HA BAC NITROGEN FERTILIZERS AND CHEMICALS

COMPANY DESCRIPTION

HA BAC NITROGEN FERTILIZERS AND CHEMICALS, a state-owned company, was established in 1960 with the assistance of the government of China. It is located in Bac Giang province, about 70 km north of Hanoi. This large-size company, with 2,434 employees, is a member of the Vietnam National Chemical Corporation (Vinachem) under the Ministry of Industry. It mainly produces urea, liquid ammonia (NH_3) and carbon dioxide (solid, liquid) for the national market, with total annual outputs of 150,000 tons urea/year, 7,200 tons liquid CO_2 and 98,000 tons NH_3. The company's annual turnover amounts to around US$ 31,746,000.

At present, the company uses seven coal-pulverized boilers to produce superheated steam at a pressure of 39. The steam is then distributed through a common steam pipeline to five turbines of the extracting and condensing type for power generation and heat processing.

The company decided to participate in the GERIAP project because they want to reduce energy cost, which is an important factor in the unit cost of their products. The assessment methodology would help them carry out a detailed review of their production processes in order to identify areas where energy consumption and waste generation can be reduced.

PROCESS DESCRIPTION

- ***Ammonia (NH_3):*** Ammonia (NH_3) is produced from atmospheric nitrogen and hydrogen from a hydrocarbon source. The hydrocarbon feedstock that has been used is gasified coal. Ammonia production from gasified coal includes the basic following processes: carbon monoxide conversion, desulphurisation and removal of carbon dioxide, which can be used for urea manufacture and ammonia synthesis.
- ***Urea:*** Urea fertilizers are produced by a reaction of liquid ammonia with carbon dioxide. The process steps include: solution synthesis, where ammonia and carbon dioxide react at a pressure of 120-250 bar to form ammonium carbamate, which is then dehydrated to form urea; solution concentration by evaporation to produce a melt; formation of solids by prilling. The carbon dioxide for urea manufacture is produced as a by-product from the ammonia plant reformer.

METHODOLOGY APPLICATION

The draft Company Energy Efficiency Methodology was used as a basis for the plant assessment to identify and implement options to reduce energy and other materials and wastes. Some of the interesting experiences are:

- ***Task 1b – Form a team and inform staff***

The company's team comprises of 11 members from different sections lead by the Vice Director. Team meetings were held to assess available information, discuss areas of energy usage and select audit focus based on analysis of energy consumption data. For two selected focus areas (boiler house and steam distribution system) the Team's tasks were agreed: (1) analysis and review of present practices (2) development and evaluation of proposed options (3) implementation and monitoring of agreed options.

Lessons learnt:

1. Team meetings are important to plan and carry out the energy assessment and implement and monitor options.
2. Team leader is the focal point for the whole project. That person also assumed responsibility for communication, data collection, organization of meetings and facilitation of the implementation project.

- ***Task 1e – Prepare assessment proposal for top management approval***

Before the GERIAP project the company had carried out a restructuring of the energy system with the assistance of an external consultant. Because of having some experiences in the energy project the staff participating in the restructuring project were invited to assist with this energy efficiency assessment.

Lesson learnt: It is useful to check if the company has done any previous work on energy assessments. Using staff who were involved in previous projects at the company has as an advantage that they already have the trust of top management which makes it easier to obtain approval to carry out an energy assessment.

- ***Task 4b – Rank feasible options for implementation***

The company's Director indicated that the profitability of the options in terms of payback (less than 1 year) was the most important selection criterion, and that greenhouse gas emission reductions and technical feasibility were important other criteria. Therefore the Team focused on getting this information as part of the option evaluation and use it as a basis to rank options for implementation.

Lesson learnt: A clear understanding of the criteria that top management finds important will make it easier for the Team to rank options for implementation. The profitability and payback period of feasible options are two very important figures that top management will ask for.

- ***Task 4c–Prepare implementation and monitoring proposal for top management approval***

The implementation plan assumed that options would be mostly implemented using internal capacity. Several options could not be implemented immediately, because of the continuous production 24 hours a day, 7 days a week. The Team Leader set a time frame for implementation of options, which coincided with an annual maintenance plan. To prepare for a successful implementation, meetings were held between staff from the heat shop and company technicians to discuss the technical aspects of implementing the options.

