

The Potential for Offshore Wind Power in the Southeast – A Regional Approach



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Outline



- SCIES background
- Why offshore wind?
- What are the challenges?
- Conclusions



South Carolina Institute for Energy Studies (SCIES)



- Organization
 - *State chartered R&D organization founded in 1981*
 - *Administratively attached to Clemson University*
 - *Report to the Vice President for Research and Economic Development*
- Mission
 - *To promote energy research in and for the state*
 - *To bring new energy technologies into the state*
 - *To contribute to regional and national energy issues*
 - *To promote energy education*
- Focus
 - *Application oriented projects with near term payoff*
 - *Research in support of applications*

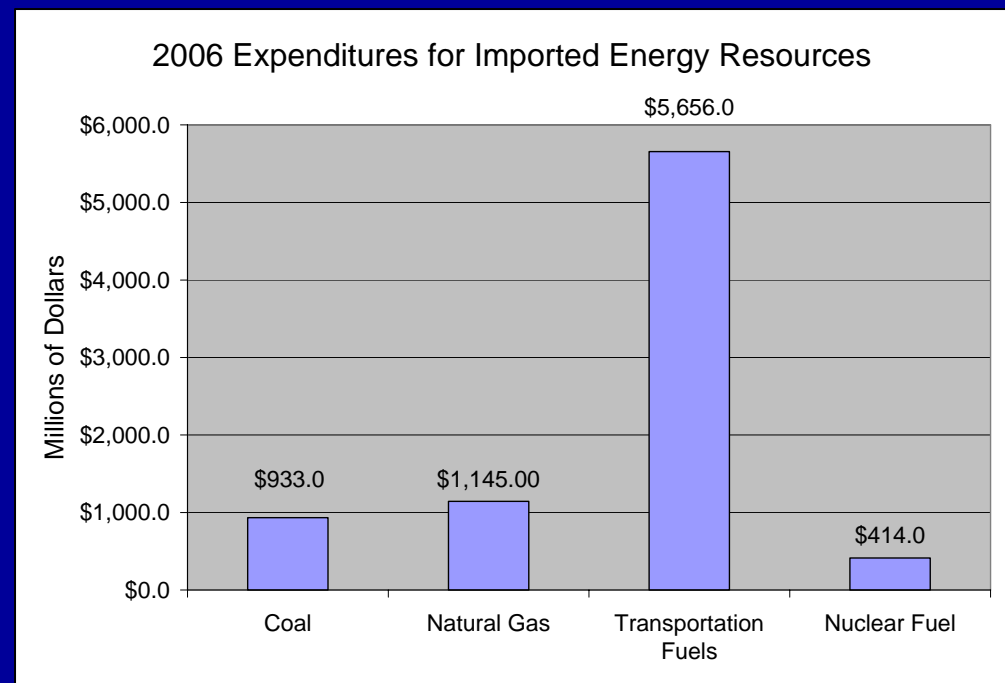


Why Offshore Wind?

“It’s the economy, stupid”



- South Carolina has no indigenous coal, oil, natural gas or uranium
- In 2006 South Carolina imported –
 - *\$2.5B in fuel for electricity and heat*
 - *\$5.6B in transportation fuels*
- Impact –
 - *Loss of jobs*
 - *Loss of tax revenues*
- Similar for other states in the region





Why Offshore Wind?

“The potential economic benefits”



- A 6,500 MW offshore wind farm, capable of producing 25% of SC's electricity would provide
 - *\$10.4B in-state capital investment*
 - \$3.3B in local construction contracts
 - Potential for in-state system fabrication
 - *\$190M/yr in-state for operation and maintenance*
- Elimination of \$500M per year in fuel imports



© GE Wind Energy



Why Offshore Wind? “The environment”



- Healthier air –
 - *No SO_x or NO_x*
 - *No acid rain*
 - *No particulates*
 - *No mercury*
- Eliminates greenhouse gases –
 - *No CO₂*
- No water used
- No nuclear fuel issues
 - *Long term storage*
 - *Proliferation*





Why Offshore Wind? “Energy Security”



- 1970's – OPEC Oil Embargo
 - *Oil prices skyrocketed*
 - *US imported 42% of its oil*
- 1990 – Gulf War
 - *Oil prices skyrocketed*
 - *US imported 47% of its oil*
- 2006 – Iraq War
 - *Oil prices skyrocketed*
 - *War costs of \$320B thru 2006*
 - *US imports 57% of its oil*

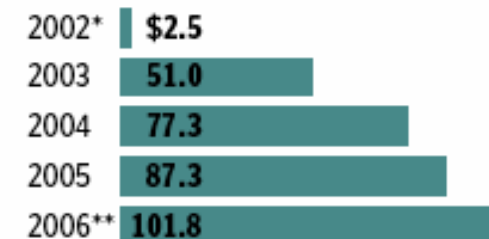


© LA Times

A Higher Count

The Congressional Research Service released new estimates of Iraq war costs.

