Energy and Economic Benefits of Offshore Wind Development in Virginia

Summer Meeting

Virginia Manufacturing Development Commission

Norfolk, VA

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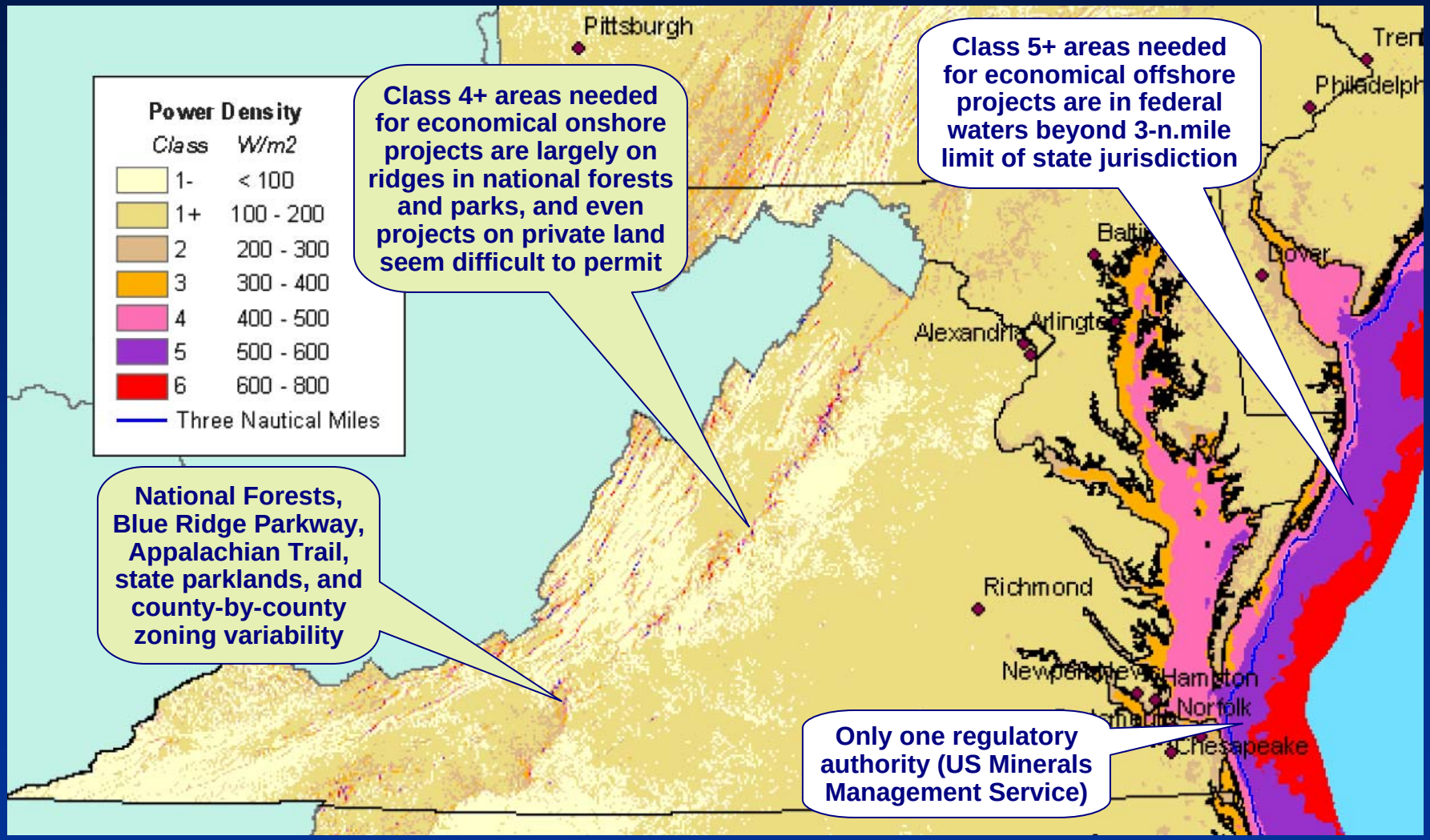
Presentation Outline

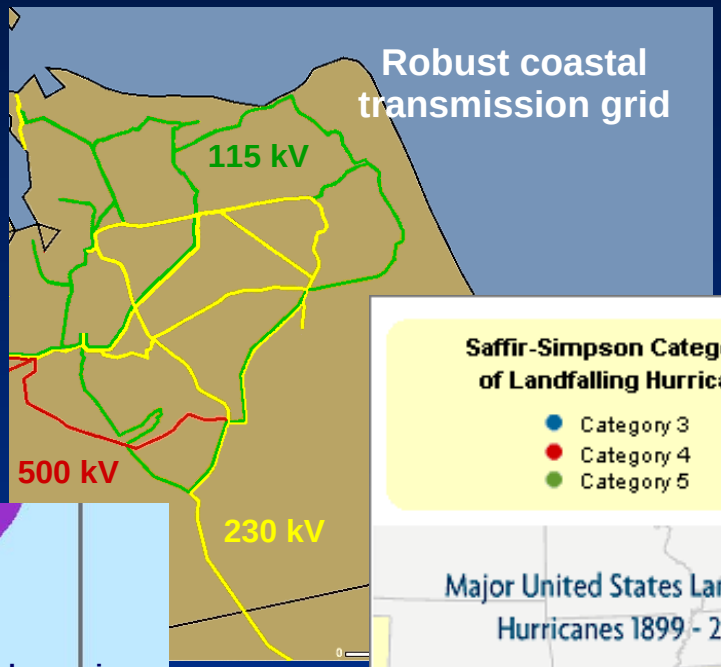
- Virginia Energy Plan data on electricity imports and planned generation supply additions
- VCERC feasibility-level design of hypothetical offshore wind projects and mapping of other ocean uses: Is there enough non-excluded area to support large enough wind projects?
- VCERC supply chain analysis and estimate of benefits to local and state economy

