Task 36

5th International Hybrid Power Systems Workshop
Virtual
Session 3B - Forecasting
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Recommended Practice for Optimal Selection of Short-term Renewable Power Production Forecast Solutions

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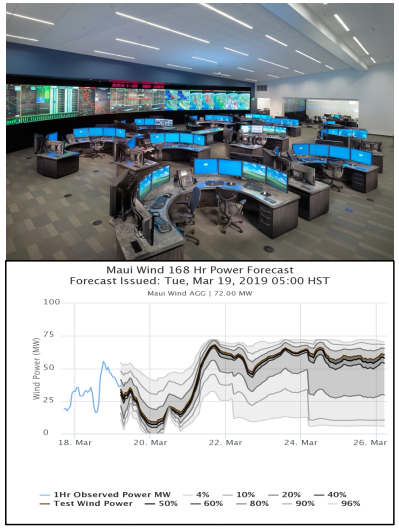
Overview

1. Background: The Problem and an Approach for a Solution
2. Overview: IEA Recommended Practice (RP) for Forecasting Solution Selection
3. Some Key Points from the RP Documents
4. Where to Get the More Information

The Problem

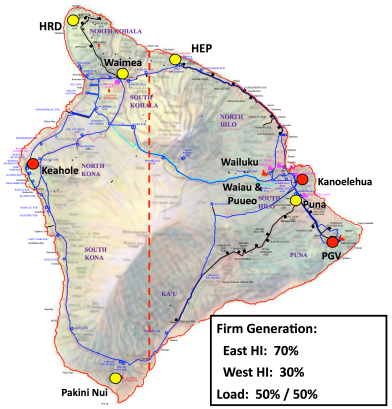
- **Documented Benefits:**
  - lower costs of variable generation integration (system)
  - high system reliability

- **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



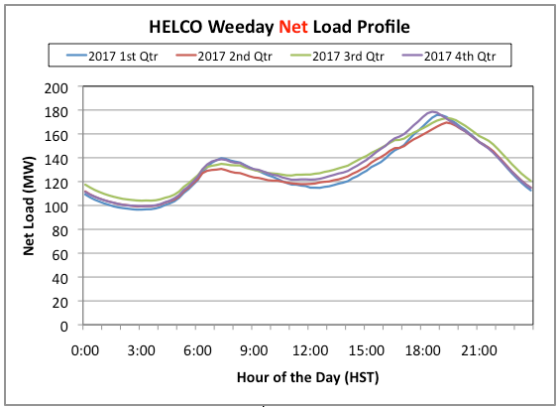
Misaligned Forecast Objectives:
An Example from the "Big Island" of Hawaii

SYSTEM OVERVIEW



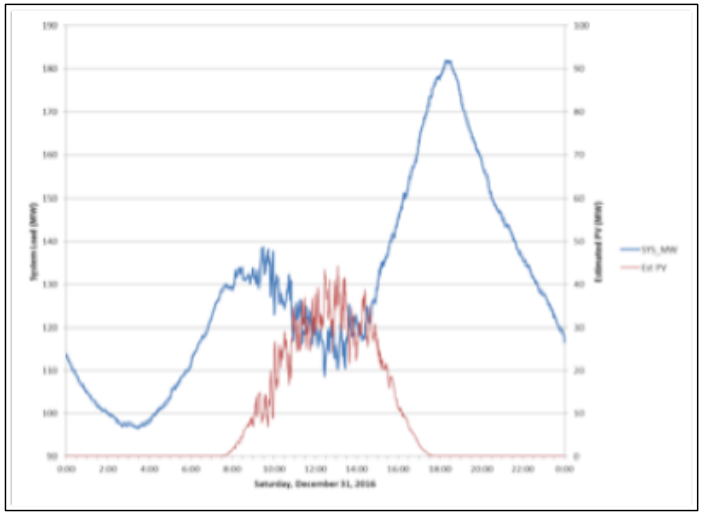
Renewable Resource	Capacity
Geothermal (1 facility)	38 MW
Hydro (3 facilities)	16.2 MW
Wind (2 facilities)	31 MW
Solar (BTM Distributed)	90 MW

