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# FLOATING WINDMILLS

**D C Chaarshani (B.E.)[1], S Yamuna (B.E)[2]**

[1,2] *Department of Mechanical Engineering (MECH)*

*Andhra University College of Engineering, Visakhapatnam, (INDIA)*

## ABSTRACT

A few hundred meters offshore, winds are twice as strong as on land in much of the world. Offshore wind energy has huge potential, and floating windmills is a promising technology. Such windmills are now being developed. They are meant to be used out at sea in deep waters, and they do not need to be permanently moored to the ocean bed. Criteria for location of an offshore wind farm is excellent wind conditions and suitable water depth. The wind farm must be situated near a strong onshore power grid and near harbours and shipyards.

The present day conventional windmills have many drawbacks. Our paper suggests an alternative to overcome the drawbacks. These alternatives are Floating Windmills.. The wind is much stronger at offshore, so you get even more advantage over conventional windmills in this New Generation Windmills.

***Keywords*–*Floating windmills, Offshore wind Energy, Location.***

## 1. INTRODUCTION

Wind results from air in motion. The circulation of air in the atmosphere is caused by the non-uniform heating of the earth's surface by the sun. Despite the wind's intermittent nature, wind patterns at any particular site remain remarkably constant year by year. Average wind speeds are greater in hilly and coastal areas than they are well inland. The winds also tend to blow more consistently and with greater strength over the surface of the water where there is a less surface drag.

The turbines may create a lot of noise, which indirectly contributes to noise pollution.

1. Wind can never be predicted. Since wind energy will require knowledge of weather and wind conditions on long term basis, it may be impractical. Therefore, in areas where a large amount of wind energy is needed one cannot depend completely on wind

2. Many potential wind farms, places where wind energy can be produced on a large scale, are far away from places for which wind energy is best suited. Therefore, the economical nature of wind energy may take a beating in terms of new sub stations and transmission lines.

3. Wind turbines have a negative impact on birds, which can be killed or injured through collision with the rotating blades.

4. Wind turbines cause loss of habitat to wildlife due to the disturbance from its noise, movement of blades, subtle food chain changes and electromagnetic fields that in some animal species affects their sonar systems.

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## II. NEED FOR FLOATING WINDMILLS

1. Energy is a major factor in today's society
2. Alternative fuel and alternative energy resources are in great demand
3. Most everyone in the world is looking for more energy efficient ways to live
4. Hybrid vehicles and other fuel-efficient technology is arising around the world
5. The world has to change, this emergency that we are experiencing today should have been taken care of long before now.

## III. WHAT ARE FLOATING WINDMILLS

Windmills that would float hundreds of miles out at sea could one day help satisfy our energy needs without being eyesores from land, scientists said today.Offshore wind turbines are not new, but they typically stand on towers that have to be driven deep into the ocean floor. This arrangement only works in water depths of about 50 feet or less—close enough to shore that they are still visible.Researchers at the Massachusetts Institute of Technology and the National Renewable Energy Laboratory (NREL) have designed a wind turbine that can be attached to a floating platform. Long steel cables would tether the corners of the floating platform to a concrete-block or other mooring system on the ocean floor, like a high-tech ship anchor. The setup is called a "tension leg platform," or TLP, and would be cheaper than fixed towers.

