ISSN (ONLINE): 2456-5717
International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Vol.3, Issue.11, November 2017

This work by IJARBEST is licensed under Creative Commons Attribution 4.0 International License. Available at https://www.ijarbest.com

Environmental protection scheme of thermal power plant in India

[1]Bablu Manna, [2]S Chattopadhyay
Research Scholar [1, 2]
Chandradeep Solar Research Institute, Kolkata- 700032, India[1, 2]

Abstract – **India is ranked fifth globally in installed power capacity with nearly 147.965 GW. India's fast economic growth comes with a growing demand for energy and it is also predicted that as it propels the path of socio-economic reforms, it will face an acute shortage of power until & unless total generation capacity is increase proportionately. The electrical & power sector in India has developed significantly over the 70 years of Independence. As the socio-economic pattern of India kept continuously evolving & development reached far off to the remotest village of it, in spite of achieving greater strides in electricity sector, access to power & reliability of power remains the major issues. Due to its geographical location, India receives a high intensity of solar radiation. Currently, India is pushing forward a massive plan of generating electricity by using solar radiation. Against this backdrop, the paper attempts to discuss the existing legal & policy framework for solar power generation. The days will not be far off when power plant shifts from large, remote centralized stations to rooftops, basements, backyard with no fuel cost characterized by quality & reliability. To tap the infinite energy from sun & transform as well as to transmit it to each household, the Indian Govt. has accelerated promotion of the use of universally available solar energy through its various policies & incentives. The benefit with solar energy is that it neither causes air pollution, nor requires any environmental impact assessment (EIA) as needed in case of hydro power, neither does it cause noise pollution. So the energy promised by solar power plants generally reflects a win win situation for the country at large.**

Keywords – **Socio economic reforms, reliability of power, solar power generation, environmental impact assessment.**

I. INTRODUCTION

This research paper discusses the impacts of the coal combustion in thermal power plant. Emphasizes the problems associated with fly ash, collection using electrostatic precipitator (ESP). A thermal power station in which the prime mover is steam driven, water is heated, turns in to steam & spins the steam turbine which drives an electrical generator. After it passes through the turbine the steam condensed in a condenser & recycled to where it was heated; this is known as Rankine Cycle, the greater variation in the designer of thermal power plant station is due to the different fossil fuel resources generally used to heat the water. Some prefer to use the term energy

centre because such facilities convert form of heat energy in to electrical energy. Certain thermal power plants are designed to produce heat energy to generating electrical power.
Generally fossil fuel based thermal power plant produce a large part of from Co2 emission to the atmosphere, and efforts to reduce this are varied & widespread. The energy efficiency of a conventional thermal power plant station, considered salable energy produced as a present of the heating value of the fuel consume, is typically 33% to 48%.

Objective

The object of this paper is how to minimize the hazardous chemical reaction and emission of coal fired thermal power plant and by doing so how to clean the atmosphere and save the community at large and how the reduce the harmful effect of the thermal power station and save the nature by promoting the solar thermal power plant in place of coal fired thermal power plant.

Let us now look at the scenario of the emissions from coal based thermal power plants in India at this present juncture a glance:

Year	**Region**				
	Northern	**Western**	**Southern**	**Eastern**	**All India**
2001-02	89704.89	109796.74	71134.90	**52838.33**	323474.85
2002-03	93165.88	116728.55	78587.62	56000.77	344482.83
2003-04	102371.06	116817.91	77032.98	66264.89	362486.84
2004-05	99915.90	122452.03	78511.49	73157.09	374036.51
2005-06	104038.33	119666.63	76152.41	78400.36	378257.73
2006-07	118752.49	127870.66	82755.09	87848.35	417226.59
2007-08	120947.31	153831.83	89031.37	91272.11	455082.62
2008-09	124185.42	169576.14	93626.06	94165.38	481553.00
2009-10	127763.21	173415.44	99547.80	97929.32	498655.78

Region wise CO2 emissions from thermal power plants in India (Gg) during 2001-02 to 2009-10

