Offshore Wind: Virginia's Largest Cost-Effective, Commercially Available, Renewable Energy Resource

VIMS Industry Partnership Meeting

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VCERC Industry partner

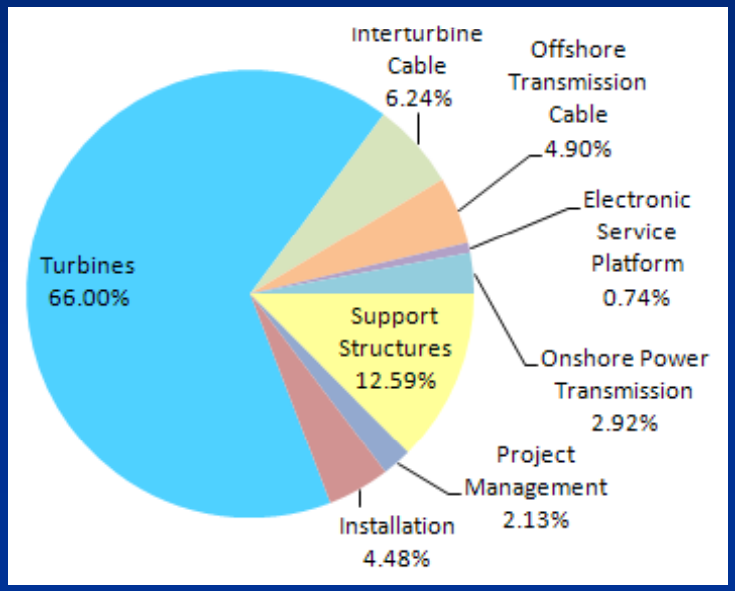
V90-3MW Offshore Wind Project

Capital cost estimated in March 2008 dollars using Virginia specific bids and published data

- *Plant Cost: $ 1,747,539,503*
- *Transmission Cost: $ 153,245,992 (shoreward of the Electronic Service Platform)*

588 MW rated capacity

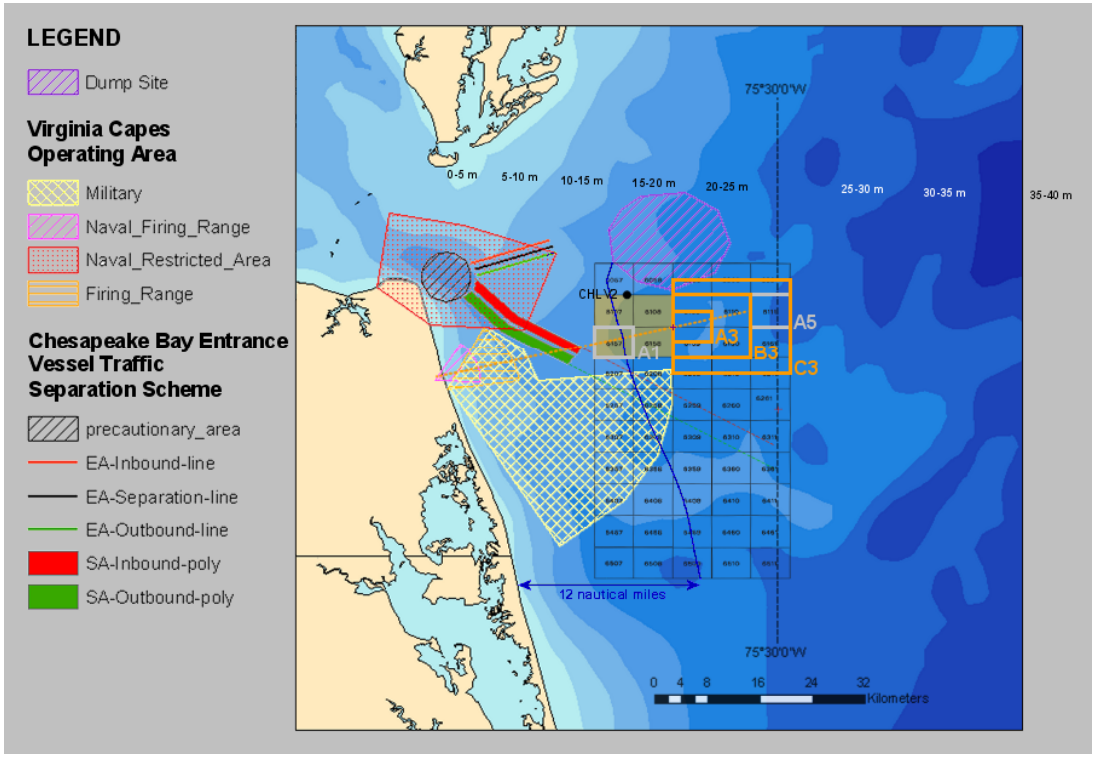
38.3% annual operational capacity factor



Monopile Foundations Driven into Seabed and Transition Pieces Grouted on Top

North Hoyle 2-MW Turbines Installed Using Towed *Seacore* Jack-Up Rigs

Northern Project Footprint Locations Selected for Proximity to CHLV2 Wind & Wave Data



