2008 Minerals Yearbook

LIME [ADVANCE RELEASE]

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Lime

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In 2008, lime sold and used decreased by less than 2% to a total of 19.9 million metric tons (Mt) (about 21.9 million short tons) at a value of $1.84 billion (table 1). Despite the decrease in production quantity, the value of lime sold and used increased by $76 million as a result of overall price increases of 6% in 2008. With a few exceptions, such as construction (-14%) and flue gas desulfurization (FGD) (+6%), most lime markets were flat or recorded small decreases compared with those of 2007. In the fourth quarter, however, consumption by major markets, such as steelmaking, decreased dramatically, and this resulted in the shutdown of lime plants in severely affected areas.

The term lime as used throughout this chapter refers primarily to six chemicals produced by the calcination of high-purity calcitic or dolomitic limestone followed by hydration where necessary. There are two high-calcium forms—high-calcium quicklime (calcium oxide, CaO) and high-calcium hydrated lime [calcium hydroxide, $Ca(OH)_2$]. There are four dolomitic forms—dolomitic quicklime (CaO•MgO), dolomitic hydrate type N [$Ca(OH)_2$•MgO], dolomitic hydrate type S [$Ca(OH)_2$•$Mg(OH)_2$], and refractory dead-burned dolomite (CaO•MgO). Lime also can be produced from a variety of calcareous materials, such as aragonite, chalk, coral, marble, and shell. It also is regenerated (produced as a byproduct) by paper mills, carbide plants, and water-treatment plants. Regenerated lime, however, is beyond the scope of this report.

Production

Domestic production data for lime were derived by the U.S. Geological Survey (USGS) from a voluntary survey of U.S. operations. The survey was sent to primary producers of quicklime and hydrate, but in order to avoid double counting, it was not sent to independent hydrators that purchase quicklime for hydration. Quantity data were collected for 28 specific and general end uses, and value data were collected by type of lime, such as high-calcium or dolomitic. Because value data were not collected by end use, value data listed in table 3 were determined by calculating the average value per metric ton of lime sold or used for each respondent and then multiplying that figure by the quantity of lime that the respondent reported sold or used for each end use. Table 3 lists the total quantity sold or used for an end use and the total value of the quicklime and hydrate sold or used for that end use calculated as described above. A similar methodology using average hydrate values was used to calculate the value of hydrate sold and used listed in table 4.

In 2008, of the 90 operations to which an annual survey form was sent, responses were received from 79 plants, representing 96% of the total sold or used by producers. Production data for the 11 nonrespondents were estimated based on prior-year production figures and other information.

Lime is a basic chemical that was produced as quicklime in 30 States and Puerto Rico. During 2008, quicklime was produced at 80 lime plants operating kilns, which included 34 plants with collocated hydrating plants. Hydrated lime also was produced at 15 standalone hydrating facilities, which included 3 plants where the kilns had been shut down and hydrate was manufactured from quicklime produced offsite. These numbers do not necessarily agree with the number of plants reported in tables 1 and 2 because for data collection purposes some company operations (owing to their physical proximity to one another) have been combined at the respondent's request. In a few States with no quicklime production, hydrating plants used quicklime shipped from other States. There were also a small number of slurry plants where lime was converted to liquid form by the addition of water prior to sale; this is sometimes called milk-of-lime. In addition to stationary slurry plants, there are mobile hot lime slurry production systems designed to slake quicklime or slurry hydrated lime to the percent solids required for each job. States with production exceeding 2 Mt were, in descending order, Missouri, Alabama, and Kentucky; States with production between 1 and 2 Mt were, in descending order, Ohio, Texas, Nevada, and Pennsylvania.

Total lime sold or used by domestic producers in 2008 was 19.9 Mt, a slight decrease compared with that of 2007. Production included the commercial sale or captive consumption of quicklime, hydrated lime, and dead-burned refractory dolomite. Traditionally, the majority of U.S. lime production is in the form of high-calcium quicklime. In 2008, the production of high-calcium quicklime increased to 14.9 Mt (16.4 million short tons), and accounted for 75% of total production. The production of high-calcium hydrate decreased by nearly 8%. Production of dolomitic quicklime decreased by 14%, while production of dolomitic hydrate recorded a slight increase. Commercial sales decreased to about 18.4 Mt (20.3 million short tons), and captive consumption decreased to 1.47 Mt (1.62 million short tons).

In February, Carmeuse North America (Pittsburgh, PA) and Oglebay Norton Co. (Cleveland, OH) finalized an agreement under which Carmeuse acquired Oglebay Norton. The new combined company was renamed Carmeuse Lime & Stone. The acquisition was expected to allow Carmeuse to expand into the limestone reagent FGD market, and to diversify into filler materials and industrial sands (Carmeuse Lime & Stone, 2008).

Gallatin Materials LLC (Verona, KY) started up its new lime plant at Verona in the first quarter of 2008. After initial startup problems, the lime kiln achieved normal production rates of about 680 metric tons per day (750 short tons per day). Other operational problems were expected to be resolved by no later than midyear (Alpha Natural Resources, Inc., 2008). In October, Mississippi Lime Co. (St. Louis, MO) acquired from

Alpha Natural Resources, Inc. (Abingdon, VA) its majority interest in Gallatin Materials. Mississippi Lime also acquired the remaining shares from minority shareholders to assume full control of Gallatin Materials. The Gallatin Materials lime plant has been renamed Mississippi Lime Co. Verona Plant (Industrial Specialties News, 2008). This acquisition integrated nicely with Mississippi Lime's recent expansion into hydrate markets in the Midwest and Southeast. In 2008, the company built a new hydrating plant in Weirton, WV, and acquired a second hydrating plant in Chester, SC (Mississippi Lime Co., 2008a, b).

