143 (68) November 2018 A 7471 E

Zucker Industrie
Sugar Industry

11

Sugar beet harvest quality
Best Available Techniques
25 years Zeitz sugar factory

Erntequalität von Zuckerrüben
Beste Verfügbare Techniken
25 Jahre Zuckerfabrik Zeitz

ESCON

LIQUID SEPARATION TECHNOLOGIES

ARi Amalgamated Research LLC



FRACTAL SHALLOW BED SMB CHROMATOGRAPHY

- Beet Sugar Industry: Molasses Desugarization with Betaine Recovery
- Sugar Refining Industry: Run-Off De-Ashing, Decolorization & Invert Removal
- Starch Industry: HFS Production, Glucose – Fructose Separation
- Biobased Products: Organic Acid Purification / Separation

60+ INDUSTRIAL FRACTAL CHROMATOGRAPHY & IEX INSTALLATIONS

ESCON GMBH
Schlossstrasse 48a
12165 Berlin • Germany
phone: +49 30 7978330-0 • fax: +49 30 7978330-285
e-mail: info@escon.com
www.escon.com

ESCON AMERICA INC.
1391 NW St. Lucie West Blvd. 126
Port St. Lucie • Florida 34986 • USA
phone: +1 772 249 4521 • e-mail: info@escon.com
www.escon.com

ESCON. ENGINEERED EFFICIENCY.

Nina Terp

How sugar mill operators can benefit by using modern rotating equipment

According to the South African Sugar Association (SASA), the South African sugar industry consistently ranks in the top 15 of approximately 120 sugar producing countries worldwide. Sugarcane is grown by approximately 24,000 registered sugarcane growers, says SASA. The six milling companies employ upwards of 7,000 people in 14 sugar mills. The industry produces an average of 2.2 mn t of sugar per season. On average, about 75% of this sugar is marketed in the Southern African Customs Union (SACU) and the remainder is exported to markets in Africa, Asia and the USA.

1 Challenges of a sugar milling company

Tongaat Hulett operates four sugar mills in South Africa and two in both Mozambique and Zimbabwe and has extensive cane operations in each of these countries as well as Swaziland. In addition to its raw sugar capability, Tongaat Hulett Sugar has a refinery in Durban (South Africa) with an annual refining capacity of some 600,000 t. Tongaat Hulett's mills have a total production capacity of 2 mn t of sugar per year. This puts the company in second place among African sugar producers behind Illovo Sugar Ltd., which now belongs to the large British food processing and retailing company, Associated British Foods (ABF).

Nowadays, sugar mill operators like Tongaat Hulett Sugar have to tackle several challenges at once. On the one hand, there is growing competition from countries such as India and Brazil, which are exporting more and more sugar at attractive prices – including to South Africa. This is compounded by ever longer periods of drought, which reduce the crop yield. Furthermore, many companies are increasingly lacking employees with the specialist know-how to operate the necessary modern machines and to adapt to often rapidly evolving processes. Additionally, the energy supply for the high-intensity processes in sugar production remains a major challenge.