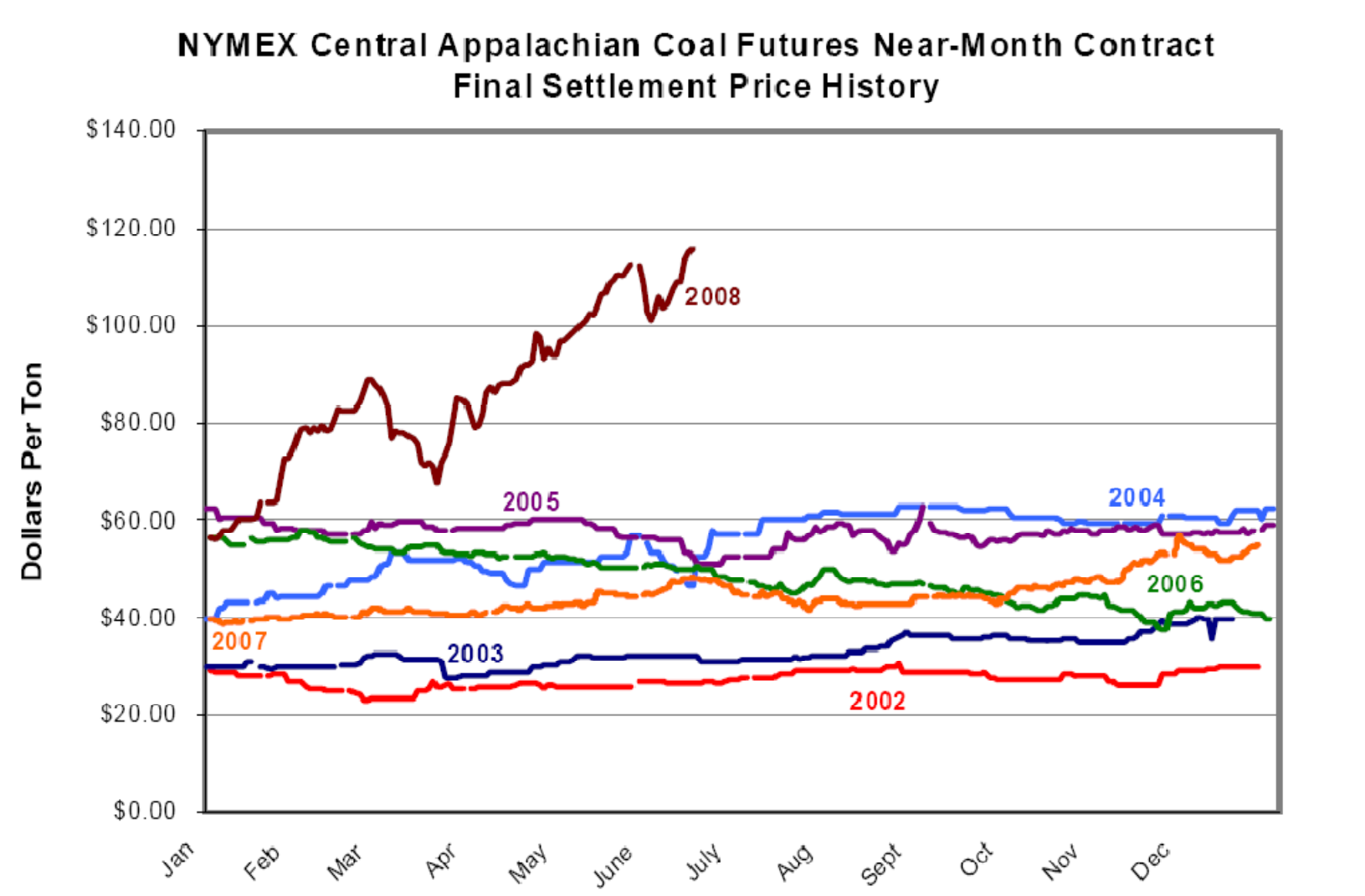
ODU's Center for Coastal Physical Oceanography is compiling data on offshore wind and wave climate.

ODU's Coastal Engineering Program is developing wind turbine tower foundation design alternatives.

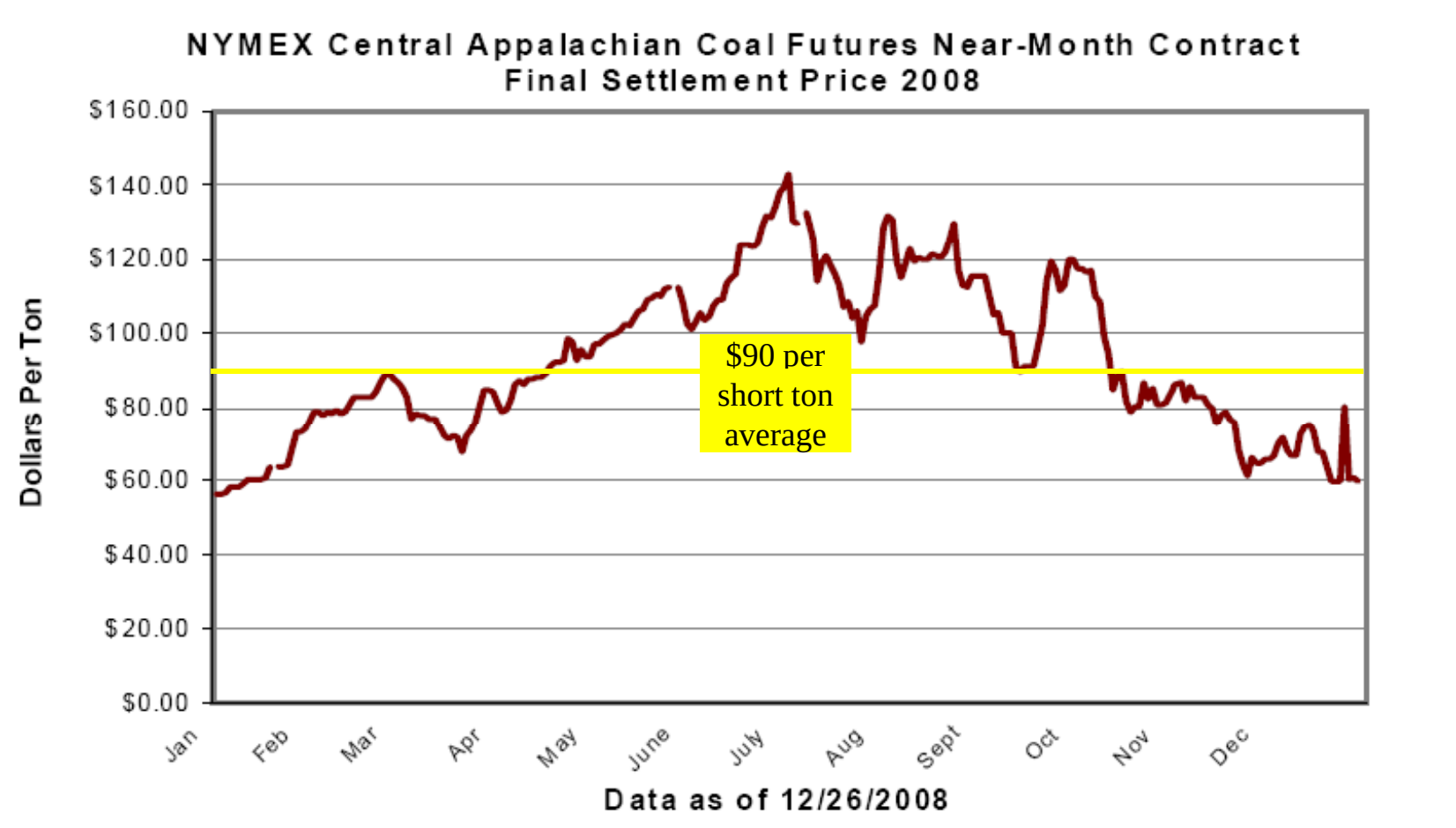
ODU's Electrical Engineering Department is developing turbine electrical interconnection design alternatives.

