Technology Fact Sheet

Regenerative burner combustion system (RBCS)[i]

1) Introduction

The high-performance industrial furnace contract for one of the steel industry in Indonesia, awarded to and executed by PMD as a New Energy & Industrial Technology Development Organization (NEDO) model project for increasing the efficient use of energy, was constructed on schedule, commissioned and, after a demonstration operation, inaugurated on May 29, 2006. This Japanese-Indonesian joint project was the first model project of its kind in Indonesia.

The furnace equipment installed by this project efficiently recovers sensible heat of the combustion exhaust gas of the steel-slab reheating furnace, for preheating combustion air. When introduced, this equipment makes it possible to cut natural-gas consumption by about 4.44 million Nm^3 a year (about 4,940 tons in crude-oil equivalent), a major contribution to the effective use of energy. At the same time, this equipment also permits a reduction in green house gas. Specifically, it can reduce carbon-dioxide emissions by about 15,000 tons a year, helping to prevent global warming. The spread of the energy-saving technology adopted for this model project will certainly contribute not only to energy savings, conservation of resources and environmental

2) Feasibility of technology and operational necessities

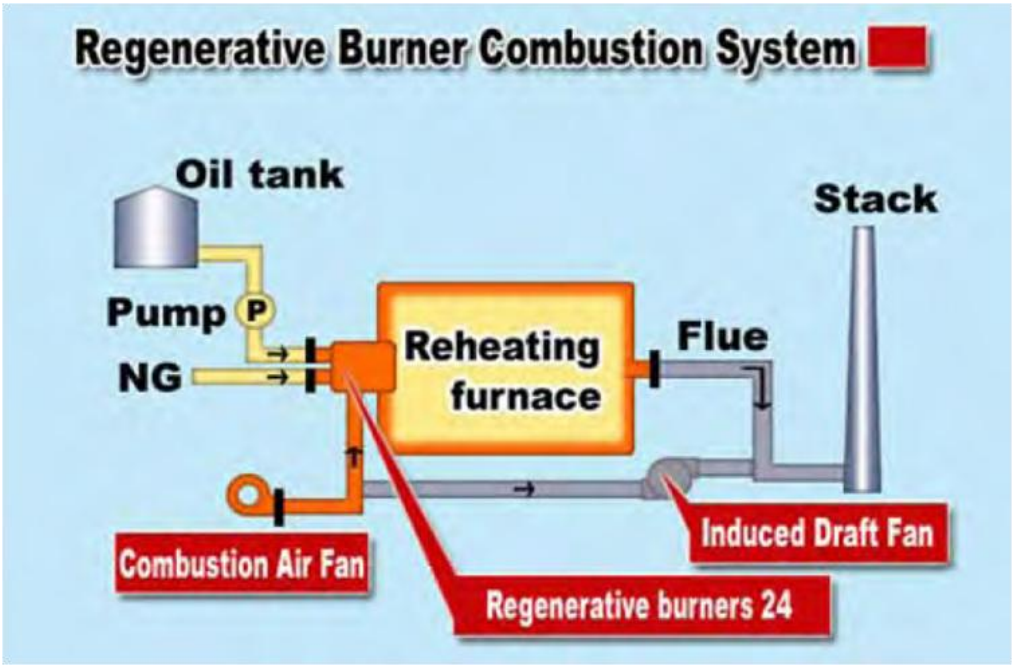
Regenerative burner is a high efficient heat recovery system by recovering waste heat of the furnace exhaust gas to heat-up combustion air at the furnace site by installing heat recovery regenerator. The key technology of RBCS is to set a pair of burner with regenerator at each burner. During combustion, one side of burner combusts fuel where another side of burner accumulates heat of exhaust gas into heat recovering regenerator.

Then combusting burner and its switch accumulated heat from exhaust gas to combust fuel at high temperature combustion air which takes heat out of heat recovering regenerator. The other side of burner accumulates heat of exhaust gas into another heat recovering regenerator, securing stable combustion and high-efficient combustion as well as low NOx.

