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Effective Measures to Resolve Emission from the Thermal Power Plants in India to Stabilize the Environmental Conditions

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Abstract:-

Thermal power stations and the other facilities are working on regional environmental preservation by complying with the laws and regulations concerning Environmental preservation during operation as well as concluding "Voluntary Agreement for Environmental Pollution Control" and "Environmental Preservation Agreement" with local governments concerned. Taking into account the characteristics of each local government and local community with respect to general environmental issues such as atmosphere, water quality, waste, noise, and greening, the Voluntary Agreement for Environmental Pollution Control provides the stricter values than those of the regulatory Standards of the central and local governments, and the results of measurements are Regularly reported to the local governments.

Keywords: - [Thermal Power Plant Emission Control, Survey Power plants, Resolving Emission]

1. INTRODUCTION

The main air pollutants discharged from a thermal plant are sulfur oxide (SOx), nitrogen oxide (NOx), and soot and dust. We are making Efforts to control emissions through the fuel measures including the use of high-quality fuel and the facility improvement Measures including the installation of de nitrification facilities, electrostatic precipitators, and flue gas desulfurization facilities, as well as through the complete combustion management while seeking prevention of air pollution by implementing the operation measures such as monitoring of emission sources. As a result of these efforts, the emission intensity in FY2005 amounted to 0.31 g/kWh for SOx and 0.36 g/kWh for NOx, respectively achieving the world's top-level actual results.

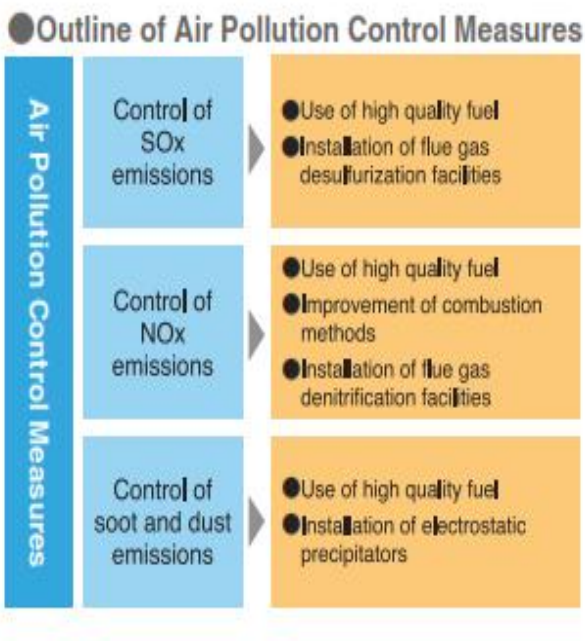

Figure 1: Control Measure

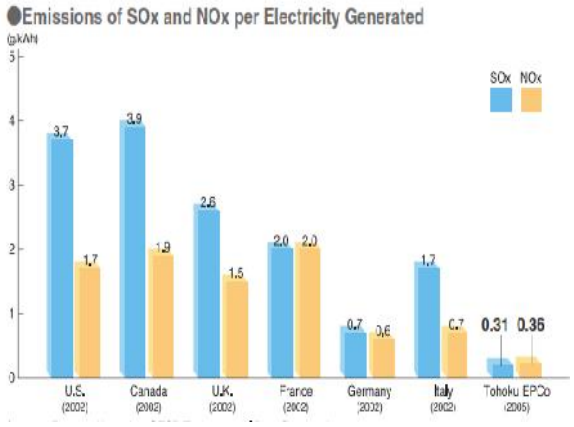

Figure 2: Comparison Chart

The Emerge of power plants in Asian countries is increased; Power plants produce a lot of emissions in the process of converting energy from fossil fuels to Electricity. About 70 % of energy used by India is produced in Coal fired thermal power plants. Not just India, people all over the world heavily rely on thermal power stations. This is because of the abundant availability of coal, reliable cheap power and early advent of 'steam engine' technology. Due to the chemical reaction of thermal power plant. the sun's rays were blocked by an ominious chemical and dust cloud that led to dark days, crop failures, famine and riots. Coal fired thermal power plants are one of the main contributors for atmospheric pollution and greenhouse gases. Emissions that come from these plants could be categorized into three different categories:

- Gaseous emissions Carbon Dioxide, Carbon Monoxide, Sulphur Dioxide and Nitrogen Dioxide which lead to global warming and acid rain.
- Particulate emissions - this fine dust that is emanated from the stacks of power plants is a health hazard.
- Trace elements like Mercury, Cadmium and Lead which are also health hazards.

