Space optimisation

Often the space available for new equipment can present a challenge, and the need for space-friendly equipment becomes important. Simatek's Lead Engineer, Lars Kokholm Kristensen, and Global Sales Manager, Alaa Aburayyan, present different multi-pollutant control solutions that guarantee compliance with the most stringent environmental regulations and are even more valuable when it comes to solving space issues.

■ *by **Line Bach**, Simatek, Denmark*

There can be several reasons why cement producers need to upgrade a plant's existing air pollution control (APC) equipment, either by introducing new systems or technologies, including:

- increased kiln production
- alternative fuels usage
- new stringent environmental regulations
- existing equipment reaching the end of its lifetime.

Increasing the production rate of a kiln can lead to a higher flow rate that an existing APC systems may not be able to cope with. The use of alternative fuels creates new pollutants such as particulate matter (PM), NO_x, SO_x, hydrocarbons (HC), chlorine and heavy metals. If the limits of these pollutants are exceeded, the installation of new technologies, dry sorbent injection systems (DSIS) or far more expensive technologies like semi-wet or wet systems may be required. Moreover, a new chlorine bypass system is highly likely to be introduced to continue with fossil fuel substitution.

As a result of its extensive dust control experiences and R&D activities, Denmark-based Simatek can often address these challenges without major modifications to existing equipment while maintaining or reducing the plant's current footprint.

The company can also replace existing equipment while optimising the space to be used for new equipment, therefore avoiding further plant extensions with related capital and operating expenditure.

Case study

At one cement plant, Simatek was requested to provide a dedusting solution for a baghouse with the following features:

- flow rate: 300,000m³/h
- air-to-cloth ratio: ~1.00m²/m³/min
- cloth area: ~5000m²

Figure 1: space optimisation – before (left) and after (right)

- dust load: medium – ~300g/m³
- temperature: low – ~0-100˚C
- design pressure: medium – 800-1000mmWC.

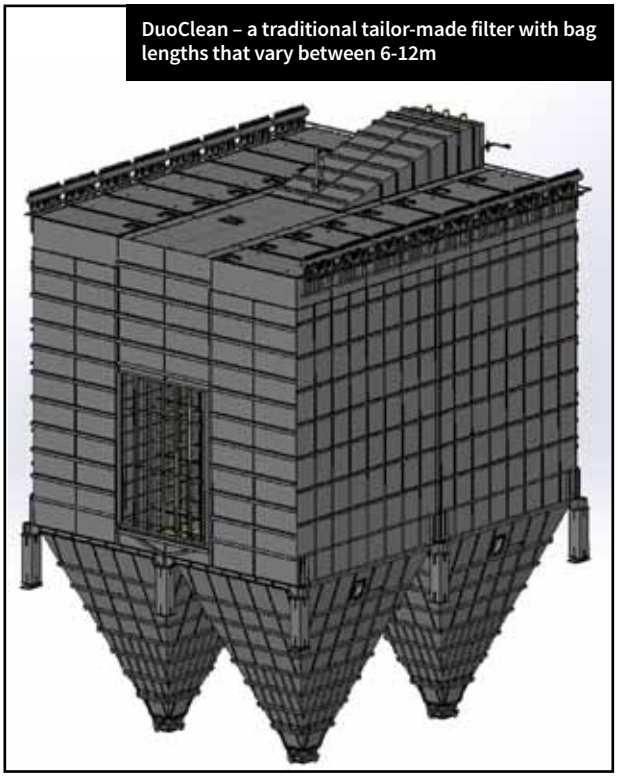
The cement producer considered three systems from Simatek: the DuoClean, DuoClean2 and SimPulse 3CS.

