SHIJIAZHUANG IRON & STEEL COMPANY LIMITED

COMPANY DESCRIPTION

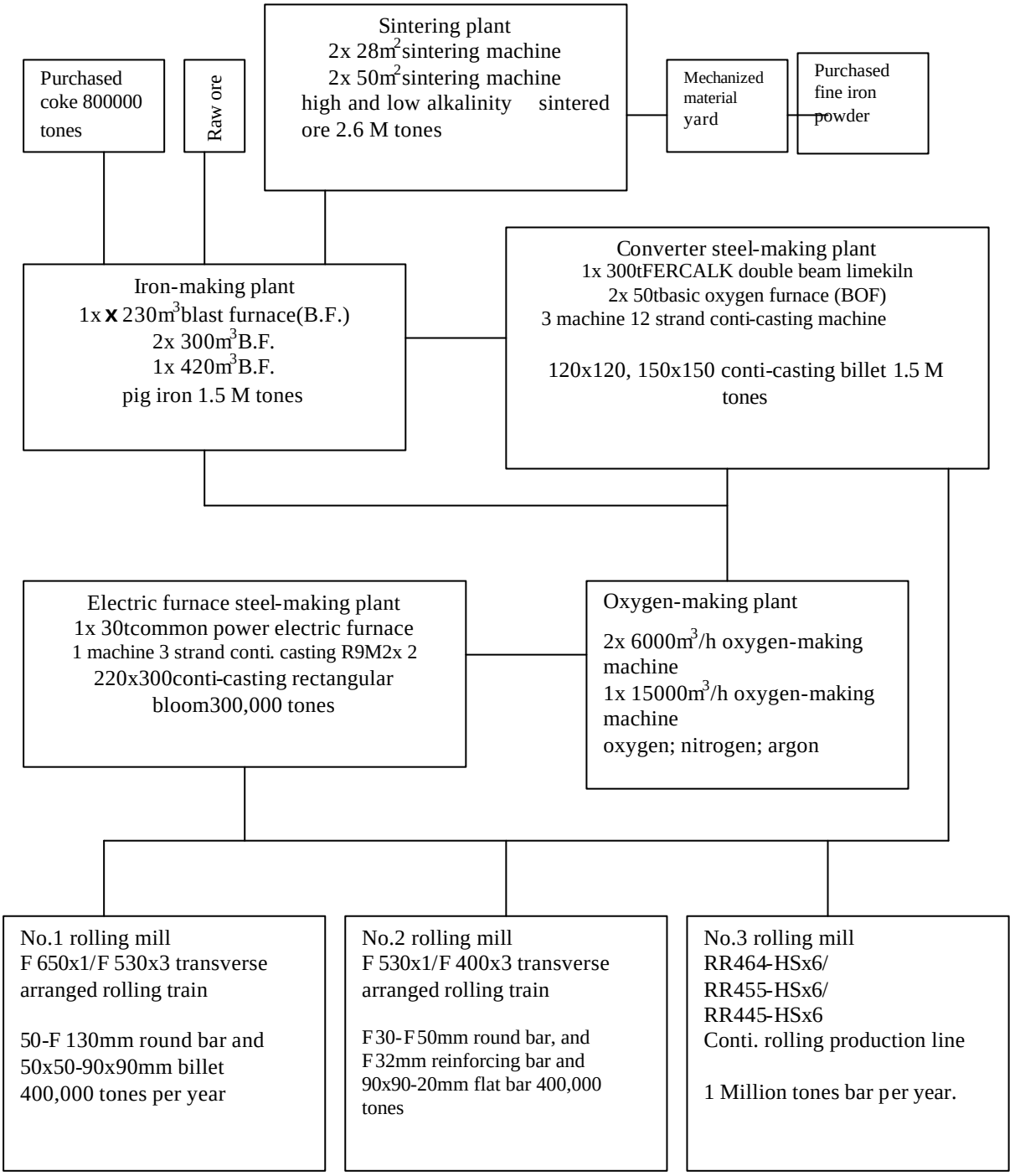
Shijiazhuang Iron & Steel Co., Ltd. (hereafter referred to as *Shigang*) is located in Shijiazhuang city, the capital of Hebei province in China. It is a large state-owned enterprise, producing high-quality carbon structural round steel, with 8300 employees. Shigang had been changed into an enterprise for producing automobile steel from an enterprise producing normal steel. Built in 1957, Shigang is now capable of producing 2.6 million tons of steel per year, and the annual output is about 2 million tons. The company's products are mainly sold to domestic market, and the annual sale is nearly US$ 800 million. Shigang attached high importance to the GERIAP project, because they wanted to improve the company's capability in cleaner production and thus, bring down the production costs and avoid negative environmental impacts.