Annual cost of Iraq war, in billions



*Includes some money authorized in 2001.

** Includes supplemental request.

SOURCE: Congressional Research Service

GRAPHIC: The Washington Post

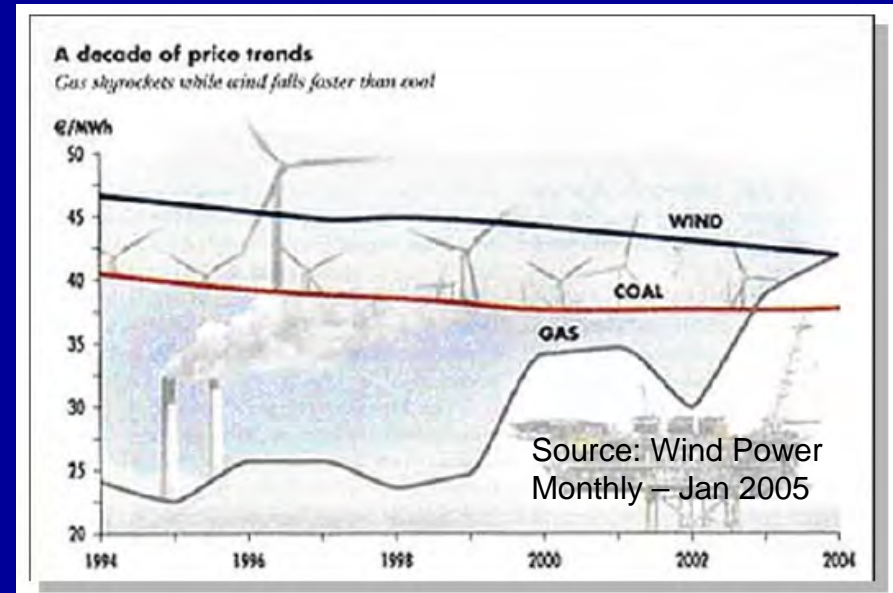
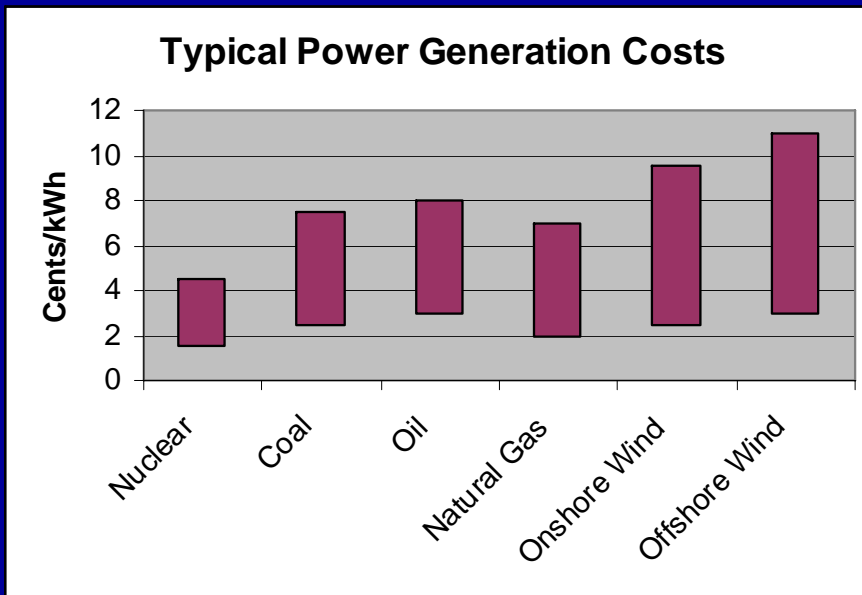
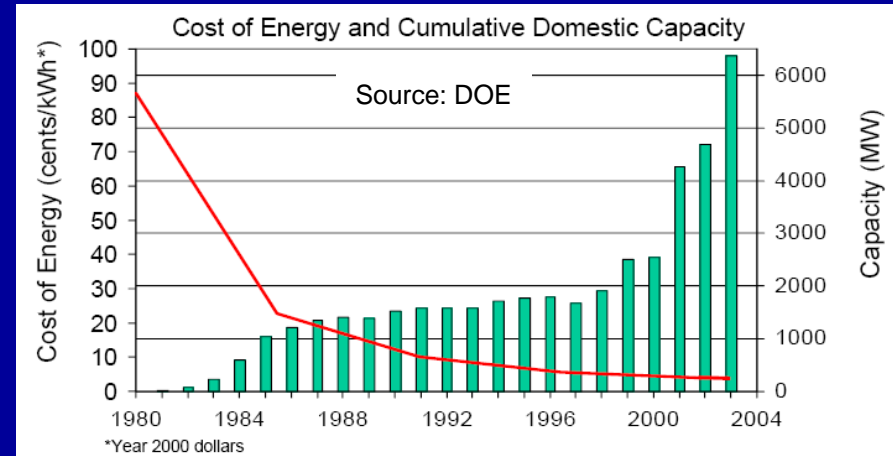
- Reduces NG imports and makes NG and coal
- available for conversion to transportation fuels
- Allows biofuels to be dedicated to transportation uses
- Provides electricity for future plug-in hybrids
- Produce hydrogen fuel for transportation use



