



P90 and the Financial Value of Accurate Modeling

Independent Engineer's Perspective

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May 8, 2024

Our Work

Renewable Energy Projects

Technical Advisory

Independent Engineering
Owner's advisory
Siting and development support

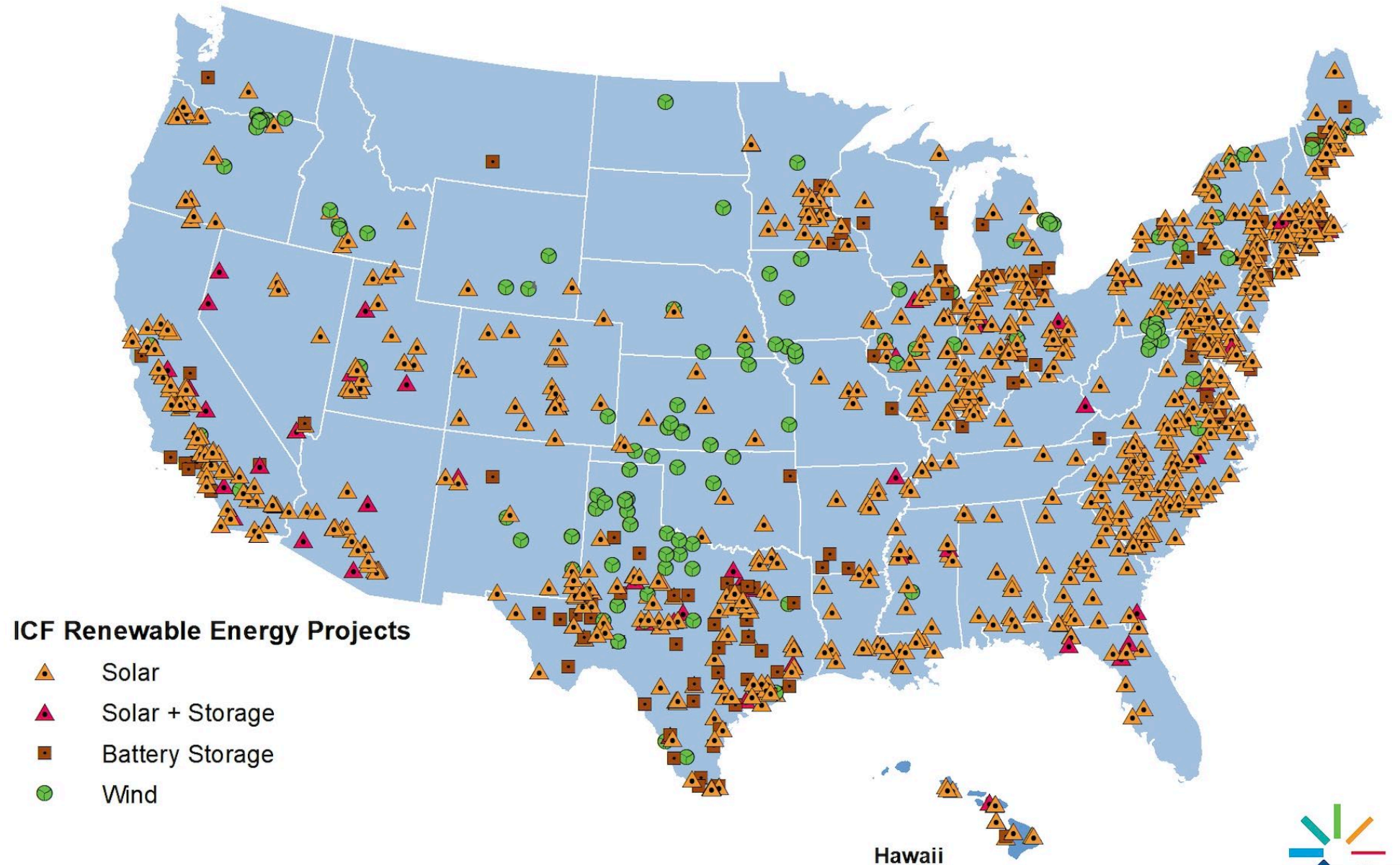
Transmission and Markets

Transmission congestion and curtailment forecasting
Market pricing forecasting
Retail rate forecasting

Grid Engineering and Analytics

Substation Engineering
Powerflow and short circuit modeling
Technology and design consulting

ICF Project Support



Role of an Independent Engineer



- **Role of an Independent Engineer**
 - Independent technical review of projects and portfolios by providing unbiased view of potential risks
- **Transactions We Support**
 - Project/Portfolio finance and tax equity investment
 - Refinance
 - Buy-side / sell-side
 - Mergers and acquisitions
- **Who Do We Support**
 - Project developers and sponsors
 - Financiers and investors
 - Project Owner's
 - Regardless of which entity engages ICF, results should be the same
- **What Do We Review**
 - Project site and participants
 - Commercial Agreements (IA, EPC, Offtake, O&M, AM)
 - Equipment, Design, Operating Plan
 - Energy Generation
 - E&P
 - Financial Model

