Examples of Offshore Renewable Energy

Wind Energy
Wave Energy
Ocean Current Energy
ELECTRICITY DEMAND ON THE RISE

Data courtesy of Marc Imhoff (NASA/GSFC) and Christopher Elvidge (NOAA/NGDC). Image by Craig Mayhew (NASA/GSFC) and Robert Simmon (NASA/GSFC)
Population Density of the Contiguous United States
What About Watts?

- Household power is measured in KW (kilowatts)
- 1,000 KW = 1 MW (megawatt)
- 1,000 MW = 1 GW (gigawatt)

- A mid-size coal-fired electrical plant produces ~350 MW; so 1 GW = output from 3 typical coal plants
Energy Consumption

- The average American household uses about 10,655 kilowatt-hours per year (kWh/y)

- 1 GW of wind power will supply between 225,000 to 300,000 average U.S. homes with power annually.
## Regional Offshore Wind Energy Potential Capacity

<table>
<thead>
<tr>
<th>Region</th>
<th>Shallow Waters</th>
<th>Deeper Waters</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic</td>
<td>253.2 GW</td>
<td>770.9 GW</td>
<td>1024 GW</td>
</tr>
<tr>
<td>Pacific</td>
<td>10.6 GW</td>
<td>891.4 GW</td>
<td>902 GW</td>
</tr>
<tr>
<td>Gulf</td>
<td>0 GW</td>
<td>67 GW</td>
<td>67 GW</td>
</tr>
</tbody>
</table>

### GW by Depth (m)

<table>
<thead>
<tr>
<th>Region</th>
<th>0 - 30</th>
<th>30 - 60</th>
<th>60 - 900</th>
<th>&gt; 900</th>
</tr>
</thead>
<tbody>
<tr>
<td>New England</td>
<td>59.2</td>
<td>127.7</td>
<td>273.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Mid Atlantic</td>
<td>165.6</td>
<td>181.6</td>
<td>59.7</td>
<td>56.6</td>
</tr>
<tr>
<td>S. Atlantic Bight</td>
<td>28.4</td>
<td>58.2</td>
<td>13.7</td>
<td>0.0</td>
</tr>
<tr>
<td>California</td>
<td>2.3</td>
<td>4.8</td>
<td>130.5</td>
<td>277.9</td>
</tr>
<tr>
<td>Pacific Northwest</td>
<td>7.5</td>
<td>19.2</td>
<td>188.1</td>
<td>121.0</td>
</tr>
<tr>
<td>Great Lakes</td>
<td>166.6</td>
<td>137.0</td>
<td>813.2</td>
<td>0.0</td>
</tr>
<tr>
<td>Gulf of Mexico</td>
<td>0.0</td>
<td>12.3</td>
<td>54.7</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>429.5</td>
<td>540.7</td>
<td>1,533.3</td>
<td>455.5</td>
</tr>
</tbody>
</table>

- **Shallow Waters** represents regions where the water depth is less than 30 meters.
- **Deeper Waters** represents regions where the water depth is between 30 and 60 meters.
- **Total** represents the sum of capacities in shallow and deeper waters.
Mid-Atlantic Resource

NREL estimates a gross resource of 463 GW. Assuming about 40%—185 GW (1,257 TWh/y)—could be developed, that would power about 53.3 million average U.S. homes.
Oil and Gas Resources

After more than 50 years of exploration and development, 70% of total resources are yet to be discovered.
Undiscovered Technically Recoverable Oil and Gas Resources
2006 National Assessment Results

**OCS Oil**

- AK: 25 billion barrels of oil
- Atlantic: 10 billion barrels of oil
- GOM: 45 billion barrels of oil
- Pacific: 15 billion barrels of oil

**OCS Gas**

- AK: 100 trillion cubic feet of gas
- Atlantic: 50 trillion cubic feet of gas
- GOM: 250 trillion cubic feet of gas
- Pacific: 25 trillion cubic feet of gas
U.S. Annual Oil Production, OCS Reserves, and Resources

<table>
<thead>
<tr>
<th></th>
<th>Production</th>
<th>Reserves</th>
<th>Econ Rec ($110/bbl)</th>
<th>Tech Rec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>1.85</td>
<td>15.43</td>
<td>64.85</td>
<td>85.88</td>
</tr>
</tbody>
</table>
U.S. Annual Gas Production, OCS Reserves, and Resources

Natural Gas

<table>
<thead>
<tr>
<th>Category</th>
<th>Trillion Cubic Feet of Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>20.09</td>
</tr>
<tr>
<td>Reserves</td>
<td>60.17</td>
</tr>
<tr>
<td>Econ Rec ($11.74/Mcf)</td>
<td>270.43</td>
</tr>
<tr>
<td>Tech Rec</td>
<td>419.88</td>
</tr>
</tbody>
</table>

Trillion Cubic Feet of Gas
Atlantic OCS Exploratory Wells and Seismic Data

Atlantic OCS Region

- Exploratory Wells
- MMS Planning Areas
- 2-D Seismic Data
Atlantic OCS Area
Undiscovered Oil and Gas Resources

Oil Resources:
1.1 – 7.6 billion barrels

Gas Resources:
14.3 – 66.5 trillion cubic feet
Atlantic OCS Oil and Gas Resource Data Gaps

• Seismic data are more than 25 years old.

• New seismic data needed for certain areas to better inform resource management.

• Current interest by seismic industry:
  – 5 companies submitted permit applications for seismic surveys,
  – 1 company submitted permit for an aeromagnetic survey.

• MMS has announced intent to prepare an Environmental Impact Statement on geological and geophysical activities in this region.
Key Environmental Issues

Stewardship
Our Overriding Consideration

BALANCING:

• the Nation’s energy needs

• Environmental sensitivity and marine productivity

• Multiple use of the sea and seabed
The Challenge of Climate Change

Forecasting, planning for and mitigating:

- **Long-term Ecosystem Changes**
  - (and effects on species and habitats)

- **Changes in Renewable Energy Resources**
  - e.g. Wind and Wave frequency, persistence, etc.

- **Changes in Environmental Conditions and Impacts to Energy Infrastructure**
  - (storms, sea level, wave heights, etc.)
Atlantic Coast and Offshore
Key Challenges & Information Gaps

- Noise in the Sea - effects of noise on marine species
- Lack of Existing Onshore Infrastructure to support development
- Bird Interactions: Baselines & Migration Patterns
- Fisheries; Multiple-use of OCS; Tourism