Waves and solar radiation are also measured on CHLV2

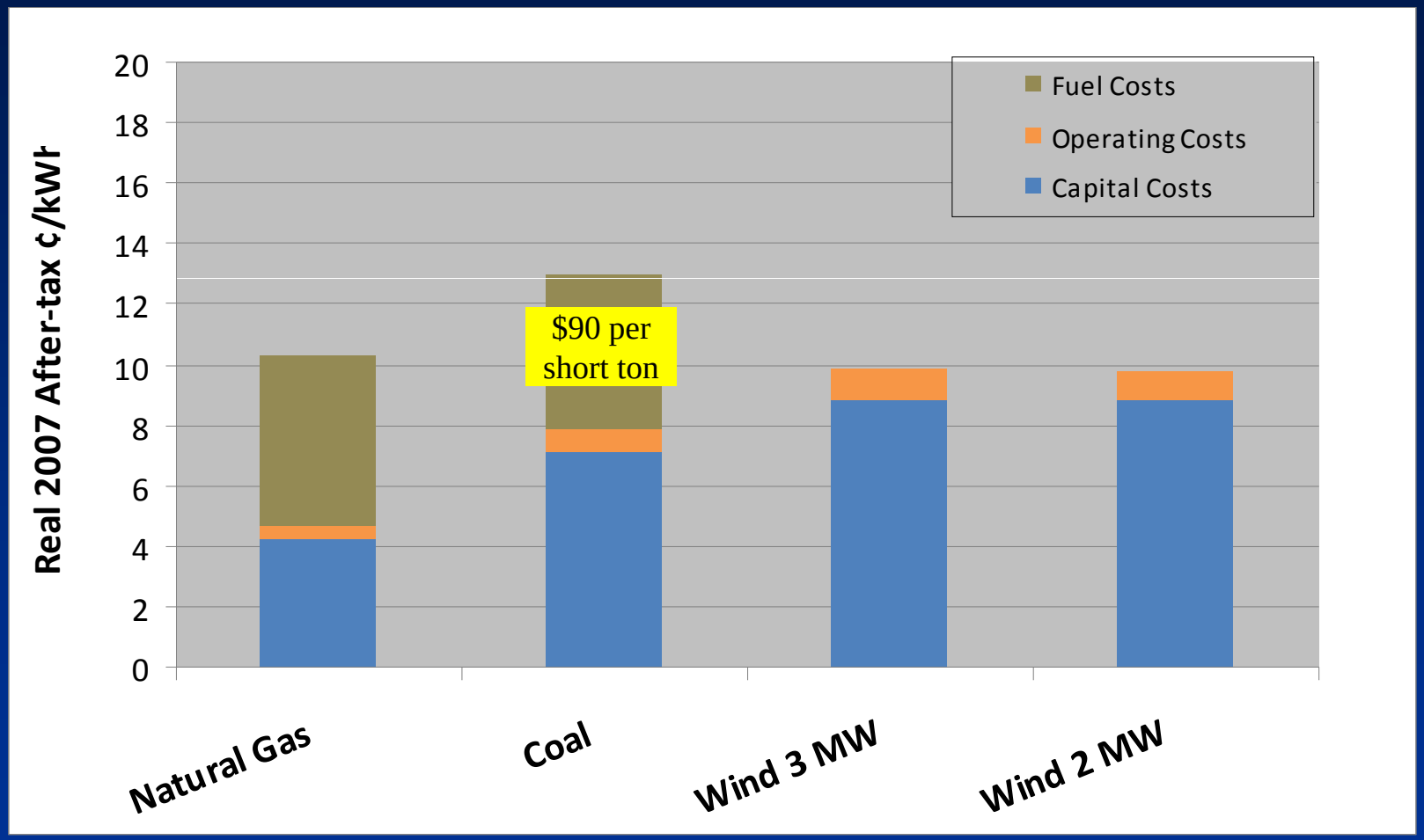
What Coal Price to Use?
Central Appalachian Coal No Longer Stably Priced