Year	**Region**				
	Northern	**Western**	**Southern**	**Eastern**	**All India**
2001-02	0.93	0.93	0.89	0.95	0.92
2002-03	0.94	0.91	0.88	0.96	0.92
2003-04	1.00	0.94	0.82	1.00	0.94
2004-05	0.95	0.96	0.82	1.00	0.93
2005-06	0.94	0.95	0.82	0.92	0.91
2006-07	0.98	0.97	0.84	0.95	0.94
2007-08	0.96	1.00	0.88	0.96	0.95
2008-09	0.94	1.00	0.87	0.94	0.95
2009-10	0.93	0.98	0.87	0.94	0.94

Region wise CO2 emissions per unit of electricity generation (kg/kWh) during 2001-02 to 009-10

Year	Region				
	Northern	Western	Southern	Eastern	All India
2001-02	558.85	873.55	745.74	341.79	2513.93
2002-03	579.01	915.25	774.32	361.94	2630.52
2003-04	643.27	918.21	782.97	428.09	2772.54
2004-05	623.81	952.22	803.65	473.56	2853.24
2005-06	650.25	916.95	800.00	507.66	2874.86
2006-07	748.97	1022.69	834.56	570.21	3176.43
2007-08	758.25	1243.12	906.36	593.67	3501.41
2008-09	780.51	1336.77	937.95	608.76	3663.99
2009-10	822.54	1374.66	1012.53	630.71	3840.44

Region wise SO2 emissions (Gg) during 2001-02 to 2009-10

Year	Region				
	Northern	Western	Southern	Eastern	All India
2001-02	558.85	873.55	745.74	341.79	2513.93
2002-03	579.01	915.25	774.32	361.94	2630.52
2003-04	643.27	918.21	782.97	428.09	2772.54
2004-05	623.81	952.22	803.65	473.56	2853.24
2005-06	650.25	916.95	800.00	507.66	2874.86
2006-07	748.97	1022.69	834.56	570.21	3176.43
2007-08	758.25	1243.12	906.36	593.67	3501.41
2008-09	780.51	1336.77	937.95	608.76	3663.99
2009-10	822.54	1374.66	1012.53	630.71	3840.44

Region wise NO emissions (Gg) during 2001-02 to 2009-10

Year	Region				
	Northern	Western	Southern	Eastern	All India
2001-02	447.05	510.06	332.86	212.10	1502.07
2002-03	464.52	543.33	369.05	224.35	1601.25
2003-04	511.53	541.42	361.46	262.01	1676.42
2004-05	499.13	567.06	366.90	284.46	1717.56
2005-06	523.38	564.38	349.68	306.49	1743.78
2006-07	594.73	628.77	383.24	341.29	1948.03
2007-08	603.75	720.07	413.11	352.09	2089.02
2008-09	620.69	772.89	423.17	374.16	2190.91
2009-10	639.75	820.95	464.85	389.14	2314.95

ISSN (ONLINE): 2456-5717
International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Vol.3, Issue.11, November 2017

Region wise NO emissions per unit of electricity generation (g/kWh) during 2001-02 to 2009-10

Year	**Region**				
	Northern	**Western**	**Southern**	**Eastern**	**All India**
2001-02	4.62	4.32	4.19	3.80	4.29
2002-03	4.68	4.25	4.15	3.83	4.28
2003-04	5.0	4.36	3.85	3.97	4.34
2004-05	4.74	4.43	3.85	3.88	4.27
2005-06	4.73	4.43	3.80	3.60	4.22
2006-07	4.92	4.78	3.88	3.68	4.39
2007-08	4.78	4.69	4.07	3.69	4.38
2008-09	4.69	4.56	3.94	3.75	4.34
2009-10	4.67	4.64	4.07	3.72	4.34

II. METHODOLOGY & LITERATURE SURVEY

This research paper is organized according to the objectives stated above. The methodology adopted and literature survey comprises of the following initiatives:

a) Analysis of the present status of Thermal Power Plants in India.
b) Trends in the adaptation of safety measures in Thermal Power Plants.
c) Analysis of integration of safety measures in Thermal Power Plants.
d) Assessment of Green House Gas (GHG) generation from Thermal Power Plants.
e) Analysis of advantages & challenges related to the concept

III. CASE STUDY - I

Title:

NTPCL-SAIL Captive power plant field visit

Date:

14.7.2016

Location:

Asansol Durgapur development authority, Plant gate, Taluk - Durgapur MC, District – Bardhaman, State - West Bengal, Pin – 713204.

