

WINLAR

(SOLAR AND WIND ENERGY SYSTEM)

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Abstract: There is an emergency need to work out an extension of non-conventional hand in total power generation as we see a lot of power scarcity due to lack of surplus amount of natural resources. Our project “WINLAR” is an archetype which helps in harnessing wind and solar energy within a single model. In view of considering different aspects like low installation cost, decrease in cost charge per unit, development in the area, employment, direct connection of wind power plant to conventional grid are some of the advantages of our prototype, places where wind currents would be high will be of good use for the constructive output of our prototype.

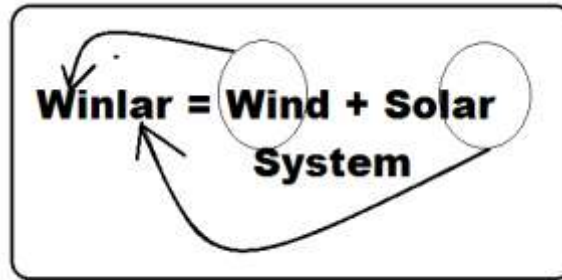
Keywords: WINLAR, Solar power, Wind power, Hybrid power generation, WITIRCITY, Solar vanes, Principle of induction, Special axial machines, Grid interfacing.

INTRODUCTION

Now-a-days we see many different types of power generation methods like Thermal, nuclear, Wind, Bio Gas, Solar and etc... Among all thermal power is the largest source of power in India. It produces 75% of the total power in India i.e. Around 89000 MW from 102 thermal power stations. And nuclear power produces around 4560 MW with 9 centers and In wind India stands as the 5th largest power production in the world. It supplies around 9853 MW with 24 wind mill stations situated. But the solar energy system is still backing in India when compared to other countries except in Gujarat. And many power plants like Hydro, Diesel, Gas and etc. Are producing 5000 to 9000 MW of power every year. Even though as India is producing this much amount of power every year, it is not sufficient to meet the demands of the people. Along with this if we see now-a-days the contribution of thermal power is going to reduce due to the fact of reduction of coal in the nature. Thus there is an immediate need to focus on the renewable sources to help our future generation for better enforcement. This concept of WINLAR is a renewable system which can tackle both wind and solar energy at a time to serve for the better purpose.

1. WINLAR:

This is completely a pure combinational idea which has not been implemented up to now in present days. Here the name WINLAR suggests as



1. (A) WINLAR

This is quite different form of hybrid system. Here we use both solar modules and wind system to form a single unit called as “**multi-unit**” which will be briefly described later. Normally we see many hybrid systems which re the combination of solar and wind in practice.

1.1 Aim of WINLAR:

The main aim of WINLAR is to have a multi-unit which is not of course as shown above. This system has a single set up for capturing both wind and solar energy that to at a time. So, we can think that this is an advanced version of Hybrid system.

1.2 WINLAR Description:

Here the vanes of the system are replaced

By solar plates which means the solar modules need to be designed in the form of the vanes of required length. Here the system design changes for a normal hybrid system to WINLAR.

If we see there are few components in design of WINLAR system they are

1. Solar Panels
2. Solar vanes
3. Gear box
4. Generator
5. Transformer
6. Inverter
7. Tower
8. Controller

Finally we need to have an overview over conversion techniques we want to introduce.

1.2.1 Solar panels:

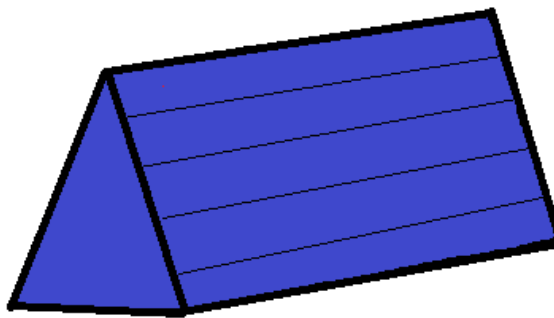
Solar light is the most energetic radiant light and [heat](#) from the [sun](#), is harnessed using a range of ever-evolving technologies such as [solar heating](#), solar photovoltaic's, [solar thermal and thermal electricity](#), [solar architecture](#) and [artificial photosynthesis](#). Here we use a mono crystalline and active solar panel which consists of photovoltaic cells.

