GENIVAR Actual vs. Predicted Yield Estimates

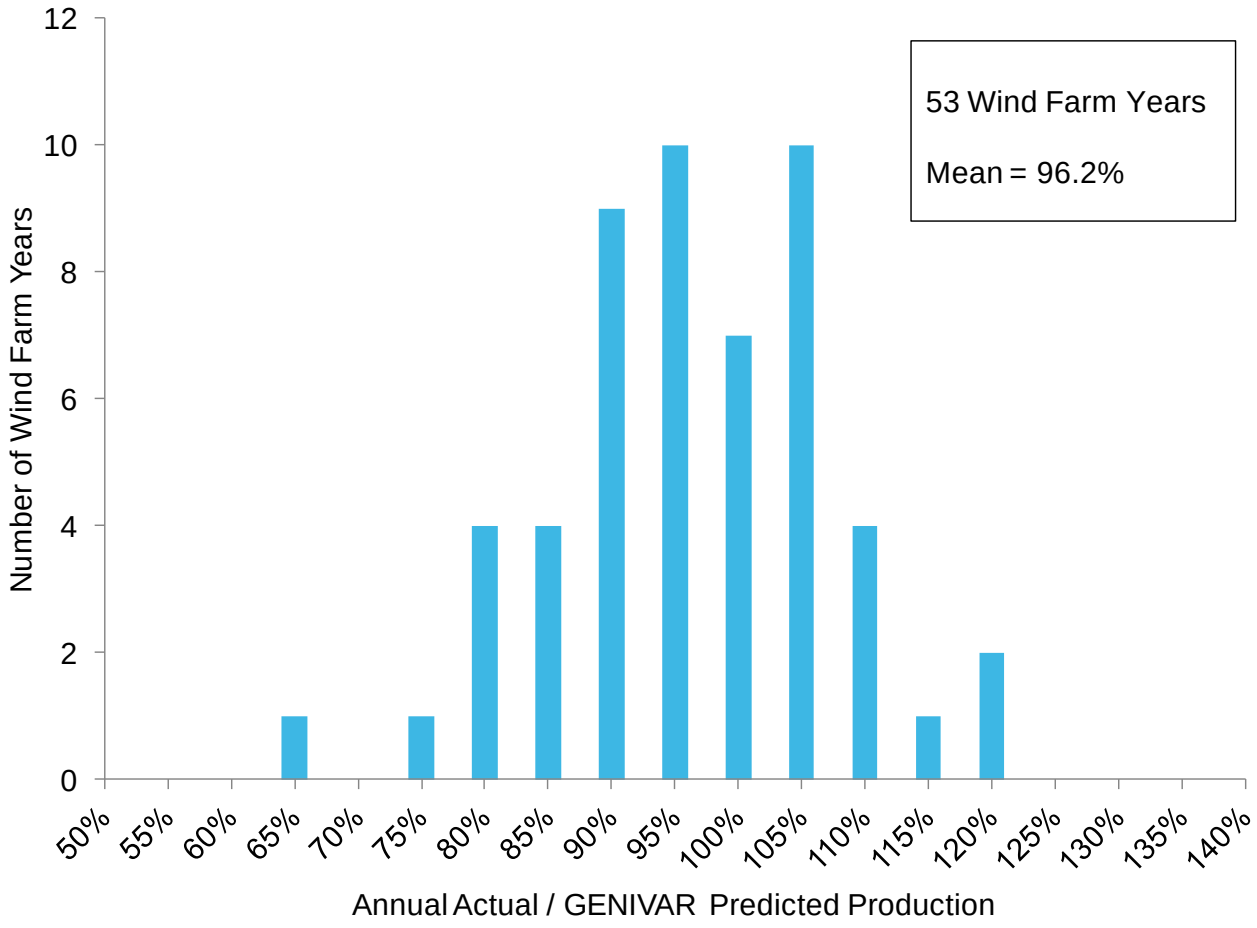
Validation Study Summary

GENIVAR

VALIDATION STUDY

- Goal of validation study is to quantify error in pre-construction energy estimates and identify trends
- Production data obtained from revenue meter for those projects where available
- Pre-construction yield estimates based on final GENIVAR pre-construction wind resource report

