Zero Carbon Emission-Future

Wind Energy In The Traction [WET]

Saravanan L
Department of Electrical & Electronics Engineering
Jayaram College of Engineering & Technology
Trichy, India,

Siva Sankari P
Department of Electrical & Electronics Engineering
Jayaram College of Engineering & Technology
Trichy, India,

***Abstract*— The requirements of fuel for transportations, electricity and other process are all plays major role in the development of nation. Hence not only developed countries but also developing and non-developed countries all are depends on fossil fuel to fulfill their requirements. Due to burning of fossil fuels, green house gases include carbon dioxide level in atmosphere goes to increases in huge rate. Hence global temperature rising, snow melting, ozone layer depletion etc are taken place. To control the rate of carbon emission using renewable energy sources for power generations, transportations etc is only way. This is achieving by building zero carbon emission city.**

Keywords*—Fuel requirements; fossil fuel; Nation development-Renewable energy sources; Zero carbon emission cities.

I. INTR0DUCTI0N

It is necessary to reduce $C0_2$ emissions against global warming, and the activities are expanding all over the world. As the world continues its reliance on fossil fuels to meet its growing energy demand, the associated environmental and climate change challenges must be adequately addressed. The world is undergoing the largest wave of urban growth in history and this process is mainly a domain of developing countries. The growth in human population is largest in the developing world, with Africa's and Asia's urban population projected to double between 2000 and 2030. With approximately 3.4 billion people, more than 50 percent of the world population living in cities and both human activities and the use of energy also concentrated in cities, the urban areas have become the root cause of orientating societies toward mass production, mass consumption and mass dumping of waste. In the world-wide urbanization process a particular significance has mega-cities more than 600 million people will be living in about 60 mega-cities worldwide. While megacities have captured much public attention, most of the new growth will occur in smaller towns and cities, which have fewer resources to respond to the magnitude of the change. Urban areas sprawl deeply into regions surrounding cities and towns. Increased income and wealth has enabled extensive new construction of infrastructures, power demand and transportation within functional urban regions.

II. CARB0N EMISSI0N

Carbon dioxide ($C0_2$) is the primary greenhouse gas emitted through human activities. Carbon dioxide is naturally present in the atmosphere as part of the Earth's carbon cycle. Human activities are altering the carbon cycle—both by adding more $C0_2$ to the atmosphere and by influencing the ability of natural sinks, like forests to remove $C0_2$ from the atmosphere.

While $C0_2$ emissions come from a variety of natural sources, human-related emissions are responsible for the increase that has occurred in the atmosphere since the industrial revolution. The main human activity that emits $C0_2$ is the combustion of fossil fuels like coal, natural gas and oil for energy and transportation, although certain industrial processes and land-use changes also emit $C0_2$. The main sources of $C0_2$ emissions are described below.

Electricity,
Transportation,
Industry.

Power-generating stations worldwide release 12 billion tones of $C0_2$ every year as they burn coal, oil or natural gas; home and commercial heating plants release another 11 billion tons. Carbon dioxide levels varied between about 180 and 300 parts per million during the 650,000 years prior to industrialization as recorded in air bubbles trapped in ice in Antarctica. But since industrialization began in the 18th century, the concentration of carbon dioxide in the atmosphere has increased from about 280 to 390ppm a rise of about 40%.

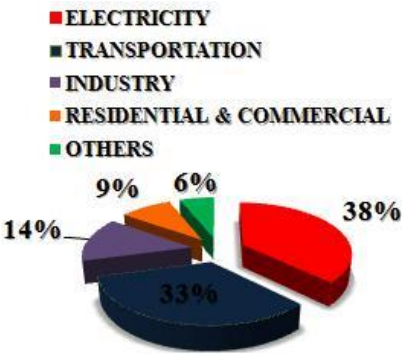

Fig-1: Various sources for $C0_2$ Emission in atmosphere

We also know that human activities, such as burning fossil fuels, producing cement and destroying rainforests, have disturbed the natural equilibrium of the carbon cycle by emitting an additional 7billion tones each year. From figure.1 it is clear. Major amount of carbon emission taken place during power generation and transportations. In earlier 18 centuries there are only few power generating stations and carbon emitting vehicles. But in middle of 19th and 20th centuries due to world war, urbanizations, nuclear weapons etc the rate of CO_2 emission increasing jet speed in atmosphere. Due to this we forced to meet serious climate changing, pollutions, global warming, ozone depletion etc.

III. CLIMATE CHANGES

Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time. Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions. Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have also been identified as significant causes of recent climate change, often referred to as "global warming".