Lesson learnt: It is useful to set the implementation plan to coincide with any scheduled maintenance plans at the plant to prepare the shop floor staff and technicians accordingly.

- ***Task 5b – Evaluation meeting with top management***

Thanks to the positive results from the energy options implemented, top management supported further energy efficiency activities that were proposed by the team relating to the spray nozzle of the boiler.

Lesson learnt: Successful results from the first assessment are a very good reason for the company to continue to continue with their energy efficiency program.

- ***Step 6 – Continuous improvement***

The company is now considering implementing an environmental management system and having it certified to the ISO 14001 standards. The Team's knowledge on how the company deals with issues, including energy issues, its work on energy efficiency options and efforts to inform management about new ideas to improve energy efficiency, were essential to top management's willingness to continue with this.

Lesson learnt: Creativeness of Staff in dealing with energy issues is important to convince management to continue with energy efficiency in the future.

OPTIONS

As explained above, the energy assessment carried out by the company resulted in the implementation of twenty options:

- Four options, including detailed feasibility analyses, were developed by the Team with the support of the VNCPC. Coal savings from these measures has been estimated to 1,912 tons/year, which result in yearly cost savings of US$ 41,542. The corresponding investment amounted to US$ 23,020.
- Sixteen additional measures were developed by the Team without specific support from the VNCPC. The company invested US$ 205,083 to implement these measures. The global cost savings from these measures can be deducted from the overall benefits elaborated in table 2.

These 20 energy efficiency measures have already been identified and implemented. They are summarized in the table 1 below.

Table 1a: OPTIONS GENERATED DURING THE GERIAP PROJECT

FOCUS AREA/ OPTION	CP TECHNIQUE	FINANCIAL FEASIBILITY	ENVIRONMENTAL BENEFITS	COMMENTS
Boiler 5/ Maintenance of coal mill and fine coal feeding system	Good housekeeping	▪ Investment: Nil ▪ Operating cost: US$ 11,740 ▪ Cost savings: US$ 26,400 /yr ▪ Annual net savings: US$ 14,660 ▪ Payback period: not given	▪ Coal savings: 1,200 tons /yr ▪ GHG emission reduction: 3,012 tCO2/yr ▪ Reduction of ash: 250 tons/yr	Increased combustion efficiency The results are estimated
Reduction of flue gas temperature of air heater of pulverised coal-fired boiler		▪ Investment: US$ 3,500 ▪ Cost savings: US$ 8,694 /yr ▪ Payback period: 5 months	▪ Coal savings: 414 t/yr ▪ GHG emission reductions: 1,040 tCO2/yr ▪ Reduction of ash: 87 tons/yr	Increased combustion efficiency The results are estimated
Steam piping/ Repair damaged insulation of steam pipes.	Good housekeeping	▪ Investment: US$ 656 ▪ Cost savings: US$ 2,268/yr ▪ Payback period: 4 months	▪ Coal savings: 108 t/yr ▪ GHG emission reductions: 271 tCO2/yr	The results are estimated
Steam piping/ Steam Leak Survey, Leak Repair and Pipeline Insulation	Good housekeeping	▪ Investment: US$1,930 ▪ Cost savings: US$4,180 ▪ Payback period: ▪ 6 months	▪ Coal savings: 190 tons/year. ▪ GHG emission reduction: 477 tCO2/yr	The results are estimated

