DESIGN OF WIND TIDAL HYBRID ENERGY GENERATION

Priyanka J, Dr. Sivakumar R
Department of Electronics and Instrumentation Engineering,
St. Joseph's College of Engineering,
OMR, Chennai 600119, India.
Email:
priyakumar2198@gmail.com

***Abstract*— Now a days electricity plays a major role in day to day life. India and various countries are following some harmful methods to produce electric power which leads to damages by polluting our ecosystem completely.There are many ways to produce electric power without polluting our environment called renewable sources of energy production using wind, solar, tidal, biogas, etc. Hereby we planned to produce electric power with the help of tidal energy and windmill mechanism which is named as WIND-TIDAL Energy generation. For this plan of proposal we planned to erect floating rotational disc over the sea level. There are two blades present in this setup one is fixed and another one is flexible. The fixed blade gets placed below the floating disc and the flexible blade is placed above the floating disc. The fixed blade receives tidal energy with the help of sea waves, and the flexible blade receives wind energy with the help of atmospheric air.**

Keywords—Hybrid design; tidal and wind; floating turbine; onshore; continuous input

I. INTRODUCTION

Recently the national planning of Sweeden government adopted wind energy for power generation. They planned to generate 10 TWh by 2015 and they substantially increased from current 0.6 TWh level. While global energies and national policies as well as general public point out wind power as environmental friendly. Most of the objections over it to local level that tend to have environmental origin [1]. Current understanding and review of tidal energy resource is the context of the emerging technology of tidal stream power generation. A geographical focus is on the north west European continental shelf. These estimations were reviewed as such some analytical models of energy extractions by tidal stream power [2]. In recent days, many countries are step in forward to start to go with non conventional renewable energy for electricity production. Many developments is going on to make it hybrid to receive efficient power. By under going many research to enhance continuous power generation with respect to the wind, tide, dynamics, transformer, etc [3].

In future, there is possibility for chronological multiple model may construct in coastal regions to supply power to residence or to have storage in battery by combining TPGS (tidal power generation system) and WPGS (wind power generation system) [4]. The main conflicts in non-conventional energy resource is the intermittent nature, drop of input energy because wind and tide depends on force of one with other. So hybrid of these two leads to support things when one fails to give input [5]. The power generation takes place through the hydraulic pressure which receives mechanical energy through tidal energy with the help of disc movement over the sea level with respect to the waves. Transmission of power for electricity generation is done through the hydraulic pump to the turbines by passing the pressurized water [6]. For avoidance of power fluctuation due to the lack of input power to the device and the input power is received through dual ways to generate continuous input and continuous power generation to the maximum [7].

II. METHODOLOGY

Generation of electric power using free renewable energy without polluting the environment. Here we are using tide to get continuous rotation and wind to give boost up power. Our Floating disc is designed to give revolution with respect to the flow of tide. And the disc is placed in certain height to avoid or reduce loss in production due to return force from the tide. Disc is getting input using the tide, with the help of the tidal input which makes the floating disc to rotate to get output. With the help of disc rotation we receive mechanical energy and then the energy conversion takes place (i.e) mechanical energy gets converted into electrical energy. Finally Using this energy conversion the work done takes with the help of existing mechanism. The parts used for this mechanism as follows Floating disc, Blades, Transmission Shaft, Driving Gear, Idle Gear 1. Idle Gear 2. Idle Gear 3. Idle Gear 4. Driven Gear, 5. Generator.

A. *Floating Disc*

The floating disc consists of fixed blade and flexible blade. The fixed blade receives the tidal energy, and the flexible blade receives wind energy as input.

Diameter of the floating disc – 550 mm
Thickness of the floating disc – 15 mm
Length of the fixed blade – 250 mm
Length of the flexible blade – 250 mm
Width of the fixed blade – 30 mm
Width of the flexible blade – 30 mm
Thickness of the fixed blade – 15 mm
Thickness of the flexible blade – 15 mm

B. *Transmission Shaft*

The transmission shaft which is interconnected with the floating rotational disc and driving gear to receive input power from floating disc for further steps.

