SMART Wind Consortium

Developing a Consensus-Based Sustainable Manufacturing, Advanced Research & Technology Roadmap for Distributed Wind

July 2014
2-year grant awarded to DWEA, supported by eFormative Options and Wind Advisors Team to:

1) Form a **consortium** of DW manufacturers, suppliers, university researchers, manufacturing centers; and

2) Develop a **roadmap** to identify manufacturing gaps, prioritize actions, and foster solutions

**Overall program aim:**

**Strengthen U.S. manufacturing and innovation performance**
**NIST: Basic Stats and Facts**

- **Major assets**
  - ~3,000 employees
  - ~2,700 associates and facilities users
  - ~1,300 field staff in partner organizations
  - Two main locations: Gaithersburg, Md., and Boulder, Colo.
  - Four external collaborative institutes: basic physics, biotech, quantum, and marine science

**FY 2013 Appropriations ($ in M)**

- STRS: $133.6
- ITS: $119.4
- AmTech: $14.2
- MEP: $56
- Construction: $579.80
NIST Programs

NIST Laboratories

- Providing measurement solutions for industry and the nation

Hollings Manufacturing Extension Partnership

- Nationwide network helping smaller manufacturers compete globally

Baldrige Performance Excellence Program

- Strengthening performance excellence in U.S. organizations
NIST’s Unique Mission

To promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.

- Mission focus: Targeted programs to advance U.S. innovation and boost economic growth
- Deep research expertise underpins technological innovation – e.g. lasers, memory, GPS, wireless
- Non-regulatory status enables important role as a convener that facilitates collaboration between industry and government

**Cybersecurity:** Improved response to cyber threats

**Nanomanufacturing:** New measurement tools for advanced materials manufacturing

**Energy:** Measurements and standards for energy security
NIST Priority Research Areas

- Advanced Manufacturing
- IT and Cybersecurity
- Healthcare
- Forensic Science
- Disaster Resilience
- Cyberphysical Systems
- Advanced Communications
What is AMTech?

Advanced Manufacturing Technology Consortia (AMTech) Program

- Newly launched by NIST in FY 2013
  - To incentivize the formation of and provide resources to industry-led consortia
    - To support basic and applied research
    - On long-term, pre-competitive and enabling technology development
  - For the U.S. manufacturing industry

- AMTech-supported consortia will strengthen the capacity of U.S. industry and the nation to compete in global markets
FY 2013 AMTech planning awards will fund eligible applicants to create new or strengthen existing industry-led technology consortia.

AMTech-supported consortia will:
- Identify and prioritize long-term, pre-competitive industrial research needs;
- Enable technology development;
- Create the infrastructure necessary for more efficient transfer of technology;
- Represent a broad range of involved firms across stages of the value chain.

Once fully implemented, NIST envisions AMTech to offer funding in two broad areas: planning awards and implementation awards.
2013 AMTech Planning Grants

Intended to:

- Establish and strengthen industry-led consortia focused on developing advanced technologies to address major technical problems that inhibit growth of advanced manufacturing in the U.S.

- Identify and prioritize research projects supporting long-term industrial research needs and activities including creating or updating existing industry-led, shared-vision roadmaps for development of technologies underpinning next-generation and/or transformational innovations

- Undertake other activities designed to establish and strengthen industry-led, multi-partner consortia that catalyze technology infrastructure and American excellence in advanced manufacturing
AMTech Competition Results

Consortia Characteristics
Consortium Status: 11 New
8 Existing

Crosscutting Technologies (# of efforts)
1 - Additive Manufacturing
2 - Advanced Forming & Joining Technologies
7 - Advanced Manufacturing & Testing Equipment
2 - Advanced Materials Design, Synthesis & Processing
1 - Advancing Sensing, Measurement & Process Control
1 - Biomanufacturing & Bioinformatics
1 - Flexible Electronics Manufacturing
2 - Sustainable Manufacturing
2 - Visualization, Informatics & Digital Manufacturing Technologies

Full list at www.nist.gov/amo
Industry Participation

DWEA speaks for all the Major Players
**Consortium:** an agreement, combination, or group (as of companies) formed to undertake an enterprise beyond the resources of any one member

