Performance conversion

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New, tougher restrictions on emissions coupled with the use of secondary fuels make it necessary to take a closer look at filtration procedures in cement production. Today's industry needs to cope with a variety of challenges. Fixed and variable costs in capital-intensive cement manufacturing need to be reduced by means of procedural innovations, while EU plans to design emissions trading in the future considerably increase burdens on the cement industry. In addition, guidelines on dust collection will become more stringent.

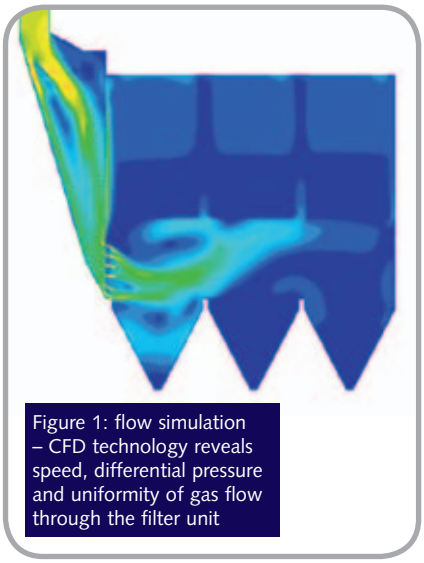


Figure 1: flow simulation – CFD technology reveals speed, differential pressure and uniformity of gas flow through the filter unit

The greatest dust sources are raw mills, rotary kilns, clinker coolers and cement mills. Generally, bag filters or electrostatic precipitators (ESPs) are used for these.

At 26 per cent of the gross added value, energy costs for the manufacture of cement are among the highest for all industry sectors.[1] Cement manufacturers therefore have a vested interest in conserving valuable, expensive raw material deposits for use as a basis in production. By using secondary fuels, fuel costs can be lowered. However, requirements for environmentally-responsible recycling of these materials need to be observed. To achieve this, conversion of ESPs into bag filters is essential and, indeed, unavoidable.

Compared to ESPs, the benefits of Intensiv-Filter bag filters include:

- constant and less clean gas dust content, especially when using secondary fuels to comply with requirements of authorities
- efficiency of bag filters is not dependent on changing operating parameters
- dust collection is not determined by water content or gas properties
- no CO trips for kiln dedusting applications
- online maintenance capabilities
- simple access clean-gas-side.

Besides the above benefits, Intensiv-Filter believes that converting ESPs into bag filters can also bring further advantages for cement manufacturers:

- cleaning is offline or semi-offline and within the low pressure range with the reduction in mechanical load on the filter sleeves leading to a longer service life.
- filter sleeves of 8m length enable existing ESP housings to be used so there's no need to increase the floorspace.
- duct work and dust discharge systems can also continue to be used
- conversion time is reduced considerably by filter heads with variable filter head sizes and can be carried out during scheduled downtime
- investment for a conversion is considerably less than the cost of a new installation.

Each conversion has its own prerequisites meaning a separate concept is required. As a supplier of complete system solutions, Intensiv-Filter will plan this concept precisely by carrying out

Figure 2: installation, February 2008

detailed analyses. A typical case was the upgrading to bag filter for the kiln/raw mill dedusting at Deuna Zement GmbH, Germany.

To comply with lower dust emission values, the existing ESP unit was upgraded to an Intensiv-Filter ProJect® filter with low pressure, semi-offline cleaning and 8m sleeve length. Regeneration of the filter was realised by means of intelligent cleaning control using the JetBus Controller®, which regulates cleaning prepressure and controls the shut-off flaps when necessary. The filter installation's operation is automatically adjusted to prevailing requirements by the JetBus Controller.

The head plates were removed from the existing ESP housing and Intensiv-Filter head modules (known as compartments) welded on. The compartments were then insulated on the clean-gas-side and equipped with pneumatic shut-off valves which are activated automatically as well as being externally accessible for maintenance purposes.

The clean gas side of the new bag filter was connected at each side to the existing clean gas duct work and filter fan. Access is via the remaining, upper section of the ESP housing – a penthouse design with a weatherproof roof. The existing ESP outlet was removed and then sealed with a new insulated housing wall. There was no need to convert the dust discharge system.

The goal, besides extensive use of the existing electrostatic filter housing, was to realise an air to cloth ratio of 60m³/m² h. To reach this, unlike with conventional ESP upgrades, the raw gas plenum was fitted entirely with sleeves. Owing to these spatial restrictions, the raw gas inlet in particular had to be optimised and the associated bag inflow optimised. To achieve this, a lamella system specially developed by Intensiv-Filter was used. Besides reducing inflow speed, it was also possible to achieve uniform distribution of the volume flow to the bag packages. The high-efficiency Intensiv-Filter cleaning system is aided by the ensuing reduction in upward flow between the bags. Further advantages of flow optimisation include a significant reduction of filter resistance and associated operating costs plus an optimised dust settlement into the hoppers due to uniformly low speeds in the entire raw gas plenum.

Flow simulation

Optimisation of measures is by means of comprehensive flow simulations in various versions using CFD software. The spread of speeds in the filter can be seen in the flow simulation diagram (see Figure 3). The uniformity of the bag inflow and low differential pressure in the filter have also been proven in practice.

As part of the regular winter shutdown, approximately 130t of ESP materials were dismantled and scrapped, after which the prefabricated bag filter components were fitted – an operation which caused quite a stir. After a total of six weeks of assembly and commissioning work, the new filter was in operation (see Figure 2).

