Meteorology and Market Design for Grid Services Workshop
Online Webinar Session
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IEA Wind Recommended Practice on Renewable Energy Forecast Solution Selection

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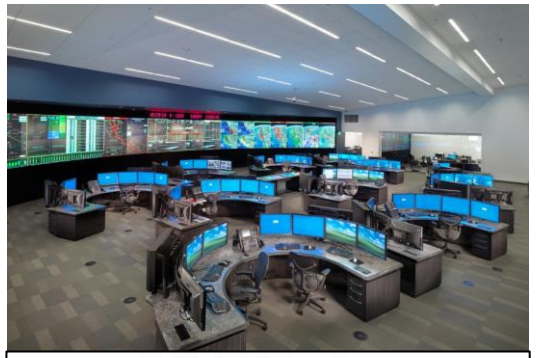
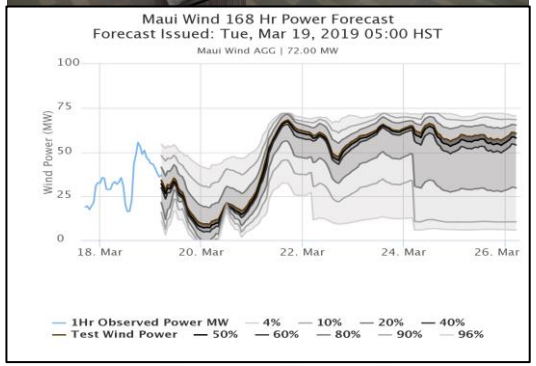
Overview

- Motivation
- Structure of IEA Recommended Practices for Forecast Solution Selection
- Key Points in Each Component Document
- Where to Get More Information

The Issue

- **Documented Benefits:** Use of forecasts to assist in the management of the variability of wind-based (and solar-based) generation can lower variable generation integration (system) costs while maintaining the required high system reliability
- **Problem:** A substantial amount of the potential value of forecasting is not realized due to the use of non-optimal forecast solutions by users
    - Specification of the wrong forecast performance objective(s)
    - Poorly designed and executed benchmarks/trials of alternative solutions
    - Use of non-optimal evaluation metrics for forecast evaluation





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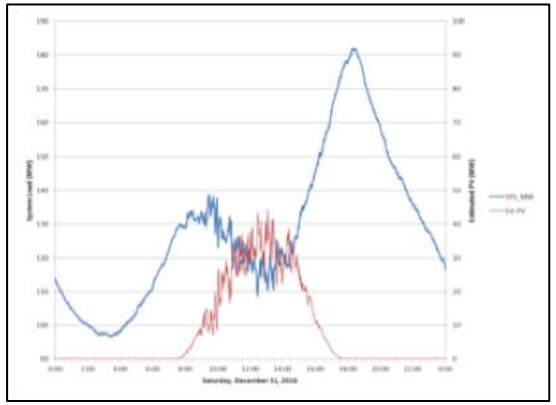
Misaligned Forecast Objectives: An Example from the "Big Island" of Hawaii

WHAT THEY REQUESTED VS. WHAT THEY NEED

REQUESTED: 0-6 hr forecasts that minimize the squared error for every 15-min interval

- Produced from multi-method (NWP, statistical, satellite cloud advection) forecast ensemble
- Two Forecast Time Frames
  - **Intra-day**
    - 0-6 hrs ahead in 15-min time steps
    - 15-min updates
  - Multiple Day
    - 0-7 days ahead in 1-hr time steps
    - 1 hr updates
- **Resulting Forecast Attributes**: phase and amplitude errors in small scale cloud features at 15-min scale force squared error optimization to create a smooth forecast (minimal temporal variability)