SMART Wind Consortium will connect more than 80 collaborators to form consensus on near-term and mid-term plans needed to increase cost competitiveness through the use of advanced manufacturing techniques

www.distributedwind.org/smart-wind-sign-up/
Core Team

DWEA Executive Director
Jennifer Jenkins

DWEA Communications Manager
Lauren Glickman
WindyGlick

Project Manager
Heather Rhoads-Weaver
eFormative Options

Technical Lead
Trudy Forsyth
Wind Advisors Team

Technical Co-Lead
Brent Summerville
Summerville Wind & Sun
Why Distributed Wind: Benefits to America

- Promotes more energy choices for Americans
- Plays to American technology and manufacturing strengths
- Creates long-term sustainable jobs
- Strengthens exports
- Increases private sector investment in clean energy
- Places more wind energy in the public eye
Distributed Wind’s Diverse Market Potential

- Residential
- Schools
- Commercial
- Military
- Farms
- Public
- Foreign Assistance
### U.S. Small Wind Domestic, Imports, and Export Sales

#### Estimated Total Available Market (2030 Theoretical Potential)

<table>
<thead>
<tr>
<th>Market Segment</th>
<th>2013 Size, Units</th>
<th>Data Source</th>
<th>2030 Size, Units</th>
<th>Percent Suitable</th>
<th>2030 Potential Installed Units</th>
<th>Average Size (kW)</th>
<th>Potential (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Businesses</td>
<td>8,900,000</td>
<td>Census, 2008</td>
<td>14,300,000</td>
<td>15%</td>
<td>2,145,000</td>
<td>350</td>
<td>750,750</td>
</tr>
<tr>
<td>Rural Residential</td>
<td>30,600,000</td>
<td>HUD, 2009</td>
<td>49,100,000</td>
<td>50%</td>
<td>24,550,000</td>
<td>10</td>
<td>245,500</td>
</tr>
<tr>
<td>Farm</td>
<td>2,200,000</td>
<td>USDA, 2007</td>
<td>2,200,000</td>
<td>60%</td>
<td>1,320,000</td>
<td>150</td>
<td>198,000</td>
</tr>
<tr>
<td>Public Buildings</td>
<td>1,200,000</td>
<td>DWEA Estimate</td>
<td>1,350,000</td>
<td>25%</td>
<td>337,500</td>
<td>250</td>
<td>84,375</td>
</tr>
<tr>
<td>Schools</td>
<td>140,000</td>
<td>NCES, 2010</td>
<td>165,000</td>
<td>40%</td>
<td>66,000</td>
<td>250</td>
<td>16,500</td>
</tr>
</tbody>
</table>

Total Potential (MW): 1,295,125
Last Small Wind Industry Roadmap was produced in 2002

SMART Wind project will identify and prioritize cost-effective solutions so U.S. distributed wind industry can claim its share of projected potential global $2 trillion market
Initial SMART Wind strategies

- Identify common distributed wind manufacturing gaps and barriers
- Prioritize solutions to those gaps for today and for future scalability
- Facilitate a rapid transfer of innovation into American-manufactured wind turbines, open new market opportunities, expand distributed wind applications
- Reduce lifecycle costs, maintain high product quality and value
- Secure U.S. global competitiveness and leadership
Consortium Meetings

- Bring together critical U.S. distributed wind turbine and component manufacturers to maintain edge in a growing global market
- Leverage industry-academic dialogue to develop strategies to aid distributed wind industry growth and advance innovative manufacturing techniques
- Share ideas and forge ahead as global leaders in the growing market of distributed wind
Consortium Structure: DW Supply Chain

**Raw Materials**
- Steel
- Cast Iron
- Fiberglass
- Rare Earth Magnets
- Copper
- Rubber
- Concrete
- Aluminum

**Component Manufacturing**
- Blades
- Generators
- Power Electronics
- Towers
- Shaft
- Gearbox
- Nacelle
- Bearings

**Subsystems**
- Mechanical
- Composites
- Electrical
- Support Structures

**Distributed Wind Turbines**
Distributed wind energy turbine systems, subsystems, components and piece parts divided into four subgroups

**Electrical Systems**
- Inverter
- Controller
- Alternator
- Power electronics
- Generator
- Magnets
- Bus bars
- Slip rings
- Interconnection
- System monitoring

**Mechanical Systems**
- Shafts
- Bearings
- Braking system
- Gearbox
- Pitching system
- Furling system
- Yaw system

**Composites**
- Blades
- Nacelle housing
- Nosecone
- Tower

**Support Structures**
- Tower
- Access ladder
- Foundation
- Anchoring System
- Permitting
Subgroup Boundaries

- **Mechanical subsystems**
  - Boundary vs. Support Structure is the tower top
  - Rotor, hub, mainshaft, mainframe: Rotor connection to generator, generator support
  - Overspeed control/yaw mechanism (i.e. pitching, furling, yawing)
  - Tower top/bed plate, tower adapter

- **Electrical subsystems**
  - Generator
  - Power electronics
  - Balance of system electrical components (all the way up to the electrical service; transformer, bus bars, slip rings, etc.)

