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06/09/04 03:13 PM

To: GVSAAnand@nagarjunagroup.com
cc: "KameswarRao G" <KameswarRao@nagarjunagroup.com>, "Prabhu M" <PrabhuM@nagarjunagroup.com>, "Swarup R" <rswarup@nagarjunagroup.com>, Shuvendu Bose <Shuvendu.Bose@in.ey.com>, stalin@nagarjunagroup.com, Sujeet Kishen <Sujeet.Kishen@in.ey.com>
Subject: Re: Projects for reducing Green House Gas emissions [Virus checked SG]

Dear Mr. Anand,

Thanks for the information you have sent for few of the projects at your plant.

However, we would also like to have information on the projected savings (e.g., in terms of kWh or tonne of steam i.e, enthalpy or both), project investment, IRR etc. Also please send us information on fuel consumption rate, steam and power generation data to compute the emission coefficient.

Look forward to receiving the balance information soon.

Regards.

Pl. Note the change in my e-mail id: Parthapratim.Chaudhuri@in.ey.com

"Anand G V S"
<GVSAAnand@nagarjunagroup.com>

09/04/2004 11:12 AM

To:
Shuvendu.Bose@in.ey.com,
Parthapratim.Chaudhuri@in.ey.com

m
cc: "Prabhu M"
<PrabhuM@nagarjunagroup.com>, "KameswarRao G"
<KameswarRao@nagarjunagroup.com>, "Swarup R"

<rswarup@nagarjunagroup.com>
Subject: Projects for
reducing Green House Gas
emissions [Virus checked SG]

Dear Mr Shuvendu Bose,

This has reference to your visit to our site and the mail from Mr.Chaudhuri to our GM(Plant Operations), Mr.G Kameswara Rao on the subject matter. Thanks for the presentation you made here at our premises and subsequent discussions we had with you on various projects ultimately leading to the reduction in Green house gas emissions.

We have further reviewed these projects.

Please find attached a brief note on each of these projects arranged in the order of descending priority.

(See attached file: cdm 040904.doc)

We hope this information to suffice the present requirement. For any further details/clarifications please contact Mr.M.Prabhu,Sr Manager(Process).

His mail ID : prabhum@nagarjunagroup.com
Contact number : 0884 2360025

Thank you and regards,
G V S Anand

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- cdm 040904.doc

1. Gas Turbine (GT) power Augmentation and Cooling water pumps drive change over

At present two-ammonia plant cooling water pumps (each 1.2 MW rating) are driven by fully condensing type steam Turbines. There is a considerable energy saving when these pumps are driven by electric power due to generation, distribution and end usage efficiencies. So it is proposed to change both these turbines to motors.

However NFCL is operating one Frame III GT and one frame V GT near to peak load to cater to the present requirement of the over all complex. Both the GTs are running based on Natural gas as fuel.

To augment the power from GT-C to meet the additional power requirement due to the above proposed change the following modification to the frame V GT are proposed

- **Up-rated Mechanical parts**
- **Steam injection to gas turbine**

This will result in higher power output & reduced heat rate and thus increased GT efficiency.

2. Flue gas temperature reduction in Ammonia in Primary reformer waste heat section

The flue gas going out of Ammonia -1 primary reformer convective section is at a temperature of about 190 Deg C compared to the design of 150 Deg C. Various methods to recover the heat is under study. The most optimum scheme of utilizing the heat will be implemented thereby reducing the specific energy consumption in Ammonia plant.

3. Reducing heat losses in the reformer furnaces

Presently the heat losses from Primary reformers are more. It is proposed to replace the cera fibres with new improved ones and to install additional layer of fiber modules over refractory (Veneering). By this modification the heat losses can be minimized and furnace efficiency improved.

4. CO₂ recovery from flue gas

Presently NFCL is consuming Natural gas and Naphtha as raw materials for manufacturing Urea. There is good difference between the carbon number of naphtha and natural gas and thus the CO₂ generated through these two sources in the CO₂ removal section. When both plants switch over to Complete Natural gas as raw material, there will be deficit of CO₂ to produce urea. This scenario is likely to arise in about two years time due to Reliance Gas finding. Hence it is planned to recover CO₂ from the flue gases of primary reformer to meet the shortage.

5. Installing advanced process control.

All our process plants are being operated through DCS system and controlled through PID controllers and in some places dedicated Single Loop Programmable Controllers (SLPCs). It is left to the operators to fine-tune the parameters with respect to production and energy to optimum levels. The advanced process controllers are basically multi variable controllers taking input from various sources and stretching the PID controllers to operate close the design/ constraint limits. This is achieved by minimizing the variations or disturbances in the process variable. This type of control systems is employed almost in all modern refineries and in a few ammonia plants. This system reduces overall specific energy consumption in the complex.

6. Reducing the pressure drop across Control valve

In some of the services the pressure drop across the valves are more resulting in lower syn gas compressor suction pressure. Additional energy needs be spent to overcome the pressure loss in the system. It is proposed to change such valves in the complex with a low pressure drop valves.

7. Solar heating for canteen hot water generation

Presently electric power is being used for heating the water in canteen. It is planned to substitute this heating source with solar heating source by installing solar panels.

8. Suction chilling of compressors

Presently low-pressure steams generated in urea plants are being injected to CO₂ compressor turbine as an additional driving medium. Instead some this steam will be used in a new refrigeration (Vapor absorption type) system and the chilled water in turn will cool the suction of major compressors, thus

saving high-pressure steam and thereby reducing the overall complex specific energy.

9. Power recovery from Process condensate

To remove traces of impurities from the process condensate originating in both ammonia plants, the condensate is stripped with Medium pressure steam and the steam is further utilized in the reformer as process steam. The treated condensate which is at about 35 KSC is sent to further treatment in Mixed ION exchange bed which is operating at about 2 KSC. Hence it is proposed to install a power recovery turbine.

10.CO2 removal section revamp

The present specific energy consumption in CO2 removal section using Giammarco Vetrocoke solution is higher compared to the aMDEA solution. The solution swap along with better heat recovery system brings down the regeneration heat required in the system. This proposal thus lowers the energy consumption in Ammonia plants.

11.Power recovery from Natural gas

Natural gas is available at 40 KSC at our battery limit and it is let down to 6 KSC through control valve and used as fuel in boilers and in various furnaces in the complex. By installing a turbine this pressure energy can be converted into electrical energy. About 1 MW power can be generated through this scheme.