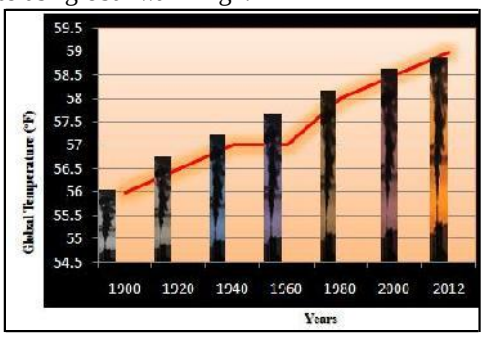

Fig-2: Global temperature changes in last 100 years.

A climate record extending deep into the Earth's past has been assembled, and continues to be built up, based on geological evidence from borehole temperature profiles, cores removed from deep accumulations of ice, floral and faunal records, glacial per glacial processes, stable-isotope and other analyses of sediment layers, and records of past sea levels.

IV. CARBON EMISSION LEVEL

Carbon dioxide is a greenhouse gas, and geological observations that we now have for the last 20 million years lend strong support to the idea that carbon dioxide is an important agent for driving climate change throughout Earth's history. By analyzing the chemistry of bubbles of ancient air trapped in Antarctic ice, we have been able to determine the composition of Earth's atmosphere going back as far as 800,000 years for good understanding of how carbon dioxide levels have varied in the atmosphere since that time. But there has been little agreement how to reconstruct carbon dioxide levels prior to 800,000 years ago. We are able, for the first time, to accurately reproduce the ice-core record for the last 800,000 years the record of atmospheric $C0_2$ based on measurements of carbon dioxide in gas bubbles in ice. When there is evidence for the growth of a large ice sheet on Antarctica or on Greenland or the growth of sea ice in the Arctic Ocean, the evidence for a dramatic change in carbon dioxide levels over the last 20 million years. A slightly shocking finding is that the only time in the last 20 million years that we find evidence for carbon dioxide levels similar to the modern level of 387 parts per million was 15 to 20 million years ago, when the planet was dramatically different. Levels of carbon dioxide have varied only between 180 and 300 parts per million over the last 800,000 years until recent decades. It has been known that modern-day levels of carbon dioxide are unprecedented over the last 800,000 years, but the finding that modern levels have not been reached in the last 15 million years is new.

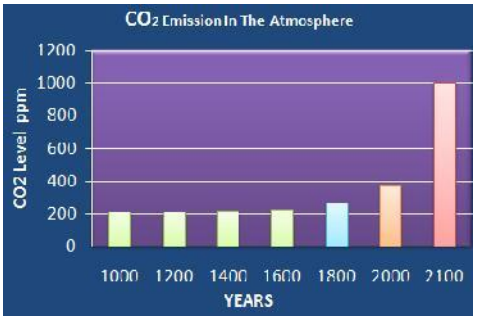

Fig-3: CO_2 level in atmosphere

Prior to the Industrial Revolution of the late 19th and early 20th centuries, the carbon dioxide level was about 280 parts per million. Globally, temperatures were 5 to 10 degrees Fahrenheit warmer. We can now have confidence in making statements about how carbon dioxide has varied throughout history. In the last 20 million years, key features of the climate record include the sudden appearance of ice on Antarctica about 14 million years ago and a rise in sea level of approximately 75 to 120 feet. But now shown that this dramatic rise in sea level is associated with an increase in carbon dioxide levels of about 100 parts per million. Today the Arctic Ocean is covered with frozen ice all year long, an ice cap that has been there for about 14 million years. Prior to that, there was no permanent sea ice cap in the Arctic. Some projections show carbon dioxide levels rising as high as 600 or even 900 parts per million in the next century if no action is taken to reduce carbon dioxide.

V. CARBON NEUTRALIZATION

Carbon neutrality, or having a net zero carbon footprint, means achieving net zero carbon emission by balancing a measured amount of carbon released with an equivalent amount sequestered or offset, or buying enough carbon credits to make up the difference. It is used in the context of carbon dioxide releasing processes associated with transportation, energy production, and industrial processes such as production of carbon neutral fuel.

COUNTRIES	CO_2 EMISSION PER YEAR
China	7,711mtonne
Usa	5,425mtonne
India	1,602mtonne
Russia	1,572mtonne
Japan	1,098mtonne

TABLE: I. Top 5 nations and its annual carbon emission ratings

The carbon neutrality concept may be extended to include other greenhouse gases (GHG) measured in terms of their carbon dioxide equivalence the impact a GHG has on the atmosphere expressed in the equivalent amount of $C0_2$. The other GHG gases are methane (CH_4), nitrous oxide (N_20), hydro fluorocarbon (HFC), per fluorocarbons (PFC), and sulphur hexafluoride (SF_6). Carbon emission is controlled by using renewable energy resources.

