

Use of Offshore Wind Farms to Generate Dubai's Future Electricity Needs

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Situation

Electricity demand is increasing and will increase more in Dubai due to EXPO 2020. Fossil fuels are used to generate electricity are depleting. Therefore, there has to be a solution to cover this increase and prevent any reduction in electricity supply.

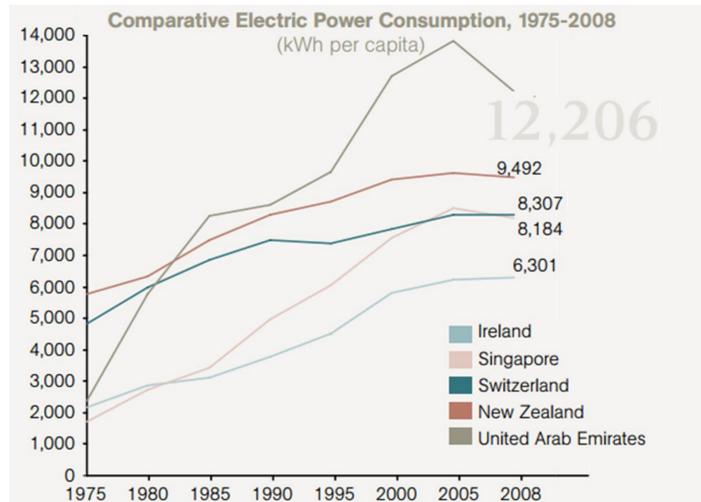


Figure 1: Electric consumption in the UAE [1]

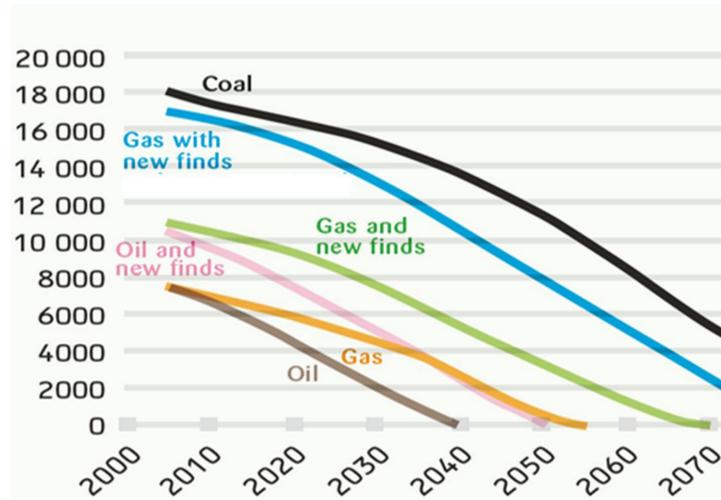


Figure 2: Depletion of Fossil Fuels [2]

Problem

Electricity Consumption

- UAE's rapid modernization is reflected in the rise of electricity consumption and this demand will continue

Fossil Fuels

- Fossil fuel resources are depleting
- Building more electricity generators will only increase the usage of fossil fuels thus depleting them faster

Environment

- How to generate electric power without harming the environment?
- Generators that depend on fossil fuels are known to be harmful for the environment

Solution

- Offshore wind farms are groups of wind turbines constructed on platforms on water to generate electricity from the wind over the sea or ocean
- More electricity is supplied from offshore wind farms than in land
- "Better wind speeds are available offshore compared to on land..."[3]



Figure 3: Power Generation from onshore wind farms [4]



Figure 4: Power Generation from offshore wind farms [5]

Advantages:

- Offshore wind farms are environment friendly because they do not emit any kind greenhouse gasses, which are very harmful for the environment
- Offshore wind farms meets the renewable energy standards set by many countries such as USA [6]
- Offshore wind farms produce electricity in a more consistent manner than onshore wind farms due to the consistency of wind over the sea

Disadvantages:

- Offshore wind farms are more costly than onshore because the building operation on sea is more expensive and the lack of electrical infrastructures over the sea
- Specialist knowledge needs to be acquired in order to improve the construction and needs of wind farms

Evaluation

Environment

- Destruction of on-land habitat and noise pollution is avoided by locating the wind farms offshore and away from inhabited areas
- When the structure of a wind turbine settles in water, marine life tends to flourish around it, treating it as shelter
- The site chosen should not contain coral reefs, because of their fragility

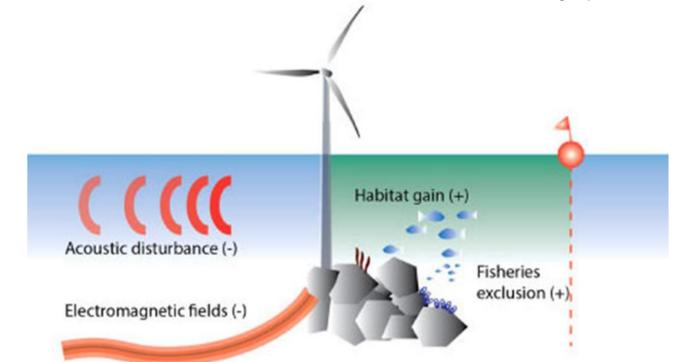


Figure 5: Impact of offshore wind farms on marine life [7]

Cost

- Initial costs are expensive and maintenance costs are similarly high. However, as this energy production method is promising to increase worldwide it is expected that cheaper, more efficient methods of construction and maintenance will be developed. According to the European Wind Energy Association by 2020 wind energy will cost €57.41 per Megawatt hour (MWh); less than coal at €80.3[8]
- The wind turbines should be constructed to stand high. Because at higher altitudes there is more wind power available. Which means more power will be produced and the production will be more cost efficient

Durability

- Material chosen is resistant to saline erosion
- The larger the surface area of the rotor blades, the more the wind energy will be captured and so the more power will be produced

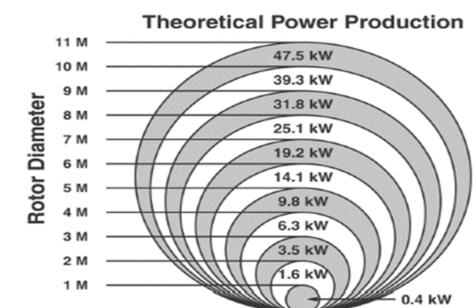


Figure 6: Theoretical Power Production [9]

- Therefore we are looking for high strength, low mass and large area for optimum power production. The solution to this is using Carbon nanotube based composites in constructing the rotor blades. Another solution is COC, cellulose nanocrystals which is strong, light and relatively inexpensive

References

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