- **Weekday Net load: 2 daily peaks**
  - Morning (~0800): 130-140 MW
    - Morning rise in gross load followed by morning rise in PV production
  - Evening (~1800): 170-180 MW
- **Weekday Net load: 2 daily minima**
  - Nighttime (~0300): 95-105 MW
  - Daytime (~1200): 115-125 MW
    - Associated with peak of distributed PV



Misaligned Forecast Objectives:
An Example from the "Big Island" of Hawaii
WHAT THEY REQUESTED VS. WHAT THEY NEED

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



- REQUESTED Forecast:
- **Multi-method forecast** (NWP, statistical, satellite cloud advection)
- 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

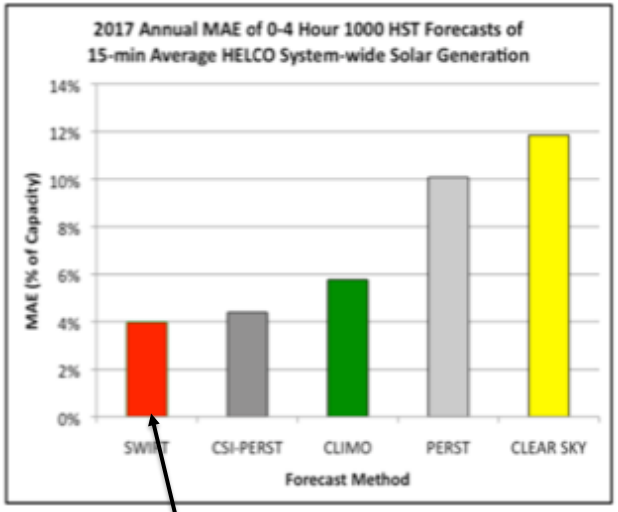
NEED: Mid-day (1000-1400) range of variability forecast (generation envelope)

PROVIDED: Forecasts that minimize the squared error for every 15-min interval

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

THE RESULT

Mean Absolute Error (or RMSE) looks good!

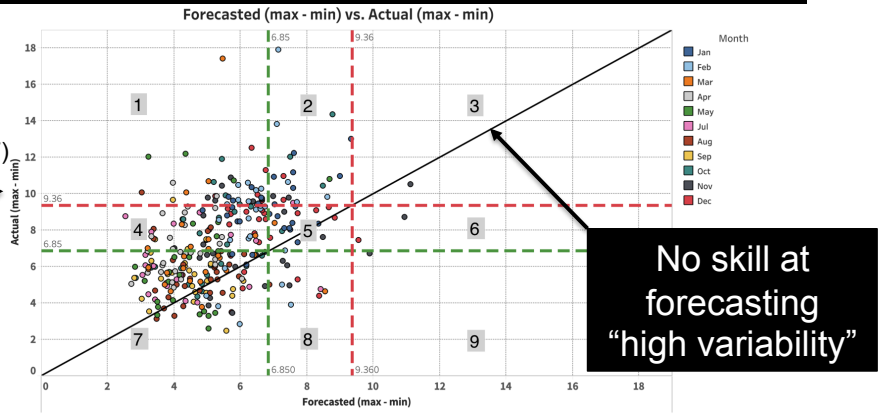


MAE for 0-4 hr forecasts for mid-day period is 4 % of Capacity and 15% lower than "smart persistence"

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…….

Background: What is IEA Wind and Task 36?