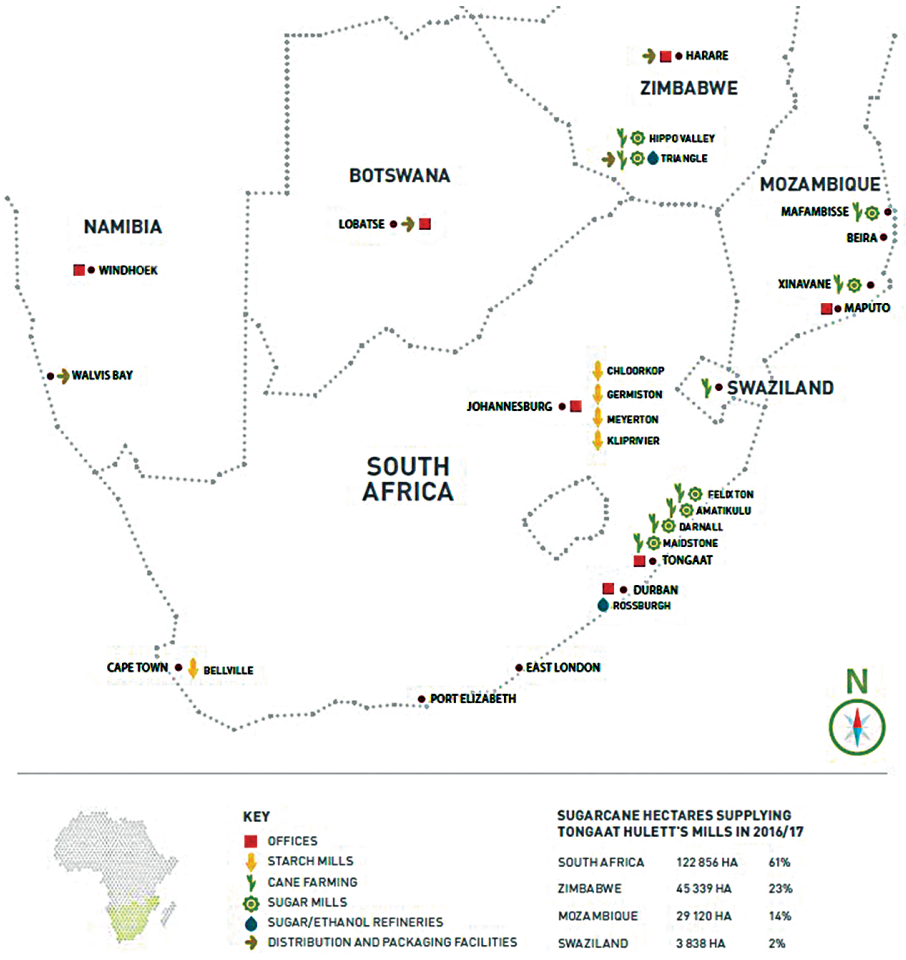


Fig. 1: Tongaat Hulett Sugar owns eight sugar mills – four in South Africa, two in Zimbabwe and another two in Mozambique

2 Ensuring reliable production processes

"Sometimes an entire plant is shut down four times a week – including all turbines, generators and auxiliary systems," says Morne Bester, Business Development Manager at Tongaat Hulett Sugar. „This is why reliability is a big qualifier for us," he explains. In many of its mills, the company relies on technology made in Germany. "Siemens offers high quality, highly engineered and reliable machines," Bester is convinced. For example, more than 60 % of the approximately 25 steam turbines with an output of 7 to 25 MW come from the German manufacturer, which has been operating in South Africa for more than 150 years.

Moreover, over the last three years Tongaat Hulett Sugar has successfully upgraded the centrifugal systems at their refinery in Durban. Siemens installed the SINAMICS S150 ready-to-connect converters in a standard control cabinet, new motors and a controller system: Simatic S7-300. "With the existing mechanical components we have been able to increase the produc-

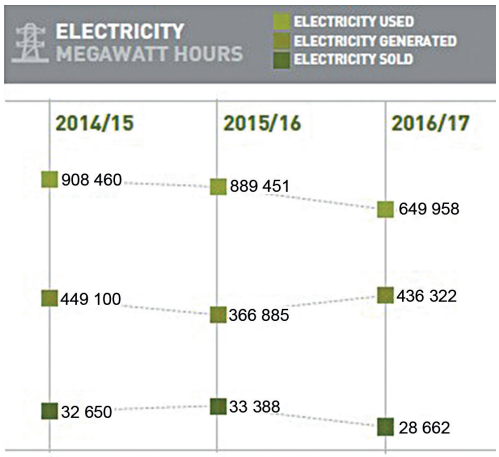


Fig. 2: Between the years 2014/15 and 2016/17 the electricity consumption of Tongaat Hulett decreased, while the amount of generated electricity increased. The proportion of sold electricity rose in 2015/16 and declined again in 2016/17. (Source: Tongaat Hulett's annual report 2017)

tion efficiency of the centrifugal machines by up to 20%," says Yusuf Vally, Siemens Key Account Manager for Tongaat Hulett.

3 How to further develop efficient electricity generation

Tongaat's eight sugar mills all generate electricity from bagasse during the sugarcane crushing season. If efficiently used, the bagasse can produce enough energy to allow a common sugar mill to be self-sufficient with respect to fuel and electricity.

For the year ending 31 March 2017, the entire Tongaat Hulett company used a total of 649,958 MWh of electricity across all its operations and offices (see Figure 1). It generated 436,322 MWh from its sugar mills, predominantly from bagasse, and sold 28,662 MWh to the national grid. Other sources of fuel that are used include coal, 300,268 t, diesel, 10.9 mn L, petrol, 0.857 mn L, gas, 472,349 GJ and wood.

In some instances, the mills supply electricity to the grid.

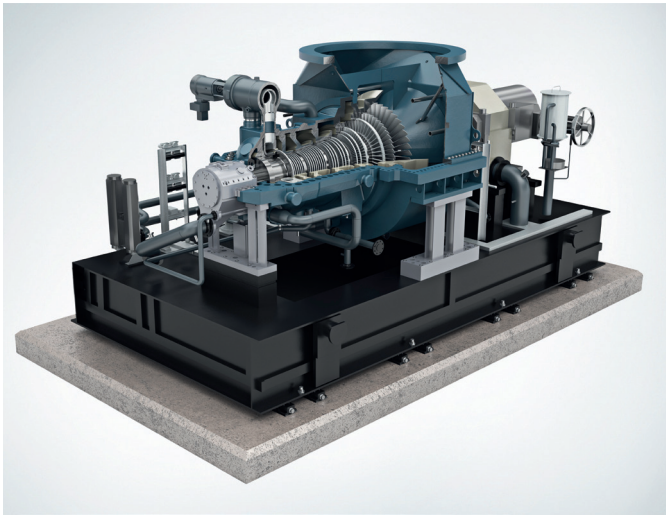


Fig. 3: The most often sold Siemens steam turbine for power generation in sugar mills is the SST-300



Fig. 4: Bagasse is a valuable fuel for the power generation

Bester adds: "We have the opportunity to share an electricity surplus with other Tongaat Hulett facilities, for instance in Johannesburg."

