A Vision for High Volume Wind Energy Markets

AWEA Windpower 2006

Robert Thresher

NREL/PR-500-40101
Presented at Windpower 2006 Conference & Exhibition held June 4-7, 2006 in Pittsburgh, Pennsylvania.

Disclaimer and Government License

Today 2006

Bulk Power Generator
5-8¢ at 13mph
With No PTC

- Land Based
- Bulk Electricity
- Wind Farms

Less than 1% of Electricity Market

Tomorrow

Land-Based Electricity Path

Land-Based LWST Large-Scale 2–5 MW

Transmission Barriers

LWST Turbines:
- 3.6¢/kWh at 13mph
- Electricity Market

2012

Offshore Electricity Path

Offshore Turbines 5 MW and Larger

Cost & Regulatory Barriers

Offshore LWST Turbine:
- 5 cents/kWh
- Shallow/***Deep*** *water*
- Electricity Market
- Higher wind Sites

2014 and Beyond

Advanced Applications Path

- **Hydrogen**
- **Clean Water**
- **Plug Hybrids**

Cost & Infrastructure Barriers

Custom Turbines for Multi-markets:
- Electricity
- H2 production
- Desalinate water
- Transport & Storage

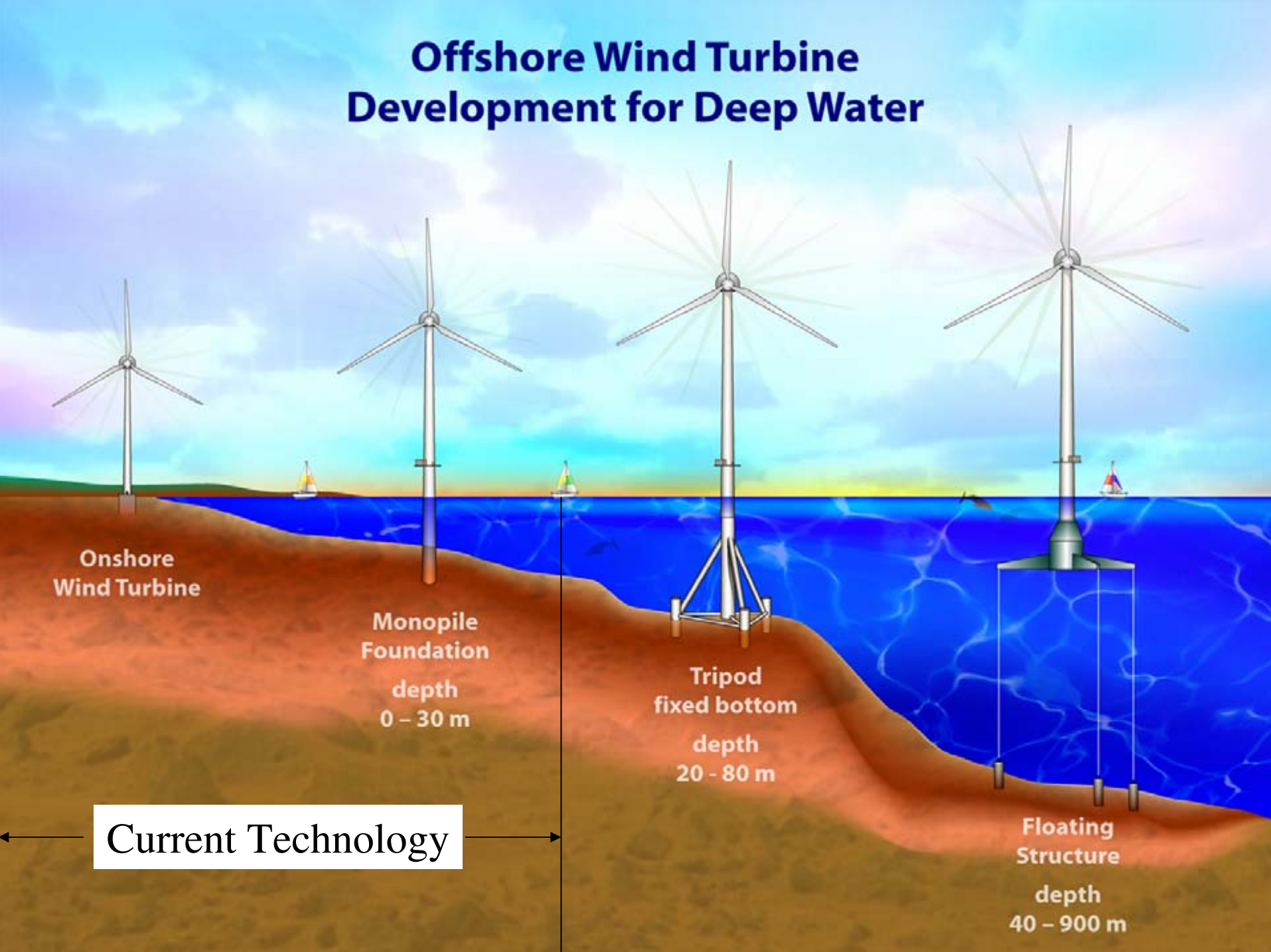
2020 and Beyond

Advanced Turbines Competitive without a PTC

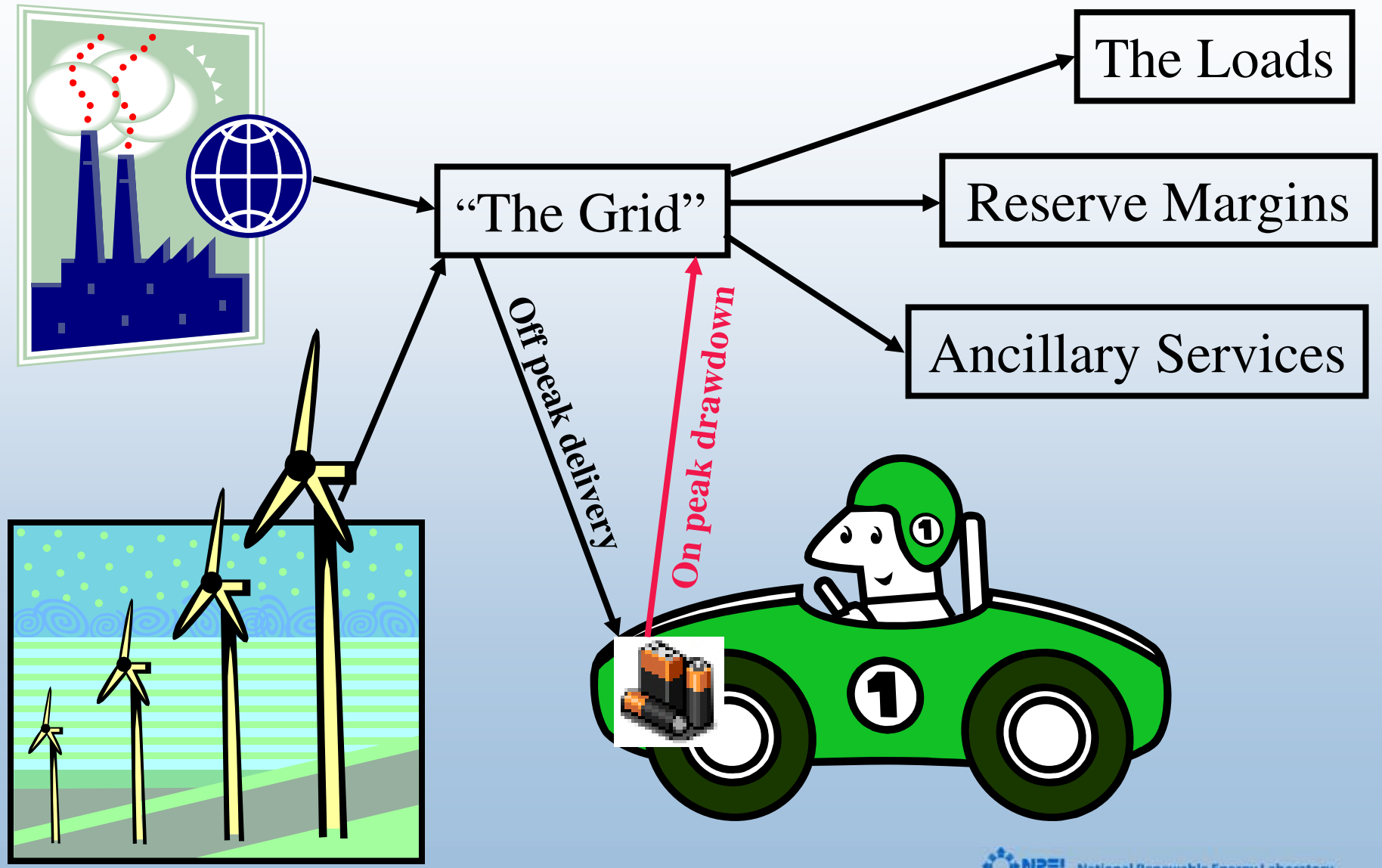
- Lifetime O&M cost reduction through innovation giving high reliability
- Condition monitoring to actively analyze the turbine condition and forecast maintenance
- Drivetrain innovation to reduce weight/cost while improving reliability
- Active rotor pitch and speed control for load reduction and more energy
- Lighter rotors with higher tip speeds and more flexible blades giving higher energy and lower loads
- Twist/flap coupling for passive load control during turbulence conditions
- Scaling to larger sizes with transport and installation constraints?

NPS 1.5 MW Direct Drive

Clipper 2.5MW DGenQ


Offshore Wind Turbine
Development for Deep Water
Onshore
Wind Turbine
Monopile
Foundation
depth
0 – 30 m
Tripod
fixed bottom
depth
20 - 80 m
Floating
Structure
depth
40 – 900 m
Current Technology

Plug Hybrid Electric Vehicles
(A Future Off-Peak Electricity Market with Storage)



Offshore Wind / Wave Synergy

- Long-term Possibility +20 Years
- Maximize Grid Interconnect Potential
- Reduce Intermittency & Increase Total Energy Output
- Increase System Reliability & Reduce Maintenance

Credit: GE Energy

Wind / Wave Integrated Platform

Reproduced with permission of Hy-Spec Eng