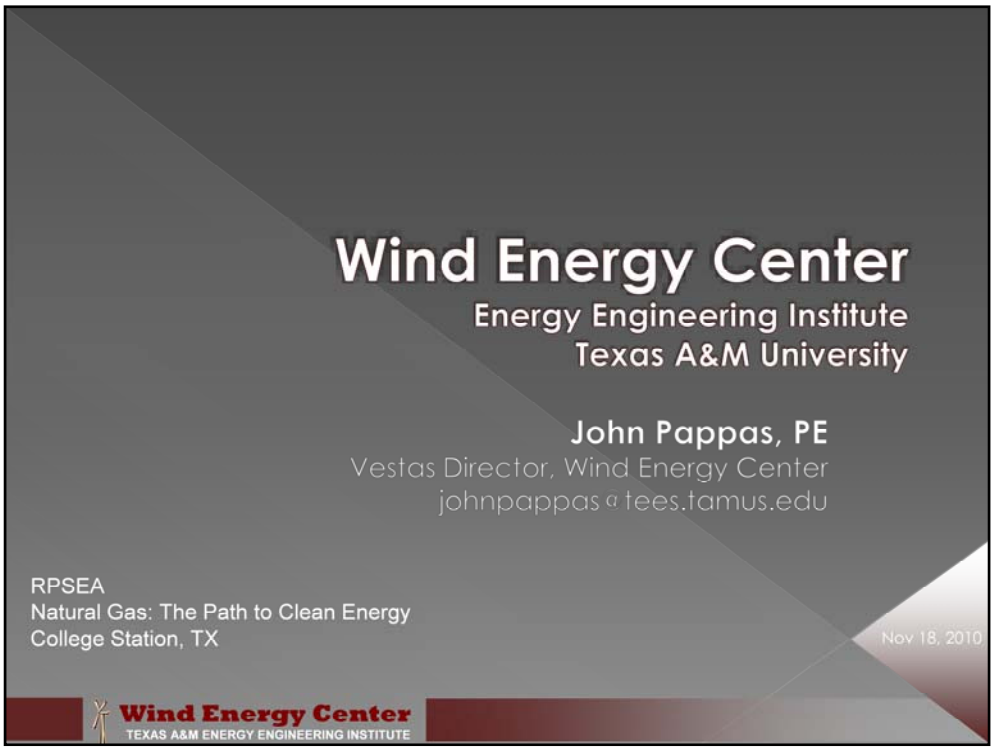
Wind Energy Center
Energy Engineering Institute
Texas A&M University
John Pappas, PE
Vestas Director, Wind Energy Center
johnpappas@tees.tamus.edu
RPSEA
Natural Gas: The Path to Clean Energy
College Station, TX
Nov 18, 2010
Wind Energy Center
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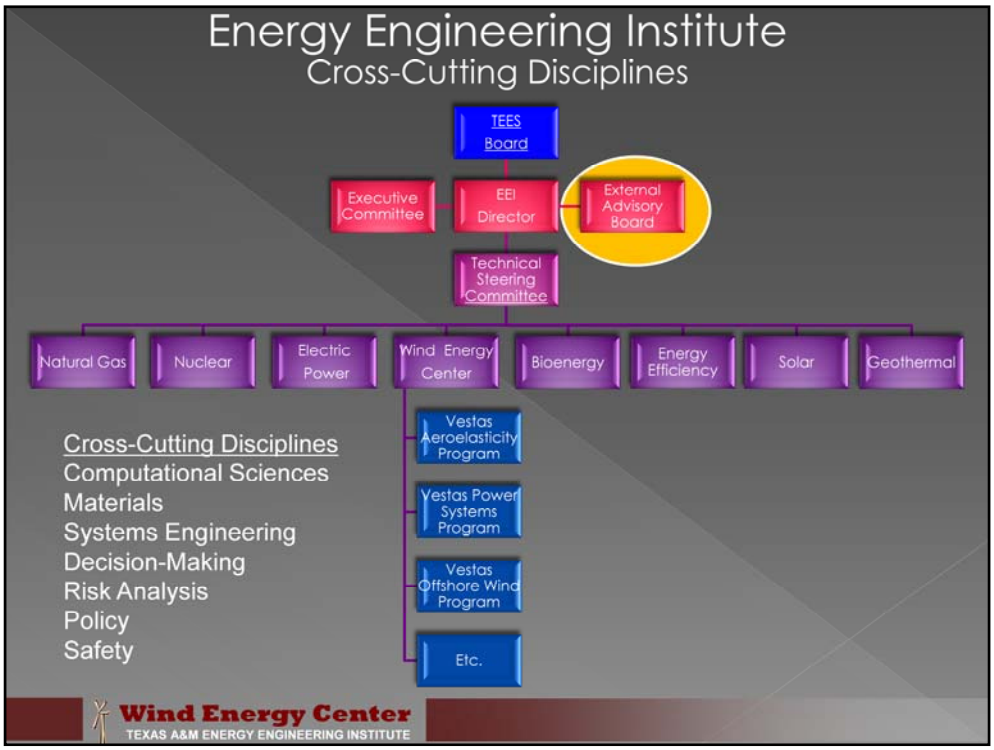

