

# 20% Wind Vision – Chapter 3 Wind Turbine Technology

Steve Lockard - TPI  
Paul Veers – Sandia Labs

## Breakout Session Goal

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The goal of this session is to work collaboratively to answer the following questions for this report chapter:

- Define a five year strategy
- Identify specific needs and actions
- Lay out roles and responsibilities
- Determine a split between federal, state and private funding.

The desired result is the skeleton of an action plan, what activities will be needed to make 20% wind by 2030 a reality.

# Current budget Background

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FY	Proposed Budget (\$m)	Total proposed federal Program budget (\$m)
08	26.4 (55%)	57.5
09	43.0 (48%)	89.2
10	58.7 (49%)	120
11	59.0 (49%)	121
12	58.0 (50%)	117
13	57.0 (52%)	109

# 20% Vision – Key Issues

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## ***Mitigate the Risk of Large-Scale Deployment***

1. Reducing the innovation risk of commercializing technology by public-private sector cost sharing of technology development and demonstration.
2. Building and equipping the next generation full-scale test facilities
3. Supporting effective certification standards that promote performance and operational excellence
4. Establishing a national program to monitor and archive U.S. fleet reliability - including system performance and plant operations and maintenance
5. Establishing a national facility for offshore wind technology

## ***Foster the Introduction of Technology Improvements***

1. Targeting RD&D initiatives including towers, blades, controls, drive trains and power electronics.
2. Increasing the capacity factor by placing larger rotors on taller towers with lighter components and load-mitigating rotors
3. Reducing the capital cost with steady learning curve improvements driven by innovative manufacturing improvements
4. Creating a wind speed and atmospheric environments database to define opportunities for increased resource with greater hub height and offshore.
5. Accelerating offshore wind technology RD&D programs

Allow expansion of the ideas or concepts outlined in the 20% report

# Identify specific needs and actions

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<b>Key Issues</b>	<b>Duration of Activity</b>	<b>Roles and Responsibilities</b>
Technology Improvement Partnerships (reduce innovation risk)		
Targeted Basic Research to support Critical Technology Initiatives (reduce innovation risk, lower cost, higher capacity factor,...)		
Full Scale Test Facilities (improve reliability – reduce O&M cost)		
Advanced Rotors and Components: Larger, Lighter, Smarter (higher capacity factor)		
Manufacturing R&D to push the learning curve (reduced capital cost)		
Reliability Monitoring and Problem Resolution, Appropriate Standards and Guidelines (improve reliability – reduce O&M cost)		
Resource Assessment & Plant Performance (including higher elevations on land, offshore, wakes – resolve underperformance, improve plant capacity)		
Offshore Test and R&D		
Distributed Wind		

# Define a five year strategy - Funding

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Key Issues	Funding	Funding (%)		
	\$ M	Federal	State/Other	Private
Technology Improvement Partnerships (reduce innovation risk)				
Targeted Basic Research to support Critical Technology Initiatives (reduce innovation risk, lower cost, higher capacity factor,...)				
Full Scale Test Facilities (improve reliability – reduce O&M cost)				
Advanced Rotors and Components: Larger, Lighter, Smarter (higher capacity factor)				
Manufacturing R&D to push the learning curve (reduced capital cost)				
Reliability Monitoring and Problem Resolution, Appropriate Standards and Guidelines (improve reliability – reduce O&M cost)				
Resource Assessment & Plant Performance (including higher elevations on land, offshore, wakes – resolve underperformance, improve plant capacity)				
Offshore Test and R&D				6
Distributed Wind				

### Examples of Specific Tasks

- Establish Public/Private partnerships for advanced component development
- Create Innovation Demonstration and Evaluation Capabilities
  - Field Evaluation
  - Laboratory Testing

Targeted Basic Research to support Critical Technology Initiatives (reduce innovation risk, lower cost, higher capacity factor,...) E Draft  
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### Examples of Specific Tasks

- Aeroacoustics research (e.g. higher tip speeds)
- Materials research (e.g. carbon fiber applications)
- Aerodynamics (inboard blade performance)
- Wind flow and wake modeling
- Advanced Controls R&D
- Tools to assess system dynamics and stability of large machines (flutter)
- Power electronics and system control

Full Scale Test Facilities  
(improve reliability – reduce O&M cost)

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### Examples of Specific Tasks

- Large scale blade test facilities
- Large scale dynamometers (drive trains and generators)
- Instrumented field testing sites

Advanced Rotors and Components:  
Larger, Lighter, Smarter  
(higher capacity factor)

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### Examples of Specific Tasks

- Light-weight blade (Materials and design)
- Taller towers
- Advanced drive trains
- Load-mitigating rotor control (active and passive)
- Robust control sensing technology
- Power Electronics – higher efficiency, system control...
- Electrical generators – lower losses, lighter, etc.

Manufacturing R&D to push the learning curve (reduced capital cost)

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### Examples of Specific Tasks

- Manufacturing Process R&D
- Automation in large scale manufacturing
- Supply chain development
- Design for manufacturability
- Materials research

Reliability Monitoring & Problem  
Resolution, Appropriate Standards and  
Guidelines (improve reliability – reduce O&M  
cost)

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Examples of Specific Tasks

- National Reliability Database for tracking issues
- Reliability Problem Solving:
  - Gearbox Reliability Collaborative
  - Blade Reliability
  - Generator Reliability
- Evaluation of appropriate standard design criteria for US environments
- Condition Monitoring

## Examples of Specific Tasks

- Measure/document combined wind and wave conditions
- Validate design criteria for US waters and local conditions
- Resource modeling and remote profiling systems
- Environmental impact estimates
- Evaluate and accessibility and serviceability
- Ultra-large scale manufacturing and logistics

Resource Assessment & Plant Performance (including higher elevations on land, offshore, wakes – resolve underperformance, improve plant capacity)

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### Examples of Specific Tasks

- Tall-tower resource data
- Remote sensing development and deployment to measure resource at elevation and offshore
- Wind Plant monitoring to define underperformance sources
- Meso-scale models of flow over and through wind plants
- Atmospheric test sites to validate inflow models
- Impact of wind on local and macro climate

### Examples of Specific Tasks

- Incorporating technology from large machines
- Acoustic Emissions
- Improved Reliability
- Optimized Aerodynamics
- Towers and Foundations