ANHUI LINQUAN CHEMICAL INDUSTRY CO LTD

COMPANY DESCRIPTION

Anhui Linquan Chemical Industrial Company Ltd. is a joint-venture stock company, located in Anhui Province. It was established in 1970 and presently has 1448 employees. The main products include ammonia, nitrogenous fertilizer, hydrogen peroxide, ammonium acid carbonate, methanol, sulfur etc., and its total annual production is about 1 million tons (which includes 300,000 tons of ammonia, 400,000 tons of urea, 50,000 tons of hydrogen peroxide). The company's annual export is 30,000 tons of urea (year 2003), and annual sales income and tax are ¥ 441,650,000 (about US$ 53,533,000) (year 2003) and ¥ 19,760,000 (US$ 2,395,000) (year 2002), respectively.

The company participated in the project because company management was interested in learning about methodologies to improve energy and environmental performance. The company had practiced CP before GERIAP. In 1999, they took part in a CP project supported by the Chinese-Canadian CP group, where they finished basic CP audit. The company's General Manager takes charge of the company's environmental management, and the Quality Monitoring & Environmental Protection Department is responsible for day to day environmental management, monitoring and measurement. Additionally, there is a Vice Chief in every section who administrates environmental work, and a pollution controlling team, whose head is the production Vice General Manager.

Fuyang's government for six consecutive years since 1997 has awarded the company. It has been named "Zero Emission Plant" and "Clean & Civilized Plant" by former province Petroleum Chemical Bureau and Chemical Engineering Administration. It was awarded the National Advanced Company of Chemical Engineering for Environmental Protection in January 2001, during the "Ninth Five" period, and as Advanced Company of "One Control, Two Standard" by province environmental protection administration in June, 2001. The company acquired the ISO14001 certification of environmental management systems in December 2003.

PROCESS DESCRIPTION

The company's production process includes the following steps:

- ***Ammonia synthesis process:*** The process includes using lump anthracite coal as raw material, fixed layer discontinuous gasification as a method to produce gas, tannin extract method for desulphurization, mid-temperature exchanger plus low-temperature exchanger, cuprammonia to extract a little CO and CO_2, synthetic ammonia and adopts a combined alcohol method to produce methanol.
- ***Urea synthesis process:*** The CO_2 gas from the decarbonization section, the preheated pressed ammonia liquor and methylamine liquor from the adsorption section are fed into the urea synthesis tower to react. After pressure reduction, the produced molten urea is transported to subsequently to a pre-distillation tower, primary dissociation tower, secondary dissociation tower, closed distillation tower, primary evaporator, and secondary evaporator. Then it decomposes excess ammonia, CO_2 and methylamine and produces 99.7% of molten urea, after which it is fed into prilling tower. After being separated by condensation, the emitted gaseous chemicals are transferred into a primary absorber tower, where CO_2 is adsorbed by a strong ammonia liquor. The condensed liquor is fed into a liquid ammonia buffer tank as return flow. The gas goes into the non-reactive washing machine where it is adsorbed by liquid ammonia from the condenser. The increased ammonia goes into an

absorber tower. Exhaust gas is transported into gas absorber tower and emitted after further absorption.

