

Outlook of Japanese Lime Industry in the Global Stage

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Lime has been around and serving mankind for centuries. Nowadays, total production of lime worldwide reaches around 120 million tons a year, with steel making, and the construction and building industry being the major users of lime products. In recent years, use of lime for environmental purposes, especially in the field of flue-gas treatment, is experiencing a tremendous growth. Limestone is one of the natural resources available abundantly and with high quality in Japan. Consequently, Japan ranks No.3 among the world's producers of lime. Through incorporating various advanced technologies, using recycled fuels, the certification of ISO and trying to keep the CO₂ emission below the level adopted by the Japanese government according to the Kyoto Protocol, Japanese lime manufacturers have made their commitment to up-keeping the world a cleaner place to live in.

Key Words : lime production statistics, Japanese lime industry, Kyoto Protocol, environmental protection

1. INTRODUCTION

It is remarkable to note that the lime, which was being used for paving roads by the ancient Romans, is now being used in highways, runaway aprons, railway tracks, etc. Moreover, the use of lime has been developed into a wide number of fields and applications that it can be regarded as "the most versatile material" of our time. Nowadays, worldwide total production of lime reaches around 120 million tons a year, Ref. [1, 2], with iron & steel making, and the construction & building industry being the major users of lime products, Ref. [3, 4]. Accordingly, higher production of lime relates to stronger and robust economic stature of a nation. Limestone deposits are widely located throughout the world. In Japan, not only there are many limestone deposits scattered all over the country, but also possess the high characteristics, such as less impurity, small grain size, etc., thereby most of the limestone deposits are suitable enough for high quality end uses. Due to this reason, Japan ranks No.3 among the world's producers of lime.

2. WORLDWIDE PRODUCTION FIGURES

According to the reports released by U.S. Geological Survey, total annual sales of lime worldwide, excluding China, can be considered around 60 to 70 million tons, Ref. [3, 4] and that although it had gone through a gradual decline during the last five years, it then rebounded to mid 60s in the year 2003. On the other hand, the International Lime Association (ILA) which is made up of 29 members/countries, also releases annual sales figures of lime for member countries. Table 1 lists the report for total sales of lime in the years 1997 to 2003. In the year 2003, most of the members reported a sizable increase in sales compared to 2002 (Table 2). With regard to limestone resources, U.S. Geological Survey recently issued the total world lime production figure for 2004 and stated that the world resources of limestone and dolomite suitable

Table 1 ILA total sales of lime in the years 1997 to 2003

Year	Million Tons	No. of ILA member countries reported
1997	69.164	26
1998	71.920	27
1999	68.970	28
2000	65.700	25
2001	61.600	25
2002	59.800	22
2003	63.924	22

Table 2 ILA 10 top total sales of lime in the year 2003

ILA Member country	Sales (Million Tons)	Change compared to 2002
U.S.	17.600	6.6% increase
Japan	10.454	11.1% increase
Germany	6.637	No change
Mexico	5.661	10.1% increase
Korea	3.597	No report in 2002
Turkey	3.321	1.1% increase
France	3.007	1.3% increase
Italy	2.166	3.6% increase
Belgium	1.968	No report in 2002
Spain	1.787	2.1% decrease

Note : as per report of ILA

for lime manufacture are adequate (Table 3).

Surely, steel industry is the largest consumer of the lime and lime related products (Table 4). On the other hand, during the recent years, lime manufacturers are experiencing a significant increase in the field of environmental uses. At present, the most pressing issue is related to increasing demand and the significant

Table 3 Worldwide total production of lime¹
(Million tons)

Country	2003	2004 ²
United States	19.200	20.400
Austria	2.000	2.000
Brazil	6.500	6.500
Canada	2.200	2.250
China	23.000	23.500
France	2.500	2.500
Germany	7.000	6.500
Iran	2.200	2.000
Italy ²	3.000	3.000
Japan ³	9.500	10.600
Mexico	6.500	6.500
Poland	1.900	2.000
Russia	8.000	8.000
S Africa ⁴	1.600	1.900
UK	2.000	2.000
Others	24.900	25.000
Total	122.000	124.200

Note : as per reports of U.S. Geological Survey

¹estimated

²data are for quicklime, hydrated lime, and refractory dead-burned dolomite

³includes hydrated lime

⁴JLA data

⁵sales

Table 4 Worldwide market share of lime for 2002 and 2003

Sector	%(2002)	%(2003)
Iron & Steel	37	42
Building trade	18	17
Environmental	16	16
Building Materials, Agriculture, Exports	9	9
Chemical industry	10	7
Non-ferrous metals	3	3
Other industries	7	5

Note : as per reports of JLA

continuing effects of higher production cost associated with the increased energy cost.

