



## **CEYLON HEAVY INDUSTRIES AND CONSTRUCTION CO. LTD (CHICO)**

### **Replacement of oil burner nozzles and recuperator tubes at furnace to reduce heat loss**

#### **SUMMARY OF THE OPTION**

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CHICO is the largest steel rolling mill in Sri Lanka, located at Oruwala, in the Colombo district of Sri Lanka. The Team found that burner nozzles at the furnace were worn and oversized and that the recuperator was ineffective in its recovery of waste heat from exhaust gases. Nozzles were replaced (US\$ 5820) and a new recuperator was installed (US\$ 51,300). Savings included 150,000 liters of fuel oil worth US\$ 30,000 in 2004 (achieved in combination with improving fuel oil quality – see other case study option) and equating to 416 tons CO<sub>2</sub> per year. In 2005, the company managed to bring down the specific fuel consumption even further. In addition, the new recuperator lasts three years instead of one year for the previous recuperator, and therefore a further US\$ 34,000 is saved annually. The payback period for these options is therefore less than one year.

#### **KEYWORDS**

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Iron and Steel, Sri Lanka, Fuels and combustion, Furnaces and Refractories, Burner nozzles, Recuperator, Heat loss

#### **OBSERVATIONS**

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**Ineffective nozzles:** Heat required for the heating of steel billets is obtained by firing furnace oil in a burner. Furnace oil is atomized into combustion chamber through special designed nozzles. Prolonged usage of these nozzles and/or oversized nozzles will clog the nozzle. This results in a release of more fuel oil into the burner chamber, atomization of only part of the oil, reduced combustion efficiency and therefore increased oil consumption. Poor quality and oversized nozzles were both observed at CHICO.

**Ineffective recuperator:** CHICO's furnace exhaust line is equipped with a recuperator to recover certain amount of waste heat in exhaust gasses from the furnace. The Team found that the recuperator was not working properly. The following causes were identified:

- Air infiltration in the exhaust line (prior to the recuperator) due to the damaged pipes and therefore a substantial amount of heat is lost in the system. This was measured by comparing oxygen levels in the exhaust lines before and after the recuperator
- The recuperator efficiency was further reduced due to sedimentation of hard inorganic material in the recuperator elements or tubes, which hinders heat dissipation through the pipe walls.

#### **OPTIONS**

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For the ineffective burner nozzles it was recommended to:

- Replace the nozzles with standard size nozzles
- Install high efficiency burners



The only feasible option was the replacement of nozzles, which was accepted by the plant's management and implemented. Combustion inside the furnace improved and therefore oil consumption was reduced.

The following options were proposed to improve the recuperator heat recovery efficiency:

- Repairing the existing recuperator
- Installing an additional recuperator
- Replace the existing damaged recuperator

The GERIAP Team recommended replacement of the recuperator. With the new tubes in the recuperator, air infiltration in the exhaust line was totally eliminated. Heat recovery from the exhaust line was improved and thus substantial fuel saving was recorded.

## **RESULTS**

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### **Financial benefits**

- Investment: US\$ 57,120, calculated as follows:
  - Recuperator: US\$ 51,300
  - Burner nozzles: US\$ 5,820
- Annual operating costs: not determined
- Annual cost savings
  - Fuel oil savings: US\$ 30,000 (150,000 liters/year X US\$ 0.2 per liter of fuel oil). *Note: these savings are in combination with the oil quality improvement option*
  - Fuel oil savings in 2004 (measured in first quarter 2005): US\$ 6,843 (based on additional improvement of 1.46 liter/ton product achieved during 2004)
  - Annual savings due to extended recuperator life time: US\$ 34,200 (US\$ 51,300 per year because of a one year recuperator life time in the old situation, and  $US\$ 51,300 / 3 = US\$ 17,100$  per year because of a three year life time of the new recuperator)
- Payback period: less than one year

### **Environmental benefits**

- Annual fuel oil savings (*note: these savings are in combination with the oil quality improvement option*): 150,000 liters/year, calculated as follows:
  - Specific oil consumption improved from 54.8 liters/ton product in 2003 to 52.8 liters/ton product in 2004
  - Annual fuel oil savings: 75,000 tons product X 2 liters/ton product = 150,000 liters/year
- Further fuel oil savings in 2004 measured during first quarter of 2005 = 2.54% (1.46 liter/ton of production) compared to the 2003 figures during the first quarter of 2005.
- Annual GHG emission reduction (*note: these savings are in combination with the oil quality improvement option*): 416 tons CO<sub>2</sub>/year

Fuel oil and GHG reductions were calculated as follows (*note: these savings are in combination with the oil quality improvement option*):

- Baseline 2003 (Sep 2002 – Aug 2003) fuel oil consumption: 60,000 tons product X 54.8 liter/ton product = 3,288,000 liters/year
- Recorded fuel oil savings due to options implementation: 2 liters/ton product
- 2004 fuel oil consumption: 75,000 tons product X 52.8 liters/ton product = 3,960,000 liters/year
- GHG emission reductions in 2004 compared to 2003:
  - Absolute: 672,000 liters fuel oil increase X 0.9 X 3.08 / 1000 = 1862 tons CO<sub>2</sub> increase (because higher production)
  - Compared to business as usual: 75,000 tons product in 2004 X 2 liters/ton product reduction = 150,000 liters/year.  $150,000 \text{ liters} * 0.9 * 3.08 / 1000 = 415.8$  tons CO<sub>2</sub> reduction



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### **Other benefits**

- Less staff time involved with removing billets from rolling line
- Improved product quality
- Overall productivity improvement and hence increase in annual production: 15,000 tons/year (2004 compared with 2003). (*Note: this improvement is for all options implemented at CHICO combined*)

### **FOR MORE INFORMATION**

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#### ***GERIAP National Focal Point of Sri Lanka***

Mr. Nihal Cooray  
Manager, Small and Medium Enterprise Developers (SMED)  
Level 4, No. 53, Vauxhall Lane  
Colombo 02, Sri Lanka  
Tel: +94 1 304287, Fax: +94 1 304291  
E-mail: [projsmmed@slt.lk](mailto:projsmmed@slt.lk); [geriapsl@slt.net.lk](mailto:geriapsl@slt.net.lk)



#### ***GERIAP Company Sri Lanka***

Ceylon Heavy Industries and Construction Co.Ltd (CHICO)  
Mr. K S W Sirisena  
Factory Maintenance Manager  
CHICO Limited  
Oruwala, Athurugiriya, Sri Lanka

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