What Coal Price to Use?
Used 2008 Year Average



Cost of Energy Comparison with Fossil Fuel Fired Generation



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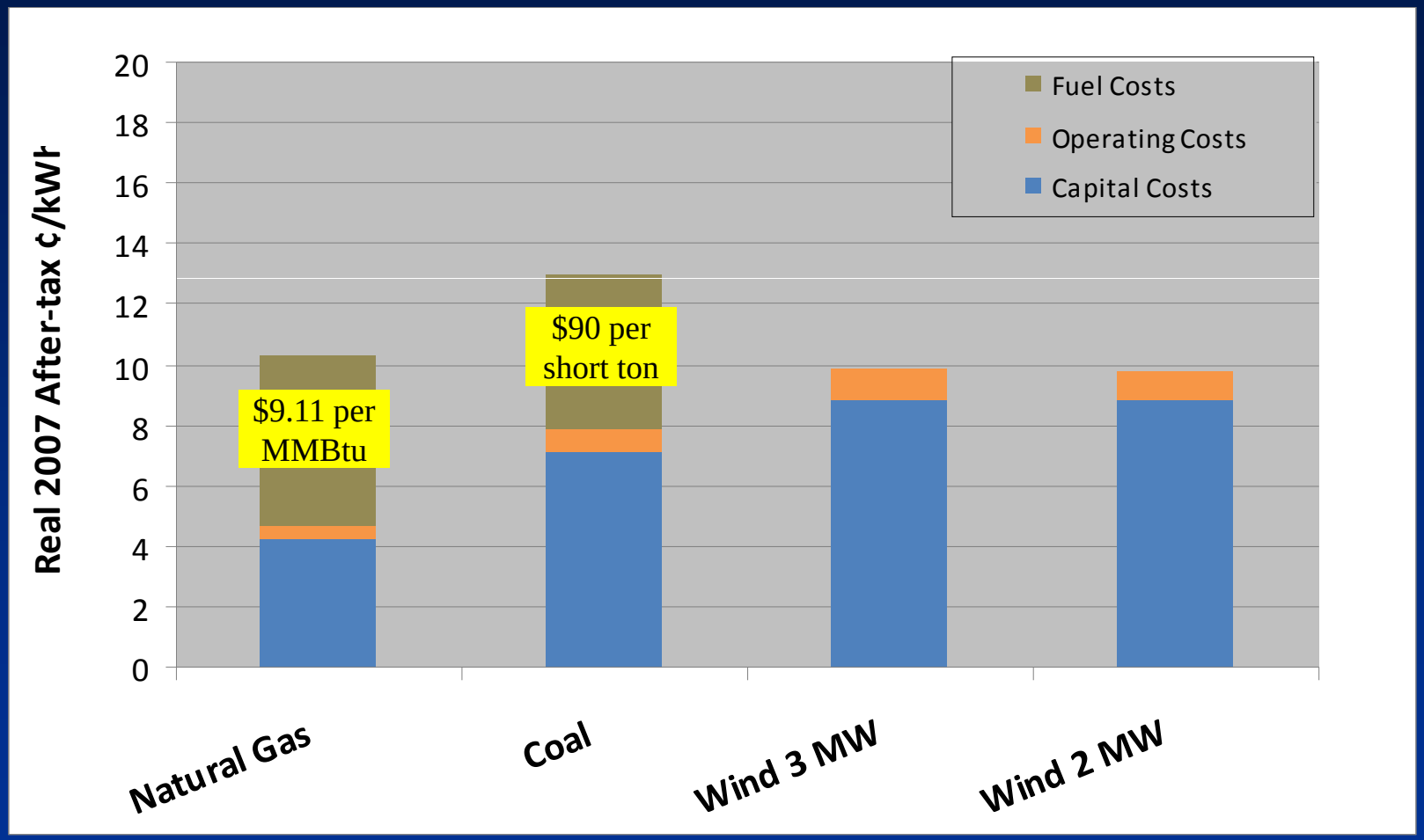
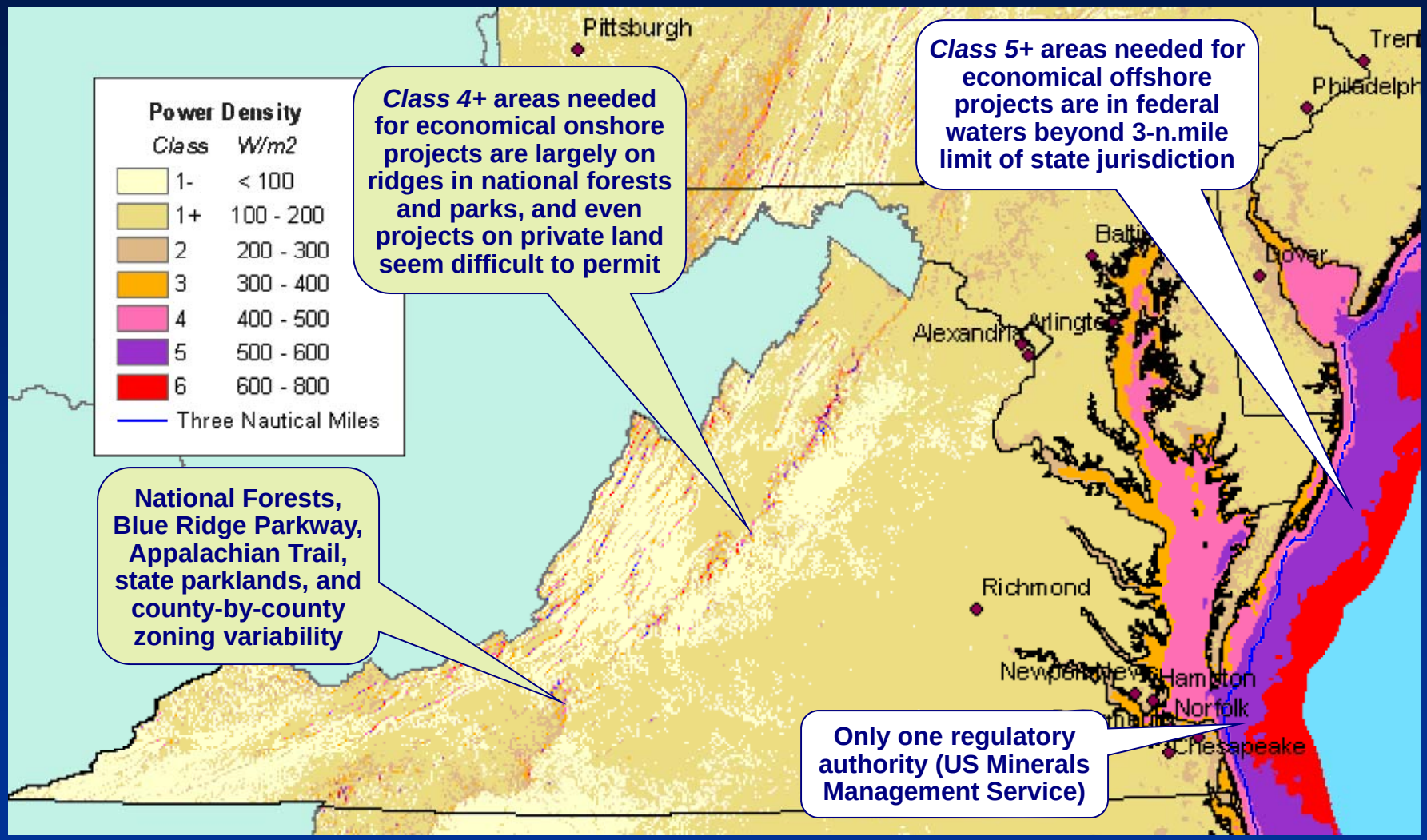


