G-STEEL PUBLIC COMPANY LIMITED

Overall Yield Improvement at Continuous Casting Machine (CCM) Process Area

SUMMARY OF THE OPTION

G-STEEL Public Company Limited is a manufacturer of approximately 1.8 million Hot Rolled Coils (HRC) per year and located in the Rayong province in Thailand.

A high yield is important for G-STEEL to remain competitive. The assessment showed that yield losses were high, especially at the Continuous Casting Machine (CCM). Yields at the CCM were improved by 2.4% in two steps:

- The improvement of operational practices that requires no investment, such as the calibration of weighing systems, scrap material preparation and practices, etc.
- The installation of a slag detector, which brought the yield close to benchmark figures of 88-89% yield.

The implementation of these options required a one-off US$ 200,000 investment but the company will obtain an annual savings of US$ 11,520,000 through 5.76 MWh electricity reduction per year. Consequently, the payback period is less than one week. In addition, 3.6 tons of CO_2 emissions will be reduced each year.

KEY WORDS

Iron and Steel, Thailand, Furnaces and Refractories

OBSERVATIONS

The steel making industry requires high yields to remain competitive. The company's Team observed that huge losses from various processes undermine the total amount of HRC produced.

The following areas were investigated to assess the amount of yields losses at G-Steel:

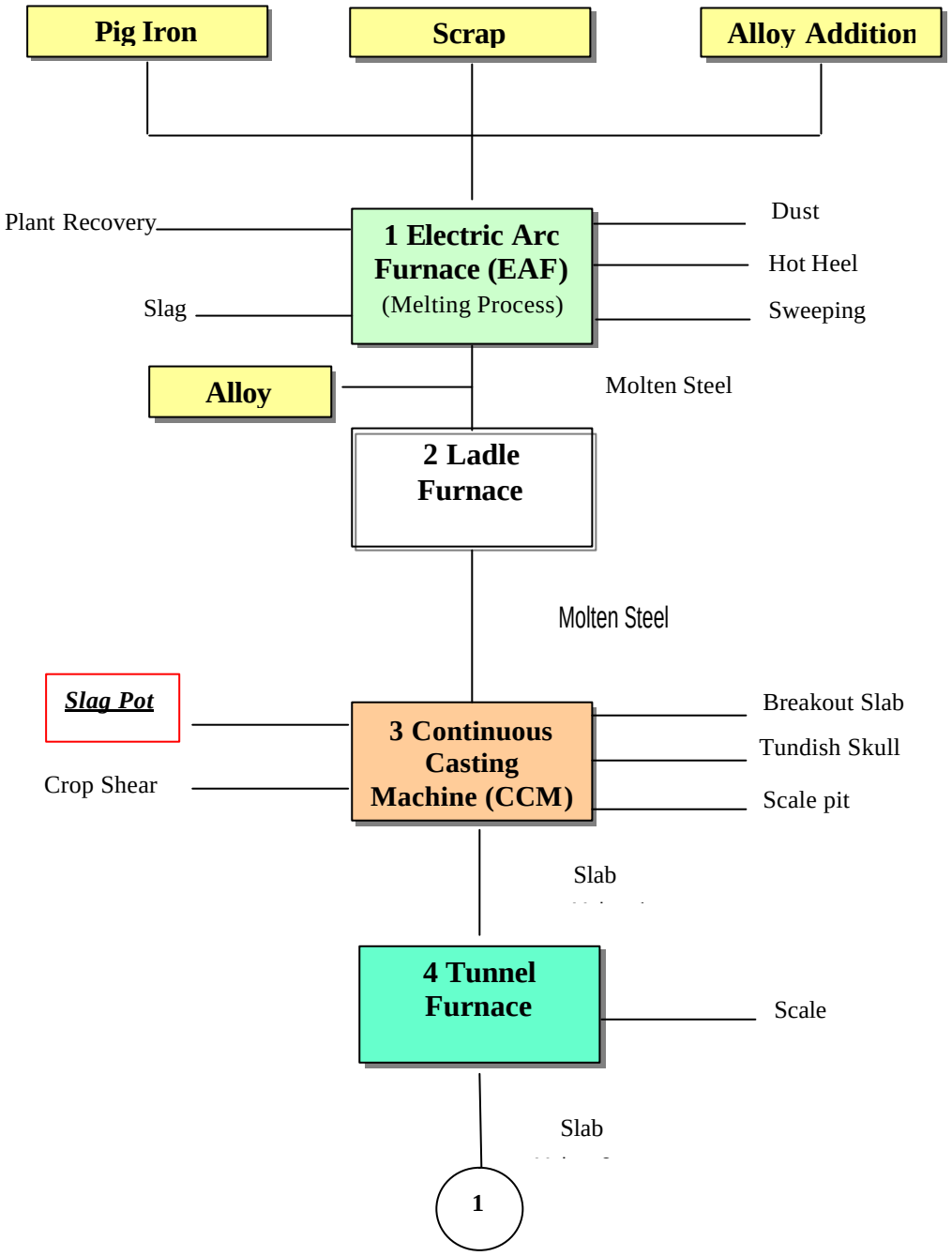
1. Weighing System
2. Scrap Material
3. Operation and Practices

