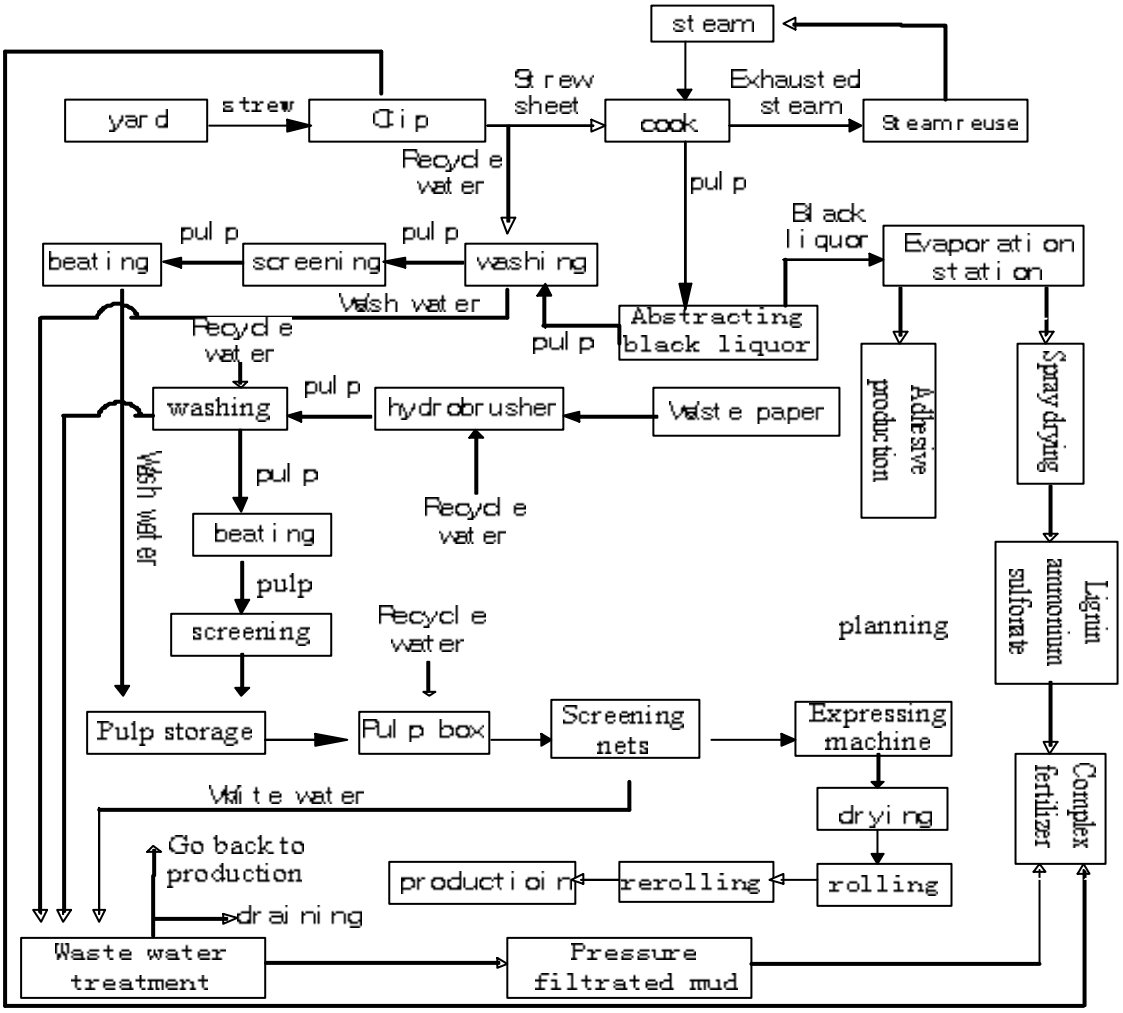
ANHUI TIANDU PAPER COMPANY LIMITED

COMPANY DESCRIPTION

Anhui Tiandu Paper Co. Ltd. is a jointly owned paper company located in the Liushipu Industrial Development Area, Anhui Province, China. It was established in March 1988 and presently has 1160 staff. The installed capacity is 50,000 tons/year but the unit is being expanded to reach a production capacity of 200,000 tons/year. The company's products are mostly sold in the domestic market as industrial paper. The company management was keen to participate in the project because they wanted to learn how to continuously improve energy efficiency and to avoid negative environmental impacts.