A. Zero Carbon Emission City

A zero-carbon city runs entirely on renewable energy; it has no carbon footprint and will not cause harm to the planet. Most cities throughout the world produce energy by burning coal, oil and gas, unintentionally emitting carbon. Almost every activity humans do involves burning one of these fossil fuels. To become a zero carbon city, an established modern city must collectively reduce emissions of greenhouse gases to zero and all practices that emit green house gases must cease. Zero-carbon city is a renewable-energy-economy city. This transition which includes decarbonising electricity and zero-emission transport is undertaken as a response to climate change. Zero-carbon cities maintain optimal living conditions while eliminating environmental impact. Instead of using established cities, many developers are starting from scratch in order to create a zero-carbon city. This way they can make sure every aspect of a city contributes to it being carbon free.

B. ZCEC is way to reduce carbon level in atmosphere

Zero carbon emission city is only way to reduce huge amount of $C0_2$ present in atmosphere. We need zero carbon dioxide emissions because of the planet carbon cycle. The various systems on Earth can remove carbon dioxide only at a very slow rate. At the same time, our fossil fuel economy is dumping $C0_2$ into the atmosphere at a very fast rate. Earth's slow systems involve converting carbon into rock which is an ocean since process and converting carbon into coal, natural gas and oil which is a land sink process. But both of these processes take thousands and millions of years. As a result, 20% of all carbon dioxide emissions remain in the atmosphere for 1,000 years. To give the planet the chance to remove some of the $C0_2$ that has been around for the past 900+ years, we need to move immediately to zero carbon emissions.

VI. WIND ENERGY IN TRACTI0N

In this WET [Wind Energy in the Traction] method the wind turbine has been placed on the sides of the traction. By this way we can eliminate the aero dynamical problems cause in traction. When train runs above the rail wind turbine starts to rotate due to kinetic energy of the wind.

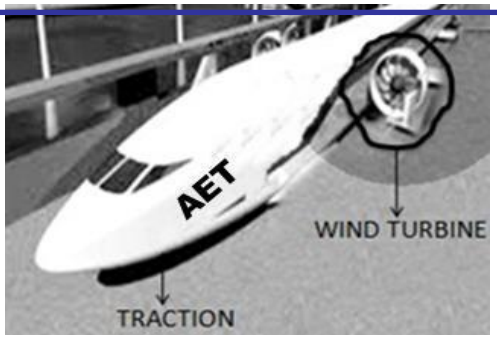

Fig -4: Wind Turbine positioned on sides of the traction

The speed of rotation of wind turbine depends on the speed of train. When train moves at high speed the wind flow also cross the turbine blades at high speed, hence it makes the large power output. But if very high speed flows of train danger to wind turbines because it damage the wind turbines. The wind turbines are covered by protection shield, the speed of wind also continuously measured by Propeller-type wind-speed sensor or Cup-type wind-speed sensor. The opposing force produced in this method is more than normal diesel engine train. It has been eliminated by made some modification in the traction design. By using a limited number of blocks for passengers, by using a light weight metals for construction. The amount of power production depends on wind turbine capacity, train speed and other some factors. Because of the method we also want to done some modification around the area near to train roots.

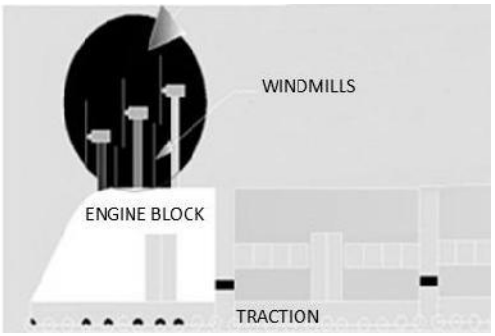

Fig -5: Wind Turbine positioned above roof of the traction

The size of system depends on how plan to use the power that is generated. Small wind turbines can range in size from 20 watts to 100 kilowatts (kw) with a 20-500 watt system being used to charge batteries 5 to 15 kw. Normally wind systems consist of a rotor or blades, a generator mounted on a frame, a tower, the necessary wiring and the balance of system components: controllers, inverters, and possibly batteries. Through the spinning Blades, the rotor trap the kinetic energy of the wind and convert it into rotary motion to drive the generator, which produces electricity. But in this method the tower has been not necessary. The diameter of the rotor and the maximum wind speed determine the amount of power that can be produced.