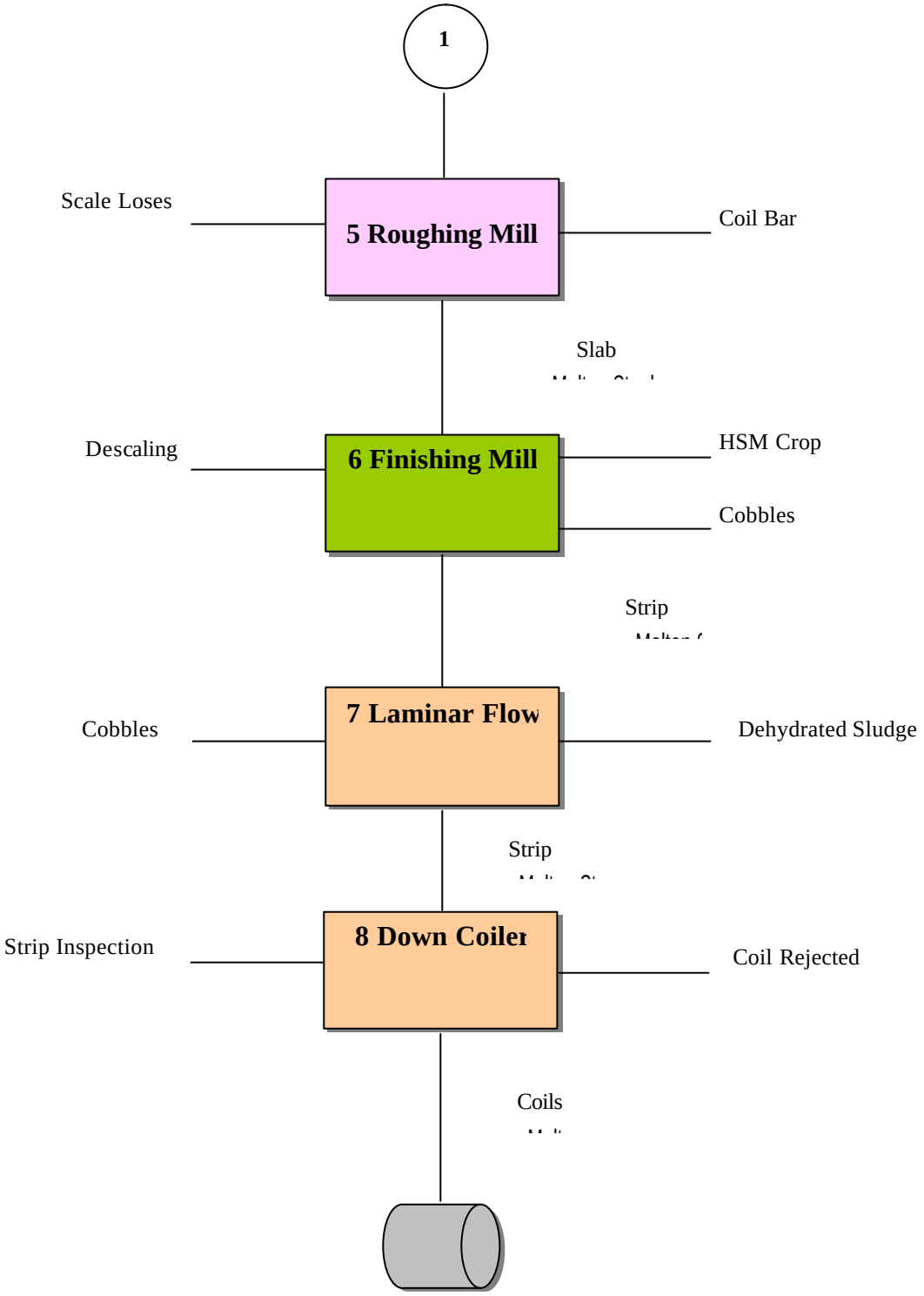
Two areas where investigated in detail because yield losses were high:

1. Meltshop Process Area (Electric Arc Furnace)
2. Continuous Casting Machine (CCM) Process Area

Figure 1 illustrates yield losses from each production process step. G-Steel's Team found that the remaining liquid steel in the ladle or slag pot (located in the CCM process area) had the biggest impact on the total yield loss.

Figure 1: Yield Loss Break down Structure




1
Scale Loses
5 Roughing Mill
Coil Bar
Slab
Descaling
6 Finishing Mill
HSM Crop
Cobbles
Strip
Cobbles
7 Laminar Flow
Dehydrated Sludge
Strip
Strip Inspection
8 Down Coiler
Coil Rejected
Coils

OPTIONS

The company's Team identified three levels for improving the yields, depending on which improvement measures would be implemented:

1. Improvement at level of 85 %
   - EAF Yield = 91 %
   - CCM Yield = 95 %
   - HSM Yield = 98.5 %
2. Improvement at level of 87 %
   - EAF Yield = 92 %
   - CCM Yield = 97 %
   - HSM Yield = 98.5 %
3. Improvement at level of 88 – 89 %
   - EAF Yield = 92.5 %
   - CCM Yield = 98 %
   - HSM Yield = 98.5 %

To achieve this, the following action plan was recommended:

- FeO: adding carbon to reduce the composition of slag during foaming, and adjust the carbon injection flow rate. An analysis showed that the yield at the EAF can be increased by 1 or 1.5%.
- MgO: the analysis showed that the MgO % in the slag has an influence on the FeO % in slag.
- FeMn: to increase the EAF yield and maintain Al2O3, FeMn must also be used in order to increase the yield with 1~ 1.5 %.
- Alu-Mix: to kill the FeO in the slag, Alu-mix can be used to increase the Al2O3 in slag from 4% to 8%.
- Installation of a Slag Detector
- Scrap Recipe: this was assessed in detail, and the expected yield improvement is 2 %.

Because the biggest improvement potential was at the Continuous Casting Machine (CCM), the first phase in 2005 focused on improving yields in this area, which was done in two steps:

- Improvement of operational practices that requires no investment cost but can result in savings, e.g. calibration of weighing systems, scrap material preparation and practices, etc.
- Installation of a slag detector, which brought the yield close to benchmark figures of 88-89% yield.

RESULTS

Financial benefits

- Investment: US$ 200,000, which included:
  - Engineering
  - Sensors for all Ladles
  - Refractory Modification
  - Control / Detector system (i.e. microprocessors, servers, monitors, panels, etc.)
- Annual operating costs: not provided
- Annual cost savings: US$ 11,520,000 (28,800 X 400)
- Payback period: one week (200,000/11,520,000)
- Annual yields improvement: 28,800 tons (1,200,000 X 2.4%), based on the following data:
  - Percentage of yields before implementation: 81.4%
  - Percentage of yields after implementation: 83.8%
  - Percentage of yields improvement: 2.4 % (83.8 – 81.4)
  - Monthly yields: 100,000 ton/month
  - Annual yields: 1,200,000 ton/year (100,000 X 12)

Environmental benefits

- Annual electricity reduction: 5.76 MWh
- Annual GHG emission reduction: 3.6 ton CO_2 (5.76 MWh X 0.618 ton CO_2/MWh)