Why Offshore Wind? “It’s cost competitive”



- Wind is approaching cost parity with fossil and nuclear fuels
- Price trends favor wind
- Emission restrictions will increase wind competitiveness



Source: World Renewable Energy Report – 2002-2007



Why Offshore Wind?

“Negligible onshore potential”



- Onshore wind resources are mainly in the mid-west
- Major eastern electrical loads are concentrated near the coast
- Nation’s electrical grid not constructed for efficient high power transmission over long interstate distances



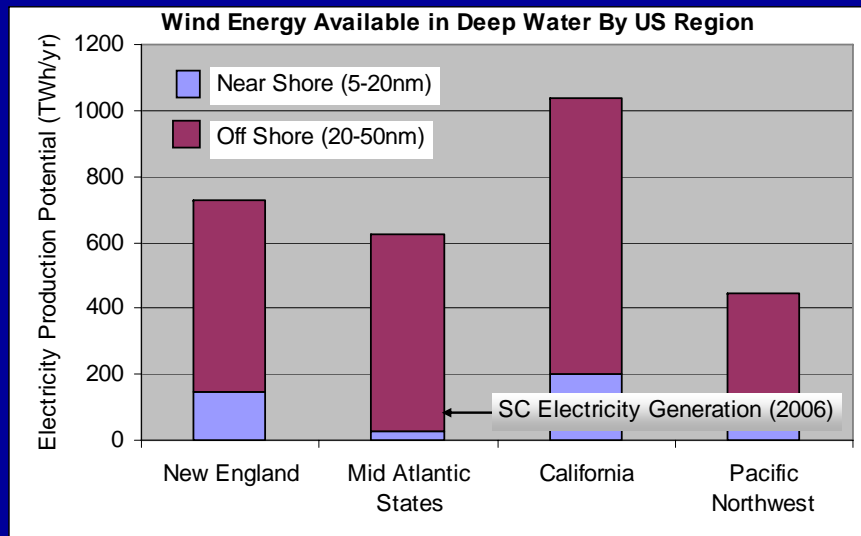
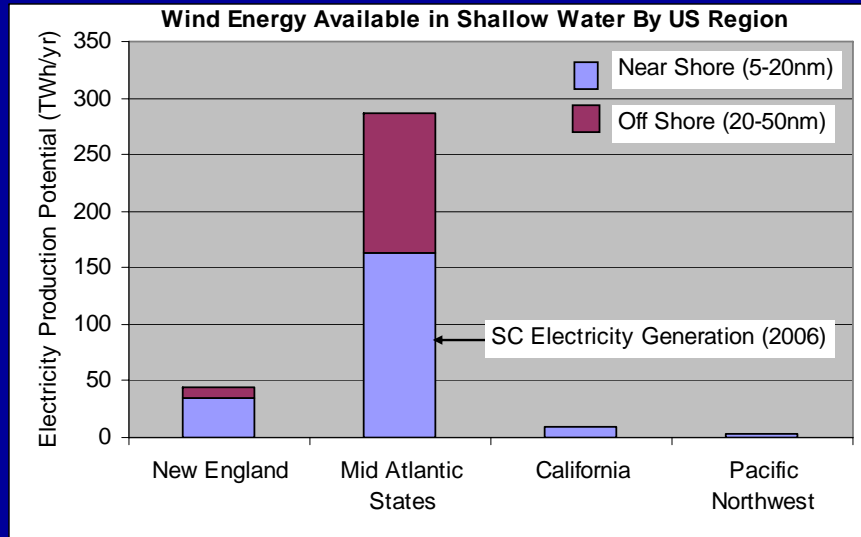


Why Offshore Wind?