Diameter of the transmission shaft – 18 mm
Length of the transmission shaft – 500 mm

C. *Driving Gear*

Driving gear which is connected with the transmission shaft which transmit the power to the crank with the help of driven gear.
Diameter of the driving gear – 500 mm
Number of teeth of the driving gear - 24

Pitch angle of the driving gear - 20
Pitch of the driving gear – 10

D. *Driven Gear*

Driven gear is the part which is interconnected with the crank mechanism and driving gear which increase the received power from the driving gear and transmits power to the crank.
Diameter of the driven gear – 25 mm
Number of teeth of the driven gear - 15
Pitch angle of the driven gear - 20
Pitch of the driven gear – 10

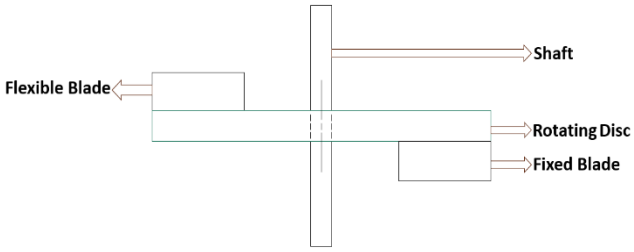
E. *Idle Gear 1-4*

The idle gear is used to increase the rpm of the driven gear by the driving gear. Here we are using 4 idle gear in the power train to transmit the input power to the generator through the driven gear.

IDLE GEAR	DIAMETER
1	150 mm
2	400 mm
3	25 mm
4	600 mm

F. *Generator*

Here the generator is connected with the crank mechanism plays the final role by receiving the mechanical energy through the crank shaft and produce electrical energy. Hence the target achieved with the help of our proposed design.