1.2.2 Solar vanes:



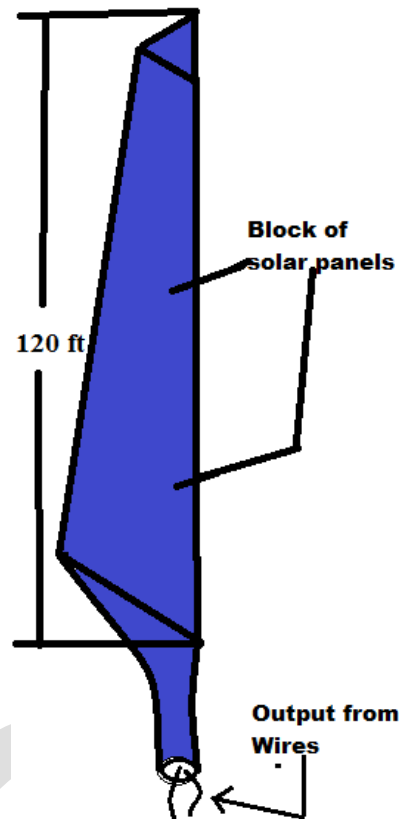
1.2.2 (A) Ordinary Wind vane

The main function of vanes is to convert the kinetic energy to electrical energy. The vanes are here replaced with a specially designed solar module or with a group of solar plates placed on the vanes which are made of which are of light weight. Here we are considering the vane structure to be of triangular i.e. Pyramidal as shown



1.2.2 (B) Formatted pyramidal Wind vane

The length of these solar plated vanes is assumed to be about 7 to 10 ms which is of a diameter of 16 to 22 m. And solar planes are plated on the vanes which are made of light fiber. The above shown pyramidal structural vane is used as a normal vane with a hub which is fixed to a rotor shaft. This WINLAR has three vanes of pyramidal structured fixed to the hub.



1.2.2(C) Cross sectional View of Assumed structure of wind vane

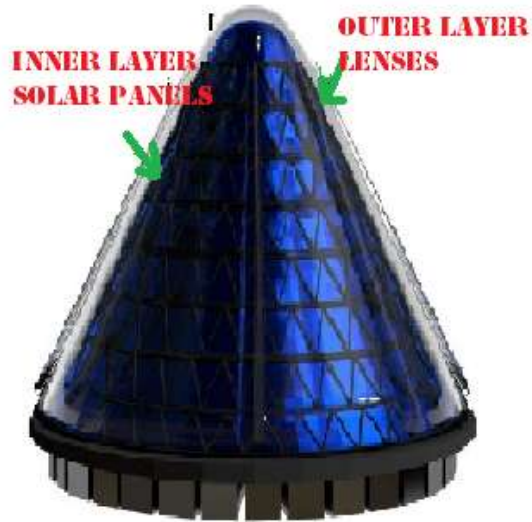
So, by connecting these types of vanes there are a few advantages of the WINLAR systems and they are

- It reduces the angle of rotation to the direction of wind
- We get the same cross sectional area to cut
- This helps us to attain maximum lift and minimum drag such that it increases the efficiency.
- As increasing solar energy harnessing to maximum extent this is useful as the vane rotates the light can always incident on it at 90 degrees or to the extent of maximum.

Here we have one more idea towards the enhancement of the solar vane i.e by using the already developed technology of solar panels i.e. V3 Solar Spin Cells.

1.2.3 V3 Solar Spin Cells:

A V3Solar panel is a type of solar cell which can generate electricity more than 20 times to that of a normal flat plate solar panel of the same panel area. This is panel is a combination of concentrating lenses, dynamic spin and advanced electronics. Normally this V3 panels are conical in shape s shown in the figure.



