ENERGY RECOVERY FROM EXHAUST FAN IN INDUSTRY

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ABSTRACT

Exhaust ventilation systems have been widely used in factories with multiple heat or pollutant sources. However, conventional "static" designs that fail to consider overlapping terminal ventilation demands result in oversized exhaust systems and high energy consumptionOur primary goal is to suggest an idea that can surmount theseconundrums and utilize the wind energy to its maximum extent. This paper deals with the wind energy that can be derived from the wasted wind energy from industrial exhaust fans. The wind force from an exhaust fan can drive a small windmill and the energy generated from it will be stored in energy storage unit. The power stored in the battery can be transmuted into ac with the help of an inverter and then it can be supplied to the load and hence, this wasted power from exhaust fan can be utilized to meet the growing energy demand.

Keyword : - *Renewable energy, wind energy , wind turbine*

1.Introduction

Wind is the quickest developing energy innovation on the planet and it is the worldwide energy example of overcoming adversity of the 21st century. The speed of progress has been fast for a particularly youthful industry. Over the most recent 30 years development rates continue assumptions and a record limit of turbines was introduced globally. Wind energy for power creation today is an experienced, serious and practically contamination free Technology broadly utilized in numerous regions of world. The Wind Technology changes over the energy accessible in Wind to power or mechanical force using wind turbines. The capacity of a breeze turbine is to change over the movement of the Wind energy into rotational energy that can be utilized to drive a generator. Wind turbines are catch the force from the Wind by methods for efficiently planned sharp edges and convert it into pivoting mechanical force. A breeze turbine sharp edge use air foils is to create mechanical force.
In the power starved developing countries, Wind power is the variable source of electricity, which can be installed and transmitted very rapidly, even in remote, inaccessible and hilly areas. Electricity generation from Wind never depletes and never increases in price. The electricity developed by these systems could protect several billion barrels of oil and avoid more million tons of carbon and other emissions.

2. GLOBAL WIND ENERGYMARKET

Wind power has now set up itself as a standard power age source and assumes a focal part in an expanding number of nations prompt and longer term energy plans. Following 15 years prior normal total development paces of about 27%. The business wind power establishments in around 82 nations toward the finish of a year ago's added up to around 241 GW, having expanded by in excess of multiple times over that equivalent period. 22 nations have in excess of 1,000 MW introduced limit. This advancement was driven by the China , US , Germany , Spain and India and it carried worldwide total introduced ability to 2,82,481 MW (starting at 30 June 2012). The main five nations as far as combined introduced limit are China (75,563MW), the US (60,008MW), Germany (31,331MW), Spain (22,7965MW) and India (18, 420MW). As far as monetary worth, wind force could supply up to 12% of worldwide power by 2020, making 1.4 million new openings and decreasing CO2 discharge by more than 1.5 million tons each year, in excess of multiple times the present level. By 2030 breeze force could give over 20% of worldwide power supply. Today China, US, Germany, Spain and India are the breeze energy key market players at worldwide level.

3. WIND ENERGY ININDIA

India ranks as the world's seventh largest energy Producing country and fifth largest energy consuming country. India is also the fifth largest oil and seventh largest gas importer in the world. Due to increasing gaps between domestic energy demand and supply, India's incremental energy demand for the next decade is projected to be among the highest in the world. Under these situations, in order to gain energy freedom and obtain healthy sustainable Growth India must invest in renewable energy sector. The geographical location and its climate provide various advantages for renewable energy investments and production in India. Therefore, in order eliminate Dependency and handle environmental problems related to the consumption of fossil fuels, India must start investing in renewable such as wind, solar, biomass andgeothermal.

The total potential estimated by the Centre for Wind Energy Technology (C-WET) at around 45 GW, and was recently increased to 48.5 GW [12]. The Indian Wind Turbine Manufacturers Association (IWTMA) estimates that the potential is around 65-70 GW. The World Institute for Sustainable Energy, India (WISE) considers that with larger turbines, greater land availability and expanded resource exploration, the potential could be as big as 100 GW [4.5].The comprehensive wind mapping exercise initiated by MNRE, which established a countrywide network of 1050wind monitoring and wind mapping states.