Cement producers view investments in modern filter technology as the best way to achieve environmentally-friendly cement production. Reduction of emissions is an important factor here. With the Intensiv-Filter bag filter, legal limit values are undercut considerably when compared to an ESP.

There is no doubt that conversion of an ESP into a ProJet filter represents an important contribution to sustainability in cement production.

As well as consistent measures to reduce costs and conserve fossil fuels, a further goal is to maintain air purity and reduce emissions at all times.

Table 1: Deuna Zement project data

Gas type	Kiln, raw mill and pre-dusted bypass off-gas
Gas flow rate (m³/h)	550,000
Max. gas temperature (°C)	240
Dust type	Kiln /raw mill dust
Raw gas dust content (g/m³)	60-80
Residual dust (mg/N m³)	<8
Filter medium	GL/PTFE 750
Filter surface area (m²)	approximately 9300
Cleaning pressure (bar)	1.5-3.5
Pressure loss (Pa)	1200
Cleaning	Semi-offline

References

1. Vdz Online. Sustainability in the cement industry. Documentation of contributors and handling options.

Figure 3: after successful commissioning

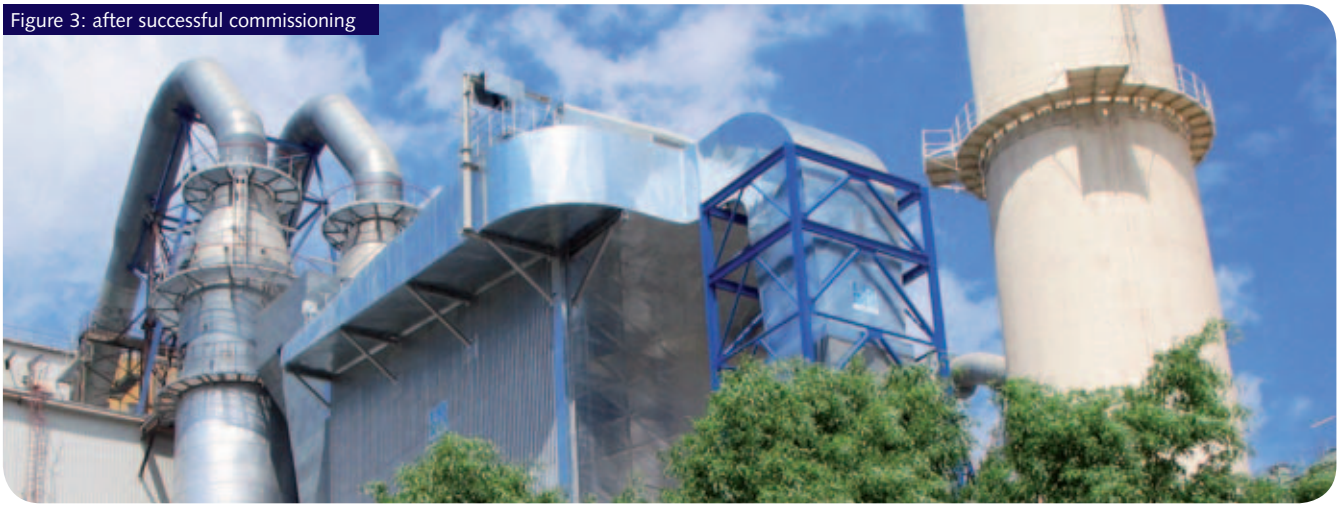
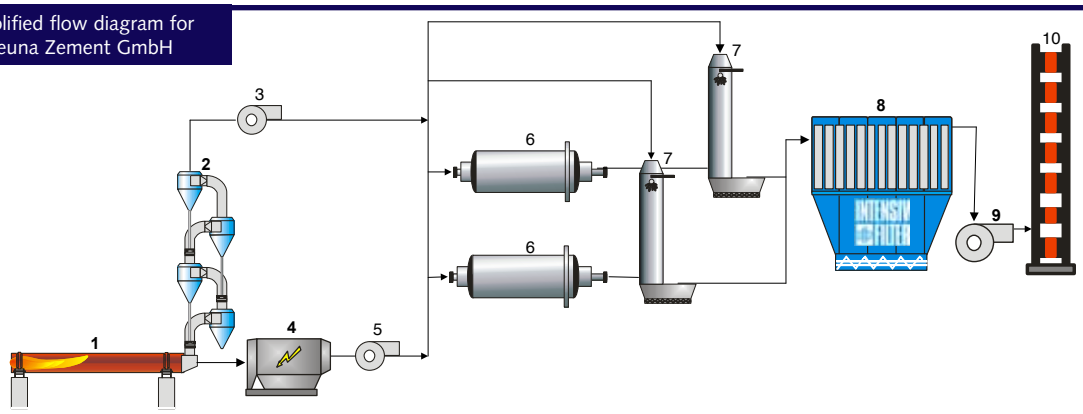


Figure 4: simplified flow diagram for Kiln N°1 at Deuna Zement GmbH



Legende

1	Rotary kiln	4	Electrostatic precipitator for alkali bypass	7	Gas conditioning tower
2	Cyclone preheater	5	ESP fan for alkali bypass	8	Bag filter
3	ID – fan	6	Raw mill units 1+2	9	Filter fan
				10	Stack