“Substantial offshore potential”



- The mid-Atlantic has the more wind energy available in shallow waters than all other regions of the US combined
 - *Can be exploited now using technologies proven in Europe*
- Close to major population centers and grid connections
- More than twice the shallow water potential exists in deeper waters within 50 nm of shore
 - *Future potential based on emerging technologies*



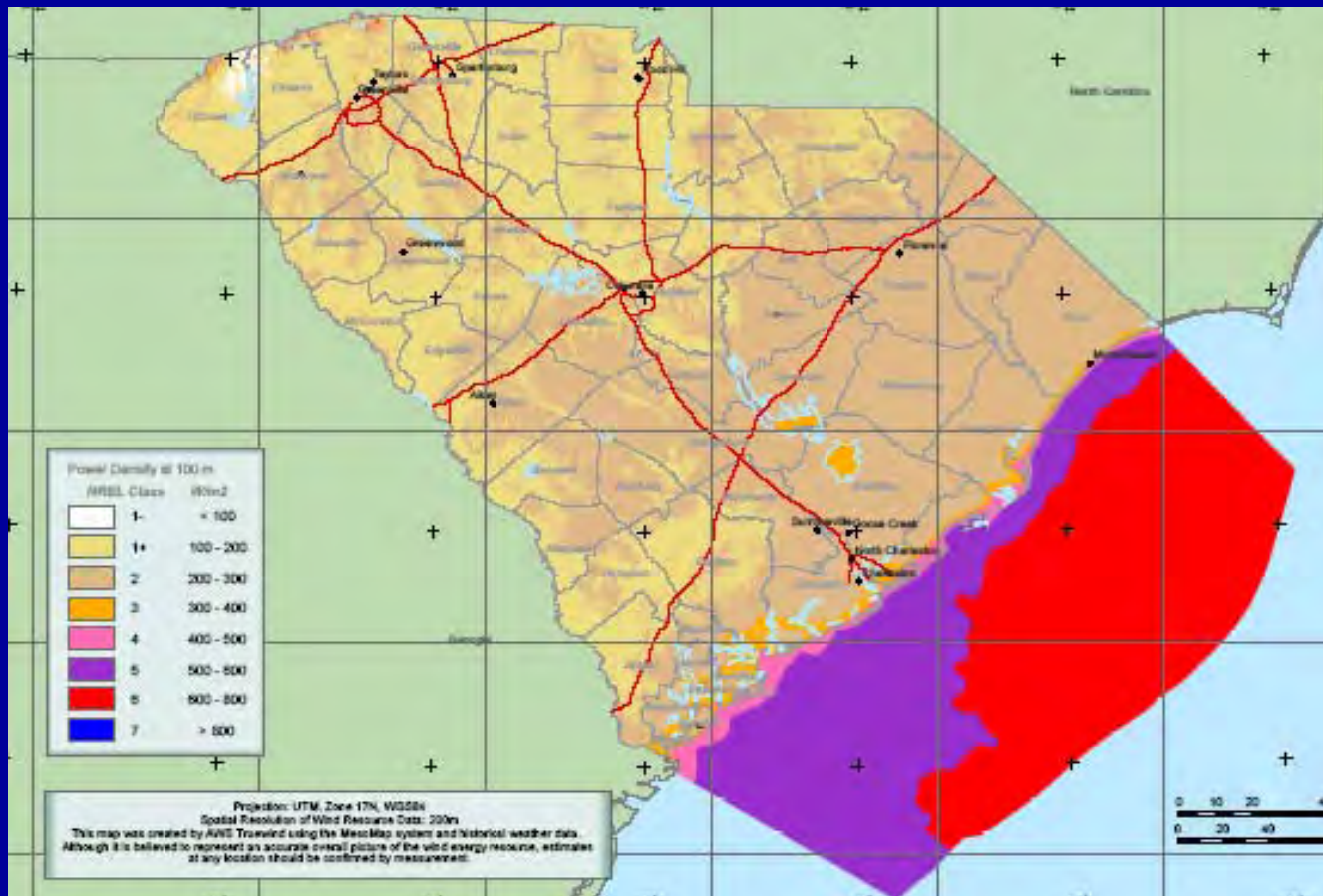


Why Offshore Wind?

“Excellent near-shore potential”



- South Carolina has sustained category 5 and 6 winds (rated “excellent” to “outstanding”) near shore, along its entire coastline