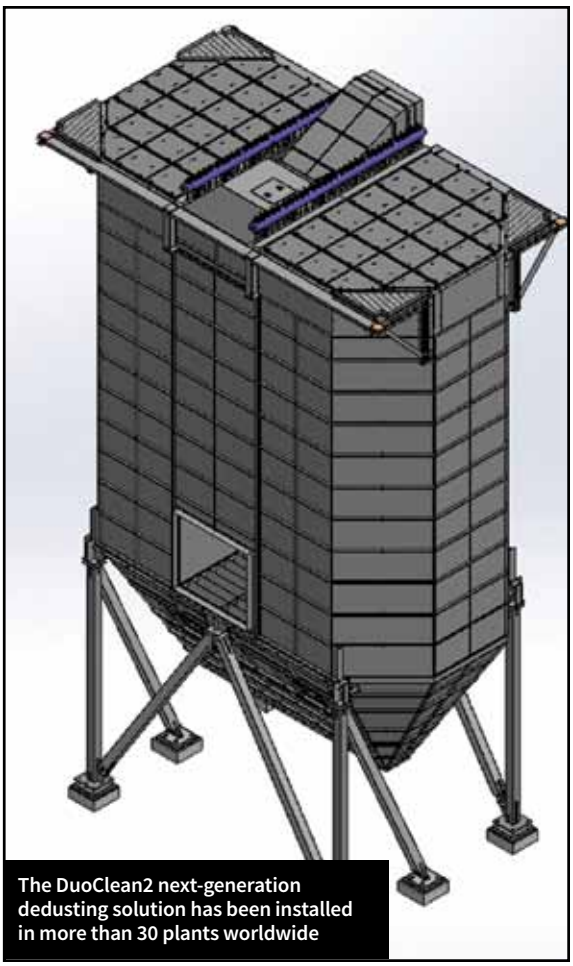
Solution 1: DuoClean

The DuoClean is a traditional tailor-made baghouse, sized to cope with the plant's dedusting requirements. The filter bag length can vary between 6-12m. It has a dual flow approach, with the input flow split between the hopper entry (vertical) and the side entry (horizontal through the bag zone). The longer the bag, the more flow comes from the side.

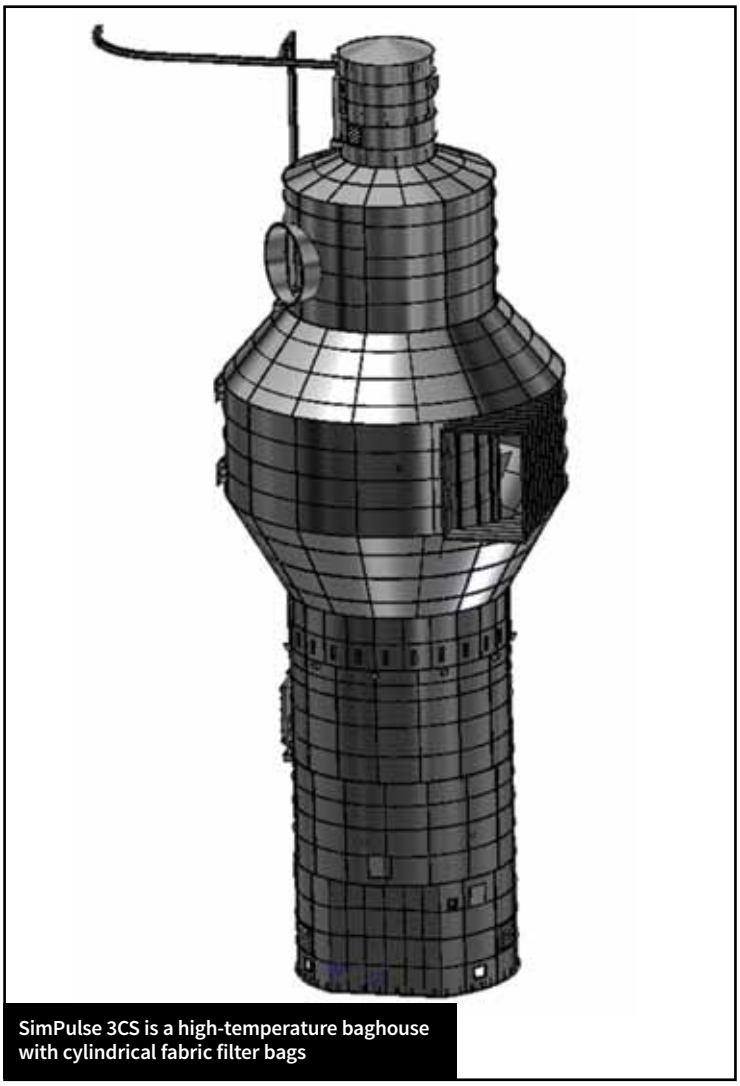
The filter is a single-compartment type and therefore, no online maintenance is possible. The built-in gas distribution system is excellent for handling medium to high dust loads. The filter can be equipped with outlet dampers and sized so it can continue to operate when a few bags are broken. In addition, this type of filter has top access to bags and is covered by a weather-proof enclosure, which is high

DuoClean – a traditional tailor-made filter with bag lengths that vary between 6-12m





The DuoClean2 next-generation dedusting solution has been installed in more than 30 plants worldwide



SimPulse 3CS is a high-temperature baghouse with cylindrical fabric filter bags

enough to take the cages out of the bags.

The filter's cleaning system is a traditional jet pulse system, where up to 24 bags are cleaned by one diaphragm valve. The cleaning pressure is 1.5-5bar, depending on the configuration and selected diaphragm valve (48.3-88.9mm/1.5-3in).

Burst bag detection is made possible by adding a number of burst bag detectors to the outlet end. The bag can be identified down to the cleaning valve level. If minor leaks are detected, the specific valve can be taken out of the cleaning cycle and the leakage potentially reduced.

The Duoclean system is a well-proven filter with more than 100 installations worldwide.