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Sr. No.	States	Wind potential (MW)	Cumulative installation (MW)
1.	Andhra Pradesh	8,968	245.5
2.	Gujarat	10,645	2,966.3
3.	Karnataka	11,531	1,933.5
4.	Kerala	1,171	35.1
5.	Madhya Pradesh	1,019	376.4
6.	Maharashtra	4,584	2,733.3
7.	Rajasthan	4,858	2,070.7
8.	Tamil Nadu	5,530	6,987.6
9.	Others	255	3.2
10.	Total	48,561	17,351.6

Table :1 Wind Power Potential and Development in India

4. WORKING PRINCIPLE

The exhaust fan in big industries can play a seminal role in producing electrical energy which can surmount the energy demand to certain extent. The wind force from the exhaust fan can be directed towards a small windmill in front of it. The wind thrust from the exhaust fan can drive wind turbine and these wind turbines produce electricity which can be stored in storage unit. The storage unit may vary according to the production of electricity from the wind turbines. Then inverter will convert the stored dc energy into ac. This ac energy can be supplied to the load and grid.

This mechanism begets several advantages:

Wasted wind force from the exhaust fan can be utilized to generated electrical power.

- It will surmount the present day problems of wind energy conversion, that is, it canprovide a constant source of wind and thewind fluctuations can be surmounted.
- It will not be affected by geographicallocations and hence can be implemented inmany big industries.
- It will be plentiful, renewable and ecofriendly source of energy.
- The stored energy can be used when main supply is cut off. Hence, can be used as anEmergency unit

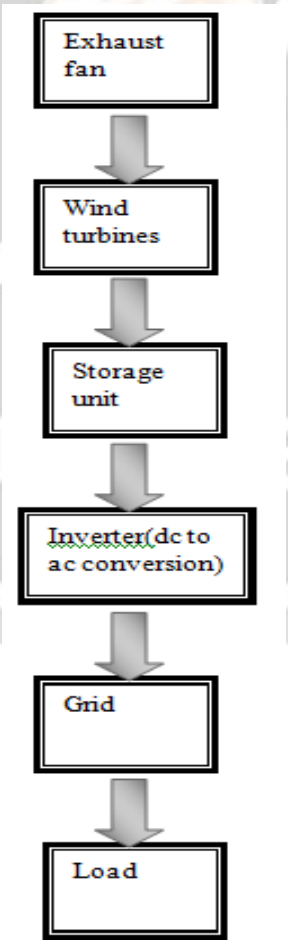

Fig 1. Flow chart of the process of using exhaust fan as a source of power

5. Calculation of power generated from wind turbine from wind speed of industrial exhaust fans:

Plant	Diameter(m)	Speed(rpm)	Gas density(kg/m³)	Motor (MW)	Temperature (degree Celsius)	Wind speed(m/s) approximately
Sinter plant 1	3	1000		6		16.4
Sinter plant 2	3.695	990	0.7	5.7	160	15.5
Sinter plant 3	3.5	1000	0.6359	8	170	16.2

Table 2 : specification of exhaust fans used in Rourkela Steel Plant

The wind speed suitable for viable wind turbine generating system is 5m/s or more. Air normally has a density of approximately 1.2 kg/m3(at sea level and at 15°C), as per the International Standard Atmosphere (ISA).But in the calculation, gas density of 0.7 kg/m3 is taken into account. The speed of wind coming out of exhaust fan is very high and when such high wind force strike the wind turbines, it can generate electricity either an equal amount or 1.5-2 times more than the power generated from atmospheric wind and this generation of power varies depending upon the speed of wind from the exhaust fan. This has been proved in the calculation.

6. Calculation for wind turbine

Calculating the energy available in the wind relies on knowledge of basic geometry and the physics behind kinetic energy. If the air mass is *m* and it moves with an average velocity *V*, the kinetic energy (KE) of the wind is:

$$KE = \frac{1}{2}mv^2$$ Joules (1)

The mass of airhitting our wind turbine (which sweeps a known area) each second is given by the following equation:

Mass hitting in wind turbine = *V* x A x p / second (2)

Where V is velocity in meter per second, are in meter2 .*p*is the density of air (which at sea level is 1.2256 kgm-3). And therefore, the power in the wind hitting a wind turbine with a certain swept area is given by simply inserting the mass per second calculation into the standard kinetic energy equation given above resulting in the following vital equation:

Power density= 0.5 x p x A x V

7. CONCLUSIONS

It is observed that the wind from the exhaust canwork as a very good source of electricity. The wind speed is sometimes more than the natural air speed and hence can generate even more electrical power than what is produced from natural air. As it is discussed earlier that wind from exhaust fan may get dispersed after some

time, there should be some kind of directors/connectors that will guide the wind from the exhaust fan directly to wind turbines without getting the average speed of the wind decreased as the velocity of the wind is most important factor in the system.

8. REFERENCES

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