Purpose:

Data collection, sample collection of fly ash inside the plant and also find out the quality of air inside the plant area premises specially coal handling area and ash handling area.

Machineries found at spot:

Hoppers, Buffer hoppers, Crusher, Air compressor, vacuum pumps, high capacity slurry dispensed pumps, conveyor belt, bunker, boiler, ESP (electrostatic precipitator), ID fan, Hammer raping mechanism, Economizer.

Description:

Durgapur captive power plan is situated in Bardwan district of West Bengal located at Durgapur, is a joint venture company of NTPC-SAIL Power Company private limited, total capacity is 120 mw supplying electricity to DSP Durgapur steel plant who is also the mother plant of NTPC-SAIL captive power plant. The field visit was indeed a fruitful one.

It was always a pleasure to have a experience person if you are going for a field visit for the first time accompanied by such like Assistant General Manager (Electrical) Mr. Jaydeb Biswas of Durgapur Steel Plant; along with Mr. Farooqui AGM (EMD) they always guided me whenever require any suggestion. All the supporting stuffs like Mr. Ashis mukherjee AGM (Coal department) instruct Mr. arabinda nandy (Manager fuel management) to go alongside with us and guide the entire coal handling area, including Coal yard, transport Coal from yard to crusher he explain each and every thing how they are minimizing the dust goes to air and with that how they are maintaining environment also. First he showed how coal is coming from coal bed to yard by tippler, all the way dust keep on hovering in the air and polluting the surrounding up to underground hopper from there coal transport to the crusher with the help of conveyor belting system. Second he showed there is no such arrangement of water sprinkler to the coal yard as rainy season takes place that time but there is no place to sprinkle the water as no such arrangement is found at the yard and no dust sucker arrangement was found at the coal yard. Third he showed some plastic sheet is being used to protect the coal dust at the coal stock yard so coal dust not to fly is the air when there is wind but that is also in limited places. Fourth the lowest grade of coal is being used at the plant E, F, G grade this can be of high ash content ones. Fifth in crushing position also no such arrangement of dust sucker is being found open crushing is carried on in the plant. This is the sorry condition of the entire coal handling plant, no such move is being found to mitigate the coal dust.

Now comes to ash handling plant area, after burning the coal in the broiler all the ash comes in the ESP 1st chamber where 70% off ash is collecting, then 2nd chamber where 20-25% of ash is collecting and then 3rd chamber where 5% ash is collected, as far as ESP is concern it is having 99.99% dust sucking capacity available after all this process if any fly ash still remain in the chamber goes out with the help of ID fan goes out from Chimney in to the air. All fly ash store in the hopper then with the help of water pump out to the slurry pond. From slurry pond to wet fly ash goes to fly ash stock yard where land is being degraded as it chemically contaminates with fly ash and water mixes with fly ash destroy the land fertility also damage the water body at large. Then with the help of lorry ash goes out to different location and water after treatment discharge in the river. As this plant is old one instead of ESP technology implemented in the plant still a

certain amount of fly ash can be seen everywhere inside the plant with the naked eyes. Fly ash goes out from chimney can fly up to 2.5 kms and also spread extensive in nature.

Conclusion:

Although the NTPCL-SAIL captive power plant is doing their bit to minimize the environmental degradation job but still a lots of work to be done at every end to mitigate the damage from the coal handling as well as fly ash handling areas. Specially plant operation areas including coal handling areas, coal stacking areas, coal transport areas, crushing areas, boiler surrounding areas and disposing areas of fly ash after proper treatment of water for further usage. Water should be purifying first then discharge for further use. It should not mix direct in to river.

IV. CASE STUDY - II

Title:

Kakatiya Thermal Power plant visit.

Date:

29.7.2016.

Location:

Bhupalpally Warangal, telangana.

Purpose:

Data collection, sample collection of fly ash inside the plant and also find out the quality of air inside the plant area premises specially coal handling area and ash handling area.