VALIDATION STUDY



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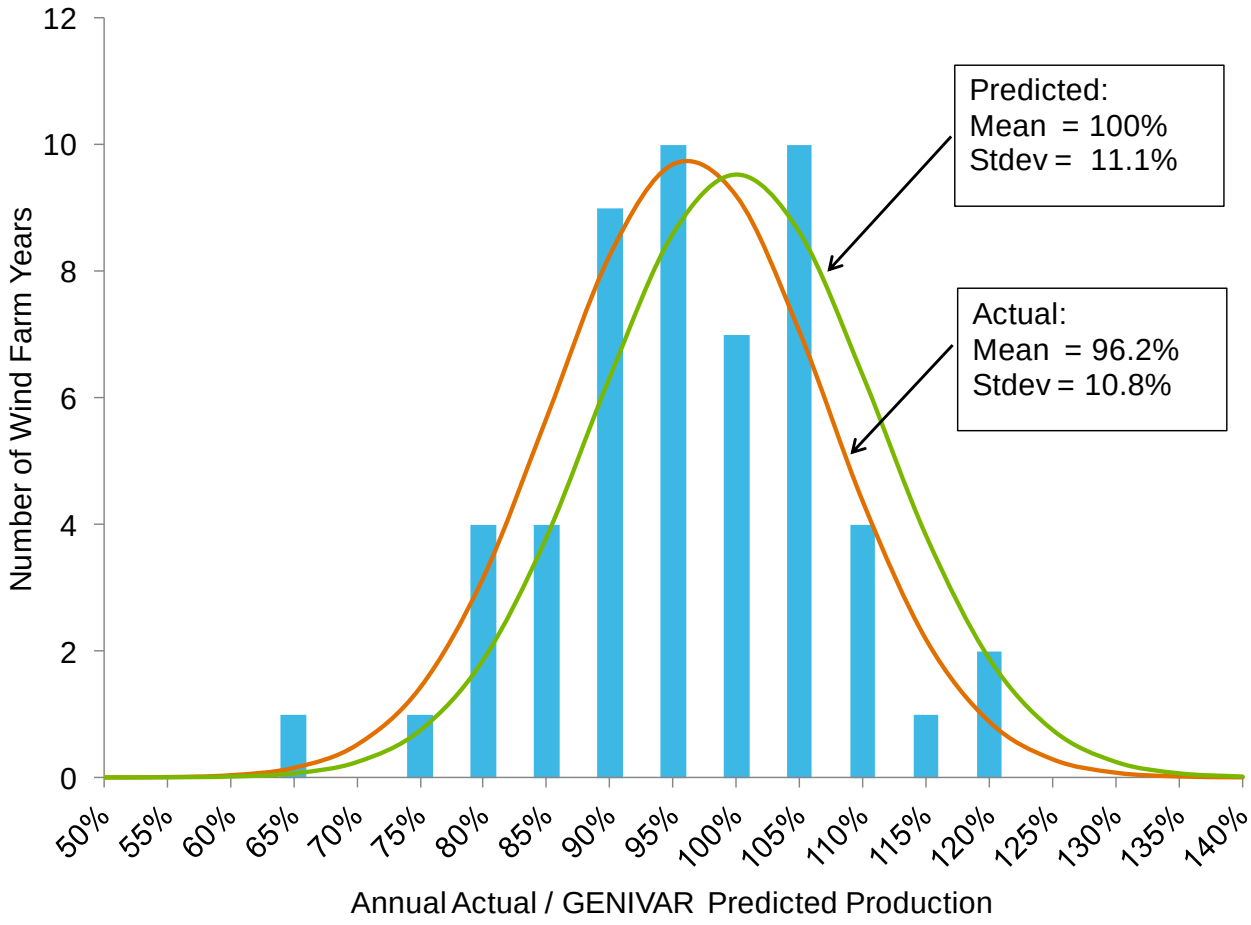
VALIDATION STUDY