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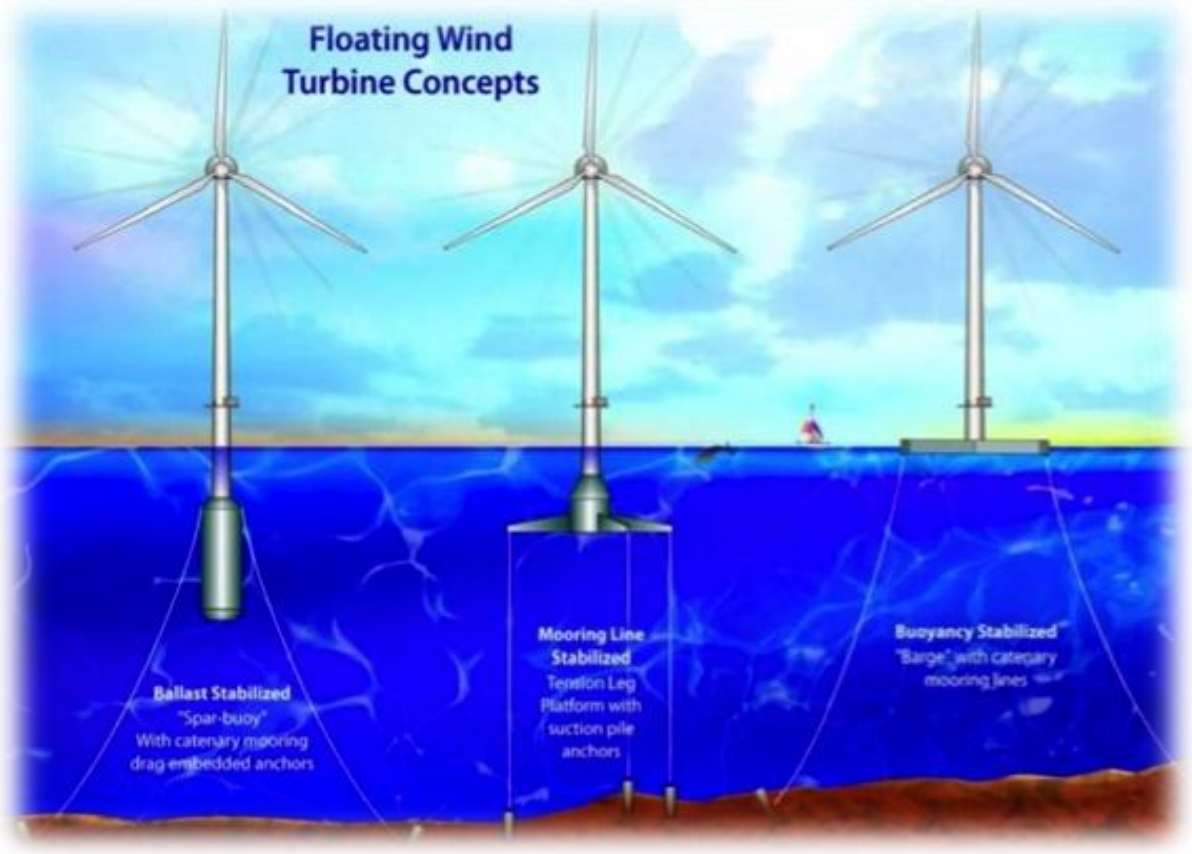


"You don't pay anything to be buoyant," said Paul Sclavounos, an MIT professor of mechanical engineering and naval architecture who was involved in the design.Like the offshore windmills currently in use, the TLP would use undersea cables to shuttle the electricity to land.The researchers estimate their floater-mounted turbines could work in water depths ranging from about 100 to 650 feet. This means that in the northeastern United States, they could be placed about 30 to 100 miles out at sea. Because winds are stronger farther offshore, the floating windmills could also generate more energy—5.0 megawatts (MW), compared to 1.5 MW for onshore units and 3.5 MW for conventional offshore setups.To save money, assembly of the TLP could be done onshore—probably at a shipyard—and towed out to sea by a tugboat, the researchers say.

Sclavounos estimates that building and installing the TLP should cost a third of what it costs to install current offshore tower windmills. Another advantage of using floating platforms is that the windmills could be moved around.

## IV. DESIGN CONSIDERATIONS

What if wind farms could be built in harbors and installed with a standard tug boat in deep water, where winds are strongest, without requiring underwater foundations or heavy offshore construction techniques?

This is the promise of floating offshore windmills.

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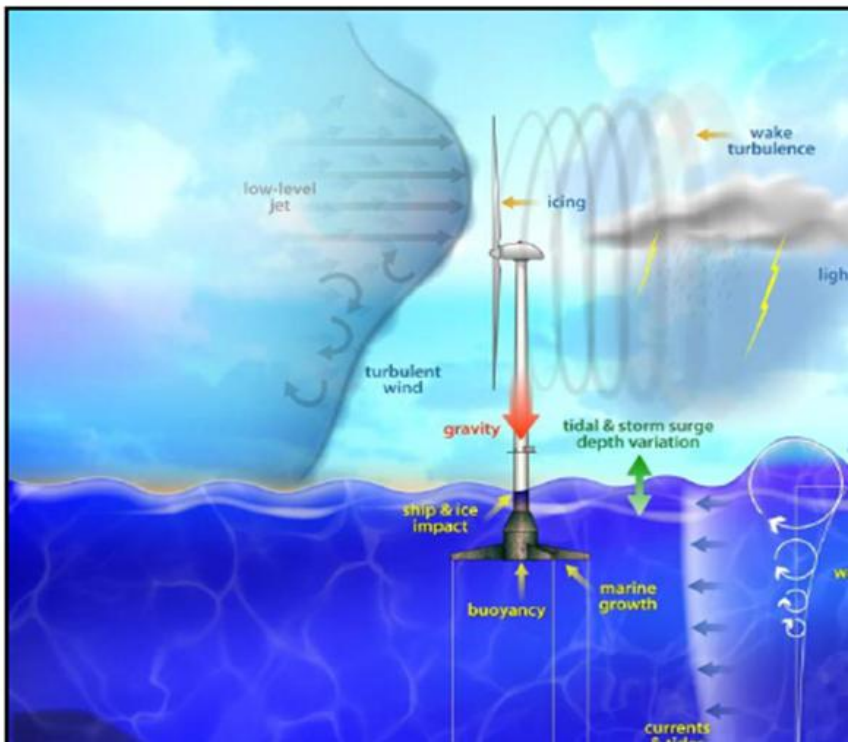
The windmill will be mounted on a semi-submersible platform that combines steel columns connected to a central concrete base. Not only can it withstand offshore conditions and be moored to a wide range of sea beds with minimal disruption to the habitat, it can be manufactured at most ports using local steel and concrete manufacturing facilities. The floater will be between 40 and 60 meters wide. Thanks also to the floating design, the structures can be assembled in port rather than in open sea and brought back to port for heavy maintenance. This reduces the time and cost associated with assembly and maintenance by removing the need for lengthy offshore campaigns.

