

Reduction of Pollution At India-Review of Wind Energy

Kumar P^{#1}, Jhon Rajan A^{#2}

*# Mechanical Engineering Department,
Sathyabama University
Chennai, India*

¹ rkpkumar@gmail.com

Abstract

For the last two decades many forum and individuals talks about pollution, global warming, North pole melting, Sea level increasing, Acid rain, Heat wave, cancer affecting the younger generation, agricultural productivity is dropped by 50% due to higher pollution. There are many study and research articles published. But how many of us know why this is happening, what are all the causes? How this is affecting us also affect the future generation? Most of us are ignorant in this aspect.

The pollution is created in the universe, mainly by the activity of man. The pollution which has been created in the universe is irreversible. Automobiles are one of key requirement for our day to day life. Without automobile we could not move from one location to another. All automobiles are creating pollution like bus, train, airplanes, ship etc. There are many research is going on to reduce the pollution from automobiles by hybrid engines, battery operated vehicles. Still this are all at the feasibility studies. Like this, power plants are producing huge amount of pollution. Since country like India, china is on the growth phase the power requirement in the country is growing much faster phase. Always still there is gap between the demand and supplies.

The demand is on the higher than the supplies. To meet the power requirement many coal based power plants are installed. All these coal based power plants are creating huge pollution. There is no global single solution available to make the pollution as zero. In this review paper I am going to discuss about air pollutions and its details especially at India, various alternate power productions sources which will give less pollution as alternative for coal power plant to reduce pollution at India. Also in this I am critically evaluating the immediate action at India and review of wind energy at India for reduction of pollution

I am not concluding my solution is going to make the pollution as zero at India. Instead of doing research for many years how to reduce pollution, let us start implementing the available solution that will reduce the pollution to

certain percentage. This research paper further can explore the problems of implementation of solution at India so that the pollution can be reduced to certain percentage.

Keyword: Pollution, Power, activity of man, global solution, Coal based power plant.

Introduction

For the past two decades many forum and individuals talks about pollution, global warming, North pole melting, Sea level increasing, Acid rain, Heat wave, cancer affecting the younger generation, agricultural productivity is dropped by 50% due to higher pollution. Everyone came to know about these news through newspaper or television news. But how many of us know why this is happening, what are all the causes? How this is affecting us also affect the future generation? Most of us are ignorant in this aspect. The pollution are mainly classified as Air pollution, Land pollution, Light pollution, Noise pollution, Thermal pollution, Visual pollution, Water pollution,

Air pollution:

This is one of the pollution created in the air. This is caused by coal based power production, Exhaust fumes from vehicles, radiation from nuclear spills or accident.

- a) *Land pollution:* This is degradation of land .Oil spill on the land, waste dumping on the earth. Dumping of hazardous chemicals in the land.
- b) *Light pollution:* This is created mainly by means of light. Especially all the street lights in the road will create pollution.
- c) *Noise pollution:* This is created by means of noise. The automobiles aircrafts other mechanization activities created noise pollution.
- d) *Thermal pollution:* This is mainly by increase in temperature. The water in the lake is increased heat due to nearby industry.
- e) *Visual pollution:* This is created mainly by advertisement color full lighting.
- f) *Water Pollution:* This is the pollution created in the water. This is caused by industry mixing their wastages. Dumping waster oils in the water. Sewage water mixed with Lake Etc.

These are all different pollutions in the world .All these pollutions are created by human activities only. The pollutions which is created in the world is irreversible. There is no global solution to make the pollution as zero. The solution to these problems is reducing the activities which are creating pollution and introduce alternate options to meet our requirement. This review paper gives insightful information about the pollution and some critical question and answer towards pollution. Also suggested the immediate action that will reduce pollution as alternate for power production at India. Though the solution will not make pollution as zero but definitely reduce the pollution, like these different alternate solutions for pollution will reduce the pollution.

Details About Pollution

Any pollution will cause different kind of risk for our health and living profile. It has become very difficult to summarize the information. Nevertheless, the decisions of public, government officials, and political personalities are destroying the nature and creating the pollution and causing problems.

It is estimated that the global burden of disease is associated with environment, pollution and ranges from 23 percent (WHO 1997) to 30 percent (Smith, Corvalan and Kiellstrom 1999) these infectious disease is related to sanitation, water and hygiene of food. Respiratory disease is related to air pollution from coal burning, burning and vector borne disease with environmental component such as malaria. The above three types of disease contributes to 6 percent of the global burden of disease. (WHO 2002).