Issue: large mid-day net load variability driven by distributed PV variability



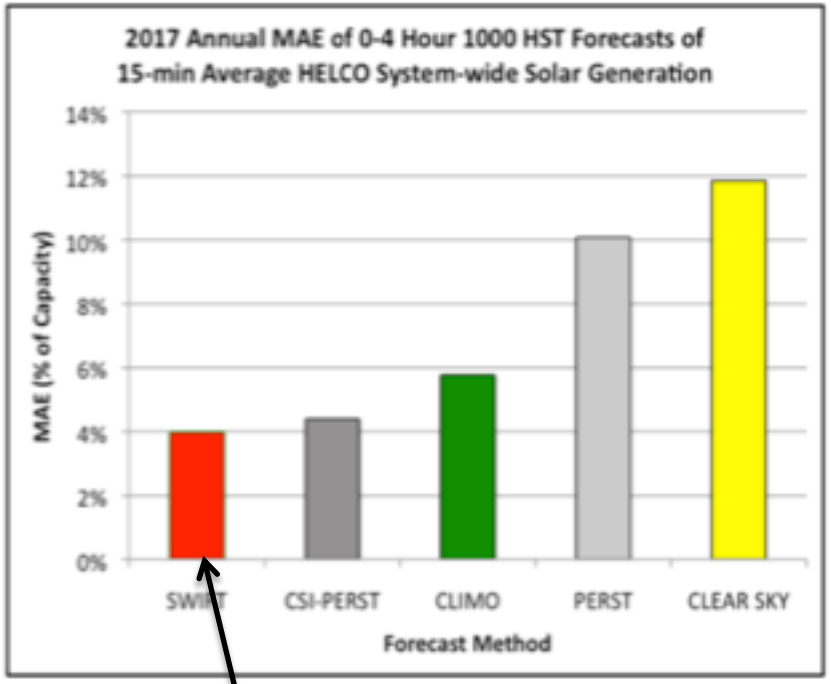
- Adequate ramping capability must be available with the online units to ensure that the system frequency doesn't go too high or too low
- Key Question: What will be the optimal mix of online and offline (quick-start) ramping resources for the midday period?

NEED: Mid-day (1000-1400) range of variability forecast (not necessary to have each 15-min period correct – just the generation envelope)

Misaligned Forecast Objectives: An Example from the "Big Island" of Hawaii

THE RESULT

Mean Absolute Error (or RMSE) looks good!

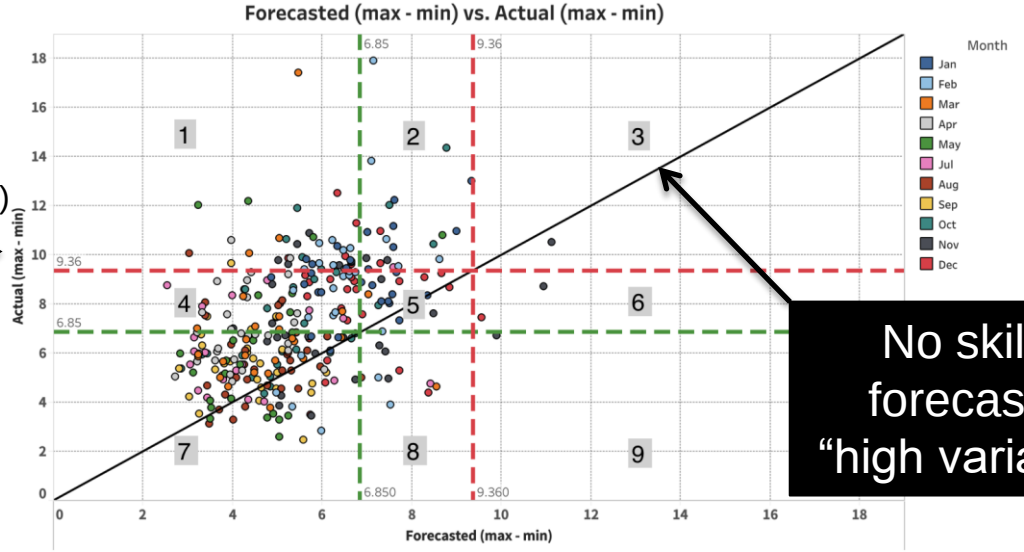


MAE for 0-4 hr forecasts for mid-day period is 4 % of Capacity and 15% lower than "smart persistence"

Same period (2017)

Prediction of Variability is Inadequate for Decision-Making on Mid-day Reserves

Actual vs Forecasted Mid-day Range of 15-min Solar Gen (MW)



No skill at forecasting "high variability"

Count		Forecasted			
Observed	Category	Low	Moderate	High	Obs %
	High	40	21	1	20.0%
	Moderate	72	20	2	30.3%
	Low	143	10	1	49.7%
	Forecast %	82.3%	16.5%	1.3%	100.0%

To Address this Issue: International group of experts have interacted under the framework of IEA Wind Task 36 to formulate a set of documents that specify the “best practices” for selecting a renewable energy forecasting solution…….

