

# Other NREL Hybrids Activities

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Wind/Diesel Workshop 2004

**NWTC Site View and Location of  
HPTB - DERTF**



# Update on NREL Hybrid/DER Test Facility

Teaming with the distributed generation group to expand the facilities capabilities



Expansion of HPTB switch panels

Electrical and Mechanical modifications for research testing completed

Hydrogen test facility

# NREL Hybrid/DER Test Facility



Construction completed and General Purpose Equipment installed

- 200kW Grid Simulator – Simulate utility grid and full control of voltage and frequency.
- KeyTek Surge Tester – Simulate high-voltage (up to 20,000V) lightning strikes.
- Expanded DAS and switchboard capabilities.
- Concrete Pad for DG Testing installed
- Installation of a 10 kW PV Array
- Installation on an electrolyzer and fuel cell for characterization and testing.
- Installation of Capstone Turbine completed
- No hybrids testing



# IEA Annex XIX

## Turbines in Cold Climates



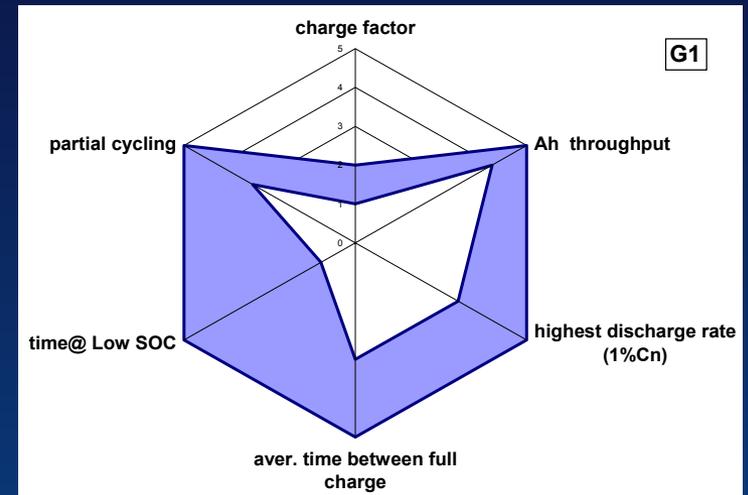
- Completion of a state of the art report on turbine operation, icing and monitoring.
- Working on a site classification guideline and guidelines for applying wind energy in cold climate
- <http://arcticwind.vtt.fi/>

# IEA status

- listserve with over 35 manufactures and suppliers.
- Still lots of questions and challenges still to be addressed including many problems with equipment and ice detection.
- No current work at NREL in this area
- Annex ends at the end of the calendar year - unclear if it will continue due to lack of support.

# EU Benchmarking Project

- Completed testing and benchmarking of batteries for RE applications, focusing on LA batteries.
  - Use classification
  - Battery stress factors
  - Battery recommendations
- Testing of batteries under wind profiles
- Assessment and improvement of battery life models



	Corrosion	Sulphation	Shedding	Drying out	Degradation	Stratification
Discharge rate	Indirect impact	High impact	Probably impact	No impact	Impact	Impact
Time of low state of charge	Indirect impact	Strong correlation	No direct impact	No impact	No impact	Indirect effect
Ah throughput	No impact	No direct impact	Indirect impact	No direct impact	Impact	Strong positive correlation
Charge factor	No direct impact	Positive impact	Strong impact	Strong impact	No direct impact	Strong correlation
Time between full charge	Strong negative correlation	Strong positive correlation	Negative influence	Negative influence	No direct impact	Strong positive correlation
Partial cycling	Indirect impact	Positive impact	No direct impact	No direct impact	No direct impact	Conditionally impact
Temperature	Strong impact	Conditionally impact	No direct impact	Positive correlation	Low impact	No direct impact

# Benchmarking results



- Active web site with recommendations to be on line shortly: [www.ecn.nl/resdas](http://www.ecn.nl/resdas) (petten)
  - general recommendations
  - System specific recommendations
  - use specific recommendations
- Focused on applications primarily with DC based power systems though work is
- Project site: [www.benchmarking.eu.org](http://www.benchmarking.eu.org)
- Project ends at the end of the calendar year - no plans for continuing the work.

# Analysis, Market Development and FEMP

- Completed draft assessments for hybrid power systems for South Pole and McMurdo Station
- Assessment ongoing for Summit base in Greenland
- Further project assistance work in Chile
- Conducting assessments in China and Maldives as part of other project work (early stages)

# Other NREL Hybrids Activities

- Continued work on small wind turbines and characterization.
- Fuel cell and electrolyzer characterization
- Improved version of the Hybrid2 software to be released at the end of the calendar year.
- Continued reduction in the support of hybrids at NREL - Other than minimal support for the HPTB, funding for this year very unclear but at this point is zero.