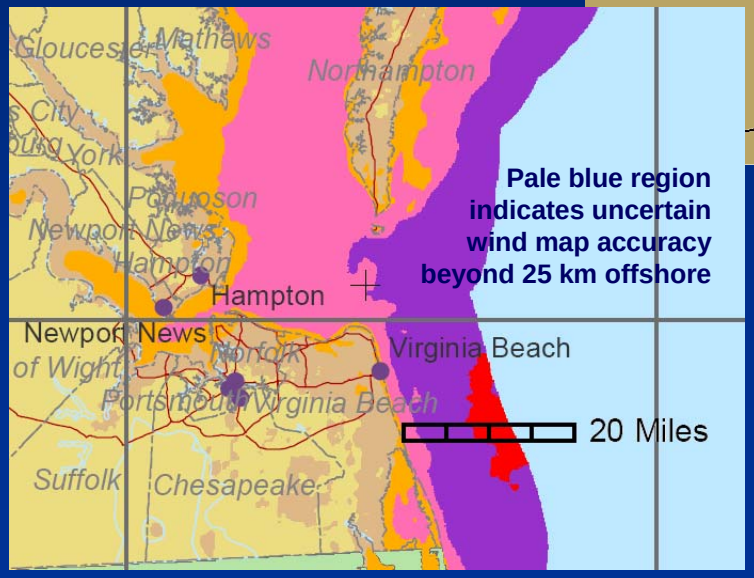
Virginia's Wind Energy Resources Offshore are Much Larger than on Land



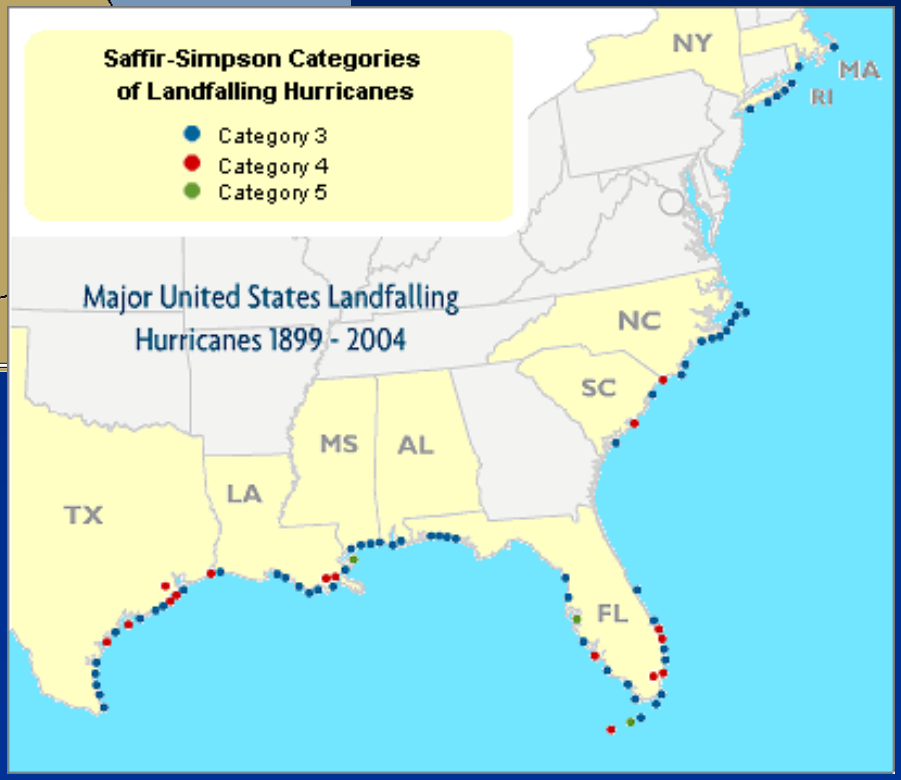
Hampton Roads Area has Unique Features Favorable for Offshore Wind Power Development

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)



Electricity Import Scenarios for Virginia

(www.dmme.virginia.gov/vaenergyplan.shtml, Table 2-4)

Scenario	Year	Peak Electrical Demand for Virginia (MW)	Conservation & Energy Efficiency Savings	Conservation & Energy Efficiency (MW)	Net Summer Generation Capacity (MW)	Net Generation Change (MW)	Electricity Imports (% of Total Capacity)
Base Case	2005	32,026	0%	0	22,599		29.4%
1	2016	39,250	0%	0	22,599	0	42.4%
2	2016	39,250	0%	0	27,697	5,098	29.4%
3	2016	33,755	14%	5,495	22,599	0	33.0%
4	2016	33,755	14%	5,495	23,819	1,220	29.4%
5	2016	33,755	14%	5,495	33,755	11,156	0%

If there is ***no*** demand reduction through conservation and energy efficiency measures, than nearly 5,100 MW of new generation will be needed by 2016, in order to maintain electricity imports at existing levels (Base Case = 29.4%).

To Keep Import % Constant, Approximately 3,600 MW of New Generation Capacity is Needed

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3	2016	33,755			22,599	5,098 - 1,500 = 3,598	
4	2016	33,755			23,819	1,220	29.4%
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Virginia has established a target of meeting 10 percent of its 2006 electric demands through conservation by 2022. Prorating this target over the next ten years, the state should be able to meet 6 to 7 percent of this goal, or nearly 1,500 megawatts, by 2016.

If there is ***1,500 MW*** of demand reduction through conservation and energy efficiency measures, than new generation needed by 2016 is only ~3,600 MW, in order to maintain electricity imports at existing levels (Base Case = 29.4%).