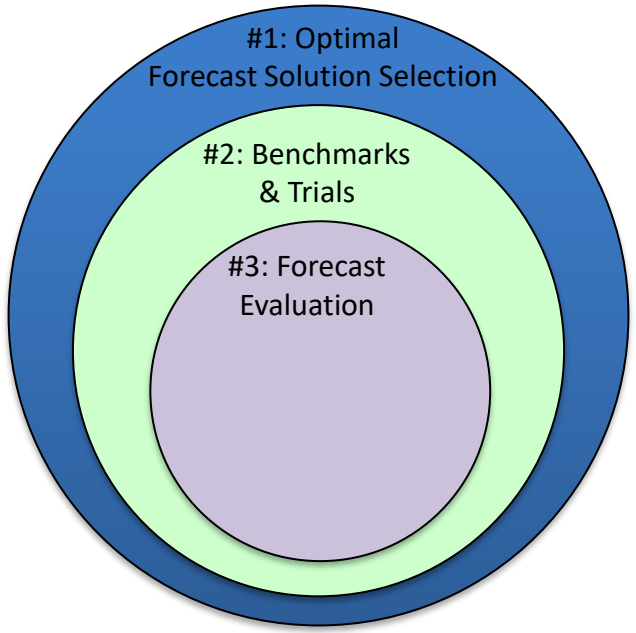
Structure of IEA-WIND Recommended Practice For Forecasting Solution Selection

Target: Compile guidance for the implementation of renewable energy forecasting into system operation

Approach: Develop a set of 3 documents that specify IEA Wind Recommended Practices for:

1. **Selection of an Optimal Forecast Solution**
2. **Design and Execution of Benchmarks and Trials**
3. **Evaluation of Forecasts and Forecast Solutions**

Current Status: Accepted by IEA Wind ExCo & published

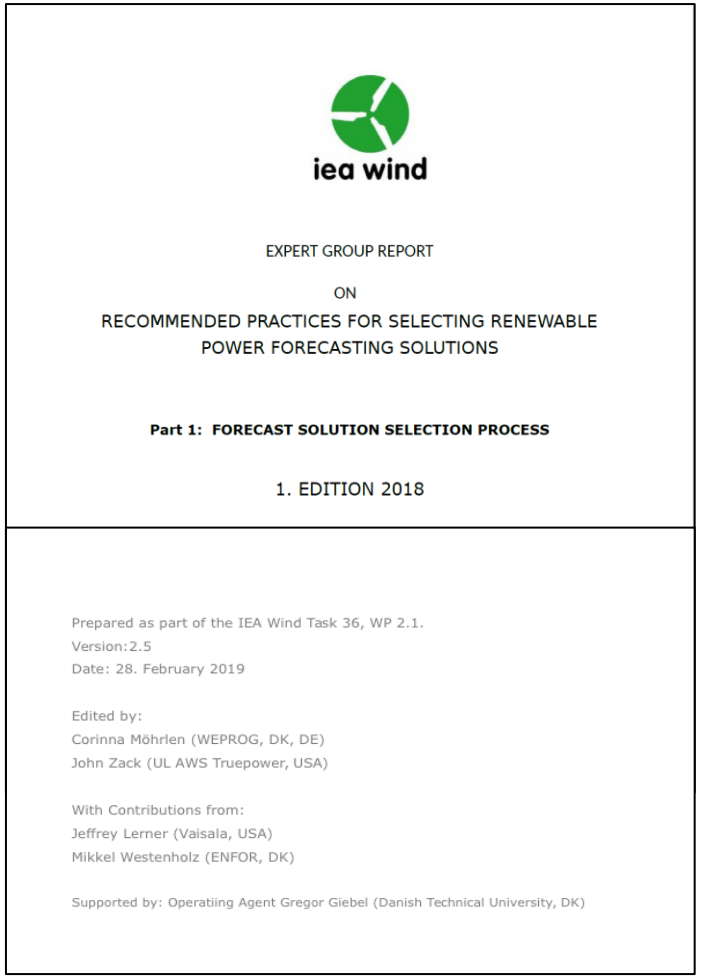


The best practices guidelines are based on many years of industry experience and are intended to achieve maximum benefit for all parties involved in the forecasting area.