PROCESS DESCRIPTION

Presently, Shigang integrates its plants of sintering, iron-making, steel-making and steel-rolling and mini-mills of EAF (electric arc furnace) and steel-rolling. The production process includes:

- ***Raw material purchasing:*** All raw materials are purchased from the domestic and international markets, including domestically-made fine iron powder, imported ore, domestically-made coke, low sulphur coal etc. The iron ore or iron dreg is piled up and covered to reduce dust.
- ***Sintering***: There are four sintering machines, the sintered ore is used by blast furnaces. High-efficiency electronic dust removers are installed to reduce dust. Blast furnace coal gas is used for ignition to save energy.
- ***Iron-making:*** There are four blast furnaces, and the annual pig iron output is 1.7 million tons. All molten iron is used for steel-making. A bag filter is installed in the blast furnaces to collect dust. All the coal gas from blast furnaces is reclaimed to improve energy efficiency.
- ***Steel-making:*** There are two converters and one electronic furnace in this production process, and the annual steel output is 2.07 million tons. The main products include high-quality carbon structure steel, alloy structure steel, gear steel, spring steel and bearing steel. Coal gas collecting equipments, converter furnace gases hood for vaporization cooling system are installed in the converter to save energy. The dust is collected by a bag filter.
- ***Steel-rolling:*** There are four production lines. The 3rd steel rolling mill has a continuous bar rolling production line with a capacity of 600 thousand tons, and the main products are steel bar and wire. The technologies of surplus heat reclamation and combustion-supporting through waste smoke preheating is adopted in the steeling rolling process, which saves energy.

The production process is shown below:



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***

Environmental and energy issues are dealt with by different departments. Energy is managed by the Engineering & Equipment Department where an Energy Control Manager has been appointed for each department (iron plant, steel plant, each of the three rolling mills, power

plant, oxygen plant, and the remaining sections). Environmental issues are the responsibility of the Safety and Cleaner Production Department. To ensure that the perspectives from both departments would be considered during the assessment, both departments were represented in the Team.

Lesson learnt: When environmental and energy issues are the responsibility of different department in a company then it is important to include representatives from both departments in the Team to ensure that the environmental and the cost/production aspects of energy are covered during the assessment.

- ***Task 1d – Select focus areas***

This steel plant is located in the city of Shijiazhuang. As the city is expanding, the plant has to consider the residents living around the plant and take initiatives to reduce resources that are also in demand from the growing population. This particularly applies to ground water, as ground water levels in the city's aquifer are reported to have lowered from minus 30 meters to minus 70 meters in the last 20 years! Because the plant is a large consumer (600,000 m3/month) and ground water costs 1.5 rmb/m^3 compared to 3 rmb/m^3 for municipal water, the company wishes to continue to use ground water but try and reduce water consumption at the same time. Water consumption was therefore an important selection criteria for focus areas, and cooling towers were selected as a focus area as they consume a lot of energy and water.

Lesson learnt: Other resources than energy, such as water, can be important when selecting focus areas, especially when these are expensive, when there is a shortage or when it is a priority in Government's policies.

- ***Task 2d – Technical, economic and environmental evaluation of options***

The company decided to install a cogeneration system but as this is expensive it is difficult to secure the required investment capital. As a solution the company has planned its installation over a three year period so that the costs can be spread over three financial budgets. In addition, the company was interested in finding out about ESCOs (energy service companies) in China, which could assist in lending the company part of the required capital in return of a percentage of the profits.

Lesson learnt: When obtaining the financial capital for expensive options is a barrier it may be possible to spread the option's implementation over a number of years. Another option is to seek assistance from ESCOs which have been established in several Asian countries to provide the investment costs for energy projects in return for a percentage of the savings for a number of years.