Electric Generation Facilities Planned in Virginia

(www.dmme.virginia.gov/vaenergyplan.shtml, Table 4-3, modified)

Owner Name	Plant Name	Unit	County in Virginia	Primary Fuel	Nameplate Capacity (MW)	Estimated Commercial Online Date
Feasibility Stage (Planned new generator undergoing feasibility study)						
Hydro Matrix LP	Flannagan Hydroelectric Project	1	Dickenson	Water	5	Not available
Dominion Resources	North Anna	NB3	Louisa	Uranium	917	January 1, 2050
Proposed (New generator planned for installation)						
Virginia Electric & Power	Virginia City Hybrid Energy Center	ST1	Wise	Coal	**585**	June 1, 2012
Application Pending (Application filed for permits, regulatory approval pending)						
Dominion Resources	CPV Warren Power Generating	CC1	Warren	Natural Gas	520	June 1, 2010
Highland New Wind Development LLC	Highland County Wind	WT1 19	Highland	Wind	38	December 31, 2008
Dominion Resources	Ladysmith Generation Facility		Caroline	Natural Gas/Fuel Oil	300	August 2008
Dominion Resources	**Buckingham County**		**Buckingham**	**Natural Gas**	**580**	**Summer 2011**

Two landfill gas projects totaling 3.14 MW generation capacity are not shown here. Data on Buckingham County combined cycle plant are from www.dom.com/news/elec2008/pr0311a.jsp

At Least 1,600 MW of Additional Generation Needed by 2016 if Import % to Remain Constant

Planned large (>50 MW) generation projects likely to be operating by 2016 total ***1,985 MW***

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Offshore Wind Feasibility-Level Design

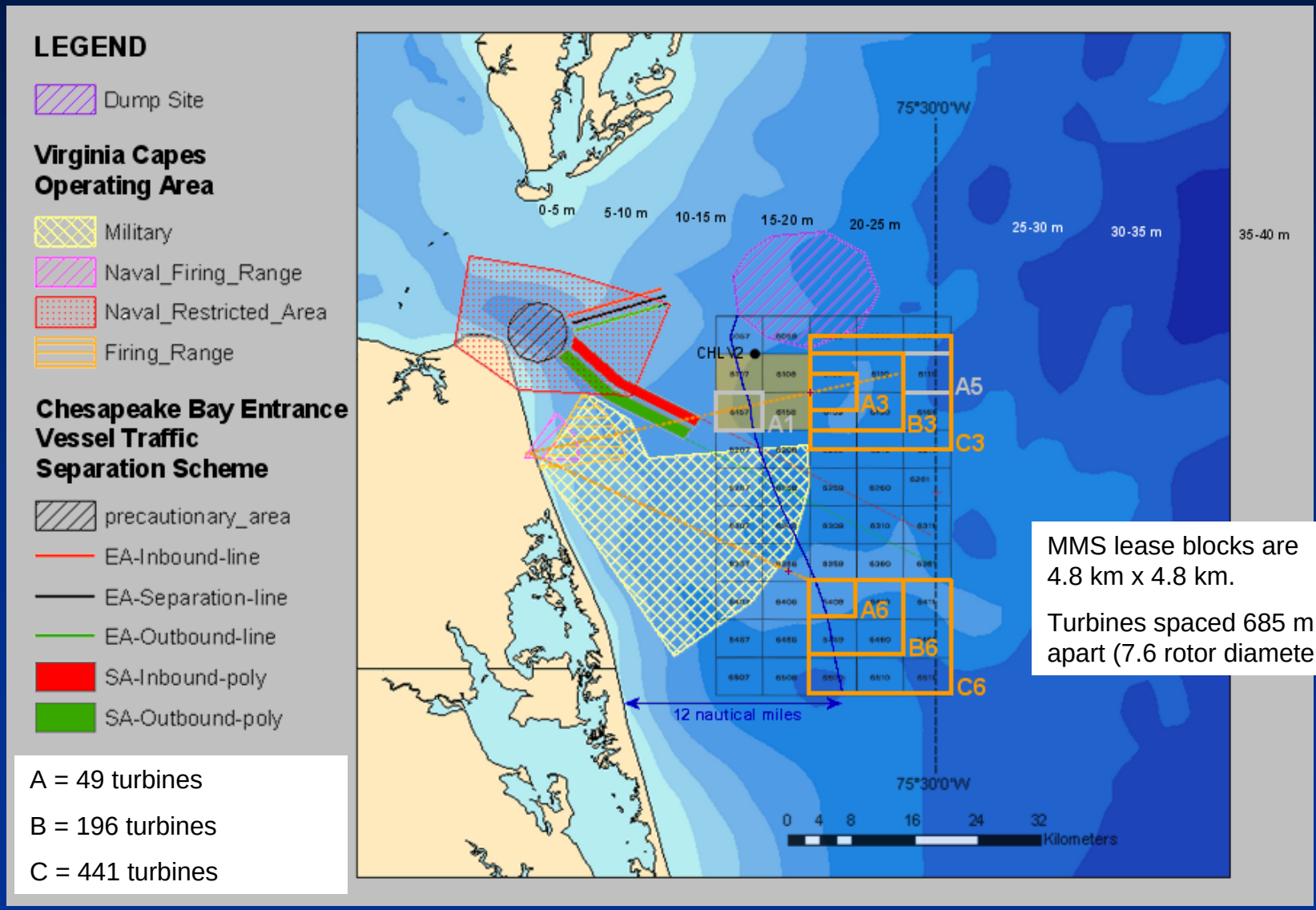
VT-ARI responsible for overall direction and preparation of final report

- *Which wind turbine models, foundations and hub heights are optimal for Virginia's offshore wind climate?*
- *For optimized, integrated design, what is cost of energy (COE) for different project financing scenarios?*
- *What is effect on COE of project size in the range from 250 MW to 1,000 MW?*
- *What is effect on COE of distance offshore in the range from 10 km to 50 km for AC and DC transmission?*
- *How do seasonal and hourly output distributions match utility grid power demand?*