As a result of an ongoing slump in construction markets, the precipitous decline in steel production in November and December, and other localized market problems, the lime industry idled six plants late in 2008. These plants were operated by Carmeuse Lime & Stone and Chemical Lime Co. (Fort Worth, TX), and were in Arizona, Illinois, Ohio, Utah, Virginia, and Wisconsin.

At yearend, the top 10 companies were, in descending order of U.S. lime production, Carmeuse Lime & Stone, Chemical Lime, Graymont Ltd., Mississippi Lime, United States Lime & Minerals, Inc., Martin Marietta Magnesia Specialties LLC, Western Lime Corp., Southern Lime Co., ArcelorMittal USA Inc., and Austin White Lime Co. These companies operated 39 lime plants and 12 separate hydrating plants and accounted for 92% of the combined commercial lime sales and 88% of total lime production.

Consumption

According to the National Bureau of Economic Research (2008), the U.S. economy entered a recession in December 2007. With the downturn in the economy, most lime markets decreased in 2008. The approximate breakdown of consumption by general end-use sectors was as follows: 36% for metallurgical uses, 30% for environmental uses, 22% for chemical and industrial uses, 10% for construction uses, and 1% for refractory dolomite (table 3). The construction sector accounted for most of the decrease in overall lime consumption, decreasing by 14% compared with that of 2007. Major market sectors "chemical and industrial" and "metallurgical" decreased slightly or were essentially unchanged. Driven by the nearly 6% increase in consumption for FGD, the environmental sector exhibited a slight increase compared with that of 2007.

Commercial sales accounted for about 93% of total lime consumption. Captive lime accounted for about 7% of consumption and was used mainly in the production of steel in basic oxygen furnaces (BOF), sugar refining, magnesia production, and refractories. Almost all data on captive lime consumption are withheld to avoid disclosing company proprietary information. As a result, table 3 lists the total quantity and value of lime by end use. End uses with captive consumption are listed in footnote 4 of the table.

In steel refining, quicklime is used as a flux to remove impurities, such as phosphorus, silica, and sulfur. The steel industry accounted for about 30% of all lime consumed in the United States. In 2008, lime consumption for steelmaking and related uses was essentially unchanged at 5.86 Mt, even though raw steel production in the United States decreased by nearly 7% compared with that of 2007 (M.D. Fenton, U.S. Geological Survey, written commun., May 13, 2009).

In nonferrous metallurgy, lime is used in the beneficiation of copper ores to neutralize the acidic effects of pyrite and other iron sulfides and to maintain the proper pH in the flotation process. Lime is used to process alumina and magnesia, to extract uranium from gold slimes, to recover nickel by precipitation, and to control the pH of the sodium cyanide solution used to leach gold and silver from the ore. Gold and silver are recovered using heap leaching where small pieces of crushed ore are treated outdoors and carbon-in-pulp cyanidation when the ore is leached in agitation tanks. Heap leaching involves crushing the ore, mixing it with lime for pH control and agglomeration, and stacking the ore in heaps on specially prepared pads for treatment with cyanide solution. Lime is used to maintain the pH of the cyanide solution at a level between 10 and 11 to maximize the recovery of precious metals and to prevent the creation of hydrogen cyanide. Lime consumed for these various uses is included in table 3 under the category "Nonferrous metallurgy." Lime consumption in nonferrous metallurgy (aluminum and bauxite processing, concentration of copper and gold ores, and unspecified nonferrous uses) was essentially unchanged in 2007. Although specific data are not collected on lime consumption for copper recovery or for gold recovery, consumption for copper is believed to have increased as a result of a 24% increase in copper flotation concentrate production compared with that of 2007 (D.L. Edelstein, U.S. Geological Survey, written commun., May 7, 2009). Partially offsetting an increase in consumption for copper flotation was a likely decrease in consumption for gold recovery. Total U.S. gold production decreased by an estimated 4% in 2008, driven by a 6% decrease in Nevada, which accounts for more than 75% of U.S. gold production (George, 2009).

Environmental remediation uses of lime in mining include treatment of the tailings that result from the recovery of precious metals, such as gold and silver. These tailings may contain elevated levels of cyanides, and lime is used to recover cyanides in such treatment processes as alkaline chlorination, Caro's acid (H_2SO_5), Cyanisorb™, and sulfur dioxide/air.

Lime is used, generally in conjunction with soda ash, for softening municipal and plant process water. This precipitation process removes bivalent soluble calcium and magnesium cations (and, to a lesser extent, ferrous iron, manganese, strontium, and zinc) that contribute to the hardness of water. This process also reduces carbonate alkalinity and total dissolved solids. Lime consumption for drinking water treatment was unchanged compared with that of 2007.

In sewage treatment, the traditional role of lime is to control pH in the sludge digester, which removes dissolved and suspended solids that contain phosphates and nitrogen compounds. Lime also aids in clarification and in destroying harmful bacteria. The leading use in sewage treatment is to stabilize the resulting sewage sludge. Sewage sludge stabilization, also called biosolids stabilization, reduces odors, pathogens, and putrescibility of the solids. Lime stabilization involves mixing quicklime with the sludge to raise the temperature and pH of the sludge to minimum levels for a specified period of time. In 2008, lime consumption for all sludge treatment decreased by about 3%, although the sewage sludge component decreased by 7% compared with that of 2007.

