



White Paper

FGD Gypsum Dewatering: A Filter Belt Generation used all over the World

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Although the market share of renewable energies has risen exponentially, coal is still the base for more than 40% of the world's electricity production. In recently built plants, flue gas desulphurisation is a standard. For further processing of the herewith produced gypsum sludge effective dewatering is of paramount importance.

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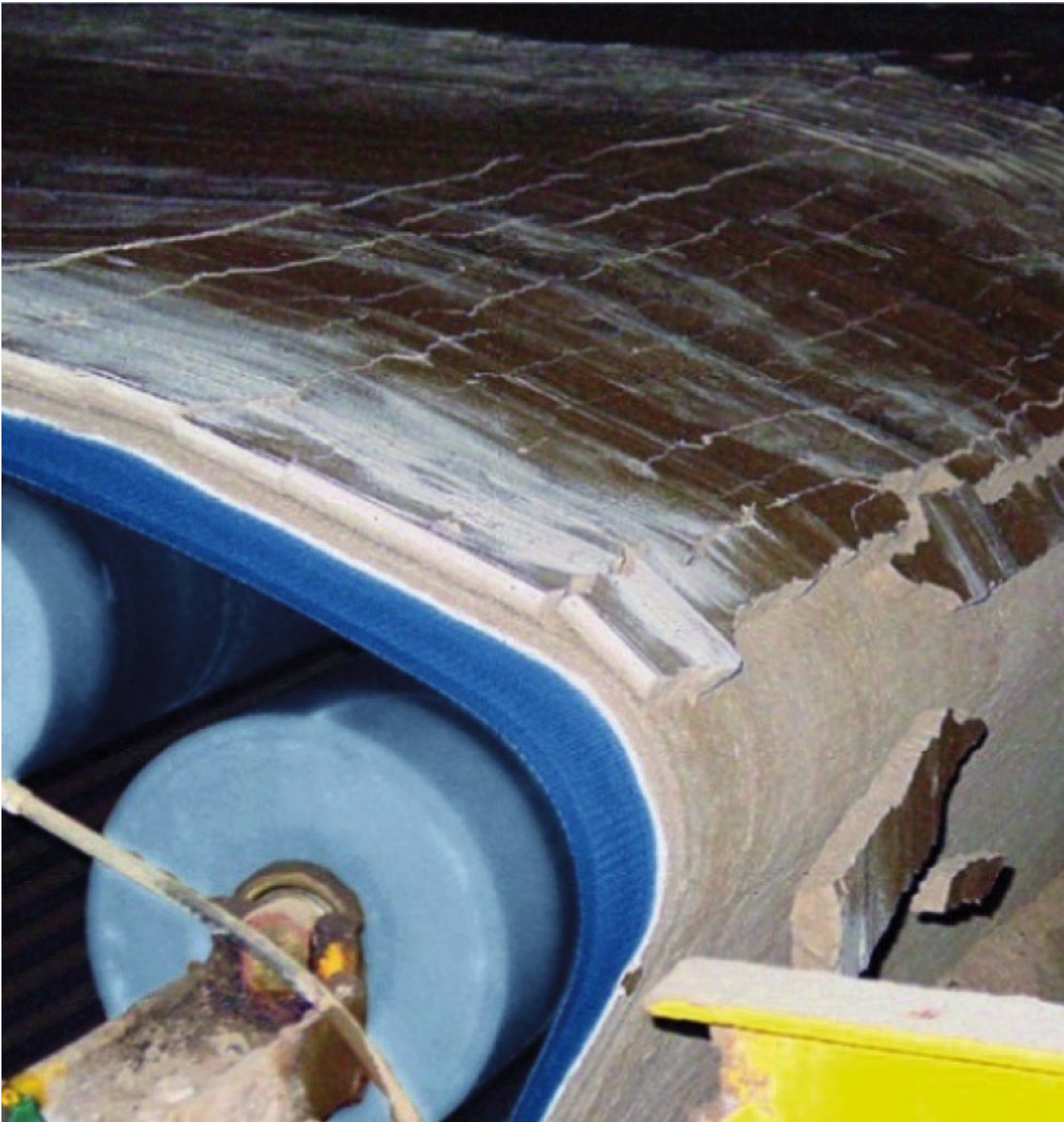
Visible from afar, the white plumes of power. (Picture: © GKD/Rudi Böhmer)

