



Project Development & Finance at NREL

Wind Energy – Resource Assessment in a Development Context

APCESE 2011

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The National Renewable Energy Laboratory (NREL)

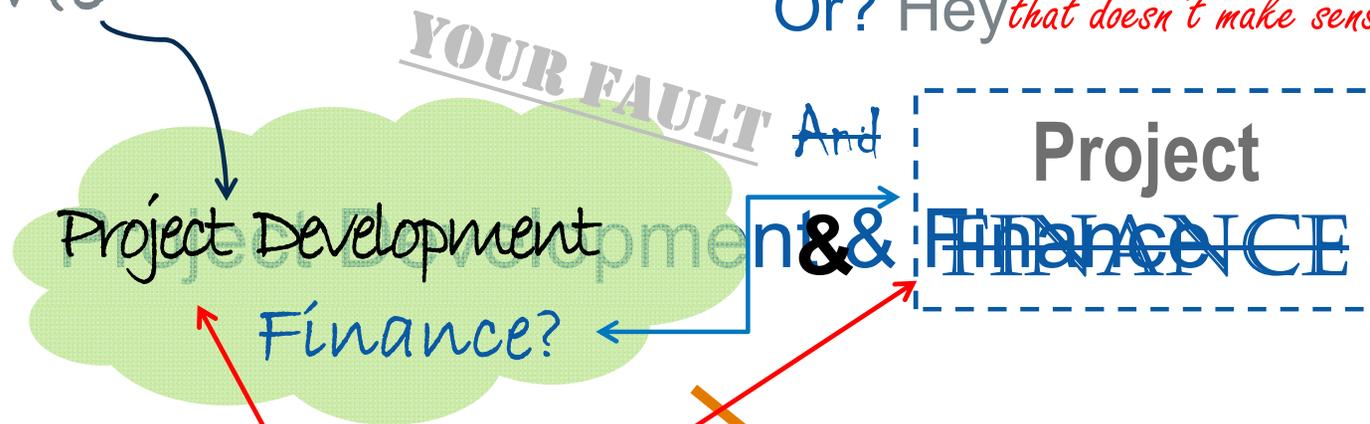
NREL is the only federal laboratory dedicated to the research, development, commercialization and deployment of renewable energy and energy efficiency technologies.

- ✓ Basic Scientific Research - R&D
- ✓ Applied Research and Engineering
- ✓ Testing, Scale-up and Demonstration
- ✓ Strategic Analysis
- ✓ Deployment and Market Transformation

Who?!

Me?

