WIND ENERGY COLLECTORS
(A Scenario in Renewable Energy sources)

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Significance of Renewable sources

- Rapid growth in energy demand due to Industrial need & household consumption.

- Over dependency on Non renewable like fossil fuel i.e Coal (59% of electricity generation) which is responsible for Green house gases (GHGs).

  Source: [https://en.wikipedia.org/wiki/Electricity_sector_in_India](https://en.wikipedia.org/wiki/Electricity_sector_in_India)

- Limited availability of conventional energy.

- Severe power demand supply gap, 60 crores of population from 20 states is affected by power shortage.

**INTRODUCTION**

- WECS is a Scientific process of gathering energy from The Wind.
- Windmill is a machine for wind energy conversion.
- Wind turbine converts the K.E of wind’s motion to Mechanical Energy transmitted by Shaft.

**Application:-**

1. **Small Scale (Traditional)**:-  
   Range: 80 kW to 3,000 kW.  
   Usage: Mill for grinding Grains, Water pumping

2. **Large (Commercial)** :-  
   Range:- above 3000kW  
   Usage: Electric power Generation.
Growth in Wind Energy (Present scenario)

- "It is one of the most successful renewable energy technologies globally, and today wind energy contributes to nearly 70% renewable energy installations in our country" Ministry for New and Renewable Energy (MNRE).

- India Comes at 5th position in Global Wind Energy Production.

- Global
  - USA (35,159 MW)
  - Germany (25,777 MW)
  - Spain (19,149 MW)
  - China (25,104 MW)

### Supplies and market share

<table>
<thead>
<tr>
<th>Company</th>
<th>MW</th>
<th>Market Share (%)</th>
</tr>
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<tbody>
<tr>
<td>Suzlon Energy</td>
<td>1,148.55</td>
<td>36.31</td>
</tr>
<tr>
<td>Enercon India</td>
<td>767.20</td>
<td>24.25</td>
</tr>
<tr>
<td>Regen Powertech</td>
<td>415.50</td>
<td>13.13</td>
</tr>
<tr>
<td>Gamesa</td>
<td>312.35</td>
<td>9.87</td>
</tr>
<tr>
<td>Vestas</td>
<td>260.10</td>
<td>8.22</td>
</tr>
</tbody>
</table>
Potential states in wind production

<table>
<thead>
<tr>
<th>S No</th>
<th>States</th>
<th>Gross Renewable capacity (MW)</th>
<th>Wind capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tamil Nadu</td>
<td>7491</td>
<td>7154</td>
</tr>
<tr>
<td>2</td>
<td>Maharashtra</td>
<td>4497</td>
<td>2976</td>
</tr>
<tr>
<td>3</td>
<td>Gujarat</td>
<td>4042</td>
<td>3114</td>
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<td>4</td>
<td>Karnataka</td>
<td>3571</td>
<td>2113</td>
</tr>
<tr>
<td>5</td>
<td>Rajasthan</td>
<td>3360</td>
<td>2355</td>
</tr>
</tbody>
</table>

COMPONENT & MECHANISM OF WIND TURBINE
Types of Wind turbine generator

1) HORIZONTAL AXIS TYPE :-
   - Two Aerodynamic Blade
   - Propeller type with Single Blade
   - Multiblade Type
   - Mill Dutch Type
   - Sail type

2) VERTICAL TYPE :-
   - Savonius Type rotor
   - Darrieus Type Rotor
A. HORIZONTAL AXIS WIND ROTOR

- The common wind Turbine With a horizontal(almost horizontal axis).
- It Based on the Simple Principle.
- But Design of Large plant which will produce Electric Power Economicaly is Complex.
- Some parts are Rotor,Transmission,Generator and Tower be as Sufficient as possible.
- These component must function effectively in combination.
a) Horizontal with two blades

OVERVIEW

- Two blade wind rotor is mostly preferable under Horizontal Type.
- If the Blades are made up of Metal
  - Flexing reduces Fatigue life, undesirable Economical point of view.
  - More load Applied on the Turbine
  - If Vibrational mode concide with Natural mode of vibration, the whole system Shake itself.
- Because of the High cost of Blade, rotor with more than 2 blades are not recommended.
- Rotar wit 3 or 4 blades would have Higher Power coefficient.
More than 560 windmills have been erected in Satara by Suzlon India Ltd.
Capacity varies from 350 kVA rating to 1000 kVA.
Power is generated at low voltage of 415 volts and is then stepped up by transformers near the base of the tower.

Tower Height upto 50 meter is used
3 blade Horizontal axis rotor is used.

Monitoring Stations have PCs which monitor parameters like wind speed, wind direction, kW, rotational speed, power generation trend, faults etc.
Horizontal with 1 Blade rotor

• Long blade (upto 60 m) can mounted on rigid hub.
• With long blade, bending moment may occur due to Shadow, Gravity, Shift in wind direction.
• Lower blade weight & cost is Desirable
• Vibration produced, due to Aerodynamic torque.
Horizontal axis with multiblade rotor

- Blades can be made up to sheet metal or Aluminium.
- Rotor have high strength to weight ratio.
- Wind speed up to 60 km/hr can generate freewheeling operation.
- Good power coefficient.
- High starting torque & simple construction.
4. Mill-dutch type

- One of the oldest design having traditional usage under mills & water pumping.