The future of electricity production belongs to renewable energies. Experts agree notwithstanding that up to the year 2040 non-renewable energies will have 80% of the energy mix worldwide. Actually, coal is the world's second most important fossil energy source after petroleum. In 2015, coal covered 29% of global primary energy consumption [1]. In Germany more than 40% of domestic power generation. Almost every fourth kilowatt hour of power consumed in Germany came from brown coal [2]. Domestic hard coal production is on the decrease due to the expiration of subsidies in 2018. By contrast, significantly more hard coal than brown coal is being produced globally. The flue gas formed by every coal combustion is being scrubbed in an ecologically responsible way in flue gas

desulphurisation plants (FGDP), inter alia. FGD gypsum emerges as a byproduct of this process – about 7 million tonnes annually in Germany alone [3]. This base material is required in the construction and cement industry in very large quantities, e. g. in the manufacture of drywall. For FGD gypsum dewatering in vacuum belt filter systems the largest coal power stations in the world rely on filter belts of the Vacubelt type from [**GKD - Gebr. Kufferath AG**](#). Virtually every well-known plant manufacturer relies on the efficiency of these filter cloths too.

Benefits of State-of-the-Art environmental Standards

In 2015, 6.7 gigatonnes (= 6.7 billion tonnes) of hard coal (hard brown coal, mineral coal, anthracite coal) and 1 gigatonne of soft brown coal were produced around the world. The three countries leading in the production of hard coal, are China (3.4 gigatonnes), followed by the USA (0.75 gigatonnes), and India (0.64 gigatonnes) [4]. In parallel to the constantly increasing production volumes, newly constructed power stations, station expansions and renovations are booming. It is the goal of these activities to increase the efficiency of the conversion of coal into electricity and to continue to decrease emissions through improved technologies for dedusting, denitrifying and desulphurising flue gases. One of these power stations of the future was unfolding in 2012 in Neurath in the form of two new brown coal power station blocks. Each of these power station blocks has a gross output of 1100 megawatts and an efficiency factor of more than 43%.



Dewatered gypsum dissolves from the belt. (Picture: © GKD)

Their optimised plant technology is basically in line with the concept of the blocks already in place but takes much better advantage of the fuel used. As a result, they increase their efficiency by almost one third compared with the hitherto existing plants. Consequently, they greatly decrease gas and dust emissions as well. In this way, in the flue gas desulphurisation plant, for instance, more than

90% of the sulphur dioxide is separated and transformed into gypsum slurry. The subsequently condensed, 60 to 65 degrees Celsius hot gypsum suspension is dewatered in vacuum belt filters in a continuous process. This operation imposes tough demands on the mechanical, thermal and chemical capacity of the filter belt used.