Generation Modeling Throughout the Project Lifecycle



- **Development**

- Site selection and assessment
- Design optimization
- Offtake negotiation

- **Financing**

- Debt and investment sizing
- Risk review and downside assessment

- **Construction Monitoring**

- Acceptance testing
- Impact of design changes

- **Operations and Maintenance**

- Understand performance, identify underperformance
- Near-term forecasting
- Evaluating capital expenditures

- **Mergers and Acquisitions**

- Pricing / Sizing
- Upside and downside potential/risk
- Distressed asset review

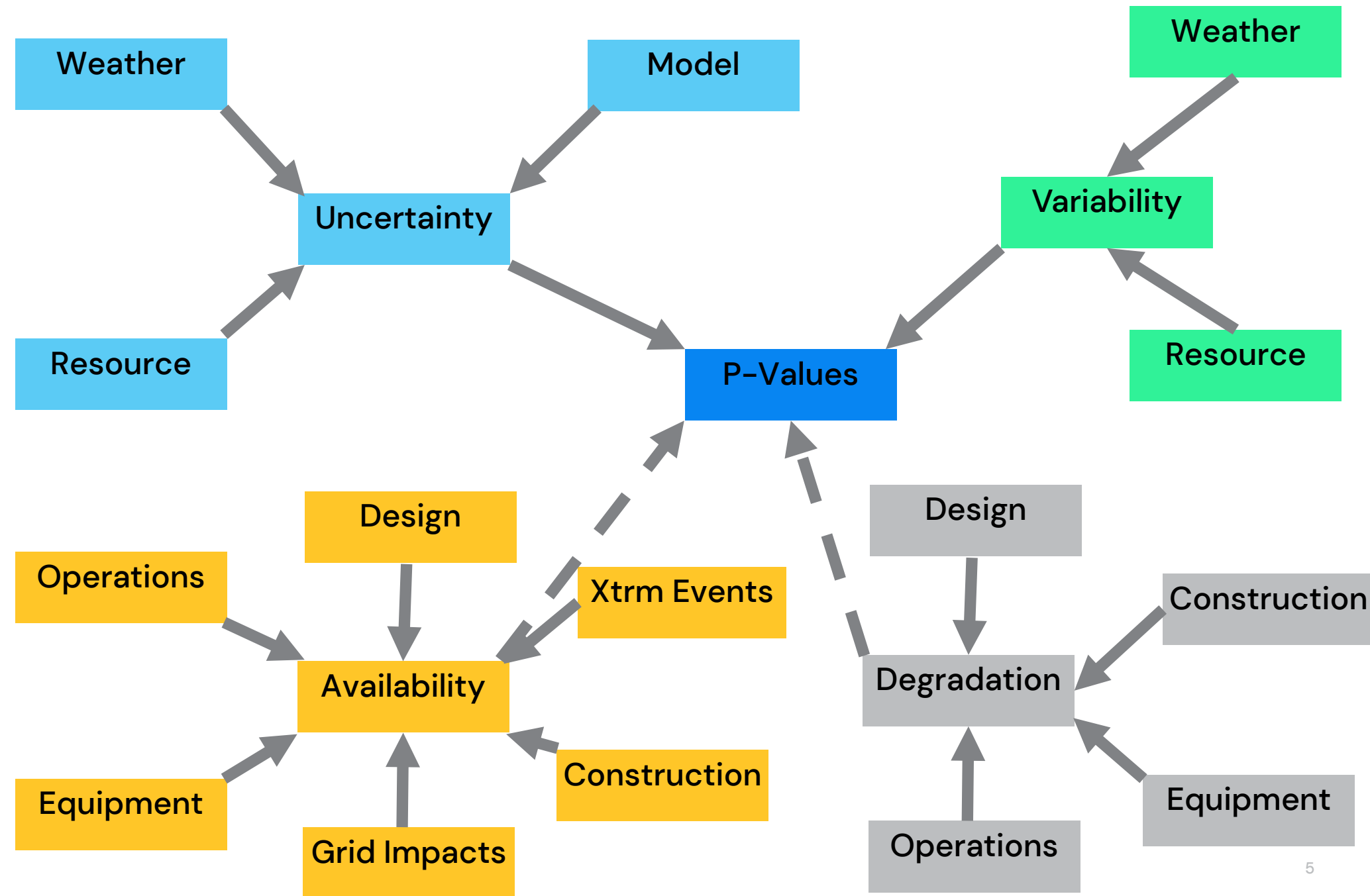
- **Decommissioning / End of Life**

- Potential for Repowering
- Remaining value

What Drives P-Values

Key Considerations and Questions

- What should be include in a P-Value?
- What should be considered a case scenario?
- "Black Box" uncertainty vs individual sources of error/uncertainty
- What is the value of standardization?
- How can data be shared across the industry?
- How does modeling and uncertainty appropriately account for novel methods and technologies?