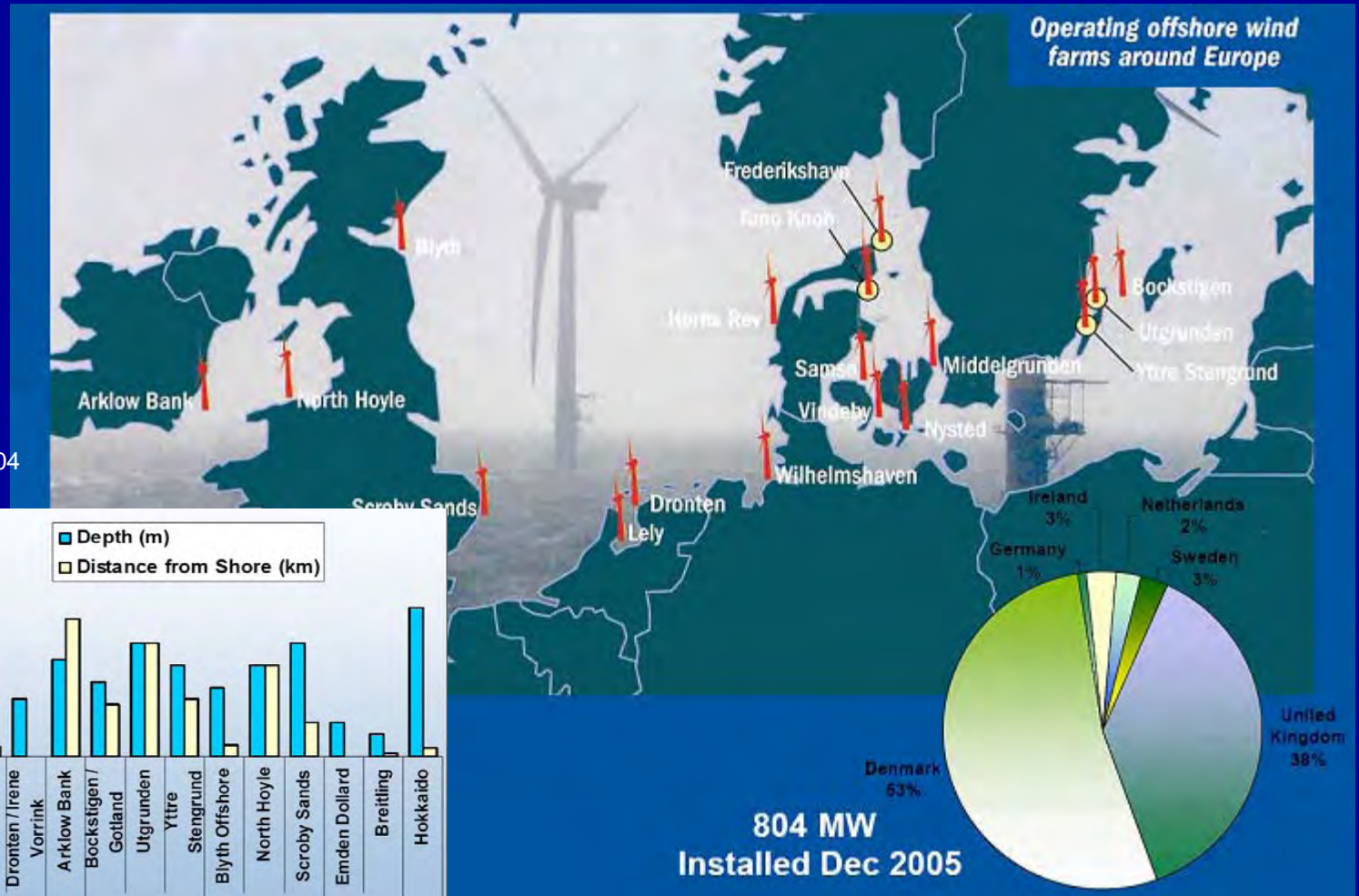




Why Offshore Winds? “It’s proven technology”



European wind farms have been installed in similar water depths and operated under more severe environmental conditions since 1991