Machineries found at spot:

Hoppers, Buffer hoppers, Crusher, Air compressor, vacuum pumps, high capacity slurry dispensed pumps, conveyor belt, bunker, boiler, ESP (electrostatic precipitator), ID fan, Hammer raping mechanism, Economizer, Airlock vessel, Tube settler.

Description:

Kakatiya thermal power project is situated at Bhupalpalli district of Warangal in Telangana State is a fully State Govt own enterprise total capacity is 660 mw.

First of all to summarize the visit at KTPP at bhupalpalli was a memorable one, it was indeed a very good experience in all respect especially the new technologies are working well to cope with the environmental imbalance inside the plant area and outside the surrounding also and all the members and stuffs were very much cooperative and helpful all the way, especially Mr. A. siva kumar Head of the Plant of TSGENCO.

Field Exposure:

Mr. P. srinivas Mechanical engineer (ADE) Assistant division engineer explains the brief about coal handling process, all though a good system is being following everywhere in the coal handling area but in spite of that a small amount of coal dust goes in to the air while coal is being transported from coal bed to coal yard the distance is 10Kms and the use wagon tippler and lorry to bring the coal from bed to the coal yard and from coal yard to bunker. While dumping coal from the lorry and wagon Tripler some coal dust goes into the air. The water used for sprinkling on the coal is spread everywhere and contaminate the ground water and resulting chemically effluent to the entire area. Proper precaution is required while handling the coal manually.

Daily coal consumption is for 500 mw is 7500-8000 T/day and mostly are E, F, and G grade with 40% ash content, out of 40%, 70% are fly ash and 30% are bottom ash. Daily about 2000-2500 T/day fly ash generated and daily 50-60 trucks are loaded fully with ash loaded go to dump yard. From plant to dump yard fly ash being covered with plastic sheet, but despite covered with sheet some fly ash fly from the trucks and damage the air quality of the surroundings.

Main emissions from coal fired and lignite based thermal power plants are CO2, NOx, SOx, and air-borne inorganic particles such as fly ash, carbonaceous material (soot), suspended particulate matter (SPM), and other trace gas species.

Mr. sampadh kumar Electrical Engineer C&I (control & instrumentation) explains the fly ash comes from hopper mixing with water and goes to slurry pond with high capacity slurry dispensed pumping facility it reached to the pond where the water is being treated and reused after filtration the water is reuse and back to plant again, but in this process the quality of water is always harmful because the water is not fresh and any contact of water with land is highly chemically contaminated with acidic effect it also harmful for human body also. Pond water quality especially aqua culture system of the water damages the fresh water resource.

- 1st Stage: To deal with the environmental degradation specially slurry pond water is concern it is being monitored time and again here also a new technology is implemented called tube settler at every stage to save the slurry pond from being polluted TSGENCO is using thick plastic sheet which will last 400 years to restrict the pond water to contaminate and save the water to degrade and save the nature. Water is being reusing for continuous use of KTPP plant. After clearing the water in the pond then using the water for plant use because some ash is still remain in the water.
- 2nd Stage: Again same process is being followed like 1st stage water is collected from the 1st chamber through tube settler for reuse from the pond for further process.
- 3rd Stage: Again same process here also followed like 2nd stage water is being collected from the 2nd chamber through tube settler for reuse from the pond for further process.
- 4th Stage: After 3rd stage now water is being 90% free for reuse and 10% ash is there, that can be usable after using chemical dosing for plant for reuse the water system.

Fly ash fly from the chimney is also spread 2.5 kms is another cause of concern for nearby residence and for agricultural field also.

Conclusion:

Although the TSGENCO is doing a very commendable job but still a lots of work to be done at every end to mitigate the damage from the coal handling as well as fly ash handling areas. Specially plant operation areas including coal handling areas, coal stacking areas, coal transport areas, crushing areas, boiler surrounding areas.