Cost of Energy Comparison with Fossil Fuel Fired Generation

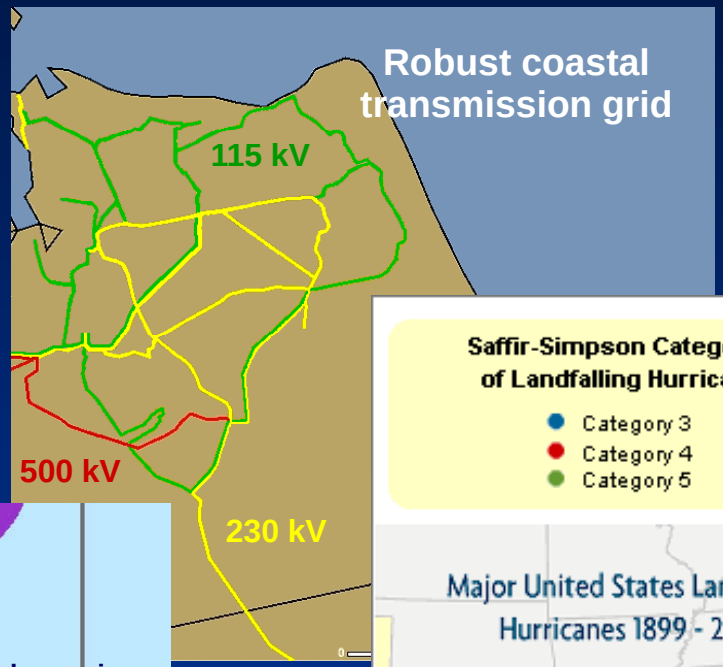
	Natural Gas	Coal	Offshore Wind	
			V90-3MW	V90-2MW
Name Plate Capacity (MW)	580	585	588	588
Operational Capacity Factor	89.9%	89.9%	38.3%	47.9%
PJM Capacity Factor	89.9%	89.9%	19.6%	27.7%
Energy Produced (MWh/Year)	4,568,080	4,607,460	1,972,069	2,466,471
Economic Life	25	50	25	25
Emissions				
NO_x (lbs/MWh)	0.08	0.76	-	-
SO_x (lbs/MWh)	-	1.31	-	-
CO_2 (lbs/MWh)	800.81	2,100.10	-	-
Overnight Plant Cost ($/kW)	1,058	3,077	3,135	3,943
Levelized Energy Cost ($/kWh)	10.9	14.2	12.2	12.2
...with PTC and Bonus Dep ($/kWh)	10.9	14.2	9.9	9.8

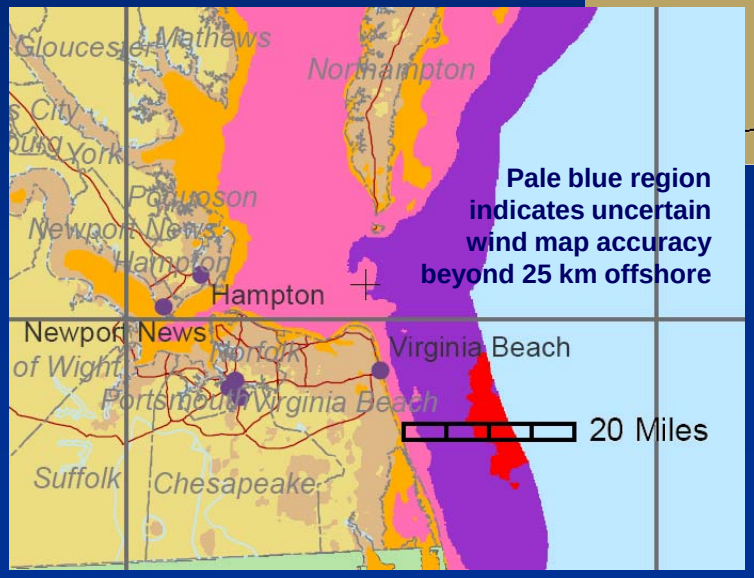
Virginia's Wind Energy Resources Offshore are Much Larger than on Land



Hampton Roads Area has Unique Features Favorable for Offshore Wind Power Development

Class 6 ( ) wind energy resource located within 10-15 miles (16-24 km) of shoreline and close to major, growing centers of power demand

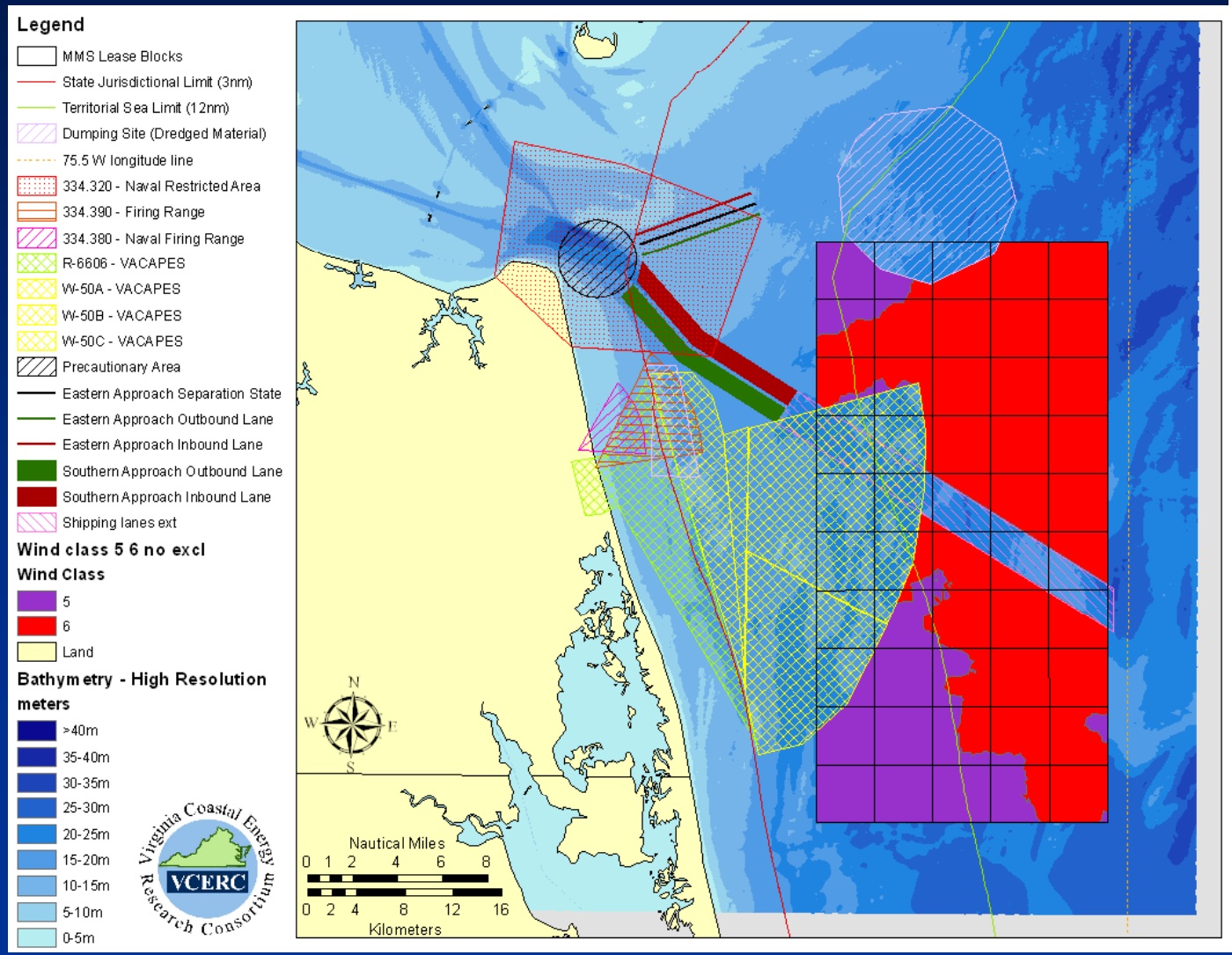




Minimal probability of major hurricane strike (Categories 3 through 5)

GIS Analysis and Mapping of Resource

Focus on 50 MMS lease blocks and avoid all excluded areas



MMS lease blocks are 4.8 km x 4.8 km, with each block having 7 x 7 turbines.