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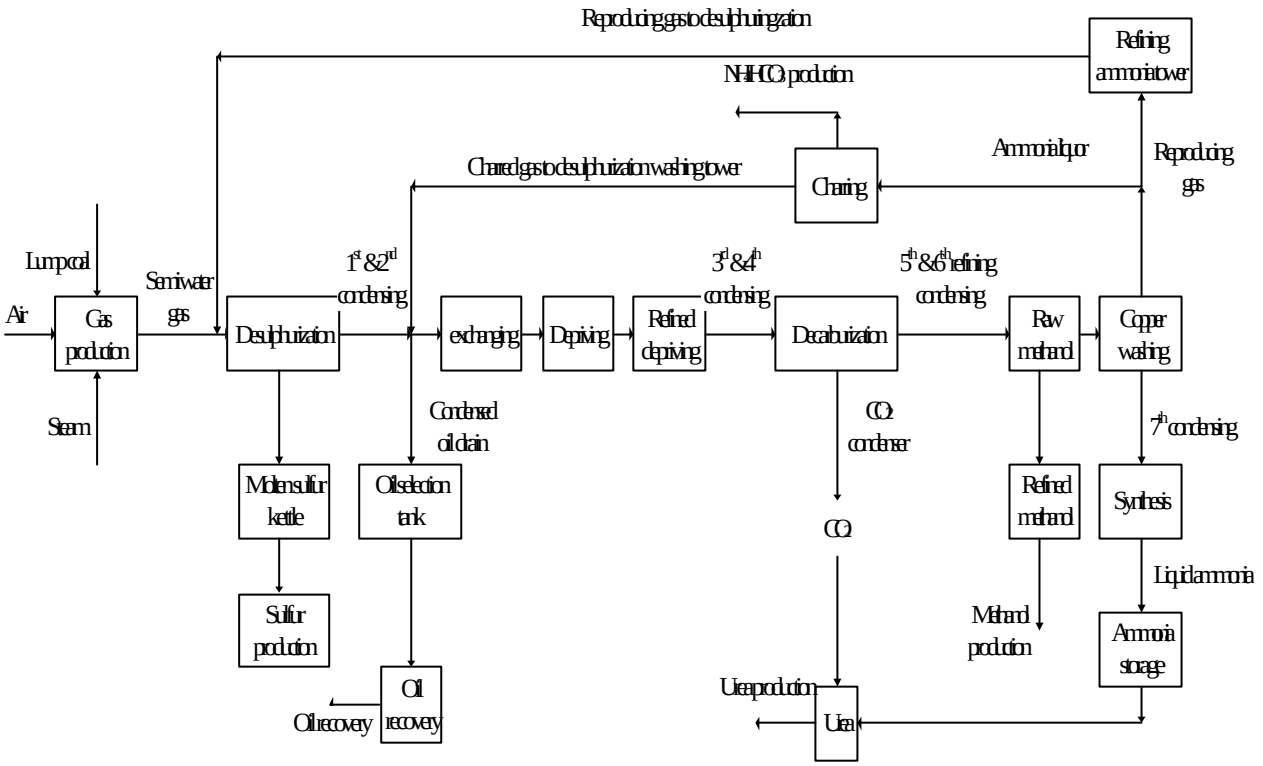
Figure: Process flow diagram of Anhui Linquan Chemical Industrial Company Ltd.



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 1c – Pre-assessment to collect general information***

A plant layout was obtained for this chemical plant. This will assist with the walkthrough and understanding the relationship between processes and equipments.

- ***Task 3c – Identify possible options***

Following the energy assessment and determination of causes of losses, a meeting was organized to brainstorm about possible energy efficiency options. In order to get a wide range of possible options two groups of people were invited: (1) the members of the plant's Team who are familiar with the plant's production processes and equipment and (2) Domestic and international industry and Cleaner Production experts who can bring in experiences from similar production processes and equipment at other plants. The group as a whole discussed the identified options to decide which options to select for feasibility analysis.

Lesson learnt: Involving plant staff as well as external industry and Cleaner Production experts will improve the quality of possible options identified as each group will have a different input.

- ***Task 2d – Quantify losses through a material balance***

There were two major losses observed for the water gas department: heat loss from blow gas and relaxed gas and CO loss in the pipe transport system. This made it possible to come up with an

option to install a heat recovery system that would provide a solution for both losses: heat is reused and lost CO gas is captured and burnt.
Lesson learnt: Because a material balance gives a clear indication of all major losses for one focus are and this makes it easier to find options that deal with all losses together instead of each loss separately.