EEI was formed by TAMU because of the need to expand its capabilities in the emerging energy technology sectors.

TAMU recognizes that developing the technologies requires eliminating the type of stove piping that has often characterized university research and instead requires leveraging and combining the diverse capabilities of the institution.

In addition, reduced financial resources and the need for regional and national solutions to energy technology problems increases the need for collaboration with industry and our peer institutions.

The EEI is TAMU's vehicle for increasing that collaboration and operating in the multidisciplinary mode that this type of technology development demands.

Texas A&M Wind Energy Center

- Established to grow TAMU activity and reputation in the wind energy sector
  - First BOR-approved center within EEI
- BOR approval over a year ago
  - Center director hired and center activity begun late summer 2010
- Vestas MRA & MOU
  - MRA framework for research activities
  - MOU covers operations and center goals
- Start up funding from Vestas Wind Energy
  - Center formation and initial administration
  - Achievement of short-term goals
    - Development of graduate research projects
    - Undergrad capstone and multidisciplinary projects

•WEC is an new research unit ofTAMU that is formalized through charter and approval by the TAMUS BOR

•Goals and mission are ….

Starting Point & Foundations

Approximately 30 faculty and professional researchers actively engaged in wind power or directly applicable research

- Structures
  - On- & off-shore
  - Wind/wave/structure interaction
  - Vibration
  - Health monitoring
- Rotor and drivetrain
  - Rotordynamic and vibration analysis and control
  - Advanced bearings
  - Magnetic gears
  - Advanced generators
- Logistics and [illegible]
  - Process mapping
  - Network optimization
  - Transportation management
  - Policy and best practices