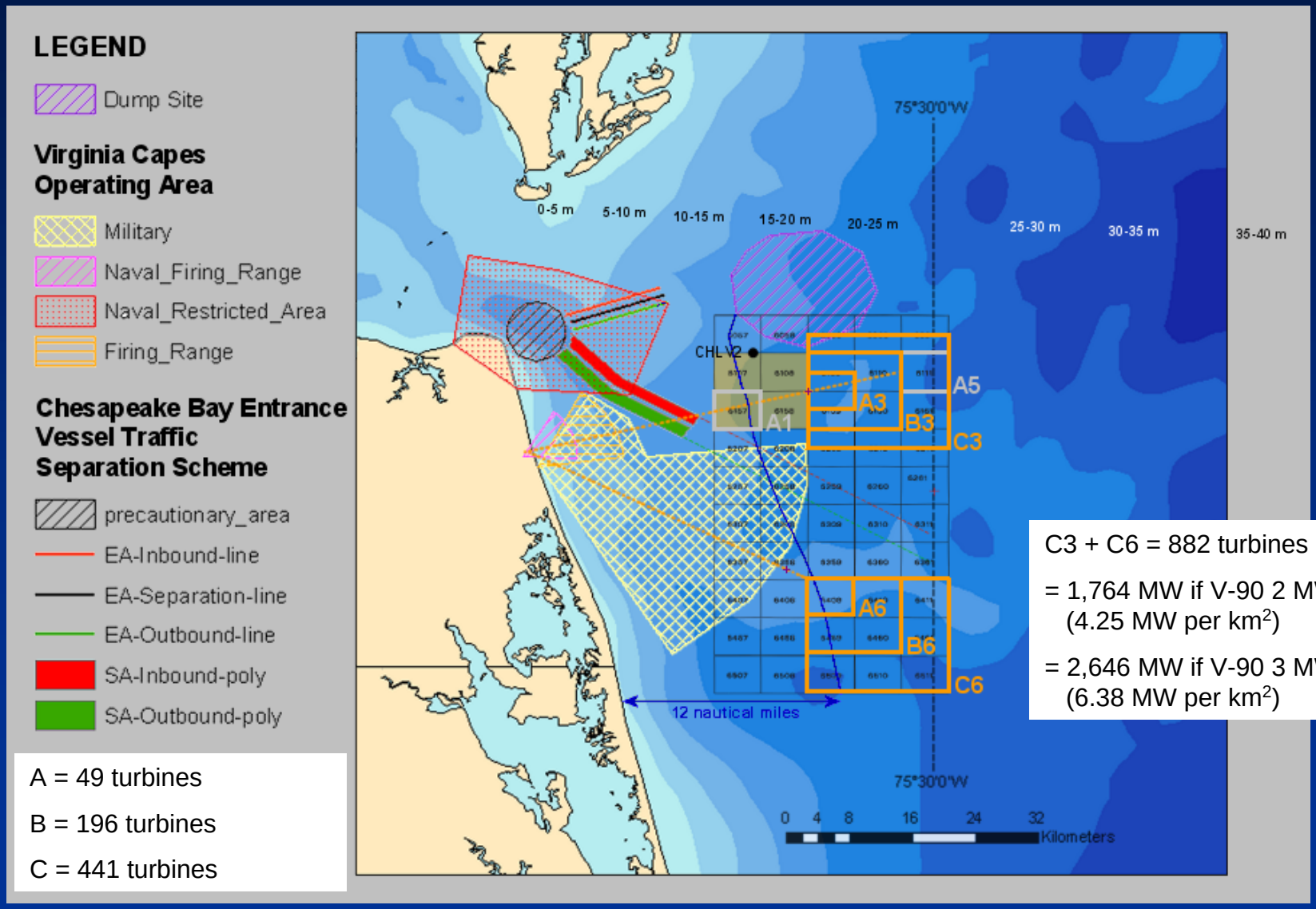
Horns Rev Example of Large European Project

Project capacity = 160 MW (80 turbines), occupying 5.0 km x 3.9 km area (~ 8 MW per sq.km)
Mean wind speed = 9.7 m/s at 70-m hub height (Class 6)
Annual energy output = 600 GWh (43% capacity factor)
Capital investment = 270 million Euro ($248 million → $1,550/kW) in 2002