In FGD systems serving coal-fired powerplants, incinerators (most are waste-to-energy powerplants), and industrial plants, lime is injected into the flue gas to remove acidic gases, particularly sulfur dioxide (SO_2) and hydrochloric acid (HCl). It also may be used to stabilize the resulting sludge before disposal. Many FGD systems at utility powerplants are now designed to produce byproduct gypsum from the SO_2 emissions. This byproduct material is suitable for use in manufacturing gypsum wallboard, cement production, and agriculture. Hydrated lime may be used in another FGD-related market—to control sulfur trioxide (SO_3) emissions from selective catalytic reduction (SCR) systems installed at powerplants to control emissions of nitrogen oxides (NO_x). Utility powerplants are by far the largest consumers of lime for FGD and accounted for 92% of the total FGD market in 2008. Incinerators, industrial boilers, and other FGD uses accounted for the remaining 8%. In 2008, consumption increased in the utility powerplant market (+6%) and in the combined industrial boiler and other FGD markets (+8%) compared with those of 2007. The incinerator market, however, recorded a decrease of 4% during the same period.

Lime is used by the pulp and paper industry in the basic Kraft pulping process where wood chips and an aqueous solution (called liquor) of sodium hydroxide and sodium sulfide are heated in a digester. The cooked wood chips (pulp) are discharged under pressure along with the spent liquor. The pulp is screened, washed, and sent directly either to the paper machine or to the bleaching plant. Lime is sometimes used to produce calcium hypochlorite bleach for bleaching the paper pulp. The spent liquor is processed through a recovery furnace where dissolved organics are burned to recover waste heat, sodium sulfide, and sodium carbonate. The recovered sodium sulfide and sodium carbonate are diluted with water and then treated with slaked lime to recausticize the sodium carbonate into sodium hydroxide (caustic soda) for reuse. The byproduct calcium carbonate is recalcined in a lime kiln to recover lime for reuse. The paper industry also uses lime as a coagulant aid in the clarification of plant process water. In 2008, consumption for pulp and paper production was essentially unchanged compared with that of 2008.

Lime is used to make precipitated calcium carbonate (PCC), a specialty filler used in premium-quality coated and uncoated papers, paint, and plastics. The most common PCC production process used in the United States is the carbonation process. Carbon dioxide (CO_2) is bubbled through milk-of-lime to form a precipitate of calcium carbonate and water. The reaction conditions determine the size and shape of the resulting PCC crystals. Lime used for PCC production decreased by 12% compared with that of 2007.

The chemical industry uses lime in the manufacture of alkalis. Quicklime is combined with coke to produce calcium carbide, which is used to make acetylene and calcium cyanide. Lime is used to make calcium hypochlorite, citric acid, petrochemicals, and other chemicals.

In sugar refining, milk-of-lime is used to raise the pH of the product stream, precipitating colloidal impurities. The lime itself is then removed by reaction with CO_2 to precipitate calcium carbonate.

In road paving, hydrated lime is used in hot mix asphalt to act as an antistripping agent. Stripping is generally defined as a loss of adhesion between the aggregate surface and the asphalt cement binder in the presence of moisture. Lime also is used in cold in-place recycling for the rehabilitation of distressed asphalt pavements. Existing asphalt pavement is pulverized using a milling machine, and a hot lime slurry is added along with asphalt emulsion. The cold recycled mix is placed and compacted by conventional paving equipment, which produces a smooth base course for the new asphalt surface. In 2008, reflecting the slowing economy and reduced highway spending in many States, sales of lime for use in asphalt decreased by 29% compared with those for 2007.

In construction, hydrated lime and quicklime are used to stabilize fine-grained soils in place of materials that are employed as subbases, such as hydraulic clay fills or otherwise poor-quality clay and silty materials obtained from cuts or borrow pits. Lime also is used in base stabilization, which includes upgrading the strength and consistency properties of aggregates that may be judged unusable or marginal without stabilization. Common applications for lime stabilization included the construction of airfields, building foundations, earthen dams, parking areas, and roads.

Limes sales for soil stabilization tend to be cyclical, especially in large market areas such as Texas. There is competition between lime, cement, fly ash, cement kiln dust, and other additives (liquid enzymes, for example). Choices made by consumers can depend on availability, price, contract specifications, soil chemistry, and State and Federal funding in the case of highway construction projects. In 2008, the soil stabilization market was adversely affected by the slowing economy and by reduced highway spending levels in major markets such as Texas. The bulk of lime consumed for soil stabilization is used in stabilizing road base soils during road and highway construction, and the largest market for such work is Texas, which has more paved lane miles than any other State (more than 192,000 miles). Total U.S. lime sales for soil stabilization decreased by nearly 9% (or 136,000 t) compared with those for 2007, and Texas lime plants accounted for 50% of the nationwide decrease.

Hydrated lime is used in the traditional building sector in mortars, plaster, and stucco. Standard cement mortars that include lime exhibit superior workability balanced with appropriate compressive strength, as well as low water permeability and superior bond strength. Lime is a major constituent in exterior and interior stuccos and plasters, enhancing the strength, durability, and workability of these finishes. A small amount of hydrated lime also is used in the renovation of old structures built with lime mortars, which were prevalent before the development of portland cement mortars. Modern portland cement mortars are incompatible with old lime mortars. Hydrated lime also is used to make synthetic hydraulic lime, which is produced by blending powdered hydrated lime with pulverized pozzolanic or hydraulic materials.