What is the IEA (International Energy Agency)? (www.iea.org)

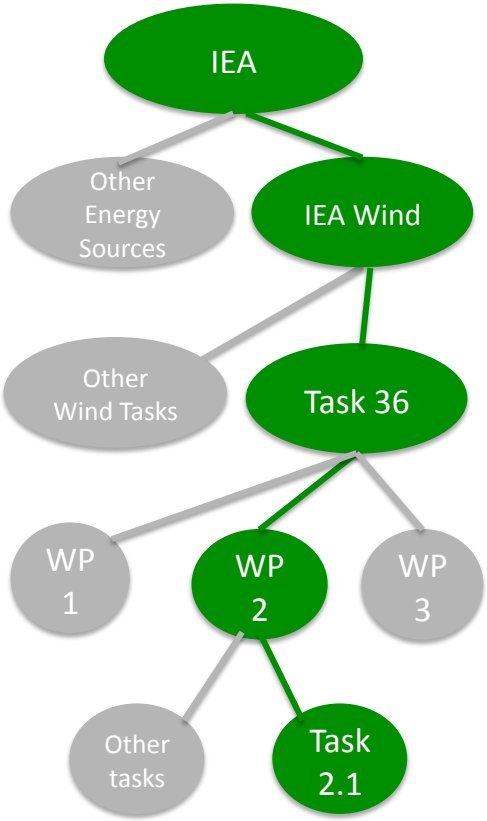
- International organization within OECD with 30 member countries and 8 associates
- Promotes global dialogue on energy, providing authoritative analysis through a wide range of publications
- **"IEA Wind" - IEA Wind Technology Collaboration Programme (IEA Wind TCP)**
  - One activity: convenes panels of experts to address specific topics/issues such as Task 36

Task 36: Forecasting for Wind Energy: (www.ieawindforecasting.dk)

- One of several ongoing Tasks of IEA Wind: https://community.ieawind.org/home
- Phase 1 started in 2016 for 3 years; Phase 2 began in 2019 for additional 3 years
- Operating Agent is Gregor Giebel of DTU Wind Energy
- Objective: facilitate improvements in performance and **value of wind energy forecasts**

Task 36 Scope: Three "Work Packages"

- WP1: Global Coordination in Forecast Model Improvement
- WP2: Benchmarking, Predictability and Model Uncertainty
  - **Task 2.1: Recommended Best Practices for Forecast Solution Selection**
- WP3: Usage of Probabilistic Forecasts and Scenarios

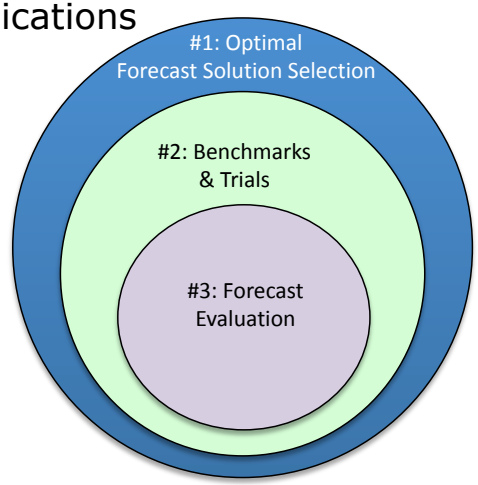


Result of the Task 36 WP2.1:
Recommended Practices for the Selection of Renewable Energy Forecasting Solutions

Target: Guidance for the optimal selection of renewable energy forecasting solutions for a wide range of user types and applications

Result: Set of 3 documents specifying IEA Wind Task 36 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**