**ENERGY PRODUCTION FROM WINDMILL:**

1. The wind blows on the blades and makes them turn.
2. The blades turns a shaft inside the nacelle (the box at the top of the turbine)
3. The shaft goes into a gearbox which increases the rotation speed enough for...
4. The generator, which uses magnetic fields to convert the rotational energy into electrical energy. These are similar to those found in normal power stations.
5. The power output goes to a transformer, which converts the electricity coming out of the generator at around 700 Volts (V) to the right voltage for distribution system, typically 33,000 V.
6. The national grid transmits the power around the country.

Instruments to measure the wind speed and direction are fitted on top of the nacelle. When the wind changes direction motors turn the nacelle, and the blades along with it, around to face the wind.




**Dynamics associated with the design of advanced offshore wind energy systems with floating platforms (Musial 2010)**

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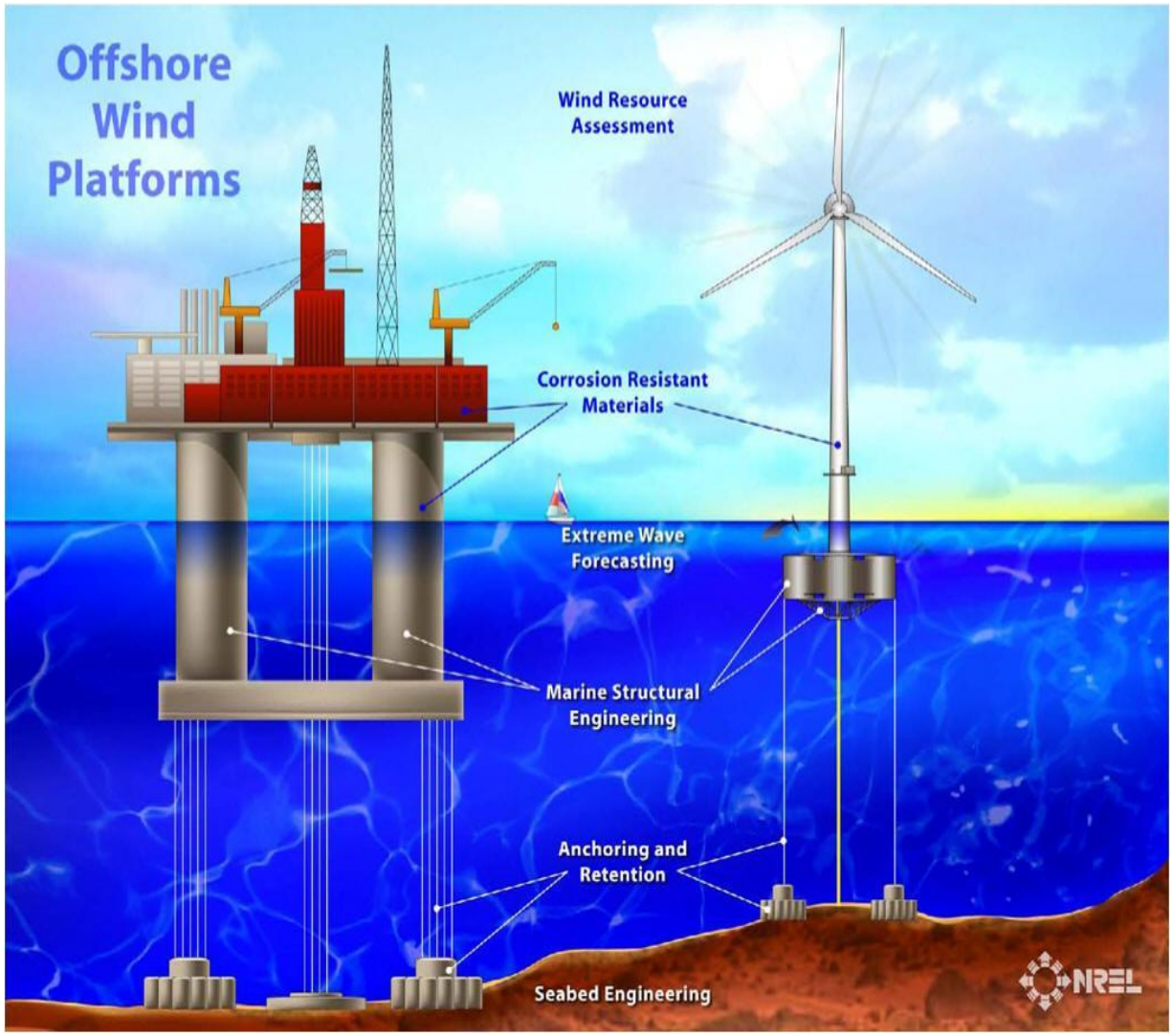