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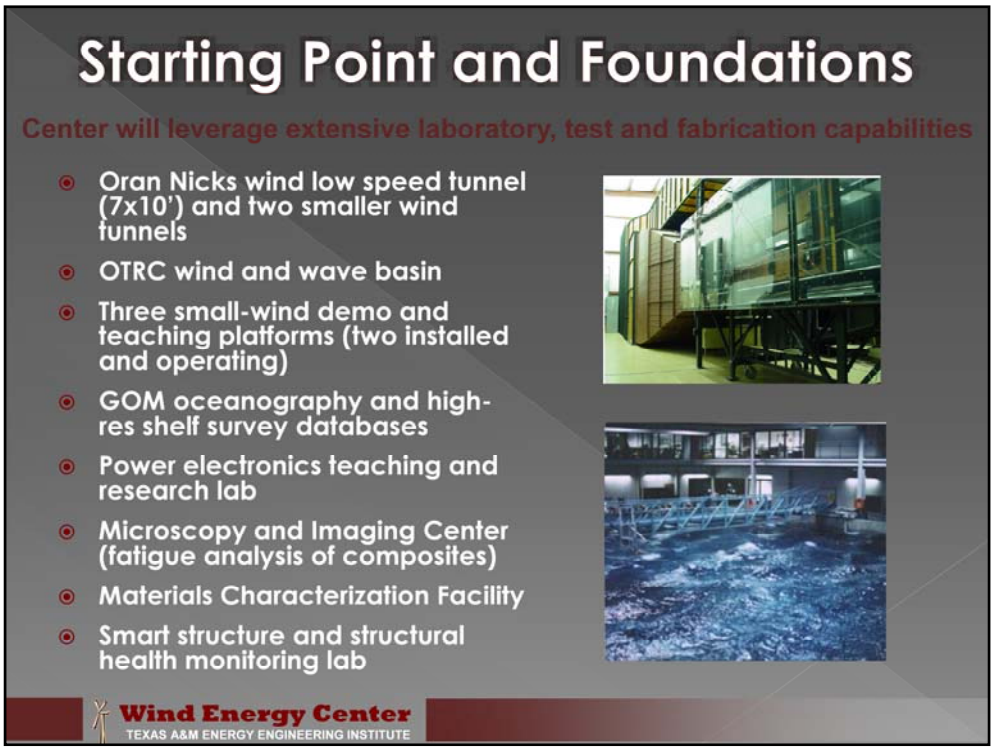
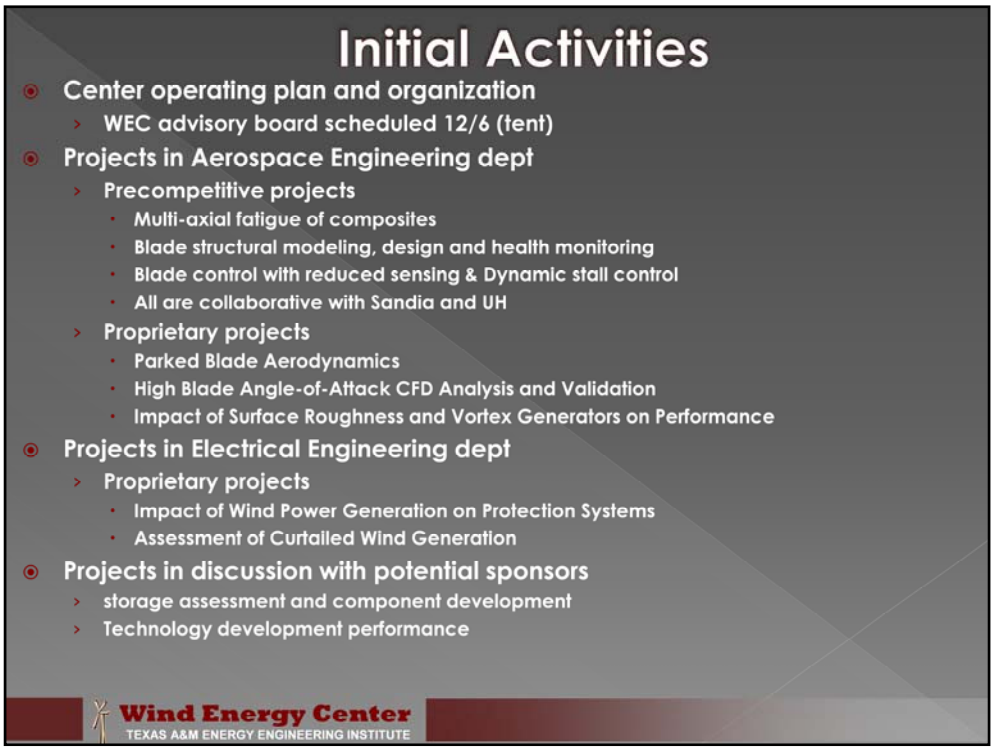


Faculties and research activities have created a critical mass that make creating a Wind Energy Center the obvious next step

Idea is to focus these resources, encourage multidisciplinary interaction and research and raise the level of impact the TAMU has on wind power technology



This is where we are three months in. 650 k

Initial Activities

- Outreach to industry and technical community organizations
  - Communicating WEC goals and need to increase collaborative university research to meet national goals and industry needs
  - The Wind Alliance Collaborative Offshore Wind Initiative
  - Invitations to speak at several conferences, schools
- Initiatives to increase multi-disciplinary and graduate student project funding
- Developing major projects with DoE, industry & universities
  - Offshore wind
  - Demonstration of prototype turbine