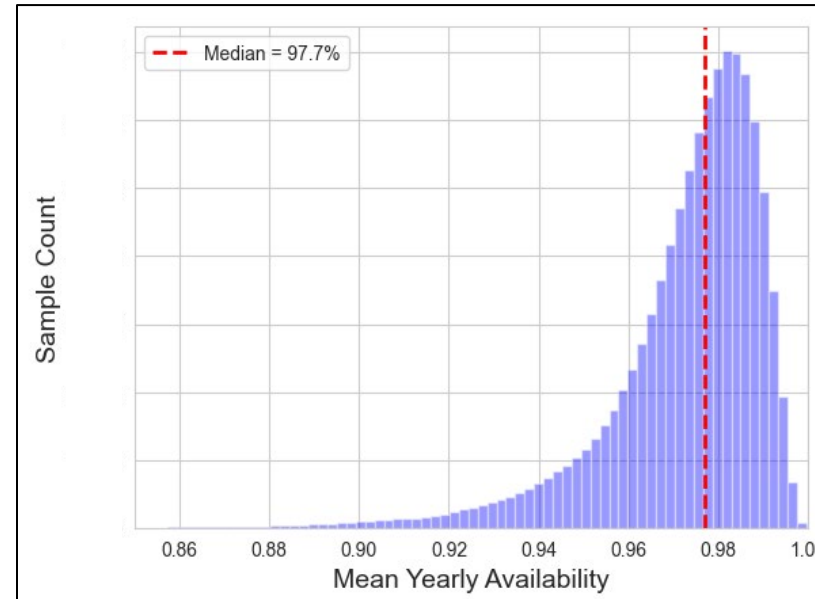


Availability Considerations

Key Considerations and Questions

- Not all Projects are alike.
- Not all distributions are normal.
- How do we compare a single Project to a broad data pool?
- How should peer operating data be considered?
- Not all distributions are normal.
- How is availability defined?
- How are one-time events considered?
- Inconsistent means of reporting availability (contractual vs actual).
- Grid reliability any curtailment.

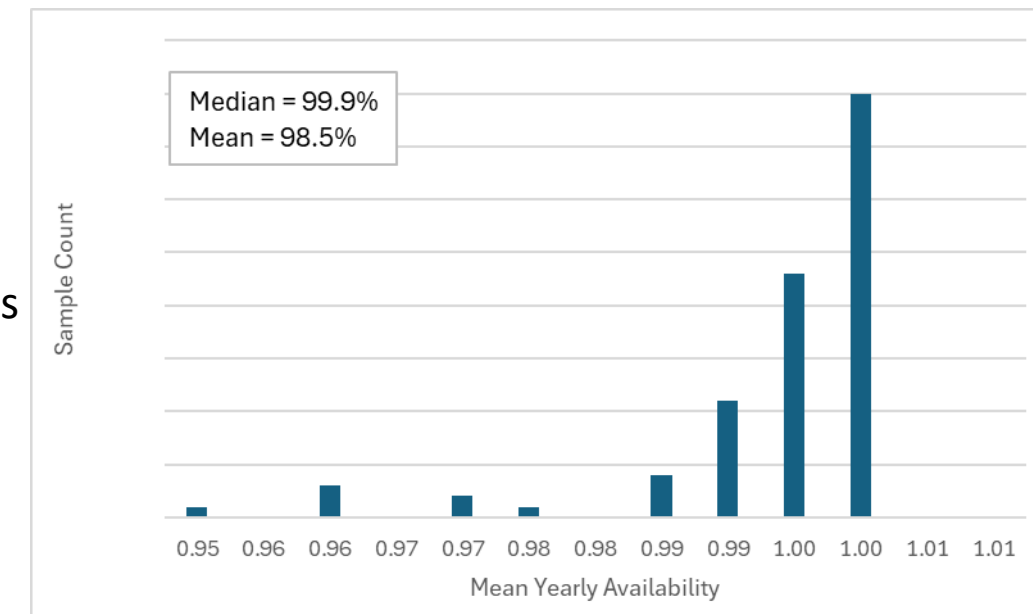
Full Data Pool



Key Availability Drivers

- Operator history
- Response times
- Staffing plan
- Location
- O&M agreement warranties and guarantees
- Equipment selection and electrical design
- Preventative maintenance schedule
- Spare parts

Select O&M Provider and Region



How Does Modeling and Modeling Uncertainty Impact the IE



- Implications to the IE
 - Debt and investment sizing
 - Articulation of risks
 - Apples to apples comparison
 - No direct financial risk, instead, reputational risk
 - Overly conservative modeling = developers won't engage
 - Overly aggressive/inaccurate modeling = Industry will no longer accept our work
- Needs
 - Operating data
 - Standardization of processes
 - Standardization of Language

Thank You!



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