Feasibility Studies with the Aim of Developing a Bilateral Offset Credit Mechanism   FY2011

Studies for Project Exploration and Planning

Study for Project Exploration and Planning
Energy Saving by Introducing Auto Combustion Control System (ACCS) for Coke Oven in India

New Energy and Industrial Technology Development Organization (NEDO)
Mitsubishi Chemical Engineering Corporation
This FS is to research the possibility that ACCS Technology is fit for Indian coke producers to save energy and reduce GHG emission aiming of developing a Bilateral Offset Credit Mechanism (BOCM).

The fundamental idea and know-how of ACCS has been developed by Kansai Coke and Chemicals Co. Ltd., one of Mitsubishi Chemical Group companies. Mitsubishi Chemical Engineering and Kansai Coke and chemicals are jointly prepared to develop their ACCS to Coke producers domestic and abroad.

Two set of ACCS have been installed by the model project scheme sponsored by NEDO and are under operation successfully and effectively in Shanxi Sunlight Coking, China.

Site surveys at Tata Steel, RINL and JSW Steel were implemented.
Auto Combustion Control System (ACCS) is One of energy saving technologies for coke oven which also contribute to reduce GHG Emission by reducing fuel gas for carbonizing in coke oven. ACCS is a computer aided energy saving System by detecting both temperature of fuel combusting gas and generated gas (coke oven gas = COG) to realize adequate and economical operating condition of coke oven. The typical concept of ACCS as follows;

① Continuous measuring of exhaust gas (COG) temperature with thermometers (thermocouples) equipped in ascension pipe of coking chamber

② Continuous measuring of flue gas temperature with thermometers (thermocouples) equipped in heating chamber

③ Operate coke oven with data gathered and processed in ACCS system
By using ACCS, the amount of fuel GAS (Purified COG), that is used to heat the raw coal, is able to reduce to appropriate amount. Then reduced amount of the fuel gas will be useful for any other usage as surplus fuel gas.

As a general stipulation coke oven is heated with Mixed Gas of COG and other BFG and LDG, and there may be special case of either solely COG case (without BFG and/or LDG) or BFG and/or LDG case (without COG).
What is ACCS? (3)

- CMC (Coal Moisture Control), CDQ (Coke Dry Quenching) and ACCS (Auto Combustion Control Systems) are the three major technologies of energy saving for Coke oven plant. Their effect are independent and don’t compete each other.
- ACCS has advantage of cost / performance in energy saving and GHG emission reduction over CMC and CDQ.
- The train of equipment and facilities in coking plant:
## Site Survey Plan

**Items to be observed and measured at site survey**
- Coke oven group configuration
- Operation method
- Computer-aded operation system
- Fuel gas line
- Overall condition of Coke oven plant
- Log data of individual coking chambers (temperature, coking time, feedstock input rate, production rate, air ratio in flue stack etc.)
- Condition of combustion and coking
- Observation of net coking time and soaking time.

**Analysis of the data**
- Estimation of shortening possibility of soaking time shortening
- Estimation of energy saving
- Estimation of CO2 emission reduction

## Site Survey Result

Site survey and analysis revealed the followings:
- Site surveys at Tata Steel, RINL and JSW Steel were done.
- By the survey and analysis revealed that there is a certain possibility of ACCS introduced into coke producers.
- By applying ACCS energy consumption in coke oven can be reduced about 5%.
- For example by 2 million ton of coke production per annum, it can be estimated to reduce energy consumption by 387 TJ/y, and also reduce CO2 emission of 28 thousand ton per annum.
- Annual production of coke (metallurgical coke) in India is estimated 35 million ton per annum, so maximum potential CO2 emission reduction by ACCS is estimated as 490 thousand ton per annum.
Basic Idea of MRV Methodology

MRV methodology plan is based on J-MRV Guideline prepared by JBIC (J-MRV002 / Methodologies for energy efficient project), reflecting experience in China case.

Points to be highlighted in the process of establishing a methodology

- To simplify industrial facility’s complicated energy structure as fur as possible
- More than two gases (for example BFG and LDG other than COG) are used
- More than two users of saved energy are designated
- Users of saved energy both in and out of the company are involved
- Measuring method and point of gas flow rate and heat value

- To make clear the interrelation between coke production rate (periodical measuring) and fuel gas consumption (continuous measuring) taking time lag factor into consideration

- Additionality, Barriers (First-of-its-kind, Investment etc.)
MRV Methodology for BOCM

- [GHG Emission Reduction]
  \[ ER_y = BE_y - PE_y \]

  \[ BE_y = BE_{\text{ref}} \times \left( \frac{PP_{cl,y}}{BP_{cl,\text{ref}}} \right) \] or \[ BE_y = BE_{\text{ref}} \times \left( \frac{PP_{ck,y}}{BP_{ck,\text{ref}}} \right) \]

- [GHG Emission in Reference Scenario]
  \[ BE_{\text{ref}} = \sum_i (BC_{\text{heat},i,\text{ref}} \times EF_{\text{fuel},i}) \]

- [GHG Emission in Project]
  \[ PE_y = \sum_i (PC_{\text{heat},i,y} \times EF_{\text{fuel},i}) \]

- [Heat Energy Consumption in Reference Scenario]
  \[ BC_{\text{heat},i,y} = LC_i \times BC_{\text{fuel},i,y} \]

- [Heat Energy Consumption in Project]
  \[ PC_{\text{heat},i,y} = LC_i \times PC_{\text{fuel},i,y} \]
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Remaining Issues to be solved on next stage

1. Possibility of Official Assistance Scheme for Energy Saving Technologies
2. Possibility of Low Interest Rate Financing by JBIC etc.
3. Detailed MRV Structure Building
4. Detailed Survey on Customs Tariff and Taxation Scheme
5. Survey on Local Supplier (Computer, DCS, Thermocouples, Gas Flow meter)
6. Inland Transportation (especially Fragile Product)
7. Overall Market Research on Coke Producers