- ***Continuous improvement***

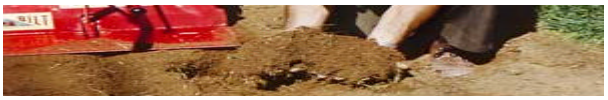
Energy efficiency is part of the day-to-day operations of the entire company under the environmental management system. An interesting example is new company regulations that have been established to encourage employees to take part in energy efficiency and Cleaner Production activities. For example, in 2004 top management passed the "10th memoir of company's management meeting". This memoir states that the employees in charge of raw material procurement will be rewarded if the raw materials purchased meet minimum quality requirements.
Lesson learnt: Rewarding schemes for staff are a good mechanism to ensure that staff will continue to focus on improving resource and energy efficiency.

OPTIONS

- The focus areas selected for the project were (1) heat & power department, (H& P) and (2) water gas production department.
- A total of seven options were suggested, of which six were implemented and one option was found unfeasible. For the six options implemented, the results of two options were measured..
- For the two options implemented and measured, the total investment cost was US$ 686,000 (about 5,659,000 RMB), annual savings were US$ 1,326,000 (10,940,000 RMB), and the total payback period was six months.
- For the six options implemented, the total coal reductions are 35,883 ton/year and electricity reductions 42,000 kWh/year
- GHG emission reductions are 54,307 tons per year, which represents 5.5% of the total company GHG emissions in 2003
- Other atmospheric pollutants reductions included SO_2 (5 ton/year), NO_x (196.7 ton/year), CO (8.2 ton/year), and PM_{10} (216 ton/year).

Table 1: EXAMPLES OF OPTIONS IMPLEMENTED AND INVESTIGATED

FOCUS AREA/ OPTION	CP TECHNIQUE	FINANCIAL FEASIBILITY	ENVIRONMENTAL BENEFITS	COMMENTS
H&P Department./ Increasing the efficiency of boiler by replacing to chain boilers with fluidized bed boilers	New technology/ equipment		▪ Data not available at time of writing	▪ One boiler has been replaced until now
H&P Department/ Insulation and leak repair of steam pipelines *(see case study)*	Good housekeeping	▪ Data not available at time of writing	▪ Data not available at time of writing	▪ Implemented ▪ Data not available at time of writing.
H&P Department/ Replacement of glue sphere with screw cordonnier system in steam turbine condenser *(see case*	New technology/ equipment	▪ Investment: US$ 62,000 ▪ Cost savings: US$ 101,032 /yr ▪ Payback period:	▪ Coal savings: 2,240 t/yr ▪ Electricity savings: 42,000 kWh/yr ▪ GHG emission	▪ Identified before GERIAP project but investigated and implemented during GERIAP



FOCUS AREA/ OPTION	CP TECHNIQUE	FINANCIAL FEASIBILITY	ENVIRONMENTAL BENEFITS	COMMENTS
study)		7 months	reduction: CO_2 3,710 t/yr ▪ Other emission reductions: SO_2, NO_x, CO, PM_{10}	project
Water gas department/ Revised procedure to screen coal feeding to ensure homogeneous combustion *(see case study)*	New technology/ equipment	▪ Data not available at time of writing	▪ Data not available at time of writing	▪ Implemented ▪ Investment was needed for machines to make coal briquettes
Water gas department/ Heat recovery from blown gas and relaxed gas at water gas production *(see case study)*	New technology/ equipment	▪ Investment: US$ 624,000 ▪ Annual cost savings: US$ 1,225,033 ▪ Payback period: 6 months	▪ Coal reduction: 33,643 t/yr ▪ GHG emission reduction: 51,137 tons CO_2/yr ▪ Other emission reduction: SO_2, NO_x, CO, PM_{10}	▪ Identified before GERIAP project but investigated and implemented during GERIAP project
H&P Department/ Changing water membrane dust catcher into electricity dust catcher	New technology/ equipment	▪ Investment: US$ 362,000 ▪ Cost savings: US$ 12,000 /yr ▪ Payback period: 1.2 yr	▪ Reduction of dust by about 70,000 tons	▪ Not implemented because no market for dust in company's vicinity

FOR MORE INFORMATION

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