PROCESS DESCRIPTION

Figure 1 gives a schematic overview of the production process.



A brief description of the production process is as follows:

- Pretreated straw, and ammonium and ammonium acid carbonate, which are added as a buffering agent, are put into digesters, together with high-pressure steam.
- The mixture is continuously cooked for 2-3 hours and then blown to the blow tanks under high pressure.
- Most of the strong black liquor is separated by a double-screw squeezer, and then transformed into adhesives through the evaporation method.
- Part of the remaining liquor is reused to cook and burn after being mixed with coal.
- Refined pulp is treated from unwashed pulp through screening, washing, and removing residue and dust steps.
- After washing, cleaning, beating and charging processes, the refined pulp is transferred to forming and pressing machines to finally produce paper.

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 1a – Meeting with top management***

The external facilitators went through the Energy Management Matrix with top management to find out what the company is already doing to manage energy consumption. It was found that top management places an emphasis on staff training. The company has a training programme that trains staff in their vocation (e.g. electrical engineering), on new technologies before they are implemented (e.g. cogeneration), and operation of the plant (e.g. energy efficiency galls under this). Experts from universities and research institutes are invited to give training sessions on operation of the plant, which all cadre men are required to attend, but other interested staff can attend also, followed by an examination to test new knowledge and skills. For example, in August 2004, three teachers from Tianjin Science and Technology University gave 1.5-hour training sessions after work hours for six weeks to plant staff about papermaking techniques, equipments and technology development in China and around the world.

Lesson learnt: Existing training programmes can be useful to deliver training on energy efficiency, rather than establishing a separate energy efficiency training programme.

- ***Task 2e – Material and energy balance***

Because water and material use has such an impact on the energy consumption, the Team established a material balance and water balance. For example, when materials are lost in the production process, then all energy to produce the interim product of paper making has been wasted. Similarly, for example, if steam is lost through blow down that is not recovered, then the energy to generate steam has also been lost.

Lesson learnt: Establishing a material and water balance can be useful in identifying energy losses also.

- ***Task 3a – Technical, economic and environmental feasibility analysis***

The company lacked electricity and also needed a new boiler so considered has installed a cogeneration system that combines heat and power generation. This requires and investment of 17 million CNY (approximately US$ 2 million) with annual savings of 4.947 million CNY (approximately US$ 0.6 million). The simple payback period is not enough to know if this option is financially feasible because with such a large amount of money you must take into how much

this money is worth in the future (i.e. you can do less with 17 million CNY in one year from now) because it may be better to invest it in something else with a better return on investment. The Net Present Value (NPV) was therefore calculated for this option as follows:

$$NPV = \sum_{j=1}^{n} \frac{F}{(1+i)^{j}} - I$$

Where, F = increased annual cash flows; I = total investment; i = annual interest rate (%), choosing 6%; j = year, equal to 1 -10; n = life of project (in years), choosing 10 years.

NPV = 4.947 X 7.36 – 17 = 19.41

Because the NPV is positive, the project is profitable.

Lesson learnt: When an option requires high investment then the Net Present Value should be calculated in addition to the payback period to determine financial feasibility of the option.

- ***Task 4a – Technical, economic and environmental feasibility analysis***

Local and regional pollution is become a more important issue and the Chinese Government's policies to reduce pollution levels are getting more strict. For this reason the environmental feasibility analysis of options also included the calculation of reductions in SO_2, NO_x, CO and particulate matter (PM) emissions in addition to greenhouse gas emissions (CO_2). For example, the cogeneration plant's implementation would result in the following emission reductions:

Pollutant	CO_2	SO_2	NO_x	CO	PM_{10}
Reduced amount (tons)	15,057	1.10	54.03	2.25	59.44

- ***Task 5 – Continuous improvement***

The company has a quality and environmental management system certified to the ISO standards, which provides the framework for continued energy efficiency improvement. In China the Government plays an important role in the attention companies to environmental issues including energy efficiency. This plant receives support from the National Development and Reform Commission (NDRC) and State Environmental Protection Administration (SEPA) to continue with Cleaner Production and energy efficiency as part of the Governments "circular economy" policy.