1.2.3. (A) V3 Solar Cell

Construction:

The V3 Spin Cell features two cones, one made up of hundreds of triangular PV cells and a static hermetically-sealed outer lens concentrator comprising a series of interlocking rings and a number of tubular lenses spaced equally around the outside surface. According to V3 Solar, the Spin Cell's cone has been set at an angle of 56 percent to enable capture of the sun's light at more angles than flat PV panels.

Working:

On the first layer there are lenses which focusing the light on the inner layer which is made of thousands of solar panels which are rotating such that these light is focused continuously on the rotating solar panels which will avoid the heat.

2.2.4. Inverter:

Inverter is used to convert DC to Ac and connected to a transformer for stepping up the voltage.

Specifications:

Size: 600*300*700 mm

Weight: 50- 68 Kg Capacity: 5 to15KW



1.2.4. (A) Inverter

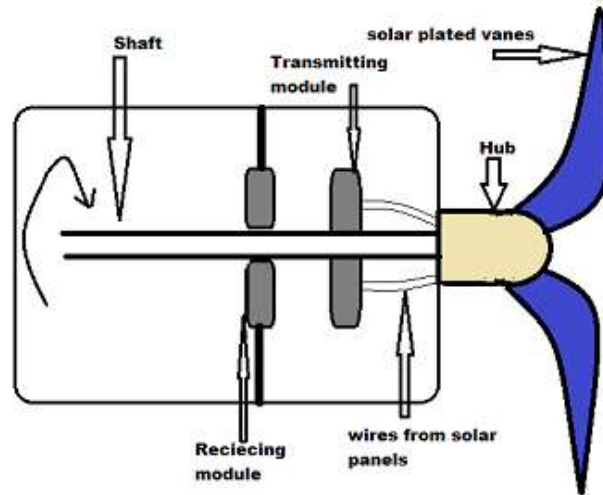
3.0 Conversion Techniques:

As we're using a solar plated module there is an ambiguity i.e. How to transform current obtained by the rotating solar plated vanes into the static one. For this we have developed three models and they are

- I. WITRICITY
- II. Induction machine concept

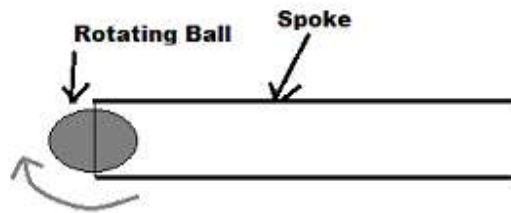
2.1 WITICITY:

WITRICITY refers to transmission of power through air. In this concept we are using two modules which are specified as transmitter and receiver. In our implementation we are using this WITRICITY for a length lower than 200cms. Thus this could serve the purpose