The world health organization indicated the outdoor air pollution contributes as much as 0.6 to 1.4 percent of the disease in the developed countries.

A. Air pollution

Air pollution usually classified as suspended particulate matters (SPM) and pollution from gas. SPM is classified according to the suspended particles. The finer fraction, PM10 is the most hazardous. PM2.5 (particles diameter less than 10 microns and 2.5 microns respectively) The PM2.5 is created by condensation of gaseous pollution (SO₂, NO₂) these pollution is the outcome of vehicle exhaust, coal fly, cement, metal dust and mineral dust.

Some of the critical question and answer related to pollution.

1. Is the temperature of earth is really raising?

Yes. Though there is fluctuation of climate and temperature on every year, the average global temperature is increased over the past 50 years considerably. As per the scientist information the average U.S temperature could be increased by 3 degrees to 9 degrees higher by end of the century.

2. What is global warming?

The greenhouse gases like carbon dioxide have heated the earth and caused rise in the temperature which, in future the result in the melting of ice caps, rise in the sea level and sinking of coastal areas. This slow destruction of earth is called global warming.

3. Is the raising temperature causing any problems to the earth?

Yes. The climatic changes are already causing damages in many parts of the world. In 2002, Oregon, Colorado face the worst forest fire. In the same year drought created dust storms in Colorado and Montana. The impact of climatic changes and temperature rise also affected Europe and India. In 2003 more than 20000 and 1500 deaths occurred respectively in those countries.

4. Which country is the largest pollution creator for the global warming?

U.S is the largest producer of pollution. Though U.S has 4 percent of the world population created 25 percent pollution creator. The major pollution created from coal based power production and automobile pollution.

5. Is it possible to reduce the power plant pollution and still manage the electricity requirement?

The only solution to reduce the pollution from coal based power production is to produce the power through renewable energy sources such as wind and solar.

B. Pollution at India

India is a highly populated country, also wide area. The air at India is polluted highly. water and noise pollution also high at urban area. Though the emission of greenhouse gas is lower than other developed country, recently the urban area of India is developing higher pollution. The health is getting affected becoming higher due to pollution.

As per WHO, the 15 Indian cities feature in the list of 30 most polluted cities in the world. The major contributor for the pollution is burning of coal for power production, vehicle and industry pollution. The details of different metro pollution details are given in the Fig.1

Centre for science and environment has analyzed the official date of air quality of different cities. There prevalent pollutants in India are particulate matter (PM), nitrogen oxide.

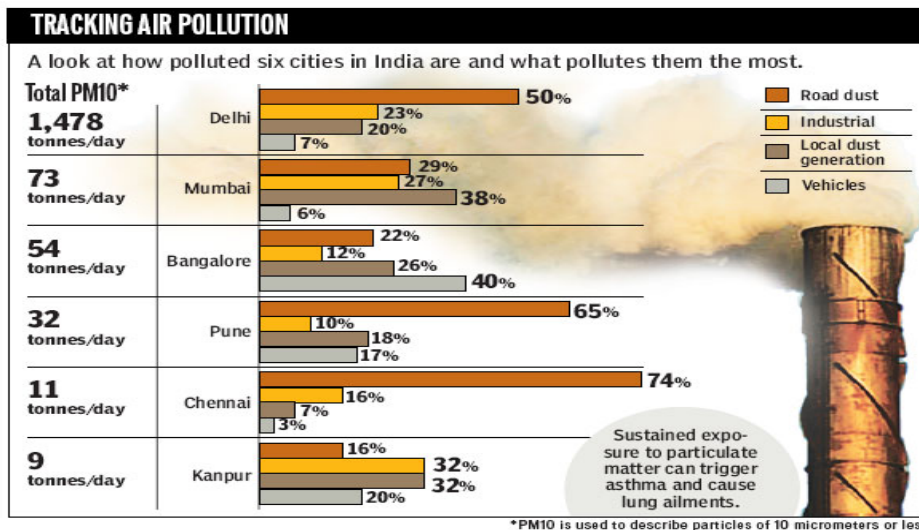


Figure 1: Tracking air pollution

There is a desperate action to be taken for reduction of pollution at India based on the above information. There is no global solution to make zero pollution, already for the past 20 years everyone talks about the pollution and no concrete action is implemented the situation become further .In this review paper I am going to discuss

about the alternate power production to reduce the use of coal power production. This is one of the highest pollution creators. The only alternate source for this is increasing the power production through renewable energy sources. In renewable both wind and solar having potential at India. Since the solar in nascent stage of implementation I have taken wind energy for my further study.

