



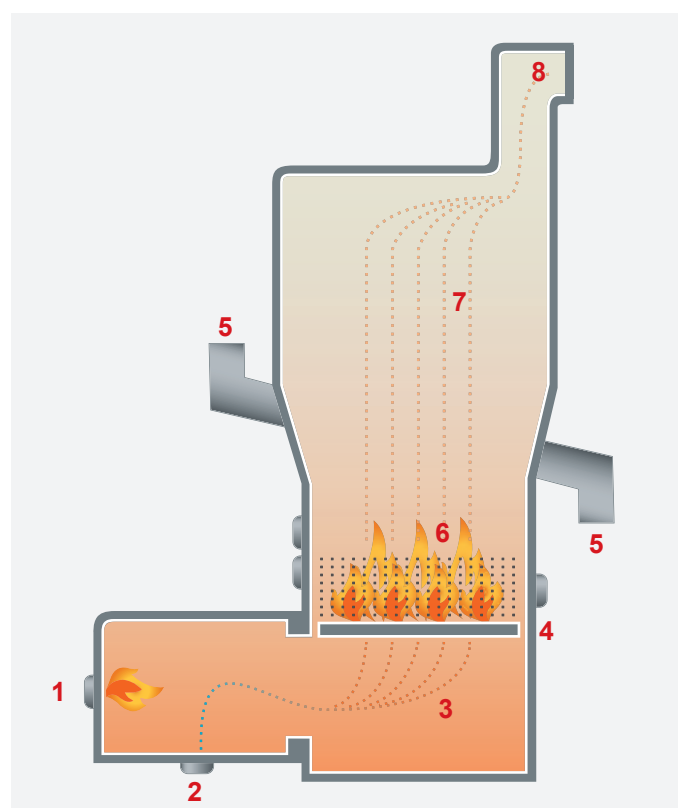
STATIONARY FLUIDIZED BED INCINERATOR THERMAL TREATMENT OF OIL SHALE

EISENMANN'S STATIONARY FLUIDIZED BED INCINERATOR WITH ENERGY RECOVERY PRODUCES BURNT OIL SHALE FOR A CEMENT MANUFACTURER.

Burnt oil shale is frequently used as an ingredient in high-quality cement for ready-mixed concrete and concrete products – and is in great demand. Cement containing burnt oil shale is superior to conventional cement due to its good water retention properties, moderate heat build-up, suitability for use in exposed concrete, elasticity of fresh concrete and good green compressive strength. Currently, oil shale extraction in Germany is limited to just one south-western town, Dotternhausen. There, Eisenmann has installed a stationary fluidized bed incinerator for the production of burnt oil shale for a cement manufacturer, Holcim Süddeutschland. The energy generated during the combustion process is converted into electricity.

Burning oil shale

Crushed oil shale is placed into the fluidized bed via a shaft. The fluidized bed is located directly above the nozzle floor which, in turn, is directly above the windbox. High-pressure fluidizing air is injected into the windbox. The fluidized bed incinerator also features a start-up burner. It heats fluidizing air when the incinerator is fired up. The hot air ascends into the fluidized bed through the nozzle floor. This loosens the bed, and transforms it into a near-fluid state. This enables it to readily take up the crushed oil shale that is continuously added. A high degree of turbulence in the fluidized bed ensures very good ignition and combustion and highly effective heat transfer. This means the oil shale quickly reaches the required reaction temperature. Residual water and water of crystallization is extracted from the minerals and evaporated. In addition, the oil shale's organic content (around 10 percent) is converted into natural gas, and the minerals are partially oxidized. Flue gasses produced in the incineration process are post-combusted in the freeboard, located directly above the fluidizing bed.



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|------------------|------------------|
| 1 Burner | 5 Shaft |
| 2 Fluidizing air | 6 Fluidizing bed |
| 3 Windbox | 7 Freeboard |
| 4 Nozzle floor | 8 Exhaust air |



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Energy recovery

To recover energy from the combustion process, the exhaust gases are cooled using a waste-heat recovery boiler. This generates steam, which is fed to a turbine. The process produces around 3.5 MW of electricity – meeting around 25 percent of the cement plant's electricity demand.

Made-to-measure fluidized bed incinerator

The incinerator used at Holcim is unique in many ways, and offers several benefits compared to conventional fluidized bed incinerators. It is designed to save operating costs and resources, reduce waste, and take up less space. Parts of the waste-heat recovery boiler are integrated into the fluidized bed incinerator: the freeboard has a membrane-wall design, and the fluidized bed features insertable heat exchangers. This reduces volumetric flow rate of the exhaust gas by around 20 percent as compared to conventional systems. In addition, this state-of-the-art incinerator takes up 20 percent less space, and its ventilators use 20 percent less electricity.

The combustion air and recirculated gas are sprayed in a multi-stage process, making it possible to precisely regulate the temperature and oxygen circulation. This means that hydrocarbon, nitric oxide, carbon monoxide and sulfur oxide emissions are already below defined thresholds during the combustion

process – eliminating the need for a sophisticated exhaust gas purification system. What's more, no additives are required for flue gas purification, and no waste is generated during the incineration process and during exhaust gas purification.

Despite the integrated heat exchanger, and oil shale's low calorific value (3,000 to 3,600 kJ/kg), the system is autothermal. Additional fuel is only needed for starting up the incinerator.



Fluidized bed incinerator for thermal treatment of oil shale at a cement plant

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