In above specified figure 2, the windmills are placed above the traction. This is another method of producing wind energy in traction. The small size windmills are placed above the traction. The electric train run over railroad tracks, the alternative form of wind energy produced by train is very

unique. If the wind is properly directed towards the wind turbine blades, optimum electricity may be generated.

The desired direction of wind is obtained by a means for channeling wind, in the direction of the wind turbine.

A. Aerodynamics

Aerodynamics is the science and study of the physical laws of the behavior of objects in an air flow and the forces that are produced by air flows. The shape of the aerodynamic profile is decisive for blade performance. Even minor alterations in the shape of the profile can greatly alter the power curve and noise level. Therefore a blade designer does not merely sit down and outline the shape when designing a new blade. The aerodynamic profile is formed with a rear side, is much more curved than the front side facing the wind.

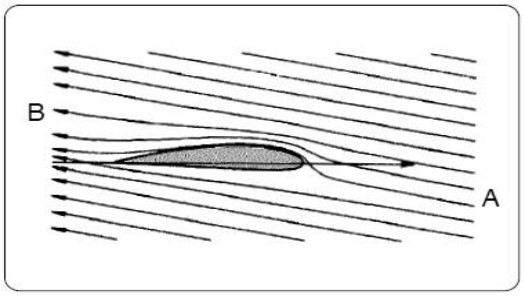

Fig -6: Wind flow across blade

Two portions of air molecules side by side in the air flow moving towards the profile at point A will separate and pass around the profile and will once again be side by side at point B after passing the profile's trailing edge. As the rear side is more curved than the front side on a wind turbine blade, this means that the air flowing over the rear side has to travel a longer distance from point A to B than the air flowing over the front side.

Therefore this air flow over the rear side must have a higher velocity if these two different portions of air shall be reunited at point B. Greater velocity produces a pressure drop on the rear side of the blade, and it is this pressure drop that produces the lift. The highest speed is obtained at the rounded front edge of the blade.

B. Power production

A train moving at 125mph would generate a wind speed equivalent to 60 feet/second. Wind blowing with such speed will let a normal wind power generator harness about 3500w of power. If a train is about 656 feet long, running at the pace of 187mph, and it moves along a 0.62 mile railway track in about 18 seconds, the power generated in this small period by the turbine laid on the tracks will be 2.6kW. The kinetic energy of the wind is the source of the driving force of a wind turbine. That kinetic energy can be depicted by the formula

$$E = f.\ mspec\ .v3$$

E = the kinetic energy
mspec =the specific mass (weight) of air
v = the velocity of the moving air (the wind)
f = a calculating factor without any physic meaning
The power in the wind is proportional to:
a) The area of windmill being swept by the wind
b) The cube of the wind speed
c) The air density - which varies with altitude.
The formula used for calculating the power in the wind is shown below:
Power = (density of air x swept area x velocity cubed)/2

$$P = ½.\ p\ (A)\ (V)^3$$

Where,
P is power in watts (W)
p is the air density in kilograms per cubic meter (kg/m3)
A is the swept rotor area in square meters (m2) & V is the wind speed in meters per second (m/s).

C. Problems to face

The major problem occurring in this system is some alternation has want to made in train design the train not able to move on the overflows or bridges, because mass of windmill producing opposing force toward the train. Similar the train subjected to meet some problems related to aerodynamically.

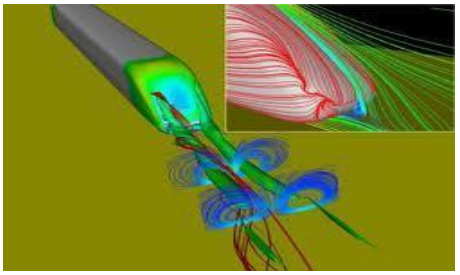

Fig -7: Traction facing aerodynamic problems

The wind turbine is position above the traction reduce the speed of train and it over come by placing it on the sides traction.

CONCLUSION

From the above topic the conclusion is we found world get polluted huge amount in last hundred years as compared with past few million years. By the process of implementing AET we are able to produce an alternate fuel, thus we are not only finding up a new way of energy but also the way to protect the natural world from fossil fuel (pollution). Thus using this new concept and project we can expect a greener and pollution free tomorrow. The whole project demands to call wind energy not only used from supplying power to consumer but also alternative fuel in transportation also. By moving toward zero carbon emission cities, we save our world for future generations. We kept pull stop for carbon emission by continuous research & development in the field of renewable energy resources. This is achieved by planting green seeds in the heart of future generations.

REFERENCE

1. Rebecca Lefton and Cathleen Kelly- Saving the arctic the urgent need to cut black carbon emission and slow climate change [August 2014].
2. Shyam Lal Verma, Ajay Bangar, Ankit Soni, Shravan