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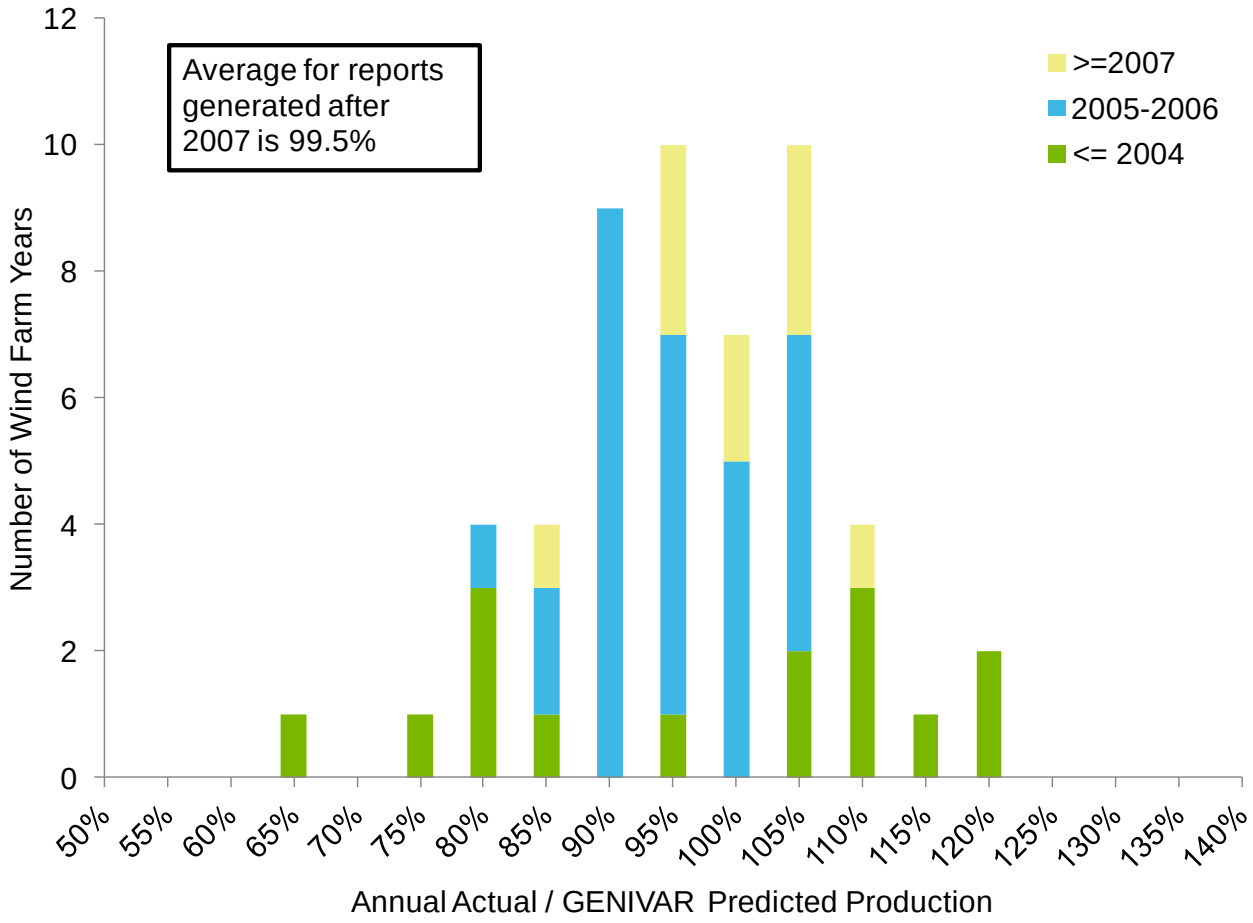
VALIDATION STUDY