The Technical Challenges



- Turbine Size
- Towers & Foundations
- Reliability
- Energy Storage



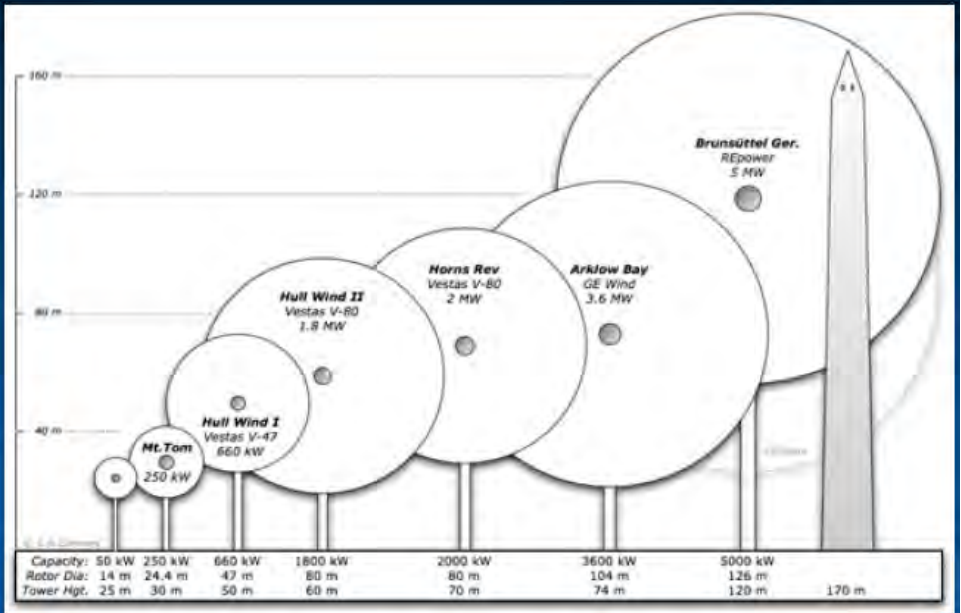
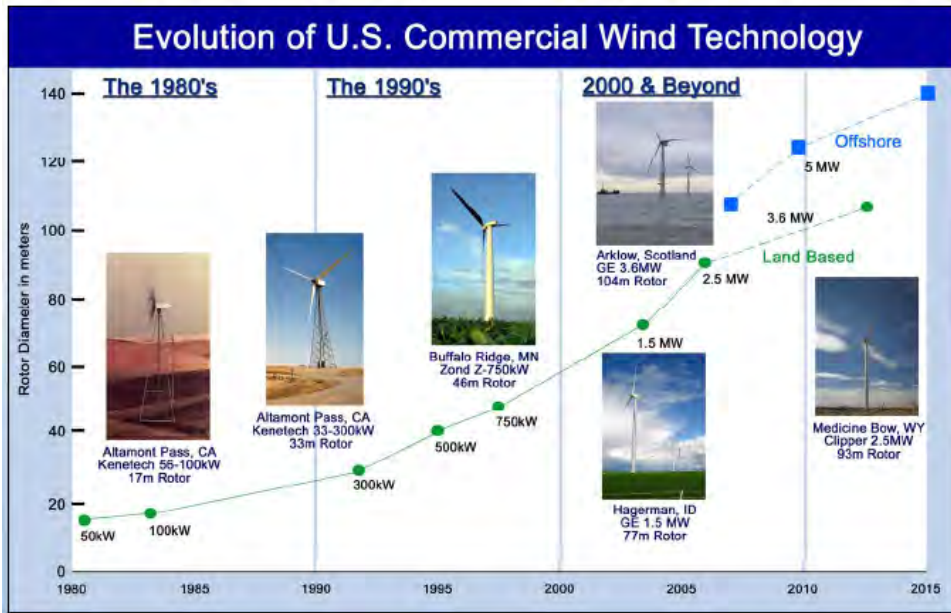
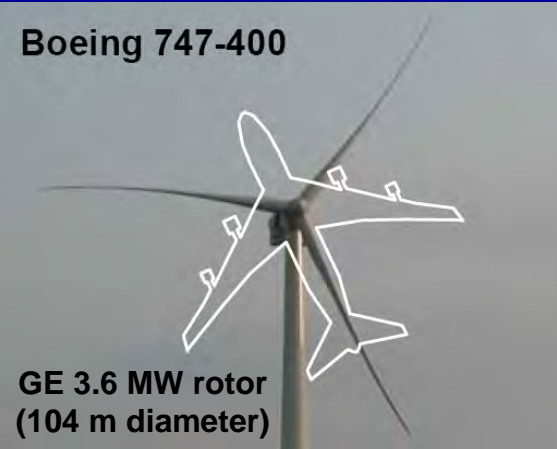
The Technical Challenges

“Turbine Size”



