

#### The Wind Energy Center at the University of Massachusetts Amherst: America's Leading University Program in Wind Power Engineering

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The Wind Energy Center at the University of Massachusetts:

### America's Leading University Program in Wind Power Engineering

History, Research, and Training

November, 2008

College of Engineering University of Massachusetts at Amherst



# **UMASS Wind Energy Center**

- Managed within the Mechanical and Industrial Engineering Department (MIE) at UMASS
- Co-directors: Professor Manwell and McGowan
- Other PIs: Department Head Mario Rotea and Assistant Professor Robert Hyers
- About 12 graduate students
- Associate Director: Patrick Quinlan
- Seven other professional staff
- Approximately \$1.5 million in annual activity
- Major sponsors: MRET, Mass. DOER, US DOE



### **Current Research at the Wind Energy Center**

- Wind resource assessment in Massachusetts
- Turbine siting and external design conditions analysis
- Icing research, noise research
- Addressing Massachusetts issues—towns, museums, farmers, students
- Turbine electrical and control issues
- Turbine machine design, structural analysis and materials issues
- Hybrid power systems/distributed generation
- State/federal and international activities
- Offshore wind energy





#### **Graduate Students!**

Wind Power Firms: General Electric, Vestas North America, Mitsubishi, Southwest Windpower, US Windpower, ESI, Flowind, Atlantic Orient Corporation, Enertech, Fayette, Carter Wind Systems, Bergey Power, Kennetech, Zond, Enron Wind, Clipper Wind, Northern Power, and Second Wind.

Wind Power Consultants: Garrad Hassan America, Global Energy Concepts, UPC Wind, NEOS Corporation, McNiff Lite Industries, Windpower Associates, Pace Global Energy Services, and GPCo (Canada).

Utilities and Wind Developers: Florida Power and Light, Southern California Edison, Northeast Utilities, Alaska Energy Authority, Ontario Hydro, Tennessee Valley Authority, and Oak Creek Energy Systems.

**Universities**: MIT, U. Texas/Arlington, Babson College, University of Wisconsin, James Madison University, University of California Davis, and University of Massachusetts.

National and State Agencies: White House Office of Science and Technology Policy, US Congress, US Department of Energy, National Renewable Energy Laboratory, Sandia National Laboratory, Massachusetts Department of Energy Resources, New York State Energy Research and Development, and Wisconsin Energy Office.

International Laboratories: Rutherford Appleton Laboratories (UK), Riso National Laboratories (Denmark), TU Delft (Netherlands), and World Institute for Sustainable Energy (India).





### **Advanced Remote Data Collection**







### Wind Engineering Education: Authors of the Leading College Text on Wind Energy

Manwell

McCowan Robers

ENERGY EXPLAINED

Theory, Des and Applica

WILEY



J.F. Manwell, J.G. McGowan and A.L. Rogers University of Massachusetts, Amherst, USA

Recent years have seen a This authoritative and accessible textbook: growth in the implementation and economic viability of wind energy technology. the first modern wind turbines. and abundant source of clean, 🔳 Discusses the characteristics of the wind renewable energy is now making resource and the atmospheric boundary laye

a significant contribution to electricity supplies workdwide. A difference of the vind turbine, before going on to consider the electrical aspects of Addressing the growing requirement for information on

the theory and practical Examines key issues of wind turbine application of wind technology Wind Energy Explained provides a thorough introduction to benefits of wind energy generation.





integration issues and analyses the economic

energy conversion and generation.

- this multi-disciplinary field. Onesides the environmental impact of single turbines and vind farms and the design of vind systems for minimal visual impact.
  - Provides a comprehensive set of tutorial problems based on the contents on each chapter.

wehensive coverage ranging from wind turbine entrol and operation to system design and public policy will speal to engineering students from a variety of backgrounds actitioners new to the field of renewable energy will find is a valuable introduction to an emerging energy source.



J. F. Manwell | J. G. McGowan | A. L. Rogers



#### History: 1970s Early Conceptual Designs for Offshore Wind in New England



#### Wind Turbine/ Spar Buoy; Multi Rotor Systems (Heronemus, UMass, 1973)





#### History: 1990s

Mt Tom, Massachusetts **Experimental Test** Site: ESI 80 WTG: 2 Bladed Downwind 250 kW **Many Modifications** 







### History: 2000s Hull, Mass. Wind Turbines



#### Hull 1-660 kW

#### Hull 2- 1.8 MW





# Training Programs at the UMASS Wind Energy Center

<u>This year</u>, first-time technician-level certificate-based educational programs sponsored by the Massachusetts Renewable Energy Trust.

- Pilot—meteorological tower installation training
- Following years—data loggers, computer methods, remote sensing
- Potential hybrid on-line on-site format

Next year: wind energy course at Greenfield Community College.

The new Green Jobs Act opens up some funding for our staff and students to share some of our expertise in:

• Wind energy resource assessment tools and techniques, including SODAR (sonic anemometer) and LIDAR (laser anemometer), both of which track wind speed and direction at the "hub height" of modern utility-scale turbines

- Wind turbine site assessment and mapping tools
- Turbine performance monitoring and testing





### Wind Energy Center

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