



Wind Turbine Development

Session A1: Alternative Energy – Solar, Wind

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Distributed Energy Systems

- Formally Northern Power Systems
- NASDAQ:DESC
- Facilities in Barre, VT (Power) and Wallingford, CT (Hydrogen)
- Focus on Power Electronics, Wind, MPower Products



Wind & Power Electronic Products R&D

- Funded by a combination of
 - Internal Funding
 - SBIR Grants
 - DOE / NREL Subcontracts
- University Partnerships

FlexPhase™ Technology

- Next Generation MW-Class Low Voltage Technology
- High Efficiency + High Power Density
- Proprietary Power Circuit
- Improved Motor/Generator and Utility Grid Performance
- 10 total power electronics patents issued or in process



Core Enabling Technology for Wind

NW100
Wind Turbine
Converter



Supports Weak Grids, Optimal for
Wind-Diesel, desalination and
MicroGrids

NW2.2
Wind Turbine
Converter



Reduced Generator Costs,
Improved Grid Performance,
5% Lower Lifetime Cost of Energy

EnergyBridge
Power Quality /
Energy Storage
Device



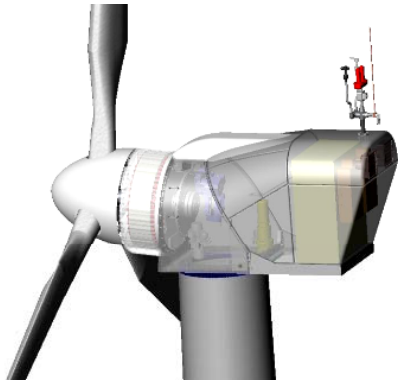
Enables higher penetration of
Wind/DG into both grid connected
and isolated grids

Enabling Technologies

PowerRouter®
Controls

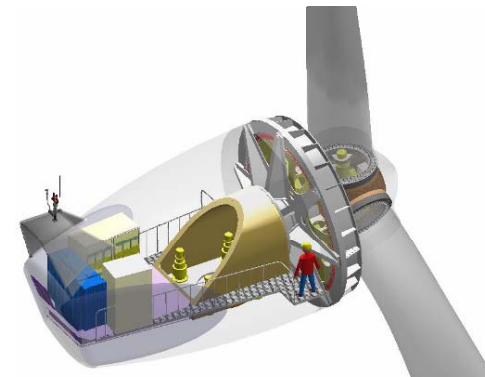
FlexPhase™ Modular
Converter Platform

Path Breaking Wind Technology



NorthWind® 100

- 100kW turbine for remote village power
- Enables hybrid systems: wind - biodiesel - H₂O purification



NorthWind® 2.2

- 2.2 MW 'Next Generation' turbine for utility scale applications
- 10% lower cost of energy
- Excels in low wind speeds

Permanent Magnet Direct Drive (PMDD) with High Energy Capture and Low O&M

The NorthWind® Wind Turbine Family - Simplicity and Reliability by Design

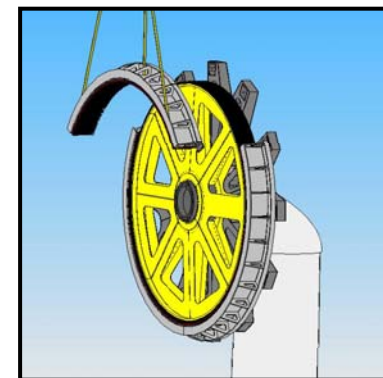
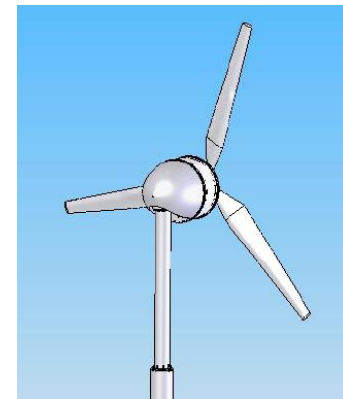
SBIR Grants, 1995-1997

- NASA SBIR for NW100 Development
 - Phases I & II awarded
 - Design of turbines for cold weather as Mars analog
- NSF: Integrated Wind Systems for Polar Applications
 - SBIR DMI-9502854
 - Phase I & II awarded
 - Studied materials and system properties in cold environments
 - Modified 3kW HR-3 turbine for arctic conditions
 - Monitoring of turbine performance



DOE SBIR Grants, 2005-present

- Development of Marine Turbines Using a Direct Drive Permanent Magnet Generator
 - SBIR DE-FG02-05ER84318
 - Phase I awarded
- Sectional Permanent Magnet Generator and Power Electronics for Multi-Megawatt, Direct Drive Wind Turbines
 - SBIR DE-FG02-05ER84317
 - Phase I & II awarded



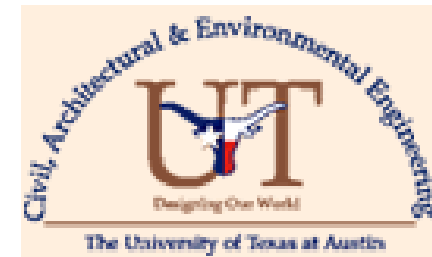
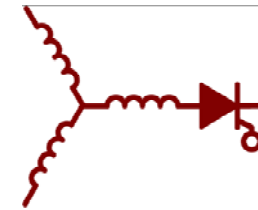
NREL Subcontracts 1997-Present

- Cold Weather Turbine Project
 - Sub contract XAT-9-29200-01
 - Proof of Concept of NW100 turbine
- Advanced Wind Turbine Drive Train Study
 - Sub contract YCX-1-30209-02
 - Optimization of MW-scale configurations
- Advanced Power Electronics for LWST Applications
 - Sub contract ZAM-3-31235-04
 - Development of FlexPhase™ power module & converter



University Partnerships

- University of Wisconsin—Madison
 - Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC)
 - Power electronics development
- University of Texas at Austin
 - Prof. Spyros Kinnas
 - Marine turbine blade design





*Extending today's resources...
creating tomorrow's choices*



Thank You