- Economics favor larger turbines

Source: NREL

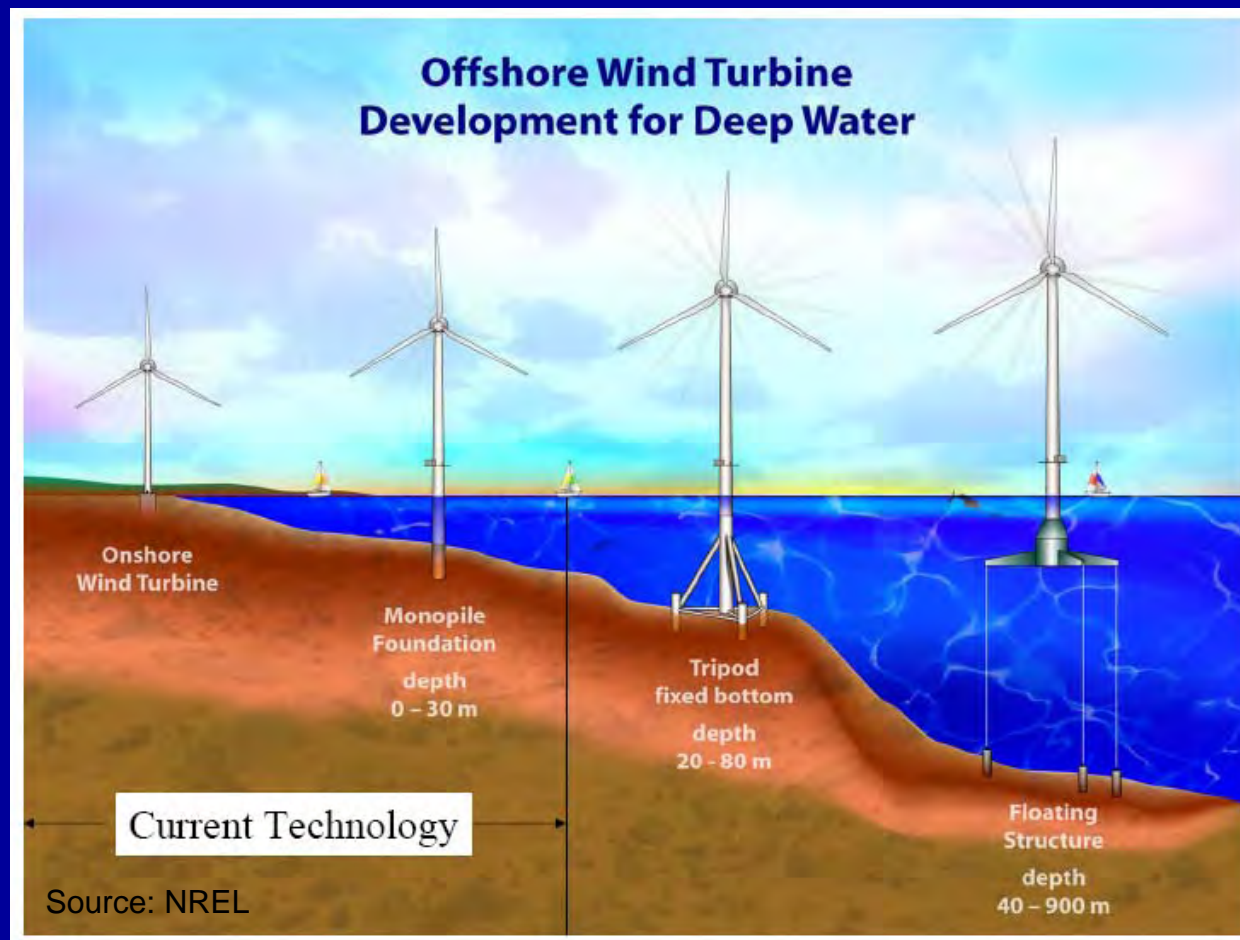




The Technical Challenges “Towers & Foundations”



- New foundation designs will be required for deeper water applications





The Technical Challenges “Reliability”



- High system reliability will be required to reduce O&M costs
 - *Minimize more difficult and costly offshore maintenance*



Source:
NREL



The Technical Challenges “Energy Storage”



- Inexpensive means to store and produce energy for low wind periods is required
- Existing pumped storage capability exists (e.g Duke Energy and Corps of Engr.)



Lake Jocassee (610 MW)



Bad Creek (1065 MW)

- Substantial additional hydro power exists
 - *Duke Energy operates 1200 MW in NC and SC*
 - *Corps of Engineers operates 1300 MW on SC/GA border with 300 MW of pumpback*
- Other peaking systems also exist



The Environmental Challenges



- The impact of location, construction and operation must be assessed
 - *Fish and the fishing industry*
 - *Migratory and marine birds and mammals*
 - *Seabed vegetation*
 - *Shipping and sea lanes*
 - *Local residents and tourism*
- Extensive studies by Great Britain and Denmark have show minimal adverse environmental effects
- Beneficial effects far outweigh negatives



Wildlife

- UK's RSPB states
 - "Climate change is the most serious long-term threat to biodiversity."
 - "between 15 and 37% of all species may be committed to extinction by 2050.....This equates to over 1 million species worldwide"