3) Benefits of the RBCS

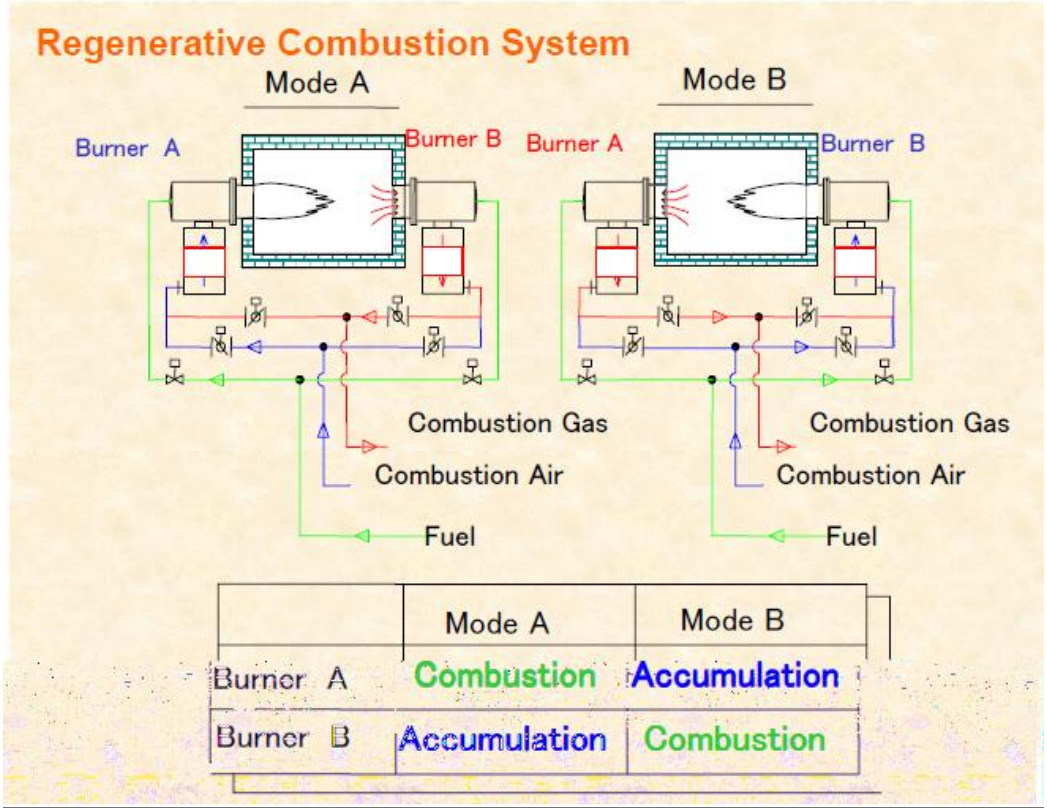
- Energy: approximately 20 to 50% of energy reduction is possible. The reduction range differ according to the types and condition of fuel
- Environment: maximum of 50% of NOx reduction is possible with high temperature combustion. The reduction range differ according to the types of furnace and condition of fuel
- Improve the quality of steel
- Increase the production of steel
- Reduce maintenance costs
- Reduce the production of crack

Figure 1 Regenerative burner combustion system



(Source: Nippon Steel, 2006)

Figure 2 Regenerative combustion system



(Source: Niga T, 2005)

A) Technical Requirements

The technical requirements for the installation of RBCS technology vary greatly depending on the size of the system and kind of technology used. Installation of this technology requires specialized technicians and operation of RBCs arranged computerize technology in the computer room, so it requires training and mentoring over a certain period before the local operators to operate their own equipment in the control room.

B) Legal/Regulatory

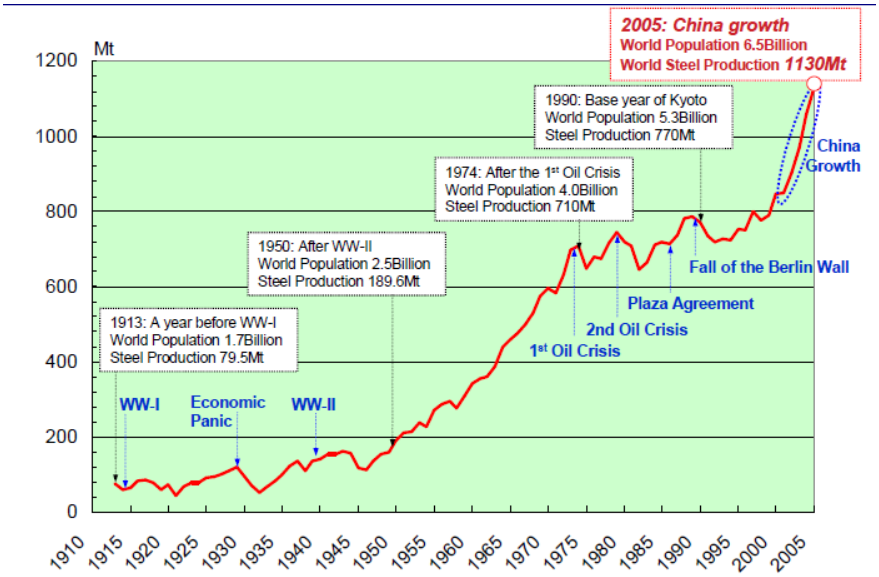
Utilization of RBCs in the related industries is not a constraint because the Indonesian government is trying to conserve energy in various sectors. Even for consumers who consume energy sector over the 6000 TOE per year shall be subject to energy conservation and disincentives if it does not do it. But the rules about disincentives have not been established. However, installation of RBCs in the related industries has to have knowledge and permission of the authorized institution as mentioned by applicable regulations in Indonesia.