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

The company will continue with Cleaner Production and energy efficiency amongst others through its energy management system, by establishing energy consumption indicators for each production department, and by giving rewards and punishments to staff for energy saving and energy wasting activities. It is interesting to note that the company has a Safety and Cleaner Production department, to show to staff that Cleaner Production is a priority for the company.

Lesson learnt: by including the Cleaner Production and/or Energy Efficiency in the name of a department, staff will be more aware that the company considers this a priority.

OPTIONS

- The focus areas selected for the project were (1) converter; (2) cooling tower.
- The Team identified a total of nine options for energy-saving and waste minimization, among which eight options were implemented. Brief information about the options is in the table below.
- The total investment on the already implemented projects was 9.75 million RMB (about US$ 1.17 million). And the annual saving was 11.48 million RMB about US$1.39 million. The combined payback period was 10 months
- The implemented projects c reduce 2711 tons of CO_2 per year (0.3% of the plant's total), In addition, nitrogen consumption is reduced by 3.7 million m^3/year, oxygen consumption by 0.677 million m^3/year and electricity by 35 million kWh/year. Water, which is the most important environmental problem in Shijuazhuang city, was reduced by 650,000 m^3 per year.

Table: EXAMPLES OF OPTIONS IMPLEMENTED AND INVESTIGATED

FOCUS AREA/ OPTION	CP TECHNIQUE	FINANCIAL FEASIBILITY	ENVIRONMENTAL BENEFITS	COMMENTS
Converter furnaces / Installation of gas hoods on converter furnace to recover heat *(see case study)*	New technology/ equipment	▪ Investment: US$ 720000 ▪ Cost savings: US$ 900000/yr ▪ Payback period: 10 months	▪ Steam savings: 148000 t/yr ▪ Coal savings: not provided ▪ GHG emission reductions: not provided ▪ Water savings	Implemented
Converter furnaces / Nitrogen flow meters, leak survey and repair *(see case study)*	Good housekeeping	▪ Investment: very low ▪ Cost savings: US$150000/yr ▪ Payback period: almost immediate	▪ Electricity savings: 150000 kWh/yr ▪ GHG emission reduction: 115 tCO2/yr ▪ Nitrogen savings: 3.7 million m^3	The overhaul was done in June 2004. These data are estimates based on July 2004 data
Converter furnaces /Oxygen flow meters, leak survey and repair	Good housekeeping	▪ Investment: very ▪ Cost savings: US$ 35000 ▪ Payback period: almost immediate	▪ Electricity savings: 600000 kWh/yr ▪ GHG emission reduction: 470 tCO2/yr ▪ Oxygen reduction: 677000 m^3/yr	The overhaul was done in June 2004. These data are estimates based on July 2004 data
Converter furnaces / Compressed air leak survey and repair	Good housekeeping	▪ Investment: low/no cost ▪ Payback period: immediate	▪ Reduction of compressed air leaks ▪ Reduction of consumption of energy.	Implemented but results not quantified
Cooling tower fan / Revised procedure to turn roof deck fan off in winter when it is not needed *(see*	Good housekeeping	▪ Investment: none ▪ Cost savings: US$ 160000 ▪ Payback period: immediate	▪ Electricity savings: 2.75 million kWh/yr ▪ GHG emission reduction: 2126 t/yr	Implemented and applicable to about 30 fans

FOCUS AREA/ OPTION	CP TECHNIQUE	FINANCIAL FEASIBILITY	ENVIRONMENTAL BENEFITS	COMMENTS
case study)				
Cooling tower / Repair of biocide dosing injection pump at cooling tower *(see case study)*	Good housekeeping	▪ Investment: none		Implemented Reduced algae growth
Cooling tower / Increase concentration of cycles to improve cooling tower efficiency	New technology/ equipment			Not implemented An increase of the concentration cycle of 1.5 to 2.5 was possible but to the proposed 4.5 – 5.5 was not technically feasible
Water system pipeline / Water conservation and recycling *(see case study)*	New technology/ equipment	▪ Investment: US$ 450000 ▪ Cost savings: US$ 300000/yr ▪ Payback period: 1.5 yr	▪ Water savings: more than 650000 m^3/yr ▪ Indirect reduction in water pollution ▪ Energy savings and GHG emission reductions: not quantified	The company's *Zero Discharge of Water* project continues to exist

FOR MORE INFORMATION

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