Table 1b: ADDITIONAL OPTIONS GENERATED BY THE TEAM

FOCUS AREA/ OPTION	CP TECHNIQUE	FINANCIAL FEASIBILITY	ENVIRONMENTAL BENEFITS	COMMENTS
Boiler 1/ Install a new level-1and level 2 economizer	New technology/ equipment	Investment: US$ 6,350 Cost savings: calculated in overall benefits.	Reduction of GHG emissions	
Boiler 1/ Replace existing steam tubes.	Good house keeping	Investment: US$ 2,540 Cost savings: Calculated in overall benefits.	Reduction of GHG emissions	
Boiler 2/ Install a new level-1 and level-2 air heater	New technology/ equipment	Investment: US$ 8,254 Cost savings: Calculated in overall benefits.	Reduction of GHG emissions	
Boiler 2/ Insulation of furnace's wall with refractory concrete	Good house keeping	Investment: US$ 2,540 Cost savings: calculated in overall benefits.	Reduction of GHG emissions	
Boiler 2/ Fixing air leaks and exhaust gas leaks	Good house keeping	Investment: US$ 12,700 Cost savings: calculated in overall benefits.	Reduction of GHG emissions	
Boiler 3/ Replace all existing devices in the boiler by new ones except boiler frame	New technology/ equipment	Investment: US$158,730 Cost savings: calculated in overall benefits.	Reduction of GHG emissions	Boiler was outdated and not operating satisfactorily
Boiler 4/ Replace the existing super heater by new one	New technology/ equipment	Investment: US$ 3,175 Cost savings: calculated in overall benefits.	Reduction of GHG emissions	
Boiler 4/ Install new wings for ID fan	New technology/ equipment	Investment: US$ 380 Cost savings: calculated in overall benefits.	Reduction of GHG emissions	
Boiler 5/ Install a new level-2 economizer	New technology/ equipment	Investment: US$ 2,540 Cost savings: calculated in overall benefits.	Reduction of GHG emissions	
Boiler 5/ Reinforce the burning zone	Good house keeping	Investment: US$ 635 Cost savings: calculated in overall benefits.	Reduction of GHG emissions	
Boiler 6,7/ Cleaning the super heater	Good house keeping	Investment: US$ 254 Cost savings: calculated in overall benefits.	Reduction of GHG emissions	
Turbine/Reinforce the high-pressure preheater of the oxygen reduction tank	Good house keeping	Investment: US$ 1,080 Cost savings: calculated in overall benefits.	Reduction of GHG emissions	
Turbine/ Improve high pressure piping	Production process/ equipment modification	Investment: US$ 1,905 Cost savings: calculated in overall benefits.	Reduction of GHG emissions	
Heat shop/ Training on boiler operation skills for boiler worker	Good house keeping	Investment: US$ 3,048 Cost savings: calculated in overall benefits.	Improved operation of the boilers	

As shown in table 2 below, the implementation of these options generated considerable economical benefits and greatly reduced the emissions of greenhouse gas (results actually achieved). Specific benefits from the four options generated with the help of the GERIAP project are summarized in table 3 (estimations).

Total investments for the implemented options were approximately US$ 223,000 (including US$ 158,730 for the complete refurbishing of boiler 3), financed by the company's own resources and generated net annual savings of US$ 149,738. The overall payback at the company was thus 18 months.

For the 20 options implemented, the total annual energy reductions were 4,502 tons of dust coal, and 1,267,361 kWh. The company's GHG emissions were reduced by 12,162 tons CO_2 between the start of the project in 2003 and the end of the project in 2005.

Table 2. Overall results

Material/Energy	Savings	Annual energy savings	Annual GHG savings	Annual financial savings
Dust Coal	2.487 kg/ ton of steam	4,502 tons of dust coal	11,300 tons CO_2	US$ 99,044
Electricity	0.7 kwh/ton of steam	1,267,361 kwh	862 tons CO_2	US$ 50,694
Total			**12,162 tons CO_2**	**US$ 149,738**

Note:
Savings per ton of steam calculated based on the difference between the consumption per ton of steam during the years 2003 and 2004.
Total amount of steam produced in 2004: 1,810,516 tons
Total amount of NH_3 produced in 2004: 100521.8 tons
Electricity: US$ 0.04 VND/kwh
Dust Coal: US$22/ ton
Stove Coal: US$36/ ton

Table 3. Benefits from the four options in the focus area of the GERIAP project

Material/Energy	Annual energy savings	Annual GHG savings	Annual financial savings
Dust Coal	1,912 tons of dust coal	4,800 tons CO_2	US$ 41,542
Ashes		337 tons of ash	

FOR MORE INFORMATION

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