

“ASTOUNDING PROGRESS OF WIND TURBINES”



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Wind Turbine History:

Earliest wind turbines known to human civilizations were constructed in 1st century AD, wind-driven wheel was used to assist heavy lifting/movement. A Greek engineer, Heron of Alexandria, developed this windwheel.

First practical usage of verticals axis windmill (whose blades were created by using cloth) was for grinding grain or draw up water. Some of these old turbines are still functional in some parts of the Eastern/Central Europe but instead of wind turbine rotor, these grinders are powered by modern electrical motors (But Old structure is still fully functional). One such machine still operation in Netherlands which grinds the corn to feed the chickens on the farm.

Idea for the first electricity producing wind turbine came from Professor James Blyth, a Scottish engineer in year 1887, even though he managed to power his home electricity by this turbine but the idea did not get much interest from local community. The first modern wind turbine for commercial purpose was developed by a Danish scientist, Poul la Cour in 1891. He was the first one to ensure steady stream of power supply from the wind turbine by use of a regulator, a Kratostrate.

By start of 20th century there were ~100 wind turbines were operation in Denmark with power output range from 5 to 25 KW.

Father of Modern Wind Turbines:

First modern wind turbines was developed by Johannes Juul in 1957, incidentally he was the former student of Poul la Cour. He developed a horizontal-axis wind turbine with a rotor diameter of 24 meters and 3 blades, very similar in design to modern wind turbines. The wind turbine has a rated capacity of 200 kW and rotor speed was controlled by aerodynamic tip breaking System.

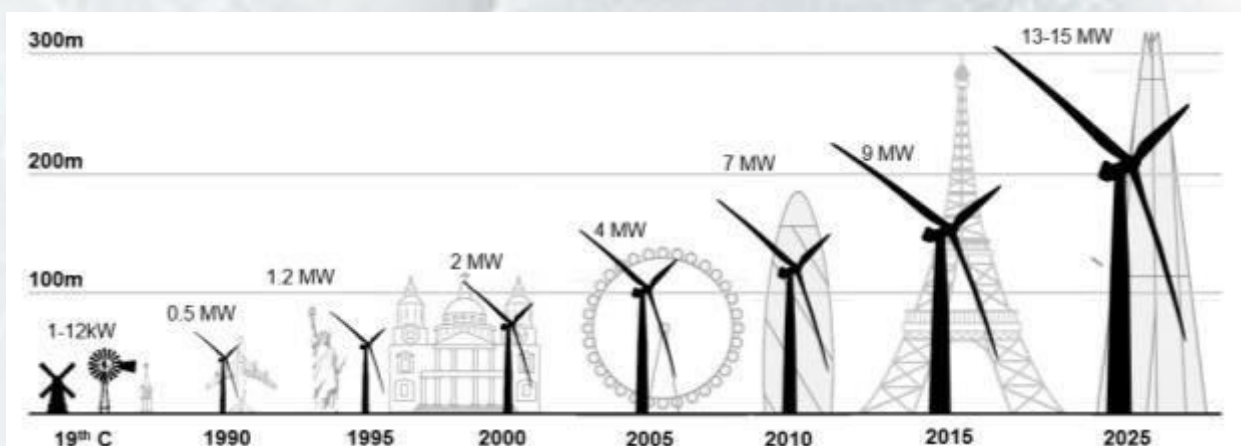


The Beginning and the distance we have travelled. Uhre, Brande Denmark

Growth of Wind Turbines from 1980 Till 2021:

With Development of Modern technologies, Advanced Controller Algorithms, and superior wind prediction methods the size and rated power has grown exponentially since the start of early 80's.

From fallowing scale representation, we can see that we have come a long way from earlier miniscule wind turbines compared to modern giants of 15 MW. 15MWturbines nacelle weighs about 500 tons i.e. equivalent to 350 average family cars weight and swept area equivalent to five and half football Fields. These astonishing development has happened in last 40 years or so and it has brought down cost of energy from 55Cents/kwh to 5 Cents/kwh. Bringing the wind energy cost of energy on par with Conventional energy sources.



Evolution of Wind Turbine Size and Power Output. (Source. <https://www.researchgate.net/>)

Wind Energy in India:

Average Indian house consume about 12 units of Electricity per day. i.e. 12Kwh. For this much electricity consumption 1 MW Turbine running at full rated capacity will power approximately 2000 Indian Homes.

But one major Disadvantage of Wind Energy is wind is not flowing with constant speed and not always at enough speed to run the wind turbine at its maximum capacity. This is where capacity factor of wind turbines comes into Picture. In India depending upon available wind condition the capacity factor ranges anywhere from 0.2 to 0.4 (The capacity factor of a wind turbine is its average power output divided by its maximum power capability) and almost 70% of annual wind energy power generation is done during the peak season of May to September.

wind speed is one of the defining parameter in deciding site location for Wind Turbine Installation. As available power at any given site is calculated by Below Formula.

$$P(\text{available in wind}) = 0.5 \times \text{air density} \times \text{Swept Area} \times \text{wind velocity cubed}$$

In India total installed capacity is close to 40000 mw. Mainly in coastal regions of Tamil Nadu, Karnataka Maharashtra, Gujrat and Rajasthan.

Employment opportunities in India:

Looking at rate at which Wind Energy Industry has grown in last four decades. There is absolutely no reason we should doubt the future of Wind Energy. As every country is pushing for green energy sources to meet the increasing Energy demands one thing is certain that Wind Energy will be taking a lead role to meet the clean Energy demands.

At present all the Market leaders in wind Energy be it offshore or Onshore wind Turbines Supplier have a engineering office based in India. To name few Vestas, Siemens Gamesa, GE, Suzlon and Many more.

At present there is a good requirement for Structural, Electrical and Software Engineers for New product Developments as well as for Service Technicians as well.