3. JAPANESE LIME INDUSTRY

3.1 Japan Lime Association

As limestone deposits are widely located, lime manufacturing facilities (large and small) can be found throughout Japan. The main lime production regions in Japan are Kuzuu area in Tochigi prefecture, Chichibu/Ome in Saitama, Akasaka in Gifu, Niimi/Ikura in Okayama, Ube in Yamaguchi, Tosa in Kouchi and Tsukumi in Oita. Accordingly, Japan Lime Association (JLA) founded in 1950, consists of 90 members. Among the members, there are 4 top-ranking industrial lime producing leaders that reach an annual sales figures of above 600 thousand tons.

3.2 Market Structure of Lime in Japan

In Japan, there are about 164 commercial lime plants, operated by members of the JLA, which cover about 63% of the total

Table 5 Typical specification of lime used for steel making in LD converter

CaO	> 90%
S	< 0.022%
P	< 0.03%
Activity	> 155ml
Size < 5mm	< 10%
> 40mm	< 5%

Table 6 JLA sales for environmental and other uses (Ton)

Sector	2004	2003	2004/2003 (%)
Non-ferrous	35,482	34,813	101.9
Water treatment	137,024	159,191	86.1
Flue gas, etc.	843,230	814,747	103.5
Other	147,259	174,707	84.3
Export	5,098	4,721	108.0

Table 7 JLA CO₂ emission figures

Year	Million tons
1990 (Kyoto Base)	2.970
1998	2.120
1999	2.250
2000	2.330
2001	2.090
2002	2.280
2003	2.320
2010 (Kyoto agreement)	2.770

production of lime in Japan. The remaining 37% is shared by captive lime manufacturing plants, especially for iron & steel, soda industries, etc. As a general guide, iron & steel industry represents 52% of the lime market's share and chemical industry 36%. Table 5 shows the typical quality requirement of lime used for steel making in LD converter. As mentioned before, Japanese lime market is also experiencing a significant increase in environmental and building sectors recently. Table 6 breaks down the environmental and miscellaneous market share of lime in Japan, showing that lime for flue gas in 2004 has increased more than 3% than that of in 2003, Ref. [5].

3.3 Major Developments in Japanese lime industry

Lime and lime related products consist mainly of limestone and dolomite, quicklime, hydrated lime and precipitated calcium carbonate, and the manufacturing processes involve excavation of the limestone deposit, calcination of limestone to obtain quicklime, slaking of quicklime to form hydrated lime and carbonation of hydrated lime in order to produce precipitated calcium carbonate.

In Japan, there are mainly four types of kiln used for lime calcination : Beckenbach annular shaft kiln, Maerz parallel flow regenerative kiln, Rotary kiln and Chisaki top-shaped kiln, which are shown in Photos 1, 2, 3 and 4 respectively. Chisaki top-shaped kiln is a Japanese original kiln technology which can realize the thermal efficiency in the calcination of undersized limestone equivalent to that of shaft kilns, thereby making a substantial contribution to more efficient utilization of one of the Japan's valuable natural resources.

3.4 Kyoto Protocol

According to the guidelines laid out by Kyoto Protocol, Japanese industries have adopted the resolution to cut the emission of greenhouse gas CO₂, to the levels of 6% below the 1990 figures by the year 2010. By employing countermeasures against global warming, such as using recycled fuels, recovering waste heat energy, upgrading kiln refractories, researching new lime calcination technology by indirect firing so that not only any (recycled) fuel can be used but also the process CO₂ (the CO₂ from the decomposition of limestone) can be obtained at high purity levels which can be decreased gas volume and easily used for CO₂ transportation, the industries of using CO₂ and so on, Japanese lime industry has been adopting means to bring down the CO₂ emission below the level adopted as of Kyoto Protocol. Table 7 shows the CO₂ emission figures of Japanese lime industry, Ref. [6], reflecting the willingness of the Japanese lime manufacturers

in addressing the global warming issue.

3.5 Commitment

In order to achieve a safer and cleaner environment, most of the Japanese lime manufacturers had acquired certification of ISO9001, while some manufacturers had even adopted ISO14000 as well.

4. CONCLUSION

The characteristics of Japanese lime industry are :

1. Japan ranks No.3 among the top world lime producers.
2. More than 60% of the lime product's market share is covered by iron & steel industry.
3. Among the 4 major types of lime kiln employed,
 - i. Maerz parallel flow regenerative kiln
 - ii. Beckenbach annular shaft kiln
 - iii. Rotary kiln and