These emissions are formed due to the Combustion process when coal is burned to produce heat. Some are avoidable, some can be controlled or reduced, and some cannot be avoided. Except for Carbon Dioxide all other emissions can be either controlled or captured with available technology at a reasonable cost.Some of these emissions depend on the quality of the fuel used. For example, sulphur dioxide depends on the amount of sulphur in coal. This is also true with the trace lements.

Carbon Dioxide- CO2.

Carbon dioxide is an unavoidable part of the combustion process. Small reductions are possible by process adjustments. Major reductions in CO2 can only be achieved by a drastic change in Power generation technology. Power generation mix has to shift from coal to other renewable resources to really eliminate CO2. Carbon capture and sequesterian systems are a costly way of eliminating a problem which will only burden the common man in developing countries. Commitments from governments to change the power generation technology and mix is of outmost importance. For this to happen the technology in developed nations must be improved.

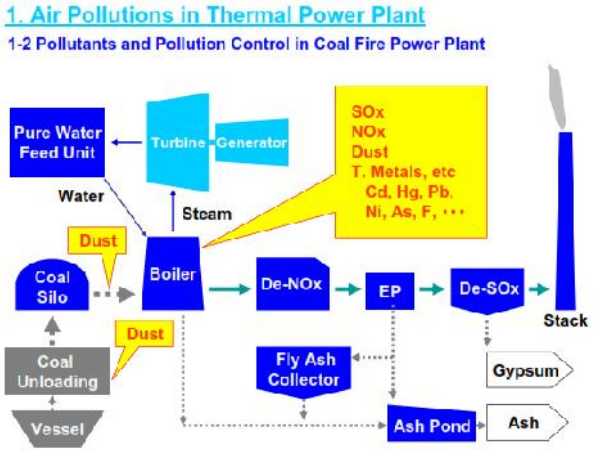

Figure 3: Type of dust collectors

In constructing power stations and other structures, the environmental impact assessment (environmental assessment) for

both during construction work and after commencement of commercial operation is conducted, and the environmental preservation measures are taken in order to minimize the impact on the surrounding environment. For this replacement plan, the procedure of the environmental assessment has been proceeded with since FY2004 under the Environmental Impact Assessment Law and the Electricity Utilities Industry Law. The procedure for the environmental impact assessment methodological report has been completed and at present the environmental impact is being predicted and evaluated through the survey of the present states of air environment, water environment, and landscaping, etc.

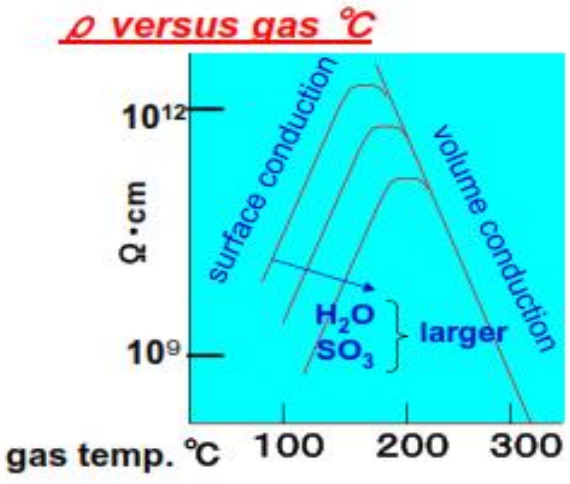

Figure 4: Conduction

2.1 OBJECTIVES OF STUDY

The objective of this study is to prepare an inventory of CO2 emissions from the present energy generation and predict the same for the next two decades. This emission inventory will provide options to policy makers for CO2 reduction in the Indian power sector. The aim of this work was to evaluate some conceptual solutions for combined-cycle power plants that could be used to meet the EU's climate goals. The thesis therefore presents studies on the following topics.