Recommended Practice page :http://www.ieawindforecasting.dk/Publications/RecommendedPractice

Part 1: Selection of an Optimal Forecast Solution

- Presents an overview of the factors that should be considered in the solution selection process
- Discusses the issues associated with each selection factor
- Provides a “decision support tool” to assist users in the design and execution of a solution selection process
- Provides practical lists and FAQ’s for the RFI/RFP tendering process



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EXPERT GROUP REPORT

ON

RECOMMENDED PRACTICES FOR SELECTING RENEWABLE POWER FORECASTING SOLUTIONS

Part 1: FORECAST SOLUTION SELECTION PROCESS

1. EDITION 2018

Prepared as part of the IEA Wind Task 36, WP 2.1.
Version:2.5
Date: 28. February 2019

Edited by:
Corinna Möhrlen (WEPROG, DK, DE)
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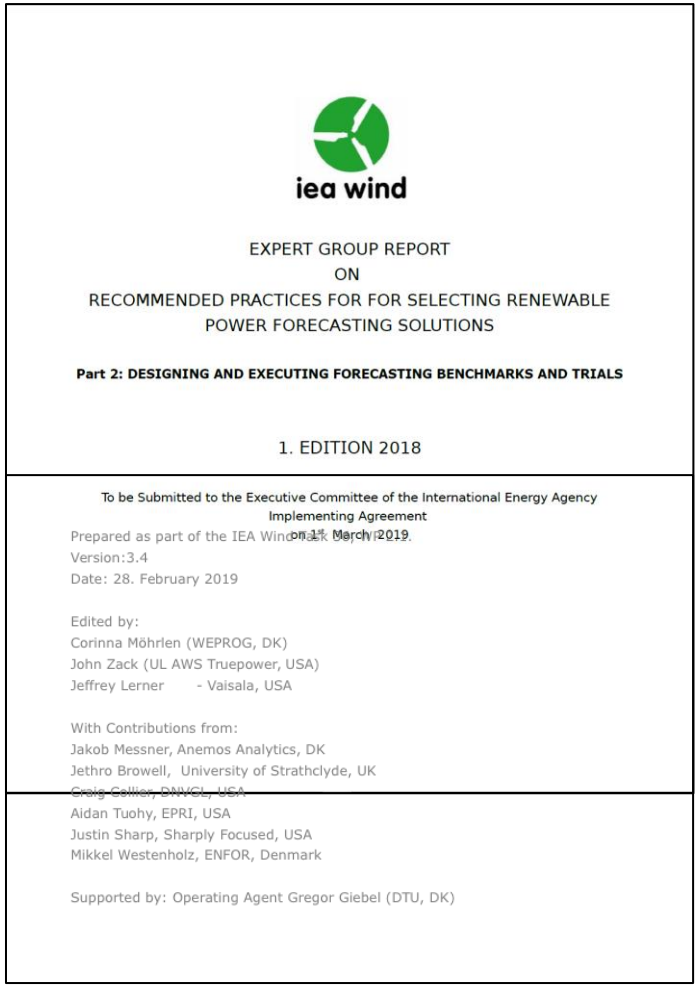
Mikkel Westenholz (ENFOR, DK)

Supported by: Operatiing Agent Gregor Giebel (Danish Technical University, DK)

Part 2: Conducting a Benchmark or Trial

- Presents the three phases of a forecasting benchmark or trial
  - Planning
  - Execution
  - Analysis
- Discusses the factors and issues that should be considered in each phase
- Provides a list of pitfalls to avoid



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EXPERT GROUP REPORT
ON
RECOMMENDED PRACTICES FOR FOR SELECTING RENEWABLE POWER FORECASTING SOLUTIONS

Part 2: DESIGNING AND EXECUTING FORECASTING BENCHMARKS AND TRIALS

1. EDITION 2018

To be Submitted to the Executive Committee of the International Energy Agency Implementing Agreement
on 1st March 2019

Prepared as part of the IEA Wind Task Deployment
Version:3.4
Date: 28. February 2019