The U.S. Census Bureau collects data on construction spending for residential construction and 16 categories of nonresidential construction. Although lime may be used in some types of nonresidential construction, most is used in residential construction, and the annual value of residential construction decreased by nearly 27% compared with that of 2007 (U.S. Census Bureau, 2009). Nearly all lime sold for traditional building uses is in the form of hydrate; in 2008, sales of hydrated lime for traditional building uses decreased by 17% compared with those of 2007. Most of the lime (87%) sold for building uses was produced at seven plants located in Nevada, Ohio, Texas, Utah, and Wisconsin.

Dead-burned dolomite, also called refractory lime, is used as a component in tar-bonded refractory brick or monolithics manufactured for use in BOF. Refractory brick also is used in the lining of many treatment and casting ladles, in argon oxygen decarburization and vacuum oxygen decarburization converters, in electric arc furnaces (EAF), and in continuous steel casting. Although the actual numbers are rounded to one significant figure to avoid disclosing company proprietary data, the production of dead-burned dolomite decreased compared with that of 2007. LWB Refractories Co. (York, PA) and Carmeuse Lime & Stone (Millersville, OH) were the only significant producers. Hydrated lime is used to produce silica refractory brick used to line industrial furnaces.

Prices

The average values per ton for the various types of lime are listed in table 5. All value data for lime are reported by type of lime produced—high-calcium quicklime, high-calcium hydrate, dolomitic quicklime, dolomitic hydrate, and dead-burned dolomite. Emphasis is placed on the average value per metric ton of lime sold.

Lime prices continued to move upward as a result of higher production costs. The following average values are compared with those of 2007. The average for all types of lime sold increased to $91.70 per metric ton ($83.20 per short ton) or about a 7% increase. The average value for high-calcium quicklime sold also increased by 7% to $87.80 per ton ($79.70 per short ton), and the average value for dolomitic quicklime sold increased by 8% to $98.50 per ton ($89.30 per short ton). The average value of high-calcium hydrate increased by 7%, but the average value of dolomitic hydrate decreased by 5%. The bulk of dolomitic hydrate is used for traditional building applications, such as mortars and plaster. It is normally sold in bagged form and as a result prices are higher than lime sold in bulk quantities. The recent severe problems in the housing construction market and the resulting decrease in building lime consumption were causative factors pushing dolomitic hydrate prices downward. Production of dolomitic hydrate, however, actually increased slightly. When the building uses markets slumped, less bagged material was sold, and dolomitic hydrate producers likely made attempts to expand sales in other markets, such as wastewater and sludge treatment.

The lime industry is very energy intensive, and the rise in oil prices had a profound impact on the cost of producing lime in the form of higher prices for diesel fuel that is used by the lime industry for explosives, lubricants, mining, and shipping. The lime companies were also affected by fuel surcharges paid to companies supplying products and other necessary supplies to the lime companies. As a result, beginning in spring 2008, some lime companies introduced fuel surcharges to their customers in order to compensate for rapidly rising gasoline and diesel prices.

Foreign Trade

The United States exported and imported quicklime, hydrated lime (slaked lime), hydraulic lime, and calcined dolomite (dolomitic lime). Combined exports of lime were 174,000 t (192,000 short tons) valued at $27.1 million. About 95% of exports went to Canada, with the remaining going to Mexico (3%), and other countries (2%) (table 6).

Combined imports of lime were 307,000 t (338,000 short tons) valued at $39.4 million, with 89% from Canada, 10% from Mexico, and 1% from other countries (table 7). Canada was the primary source of quicklime (high-calcium and dolomitic) imports and accounted for nearly 97% of the total. Mexico (54%) and Canada (44%) accounted for the majority of hydrated lime imported by the United States.

There is likely some misclassification of what is being reported as imports and exports of hydraulic lime. Natural hydraulic lime is produced from siliceous or argillaceous limestones that contain varying amounts of silica, alumina, and iron. There is no production of natural hydraulic lime in the United States. Synthetic hydraulic lime is produced by mixing hydrated lime with pozzolanic or hydraulic materials like portland cement. Exports could be synthetic hydraulic lime or, because the chemistry is quite similar, portland cement (or some other hydraulic cement product).

No tariffs are placed on imports of hydraulic lime, quicklime, and slaked lime from countries with normal trade relations (NTR) with the United States. A 3% ad valorem tariff is placed on imports of calcined dolomite from NTR countries.

World Review

Lime is not a commodity that is traded internationally. Traditionally, lime has been a low-value bulk product that could not be shipped long distances and compete with lime produced locally. Most countries contain limestone or dolomite deposits and as a result are able to manufacture lime for their own consumption. There may be some trade between countries on a regional basis where distances are not too great, such as in the European Union.

With the exception of some industrialized nations, accurate lime production data for individual countries are difficult to obtain. The variations in quality and types of lime, production technologies, and industries manufacturing lime and the frequent confusion with limestone data make accurate reporting extremely difficult and certainly incomplete (table 8). In addition to routine revisions made to individual country data, beginning in 2006 major revisions were made to the estimates for China based on new information.

Outlook

Overall lime consumption is expected to decrease as the country attempts to recover from the recession. Metallurgical markets, such as nonferrous metallurgy (mostly copper recovery) and steelmaking, are expected to experience decreases as a result of the shrinking economy. The U.S. output of copper flotation concentrates is expected to decrease by 10% to 15% in 2009 (D.L. Edelstein, U.S. Geological Survey, written commun., May 7, 2009). Iron and steel uses, which comprise 30% of U.S. lime consumption, are expected to be particularly hard hit. The World Steel Association forecast that steel use in the United States could decrease by nearly 37% in 2009 compared with that in 2008 (World Steel Association, 2009). On a simple comparison basis, that would translate to a decrease of nearly 2.2 Mt in lime consumption compared with that of 2008.

