Electricity is used daily in many everyday situations in the form of power, heat or light, whether in private households or at work. In the district of Peine, north of the Midland Canal between Hannover and Braunschweig, some of the electricity is supplied by the Mehrum coal-fired power station. The station was first put into operation in 1962. Unit 3, which was put into operation in 1979, is still running and employs a staff of 130.

The power station is a conventional thermal power station in which feed water is heated in a tank by burning coal. The resulting high-pressure steam turns a turbine connected to an electric generator. The steam then condenses and returns to the steam generator - and the cycle starts again.

The power station processed up to 5,760 tons (t) of coal daily, and with an efficiency of approximately 40.5 percent, can generate 690 megawatts of electricity. The coal stockyard has a capacity of 500,000 t. Thanks to far-reaching modernization, particularly relating to environmental protection, the efficiency has been continuously improved in recent years and the emissions reduced.

The task: complying with the required emission values

Burning coal produces not only carbon dioxide (CO₂) but also additional substances that pollute the environment, in particular nitrogen oxides, flue ash and sulfur dioxide. The strictly regulated legal limit values for these emissions require special plants with complex technology for flue gas cleaning.

Flue gas cleaning starts with special burners that already reduce the production of nitrogen oxides during combustion. A mixture of air and ammonia is added to the hot flue gas and these react in a catalyzer to form water and nitrogen, which are both natural components of the air. This process is called denitrination.
The second step is dust removal, where dust particles are electrically charged in electro filters and held as if by a powerful magnet. Finally the flue gas passes through a scrubbing tower, the absorber where chemical processes produce gypsum from the sulfur dioxide. The last process is desulfurization. The resulting gypsum is dried and, among other products, used in the building materials industry to produce gypsum plasterboard.

With all burning processes, carbon dioxide (CO₂) emissions are unavoidable. To protect the environment, overall emission values for all producers such as power stations, the cement and steel industry were limited throughout Europe. The CO₂ emissions are verified based on the raw material consumption. In the case of the Mehrum power station, this is therefore the amount of coal burned. The coal is transported by ship using the Midland Canal and stored in large piles. Depending on the electrical power that needs to be produced, the necessary amount of coal is transported to the power station using conveyor belts and continuously weighed using belt scales and recorded in the process control system.

**The solution: „Weights“ of CO₂ emissions**

The task in the Mehrum power station was to replace the previous consumption measurement system with a high-precision belt scale. One of the priorities of the operator was to have the possibility of running a simple accuracy check under conditions as realistic as possible. For this reason, the company chose the Siemens Milltronics MMI-3 belt scale with calibration chain.

The belt scale consists of three Milltronics MSI belt scale idlers with two load cells each. The scales are mounted one after the other below the idlers of the conveyor belt. The belt scale achieves measuring accuracy of +/- 0.125 percent within 25 to 100 percent of the maximum measuring range.

**Accuracy and ruggedness**

The special triple-beam parallelogram-style load cells allow direct force transfer from the idlers and remain completely un influenced by shear forces such as belt misalignment.
As a result, no additional external mechanical compensation of these shear forces is necessary. The load cells are available for capacities of up to 680 kilograms per cell. For this reason, even with high loads and heavy idlers, no bearing or lever is required for force deflection. This ensures a fast reaction time of the load cells guaranteeing highly accurate weight measurement even with strongly fluctuating feed rates.

With the triple-beam load cells and the compact design, the Milltronics MSI and MMI belt scales are practically maintenance-free and ideally suitable for applications with a large throughput of up to more than 12,000 t/h.

Simple handling of the calibration chain

The belt scale is calibrated in the Mehrum power station using a calibration chain, which places a load over a length of at least two idlers before and after the belt scale. The chain consists of individual interconnected rollers so that the chain rolls free of friction over the belt.

Mounting the chain proved to be a particular challenge. Normally supported on a drum, this is lowered by a motor onto the belt and raised again following calibration. Since the conveyor belt in the power station is located in a tunnel with little space above the belt, a special holder with a lowering device was designed by the Siemens partner Fischer-Waagen GmbH.

The chain is now on a chute that is lowered onto the belt manually. The calibration chain runs automatically on the conveyor belt. After successful calibration, the chain is pulled onto the chute again by a winch and parked in a secured position. Converting to automatic operation is possible at any time. The calibration chain used in the Mehrum power station is a double chain over seven meters long with a weight of 66 kg/m.

To measure the belt speed, a Siemens Milltronics RBSS speed sensor with a wheel on the return belt is used. This has a rugged design and a high resolution of 60 pulses per revolution.

The evaluation of the measuring signals of the belt scale and speed sensor is handled by the Milltronics BW500 belt scale integrator. It transfers the current flowrate and the totalized amount of coal to the process control system. The weights applied in calibration mode are not taken into account in the sum of the mass.

Precise detection of the CO₂ emissions

Thanks to the Siemens Milltronics MMI-3 belt scale, the coal consumption in the Mehrum power station can now be measured precisely. The basis for calculating the CO₂ emission to be verified is therefore guaranteed. This is also confirmed by Wolfgang Goedecke, head of control technology and Sven Stolle, head of process technology: „With the belt scale, we have implemented an important measure in the certification process for CO₂ monitoring. The simple handling of the calibration chain simplifies the checking of the measuring equipment according to the power station-specific QS regulations.“

Milltronics test chains for belt scales

- The roller test chain simulates via rollers the material loading on the belt and enable therefore an adjustment while the loaded belt is running
- Constant belt loading during the adjustment will be guaranteed
- Belt load from 7.4 kg/m up to 148.8 kg/m
- Rugged design for environmental conditions
- Optionally deliverable with motorized storage reel