Edited by:
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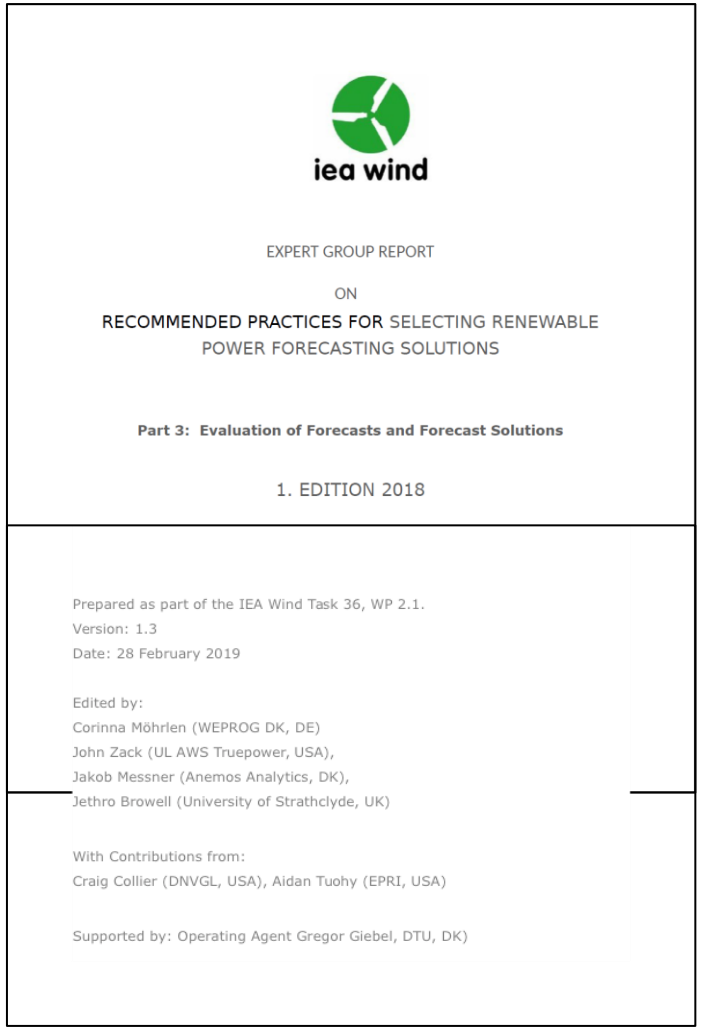
Part 3: Evaluation

- Presents the three key attributes of an evaluation process
  - Representativeness
  - Significance
  - Relevance
- Discusses the factors and issues that should be considered for each attribute
- Provides recommendations for conducting a high quality and meaningful evaluation



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RECOMMENDED PRACTICES FOR SELECTING RENEWABLE POWER FORECASTING SOLUTIONS

Part 3: Evaluation of Forecasts and Forecast Solutions

1. EDITION 2018

Prepared as part of the IEA Wind Task 36, WP 2.1.
Version: 1.3
Date: 28 February 2019

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RP-related Plans for Phase 2: 2019-2021

- *Increase awareness of the availability of the RP documents*
- *Obtain feedback on the usefulness of RP from the community*
  - *Key objective: get feedback from new or inexperienced forecast users (individual or organizations) as well as other users and industry stakeholders*
    - *RP component in Task 36 Open Space workshops held at WIW-2019 & ICEM-2019*
    - *Presentation of RP overview at several industry gatherings in 2020 & 2021*
    - *Conduct a dedicated RP workshop in 2021*

- *Expand the Scope of the RP documents*
  - *Include material on probabilistic forecast use and evaluation*
  - *Include more examples of issues and solutions*
  - *…. discuss with us, if you have suggestions not covered*

Where to Get More Information

IEA Wind Task 36 Session Topic 4: Request for Feedback on Version 1 of the Recommended Practices for Forecast Solution Selection

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RP-related Publications

RP Documents: http://www.ieawindforecasting.dk/Publications/RecommendedPractice

2019 Wind Integration Workshop (Dublin)
Paper in Proceedings
Presentation

2019 ESIG (Denver)
Presentation

YouTube Channel
Webinar on Recommended Practices

Task 36 Information

→ **Task 36 site**
- ieawindforecasting.dk

→ **Research Gate Project**
- www.researchgate.net/project/IEA-Wind-Task-36-Wind-Power-Forecasting

→ **IEA Wind Forecasting YouTube Channel:**
- www.youtube.com/channel/UCsP1rLoutSXP0ECZKicczXg