Lime's construction markets, which were down by 14% in 2008, could rebound in 2009 if significant numbers of new road and highway construction projects get underway as a result of the passage of the economic stimulus package (the American Recovery and Reinvestment Act of 2009). Many States were expected to receive stimulus funds for highway and bridge construction in the next 2 years. In addition to shovel-ready projects, the fiscal stabilization money may help States stabilize their budgets, allowing for other infrastructure investments that had been deferred. This may provide a funding buffer to lessen the need to defer future projects until such time as the economy recovers and State spending levels on transportation rebound (Moucka, 2009a).

The bulk of lime consumed for construction is used for soil stabilization and as an additive in hot mix asphalt, and both markets would benefit from increased road and highway construction. The largest market for lime soil stabilization is Texas, and in determining where to best spend the State's $2.25 billion in highway and bridge stimulus funds, the Texas Transportation Commission has been sorting through a list of recommended projects comprising 21 new highway construction projects and 266 maintenance projects (Moucka, 2009b).

The traditional building uses sector will continue to lag until such time as the home construction industry rebounds. It may be the latter part of 2010 or into 2011 before the housing market recovers.

Longer term growth is still expected in the FGD and related markets, which are expected to display significant growth as a result of the Clean Air Interstate Rule (CAIR). The CAIR will permanently cap emissions of SO_2 and NO_x in 28 Eastern States and the District of Columbia and will reduce these emissions through a cap-and-trade system. The phase I cap for NO_x emissions is scheduled to be implemented 2009, and the phase I cap for SO_2 emissions is scheduled for 2010. Possible problems arose, however, when on July 11, 2008, the Circuit Court for District of Columbia Court of Appeals vacated the CAIR in its entirety, finding that it had "more than several fatal flaws." In December, the CAIR was revived for an indefinite period when, upon rehearing, the court agreed with the U.S. Environmental Protection Agency (EPA) that the immediate effect of vacating the CAIR was counterproductive to the environment. The court therefore partly reversed its original decision by remanding the CAIR to the agency for revision and reinstating the CAIR until a new rule is ready to replace it (Demase and others, 2009).

FGD systems that use limestone already dominate the utility powerplant market, and lime price increases in recent years have effectively taken lime out of consideration for use in new FGD systems at powerplants. However, opportunities exist for dry lime FGD systems on small utility and industrial boiler units and for the use of hydrated lime to treat SO_3 wastes from SCR systems that control NO_x emissions.

Although lime has market opportunities for controlling air pollution, it is itself subject to pollution regulations that add to its production costs. Proposed revisions to the cement air toxics rule would require major reductions in emissions of hydrochloric acid, mercury, particulate matter, and total hydrocarbons, and would expand the required use of continuous emission monitors for the above pollutants. Because of the similarities in cement and lime manufacturing (both involve calcination of limestone), this new rule could set a precedent leading to more stringent emission limits on the lime industry. Furthermore, the EPA has proposed a national system for reporting greenhouse gas (GHG) emissions that would mandate major U.S.-based producers of GHG emissions to report their emissions from fuel use and industrial processes. Lime plants and other affected facilities must have a system to measure GHG emissions in place by January 1, 2010, with the first reports due in 2011 (National Lime Association, 2009). All of this translates to increased costs for lime companies and may affect the viability of older lime plants.

Major price increases were announced in fall 2008 (to be effective January 1, 2009) by some of the leading lime producers. These announcements were made before the financial crisis hit late in the year and the economy entered into a sharp decline. Overall lime demand is expected to decrease significantly in 2009, and this fact, coupled with lower prices for major lime-burning fuels such as coal, will make it likely that the growth in lime prices will slow in 2009.

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TABLE 1
SALIENT LIME STATISTICS[1, 2]

		2004	2005	2006	2007	2008
United States[3]						
Number of plants[4]		91	94	91	89	88
Sold or used by producers:						
Quicklime:						
High-calcium	thousand metric tons	14,200	14,100	15,000	14,700	14,900
Dolomitic	do.	3,020	2,990	2,950	2,700	2,310
Total	do.	17,200	17,100	18,000	17,400	17,200
Hydrated lime:						
High-calcium	do.	2,140	2,220	2,370	2,240	2,070
Dolomitic	do.	421	474	409	352	358
Total	do.	2,570	2,700	2,780	2,590	2,420
Dead-burned dolomite[5]	do.	200	200	200	200	200
Grand total:						
Quantity	do.	20,000	20,000	21,000	20,200	19,900
Value[6]	thousand dollars	1,370,000	1,500,000	1,700,000	1,760,000	1,840,000
Average value	dollars per metric ton	68.90	75.00	81.20	87.10	92.43
Lime sold	thousand metric tons	18,400	18,600	19,400	18,700	18,400
Lime used	do.	1,520	1,490	1,620	1,530	1,470
Exports:[7]						
Quantity	do.	100	133	116	144	174
Value	thousand dollars	14,300	17,500	19,200	24,800	27,100
Imports for consumption:[7]						
Quantity	thousand metric tons	232	310	298	375	307
Value	thousand dollars	25,900	33,100	36,300	49,600 r	39,400
Consumption, apparent[8]	thousand metric tons	20,100	20,200	21,200	20,400	20,000
World, production	do.	251,000	262,000 r	276,000 r	287,000 r	296,000 e

[e]Estimated. [r]Revised. do. Ditto.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]To convert metric tons to short tons, multiply metric tons by 1.102.
[3]Excludes regenerated lime; includes Puerto Rico.
[4]Includes producer-owned hydrating plants not located at lime plants.
[5]Data are rounded to no more than one significant digit to protect company proprietary data.
[6]Selling value, free on board plant.
[7]Source: U.S. Census Bureau.
[8]Defined as sold or used plus imports minus exports.