OPTIONS

- The focus areas were the Power Department and Pulp Production Department.
- In total nine options were investigated. Four options have been implemented and five options will be implemented after the new production line is completed.
- Of the four options implemented, only for one were the investment costs and financial and environmental savings quantified.
- The cogeneration (CHP) system is partly implemented. If the results of this option are combined with the fully implementation of heat recovery from blow down option, then:
  - Total investment cost US$ 2,097,364. Each year, US$ 649,697 is saved and the payback period for the investment was 3.2 years.
  - Each year, 14928 tons of coal would be reduced and # tons of CO_2.This represents a 5.2% greenhouse gas emission reduction compared with the 2003 baseline for the entire plant (approximately 434,000 tons CO2.)

Table: EXAMPLES OF OPTIONS IMPLEMENTED

FOCUS AREA/ OPTION	CP TECHNIQUE	FINANCIAL FEASIBILITY	ENVIRONMENTAL BENEFITS	COMMENTS
Pulp Production Department/ Heat recovery from blow down at pulp digesters *(see case study)*	New technology/ equipment	▪ Investment: US$ 36,364 ▪ Cost savings: US$ 49,697/yr ▪ Payback period: 9 months	▪ Coal savings: 5022 tons/yr ▪ GHG emission reduction: 7634 tons/yr ▪ SO_2: 559 tons ▪ NOx: 27 tons ▪ CO: 1 ton ▪ PM_{10}: 30 ton	Implemented
Power Department/ Insulation and leak repair of steam pipelines *(see case study)*	Good housekeeping	▪ Investment: Low	▪ Coal savings: not provided ▪ GHG emission reduction: not provided	Implemented
Production Department/ Increase cooking capacity and efficiency by improving straw feed *(see case study)*	Good housekeeping	▪ Investment: Low	▪ Energy savings: not provided	Implemented
Production Department/ Segment steam supply for paper making process and increasing drain valves	New technology/ Equipment	▪ Investment: Low	▪ Water savings: not provided	Implemented
Power Department/ Replace several small boilers with one large boiler to improve energy efficiency *(see case study)*	New technology/ equipment	▪ Investment: US$ 450,000 ▪ Cost savings: not provided ▪ Payback period: not provided	▪ Coal savings: not provided ▪ GHG and other emission reductions ▪ Water savings	Boiler was purchased and will be used after the new product line is complete
Power Department/ Installation of cogeneration to provide combined heat and power *(see case study)*	New technology/ equipment	▪ Investment: US$ 2,061,000 ▪ Cost savings: US$ 600,000 ▪ Payback period: 3.4 year	▪ Coal savings: 9906 t/yr ▪ GHG emission reduction: 15,057 tCO2 ▪ SO_2: 1 ton ▪ NOx: 54 tons ▪ CO: 2 ton ▪ PM_{10}: 59 tons	Partially implemented. Full implementation after the new product line is complete

FOCUS AREA/ OPTION	CP TECHNIQUE	FINANCIAL FEASIBILITY	ENVIRONMENTAL BENEFITS	COMMENTS
Production department/ Pre-soaking of straw before feeding into digester *(see case study)*	Production process/ equipment modification	▪ Investment: Low	▪ Coal and electricity savings: not provided	To be implemented after the new product line is complete
Production department/ Reducing liquor/solid ratio in the digester	Production process/ equipment modification	▪ Investment: Low	▪ Coal savings: not provided	
Production department/ Three-stage abstraction	Production process/ equipment modification	▪ Investment: Low	▪ Coal and electricity savings: not provided	

FOR MORE INFORMATION

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