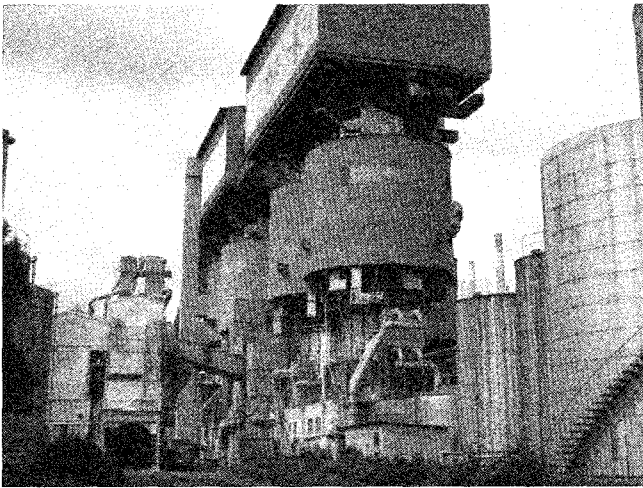


Photo 1 Beckenbach Kiln Mine Plant, Yamaguchi (300 T/D), Height approximately 30 m

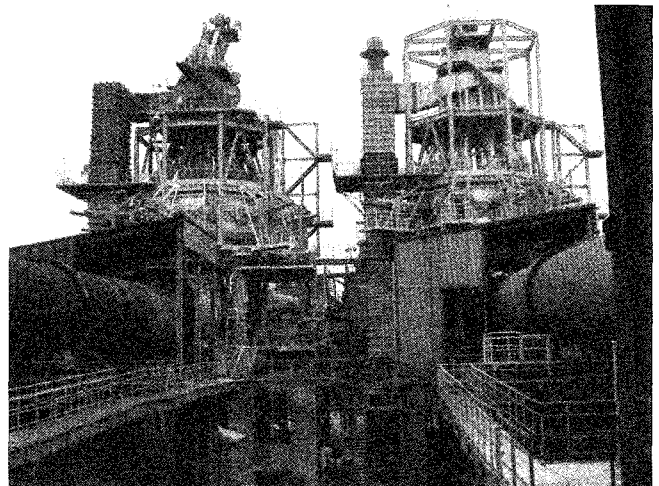


Photo 3 Rotary Kiln with Chisaki top-shape preheater, JFE Mizushima plant (500 T/D x 2), Length approximately 50 m, Height approximately 25 m

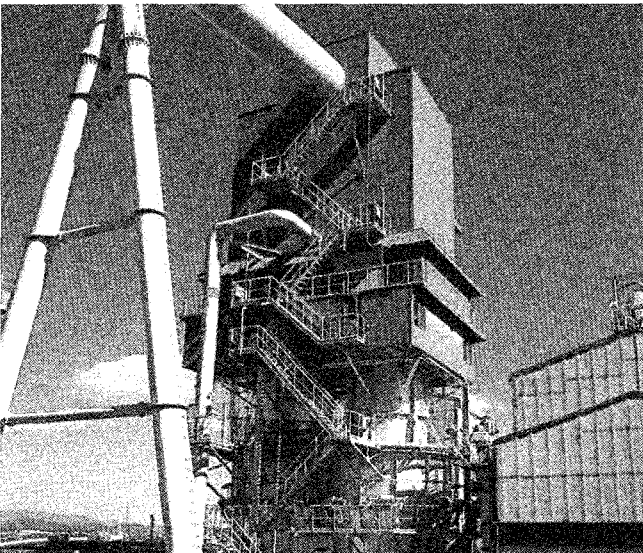


Photo 2 200T/D Maerz Kiln at Otomezaka plant, Height approximately 40 m

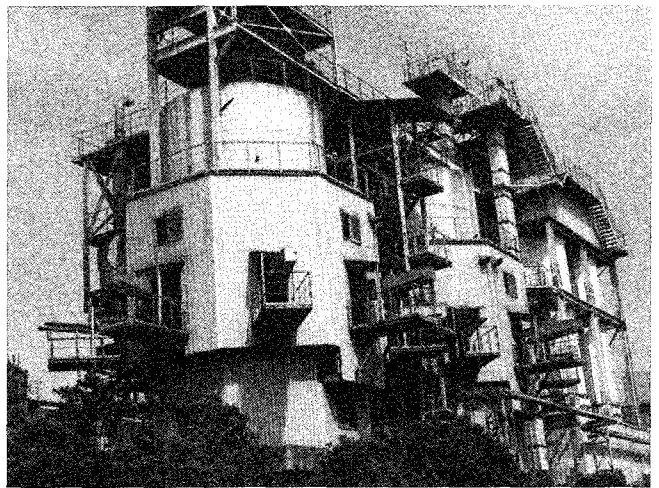


Photo 4 Chisaki top-shaped kiln, NSC Nagoya plant (100 T/D x 2), Height approximately 25 m

- iv. Chisaki top-shaped kiln, Chisaki top-shaped kiln is a Japanese original kiln technology offering improved performances.
4. Japanese lime makers have developed technologies for producing high active lime for steel making and flue gas treatment and have adopted means for reducing the CO₂ emission.

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