Or? Hey *that doesn't make sense!*

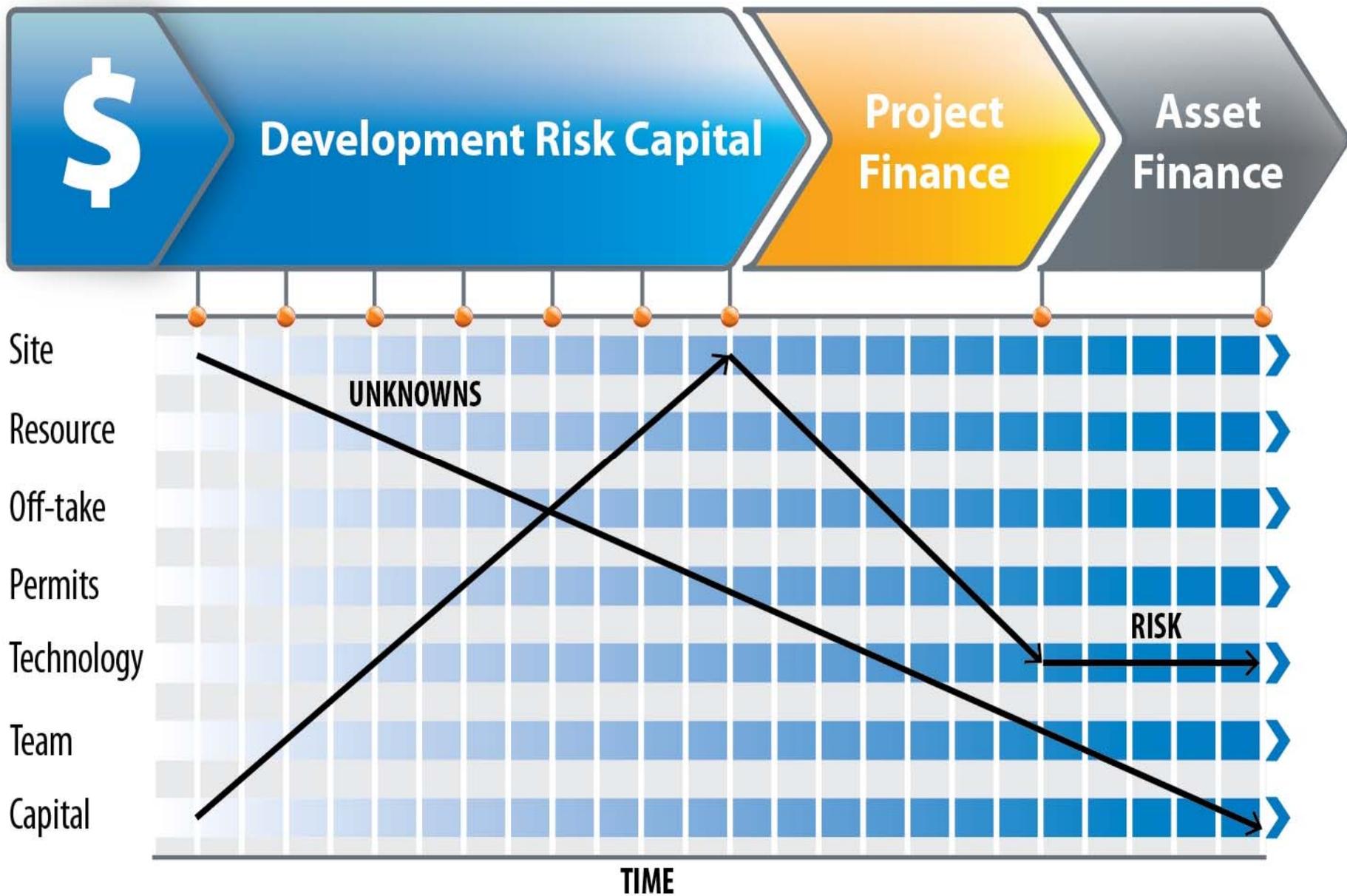


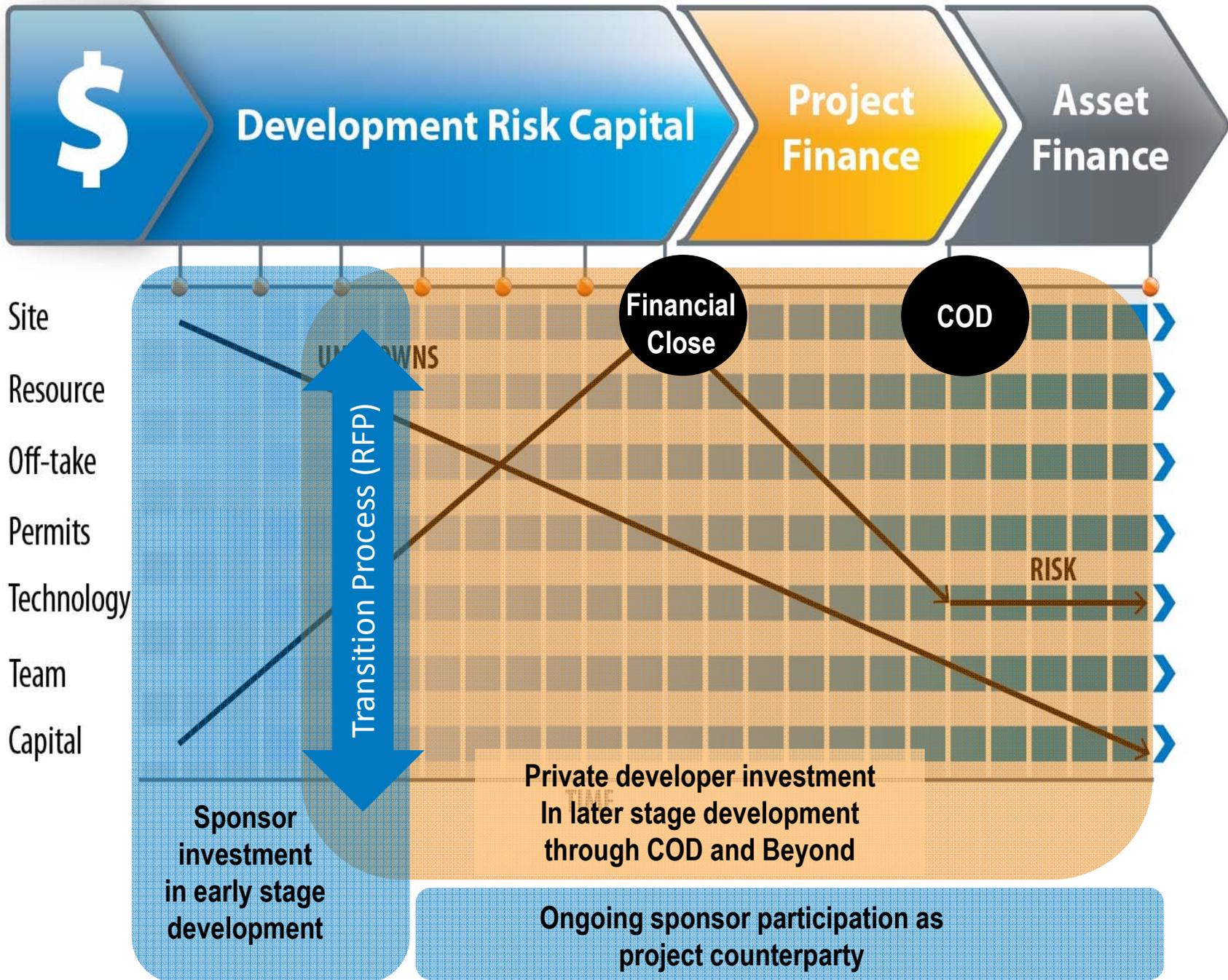
WHEN?!

“and then”



Finance





Wind Resource Assessment

Preliminary Assessment

- Review available resource information (State wind maps)
- Access local or nearby monitoring station data
- Estimate annual production – and economics