VI. RESULTS & DISCUSSIONS

To examine the reasons behind the water quality degradation in and around the coal based thermal power plant is that the water tends to contaminated with coal and oil right from the coal washery to discharge the water at river bed. The fly ash is mixed with water to form slurry and pumped out to ash pond via liquid water waste treatment plant, all other liquid waste including oils and grease are separated in the treatment plant (using lime, bleaching power liquid ammonia) for reuse. Sometimes it gets discharge straightway in the river bed after the proper treatment although some portion of the fly ash still remain in the treated water due to not taking proper care by the concern authorities mainly in old age power plant they do not have the proper equipment or material and latest technology to minimize the toxic gases chemical hazard chemical compound like CO, NOx VOCs, Pb, alkalis, acidification of river water gets happen, thermal discharge, spillage arising out of vehicular movement during transport of coal and oil, ergonomics incompatibility at workplace and other morbidities might also be present due to exposure to fly ash including metallic constituents like lead, arsenic and mercury. The radio activity content of the coal and fly ash used in different coal fired thermal power plants and the reported levels of radon activity around the coal fired thermal power plants were within the permissible limits. All the process mentioned carry out deteriorate the environment, health hazards to the workers and local people at larg

Emissions from Steam Cycle Thermal Power Plants

Source	Input	Output
Air Pollution Emissions		
Steam cycle/natural gas	Natural gas, auxiliary fuel (fuel oil, distillate, LPG), dematerialized water, cooling water, lubricants, degreasers, water treatment chemicals	NOx, CO, SOx (very low), PM10, Organic Compounds (OCs), and trace metals & compounds
Steam cycle/oil	Fuel oil, auxiliary fuel (natural gas, distillate, LPG), dematerialized water, lubricants, degreasers	NOx, SOx, CO, particulates (including PM10), trace metals & compounds, OCs
Steam cycle/Pulverized coal	Coal, dematerialized water, auxiliary fuel (fuel oil, natural gas, briquettes, lubricants, degreaser, water treatment chemicals)	NOx, CO, SOx, particulates (including PM10), fugitive dust, trace metals & compounds, OCs.
Water Pollution Emissions		
Steam cycle/pulverized coal, natural gas, oil	Coal, dematerialized water, auxiliary fuel (fuel oil, natural gas, briquettes), lubricants, degreasers, water treatment chemicals/effluent, detergents	Chlorine, acids, alkalis, suspended solids, nitrogen, phosphorus, trace metals & compounds, oil spills, degreasers, detergents
Land Pollution Emissions		
Steam cycle/pulverized coal, natural gas, oil	Coal, dematerialized water, auxiliary fuel (fuel oil, natural gas, briquettes), lubricants, degreasers, water treatment chemicals	ash, oil/chemical spills, metals & compounds, wastes

Awareness is required at mass level from the Govt. & different co-operative society for better health, safety of local people and workers inside the coal fired thermal power plant, all the power plant authorities must have well defined sector specific occupational health, safety and environmental management framework reference document in place. If we replace coal thermal power plant in place of solar thermal power plant it will be a big leap towards environment friendly atmosphere and zero emission of GHG. A further benefit of renewable energy is an increase in long-term energy security through the diversification of supply, reduction of import dependency, and mitigation of fuel price volatility, It will be important to invest in energy efficiency, particularly addressing transmission and distribution losses, as well as in new generation capacity. A transparent and consultative institutional and governance framework is needed to ensure that energy developments do not threaten fragile ecosystems or the rights and livelihoods of local people. Solar power plant brings benefits like reduction of CO_2 and creating employment generation also.

V. CONCLUSION

By 2017, growth in the production of easily accessible oil and gas will not match the projected rate of demand growth. While abundant coal exists in many parts of the world, transportation difficulties and environmental degradation ultimately pose limits to its growth. Even if it were possible for coal based thermal power plants to maintain their current shares of the energy mix and respond to increased demand, CO_2 emissions would then be on a pathway that could severely threaten human well-being. Even with the moderation, modernization and latest technology use and effective CO_2 management, the path forward is still highly challenging.

People are beginning to realize that conventional form of energy use can be both nourish and threaten what they value most their health, their community & environment for the future of their children and the planet itself.

Conservation of energy is extremely important, but we are still talking about just reducing our use of fossil fuels, not eliminating it. Lying before us is 2 major pathways for developing non conventional fossil fuel for alternatives to promote solar thermal power plant application in place of coal fired thermal power plant.

All these considerations suggests that in creating sustainable development in energy future for humanity during the coming decades, it is now need of the hour to develop & promote the solar thermal power plants on a much bigger scale for the sake of our mother earth.