Hypothetical Project Footprint Locations



Energy Potential Appears to Match State Needs

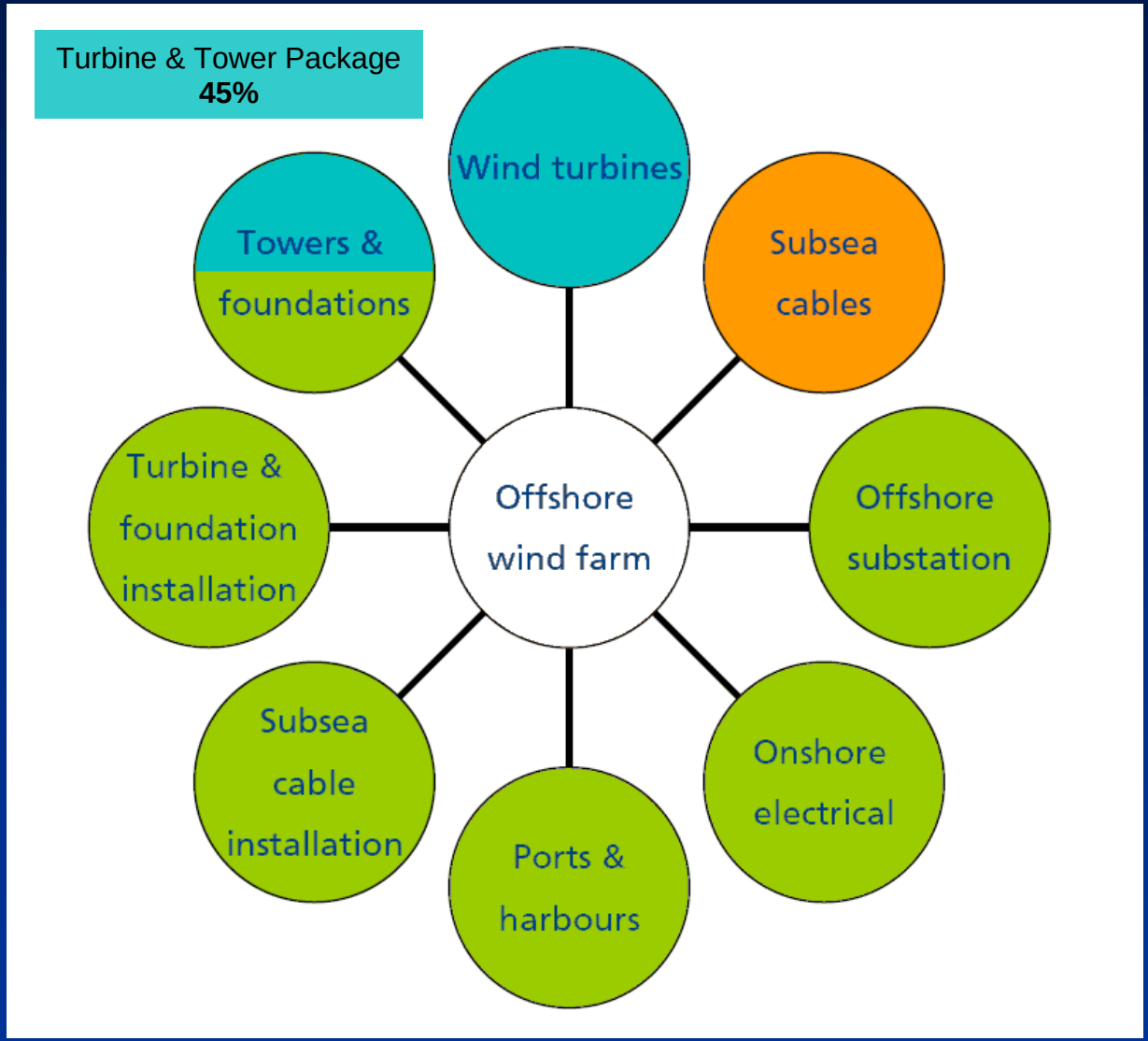


Economic Development Studies

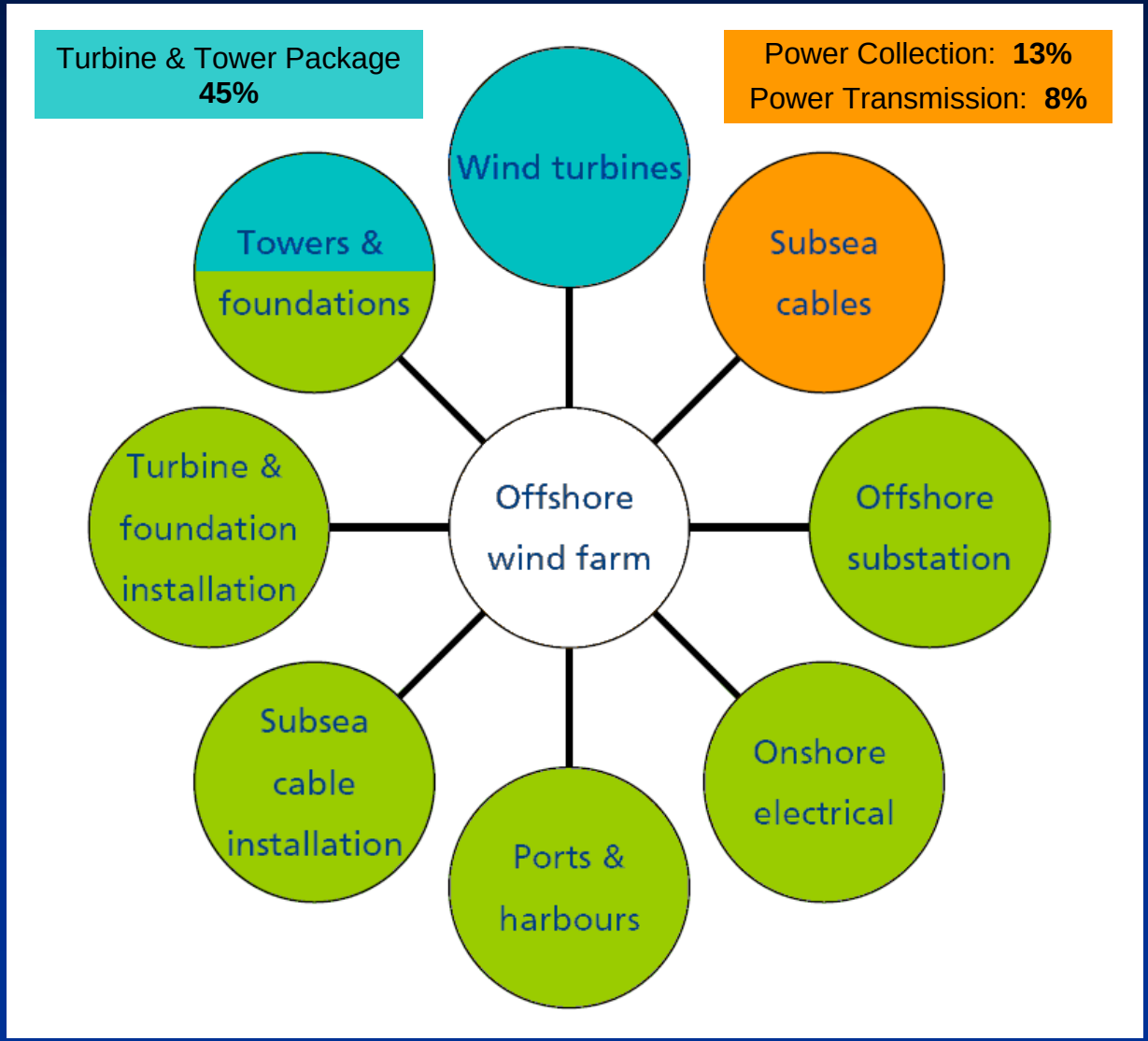
Norfolk State University and Industry Partner (SAIC) responsible for overall direction and preparation of final report

- *What are realistic timetables and magnitudes of economic development impact to build out offshore wind potential?*
- *What are workforce training needs and small business opportunities associated with this build-out?*
- *What are supply chain constraints and opportunities?*
- *Develop budget and plan to seek federal funding for ocean test bed to host offshore wind or wind/wave hybrid systems*