MECHANICAL DESIGN 2D VIEW

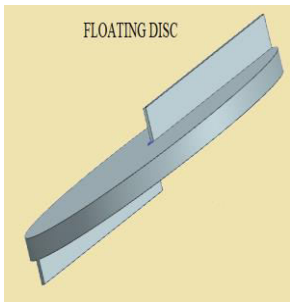


Fig. 1

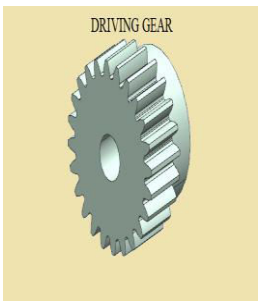


Fig. 2

Fig. 3

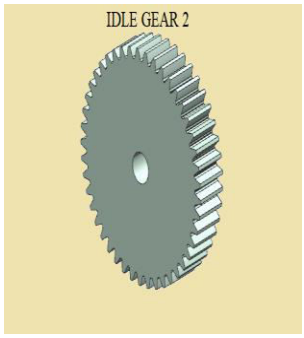


Fig. 4

Fig. 5

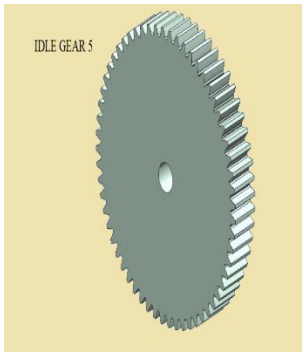


Fig. 6

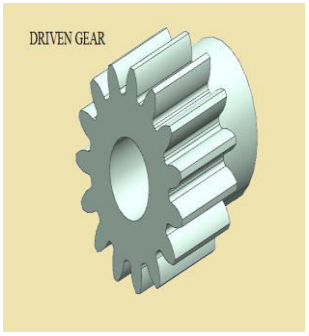


Fig. 7

Fig. 8

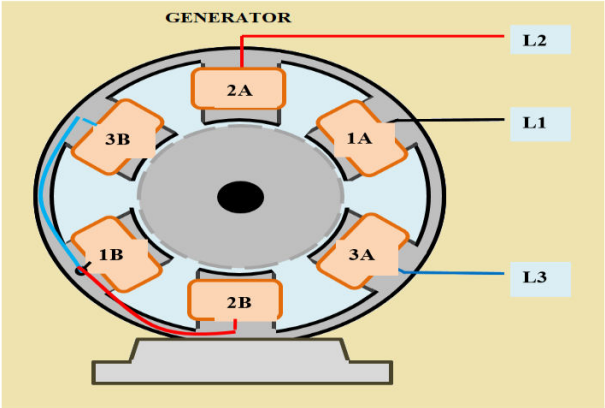
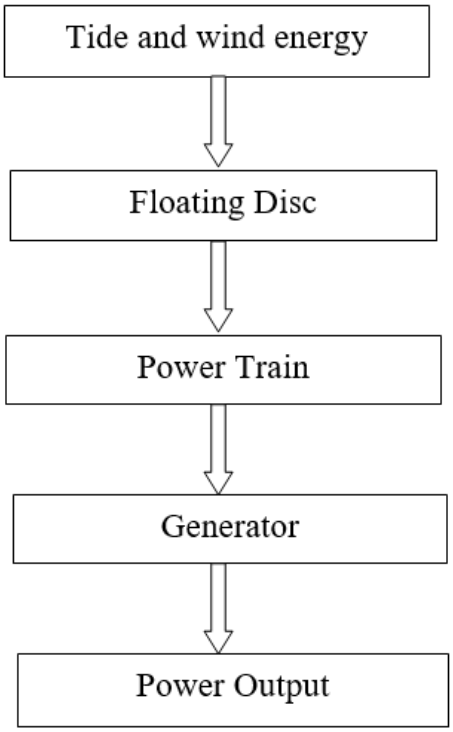


Fig. 9

III. FLOW CHAR



IV. RESULTS AND CALCULATION

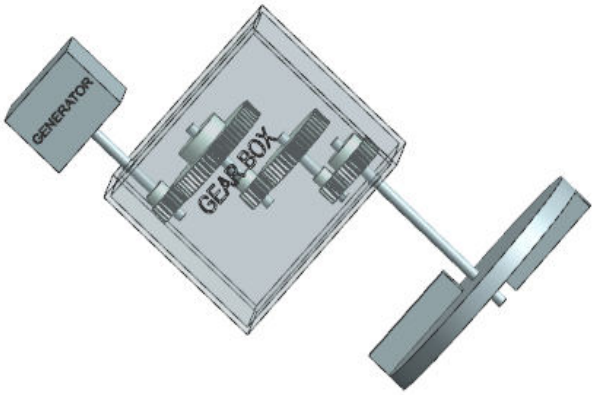
The proposed work of the paper involves in three stages collection of renewable energy (Tidal and Wind) through the floating disc in the 1st stage, and the input mechanical power transmitted through the power train in the ratio of 1:24 in the 2nd stage and finally the input power transmitted to the 3 phase generator to receive output power in final stage. From the analysis taken, the average wind speed is 11.6 km/h and the average sea wave is 24.5km/h as in 2019. And this analysis was taken using the website called weatheronline.in. If we receive this much of wave and tide, the floating disc which is fixed above the sea level gets rotated in 50 rpm. If the floating disc receives 50 rpm the driving gear which is interconnected through transmission shaft-1 with the floating disc. Then the driving gear is meshed with idle gear-1 has its rotation in the ratio of 1:2 compared with driving gear. So the speed of the idle gear-1 will be 100 rpm. The idle gear-2 is meshed with idle gear-3 and the speed of the idle gear will be 300 rpm. It is the ratio of 1:6 compared with driving gear vs idle gear-3. The idle gear-3 id interconnected with idle gear-4 with the help of transmission shaft-3. Hence the speed of the idle gear-4 and transmission shaft-3 will be 300 rpm. Finally driven gear is meshed with idle gear-4. Then the speed of the driven gear will be 940 to 1200 rpm. It is in the ratio of 1:24 of the rotation of the driving gear. The speed of the generator is similar to the speed of the driven gear because it is interlinked with transmission shaft-4. The generator consist of 6 poles. The power train and generator calculations is as follows