C. Alternate options for coal based power production:

I am making a point that there is no standard solution to make zero pollution, what I am proposing is how to minimize the pollution which has been created by the coal based power plants. Since the alternate source suggested by me in this paper is renewable energy, which will produce green energy. The main sources are given below.

1. Wind Energy
2. Solar Energy

Apart from this two sources there are bio mass hydro power are some of the green power production .Since the scope for hydro and bio mass is not a bigger MW is possible due to constraint of raw material and water. I have considered solar and wind as potential alternative source for coal based power production. India is a hot country there is no dearth of sunlight in many parts of this country. So ample scope of development of solar energy is possible. Wind energy is established way back in 1990 itself. Already more than 21000MW is installed capacity and generating power in various parts of this country. Solar energy is in the nascent stage just two years before the policy is established in some states. This will take another ten years to establish .so my focus is shifted to wind energy which is already established for the past more than 20 years and many established manufacturers are available at India.

Wind Energy At India

Wind Energy Installation at India stage wise.

The details of wind energy at different state of India is given in the table .1

Table 1: Installed Capacity Per State (MW)

State/ Month	March 2014	March 2013	March 2012	March 2011	March 2010	March 2009
Tamil Nadu	7275.68	7,162.18	6,987.60	5904.4	4907	4304.5
Karnataka	2323.85	2,135.15	1,933.50	1730	1473	1327.4
Maharashtra	4064.95	3,021.85	2,733.30	2310.8	2078	1938.9
Rajasthan	2783.45	2,684.65	2,070.70	1524.8	1088	738.4
Andhra Pradesh	783.35	447.65	245.50	200.2	236	122.5
Madhya Pradesh	423.40	386.00	376.40	275.5	229	212.8
Kerala	35.10	35.10	35.1	32.8	28	27.0
Gujarat	3447.28	3,174.58	2,966.30	2175.5	1864	1566.5

Others	4.3	4.30	3.2	0	4	1.1
Total	21141.36	19,051.46	17365	14158	11807	10242.3

So for the installed capacity is 21141 MW. But the potential of wind energy at India for grid interaction has been estimated at about **1,02,788MW** taking sites having wind power density greater than 200 W/sq. m at 80 m hub-height with 2% land availability in potential areas for setting up wind farms @ **9 MW/sq. km**.

Since wind energy is the potential to implement 100,000 MW so there should be plan be drawn by the government and separate division of government should be focused on implementation plan. Also the agency should have to interfere and sort out the issues for quicker implementation of this wind energy. By implementing 100000 MW over a period of 10 years there is a drastic reduction in pollution is possible. Whenever the production of renewable is less or zero coal based power plant can operate and fulfill the power requirement. Not necessarily to operate the coal based power plant throughout the year.

Based on the different research review paper the immediate implementation of this 100000 MW wind energy is going to give a dual benefit. One is reduction in pollution; another is power supply and demand gap reduction. I request the government should study further in depth keep this study as a based and draw a road map for implementation without further wasting time will helpful for the country.

Different Wind Turbine Models At India

Wind energy was established during 1990 itself at India, there are many different capacity machines and different technological models are evolved during the last 25 years and established in India.

Gear box high speed gear box with 1600 rpm is established with multi stage reduction. Technological improvement further developed low speed single stage gear box. Which will have less failiure.permanent management generators are established to improve the efficiency of the turbines. Gearless machines are established the rotors are directly connected to the generators; gearless design will have better efficiency,

Blade technology, two blade become three blade technology and preformed blades will give better performance; higher rotor diameter will deliver higher generation. Likewise there are many technological up gradation happened over a period of time.

Power and Electricity is the one of the key requirement for a growing economic country since India is in the growth face power requirement and infrastructure development are growing exponential with production of 1,006 terawatt hours (TWh) India is the fifth largest producer and consumer of electricity in the world after US, China, Japan and Russia.

