Preheater / Rotary Kiln Calcining Systems
**Proven experience**

Metso Minerals, Inc. has supplied more than 190 lime calcining systems, over 95 of them as preheater / rotary kiln systems. The worldwide total annual production capacity from Metso-supplied systems exceeds 25 million metric tons per year.

The Metso experience encompasses complete plant design including run of quarry limestone crushing and screening, calcining (of both high calcium and dolomitic limestones), kiln firing, quality control of system emissions, product handling and storage, and lime hydration.

Metso’s worldwide experience and expertise allows for local sourcing of major system components, near the installation site, to minimize total project costs. In addition, with a local presence in more than 50 countries, Metso can supply a complete lime plant, installed, commissioned and ready to produce quality lime products.

**Product quality**

Using its proprietary Limestone Evaluation (LSE) procedures, Metso begins its lime plant design with laboratory testing of the proposed limestone feed to determine its physical and chemical properties. This evaluation of the feed material includes such things as chemical analysis, laboratory calcination and reactivity testing, as well as certain proprietary tests to determine the material’s susceptibility to degradation. The evaluation results are used to perform the necessary process calculations, to select the proper type and size of calcining equipment, and to design the overall system required.

By thoroughly examining the proposed feed material, Metso is also able to forecast the quality of lime product that can be achieved, as well as estimate the rate at which utilities such as fuel and electric power will be consumed.

**Efficiency and flexibility in operations**

The KVS Preheater / Rotary Kiln calcining system is selected when a uniform, high quality lime product is required. Metso can also supply vertical shaft and fluid bed types of lime calcining systems, but it is the KVS Preheater / Rotary Kiln system approach to lime calcining that is the technology of choice for the more demanding applications.

The preheater / rotary kiln system can be designed to process limestone feed with a top size as large as 3 in. to a bottom size as small as 1/4 in. which maximizes quarried stone utilization, and in turn, minimizes kiln feed preparation costs. This type of calcining system is fired with a single burner that can be designed to accommodate a wide variety of fuels including coal, petroleum coke, natural gas, oil, blast furnace gas and coke oven gas. Certain waste fuels can also be used. The firing systems can be designed to fire a single fuel, or combinations of two or three different fuels.
Lime calcining systems
Preheaters
The KVS Preheater System includes an integral “live” stone storage bin. Stone flows by gravity from the bin to the preheater modules through vertical chutes, (which also provide an air seal between the process and ambient). Kiln exhaust gases enter the preheater at 1900 to 2100 Degrees F.

As these hot process gases pass through the preheater, heat is transferred to the bed of material within. This causes the release of 30 to 40 % of the limestone's CO₂. The partially calcined material is discharged from the preheater, through the transfer chute and into the rotary kiln, by sequential and controlled stroking of hydraulic plungers at the unit’s perimeter. Exhaust gases leaving the preheater have an average temperature of 450 to 500 Degrees F, and are filtered in the air pollution control equipment before being discharged to atmosphere through an exhaust stack.

The first KVS Preheater Lime Calcining System was built over sixty (60) years ago, and over the many years since, there have been substantial improvements made to the preheater design. The present-day configuration includes the KVS LPD tube, which creates an open cavity in the bed of material in each module, increasing the entry area available to the hot process gases. A more recently added feature to the polygon design is a partition wall between adjacent modules. In addition to now being able to isolate an individual module for on-line maintenance, the cavity created in the material beneath the wall further enhances the “LPD effect” on the flow of process gases through the preheater.
Key Features

**Preaheters**

For system capacities between 200 and 700 TPD, a rectangular preheater design is supplied and for capacities greater than 700 TPD a polygon design is used. The number of modules in a rectangular preheater ranges from 4 to 10, and in a polygon from 12 to 24, the dimensional details of the preheater components are essentially the same for both designs.

**Coolers**

Metso's lime calcining technology includes the KVS / Niems high efficiency contact cooler. With heat recovery efficiencies in excess of 95%, this direct contact, counter-flow heat exchanger provides both extensive cooling of the lime product, and significant preheating of secondary combustion air for the kiln firing system.

Ambient air is blown into the four quadrants of the cooler's lower chamber through a common cooling air duct. The cooling air enters the packed bed of hot granular lime product, uniformly, through a collection of fixed stainless steel air distributor. The level of material in the cooler is controlled by the frequency with which four vibratory feeders beneath the cooler are operated. Thermocouples mounted in each of the four cooler discharge spouts monitor product temperatures, and material flow through each spout is automatically adjusted to provide uniform cooling of the lime product, and at the same time, maximize heat recovery.

In addition to providing uniform product cooling and excellent heat recovery to the process, because it has virtually no moving parts— with the exception of the discharge feeders, the KVS / Niems Cooler has the lowest of maintenance requirements, and offers optimum reliability.
**PLC-Based Control**

Metso designs and supplies its own PLC-based, computer-applied process control system. At the heart of the system is a Programmable Logic Controller (or PLC), which carries out the monitoring and interlocking functions of the control system. Using control programming installed by Metso engineers, the PLC constantly compares actual operating data to pre-established setpoints for “normal” operation, and makes corrective changes to the process as needed to achieve the desired operating conditions.

Access to the process control variables is obtained through industrial desk-top computers, using Man-Machine Interface (MMI) software also supplied by Metso. To simplify control of the calcining system, Metso offers user-friendly, 3-dimensional computer screen graphics to provide the kiln operator with a clear visual reference of the overall calcining system and the process within.

**Advanced Process Control**

Metso has developed an advanced or “upper level” process control system called OCS, (an acronym for Optimization Control System). OCS is referred to as an upper level control system because it is basically installed over top of the more fundamental PLC-based controls. OCS process control is based on a proprietary set of operating “rules,” which, when applied to the various process variables, continuously evaluate and update control setpoints to optimize system performance. The addition of OCS to operating lime kiln systems has been shown to improve product quality, increase production capacity, and improve fuel and electric power consumption rates.
Our ranges:
- Process Systems
  - Lime Calcining
  - Petroleum Coke Calcining
  - Iron Ore Pelletizing
  - Waste Processing
  - Special Calcining
  - Lime Sludge Recovery
  - Lime Hydrators & Slakers

Rotary Kilns
- Direct Fired
- Indirect Fired
- Balling Drums

Fluid Beds
- Entrainment
- Bubbling

Dryers / Coolers
- Rotary Kilns
- Fluid Beds
- Indirect Fired
- Steam Tube
- Holoflite
- Impact Dryer
- Coolers

Metso Minerals (Canada)
4900 Thimens Blvd.
St. Laurent, Quebec H4R 2B2
Canada
Tel.: +1-514-335-5426
Fax: +1-514-908-7093

Metso Minerals Industries Inc.
350 Railroad Street
Danville, PA 17521-2046
USA
Phone: +1 (570) 275-3050
Fax: +1 (570) 275-6789

Metso Minerals
52 Ahston Vale Road
Bristol BS3 2HQ
United Kingdom
Phone: +44-117-978-6200
Fax: +44-117-923-1603

Metso Minerals
16 Lidco Street
Arndell Park, Sydney NSW 2148
Australia
Phone: +61-2-8825-1600
Fax: +61-2-8825-1799

Metso Minerals
64 Jet Park Road
Jet Park, Johannesburg 1600
South Africa
Phone: +27-11-961-4000
Fax: +27-11-397-5960

Metso Minerals (Sala) AB
Norängsgatan 2
P.O. Box 31
SE-733 25 Sala
Sweden
Tel.: +46-224-570-00
Fax: +46-224-369-50

www.metsominerals.com
E-mail: pyro@metso.com