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DoE Offshore Wind Program

- Large-Scale Offshore Wind Power in the US
  - Reduce time to deploy
  - Lower COE
  - Remove market barriers
- $49M tech development and demonstration program
  - 50% cost share
  - Eliminate "market barriers"
  - "Turbine in the water as fast as possible as responsibly as possible"
  - Regional collaborative with state and local support
- Significant outreach by DoE
  - Workshops and RFI
  - Three public meetings and one webinar
  - Final report detailing program rationale and objectives

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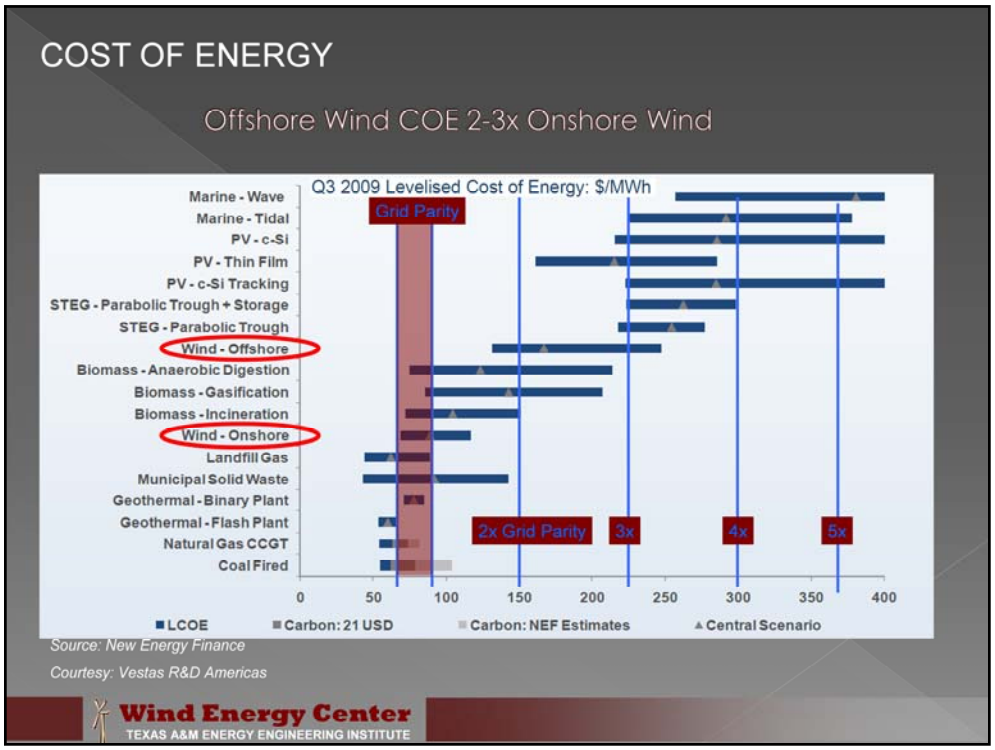


levelized cost of electricity (LCOE) providesa common way to compare the cost of energy across technologies because it takes into account the installed system price and associated costs such as financing, land, insurance, transmission, operation and maintenance, and depreciation, among other expenses.

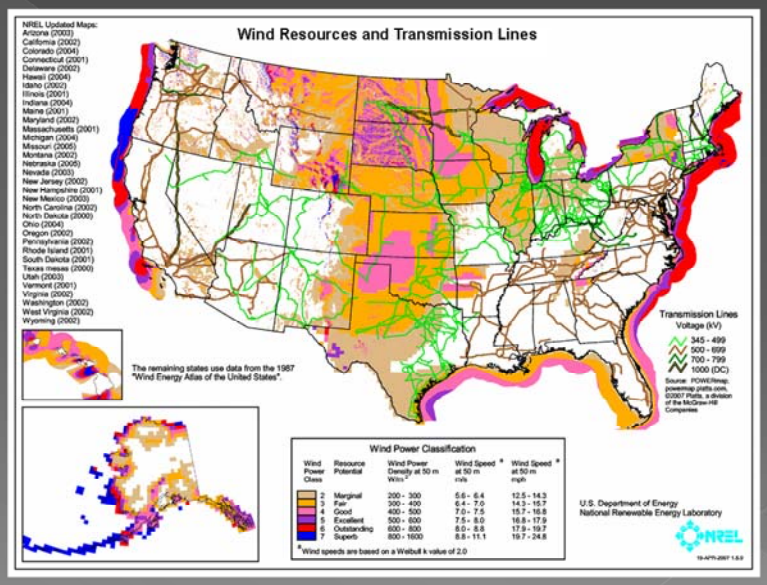
Grid parity is the point at which alternative means of generating electricity is equal in cost, or cheaper than grid power.