Gears specifications				
Name	Pitch	Speed(RPM)	Tooth	PA
Driving(N1)	10	50	24	20
Idle 1 (N2)	10	100	12	20
Idle 2 (N3)	10	100	45	20
Idle 3 (N4)	10	300	15	20
Idle 4 (N5)	10	300	60	20
Driven (N6)	10	1200	15	20

Gear Ratio of all gears with respect to RPM

N1 = 1:1
N2 = 1:2
N3 = 1:2
N4 = 1:6
N5 = 1:6
N6 = 1:24

3D View



Calculation

N = 1000 rpm
3 phase star conected
number of slots = 54
turns per coil = 10
flux per pole(∅) = 0.16 weber
flux pitches coil, Kp = 1
frequency $= \frac{PN}{120} = 6 * \frac{1000}{120} = 50$ Hz
number of coils = number of $\frac{slots}{2}$ =Generator

Derivation

P = Number of poles
F = frequency of induced emf in hz
∅ = flux per pole in weber
N = speed of the rotor in rpm
Z = number of turns in conducter per phase
Z = 2T
T = number of turns per phase

Kd = distribution factor
$= \frac{\frac{\sin m\beta}{2}}{\frac{m\sin\beta}{2}}$
Kp = pitch factor
$= \frac{\cos\alpha}{2}$
α = short pitched angle
Kf = form factor
= 1.11 for sinusoidal emf
number of revolutions per second $= \frac{N}{60}$
time taken for onr revolution $= \frac{60}{N}$
in one revolution of the rotor the flux cut by one conductor = ∅P weber
change in flux d∅ = dP
time taken, dt $= \frac{60}{N}$ second
emf induced per conductor $= d\emptyset \frac{}{dt}$
$= \emptyset \frac{\frac{P}{60}}{N} = \emptyset \frac{NP}{60}$ volts

We know that
$N = \frac{120f}{P}$
average emf per conductor $= \emptyset \frac{P}{60} * \frac{120f}{P}$
$= 2\emptyset f$volts
if there are Z conductors in series per phase then
average emf induced per phase = 2∅fZ volts
= 4∅fTph volts
[since Z = 2T]
rms value ofemf per phase = 4.44f∅Tph volts
actual available voltage per phase = 4.44f∅KpKdTph volts

$$\frac{54}{2} = 27$$

number of coils per phase $= \frac{27}{3} = 9$
number of turns per phase = turns per coil * number of coils per phase
$= 10 * 9 = 90$
slot angle $= \frac{180 \text{ degree}}{\text{number of slots per phase}}$
$= \frac{180^\circ}{9} = 20^\circ$
$Kd = \frac{\frac{\sin m\beta}{2}}{\frac{m\sin\beta}{2}}$
$= \sin 3 * 20^\circ \frac{}{2} / 3\sin 20^\circ/2$
$= \sin 30^\circ \frac{}{3\sin 10}^\circ = 0.96$
Eph = 4.44KpKdf∅Tph
$= 4.44 * 1 * 0.96 * 50 * 0.16 * 90$
Ep = 3067.93 volts
GENERATOR NAME PLATE

phase voltage		line voltage
v = 3067.96	=	5307.57 volts

frequency = 50 Hz
∅ = 3 phase
star connected
power factor = 0.85
generator rating = 1.5MVA
full load current = 165A

Transformer details

HV=5307
LV=415
Frequency=50 Hz
HV Amps=169A
LV Amps=1673A
Phase=3 phase

CONCLUSION

Here we hope that it will be one of the base for go green power production projects with renewable energy without affecting our environment. And helps to save our ecosystem from harmful method of power production like Nuclear, Lignite, etc... And we have found the new method of receiving input energy using tide and wind and simplified the mechanism to get power with the help of renewable source of energy as seen above.

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