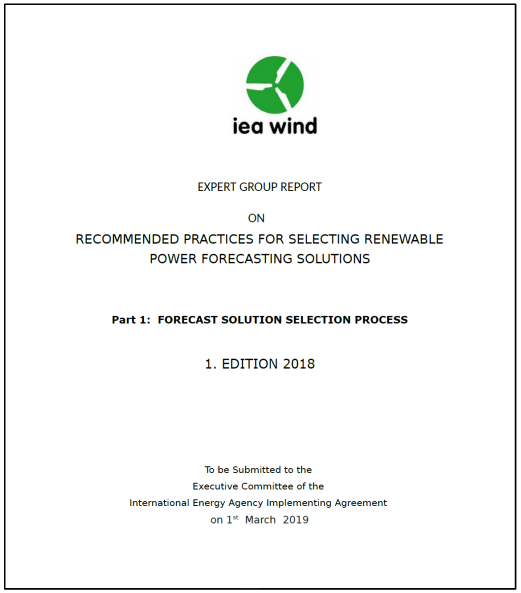


Current Status: Version 1 accepted by IEA Wind ExCo & published

Download: 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

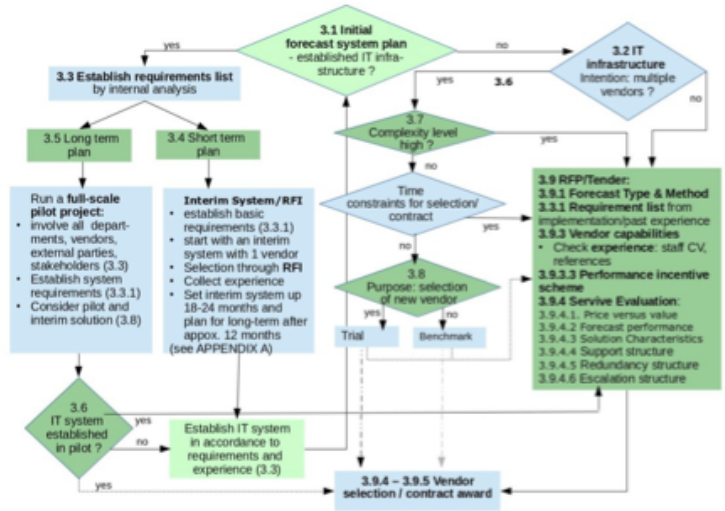
To be Submitted to the
Executive Committee of the
International Energy Agency Implementing Agreement
on 1st March 2019

Part 1: Key Points

Issue: A poorly designed or executed benchmark or trial of alternative forecast solutions is more likely to lead to a less optimal selection than a selection process that clearly defines the problem to be solved

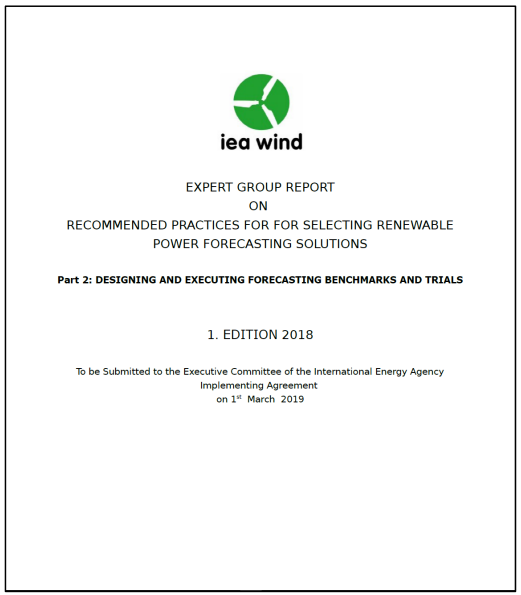
Advice: Part 1 provides a decision support tool for the design of a customized forecast solution selection process:
Remember: An optimal forecast solution needs careful formulation of the solution selection process, consistent with the problem size and the available expertise and resources

