Case study

Energy saving combined with capacity increase retrofit for Holcim cement

Fans are some of the largest power consumers in a cement plant and the use of an energy-efficient model can significantly reduce the operating costs for a cement producer.

The Holcim cement plant Höver operates a cement production line in Höver. The plant has a capacity to produce 1 million tons of cement per year.

Problem

Höver has a main filter fan that was supplied by a local fan company in 1973. The plant had seen a potential for substantial energy saving since the fan efficiency was significantly below 70%. Höver had set the target to reach at least 10% of energy saving with the new main filter fan.

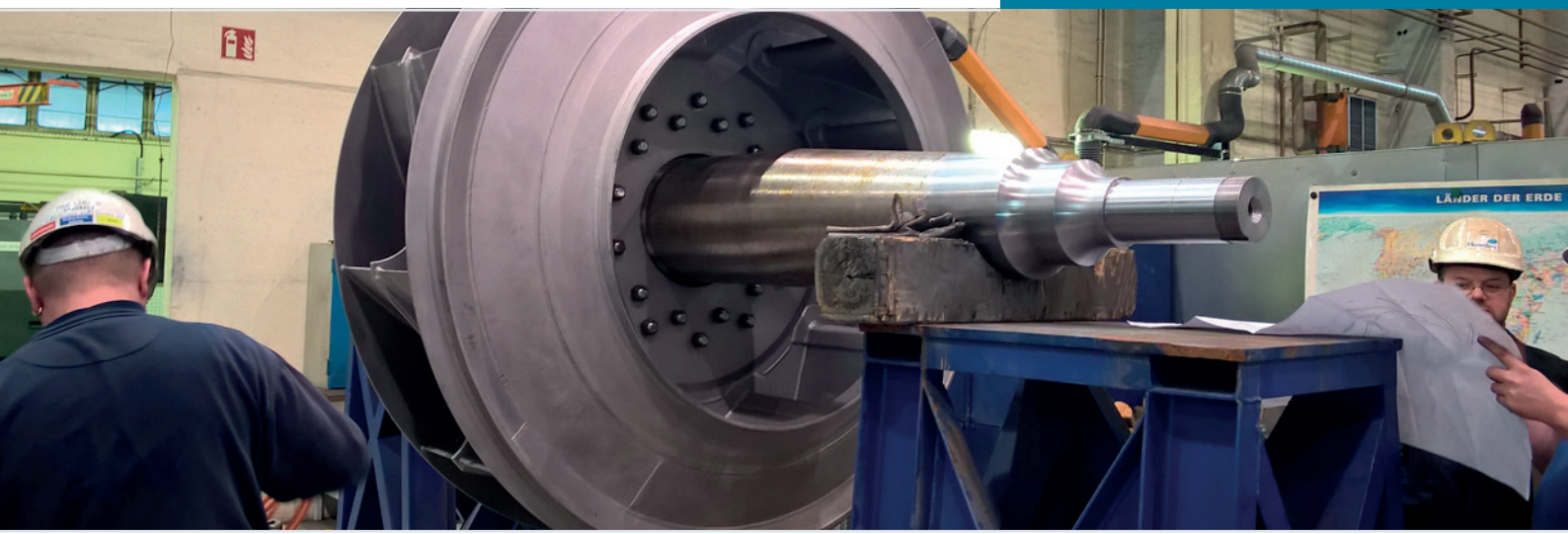
Besides the reduction of its energy bill, with the replacement of this fan, Höver was also foreseeing the possibility to debottleneck this fan in view of future plant output increase. Indeed, in this perspective of capacity escalation, the plant management set the target to replace the existing main filter fan with a new fan that could maximise the air volume flow increase, taking into account the existing installed motor power.

Howden was invited to study the case and to provide the best tailor made solution.

With its numerous brands (Howden, Fläkt Solyvent, Covent, Aeolus, Buffalo Forge etc.), Howden has over 5000 cement process fans operating around the world.

This has enabled Howden engineers to gain unrivalled experience in retrofitting cement fans throughout the world.

All Howden solutions are tailor designed to perfectly fit each application with the aim to achieve the best performances at the lowest cost.