Offshore is 2-3x onshore

And yet, Offshore farms are being built around the world

Off Wales

Why Go Offshore?



Why Offshore?

Advantages

- Better wind resources
  - Less turbulence/low roughness – more steady production
- Layout flexibility
- Less resistance from local population
- No physical limits for size and weight
- Space

Disadvantages

- Transportation
- More complex site conditions
  - Geology
  - Sea, Waves and currents
  - Saline environment
- Installation and maintenance are more complicated and expensive

V80-2.0 MW, North Hoyle, UK

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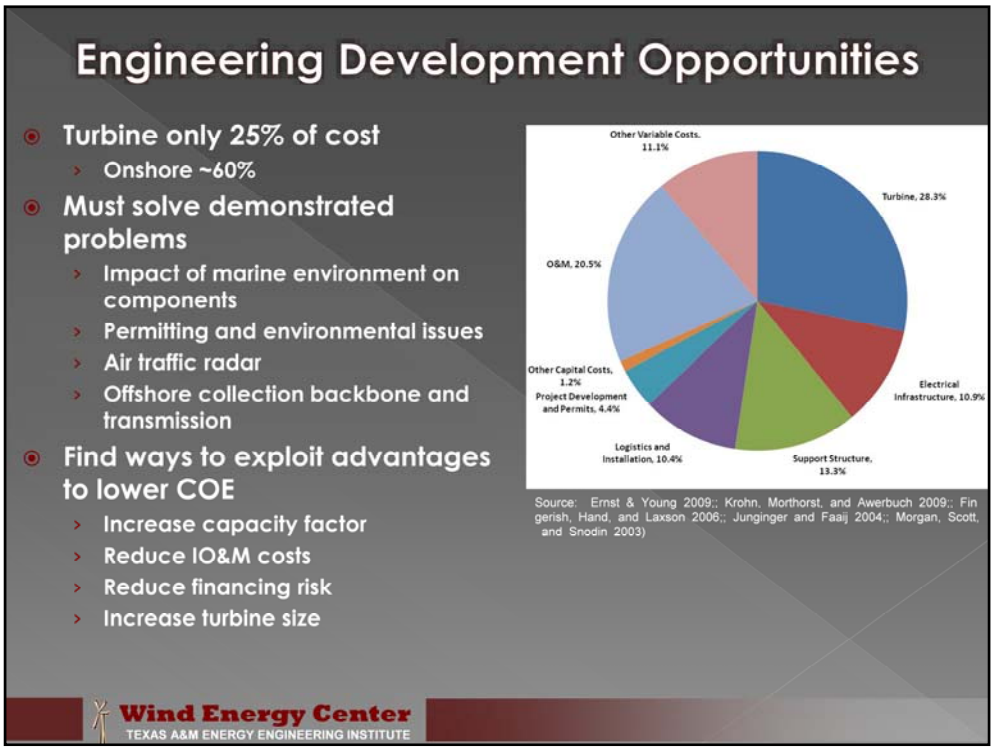

Must solve demonstrated problems

- Impact of marine environment on components
  - Especially drive train and power generation (Horns Rev Demo Project experience)
- Permitting issues
  - Cape wind is 10 years in
- Offshore backbone and transmission

Find ways to exploit advantages to lower COE

- Increase capacity factor
  - Increase reliability
  - Remote sensing and control
  - Better wind and weather forecasting tied to turbine control
- Reduce IO&M costs
  - Automated installation
  - Towed structures erected on shore
  - Remote sensing, health monitoring and control