Decision support tool



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

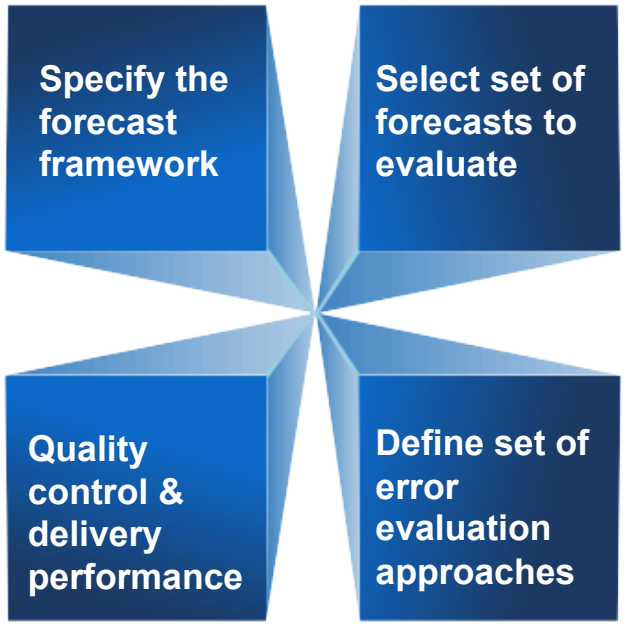
1. EDITION 2018

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

Part 2: Key Points

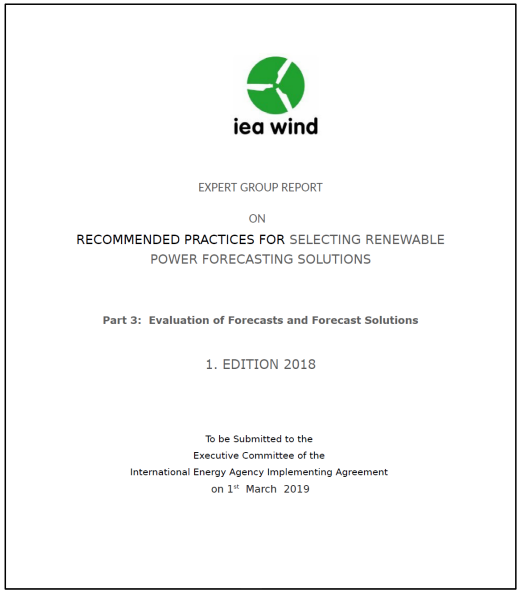
Issue: A benchmark or trial often fails to provide meaningful information to the solution selection process because it is poorly designed or executed and usually requires more resources than planned!

Advice: use the recommended practices guide and/or consult "unbiased" experts if you plan a benchmark or trial.
If it becomes an academic exercise, it's expensive learning!



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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EXPERT GROUP REPORT

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RECOMMENDED PRACTICES FOR SELECTING RENEWABLE POWER FORECASTING SOLUTIONS

Part 3: Evaluation of Forecasts and Forecast Solutions

1. EDITION 2018

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

Part 3: Key Points

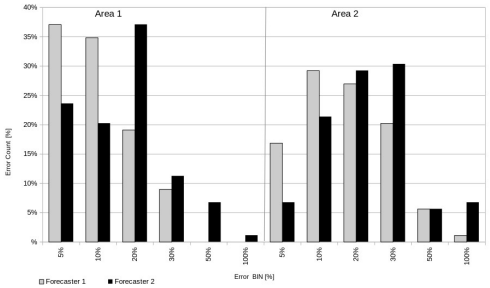
Issues: Many attempts to evaluate the accuracy of alternative forecast solutions yield misleading information to a user's solution selection process because of failures in one or more of the 3 key attribute areas:

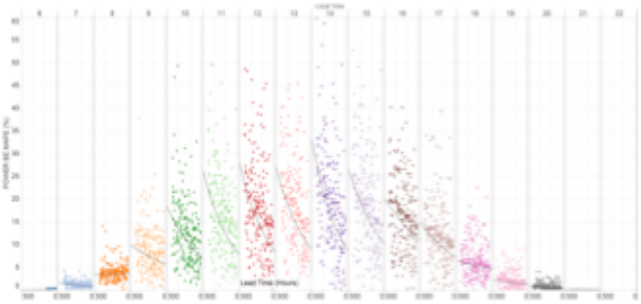
The most frequent and misunderstood mistake is with respect to "relevance"

- The user employs a set of accuracy metrics that are not appropriate, i.e. "not relevant" for the user's application
- Often accuracy assessments may give a good solution for someone else's problem, but not one's own problem!

Advice: put considerable effort into understanding and incentivising the problem solution before employing a forecast provider.

<u>Remember: Inappropriate metrics lead to wrong solutions!</u>





Where to Get More Information

WIW20 Paper

IEA Wind Task 36: Practical Application Examples from the Recommended Practices for Forecast Solution Selection

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RP-related Publications

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

2019 & 2020 Wind Integration Workshops
Paper in Proceedings
Presentation

2019 & 2020 ESIG Workshops
Presentations

YouTube Channel
Webinar on Recommended Practices

Task 36 Information

→ Task 36 site
- ieawindforecasting.dk → Publications

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

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