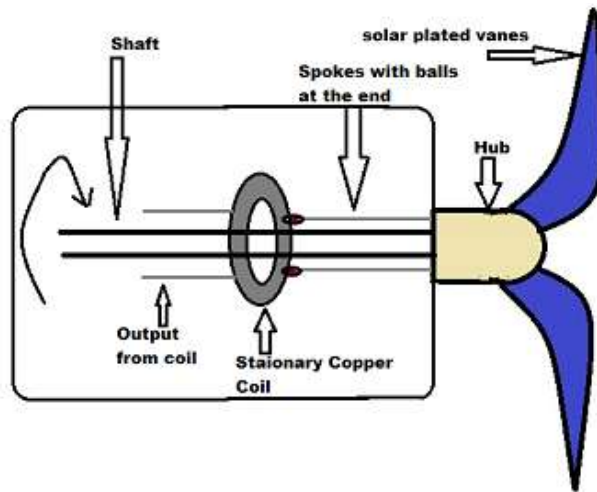
2.1. (A) WITRICITY Transmission Type

2.2 Induction machine method:



2.2. (A) Soldered Spoke

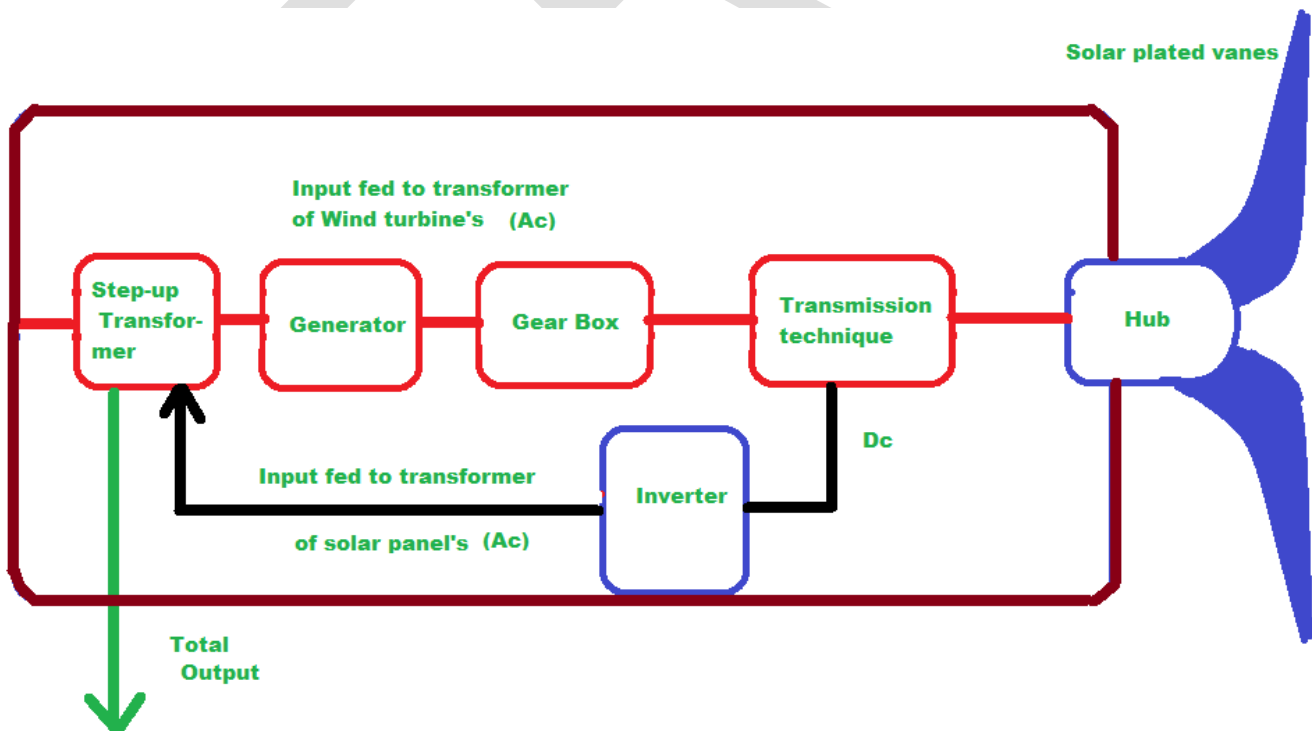
Here in this method we are using a coil which is fixed as shown in the figure. The wires of solar plated vanes coming out of the hub soldered with an iron spoke which are good conductors of electricity. These spoke have balls arranged at their tips which are placed onto the coil.



2.2. (B) Induction machine concept

In the both above mentioned methods the WITIRCITY method is better to use because in the induction concept we have many troubles such as more maintenance required because the ball bearings need to be replaced time to time.

3. Working of WINLAR:



3. (A) Block Diagram of WINLAR

The main function of this WINLAR prototype is to collect the solar energy and wind energy and also the heat energy. The wind vanes collect the kinetic energy while the same time the solar plated vanes absorb the light energy. These vanes can absorb maximum light energy since they are in triangular shape or construction. So, that the light incident on it is at an angle 135 degrees in most of the cases.