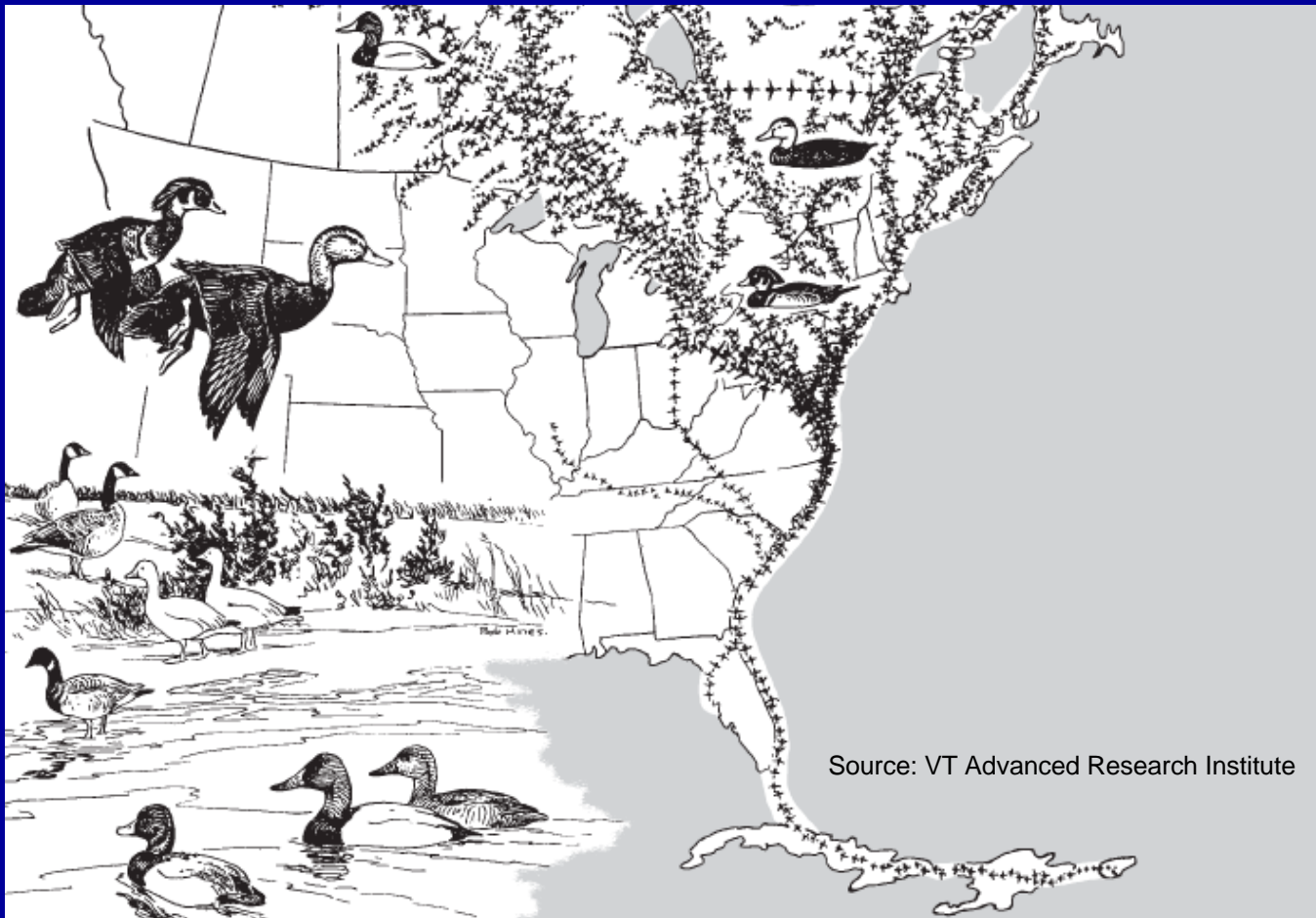
Source: VT Advanced Research Institute



The Environmental Challenges “Migratory Birds”



- Offshore wind farms avoid migratory bird routes





The Environmental Challenges “Visual Impact”



- Minimal visibility at expected distances from shore due to –
 - *Haze and humidity*
 - *Physical size and horizon*

4 n. miles



5 n. miles



7 n. miles



11 n. miles



Meteorological Optical Range Table

Code No.	Weather	Distance
0	Dense fog	Less than 50
1	Thick fog	50 - 200 yards
2	Moderate	200 - 500 yards
3	Light fog	500 - 1000 yards
4	Thin fog	.5 - 1.0 nm
5	Haze	1.0 - 2.0 nm
6	Light Haze	2.0 - 5.5 nm
7	Clear	5.5 - 11.0 nm
8	Very Clear	11.0 - 27.0 nm
9	Exceptionally Clear	Over 27.0



Source: VT Advanced Research Institute



Conclusions



- South Carolina and its neighboring coastal states have no indigenous fossil or nuclear fuel resources
 - *Lost jobs and tax revenues*
- The mid-Atlantic states possess 80% of the offshore wind that can be harvested with existing shallow water technology
 - *Equivalent to 3x the electricity produced in SC in 2006*
- Wind has substantial environmental and energy security benefits
- Technology developments remain to further reduce the cost of electricity and exploit winds over deeper waters
 - *Additional 6x the amount of electricity produced in SC in 2006*
- A regional coalition should be established
 - *Federal and State support is needed*



Questions?



Southeast Regional Offshore Wind Power Symposium

February 26-27, 2007 ❖ Charleston, SC



Symposium hosted by
Clemson University
Georgia Institute of Technology
North Carolina State University
Coastal Carolina University

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