Surviving demand changes

Economic sequels from COVID-19 will be among the worst in history. But what did the cement industry do to counter its effects? WL Gore illustrates how reducing total cost of ownership (TCO) through smart investments can allow a cement plant to remain flexible in times of low and high demand.

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Presently, the World Bank estimates that global economic growth will shrink by almost eight per cent in 2020, due to a myriad of factors including, most particularly, the effects of the COVID-19 pandemic. As cement consumption is highly sensitive to economic growth — or lack thereof — the industry is amid a challenging situation that demands creative measures to successfully weather this downturn. Any economic crisis, major or minor, highlights the importance of anticipating the future.

In the words of the noted economist (and World Bank co-founder) John Maynard Keynes, whose econometric models helped to overcome monetary crises arising from the Great Depression and Word War II: "Successful investing is anticipating the anticipation of others."

Therefore, how and where can the cement industry successfully invest to anticipate the consequences of the reality that is upon us? How much flexibility does a cement plant have, or need, to adapt successfully as it alternately faces periods of both low and high demand?

One case study in particular, spanning a two-year time frame that encompassed both low-demand and high-demand scenarios, may provide some useful answers. In this situation, strategic investment in a high-quality product with high levels of technical support provided the cement plant with the flexibility it needed to respond successfully during both economic extremes.

An example of how a cement plant's strategic investment in GORE® LOW DRAG Filter Bags has helped provide flexibility during economic extremes

Scenario 1: adjusting to significant demand destruction

When market demand drops, cement plants typically respond by adopting a "no more than necessary" approach. They will reduce both fixed and variable costs as much as possible. One of the biggest variable costs is energy. The more a cement plant produces, the more energy it consumes. So one solution to a drop in market demand is to reduce hours of operation, or, after reaching desired inventory levels, even shut down completely except for necessary maintenance activities, performed by a minimal number of workers. However, realistically, a cement plant cannot suddenly stop producing for a long period.

One alternative, in a low-demand scenario, is to find more sustainable ways to lower variable costs. In the case of cement kiln emissions, a large amount of energy is required to clean the exhaust gases, typically by means of an induced draught (ID) fan that creates negative pressure. Based on interviews with more than 50 cement plants, the energy consumed by an ID fan represents 75 per cent of the total cost of ownership (TCO) for operating the system. Accordingly, in a low-demand scenario, reducing the large amount of energy consumed by the fan will have the largest impact on reducing costs. This case study demonstrates that such energy savings can be achieved without sacrificing the production rate.

Scenario 2: avoiding bottlenecks while ramping up for higher demand

A sharp upturn in market demand can be a "good problem" to have, and the best scenario is operating at "sold-out" levels, where there is market demand for every tonne of cement that can be produced. However, successfully moving from low-demand to high-demand conditions requires added flexibility in plant operations: it requires process equipment that is prepared to maximise production without creating bottlenecks.

For example, to meet higher market demand, a kiln feed of raw material at 160tph may need to ramp up to 190tph. To achieve this production increase (assuming the overall process is stable enough to do so) the system must be able to manage more gas flow. Typically, higher gas flow leads to reduced filter bag life. Yet, in a high-demand scenario, the bottom-line benefit of increasing production should easily cover the increased cost of these consumables. However, it is also possible to produce more, while at the same time reducing TCO.

Figure 1: two significant three-month periods (Quarter A and Quarter B, respectively) in the cement plant's production after installation of the Gore filter bags

Real-world cost analysis for a cement plant

The data presented demonstrates the actual energy savings achieved by a cement plant using a variable-speed ID fan, over a two-year span that included times of both higher and lower market demand. This plant, working in partnership with WL Gore, defined and achieved the optimal balance of kiln feed rate to energy costs in both high-demand and low-demand conditions. It did so by installing GORE® LOW DRAG Filter Bags, which reduced the resistance to gas flow to the lowest levels ever achieved in this plant, which in turn contributed to corresponding reductions in energy costs. However, these benefits were achieved by the overall working partnership, of which the bags were just one component.

"Data from Quarter B shows improvements across the board – this plant saved more than 19 per cent in energy costs while increasing production."

Figure 1 highlights two significant three-month periods (Quarter A and Quarter B, respectively) in the cement plant's production after installation of the Gore filter bags. In Quarter A (the first three months after bag installation), the system had not yet been optimised. Moreover, the cleaning system was progressing to failure and a baghouse module became blocked as a result. As the red energy-consumption line in Quarter A shows, a filter bag's function is never independent of the health of the overall system.

WL Gore was committed to helping the current cement plant achieve similar, or better, results with its filter bags. Accordingly, in close collaboration with plant personnel, a team from WL Gore performed a laboratory analysis of the bags' performance. WL Gore also brought in specialists to help diagnose some of the system issues and recommend improvements that were subsequently implemented.

In Figure 1, Quarter B illustrates the very different performance achieved by the same set of GORE LOW DRAG Filter Bags after the overall system had been improved and optimised. The difference in bag performance and resulting energy savings between Quarter A and Quarter B is quantified in Table 1.

Data from Quarter B shows improvements across the board – this plant saved more than 19 per cent in energy costs while increasing production. Differential pressure was reduced, with corresponding reductions in energy consumption. The three-month energy savings for the ID fan alone exceeded US$30,000. At the same time as the energy use/cost was reduced, clinker production increased by 3.7 per cent.

These results are impressive on their own but even more impressive when considering that Quarter B occurred during March, April and May 2020, months that – in most countries of the world, and for this plant as well – represented one of the most critical shifts in industrial demand and production due to the COVID-19 shut-downs and knock-on effects.

A healthy response to challenges, crises and future good times

It is safe to say that 2020 has focussed collective attention on healthy practices, and this focus surely extends to current business practices as well. In the cement industry, certainly there is a parallel: many products in the marketplace might be considered the equivalent of "junk food snacks"… attractive as inexpensive quick fixes but not a long-term healthy investment, particularly if they "burn up" too much energy too quickly, or shorten the life of process equipment from fans and ducting to the baghouse and valves.

If, like John Maynard Keynes, the cement industry has the vision to anticipate how conditions will continue to change, it can choose to make smarter investments in technology partnerships and products that will add value to operations and reduce TCO. ■

Table 1: difference in bag performance and resulting energy savings between Quarter A and Quarter B

Quarter	Hours feeding the kiln above 160tph	Differential pressure ΔP (mbar)[1]	kW/h average of ID fan[2]	Kiln feed rate average (tph)	Clinker production (tpd)	kW/day	kW/h per tonne of clinker[3]	Benefit %
A	2081.00	17.85	1281.56	180.56	4292.00	30757.44	7.17	–
B	1128.00	15.94	1076.52	187.33	4452.92	25836.48	5.80	19.03

[1] From the inlet of the gore® low drag Filter Bag to the flange of stack fan (eg, flange to flange)
[2] ID fan creates the system's negative pressure; energy consumption is greatly improved by reducing differential pressure
[3] kW per day divided by the number of tonnes of clinker