Turbines spaced 685 m apart (7.6 rotor diameters)

Each lease block could contain 49 turbines

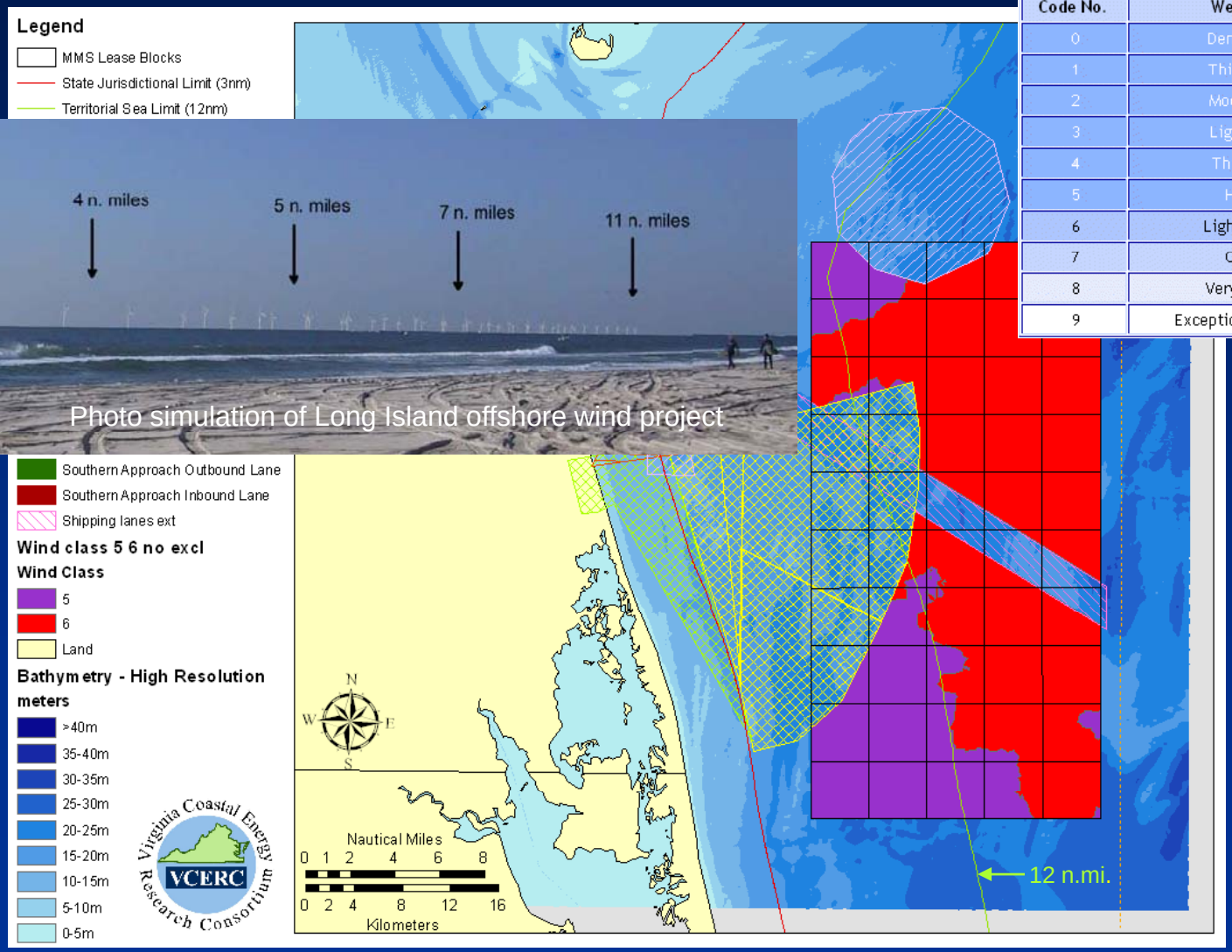
= 147 MW per block with Vestas model V-90 3 MW

