Techniques techniques. some of the power production technologies

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Techniquesto Reduce the Environmental Impacts In order to reduce theenvironmental impacts there should be a moratorium for coal-fired power plantsthat do not capture their CO_2 emissions and sequests CO_2 “. The zeroemission (emissionless) is achieved by carbon capture and sequester. An exampleof this type of plant is Elsam power station at Esbjerg, Denmark (EuropeanCommunities, 2006).

One recommendation is that the coal used for power plantsshould be clean coal. “ Clean coal” is a term used by coal industry todescribe a type of coal from where minerals and impurities are chemicallywashed of and processed (gasified, steam treated). In order to run coal-firedpower plants effectively, a cost-effective method is to run the plant on a diversetype of fuel, such as conversions to biomass or municipal waste based powerplants.

The emission level from this type of plants is estimated to be 20% lessCO_2 than a coal fired unit operating at a same capacityCombinedheat and power Combined Heat and Power (CHP)is a process to generate electricity and process heat. Instead of dischargingheat at a higher than ambient temperature, it is used to heat the buildings. This expertise is commonly practiced in some countries, for example Denmark andother Scandinavian countries and parts of Germany. Hansen 18 has shown thatCHPDH is the low-cost method of reduction in carbon emissions. Options forfossil fuel power plants The choices other thancoal-fired power plants include hydroelectric power, nuclear power, solarpower, wind power, geothermal power, tidal and new renewable energy techniques. Some of the power production technologies are proven on large industrial scale(i. e., hydroelectric, nuclear, wind, and tidal power) while others are inprototype stage.

Cost bypower generation source The costs for a fossil fuelbased power plant with a life of 30 years to 50 years is charming for investordue to the low initial investment i. e., around $1000 to $1300 per kilowattelectricity as compared to $2000 per kilowatt from an onshore wind farm. Thiscost calculation is only true when it strictly includes the cost of electricityproduction and does not consider the indirect costs supplementary to thepollutants generated due to fossil fuels burning (e. g., increased respiratorydiseases). Particulatematter control Particulate matter (PM) isoften classified as PM 2. 5 and PM 10.

PM 2. 5 is particulate matter of size 2. 5µm and less.

PM 10 is particulate matter 10 µm and less and it includes PM 2. 5. PM 2. 5 is considered to have more harmful health effects than the relativelycoarser particles. A particulate matter (PM) controldevice (equipment) remove the PM from the exhaust gas stream, stop the PM fromre-entering the exhaust gases, and remove the collected PM. The main PM controlequipment in use are Electrostatic Precipitators (ESP), Fabric Filters (FF), Mechanical Collectors (MC) and Venturi Scrubbers (VS). Each type of PM controlequipment is based on a different PM collection technique.

The FF contains baghousewhich collects the particulate matter by using finely netted filters, electrostatic precipitators creates an electromagnetic field to catchparticles, and centrifugal force is used by cyclone collectors to separateparticles ESP and FF are good to meet stringent EPA requirements of highefficiency and reliability. A FF consists of a number of joint enclosures. Eachenclosure contains up to over a thousand fabric bags made of small diametersand are attached with vertical supports. The flue gas passes through the fabricbags and PM from the flue gas is accumulated on the bag surface. The cakeformed can contribute significantly to remove other constituents of flue gas, such as SO2 and mercuryNOx control The original coal burners arereplaced with new Low NOx burners. The Low NOx burner apply advance fluiddynamics and flame thermodynamics techniques to reduce flame temperature, hence, less NOx.

NOx is controlled by using Selective Catalytic Reduction (SCR)systems and/or Non-Catalytic Reduction (SNCR) system. In these technicaltreatment systems through a series of reactions with a chemical reagentinjected into the flue gas, NOx is reduced to N2 and H2 O. The most commonlyused chemical agents are NH3 and urea ((NH2)2 CO) for SNCR. SNCR system introduceurea into temperature range of 760°C to 1100°C (1400°F to 2012 °F). Within thisrange, urea may react with available oxygen to form NOx and in this way the NOxremoved ranges from 15% to 35%. SO2 control The emissions of SO2 can becontrolled by three approaches: 1) blending of fuel, 2) switching fuel, with afuel having lower sulfur contents, or 3) removing the SO2 from the flue gases.

SOx emission limits set by various countries are given in Table 7. A variety oftechnologies are available to remove SO2 . Among these technologies theprominent are: wet flue gas desulphurization (FGD), dry flue gasdesulphurization. The dry FDG use a spray dryer absorber (SDA) or circulatingdry scrubber (CDS), or dry sorbent injection (DSI).

Conventionally used wet FGDsystems include a wet limestone process which forced oxidized S to remove asSO_2 and gypsum is obtained as a byproduct. SO_2 removal efficiency achieved byLimestone process is 98%. Wet FGD systems are designed for various typesof chemicals including magnesium-enriched lime, seawater, and soda ash (sodiumcarbonate, Na_2CO_3). Some limestone-based systems use an organic acid toenhance SO_2 removal. Wet FGDs was successfully used for coals such as lignite, anthracite, bituminous, and sub-bituminous types. Figure 6 shows the locationsof the flue gas desulfurization (FGD) option in plant.

It may be of interestthat in China, the installed capacity of FGD systems is increasing from 379 GWeat end 2008 to 723 GWe in 2020 which represents 75% of all the new FGD to beinstalled worldwide each year 20. A Spray Dry Flue Gas DesulfurizationSystems (SDA) is an example of dry FGD system. In SDA, lime slurry is atomizedand applied over the exhaust gases to absorb the SO_2 and other gases. Thesubsequent dry material with absorbed gases is collected in a downstream PMcontrol equipment, such as a FF or ESP. A small quantity of the dry materialcan be recycled to minimize the usage of lime.

The SDA cools the flue gas from340 K to 350 K before the flue gas passes through the FF. Extremely low PMemissions are possible, including PM2. 5. Approximately 96% of SO_2 can beremoved with the use of this technology which make it suitable to forcompliance of new emission limits.

Advantages of dry FGD as compare to wet FGDinclude: 1) Low construction cost, 2) Simple unit operations, 3) Less waterconsumption, 4) lLss power consumption, 5) Use of alkalinity to control the flyash for SO2 absorption as well, and 6) Dry solid byproduct (easy to manage)