The Indian power sector is one of the most diversified in the world. Sources for power generation range from commercial sources such as coal, lignite, natural gas, oil, hydro and nuclear power to other viable non-conventional sources such as wind, solar, and agriculture and domestic waste. The demand for electricity in the country has been growing at a rapid rate and is expected to grow further in the years to come. In order to meet the increasing requirement of electricity, massive addition to the installed generating capacity in the country is required.

As of April 2014, total thermal installed capacity stood at 168.4 gigawatt (GW), while hydro and renewable energy installed capacity totaled 40.5 GW and 31.7 GW, respectively with nuclear energy capacity of 4.8 GW.

Hereby given likely standard information of 53 models of 20 manufacturers capacity ranging from 250 kW to 2500kW.Refer Table .2. This report collected from the website of National Institute of Wind Energy

Table 2:

Sl No	Indian Manufacturers	Model	Capacity	Rotaor dia	Hub hieght	Tower type
1	M/s. Chiranjeevi Wind Energy Limited, Pollachi - Coimbatore	CWEL C30/250 kW	250 kW	29.8 m	50 m	Lattice
2	M/s. Gamesa Wind Turbines Private Limited, Sholinganallur, Chennai	G52-850 kW 50 Hz	850 kW	52 m	44/55/65 m	Tubular steel
		Gamesa G58-850 kW IEC IIA	850 kW	58 M	49/55/65 m	Tubular steel
		G58-850 kW 50 Hz IEC IIIB	850 kW	58 M	44/55/65/74 m	Tubular steel
		Gamesa G80-2.0MW IEC IA 50 Hz	2000KV	80 M	60/67/78 m	Tubular steel
		Gamesa G80-2.0MW IEC IIA 50 Hz	2000KV	80 m	60/67/78/100 m	Tubular steel
		Gamesa G87-2.0MW IEC IIA 50 Hz	2000KV	87 m	67/78/100 m	Tubular steel
		Gamesa G90-2.0MW IEC IIA 50 Hz	2000KV	90 m	67/78/100 m	Tubular steel
		Gamesa G90-2.0MW IEC IIIA 50 Hz	2000KV	90 m	67/78/100 m	Tubular steel
		G97-2MW IEC IIIA HH 78&90m 50 Hz	2000KV	97 m	78/90 m	Tubular steel
		G97GF-2.0MW IEC-III A HH78&90m 50Hz	2000KV	97 m	78/90 m	Tubular steel
3	M/s Garuda Vaayu Shakthi Limited, Nungambakkam, Chennai - 600 034	Garuda 700.54, EU54.1250.1-B	700Kv	54 m	73 m	Tubular steel

4	M/s. GE India Industrial Private Limited, Bangalore	GE 1.6-82.5,50 Hz	1600 kW	82.5 m	80 m	Tubular steel
		GE 1.6-87, 50Hz, LM 42.1P2	1600 kW	87 m	87 m	Tubular steel
		GE 1.7-103, GE 50.2, HH 79.7 m, 50Hz	1700 kW	103 m	79.7 m	Tubular steel
5	M/s. Global Wind Power Limited, Chennai	Norwin 750 kW	750 kW	47 m	65 m	Tubular steel
		Mingyang 1.5 MW HH 75m TC IIA	1500 kW	77.36 m	75 m	Tubular steel
		MingYang 1.5MW - 89 HH 80 m IEC S	1500 kW	89.3 m	80 m	Tubular steel
6	Towers,M/s. Inox Wind Limited Inox, Noida,Uttar Pradesh	WT2000DF	2000KV	93.3 m	80 m	Tubular steel
		DF/2000/100	2000KV	100 m	80/92 m	Tubular steel
7	M/s. Kenersys India Private Limited	K82	2000 kW	82 m	80/98 m	Tubular steel
		K100	2500 kW	100 m	85/100 m	Tubular steel
		K110	2400 kW	109 m	85/95 m	Tubular steel
8	M/s. Leitwind Shriram Manufacturing Limited, Gummidipoondi, Thiruvallur	Leitwind LTW77-1.5MW	1500 kW	76.6 m	61/65/80 m	steel and concrete
		Leitwind LTW80-1.5MW	1500 kW	80.3 m	65/80 m	Tubular steel
		Leitwind LTW80-1.8MW	1800 kW	80.3 m	65/80 m	Tubular steel
		Leitwind LTW86-1.5MW	1500 kW	86.4 m	80 m	Tubular steel
9	M/s. NuPower Technologies Limited, Nariman Point, Mumbai	W2E-93/2.05 MW	2050 kW	93.2 m	85/98.2 m	Tubular steel
		W2E-100/2.05 MW	2050 kW	100.13 m	98.2/117/141 m	98.2 m - Tubular Steel HH 117/141 m - Lattice Tower
10	M/s. Pioneer Wincon Private Limited, Saidapet, CHENNAI	Pioneer 250/29	250kW	29.6 m	50 m	Lattice