## V. ADVANTAGES

Compared to other energy sources, windmills are very kind to the environment. Compared to power stations driven by coal they will save the environment from gaese like:

· Carbon dioxide (CO2) 850,0g

· Sulphur dioxide (SO2) 2,9g

· Nitrogen dioxide (NO2) 2,6g

· Dust 0,1g · Cinders, and flying ashes 55,1g

The brand new windmills are today so competitive on good places, that the use of windmill power is one of the cheapest methods to reduce the emission of CO2 from the production of electricity. Windmills have no form of emissions of gases and other harmful substances. The wind which tries to press the blade speed a little longer up causes the generator to start producing power on the net. When the speed of the wind has reached windpower at 13-15 m/s the mill grants on its maximum at 500 kw for a 500 kw mill.

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The building and installing the TLP should cost a third of what it costs to install current offshore tower windmills. Another advantage of using floating platforms is that the windmills could be moved around.

## VI. DISADVANTAGES

Windmills are tall and they stand on places where the terrain is very open and free. Therefore there is also free outlook to the windmills. If the wind speed has reached its maximum the mill is forced to reduce speed to not hurt the windmills machinery. It is a disadvantage that the windmills don't have an engine with a greater capacity. The technology we use on windmills is very valuable and advanced, therefore the government hesitates to exploit wind power.

**Limited Resource:** Unlike solar energy, whose the source is found in every part of the world, wind energy is only able to be harnessed when there is wind available, which is not as widely found as one might first expect. This fact, along with the need to put them in unpopulated regions, greatly limits the potential areas where turbines can be installed. For these machines to be as useful as possible, they must be put on flat lands, and/or coastal places.

## VII.. FlOATING WINDMILL Vs OIL AND GAS RESERVOIRS:

1 Barrel of Oil ~ 130 kg ~ 1.5 MWh of Energy (~ 12 kWh / kg)

1 MW of Rated Wind Turbine Power @ 40% Capacity Factor ~ 9.6 MWh / Day ~ 6.4 Barrels of Oil / Day

Conversion Efficiency of Oil & Gas Engines / Turbines, Wind Turbines ~ 40-50%

1 GW Wind Farm (30 year life) ~ 70 M Barrel Oil Field ~ 6,400 Barrels / Day

Breakeven Cost of Wind Turbines $3M / Rated MW = $3 B / Rated GW

Equivalent Cost per Barrel of Oil ~ $43 / Barrel

Investment Risk in Oil & Gas: Exploration Costs & Volatility of Oil & Gas Prices

Investment Risk in Wind: Volatility of Wind Speed & Electricity Prices.

## VIII. CONCLUSION

Optimized Spar Buoy and TLP Wind Turbine Floaters

Low Responses – Use of Onshore Wind Turbines

Hybrid Offshore Wind & Wave Farms

Optimal Control to Enhance Wind and Wave Power Output

Design of Offshore Electric Grids

Attractive Economic Attributes

Project Finance for Utility Scale Offshore Wind & Wave Farms.

## IX. ACKNOWLEDGEMENTS

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