Solution 2: DuoClean2

The DuoClean2 is an updated version of the DuoClean and shares the same gas distribution system. However, it is not tailor-made as the selected design is limited to a number of predefined top boxes and the length only varies between 6-10m. The bag cleaning system, burst bag detection and gas distribution system are similar to those of the DuoClean. There is also an outlet damper option.

The casing is made of predefined panels and the filter is more octagonal in shape than rectangular. Each panel is lower in weight compared to the conventional type. This is partly due to the fact that its span is reduced compared to the rectangular filter and profiles can be made of simpler structures, which also reduces fabrication costs. Moreover, due to the lower weight and easier assembly, erection time is reduced when compared to the rectangular solution.

Simatek has installed the DuoClean2 in more than 30 locations worldwide.

Solution 3: SimPulse 3CS

SimPulse 3CS is a high-temperature baghouse with cylindrical fabric filter bags. It uses a unique servo motor-driven bag pulsing technology that is based on high pulse energy, high pulse volume and low pulse pressure. The high pulse energy and the low-pressure combination provides uniform bag cleaning with primary and secondary cleaning which, in combination with 100 per cent down-flow filtration, allows for efficient sub-micrometre filtration. The SimPulse high pulse energy enables efficient cleaning of 16m-long bags. Moreover, the low pressure results in longer bag life.

The online cleaning of two bags at the same time can be performed. The bag leak detection system can attribute a leak to either of the two bags. The SimPulse 3CS has a cleaning pulse system that automatically adjusts the cleaning pressure and the cleaning pulse energy. In critical conditions, the 3CS cleaning pulse system will automatically intensify the cleaning energy for shorter or longer periods. The cleaning pulse air is provided by a low-cost and maintenance-free claw compressor. The 3CS servo motor-driven bag pulse system is maintenance free. It is designed for outdoor installation and is provided with a walk-in plenum.

The 3CS bag filter can be provided with a dynamic pre-separator inlet for wear protection of the filter bags.

Comparing DuoClean, DuoClean2 and SimPulse 3CS

Installation of a SimPulse 3CS filter – before (left) and after (right)

The flow for the DuoClean is in the lower end, and a one-section filter can be selected. It can be sized with either 10m/127mm (10m/5in) bags or 12m/152mm (12m/6in) bags. The solution with 10m bags would have a total measurement of ~6.1m (long) x 10.1m (wide), whereas the solution with 12m bags would measure ~5.1 x 11.6m. It is also possible to build this filter as a single-line filter, which would be double in length and approximately half in width. The footprint of the DuoClean solutions would be 61m^2 and 59m^2, respectively.

Both DuoClean solutions would end up with six top boxes. Each can be manufactured in the workshop and transported to the final site in a container. The main part of the filter steel arrives at the site in panels and is to be assembled into a finished baghouse.

The flow mentioned with the DuoClean2 solution is still in the low range and a solution is possible with only one section in length, similar to those mentioned for the DuoClean filter. The supporting structure is narrower for the DuoClean2 than the DuoClean, but the casing is wider above the supporting points. The space required for this specific filter is 6m long by only 8.8m wide at ground level. The full casing width is 11.7m. The footprint is only 51m^2, 15 per cent less than than the DuoClean.

The SimPulse 3CS solution provides 5019m^2 of filter membrane area in a footprint with a diameter of 7700mm. This results in a footprint of only 47m^2.

Conclusion

Simatek provides a range of baghouses, depending on the customer's requirements. In some cases, the technologies employed are suitable in ESP-to-baghouse conversion projects and, depending on the height of the ESP, Simatek can deliver a solution using filter bags of up to 16m in length.

While all of the three above-mentioned solutions will solve dust emission issues, the DuoClean2 and SimPulse 3CS baghouses optimise the space used. Moreover, thanks to their relatively smaller footprint, each solution frees up space for other equipment to be installed, either up- or downstream of the baghouse.

A typical ESP designed for the same flow would be ~6-8m wide and much longer than any of the three solutions described, depending on whether it is a two- or three-section ESP. The SimPulse 3CS has a range between 2413-11,967m^2 per module and can be arranged in clusters of two, four or six units. ■

Table 1: solutions for optimising footprint

Parameters	Solution 1a	Solution 1b	Solution 2	Solution 3
Filter type	DC-TD/PJ-P/1200/ 10x133/(20x10) x 1	DC-TD/PJ-P/840/ 12x152/(20x7) x 1	DC2-TD/PJ-P/1200/ 10x133 /600x2/1	3CS-624
Length/ϕ (mm)	6083	5078	5794	7700
Width (mm)	10098	11638	8774	
Footprint (m^2)	61.4	59.1	50.8	46.5
Cleaning pressure	Medium to high	Medium to high	Medium to high	Low
Installation time	High	High	High	Medium