- **Composite subsystems**
  - Anything using fiber-reinforced or carbon resins including: blades, nose cones, nacelles, etc.

- **Support structure**
  - Tower, bolts, foundation, rebar, guy wires, guy clamps, ground anchors, lifting device for tilt-down tower, etc.
Roadmapping SMART Wind Schedule

**AMTech-SMART Wind Consortium Development**

- **Consortium Coordination**
  - Issue questionnaires, aggregate data into benchmark metrics, identify barriers & gaps, identify lean manufacturing opportunities
- **Subgroup Meetings (face-to-face)**
  - Consortium Launch (all); Mechanical Systems; Composites; Electrical Systems; Support Structures
- **Subgroup Virtual Meetings**
  - 3 for each subgroup
- **Financial Reports (deliverables)**

**AMTech-SMART Wind Technology Roadmap Development**

- **Develop High Level Roadmap**
  - Consortium subgroup vision and goals, rank the action plans & opportunities
- **Write Detailed Roadmap**
  - Near-term and mid-term action plans and strategies
- **Final Consortium Meeting and Internal Roadmap Review**
  - Roadmap Reviewer Subgroup
  - Review of Draft Roadmap
- **Roadmap Production & Dissemination**
  - Technical Reports (deliverables)

Timeline:

- June 2014: Consortium Launch (all); Mechanical Systems; Composites; Electrical Systems; Support Structures
- Oct 2014: Subgroup Meetings (face-to-face)
- Feb 2015: Subgroup Virtual Meetings
- June 2015: Financial Reports (deliverables)
- Oct 2015: AMTech-SMART Wind Technology Roadmap Development
- Feb 2016: Review of Draft Roadmap
- May 2016: Roadmap Production & Dissemination
- Technical Reports (deliverables)
## SMART Wind Consortium In-Person Meetings

<table>
<thead>
<tr>
<th>Meeting Description</th>
<th>Location</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Meet &amp; Greet, Initial Steering Meeting</td>
<td>Stevens Point, WI</td>
<td>June 17 and 19, 2014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In conjunction with Small Wind Conference</td>
</tr>
<tr>
<td>1 Consortium Launch</td>
<td>Albany, NY</td>
<td>October 15-16, 2014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In conjunction with DWEA All-States Summit</td>
</tr>
<tr>
<td>2 Mechanical Systems Subgroup</td>
<td>Denver, CO</td>
<td>November 12-14, 2014</td>
</tr>
<tr>
<td>3 Support Structures Subgroup</td>
<td>Denver, CO</td>
<td>January 13-14, 2015</td>
</tr>
<tr>
<td>4 Composites Subgroup</td>
<td>Denver, CO</td>
<td>February 16-18, 2015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In conjunction with DW15 Hill Event</td>
</tr>
<tr>
<td>6 Roadmap Prioritization</td>
<td>Washington, DC</td>
<td>March 2016</td>
</tr>
<tr>
<td>7 Finalize, Produce &amp; Distribute Roadmap</td>
<td></td>
<td>Project Completion: May 31, 2016</td>
</tr>
</tbody>
</table>

Register at [www.distributedwind.org/smart-wind-consortium](http://www.distributedwind.org/smart-wind-consortium)
Information Protection

- NIST protects the confidential and proprietary information about business operations and trade secrets possessed by any company or participant to the full extent of the law.

- NIST will withhold such information from disclosure pursuant to the applicable statutory authorities:
  - Freedom of Information Act (FOIA) 5 U.S.C. § 552(b)
  - Economic Espionage Act 18 U.S.C. § 1832

- Mark **all** documents with confidential information “proprietary”

- Remember, e-mail may not be secure
Questions, discussion

http://distributedwind.org/smart-wind-faqs/
To sign up for Subgroups or more information:
www.distributedwind.org/smart-wind-sign-up/
lglickman@distributedwind.org

www.distributedwind.org/events/smart-wind-consortium-launch
Register today for Oct 16 Launch Meeting – rates increase after Aug 24!