At the transformer both the electrical energies of wind and solar are combined stepped-up and transmitted to the bottom of the tower. From there to loads or to grids

3.1 Using over the Grid:

Here we consider DC motor as a backup motor this DC motor will be in parallel with the electromagnets which has the ability that can produce high magnetic field which in turn produces large generating voltage and DC motor usage can help us in attaining continuous reliability on generating power

4.2 Direct transmission of the wind energy and solar energy:

In this method we would like to transfer complete solar power through a DC-to-Ac converter and then we add this output to the power developed due to the wind energy conversion. The total output is summed up and given to transformer to step up and then to ultra or high voltage transmission lines to the grid.

4.1 Enhancements we think:

- 1) Application of phototropism concept to tracking system would increase efficiency.
- 2) Special axial machines concept introduction to wind energy conversion and that to done by harnessed solar energy would make wind power generators to connect to conventional grid.
- 3) Dynamic selection of energy selection with the help of power electronic devices and controllers such that no stone to increase efficiency.

5.0 Advantages of WINLAR prototype:

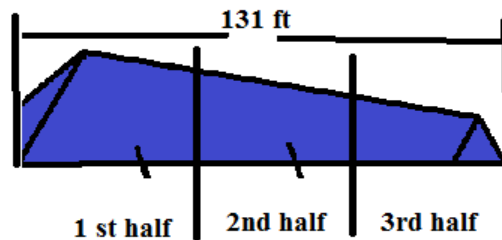
- Efficient usage of wind energy and solar energy at a time in a single prototype and continuous reliability.
- Can be reliable to use for supplying current to the village.
- Better to establish at the sea coasts in villages for the effective use.
- Increase in efficiency of the non-conventional method of generation of power.
- High output in similar or equal area which in turn reduces per unit rate.

- The power factor can be improved.
- Reduces burden on the conventional method of generation.
- Though installation may cost in high but in future good outputs and great profits can be attained.
- Low maintenance cost.

6. Solar power and Cost Calculations:

Consider vanes length be **131 ft** i.e. **40mts** and width is varying for a vane. Divide the vane into **three equal half's** and calculate the area. **Total area** be $\text{area}_1 + \text{area}_2 + \text{area}_3 = 384\text{m}^2$. Due to few uneven let total area be = **384m²**.

We are using solar modules of 320 w and 40v and 8 amp. And of size 1.66x1.51x.04mts. The **area of each module** is considering length and width is **2.192m²**. **No. of panels** required to cover the one of the three vane is = $(384/2) = 192$. modules. Assume it to be less than 184 modules like **150 modules** around.



6 (A) Area Divisions

Total for three vanes and three blades no of modules required is = $150 * 3 * 3 = 1350$ panels.

Here we practically have efficiency of solar panels is around **44.4%** so consider

Total **power** generated by panels at **44.4%** efficiency is = **125 K Watts = 0.125 MW**.

Cost is each solar module of above specifications is **\$ 214**, we do require 1350 panels and total cost is about 1 crore.

There is subsidy given by the government from **30% to 50%**. Thus we get it at half of the cost only.

7. Conclusion:

Optimal usage of renewable energy sources would be claimed as an efficient way for reducing power scarcity ,so as to improve the utility of natural resources so we tried to make out the best part of natural resources wind and solar harnessing in a unified

model which could gain a lot of prominence in mere future acquainted with power system architecture as we should always think that a minor change would result in an enormous hike in the output power especially in power systems

Ex: a surge diverter is protecting transmission line huge transient lightening stroke, ground wire protecting from indirect lightening strokes.

WINLAR utilizes both solar and wind harnessing systems which in turn has the capital investment cost, charge per unit also has an enormous reduction when compared to individual systems. Extensive research on WINLAR would also result in more practical, efficient renewable energy harnessing system which has a lot of scope for crossing of limitations that a renewable system has. It may reduce our dependency on conventional power production also which would definitely increase coal, water systems as rate of usage will be nearly equal to the rate of usage, so we could conserve our natural sources for our future generations.

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