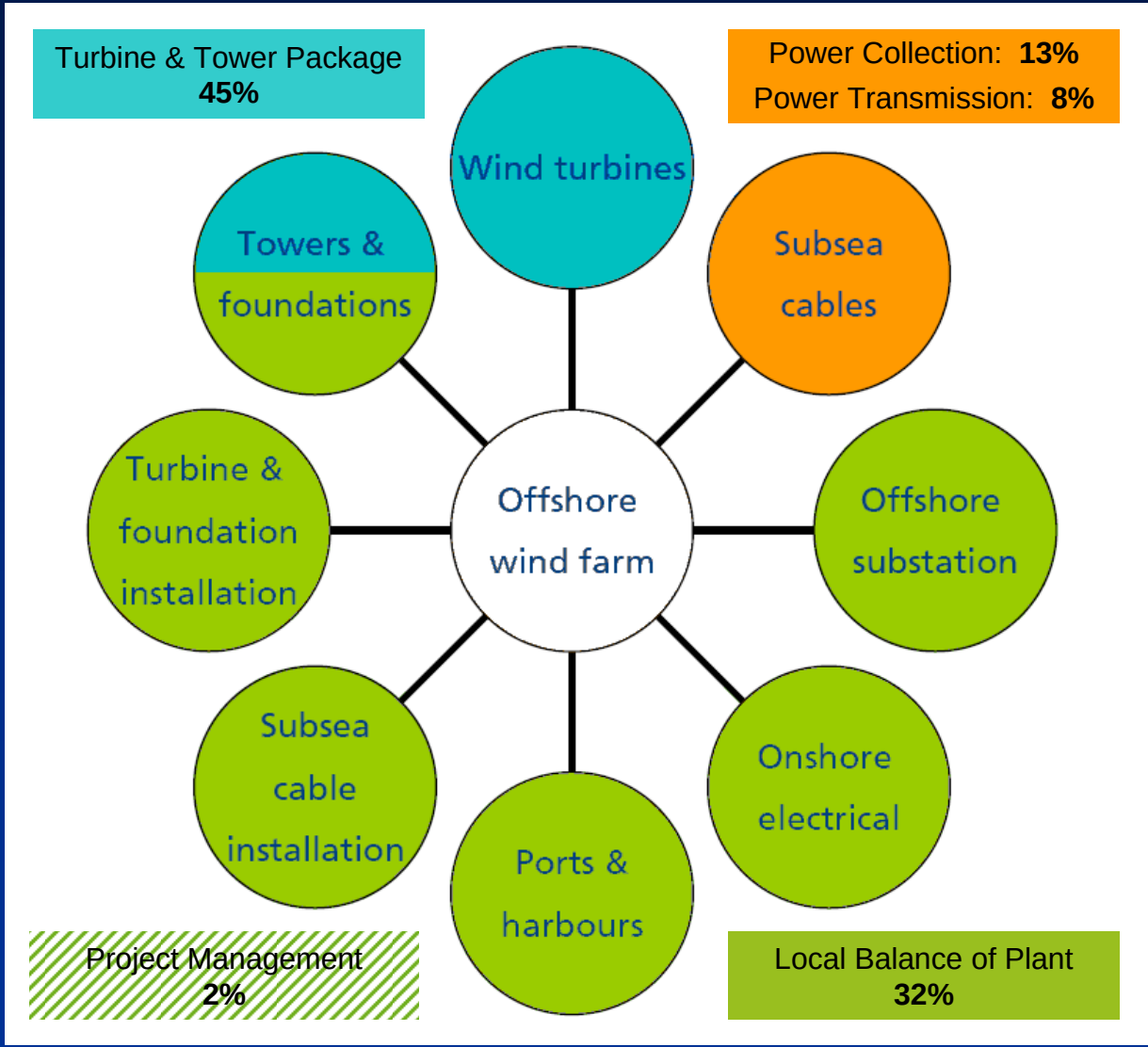
Nearly Half the Capital Cost of an Offshore Wind Project is in the Turbine & Tower Package



Another Fifth of the Capital Cost is in Submarine Power Cable Fabrication

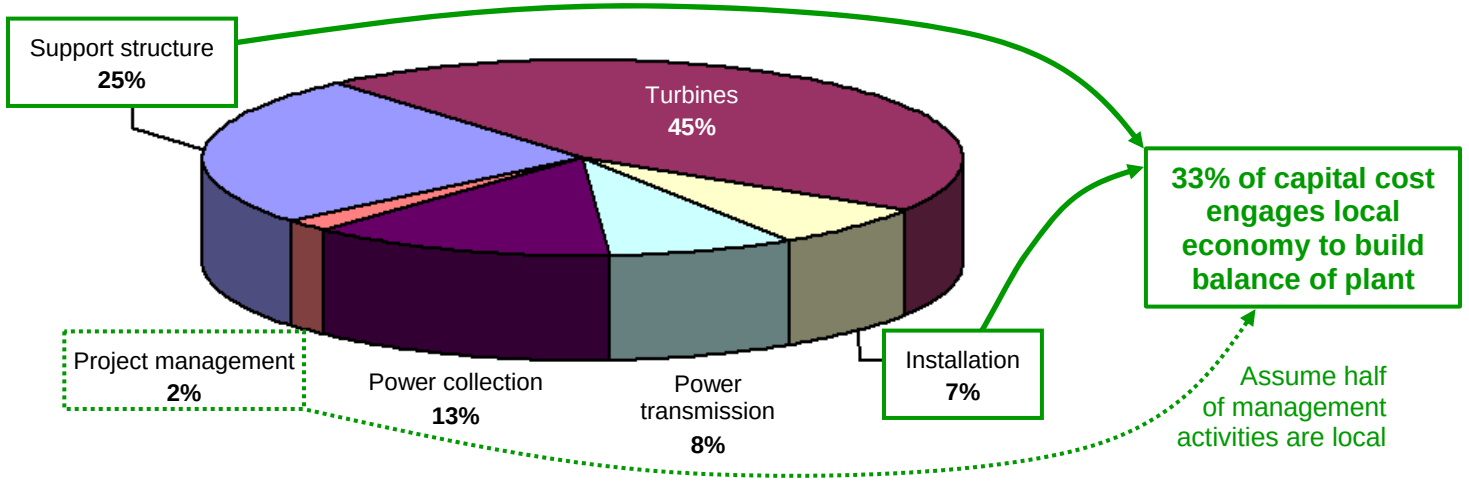


The Remaining Third of the Total Project Capital Investment Engages the Local Economy



New Sustainable Business Value of $150-200 Million per Year in Maritime Sector Alone