1. Post-combustion carbon capture processes and their implementation in combined-cycle power plants
2. Part-load strategies for thermal power plants
3. The effects of introducing bio-gas in the fuel mix of a combined-cycle power plant

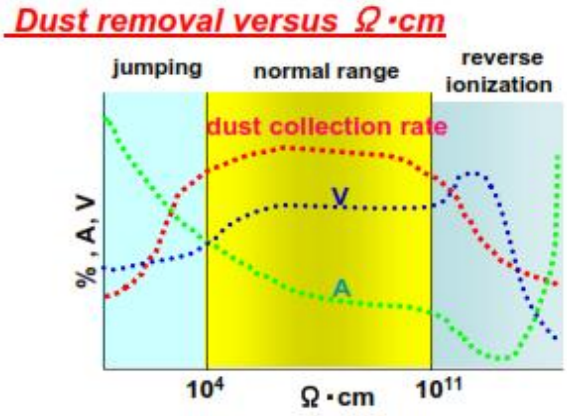

Figure 5: Dust Removal

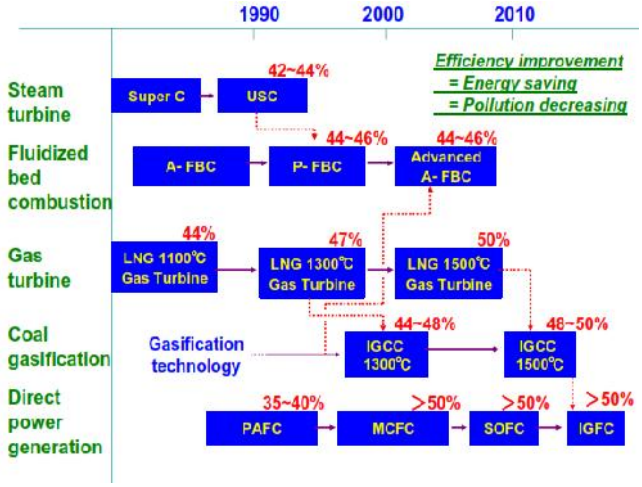

Figure 6: Efficiency in Energy Saving

3. COAL FIREDPOWER PLANT

About 70 % of energy used by India is produced in Coal fired thermal power plants. Not just India, people all over the world heavily rely on thermal power stations. This is

because of the abundant availability of coal, reliable cheap power and early advent of 'steam engine' technology. Though there is a lot of hue and cry over the CO_2 emissions and diminishing coal reserves, coal power continues to dominate the energy sector. The high pressure and high temperature steam is allowed to expand in turbines coupled with generators. Here, a part of energy is given back by the steam. Most of remaining heat is dissipated to atmosphere. More about this will be discussed in the efficiency discussion.

4. POLLUTION ASPECTS

Thermal energy is the most unclean energy. It causes thermal pollution and air pollution apart from leaving off a lot of ash. The ash can be used for other purposes or should be disposed properly otherwise during dry season , it mixes with air and makes the surrounding places uncomfortable to live. The plant also produces thermal pollution ie by adding more and more heat to the atmosphere. But as Nature is a huge sink of heat this doesn't add much trouble. Other pollution from the plant is due to production of soot, SO_x , CO_x gases and consequent problems. Nowadays, latest technologies are being implemented to minimize the emission of these gases by designing the boiler in a special way and adding other compounds so as to neutralize these gases.

Problem : Find out the theoretical efficiency of a power plant whose steam is heated up to a temperature of 400^0 Celsius and water temperature at the initial stages is 75^0 Celsius.

Efficiency : 1-(75+273)/(400+273) = 1-0.51 = 0.49 = 49 % efficiency.

Background: Observations of warming of the climate system with increases in global average air and ocean temperatures, melting of snow and ice, and rising global average sea level has caused a considerable concern in society. Much research has focused on finding the cause of this temperature increase. Several theories describing the causes of this observation have been developed, the most generally accepted is that the increase in the Earth's temperature is caused by the emission of carbon dioxide, CO2, and other so-called greenhouse gases into the Earth's atmosphere.