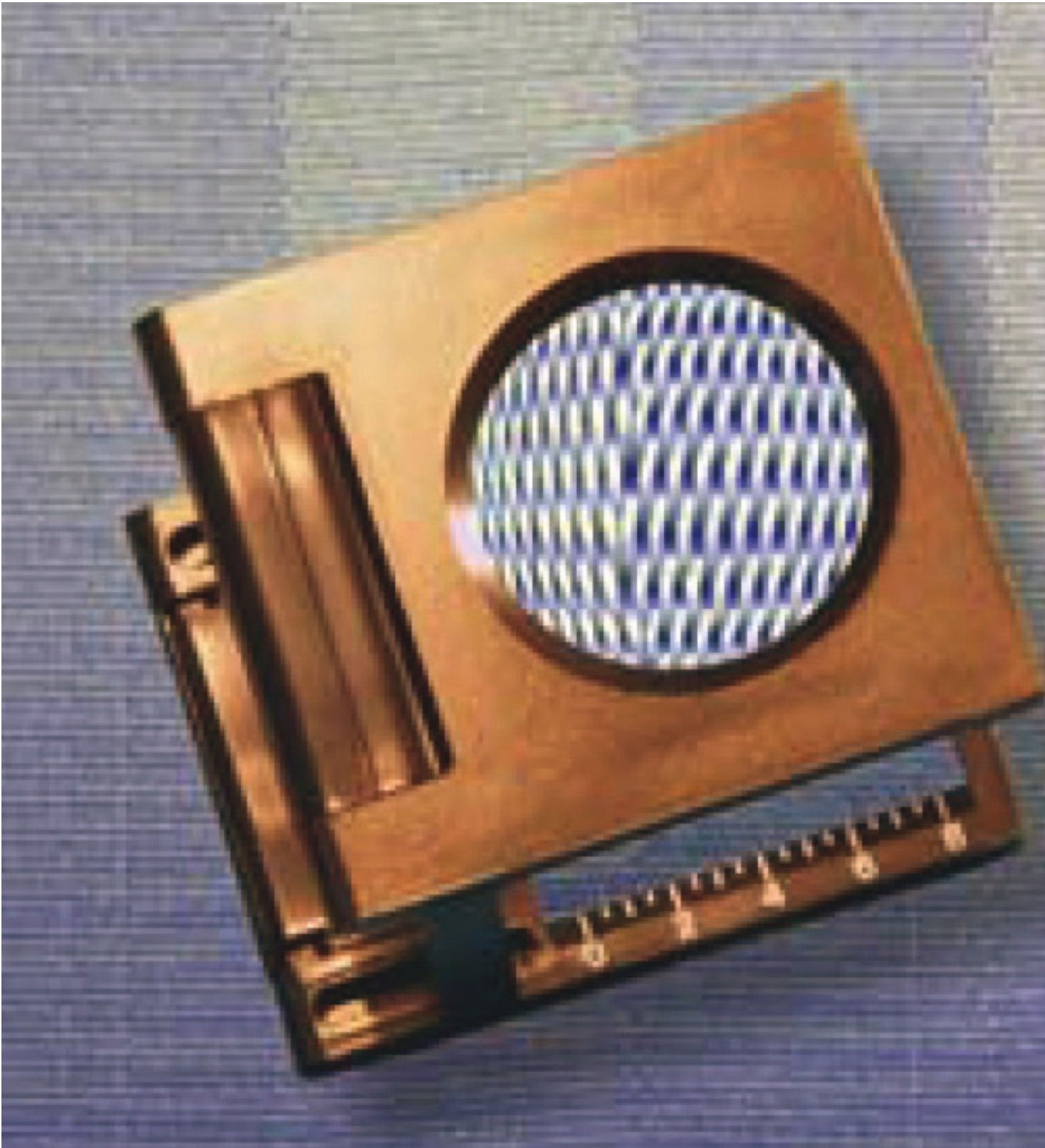
Confirmed in a direct Comparison



Belt filter for the lignite fired power station blocks with optimised plant technology in Neurath, Germany.
(Picture: © FLSmidth)

The core of the system for FGD gypsum dewatering in the new brown coal blocks with optimised plant technology in Neurath consists of two 35 metre long and

3.50 metre wide vacuum belt filter installations supplied by the international plant manufacturer FLSmidth. With a total filter surface area of 93 square metres each they range among the largest FGD belt filters in the world. For many years now FLSmidth has been relying on FGD gypsum filter cloths in Vacubelt belts from GKD. This is why in 2008 the two new blocks in Neurath were specifically equipped with the doublelayered Vacubelt 2025 filter belt. In this case, a twilled two-ply mesh made of polyester monofilaments with staple fibres is involved, whose reliability and efficiency Thomas Triebert, FLSmidth's Senior Sales Manager Power/FGD, had already learned to appreciate at several other power stations.



The Vacubelt 2015 has set new standards for vacuum filter belts.
(Picture: © GKD)

Still in the installation phase, however, as one of the belts at Neurath became damaged due to an accident in the plant, he selected the new Vacubelt 2015 belt type made entirely of polyester monofilaments as a replacement. Thomas

Triebert had been waiting for a belt like this for a long time. When GKD presented this belt at the AICHEMA 2009, he was one of the first plant manufacturers to put the innovative technology to use, in a power station project at Tušimice in the Czech Republic. The unique mesh design with more pores per square metre with a smaller opening at the same time proved itself to be especially efficient even during this initial application. With greater air permeability, faster dewatering and the fact that the mesh did not block up and was easier to clean, the Vacubelt 2015 outperformed the operating level of conventional belts by far. This is why for Thomas Triebert the installation of this type of belt as a replacement at Neurath was also obvious. The test run of the systems began in 2011. At first, the gypsum suspension with 15% solids content is condensed in hydrocyclones and then, with a solids content of 50 to 60%, spread on the giant vacuum belt filters. The belt filters extract more than 90% of the moisture from 81 tonnes of gypsum per hour – and doing so operating non-stop. The filtrate purity realised is under 0.5% with dry matter of 8%. An efficiency which Thomas Triebert confirms in his estimation that the new all-monofilament belt has set new, groundbreaking standards in the vacuum filter belt range.

