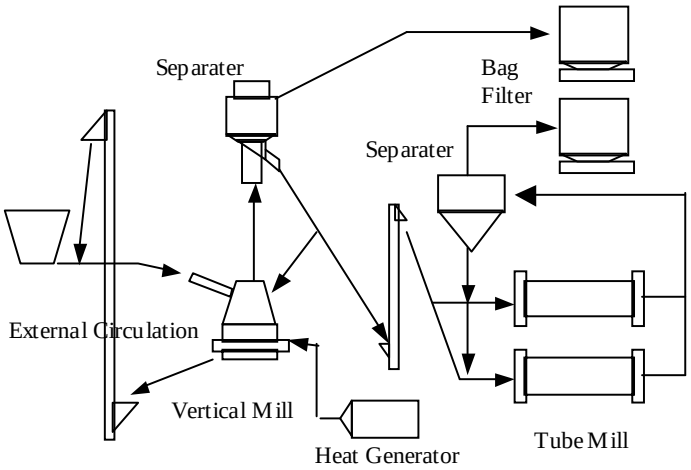
Item	Vertical roller mill for cement grinding	Application: Finishing process
Background	In the cement grinding process, grinding system using the tube mill is widely applied for long year. Recently, especially from 1980s, grinding system using the vertical roller mill, which has effective grinding performance, is developed and applied in the cement grinding process.	
Descriptions	Basic equipment structure of the vertical roller mill for cement grinding is the same as the vertical roller mill of raw material and coal grindings. The materials such as clinker and gypsum fed into the mill are ground by compression and shearing forces between the grinding table and two or four rollers, which are hydraulically loaded and controlled. Ground cement materials are sent to separator installed in mill upper position by air and classified to coarse particles and fine product. Coarse particles are returned on the grinding table to re-ground and the fine product is sent to dust collectors such as cyclone and/or bag filter. The advantage of the vertical roller mill for cement (comparison with the tube mill) 1) Highly efficient grinding is possible with considerably low electrical power consumption. 2) The residence time of cement grinding in the vertical roller mill is much shorter than that of tube mill. Since system operational control response is superior, quality management on the cement product is easy. 3) Therefore the vertical roller mill for cement produces little heat for grinding, and quality trouble due to the excessive rise of temperature of cement is less likely to occur. 4) The installation area of the vertical roller mill is about half of tube mill grinding system. But the introduction of a pre-grinding grinder has become mainstream in Japan, and the above-mentioned technology is spreading mainly overseas.	
Results	Electrical power consumption can be reduced by 30 % (compared with the tube mills).	
Cost estimation		
Related matters	External circulating system to vertical roller mill for cement.	
Reference		

Item	High efficiency grinding of blast furnace slag	Application: Finishing process
Background	In the past, slag grinding is performed in a tube mill with dryer. This requires relatively higher power consumptions, and efficiency improvement in this process has become a great concern. Improvements in slag grinding efficiency was developed and implemented with existing cement manufacturing technology.	
Descriptions	Improvements in the grinding process to produce fine granulated blast furnace slag suitable for use in the production of blast furnace cement was achieved with pre-grinding and vertical mill technologies used in cement manufacturing. 1. The installation of vertical mill In a vertical coal mill, drying, grinding, and separating/classifying of ground material are done simultaneously. The hot air used for drying is supplied with a hot wind generator. Slag contains iron grain, which could damage the rotating table and aggravate grinding efficiency. Hence, the removal of these iron grains before commencing the grinding process, using an external circulation system with a magnetic-separator device, is crucial. 2. The installation of pre-grinding equipment There are cases where a vertical mill is installed to the existing tube mill to enhance grinding efficiency while reducing power consumption. With the use of vertical mill, pre-grinding and cement grinding processes are performed separately. Reduction in the size of grinding media used in the tube mill is expected to improve grinding efficiency. However this would partially ruin overall efficiency improvement level.  **Fig. The example of the combination of tube mills and vertical mill**	
Results	Reduction in unit electricity consumption (Blended value 4,000cm^2/g) * Tube mill 70kWh/t (approx., excluding drying) * Vertical mill <40kWh/t (including separator, wind-chamber/fan, conveyor systems, and etc)	
Cost estimation	About 7.3 million US$ including cost of supplemental facilities and construction fees [40t/h] [1US$=¥110]	
Related matters	Introduction of vertical raw material mill, vertical cement mill, vertical coal mill.	
Reference		