REFERENCES

[1] Environmental impact of coal industry and thermal power plants in India. U.C.MISHRA. (Health, Safety and Environment Group, Bhabha Atomic Research Centre, Mumbai, 400 085, India). Journal of Environmental Radioactivity 72 (2004) 35–40.

[2] Power Generation from Coal Measuring and Reporting Efficiency Performance and CO2 Emissions, coal industry advisory board, International energy agency. © OECD/IEA, 2010 International Energy Agency.

[3] Mitigation of Emission in Thermal Power Plant Using Conventional and Non-Conventional Fuel, H.Chandra1, S. Paliwal2 and A. Tripathi3, International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726 www.ijesi.org Volume 2 Issue 4 ǁ April. 2013 ǁ PP.01-06.

[4] Estimation of Green House Gas Emission from Indian Coal Based Thermal Power Plant, Satyashree Ghodke1, Rohit Kumar2, Navneet Singh3,Himani khandelwal4, IOSR Journal of Engineering Apr. 2012, Vol. 2(4) pp: 591-597.

[5] High Efficiency Electric Power Generation; The Environmental Role, János Beér Massachusetts Institute of Technology Cambridge, MA 02139 USA,

[6] Estimates of Emissions from Coal Fired Thermal Power Plants in India, Department of Environmental and Occupational Health, University of South Florida, Tampa, Florida, USA, Moti L. Mittal, Chhemendra Sharma and Richa Singh, Radio and Atmospheric Sciences Division, National Physical Laboratory, Council of Scientific and Industrial Research, Dr K.S. Krishnan Road, New Delhi – 110012, India.

[7] Report on replacement of old and inefficiency sub critical units by super critical units/retirement/renovation, Prepared by TPP&D Division, CEA,September 2015.

[8] Residential consumption of electricity in India documentation of data and methodology, Background Paper, India: Strategies for Low Carbon Growth, Draft, July 2008, The World Bank.

[9] Technical EIA guidance manual for thermal power plant, prepared for the ministry of environment and forest, Government of India, by IL&FS Ecosmart, Hyderabad, August 2010.

[10] From Final report on Environmental impact assessment of 2x (500-660) MW Coal Based Thermal Power Plant at Rampal in Bagerhat District, Khulna1, Bangladesh, Ministry of power, energy and mineral resources (Power Division) Bangladesh power development board Submitted by Center for Environmental & Geographic information services (A Public Trust Under the Ministry of Water Resources) Dhaka 2013.

[11] Effects of pollutants produced by thermal power plant on environment, Vishal Vasistha, ISSN 2278 – 0149 www.ijmerr.com Vol. 3, No. 2, April 2014.

[12] Environment Impact Assessment of Thermal Power Plant for Sustainable Development, Sameer Kumar, Dhruv Katoria and Dhruv Sehgal, Department of Environment Engineering, Delhi Technological University (D.C.E), Bawana, Delhi, India, International Journal of Environmental Engineering and Management. ISSN 2231-1319, Volume 4, Number 6 (2013), pp. 567-572.

[13] Disposal and Management of Flyash, Lokeshappa B Research Scholar Centre for Environmental Science and Engineering IIT Bombay, India, Anil Kumar Dikshit Professor Centre for environmental Science and Engineering IIT Bombay, 2011 International Conference on Life Science and Technology IPCBEE vol.3 (2011) © (2011)IACSIT Press, Singapore,

[14] Fluidized bed combustion (fbc) in coal based thermal power plants Tarang Agrawal1, Sunil Kumar Dubey2 1Asst. Prof., Mechanical Engg. Dept., 2M.tech Student, Mechanical Engg. Dept. Invertis University, Bareilly, U.P, India, International journal of advance research in science & engineering, vol-05, issue no-2016, IJARSE – issn-2319-8354.

[15] Changing rules of Indian power sector: Empowering the economy, August 2015, designed by: PwC Corporate Communications, India.

[16] Environment Impact Assessment report for proposed 2x700 MWE PHWR Chutka, Madhya Pradesh, Atomik power project, CMPAPP at chutka Mandla, Madhya Pradesh, nuclear power Corporation of India & national environmental engineering institute.