

Comments from a Meteorological Perspective

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- Planning Time Scales
- Operational Time Scales

Planning Time Scale

- **Tutorial on Weather Data Sets for Power System Planning held on Tuesday**
- **Where we are**
 - Many (historical and future) datasets with vastly different attributes are available
 - Arguably, almost all have serious issues for most of the primary planning applications
 - No meaningful guidance on relative suitability of datasets for specific applications is available
 - NREL is conducting a survey on user perspectives, needs and practices
 - You can still participate! (see Luke Lavin's tutorial slides for details)
 - This will be valuable guidance for the community's future path
- **Thoughts for the Future**
 - Should we create a state-of-the-art dataset specifically for power system planning?
 - **Need standards for dataset inter-comparison to facilitate informed decision-making**
 - Key attributes are use-case dependent
 - Need to define a set of reference metrics for a set of primary use-cases
 - **Underlying Issue:** what are the relative merits (on a range of planning horizons) of using extrapolated historical attributes with recent trends vs climate model simulations?

Operational Time Scale – Part 1

- **Probabilistic Forecasts**

- Impressive effort by ISOs to develop tools/procedures to use probabilistic forecasts/information to estimate & manage generation/load uncertainty
- **Potential Next Steps: optimize the probabilistic information being used**
 - Two main issues in many current probabilistic forecast use-cases
 - Many use only historical forecast error distributions (not very sensitive to cases/scenarios)
 - Ensemble users often employ uncalibrated & sometimes very small ensembles (probably a biased representation of true uncertainty)
 - Evaluation of attributes of probabilistic forecasts has mostly not been considered
 - Which methods provide the best information about variations in uncertainty?

- **AI/Machine Learning**

- Rapidly advancing sophistication of AI/Machine Learning tools to energy forecasting problems on a broad range of times scales
- Results indicate significant improvement on time scales where NWP has not been especially effective (intra-hour, seasonal)
- But what is the future? Will AI/ML continue to provide significant increases in forecast value?
- **What benefits might be obtained from the emerging AI/ML-based Weather Prediction models?**

Operational Time Scale – Part 2

- Where to put forecast improvement effort?
 - David Larson (EPRI) commented “reducing average error” is not enough
 - Improvement in which forecast performance attributes will provide the most value?
 - Use-case dependence
- Changing relationships of met variables to power system variability
 - Hybrid power plants (information for battery charge management)
 - EVs (how will EV charging be weather-dependent?)
 - Dual mode heating pump (presentation about PEI by Debbie Lew/Nick Miller)
 - What are we not thinking about?

From a Societal Perspective

- **WHAT are we doing?**

- Estimates are that we need to 4X the current renewable installation rate to transition the current electric system to meet ~2050 GHG emission goals
- Yet we see that load growth is now poised to dramatically accelerate
 - Part of this represents electrification of heating (heat pumps) and transportation (EVs) to reduce non-electric emissions
 - But it appears a substantial amount is increased energy use (e.g. data centers)
- What is actually achievable if we accept increased energy use?