TABLE 2

LIME SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY STATE[1, 2]

State	Plants[3]	Hydrated (thousand metric tons)[4]	Quicklime[5] (thousand metric tons)[4]	Total (thousand metric tons)[4]	Value (thousands)
2007:					
Alabama	5	152	2,330	2,480	234,000
Arizona, Colorado, Montana, Nevada, New Mexico, Utah, Wyoming	16	295	2,640	2,940	242,000
California, , Idaho, Oregon, Washington	10	58	314	373	52,800
Illinois, Indiana, Missouri	6	457	3,470	3,920	317,000
Iowa, Nebraska, South Dakota	3	W	W	338	29,400
Kentucky, Tennessee, West Virginia	5	128	2,520	2,640	205,000
Ohio	6	125	1,570	1,690	159,000
Pennsylvania	4	143	954	1,100	112,000
Texas	5 r	697	923	1,620	132,000
Wisconsin	5	175	784	959	78,000
Other[6]	24	362	2,120	2,140	197,000
Total	89	2,590	17,600	20,200	1,760,000
2008:					
Alabama	5	108	2,210	2,320	239,000
Arizona, Colorado, Montana, Nevada, New Mexico, Utah, Wyoming	16	241	2,610	2,850	254,000
California, Idaho, Oregon, Washington	9	54	259	314	37,100
Illinois, Indiana, Missouri	7	453	3,490	3,940	346,000
Iowa, Nebraska, South Dakota	3	41	302	343	31,600
Kentucky, Tennessee, West Virginia	5	136	2,560	2,700	220,000
Ohio	6	117	1,550	1,670	166,000
Pennsylvania	4	186	942	1,130	126,000
Texas	5	680	819	1,500	128,000
Wisconsin	4	162	690	852	71,500
Other[6]	24	246	2,000	2,240	217,000
Total	88	2,420	17,400	19,900	1,840,000

[r]Revised. W Withheld to avoid disclosing company proprietary data; included with "Other."

[1]Excludes regenerated lime.

[2]Data are rounded to no more than three significant digits; may not add to totals shown.

[3]Includes producer-owned hydrating plants not located at lime plants.

[4]To convert metric tons to short tons, multiply metric tons by 1.102.

[5]Includes dead-burned dolomite.

[6]Includes Arkansas, Florida, Georgia, Louisiana, Massachusetts, Michigan, Minnesota, Mississippi, North Dakota, Oklahoma, Puerto Rico, Virginia, and data indicated by the symbol W.

TABLE 3

LIME SOLD AND USED BY PRODUCERS IN THE UNITED STATES, BY USE[1, 2]

(Thousand metric tons[3] and thousand dollars)

Use	2007 Quantity[4]	2007 Value[5]	2008 Quantity[4]	2008 Value[5]
Chemical and industrial:				
Fertilizer, aglime and fertilizer	32	3,490	43	3,940
Glass	187	16,100	206	19,000
Paper and pulp	859	73,500	865	79,900
Precipitated calcium carbonate	1,260	122,000	1,110	102,000
Sugar refining	703	69,700	675	62,400
Other chemical and industrial[6]	1,420	136,000	1,500	139,000
Total	4,460	421,000	4,400	406,000
Metallurgical:				
Steel and iron:				
Basic oxygen furnaces	2,590	223,000	2,590	239,000
Electric arc furnaces	2,960	270,000	2,840	263,000
Other steel and iron	358	29,800	431	39,800
Total	5,910	523,000	5,860	542,000
Nonferrous metallurgy[7]	1,370	100,000	1,370	127,000
Total	7,280	624,000 r	7,230	668,000
Construction:				
Asphalt	353	35,000	250	23,100
Building uses	435	50,100	362	33,500
Soil stabilization	1,540	123,000	1,410	130,000
Other construction	80	6,730	53	4,930
Total	2,410	215,000	2,070	191,000
Environmental:				
Flue gas desulfurization (FGD):				
Utility powerplants	3,410	248,000	3,630	335,000
Incinerators	245	23,200	235	21,700
Industrial boilers and other FGD	71	7,410	77	7,090
Total	3,730	279,000	3,940	364,000
Sludge treatment:				
Sewage	127	11,600	118	10,900
Other, industrial and hazardous	112	9,760	113	10,500
Total	239	21,400	231	21,300
Water treatment:				
Acid-mine drainage	104	10,000	90	8,290
Drinking water	946	81,600	945	87,300
Wastewater	625	60,000	597	55,200
Total	1,680	152,000	1,630	151,000
Other environmental:	175	16,300	143	13,300
Total	5,820	468,000	5,950	550,000
Refractories (dead-burned dolomite)	200 [8]	24,500 [9]	200 [8]	19,700 [10]
Grand total	20,200	1,760,000	19,900	1,840,000

[r]Revised.

[1]Excludes regenerated lime. Includes Puerto Rico.