In response to these theories, the European Union (EU) has announced very clear objectives aimed at reducing the emission of greenhouse gases in the hope that this will prevent or mitigate climate change. Other global organizations have similar objectives, but these have not been expressed as clearly. According to the EU, "Climate change could reach catastrophic levels this century unless we quickly and sharply reduce emissions of greenhouse gases" . Furthermore, "The EU needs more secure energy sources, i.e. less dependence on imports of foreign oil and gas." . The following objectives have been defined by the EU to solve these issues (note that they are unformatted quotations):

• Cutting greenhouse gases by at least 20% of 1990 levels (30% if other developed countries commit to comparable cuts)

• Increasing use of renewables (wind, solar, biomass, etc) to 20% of total energy production (currently ± 8.5%)

• Cutting energy consumption by 20% of projected 2020 levels – by improving energy efficiency The greenhouse effect is a natural increase in the temperature of Earth as energy from sunlight is trapped by the so-called greenhouse gases.

The greenhouse gases absorb thermal radiation from Earth's surface and re-radiate it in all directions. Part of this re-radiation is directed back towards the surface resulting in that energy is encapsulated in the lower part of the atmosphere. As a result, the temperature there is higher than it would be if direct heating by solar radiation were the only warming mechanism. The greenhouse gases are vital for the life on Earth, without them the mean temperature of the Earth's surface would be as low as -19 °C.

The greenhouse gases are naturally occurring in the atmosphere but human activities such as combustion increases their amount. With an increased amount of greenhouse gases their effect is magnified and the temperature in the lower part of the atmosphere will increase. Some greenhouse gases, such as carbon dioxide, are formed when materials containing carbon are combusted. If this material is part of the natural carbon cycle, for instance from renewable resources, there will be no net increase in CO2 in the atmosphere. A resource is defined as renewable if it is replaced by natural processes at a rate comparable to, or faster than, its rate of consumption by humans. Renewable fuels are fuels produced from renewable resources. Wood is a renewable biofuel and, if no fossil fuels are used to produce and harvest it, its combustion will not increase the net amount of CO2 in the atmosphere. However, the formation of fossil fuels such as oil and coal takes millions of years, and the carbon that is released when fossil fuels are combusted is therefore not part of the carbon cycle, and will increase the amount of CO2 in the atmosphere. Increasing amounts of green house gases in the atmosphere will increase the temperature even more. The work presented in this thesis is concerned with thermal power plants, and the following three factors, leading to the reduction of greenhouse gas emission from such plants, have been identified, based on the objectives set out by the EU:

• reduced CO2 emissions
• increased use of biofuels
• improved part-load abilities

In 2008, the generation of heat and electricity accounted for 41% of the globally produced CO2. The other large sectors were transport at 22% and industry at 20%. Two renewable resources are suitable for thermal power plants, namely solar power and biomass. Solar thermal power plants are not a realistic option in Northern Europe, but the availability of biomass is high, offering a more suitable alternative. The third factor mentioned above is not as obviously connected to the EU's objectives which state that 20% of the total energy production should originate from renewable sources such as wind, solar power and biomass. The use of large amounts of wind power and solar power will lead to large fluctuations in the power grid, which must be compensated for. This means that quick response to load changes and high part-load efficiencies will be important in modern power plants. Therefore, the focus of the work presented in this thesis was on combined-cycle power plants, which have the highest efficiency of commercial power plants in use today. They are usually fuelled by natural gas, which produces less carbon dioxide per unit energy released when combusted than other fossil fuels such as coal and oil.

5. CONCLUSION

The objective of the work presented in this thesis was to evaluate methods that can help power companies to meet the climate change objectives of the European Union. Three factors summarizing the requirements on future thermal power plants were identified:

• reduced CO2 emissions
• increased use of biofuels
• improved part-load abilities

The method of utilizing low-grade heat for post-combustion CO2 capture described in Section 5.2.4 and Paper I - Paper III can be used in fossil fuel power plants in order to fulfill the first requirement. If the method is implemented so that the number of pressure levels in the CCPP is reduced, this will improve the part-load ability, therefore fulfilling the third requirement. Paper IV is concerned with SCOC-CC power plants which employ a cycle designed for post-combustion

CO2 capture. This power plant cycle fulfils the first requirement. Paper V shows how a CCPP reacts if the fuel heating value is reduced by adding low calorific fuels to the fuel mix. Using fuels produced from renewable resources reduces the CO2 emissions and replaces fossil fuel, satisfying the first and second requirements. Paper VI and Paper VII evaluate load control strategies related to the third requirement. These two methods can be applied to power plants fulfilling the other requirements.

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