= 6.4 MW per km^2

GIS layers and calculations by James Madison University

Class 6 Winds are Largely Beyond the Visual Horizon

Photo simulation of Long Island offshore wind project

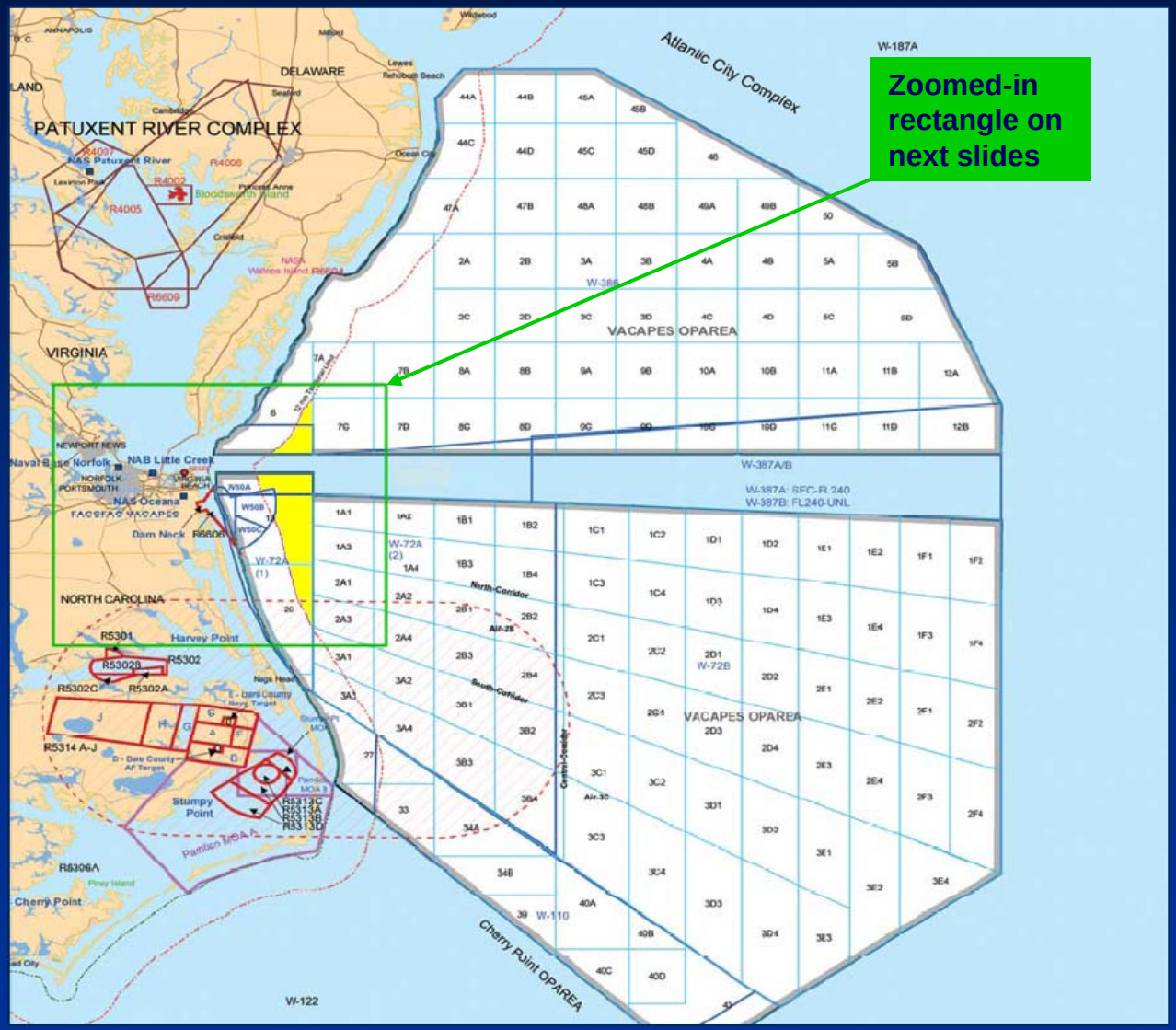


Meteorological Optical Range Table		
Code No.	Weather	Distance
0	Dense fog	Less than 50
1	Thick fog	50 - 200 yards
2	Moderate	200 - 500 yards
3	Light fog	500 - 1000 yards
4	Thin fog	.5 - 1.0 nm
5	Haze	1.0 - 2.0 nm
6	Light Haze	2.0 - 5.5 nm
7	Clear	5.5 - 11.0 nm
8	Very Clear	11.0 - 27.0 nm
9	Exceptionally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

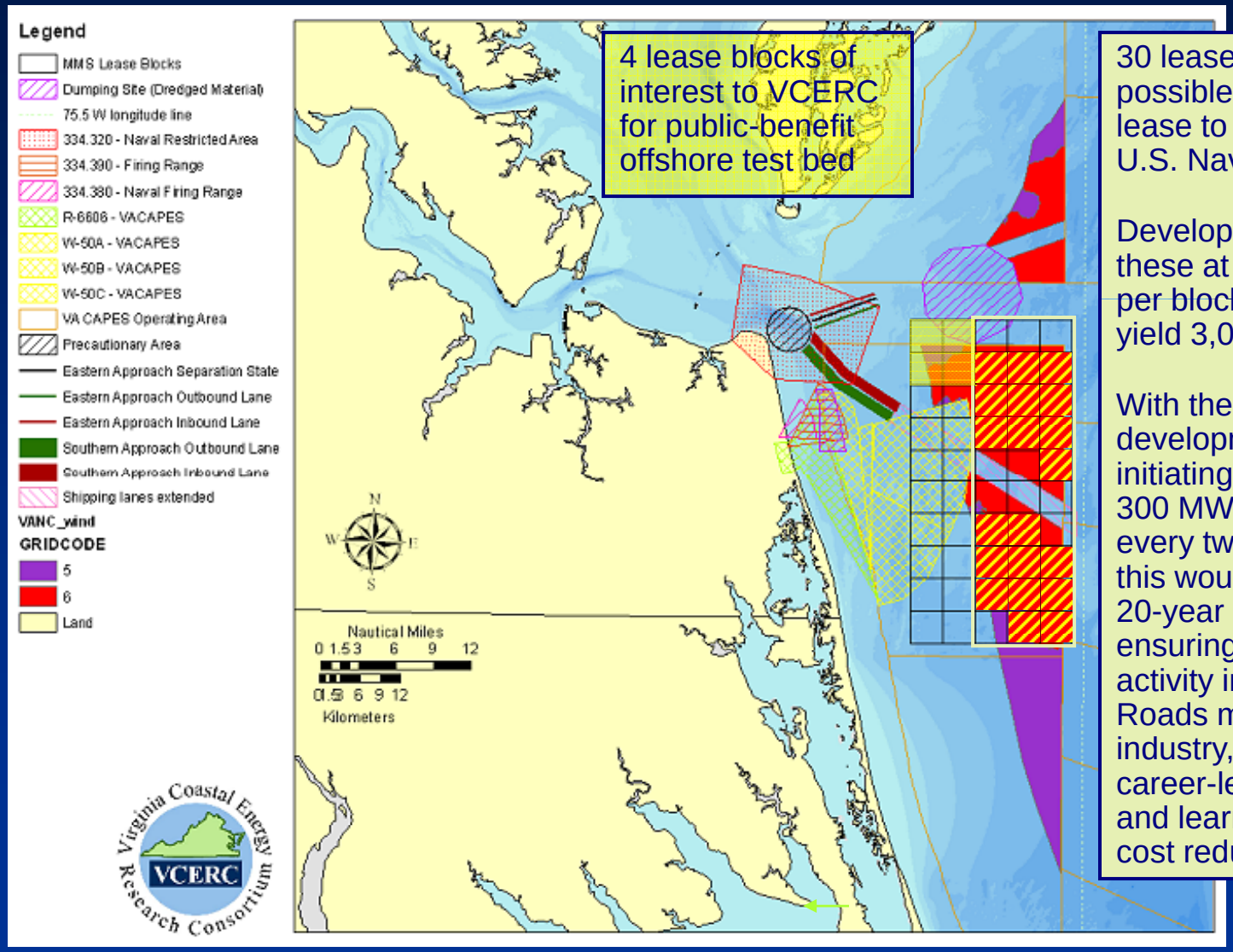
Beyond the Territorial Sea Limit of 12 n.mi., turbines would be barely visible, and then only on the clearest days.