[2]Data are rounded to no more than three significant digits; may not add to totals shown.

[3]To convert metric tons to short tons, multiply metric tons by 1.102.

[4]Quantity includes lime sold and used, where "used" denotes lime produced for internal company use for basic oxygen furnaces, magnesia, paper and pulp, precipitated calcium carbonate, refractories, and sugar refining.

[5]The U.S. Geological Survey does not collect value data by end use; the values shown are mainly derived from average lime values.

[6]May include alkalis, calcium carbide and cyanamide, calcium hypochlorite, citric acid, food (animal or human), oil and grease, oil well drilling, petrochemicals, tanning, and other uses. Magnesia is included here to avoid disclosing proprietary data.

[7]Includes aluminum and bauxite, magnesium, ore concentration (copper and gold) and other nonferrous uses.

[8]Data are rounded to one significant digit to protect company proprietary data.

[9]Values are estimated based on average value per metric ton of dead-burned dolomite for each year.

[10]Value was derived from an average lime value per metric ton rather than a specific average value per metric ton of dead-burned dolomite.

TABLE 4

HYDRATED LIME SOLD OR USED IN THE UNITED STATES, BY END USE[1, 2]

(Thousand metric tons[3] and thousand dollars)

Use	2007 Quantity[4]	2007 Value[5]	2008 Quantity[4]	2008 Value[5]
Chemical and industrial	549	63,000	571	61,200
Construction:				
Asphalt	316	32,100	215	23,100
Building uses	426	49,200	354	38,000
Soil stabilization	504	40,500	564	60,400
Other construction	18	1,750	11	1,180
Total	1,260	123,000	1,140	123,000
Environmental:				
Flue gas desulfurization (FGD):				
Utility powerplants	120	8,120	97	10,400
Incinerators	35	3,320	31	3,330
Industrial boilers and other FGD	35	4,050	36	3,840
Total	190	15,500	164	17,600
Sludge treatment:				
Sewage	23	2,710	30	3,260
Other sludge treatment	42	4,680	44	4,690
Total	65	7,380	74	7,940
Water treatment:				
Acid-mine drainage	69	7,150	69	7,350
Drinking water	151	15,900	161	17,200
Wastewater	191	20,400	160	17,200
Total	411	43,500	390	41,800
Other environmental	63	7,070	42	4,490
Metallurgy	49	5,370	40	4,340
Grand total	2,590	265,000	2,420	260,000

[1]Excludes regenerated lime. Includes Puerto Rico.

[2]Data are rounded to no more than three significant digits; may not add to totals shown.

[3]To convert metric tons to short tons, multiply metric tons by 1.102.

[4]Quantity includes hydrated lime sold and used, where "used" denotes lime produced for internal company use in building, chemical and industrial, and metallurgical sectors.

[5]The U.S. Geological Survey does not collect value data by end use; the values shown are mainly derived from an average value per metric ton of hydrated lime.

TABLE 5

LIME PRICES[1]

Type	2007 Dollars per metric ton	2007 Dollars per short ton[2]	2008 Dollars per metric ton	2008 Dollars per short ton[2]
Sold and used:				
Quicklime	84.60	76.70	89.90	81.60
Hydrate	102.40	92.90	107.20	97.30
Average all types[3]	87.10	79.00	92.40	83.90
Sold:				
High-calcium quicklime	81.80	74.20	87.80	79.70
Dolomitic quicklime	90.80	82.40	98.50	89.30
Average quicklime	83.10	75.40	89.20	80.90
High-calcium hydrate	97.50	88.40	103.90	94.30
Dolomitic hydrate	133.70	121.20	126.40	114.70
Average hydrate	102.40	92.90	107.20	97.30
Average all types[3]	85.90	78.00	91.70	83.20

[1]Average value per ton, on a free-on-board-plant basis, including cost of containers.

[2]Unit values in metric and short tons were rounded independently.

[3]Includes dead-burned dolomite.

TABLE 6

U.S. EXPORTS OF LIME, BY TYPE[1]

Type	2007 Quantity (metric tons)[2]	2007 Value[3]	2008 Quantity (metric tons)[2]	2008 Value[3]
Calcined dolomite:				
Canada	60,700	$9,220,000	65,000	$1,010,000
Germany	364	60,400	--	--
Taiwan	365	94,200	--	--
Other	1,120	474,000	870	9,730,000
Total	62,600	9,850,000	65,800	10,700,000
Hydraulic lime:				
Bahamas, The	326	54,900	307	60,000
Canada	3,710	635,000	4,400	917,000
Jamaica	4,640	714,000	--	--
Other	248	247,000	565	352,000
Total	8,930	1,650,000	5,270	1,330,000
Quicklime:				
Bahamas, The	554	155,000	154	37,200
Canada	52,500	6,970,000	81,800	10,500,000
Costa Rica	583	177,000	80	24,800
Mexico	315	208,000	5,490	536,000
Netherlands	427	1,010,000	152	429,000
Other	91	133,000	209	456,000
Total	54,500	8,650,000	87,900	12,000,000
Slaked lime, hydrate:				
Angola	537	233,000	857	428,000
Canada	11,900	2,300,000	13,700	2,340,000
Chile	325	57,200	5	6,480
Mexico	210	32,200	82	11,200
Nigeria	695	147,000	662	179,000
Philippines	442	67,700	--	--
Russia	4,140	1,490,000	--	--
Other	114	346,000	46	56,600
Total	18,300	4,670,000	15,400	3,020,000
Grand total	144,000	24,800,000	174,000	27,100,000

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]To convert metric tons to short tons, multiply metric tons by 1.102.