Offshore Technology Development and Demonstration Collaborative

- Regional, collaborative response to FOA led by The Wind Alliance
- TWA
  - Collaboration of industrial, academic and public-sector entities
  - Focus on pre-competitive improvement of workforce, infrastructure and technology
- Partial TWA membership
  - Industry: Vestas, Shell Wind, BP, Quanta Services, VEC
  - Public Sector: TXGLO, TWC, HARC, SDPUC
  - Academia: UT, UC, UW, FSU, UI
  - Total 51 members

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Emerging Strategy

- ATD and technology development aimed at removing barriers to opening market
- Advanced Technology Demonstration with a program of technology development
  - TWA manages the project and submits the proposal
  - OEM turbine, foundation, industry lead
  - TWA-member offshore operator
  - Tie to local distribution
  - Possible novel foundation
  - On Texas GLO lease
- Technology Development through Offshore Energy Research Collaborative
  - TWA academic and industry membership conduct technology development and demonstration
    - Leverage DoE investment to become self-sustaining & outlive DoE offshore program
    - Modeled on existing research centers at TAMU, UT, elsewhere
  - Located at former NSI
    - Eventual fabrication & test capability

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ATD Focus on Immediate Barriers

- Turbine in the water
  - Test platform
  - Novel platform
- Data gathering campaign
  - Meteorological and wind data
  - Impact of marine environment
  - Structural performance
  - Hurricane survivability
  - Air traffic control radar
- Addressing permitting process
  - GLO
  - Transmission to shore
  - Environmental impacts in GOM
- Reduce project risk

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Technology Development Focus on COE

- IO&M
  - Advanced platforms
  - Reduced nacelle weight
  - Forecasting and wind farm performance prediction
  - Subsea electrical distribution and grid interconnection
  - Hurricanes
- Increase reliability, life & capacity factor
  - Wind, wave and fatigue loading
  - Corrosive seawater exposure
  - Controls and condition monitoring

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Aerial view of Naval Station Ingleside and undeveloped Port of Corpus Christi Property, Ingleside, Texas

Former NSI facility – TAMU is the current developer-- Large pier, loading capabilities, excellent building infrastructure for fabrication and test

Excellent space for collaborative activity and is a potential focal point for a Wind Alliance Offshore center

Faculties and research activities have created a critical mass that make creating a Wind Energy Center the obvious next step

Idea of the WEC is to focus these resources, encourage multidisciplinary interaction and research and raise the level of impact the TAMU has on wind power technology

NSI forms a facility opportunity and anchor for the collaborative TWA offshore wind initiative

You may mention our "partnership" with TX State Technical College in Harlingen, where a wind technician program is being developed. The TSTC president, Cesar Maldonado (no relation), is planning to offer wind courses at Ingleside. Ellison is involved.

East Wharf area 1750’ at 45’ depth, West Wharf area 600’ at 37’ depth, Alpha Pier 1100’double deck, Small Craft pier 600’.

Hotel services provided are 480 volts shore electrical power, oily waste, sanitary sewer, and potable water. Double decked Alpha pier houses 3 transformer vaults, each housing 2–5250kva transformers providing 480 volts to 84 receptacles.

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Commercial Tract:
Rehab Facility
86-acre Purchase
Industry
R&D
Expansion
Commercial
Green Space
Manufacturing
Site
Commercial
Green Space
Commercial
Industry
Intel
Institute
Wind
Energy R&D
Maritime
Training
Facility
TEEX
Training
Commercial
R&D
Wind Energy
Test Facility
University
R&D
Wind Energy
Test Facility
Waterfront
Green Space
Leased SIMA
Building and
Pier and Wharf
Google

Texas A&M Wind Energy Center

- Start up proceeding well
  - Outreach
  - Early project funding successes
  - Planning for immediate future and next several years
    - Offshore proposal strategy and teaming
    - Identifying opportunities with DoD, OEMs, Project developers & Operators
  - Increasing opportunities for students in emerging energy technology

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