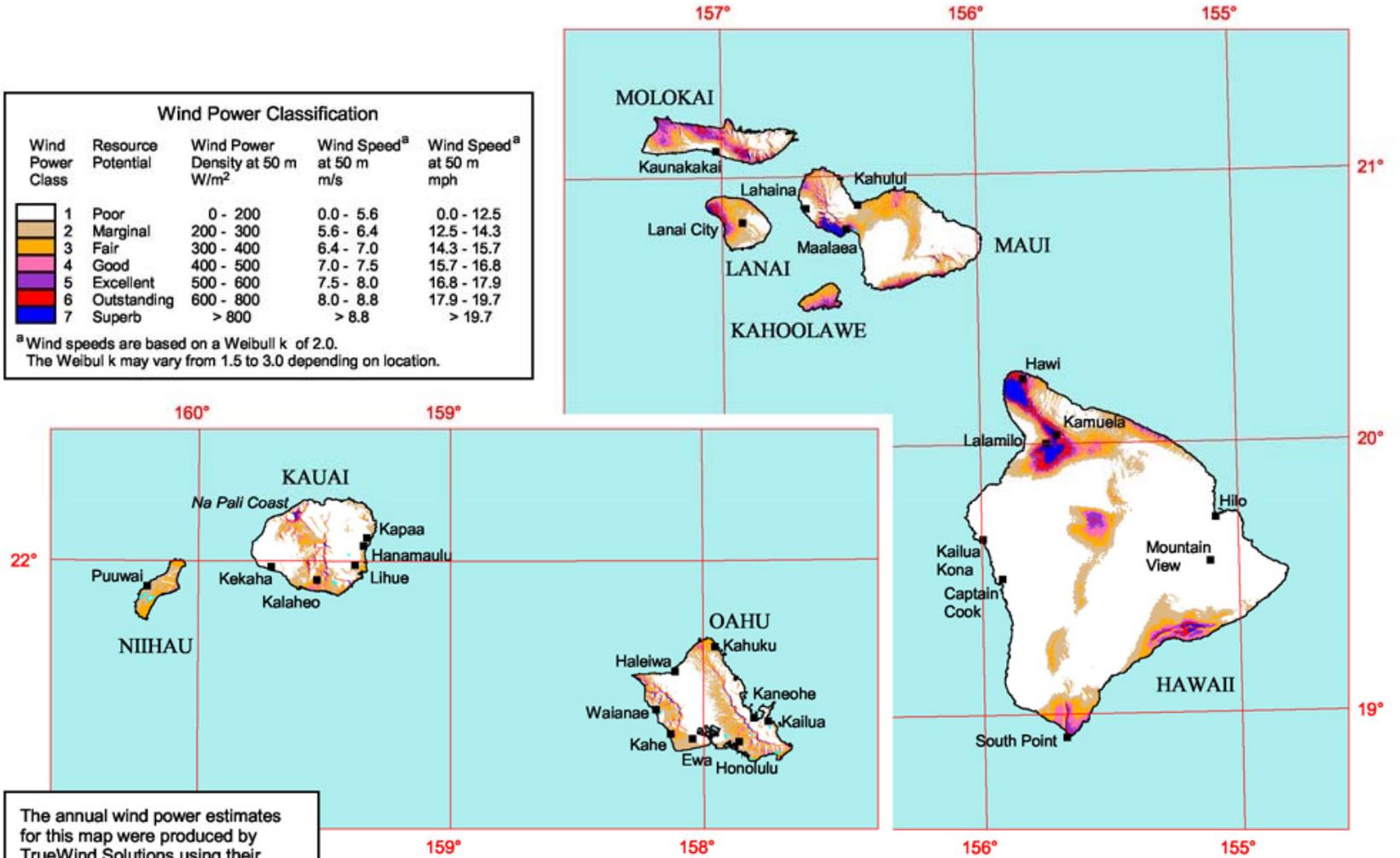
Detailed Engineering Assessment

- Collect anemometer field data
- Correlate to computer modeling/local monitoring station
- Statistical analysis – P50, P75, P90

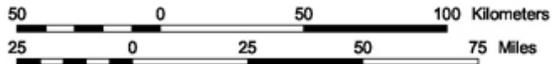
Hawaii - 50 m Wind Power

Wind Power Classification				
Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m ²	Wind Speed ^a at 50 m m/s	Wind Speed ^a at 50 m mph
1	Poor	0 - 200	0.0 - 5.6	0.0 - 12.5
2	Marginal	200 - 300	5.6 - 6.4	12.5 - 14.3
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	> 800	> 8.8	> 19.7

^a Wind speeds are based on a Weibull k of 2.0.
The Weibull k may vary from 1.5 to 3.0 depending on location.