[3]Declared free alongside ship valuation.

Source: U.S. Census Bureau.

TABLE 7

U.S. IMPORTS FOR CONSUMPTION OF LIME, BY TYPE[1]

Type	2007 Quantity (metric tons)[2]	2007 Value[r, 3]	2008 Quantity (metric tons)[2]	2008 Value[3]
Calcined dolomite:				
Canada	34,600	$3,680,000	17,600	$2,130,000
Mexico	336	94,600	--	--
Other	120	68,000	86	70,100
Total	35,000	3,840,000	17,700	2,200,000
Hydraulic lime:				
Canada	59	10,900	--	--
Mexico	449	48,500	286	32,700
Other	1,430	1,190,000	302	227,000
Total	1,940	1,250,000	588	260,000
Quicklime:				
Canada	278,000	36,900,000	238,000	29,700,000
Mexico	20,500	1,190,000	5,950	429,000
Other	1,170	663,000	1,730	386,000
Total	299,000	38,800,000	245,000	30,500,000
Slaked lime, hydrate:				
Canada	12,300	1,460,000	19,000	2,340,000
Mexico	23,900	2,880,000	23,400	3,100,000
Other	2,230	1,330,000	717	980,000
Total	38,400	5,670,000	43,200	6,420,000
Grand total	375,000	49,600,000	307,000	39,400,000

[r]Revised. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]To convert metric tons to short tons, multiply metric tons by 1.102.

[3]Declared cost, insurance, and freight valuation.

Source: U.S. Census Bureau.

TABLE 8

QUICKLIME AND HYDRATED LIME, INCLUDING DEAD-BURNED DOLOMITE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country[3]	2004	2005	2006	2007	2008[e]
Australia[e]	1,500	1,500	1,600	1,600	1,600
Austria[e]	2,000	2,000	2,000	2,000	2,000
Belgium[e, 4]	2,400	2,300	2,400	2,200	2,200
Brazil	6,900 [e]	6,500 [r]	7,057 [r]	7,393 [r]	7,400 [p]
Bulgaria[4]	1,289 [r]	1,352 [r]	1,409 [r]	1,500 [r, e]	1,500
Canada	2,386	2,289	2,185	2,134 [r]	2,069 [5]
Chile[e]	540 [r]	600 [r]	660 [r]	700 [r]	700
China[e]	140,000	150,000	160,000	170,000	180,000
Colombia[e]	1,300	1,300	1,300	1,300	1,300
Croatia[4]	250 [e]	1,988 [r]	2,155 [r]	2,200 [r, e]	2,200
Czech Republic	1,264	1,211	1,218	1,277 [r]	1,250
Egypt[e]	800	800	800	800	800
Finland[e]	432	430	430	425	425
France[e, 4]	3,600	3,300	4,000	4,000	4,000
Germany	6,947	6,823	7,119	7,218 [r]	7,000
Hungary[e]	500	500	500	500	500
India[e]	900	920	910	900	910
Iran[e]	2,500	2,500	2,600	2,600	2,700
Italy[e, 6]	6,100	6,300	5,900	6,000	6,000
Japan, quicklime only	8,507	8,879	9,014	9,359 [r]	9,500
Kazakhstan	624	702	769	828	885 [5]
Korea, Republic of	3,574	3,600	3,600 [e]	3,600 [e]	3,600
Mexico[e, 4]	6,500	6,500	6,500	6,500	6,500
Poland	1,950 [e]	1,749 [r]	1,936 [r]	2,143 [r]	2,100
Romania	1,978 [r]	1,791 [r]	1,942 [r]	1,901 [r]	1,900
Russia[e]	8,200	8,200	8,200	8,200	8,200
Saudi Arabia[e]	350	360	360	400	400
Serbia	400 [7]	400 [7]	377 [r]	320 [r]	320
Slovakia	961	946	1,104	1,123 [r]	1,100
Slovenia[e]	1,500	1,500	1,500	1,500	1,500
South Africa, burnt lime sales	1,738	1,417	1,585 [r]	1,599	1,593 [p, 5]
Spain[e, 4]	1,800	1,818 [5]	2,000	2,000 [r]	2,000
Sweden[e]	590	600	600	600	600
Taiwan	494	444	450 [e]	470 [e]	450
Tunisia	476	424	401	395 [r]	400
Turkey[e, 4]	3,400	3,400	3,600 [r]	3,600	3,600
United Kingdom[e]	2,000	2,000	2,000	2,000	1,500
United States, including Puerto Rico	20,000	20,000	21,000	20,200	19,900 [5]
Venezuela[e]	400	400	400	400	400
Vietnam	1,464	1,737	1,929	2,120	2,200
Other[e]	2,360 [r]	2,420 [r]	2,450 [r]	2,580 [r]	2,610
Total	251,000 [r]	262,000 [r]	276,000 [r]	287,000 [r]	296,000

[e]Estimated. [p]Preliminary. [r]Revised.

[1]World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through March 29, 2009.

[3]In addition to the countries listed, Argentina, Chad, Iraq, Nigeria, Pakistan, Syria, and several other nations produce lime, but output data are not reported; available general information is inadequate to formulate reliable estimates of output levels.

[4]Production estimate based on sales only; data may be incomplete.

[5]Reported figure.

[6]Includes hydraulic lime.

[7]Montenegro and Serbia formally declared independence in June 2006 from each other and dissolved their union.