- Blades are made from array of wooden slats.

- High speed can achieved easily.

- Not for commercial usage.
5. Sail type

• Blades are made from cloths, nylon or plastic.

• Horizontal axis type having better performance than vertical.

• Commercial Application
  1) Electric power generation.
  2) Pumping water.
1. Savonius rotor

- Invented by S.J Savonius in 1920.
- Work like a cup Anemometer.
- Popular as it require low velocity winds for initial operation.
- Not affected by the direction of wind as it has vertival axis.
- Wind force is more at cupped side than rounded face.
- Characteristics
  1) Self starting.
  2) Low speed.
  3) Low efficiency.
2. DARRIEUS TYPE

- Invented by G.J.M Darrieus in 1925.
- Effectively intercepts large area of wind with small blade area.
- Highly used in Canada.
- Airfoil blades provides torque about central shaft in response to stream.

Characterstics
a) Self starting.
b) High speed
c) High efficiency
d) Potential low capital cost
ACTION BY GOI TILL TODAY

- Government of India came up with National Action Plan on Climate Change (NAPCC) in Year 2008 under the Prime Minister's Office. Under this plan, the Government of India has set a target of reducing Country's carbon emissions intensity of GDP by 20% to 25% between 2005 and 2020. Since there is no GHG emissions during renewable energy generation, NAPCC encourages addition of renewable energy based capacity in the country.

- Government has already passed Electricity Act 2003 in favor of renewable energy and distributed generation. But it is not implemented in practice so far.

- Government of India has estimated the potential of 45000 MW of wind power throughout the country. So far about 3500 MW capacity has been installed in India. Neglected states like Bihar, UP, Jharkhand in wind power generation.

- Being follower of European technology, Government of India promotes big wind turbines and it does not recognize the potential of small wind turbines.
An effective Action Plan

- As per an Expert, there is a huge potentiality of small wind turbines in India, which estimate, roughly 100,000 MW power can be produced in India from only small wind turbines up to 10 KW. There are bright prospects to establish about 50 million small wind turbines from 500W to 10KW capacity. Such a huge possibility exists in India but unfortunately, small wind turbines are totally neglected by the Government of India.

- Small wind turbines can be cheaper than big wind turbines on the basis of per KW cost. If systematic efforts are made, this means that investment in small wind turbines on per KW basis will be only 1/3 of investment of big wind turbines. Thus, small wind turbines will be strongly viable throughout the world and India can become the biggest supplier of small wind turbines in the world.

- There is no awareness about the education of wind energy. Aerodynamics is a strange word in India. There is no course in India for wind energy at any university, any engineering college, and polytechnic or even at ITI level.

- If the Government recognizes the importance of small wind turbines, there should be degree and diploma courses and also short-term certificate courses of wind energy technology in every university to every ITI.

- The Government should encourage publishing technology books related to wind energy in all the regional languages and also should conduct National level Wind Expo.

- It is highly essential to give free permission to connect small wind turbines with grid power.

- There exists highly developed industrial infrastructure in India to manufacture towers, blades, wind rotors and also electronic controllers.
POSITIVE IMPACT DUE TO ACTION PLAN

- IF GOVERNMENT PERMITS GRID CONNECTION TO SMALL WIND TURBINES, THEN SIMPLE INDUCTION MOTORS CAN BE USED AS GENERATORS AND THUS SMALL WIND TURBINE WILL BECOME EXTREMELY CHEAPER AND STRONGLY VIABLE COMPARED TO BIG WIND TURBINES AND ELECTRICITY COST WILL BE FAR MORE CHEAPER THAN THAT OF THERMAL POWER STATIONS.

- INDIA WILL REALLY BECOME NUMBER ONE IN THE WORLD IN WIND ENERGY PRODUCTION AND THAT ALSO ONLY THROUGH SMALL WIND TURBINES PRODUCING ROUGHLY 100000 MW OF ELECTRICITY. BUT IT IS MOST UNFORTUNATE THAT OUR GOVERNMENT IS LACKING THIS VISION.

SOURCE HTTP://WWW.TINYTECHINDIA.COM/TEMPLATE/INDEX.PHP?ID=41&TITLE=SCOPE%20OF%20SMALL%20WIND%20TU

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AADHUNIK GLOBAL ENERGY RAJKOT
a) Climate parliament  
   Link:-  http://www.climateparl.com

b) Centre for Wind Energy Technology (CWET)  
   Link:-  http://www.cwet.tn.nic.in

c) Ministry for New and Renewable Energy (MNRE).  
   Link:-  http://www.mnre.gov.in

d) Suzlon Energy  
   Link:-  http://www.suzlon.com

e) Wikipedia Source  
   Link:-  http://www.Wikipedia.com/windenergycollector

f) Text Book :- Energy Technology by Mr GD Rai

g) Experts review from Aadhunik Global Energy ,Rajkot Gujarat  
   Link:-  http://www.tinytechindia.com/Template/index.php?id=41&Title=SCOPE%20OF%20SMALL%20WIND%20TU