Offshore Wind Energy-A Review

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Abstract
As world is suffering from energy crisis, it has become compulsion to introduce new non conventional energy sources. Offshore wind energy is one solution in that to reduce greenhouse effect. This energy is available in sea. It is similar to onshore wind energy which we are using since long but one limitation of onshore wind energy is it is to be established in high head location for efficient output. It means, it is not possible to have this type of energy source make available in area nearer to coastal area. So, offshore energy is solution for this type of problem because it can be located in sea which is original origin for wind.

Keywords: Offshore wind turbine, energy crisis

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INTRODUCTION
Offshore wind energy is a one of the solution towards energy crisis. It differs from onshore wind turbine by its location and foundation. Day by day this source of energy is in development mode. Following graphs represent development. Also following is the table of world’s largest offshore plant.

Offshore turbines require different types of bases for stability, according to the depth of water. To date, a number of different solutions exist:

- A monopile (single column) base, six meters in diameter, is used in waters up to 30 m deep.
- Gravity base structures, for use at exposed sites in water 20–80 m deep.
- Tripod piled structures, in water 20–80 m deep.
- Tripod suction caisson structures, in water 20–80 m deep.
- Conventional steel jacket structures, as used in the oil and gas industry, in water 20–80 m deep.

![Fig. 1: Global Cumulative Offshore Capacity (in MW) [1–2].](image-url)
World's largest offshore wind farms

<table>
<thead>
<tr>
<th>Wind farm</th>
<th>Capacity (MW)</th>
<th>Country</th>
<th>Turbines and model</th>
<th>Commissioned</th>
<th>Refs</th>
</tr>
</thead>
<tbody>
<tr>
<td>London Array</td>
<td>630</td>
<td>UK</td>
<td>175 × Siemens SWT-3.6</td>
<td>2012</td>
<td>[15][16][17]</td>
</tr>
<tr>
<td>Greater Gabbard</td>
<td>504</td>
<td>UK</td>
<td>140 × Siemens SWT-3.6</td>
<td>2012</td>
<td>[18]</td>
</tr>
<tr>
<td>Anholt</td>
<td>400</td>
<td>Denmark</td>
<td>111 × Siemens SWT-3.6-120</td>
<td>2013</td>
<td>[19]</td>
</tr>
<tr>
<td>BARD Offshore 1</td>
<td>400</td>
<td>Germany</td>
<td>80 × BARD 5.0 turbines</td>
<td>2013</td>
<td>[20]</td>
</tr>
<tr>
<td>Walney</td>
<td>367</td>
<td>UK</td>
<td>102 × Siemens SWT-3.6</td>
<td>2012</td>
<td>[21][22]</td>
</tr>
<tr>
<td>Thorntonbank</td>
<td>325</td>
<td>Belgium</td>
<td>64 × Serenit 6 MW</td>
<td>2013</td>
<td>[23]</td>
</tr>
<tr>
<td>Sheringham Shoal</td>
<td>317</td>
<td>UK</td>
<td>88 × Siemens 3.6</td>
<td>2013</td>
<td>[24]</td>
</tr>
<tr>
<td>Thanet</td>
<td>300</td>
<td>UK</td>
<td>100 × Vestas V90-3MW</td>
<td>2010</td>
<td>[25][26]</td>
</tr>
<tr>
<td>Meerwind Sud/Ost</td>
<td>288</td>
<td>Germany</td>
<td>80 × Siemens SWT-3.6-120</td>
<td>2014</td>
<td>[27][28]</td>
</tr>
<tr>
<td>Lincs</td>
<td>270</td>
<td>UK</td>
<td>75 × Siemens 3.6</td>
<td>2013</td>
<td>[29]</td>
</tr>
<tr>
<td>Horns Rev II</td>
<td>209</td>
<td>Denmark</td>
<td>91 × Siemens 2.3-93</td>
<td>2009</td>
<td>[30]</td>
</tr>
</tbody>
</table>

**Fig. 2:** World’s Largest Offshore Wind Farms.

**Fig. 3:** Levelized Cost of Electricity.

**Fig. 4:** Offshore Wind Turbine Foundation.
Abolhosseini and Altmann stated about replacement of fossil fuel because in this era price and pollution due to this type of fuel is increasing day by day, which inspire to develop new sources of energy having very less or nil pollution and comparatively less prices. Fossil fuels increase CO₂ in atmosphere which increases greenhouse effect. Offshore wind energy which reduces greenhouse effect by reducing CO₂ emission and also technological efficiency in offshore wind energy. Compared to different energy sources like hydro power plant, nuclear power plant; it is cheapest and requires very less investment cost, less maintenance cost and can be established anywhere [3].

Arshad and O’Kelly, in their article have stated difficulties in the development of wind turbine in terms of maintenance cost, operating cost and investment cost. As these types of energy sources are facing problem since long decades in development of efficient wind turbine structure. Having this paper is review on different possible technological development to reduce overall cost of output also to enhance attractiveness of industry for investment. Floating structure for OWT (offshore wind energy) is most efficient in cleanliness, maintenance and operating cost point of view except marine life. So, further improvement is required in direction of development of wind turbine structure; by improving its structure design and also using different material as fabrication [5].

Wind energy exploitation occurred almost five thousand years ago. At that time contemporary societies were primarily based on fossil fuels to cover the electrical energy needs. During the last thirty years, security of energy supply and environmental issues has redeveloped the interest for wind energy applications.

In this context, the current work traces the long and tough steps of wind energy development from the CA era to the development of big offshore wind parks worldwide, highlight the prospects and therefore the main challenges of wind energy applications towards the target of one thousand GW of wind power by 2030 [5].

A review of the wind energy history undertaken in the current work emphasizes on the main issues of global market facts, technology, economics, environmental performance, prospects and R&D of wind power, providing some insight and presenting the highlights for each of the fields. From the review undertaken, the dynamics of wind power at the global energy scene during the last thirty years is illustrated, while according to the targets set, the perspective of exceeding 1 TW of wind power installations by 2030 seems feasible, especially if considering the challenges introduced by the need of each country to safeguard security of supply and promote clean power technologies.

Besides that, although the leading role of the EU throughout the period of wind energy development has been designated, the return of the USA and the tremendous growth of the wind energy industry in China are also reflected. On top of that, of special interest is also the gradual adoption of wind energy by several countries of the developing world, this clearly demonstrating both the catholic character of wind power and its ability to largely substitute fossil-fueled power generation in the years to come.
CONCLUSION
It has been concluded that offshore wind energy is one of the most efficient non conventional energy source. Research and development should be made for the development of this type of energy sources. By which energy crisis can be reduced. Some research work is required for the structure foundation and also for fabrication of the structure by introducing various methods and various materials. This opens a new door for the researcher.

REFERENCES

Cite this Article