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VALIDATION STUDY

→ Progress Made

- Meteorological Data
  - Improvements and standardization of met tower configuration
  - Elevated standards for meteorological data coverage across project, including incorporation of remote sensing (lidar and sodar)
- Wind Flow Modelling
  - Accounting for bias in on-site meteorological tower placement
  - CFD wind flow models incorporated for complex terrain
  - More comprehensive validation of models leading to better understanding of potential biases

VALIDATION STUDY

→ Progress Made

- Losses
  - Expansion and standardization of loss categories
  - Consideration of skewed loss distributions
  - Understanding and modelling for large wind farm wake effects
  - Increased losses for turbine underperformance and appreciation for impact of wind flow conditions
- Confidence Intervals
  - Comprehensive consideration of sources of uncertainty and integration earlier into development process

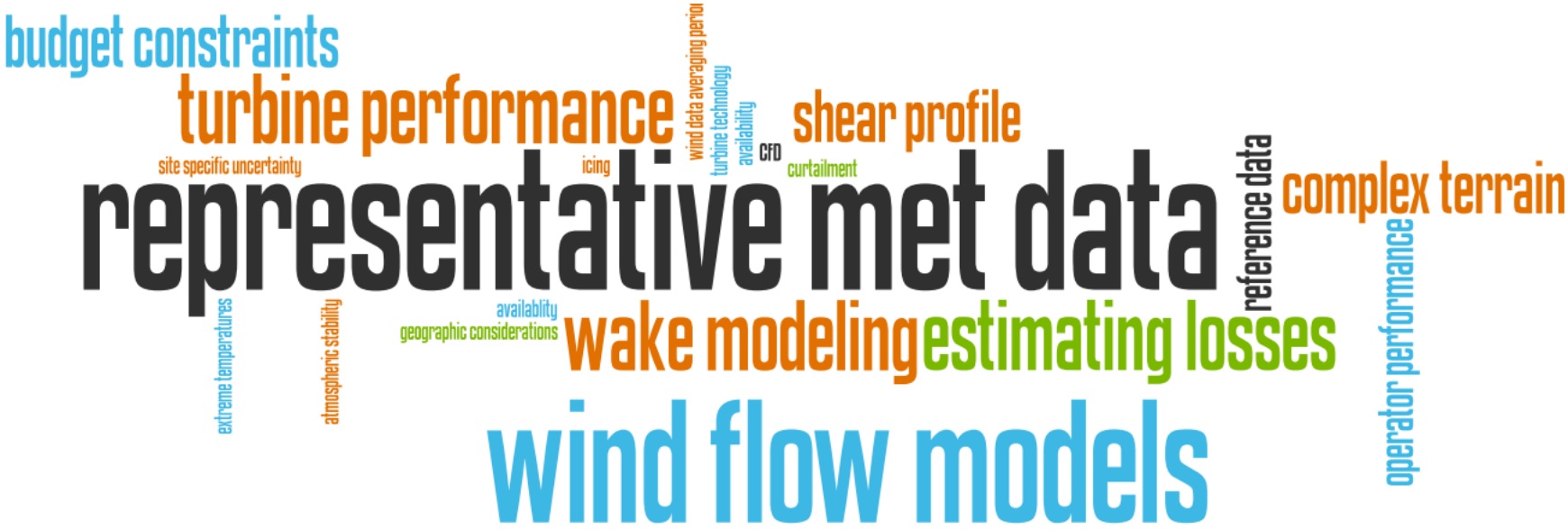
VALIDATION STUDY

→ Progress Made

- Uncertainty
  - Standard deviation of the annual actual production results closely matches the uncertainty attributed by GENIVAR in the pre-construction estimates
  - A variety of factors to consider:
    - Correlation between projects in a region
    - Larger errors (bias) in older assessments widens the distribution
    - Evolution of the assessment of uncertainty: older assessments failed to recognize some sources of uncertainty, however, recent advances in WRA have also resulted in a decrease in the magnitude of some uncertainties

VALIDATION STUDY

What, in your opinion, is one of the most significant barriers to accurately characterizing the yield and associated uncertainty for wind power projects?
(survey of industry professionals conducted by GENIVAR for 2012 AWEA WRA event)



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