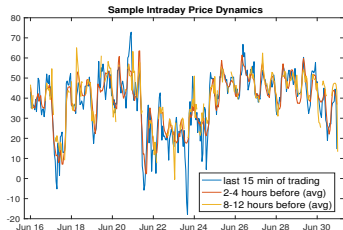
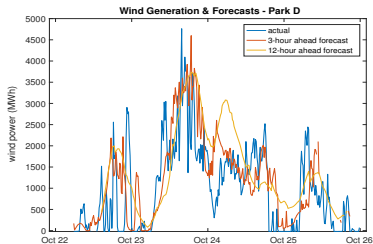
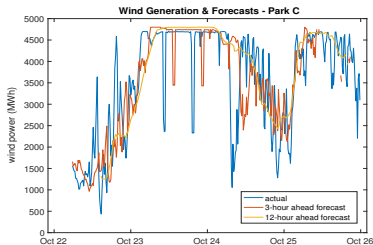
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- **hoW?** In short, by finding balancing cost to manager responding to wind forecasts $F_t(T)$ and intra-day prices $P_t(T)$, for all T .

What does the data look like?

Wind forecasts $F_t(T)$ (top) and intra-day prices $P_t(T)$ (bottom) exhibit periodicities, spikes, upper/lower bounds, and clear negative correlations:



So how do we find p ?

Simplest strategy: assume the manager sells all forecasted generation F_{t_0} day-ahead, then rebalances continually as F_t moves.

Resulting cashflows: from the manager's perspective for each T (excluding for now imbalance penalties at T):

$$\text{Cashflow}(T) = F_{t_0} P_{t_0} + \sum_{i=1}^N P_{t_i} (F_{t_{i-1}} - F_{t_i}) - F_{t_N} (P_{t_0} - p),$$

where $t_0 \approx T - 1$ (day-ahead), and $t_N \approx T$ (or last trade).

Valuation: Setting expected values equal to 0 and solving for a 'fair' p :

$$p = \frac{\sum_T \mathbb{E}[P_{t_0} (F_{t_0} - F_{t_N}) | t_0]}{\sum_T \mathbb{E}[F_{t_N} | t_0]} + \frac{\sum_T \mathbb{E}[\sum_i^N P_{t_i} (F_{t_{i-1}} - F_{t_i}) | t_0]}{\sum_T \mathbb{E}[F_{t_N} | t_0]}$$

So where are we now?

- Results: initial tests with simple strategies on historical paths.
- Insights: links with correlations generally sensible and validate ideas.
- Next steps: proper model for F and P dynamics, bid-ask spreads and analyzing different trading strategies, etc.
- Conclusions: no time for any at the moment! :)