A Trend recognised at the right Time



FGD gypsum dewatering system in Belchatov, Poland. (Picture: © thyssenkrupp Fördertechnik)

An assessment that Detlev Stronczek, Head of Sales Power Plant Processing at Thyssenkrupp Fördertechnik (TKF), also shares. He states that the Vacubelt 2015 is a “state-of-the-art filter cloth which GKD, a highly innovative firm, has brought to the market”. Consequently, he too has been using this belt type in various vacuum belt filters for FGD gypsum dewatering since 2009: in the Rheinhafen-Dampfkraftwerk Karlsruhe, Datteln 4 and Maasvlakte (Netherlands) mineral coal power stations and in the Belchatov (Poland), Turcini (Romania) and Maritza II (Bulgaria) brown coal power stations.

A Host of operational Advantages

Good reason for him to consider using this kind of belt at the Belchatov power station, for instance. With 12 blocks, this largest brown coal power station in the world supplies a total output of 4400 megawatts of electricity. Thyssenkrupp Fördertechnik had already equipped six of the blocks in years past, four of them with complete belt filter systems and two with hydrocyclones. So it was not surprising that TKF was commissioned with equipping the 13th block which is to produce another 850 megawatts of electricity. Three vacuum belt filters with 55 square metres of filter surface area each were installed here in 2011, all of them equipped with Vacubelt filter belts.



GKD Vacubelt filter belts, installed in the Belchatov FGD gypsum dewatering system.

(Picture: © thyssenkrupp Fördertechnik)

The 2015 belt type impressed Detlev Stronczek immediately for several reasons: In addition to the high air flow rate and the dewatering effect optimised as a result, the polyester monofilament's thermal resistance is particularly significant. He cites the cross-stability and smooth belt surface as another advantage, whereby the belt can be easily cleaned by spray pipes in the integrated cleaning unit. Moreover, the smooth surface texture reduces the possibility of confusion because the cloth can be applied from either side. Thanks to its extreme mechanical sturdiness the Vacubelt 2015 can be adjusted to a speed of operation in line with demand. An advantage that proves its worth with major flexibility in throughput times and nominal thickness as regards non-contract specific feeding quality for gypsum suspension in particular. The continuous density measurement immediately detects aberrant solid matter concentrations in the flue gas scrubber, the system will automatically run faster or slower in order to achieve unalteredly good results. The spreader vanes typical of TKF systems in suspension feeding also ensure uniform spreading of the gypsum suspension and unvarying dewatering efficiency even at different speeds. Belt filters equipped with Vacubelt 2015 belts reduce residual gypsum moisture permanently to under 10% and at Belchatov produce 45 tonnes of drier per unit per hour.

Established all over the World

With the exceptional efficiency of its Vacubelt 2015, GKD was able to convince a considerable number of power stations in other leading coal producing countries too. In the USA more than 15 power stations with an output volume between 1 and 2.7 gigawatts are equipped with over 35 Vacubelt belts on average every year. The all-monofilament Vacubelt 2015 in the most common belt size there is 50 metres long and 3 metres wide and is one of the favourites in American coal power stations. Nevertheless, the two-ply belt types of the successful filter belt family are being used in the USA as well: The type 2025 with staple fibres and the type 2035 with multifilament weft wires are still sought-after solutions in America. In South Africa another top power station relies on GKD's innovative belt technology: The Kusile mineral coal power station (still under construction), located some 100 kilometres east of Johannesburg, was equipped with high-performance type 2015 belts in 2011. With 4800 megawatts of rated output, Kusile is ranked among the largest coal power stations in the world. For a few years now GKD's innovative mesh design has established itself as a key element of FGD gypsum dewatering systems wherever state-of-the-art technology is used for maximum efficiency and process reliability. Leading plant manufacturers and operators opt for the Vacubelt 2015 vacuum filter belts even as original

equipment. Consistently unvarying filter performance and stability without blocking up guarantee long service lives. Even with variable gypsum volume or quality the results remain unvaryingly good. High cross-stability even at large widths is essential for continuously efficient operation and guaranteed residual moisture.

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