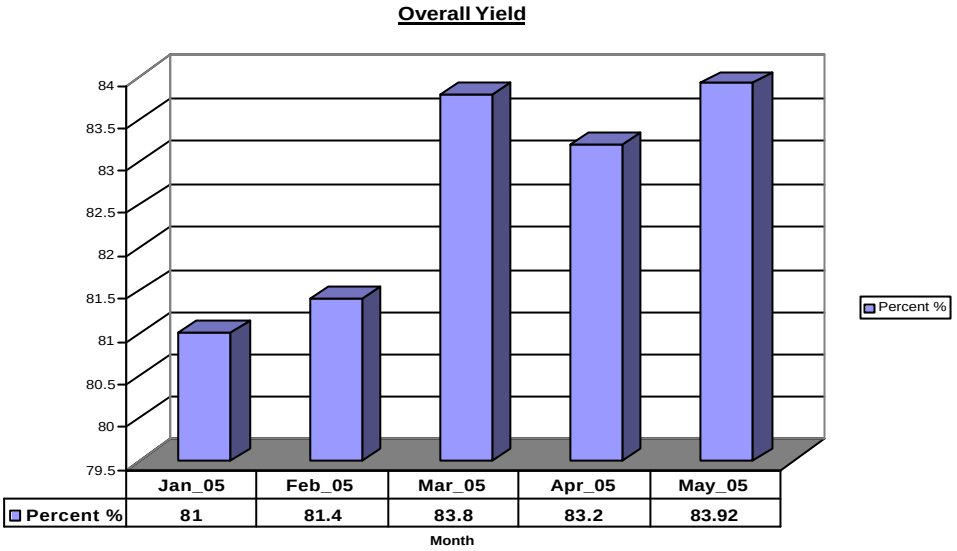


Figure 2: Yield Improvement between January and May 2005

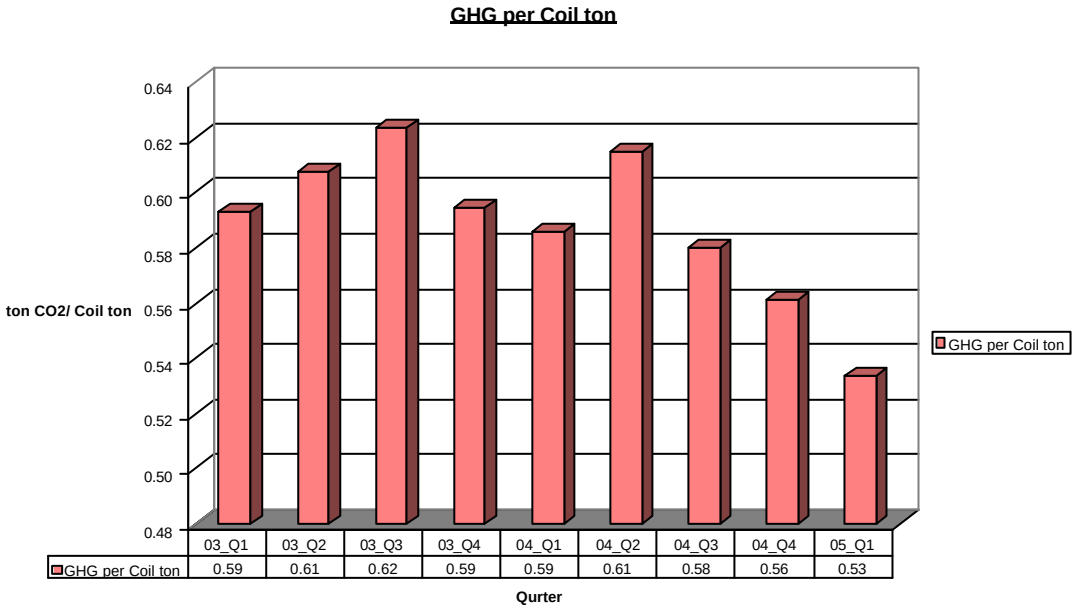


Figure 3: CO_2 emission reduction resulting from yield improvement

FOR MORE INFORMATION

GERIAP National Focal Point for Thailand
Ms. Peesamai Jenvanitpanjakul
Director of Environmental, Ecological and Energy Department
Thailand Institute of Scientific and Technological Research
196 Phahonyothin Rd., Chatuchak, Bangkok 10900, Thailand
Tel: + 66 2 5791121-30 ext. 2102
Fax: + 66 2 5796517
E-mail: peesamai@tistr.or.th
Website: www.tistr.or.th

GERIAP Company in Thailand
Mr. Thongporn Kanokpranatut
Senior Department Manager, Government Liaison
G-Steel Public Company Limited
SSP Tower 3, 18th floor,
88 Silom Road, Suriyawong,
Bangrak, Bangkok 10500, Thailand.
Tel: + 66 2 6342222 ext. 1131
Fax: + 66 2 6343839
Mobile: 0-1908-4033
E-mail: thongpornk@g-steel.com
Website: www.g-steel.com