		Pioneer Wincon 750/49	750 kW	49 m	61.1 m	Lattice
11	M/s. PowerWind Limited, Haryana	PowerWind 56	900 kW	56 m	71 m	Tubular steel
12	M/s. Regen Powertech Private Limited, Egmore, Chennai	VENSYS 77	1500 kW	76.84 m	75/85 m	Tubular steel
		VENSYS 82	1500 kW	82.34 m	70/75/85/100 m	Tubular steel
		VENSYS 87	1500 kW	86.6 m	85/100 m	Tubular steel
13	M/s. RRB Energy Limited, Poonamallee CHENNAI	V 39-500 kW with 47m Rotor diameter	500 kW	47 m	50 m	Tubular steel & Lattice
		Pawan Shakthi-600kW	600kW	47 m	50/65 m	For HH 50 m - Lattice & For HH 65 m-Tubular Steel
		Pawanshakthi PS 1800 (HH 80m / 100m)	1800 kW	82.4 m	80/100 m	Tubular steel
14	M/s. Shriram EPC Limited Egmore, Chennai - 600008	SEPC 250T	250 kW	28.5 m	41.5 m	Lattice
		SEPC 250T	250 kW	28.5 m	51.5 m	Lattice
15	M/s. Siva Windturbine India Private Limited, Erode	SIVA 250/50	250 kW	30 m	50 m	Lattice
16	M/s. Southern Wind Farms Limited, Chennai	GWL 225	225 kW	29.8 m	45 m	Tubular steel
17	M/s. Suzlon Energy Limited Tree Lounge,	Suzlon S66-1.25 MW/ MARK II	1250 kW	66 m	65/74 m	Tubular steel
		Suzlon S82V3-1500kW	1500 kW	82 m	78 m	Tubular steel
		Suzlon S88 V3A-2100kW	2100 kW	88 m	80 m	Tubular steel
		Suzlon S95 DFIG 2.1 MW	2100 kW	95 m	80/90/100 m	Tubular steel
		Suzlon S97 DFIG 2.1 MW, 50 Hz	2100 kW	97 m	80/90/100 m	Tubular steel
18	M/s. Vestas Wind Technology India Private Limited, Shollinganallur, Chennai	Vestas V100-1.8 MW 50 Hz VCS Mk 7	1800 kW	100 m	80/95/120 m	Tubular steel
		Vestas V100-	1800 kW	100 m	95 m	Tubular steel

		1.8MW 50Hz VCS Mk7.1				
		Vestas V100-2.0MW 50Hz VCS Mk7.1	2000 kW	100 m	80/95 m	Tubular steel
		Vestas V100-2.0MW 50Hz VCS Mk7	2000 kW	100 m	120/80/95 m	Tubular steel
19	M/s. Wind World (India) Limited, Mumbai	WW-53 (erstwhile E 53 in India)	800 kW	52.9 m	75 m	Concrete (Steel Upper Section)
20	M/s. Winwind Power Energy Private Limited, Chennai	WinWinD 1 MW	1000 kW	60 m	70 m	Tubular steel

PLF Details of Wind and Solar:

The plant load factor is nothing but the capacity utilisation factor, if you take wind farm this varies from 22% to 40% depends on wind site and selection of machines. for solar the PLF varies from 16% to 24%, so the wind will generate more power than solar plant. As on today to promote solar the tariff is higher for solar in some states but in long run the tariff will be rationalised. so wind generation will be always better

Wind Power Plant - 22 to 40%

Solar Power Plant - 16 to 24%

Solar Capacity In India Installed So Far And Estimation This Year

The details of solar installation at India is given below.