Total available area of Class 6 beyond 12 n.mi. is 575.6 sq.km (142,500 acres); could support 3,680 MW of wind capacity.

Virginia Capes (VACAPES) Range Complex



Consider Decades-Long Enterprise Involving Commercial Development of 30 Lease Blocks



4 lease blocks of interest to VCERC for public-benefit offshore test bed

30 lease blocks for possible long-term lease to Virginia or U.S. Navy or both.

Developing 20 of these at ~150 MW per block would yield 3,000 MW.

With the same development team initiating a new 300 MW project every two years, this would entail a 20-year build-out, ensuring sustained activity in Hampton Roads maritime industry, creating career-length jobs and learning-curve cost reductions.

Planning For Positive Impact

Determine the impact a wind farm would have on Virginia's maritime industries, specifically:

- Shipping
- Fishing
  - Commercial
  - Recreational
- Navy/DoD Operations
- Wallops Island NASA Facility

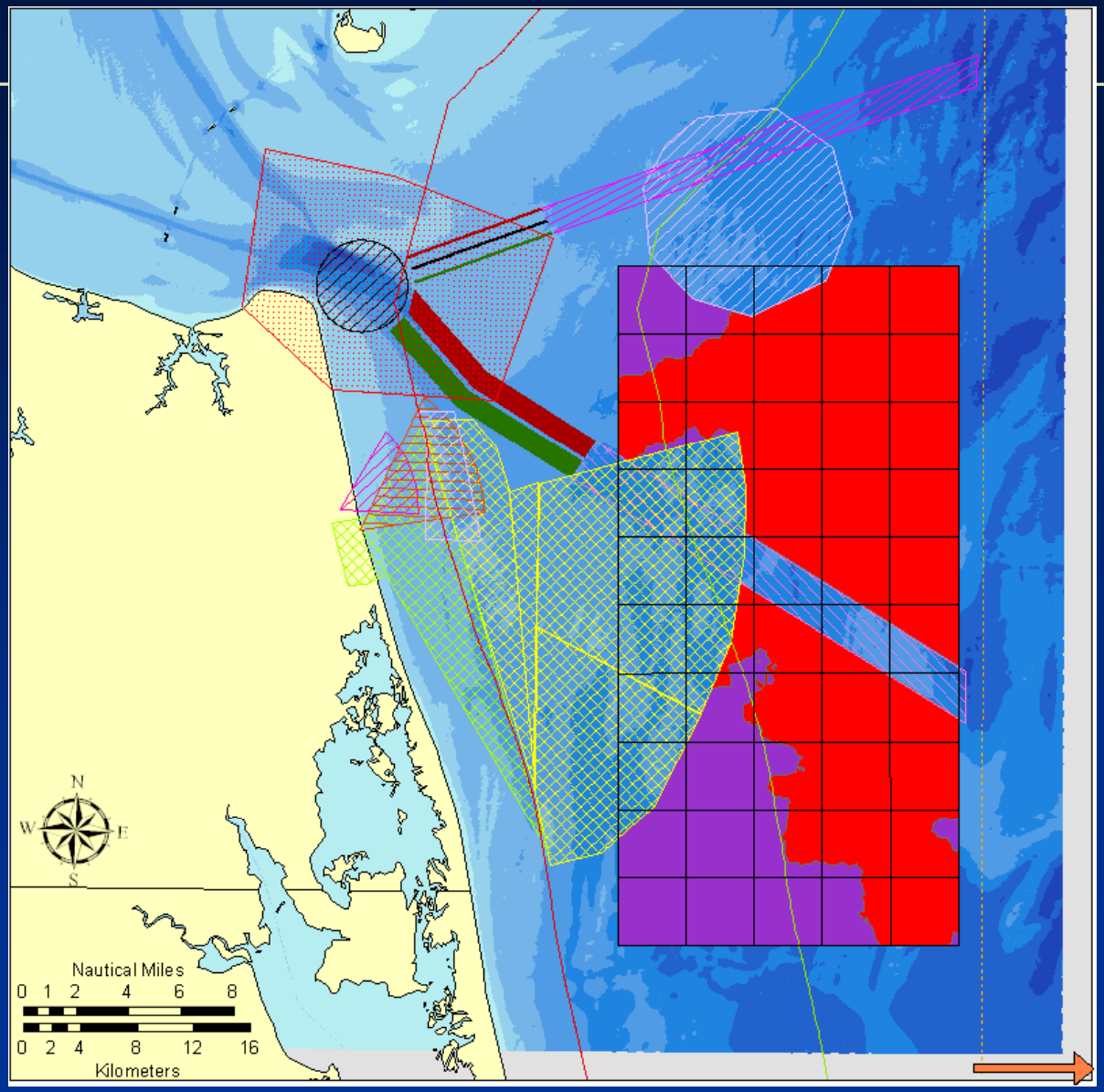
Design methods to create positive impacts for such offshore activities.

Learn from our own research as well as the experiences of others:

In 2004, a Draft Environmental Impact Statement (DEIS) released by the Army Corps of Engineers found that the proposed Cape Cod offshore wind project would have significantly less environmental impact than speculated.

The 3,800 page DEIS report was the product of three years of scientific, environmental, and economic analysis and included the input of 17 federal and state cooperating agencies as well as public comments.

Positive Impact Site Selection



Subtracting restricted military zones and shipping lanes illustrates viable sites within lease blocks.

Total available area of Class 6 winds beyond 12 nautical miles is 575.6 square kilometers (142,500 acres); could support 3,680 MW of wind capacity.

Legend

- MMS Lease Blocks
- State Jurisdictional Limit (3nm)
- Territorial Sea Limit (12nm)
- Dumping Site (Dredged Material)
- 75.5 W longitude line
- 334.320 - Naval Restricted Area
- 334.390 - Firing Range
- 334.380 - Naval Firing Range
- R-6606 - VACAPES
- W-50A - VACAPES
- W-50B - VACAPES
- W-50C - VACAPES
- Precautionary Area
- Eastern Approach Separation State
- Eastern Approach Outbound Lane
- Eastern Approach Inbound Lane
- Southern Approach Outbound Lane
- Southern Approach Inbound Lane
- Shipping lanes ext

Wind class 5 6 no excl

Wind Class

- 5
- 6
- Land

(additional shipping traffic beyond 75.5 W does not affect site selection)

Thank You!

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