Solution

Howden experts from Germany and France collaborated to carry out a full analysis of the situation. To accurately determine the system's requirements in terms of the fan's volume flow and pressure, and thus improve the efficiency of the new fan together with the existing system, Howden undertook an on-site performance test. The test results are shown in **Table 1.**

Based on the on-site test data and considering the system's situation and the future production increase requirements, Howden was able to confirm the design parameters of the new fan **(see Table 2).**

Among all available Howden fan designs, Howden cement fan retrofit experts decided to use the Solyvent fan design for this case; it provides high efficiencies, above 85% in this case, and could provide a significant air volume flow increase. In addition, Solyvent fans have the advantage of being a very proven design as they are widely used in cement plants all around the world.

As required by the cement plant, the new air volume flow was calculated by Howden engineers, considering the reuse of the existing motor. This motor power capacity being 2800 kW, Howden engineers included a minimum safety margin based on this power capacity in their calculations. In the end, the Howden solution could increase the air volume flow by 11,2% vs original flow with a fan shaft absorbed power of 2.692 kW. In addition, the pressure could be increased by 53.8%.

The replaced components included rotor, inlet cones, bearings and bearings housings, casing & inlet boxes, pedestals, coupling, dampers and base frame. The motor and the frequency converter were reused.

Table 1: Results of the main filter fan on-site test before retrofit

Flow	150	m^3/s
Static pressure increase	94,81	mbar
Density	0,877	kg/m3
Absorbed power	2014	kW
Motor capacity	2800	kW
Temperature	85	˚C
Efficiency	68,1	%
Speed	1484	rpm

Table 2: Calculated Howden fan performance (absorbed power & efficiency) under design conditions (air volume flow, pressure, density, temperature & speed)

Flow	166,81	m^3/s
Static pressure increase	145,82	mbar
Density	0,855	kg/m3
Absorbed power	2692	kW
Motor capacity	2800	kW
Temperature	95	˚C
Efficiency	85,7	%
Speed	1492	rpm

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Outcome

The new fan rotor was manufactured at Howden's Coswig workshop in Germany in only 12 weeks. It was then installed during the cement plant's yearly maintenance cycle in February 2018.

The retrofitted fan made full use of the original foundation and concrete cast counter base frame. Thanks to a great collaboration between the teams of Howden and the cement plant, Höver, the complete fan was ready for commissioning after only 13 days.

Howden also undertook extensive on-site surveying and mapping to match the reconstruction work with the original cement foundation and reducing the ducting alteration as much as possible. The new fan was tested on-site to confirm the performance of the final solution. The test results are shown in Table 3.

The comparison between the Howden fan on-site test values and the old fan are shown in Table 4. We can see that for the same air volume flow, the new fan shaft absorbed power is reduced by 238 kW per hour. This very significant reduction of power consumption provides a saving on the plant electricity bill that is close to USD 100,000 per year, which gives a payback time for the total investment just over 2 years.

Before replacement, the cement plant, Höver kiln BDP was 2.650 tons of clinker per day, but in normal operation only 2.550 – 2.600 was reachable, and the main bottleneck was the main filter fan. After this fan was replaced by Howden, it allowed the cement plant, Höver to not only save electrical energy, but also increase the production rate of the kiln to 2.850 – 2.900 tons of clinker per day.

The combined energy saving and increase of production means the payback of this retrofit job is less than 1 year.

Table 3: Results of the Howden main filter fan on-site test after retrofit

Flow	150	m^3/s
Static pressure increase	101,39	mbar
Density	0,856	kg/m3
Absorbed power	1776	kW
Motor capacity	2800	kW
Temperature	113	˚C
Efficiency	85,2	%
Speed	1303	rpm

Table 4: Comparison between the Howden fan on-site test values and the old main filter fan (table 3 – table 1)

Flow	Same	m^3/s
Static pressure increase	6.58	mbar
Density	-0.021	kg/m3
Absorbed power	-238	kW
Motor capacity	Same	kW
Temperature	28	˚C
Efficiency	17.1	%
Speed	181	rpm

Feedback

The Holcim cement plant, Höver is extremely satisfied with the performance of the new Howden fan. This main filter fan retrofit was a success as it met Holcim's expectations in terms of energy saving and capacity to increase the production without replacing the existing motor.

This case highlights Howden's ability to help its cement customers maximise the efficiency of their fans with a customised design, within all Howden designs available, that takes into account the customer targets, the needs of the fan system as well as existing site conditions and configurations.