4) Status of the technology and its future market potential

RBCs technology developed since the early 1990s in several countries, including in Japan. Today, more than 540 furnaces have used RBCs in Japan and first commercial facility constructed in 1996. The technology is already mature and has been used in several countries.

The need for RBCs technology is expected to continue to increase along with increased world steel demand in 2005 reached about 1200 million tonnes (T. Ono, 2007). The case also for Indonesia, as a developing country, steel demand will continue to increase. In 2010, of 11 million tons of steel consumption, around 8 million tonnes are national product. National steel industrial products will increase as the development of new steel industry in Kalimantan is carried out. This technology is only used in the steel industry, also can be utilized in industries that require a furnace in the production process, such as ceramics industry, automobile, non-ferrous metals, and other sectors.

Figure 3 Trend of world steel production



(Source: Nippon Steel Engineering, 2006)

5) Contribution of the technology to protection of the environment

The eco-friendly regenerative burner heating system emphasizes the highly preheated air combustion technology. This establishes energy savings resulting from the high heat recovery rate and ultimately low NOx emissions. Developing industrial burner that use highly preheated air emphasizes the suppression of NOx emissions generated by oxidation of nitrogen in the air, (thermal NOx). Studied the generation of thermal NOx and found that the generation of thermal NOx is determined by a function of temperature, oxygen concentration, and residence time. Accordingly, achieving low NOx combustion should result from: (1) the suppression of maximum flame temperature, and (2) the prevention of excess amounts of oxygen. The eco-friendly regenerative burner can be applied to any type of heating facility by simply adjusting the number of burners responding to the required heating capacity. Energy savings have reached an average of 30%, accounting for as much as 1212 TJ/y. NOx generation has significantly decreased by an average of 50%.

RBCs technology is a waste heat recovery technology that can be used in various industries that use the furnace in the production process. The use of RBCs in the steel industry technology can save the use of fossil energy, the amount depends upon the type of energy used and the conditions of the combustion chamber. RBCs equipment mounted on steel slab reheating furnace for preheating air for combustion. Based on operating experience in the steel industry RBCs one of the steel industry in Indonesia, then the fuel gas consumption can be reduced by 35% and steel production increased by 15%. Energy consumption to produce 1 kg of steel was 540 kcal, so that for steel production of 300,000 tonnes per year is expected to decline as much as 12,764 tons of CO2 per year.

6) Climate

RBCS technology is very likely to play a significant role in climate change mitigation in the future. As described above it is a rapidly growing market of iron and steel product and the RBCS can also be used in the ceramics industry, and others. It has energy payback periods

ranging from 1.2 years for good to moderate industries and lifecycle GHG emissions sekitar 38 gCO_2e/kwh (fuel use and burner condition).

7) Financial requirements and costs

RBCs are mounted on the steel industry require investment in equipment around 4 jt USD. During the installation of equipment RBCs, the furnace should be discontinued and the cessation of operation of the furnace schedule tailored to the installation schedule. However, during the commissioning of the furnace about 2 months also had to be stopped and resulted in the loss of revenue due to the cessation of production during the commissioning within 2 months of 2.5 jt USD. With the decline in gas consumption of about 35%, steel production increased by 15%, and other benefits, the ROI of the investment and revenue losses during komissioning only about 13 months (K Setiawan, 2011).

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[i] **This fact sheet has been extracted from TNA Report - Mitigation for Indonesia. You can access the complete report from the TNA project website http://tech-action.org/**