Table 3:

Sl No	State	MW	%
1	Andhra Pradesh	41.75	3.18
2	Chhattisgarh	4	0.3
3	Delhi	2.5	0.19
4	Gujarat	654.8	49.9
5	Haryana	7.8	0.59
6	Jharkhand	4	0.3
7	Karnataka	9	0.69
8	Madhya Pradesh	132	9.15
9	Maharashtra	20	1.38
10	Odisha	13	0.99
11	Punjab	9	0.69
12	Rajasthan	510.25	38.89

13	Tamil Nadu	15	1.14
14	Uttar Pradesh	12	0.91
15	Uttarakhand	5	0.38
16	West Bengal	2	0.15
17	Total	1442.1	100

Disadvantages of Solar Over Wind Energy Productivity

- Installation costs are currently high,
- Seasonal and locational conditions may yield different effects.
- Solar energy can only be harnessed when it is daytime and sunny.
- Solar collectors, panels and cells are relatively expensive to manufacture although prices are falling rapidly.
- Solar power stations can be built but they do not match the power output of similar sized conventional power stations. They are also very expensive..
- Large areas of land are required to capture the suns energy. Collectors are usually arranged together especially when electricity is to be produced and used in the same location.
- Solar power is used to charge batteries so that solar powered devices can be used at night. However, the batteries are large and heavy and need storage space. They also need replacing from time to time
- So wind energy is grown interms of technologies over a period of time and generate more generation than solar.solar still in the early stage so to get the immediate benefits wind energy is the solution as alternate power production for coal to certain extend.

Conclusion

After a thorough study of pollution, it is evident that the pollution is the main reason for health issues; pollution is the main cause for the increase in temperature is pollution causes reduction in agricultural productivity. Pollution causes less rain; our day to day life is getting affected due to pollution. Out of the various drivers for the pollution like automobile, coal based power production and industry emission, I have considered in my study alternate source for coal based power production. In this especially I have restricted my study at India due to time constrain. Renewable is the only alternate for coal based power production. Even though solar is having potential at India, due to the fact that solar energy is in the early stage, I have converge the solution to wind energy is the only immediate solution .there is a potential of 100000 MW is possible The government should form a separate division for implementation of this wind power over a period of ten years will reduce the pollution and also meet the power demand.

Acknowledgment

This research paper would not have been possible without the support from many people. The author expresses his gratitude to his guide, Dr.A.JohnRajan, who has been abundantly helpful and provided valuable assistance and guidance. Special thanks to Vijay and Rajesh for their assistance and guidance. The author wishes to express his love and gratitude to his beloved family members, especially his mother, for their understanding and endless love during the preparation of this paper. This research work is dedicated to the author's beloved mother.

References

- [1] Suman,Gurdeep Singh and Asim Kumar Pal, *Laser Ass Source apportionment of respirable particulate matter using principal component analysis – a case study*, India.
- [2] Surrender Kumar, Paramjit, *Valuation of Health Impacts of Air Pollution*, India.
- [3] Dr.S.Waseem,A.Asshrat,SafiaKhanam and Ayoza Ahmad, “*A Effects of Indoor air pollution on human health: A micro-level study of Aigargh city*,India.
- [4] Jenifer Burney, and V.Ramanathan, “*Recent climate and air pollution impacts on Indian Agricultural*.”
- [5] Dr.MukeshGarg., “*Water Pollution in India:Causes and Remedies*”.
- [6] BiswanathBishoi,AmitPrakash,V.K.Jain ,” *A comparative study of Air quality Index based on factor analysis and US_EPA methods for an urban Environment* (2007) .
- [7] Manjunath .G., GunupagiManjunath.,” *Green Marketing and its implementation in Indian Business organization*.
- [8] P.K.Baby ,” *Economic Impacts of Air pollution on Human Health and property values,A study of cochin Industrial Agglomeration* “.
- [9] Anand Kumar,Dr.AshishGarg,Prof.UppenderPandel , “*A study of Ambient Air quality status in Jaipur using Air quality Index* “.
- [10] MeenakumariYadhav,Dr.SurrenderKumar Yadhav ,” *Coal Based power plant Emitting Pollution to cause environmental health problems*”.
- [11] G.Praveen Kumar and S.Palanivel Raja,” *Dispersion modeling of so2 emission from coal fired Thermal Power Plant in Dedri*.
- [12] A.Chandra and H.Chandra,” *Impact of Indian and imported coal on Indian Thermal power plant*”.