Abstract — to study of different paper related to cleaner techniques and energy saving in power plant and there are some harmful effects for environment. The implementation of cleaner production in coal-fired power plants is necessary for environmental protection and also an effective way of energy saving and emission reduction. This paper reviews about coal and its test sample regarding its calorific value and also its ass content. So Study is carried out to reduce emission and energy saving in power plant.

I. INTRODUCTION

Electricity, the lifeline of the national economy, plays an extremely important role in Indian economic and social development. The rapid economic growth and rising living standard of the people has been more and more based on the development of electricity. A Thermal power station is a plant in which the prime material is steam driven. In this System Water is heated, turns into steam and spins a steam turbine which drives an electrical generator. After it passes through the turbine, the steam is condensed in a condenser and recycled to where it was heated, this is known as a Rankine cycle.

The greatest variation in the design of thermal power stations is due to the different fuel sources. Some prefer to use the term energy center because such facilities convert forms of heat energy into electricity. Some thermal power plants also deliver heat energy for industrial purposes, for district heating, or for desalination of water as well as delivering electrical power. A large part of human CO₂ emissions comes from this fossil fueled thermal power plants and efforts which are made to reduce these outputs are various and widespread in all over world.

One of the recent efforts going on in industry is cleaner production. Cleaner production is an efficient way to reduce the consumption of energy and environment pollution for electric power industry. But how to evaluate the performance of cleaner production is an important problem. In this paper, the performance evaluation index system of thermal power plants with cleaner production is set up. The purpose to evaluate the performance of cleaner production of thermal power plants is very important.

Coal-fired power industry is an important part of Indian electric utilities and about 80% electricity generation is from coal-fired power plants at present. The electricity consumption grew from 375.39 (billion kWh) in 2000 to 600.65 (billion kWh) in 2008 at an annual growth rate of 6.67% , while the electric power generation grew from 529.12 billion kWh in 2000 to 835.27 billion kWh at an annual growth rate of 5.78% . Future emission scenarios for the period up to 2020-21 are generated based on the estimates of the nine years from 2001-02 to 2009-10.So by increasing power output through thermal power plant also increases emission in atmosphere. Power plants in India use different qualities of coal, different combustion technologies and operating conditions are also revised. As a result, these plants have differences in achieved efficiencies (coal usage per unit of electricity). The estimates show region wise differences in total emissions as well as differences in emissions per unit of electricity. Projections by the International Energy Agency in World Energy Outlook 2000 have indicated that global CO₂ emissions would increase to 29,575 and 36,102 million tons in 2010 and 2020.So the implementation of cleaner production in coal-fired power plants is necessary for environmental protection and also an effective way of emission reduction. To measure and improve the performance of cleaner production is the essence and basic requirements of cleaner production.

II. EFFECT OF EMISSION ON HUMAN AND ENVIRONMENT WITH RESPECT TO POWER PLANT

Some terms in connection to pollutants present in flue gases of thermal power plant.

1) Dust:- Any matter carried by flue gases whose diameter is larger than 1µ (i.e., 1 micron = 10⁻⁶ mm) is called dust.

2) Cinder:- It is a dust having diameter greater than 100µ.

3) Fly ash:- Cinder in smaller sizes is called fly ash.

4) Smoke: - Smoke consists of particles smaller than 10µ. It is produced due to incomplete combustion of volatile component present in fuel.

5) Soot: - Particles forming smoke are collected or deposited in a place, their accumulation is called soot.

And some other major pollutants which are coming out of smokestack are those harmful gases like CO, CO₂, SO₂, and NOₓ. Here H₂SO₄ is very irritating to the upper respiratory tract. It penetrates deep in to lungs which gradually damages and this also damages vegetation and forestry. Another source of SO₂ is from bituminous coal and crude oil [1].

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of pollutant</th>
<th>Effect on Human being</th>
<th>Effect on vegetation</th>
<th>Effect of metal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SO₂</td>
<td>Suffocation, irritation of throat and eyes, respiratory asthma, lung cancer</td>
<td>Destruction of crops, reduction of yield</td>
<td>Corrosion</td>
</tr>
<tr>
<td>2</td>
<td>NOₓ</td>
<td>Irritation,</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
indian coal based on its calorific value is as follows: bituminous and sub-bituminous coal. The gradation of coal is heated. those combustible constituents of coal that vaporize when not combined with other elements. Volatile matter refers to fixed carbon. Fixed carbon refers to carbon in its free state, mainly of volatile matter and moisture content with low coal from geological perspective. It is a soft coal composed of bone, disease of teeth, respiratory problem. Anthracite is the oldest coal from geological perspective. It is a hard coal composed mainly of carbon with little volatile content. Lignite is the youngest coal from geological perspective. It is a soft coal composed mainly of volatile matter and moisture content with low fixed carbon. Fixed carbon refers to carbon in its free state, not combined with other elements. Volatile matter refers to those combustible constituents of coal that vaporize when coal is heated.