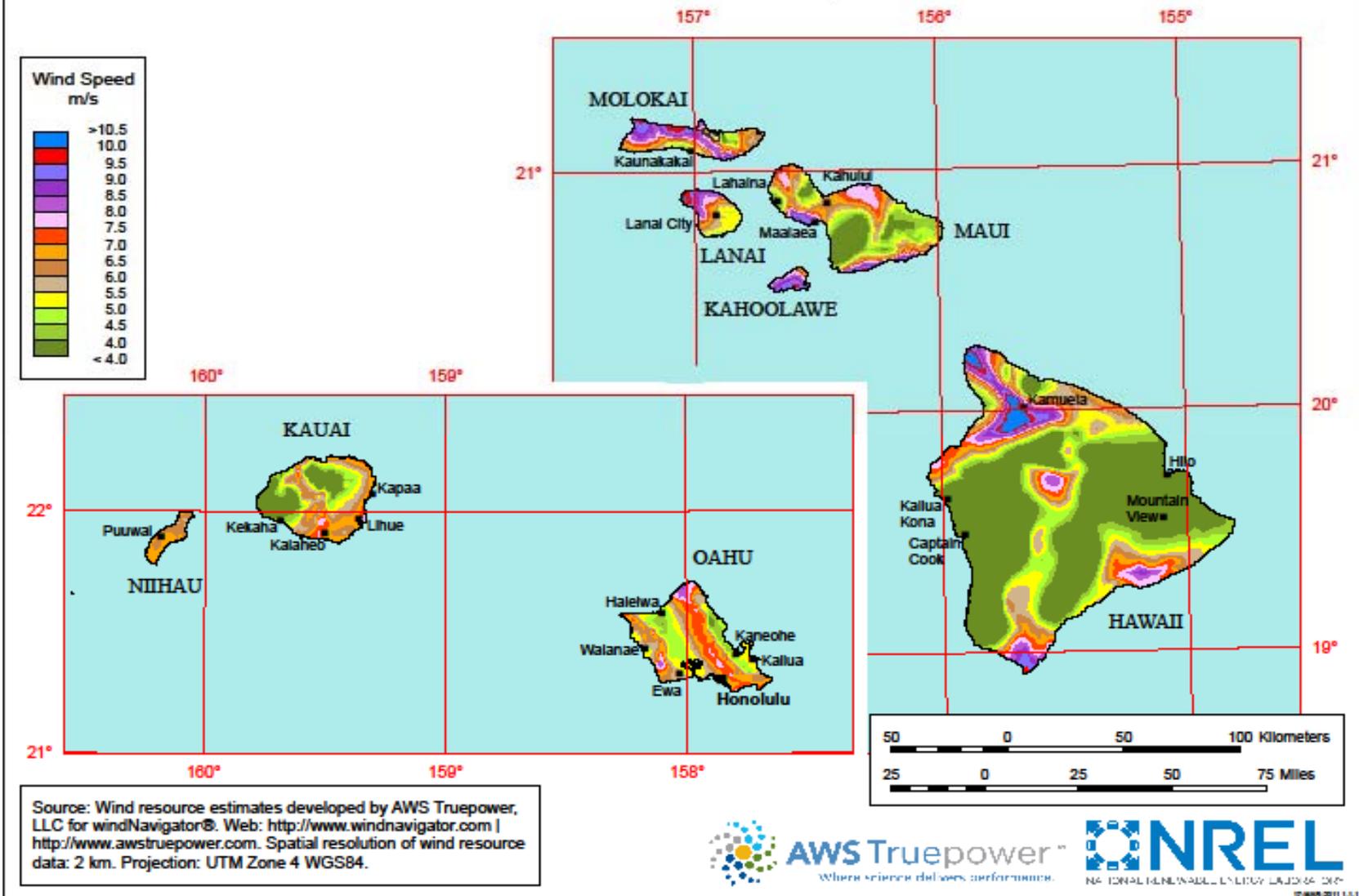
The annual wind power estimates for this map were produced by TrueWind Solutions using their Mesomap system and historical weather data. It has been validated with available surface data by NREL and wind energy meteorological consultants.



U.S. Department of Energy
National Renewable Energy Laboratory

12-JUL-2005 2.1.5

Hawaii - Annual Average Wind Speed at 80 m



Important Factors

Wind Resource and Conversion

- Speed
- Consistency
- Shear – change over vertical distance
- Spinning area of blade
- Equipment capabilities and mechanics
- O&M

Small Scale Wind

Not necessarily “easier”

- Performance impacted by existing or future structures, trees, or land forms
- Siting can be tricky; lower heights and project value increase complexity and less money available for engineering
- Experience Counts

Community Scale Wind

Well suited for Hawaii

- Sizing of turbines/projects relative to smaller grid(s)
- Rural applications benefit from existing resource
- Interconnected and stand-alone systems
- Wind-diesel hybrid
- Experience Counts

Utility Scale Wind

Contributions/Challenges

- Community and environmental impacts
- Transmission
- Resource and integration studies
- Experience Counts



Mahalo