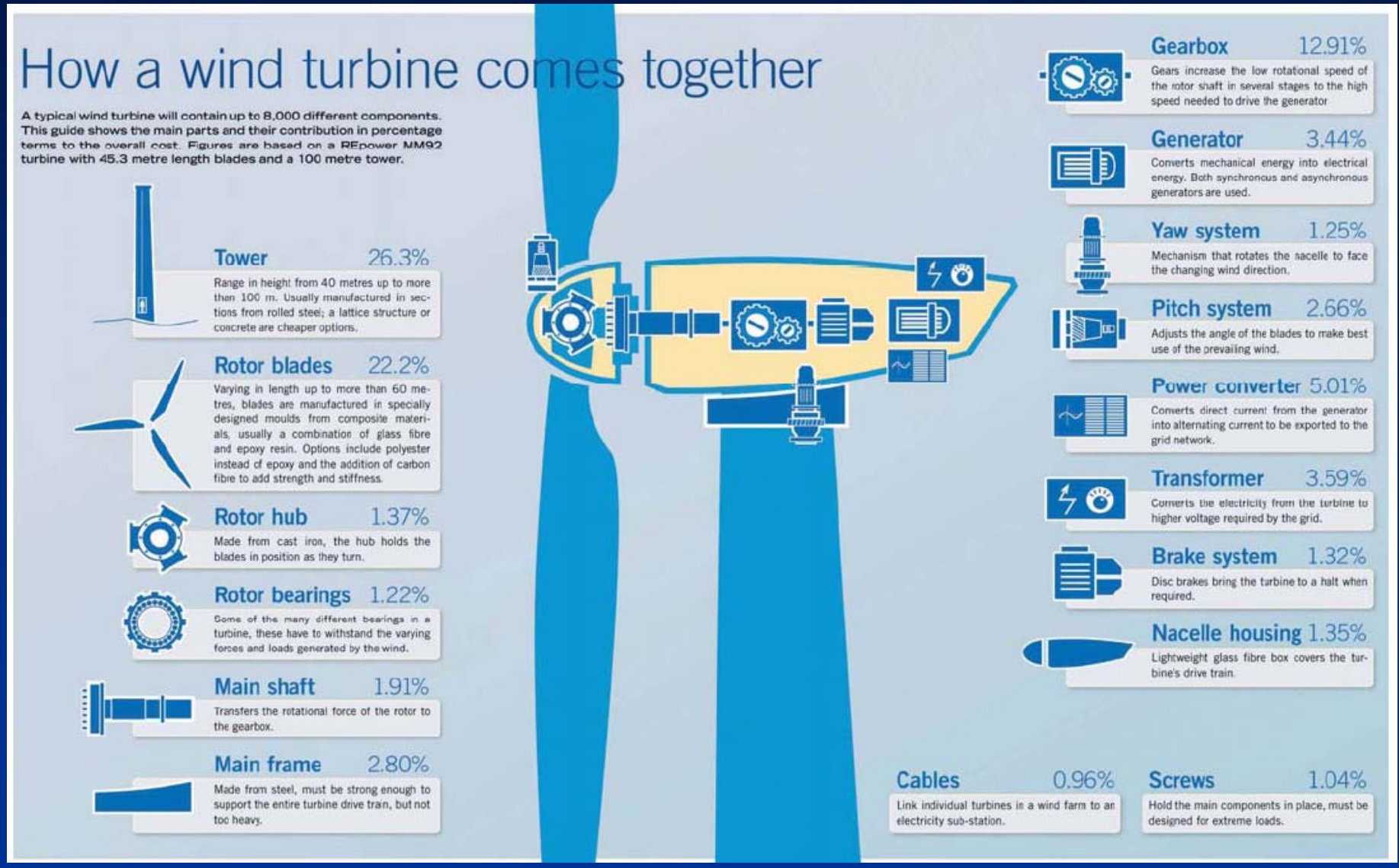
Typical capital cost breakdown for monopile-based offshore wind project



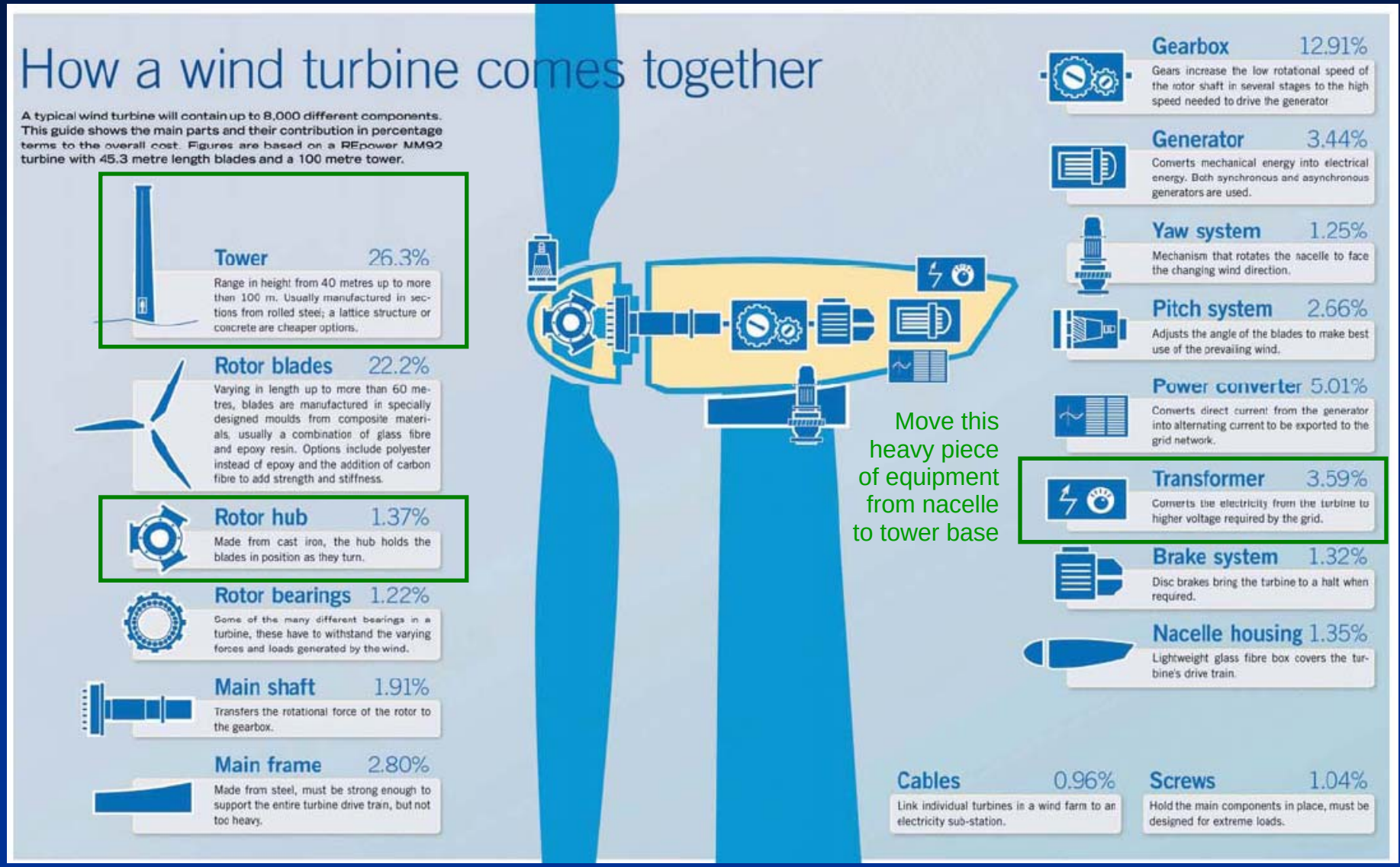
Estimated maritime industry value of fabrication, installation, and service contracts for notional 2,000 MW of installed offshore wind capacity:

- Assume capital cost is double that of Horns Rev project
- At $3,100 per installed kW, total capital investment (CI) = $6.2 billion
- Assuming an installation rate of 200 MW per year= $620 million per year over 10-year build-out
- Value of local fabrication and installation contracts = $200 million per year until fully built out
- Value of local offshore service contracts (2.5% of CI) = $155 million per year after fully built out

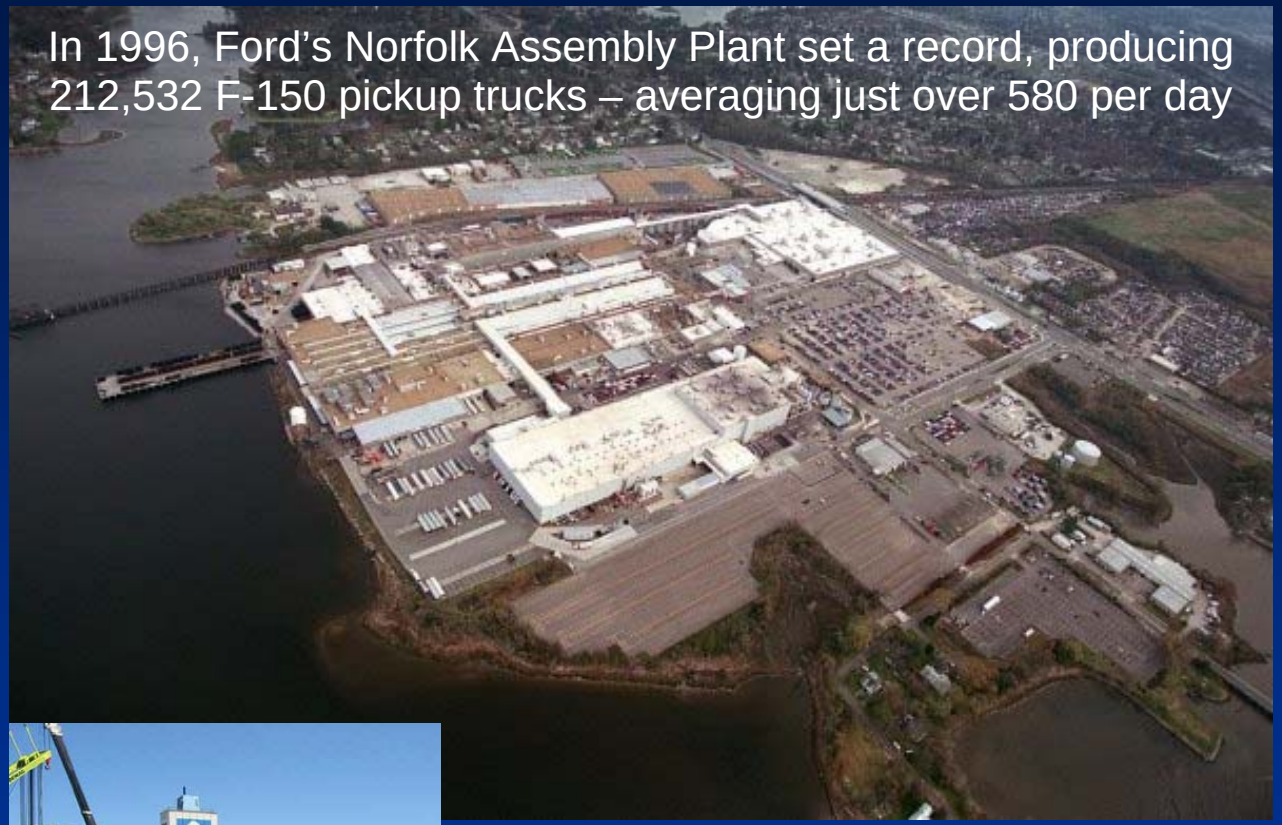
Turbine & Tower Package Cost Breakdown



Of the Turbine & Tower Package Cost, About 30% Might be Readily Sourced in Virginia



The Remaining 70% Represents a Potential Manufacturing Possibility in Norfolk



During World War II, this plant temporarily retooled from automobile manufacture to the production of landing craft. With road, rail, and deep-water access, this site is well positioned to be retooled yet again, for offshore wind turbine assembly.

Thank You!

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