the common coals used in Indian industry are bituminous and sub-bituminous coal. the gradation of Indian coal based on its calorific value is as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Calorific Value Range (in kcal/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Exceeding 6200</td>
</tr>
<tr>
<td>B</td>
<td>5600 – 6200</td>
</tr>
<tr>
<td>C</td>
<td>4940 – 5600</td>
</tr>
<tr>
<td>D</td>
<td>4200 – 4940</td>
</tr>
<tr>
<td>E</td>
<td>3360 – 4200</td>
</tr>
<tr>
<td>F</td>
<td>2400 – 3360</td>
</tr>
<tr>
<td>G</td>
<td>1300 – 2400</td>
</tr>
</tbody>
</table>

Table. 2: Calorific value and range of coal

normally D, E and F coal grades are available to Indian industry. Here chemical composition of coal has a strong influence on its combustibility. So the properties of coal are broadly classified as Physical properties and Chemical properties.

The heating value of coal varies from coal field to coal field [5]. The typical GCVs for various coals are given.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lignite (Dry Basis)</th>
<th>Indian Coal</th>
<th>Indonesian Coal</th>
<th>South African Coal</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCV (kcal/kg)</td>
<td>4,500*</td>
<td>4,000</td>
<td>5,500</td>
<td>6,000</td>
</tr>
</tbody>
</table>

Table. 3: Different countries CV range.

Grades of North Eastern Coalfields:

<table>
<thead>
<tr>
<th>Grades</th>
<th>UHV (Kcal/Kg)</th>
<th>Corresponding Ash% + Moisture %age</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6200–6299</td>
<td>18.85 – 19.57</td>
</tr>
<tr>
<td>B</td>
<td>5600 – 6199</td>
<td>19.58 – 23.91</td>
</tr>
</tbody>
</table>

Table. 4: Grades of NEC

A. Fixed carbon:
Fixed carbon is the solid fuel left in the furnace after volatile matter is distilled off. It consists mostly of carbon but also contains some hydrogen, oxygen, sulphur and nitrogen not driven off with the gases. Fixed carbon gives a rough estimate of heating value of coal

B. Volatile Matter:
Volatile matters are the methane, hydrocarbons, hydrogen and carbon monoxide, and incombustible gases like carbon dioxide and nitrogen found in coal. Thus the volatile matter is an index of the gaseous fuels present. Typical range of volatile matter is 20 to 35%.

Volatile Matter
- Proportionately increases flame length, and helps in easier ignition of coal.
- Sets minimum limit on the furnace height and volume.
- Influences secondary air requirement and distribution aspects.
- Influences secondary oil support

C. Ash Content:
Ash is an impurity that will not burn. Typical range is 5 to 40%.

Ash
- Reduces handling and burning capacity.
- Increases handling costs.
- Affects combustion efficiency and boiler efficiency
- Causes clinkering and slagging.

D. Moisture Content:
Moisture in coal must be transported, handled and stored. Since it replaces combustible matter, it decreases the heat content per kg of coal. Typical range is 0.5 to 10%

Moisture
- Increases heat loss, due to evaporation and superheating of vapour
- Helps, to a limit, in binding fines.
- Aids radiation heat transfer.

E. Sulphur Content:
Typical range is 0.5 to 0.8% normally.

Sulphur
- Affects clinkering and slagging tendencies
- Corrodes chimney and other equipment such as air heaters and economizers
- Limits exit flue gas temperature.

IV. ANALYSIS OF COAL SAMPLE

A. Sample Preparation
The sample was taken from the storage of power plant which is in Ahmedabad situated in Gujarat. Usually this coal is transported through locomotives. The basis for any acid treatment technology is the removal of inorganic species by the action of acid added to the hydrophilic coal and water [3]. A correlation between the acidity and temperature of the treatment method, and the removal of inorganic species from coal has been established.

Initial Calorific value of coal is 6455.88 kcal/kg
B. Experimental Procedure

The coal is washed in water and dipped. After drying it is being tested to find its calorific value. Next procedure was carried out on other sample of coal which was washed by acid solution (HCL) it was also dipped and same procedure was repeated for calorific value of this sample. Calorific value is being shown below.

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Holding Time (minutes)</th>
<th>Water wash</th>
<th>Acid wash</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>6847.15</td>
<td>6267.45</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>7087.13</td>
<td>5936.06</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>7342.04</td>
<td>5441.31</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>7518.34</td>
<td>5338.68</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td>7541.55</td>
<td>5367.09</td>
</tr>
</tbody>
</table>

Table. 5: Coal Sample Testing

These graph shows different reading of coal by different method.

V. CONCLUSION.

The summary of the present literature review is as follows:
1) Coal is basic necessity of human and so process modification is must require in power plant were coal is basic raw material.
2) The purpose of this is to achieve greater efficiency in boiler combustion and also to minimise flue gases from atmosphere.
3) Different test were carried out for increasing coals calorific value and also to get higher results in it.
4) Many implements are carried out in power industry but this process modification is better option to increase overall output of plant.
5) As per the result water wash coal is better compare to acid wash coal.
6) There are different changes being done in boiler efficiency but to increase its combustion process its coal should be having high calorific value.

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