Although South Africa's Ministry of Energy set feed-in tariffs for independent energy producers for the first time in 2018 as part of its "Independent Power Producer (IPP) Procurement" program, feeding large amounts of electricity into the country's power grid is still difficult and unprofitable for industrial companies such as Tongaat Hulett Sugar, says the company. Financial incentives are lacking. Changing that and helping to shape the current transformation is a future ambition and defined goal of the company. "Cogeneration, for example, does not play a major role for us at the moment. However, we would like to develop this area. This way, we would also be able to contribute to improving the overall power supply to the African population," says Bester.

The further development of the regulatory frameworks in South Africa could therefore potentially result in Tongaat Hulett expanding the business's ability to generate electricity from bagasse. In the short to medium term, this would involve projects across the company's sugar mills to significantly increase electricity generation from bagasse.

4 Using reliable technology is the basis to keeping up in a global competition

This is where modern technology is coming in. Amongst the many Siemens turbines, Tongaat Hulett Sugar owns steam turbines in a condensing or backpressure application. "The SST-300 for sugar mills combines best technology with more than 20 years of experience. In the last decade alone, we installed the turbine in over 500 industrial and power applications of customers all over the world," says Stanley Dorasamy, responsible Manager for the industrial vertical sugar at Siemens Gas and Power.

The SST-300 is a pre-designed steam turbine based on an enhanced platform design. All Siemens industrial steam turbines in the range of up to 250 MW follow this global design standard, which enables high manufacturing flexibility and ensures the reliability and availability of Siemens' products.

Moreover, by enabling easy access to the installed components like the turbine, gearbox, generator and auxiliaries, the proven installation and maintenance concept lowers maintenance costs.



Fig. 5: To and from the ports the steam turbine generator set is a heavy duty transport ...

The reliable steam turbine offers a fast start-up time, condensing and back pressure applications and the newest blading technology. Even daily starts and stops are no problem for the high-end machine that can also be monitored remotely. To achieve an optimal performance in different operation regimes, various valve configurations are possible.

Thinking of the eroding technical know-how in some places, for Morne Bester knowledge transfer is one of the most important things when it comes to the technical equipment. "This is one of the reasons why we are increasingly relying on the original equipment manufacturers [OEM] of the technology. During a turbine's commissioning phase for example, it's imperative that an OEM expert accompanies the entire process at our site so that we have the necessary services available on-time," says Bester and continues, "The other big advantage of this is that experts from Siemens are able to educate and train our staff on the new technology, thus ensuring the necessary knowledge transfer."

Dorasamy from Siemens emphasizes: "To have the special technical skills at hand is convenient for the sugar mill operators and makes them feel safe and calm, because during the sometimes complex commissioning process of a steam turbine, for example, they can completely rely on us. We don't leave until the plant is running."

To better understand what is of most importance during this process and what sugar mill operators may have to take care of, it is necessary to understand the most important milestones of a steam turbine commissioning at a sugar mill, says Dorasamy.

After passing the appropriate quality clearances, the turbine is packed at the manufacturer's site and begins its journey via road, rail and water if required. As soon as it has reached its destination and has been unloaded, the installation begins.

In the meantime, Siemens prepares the turbine foundation on-site and installs the base plates. "A careful leveling of these plates is necessary to ensure trouble-free operation", explains Dorasamy. Once the foundation is ready, the OEM lifts the now arrived turbine and places it on the prepared foundation. Special cranes or jacking arrangements are used for this purpose. Now it is time for the auxiliaries like the gearbox, alternator, condenser and lube oil system. These are all placed on respective foundations.



Fig. 6: ... executed by well experienced logistics specialists.

"It is important that we carefully align and carry out the turbine, gearbox and the alternators," emphasizes the industrial vertical manager. "The shafts of all three products need to be aligned precisely. This job requires special skills and a thorough technical supervision."

After being aligned to the turbine generator train, the condenser or exhaust duct is connected to the turbine exhaust. To stimulate operating conditions the mechanics fill-up the condenser with water during this process, before connecting it to the turbine and leveling the condenser. "Then we need to supply the turbine bearings with high purity during operation oil for cooling purposes," Stanley Dorasamy continues. This is achieved through a dedicated lube oil system, which is connected to the turbine with a metallic piping. In order to ensure that the oil supplied to the turbine is free of dirt, the experts thoroughly clean the external particle pipes before fitting them together.

The next step is to regularly check the filter and the purity of oil and – once the desired purity is achieved – to connect the turbine to the oil system. Dorasamy: "This process is known as oil flushing. While this process is taking place, we install the instruments that are required for the turbine operation. They are connected to turbine control system via cables."

In this way, the engineers can continuously monitor all parameters like bearing temperatures, machine vibrations and speed of the turbine, which ensures a safe and trouble-free operation.

After the successful completion of this cold commissioning, the team connects special piping that carries high temperature, high pressure steam – the hot commissioning is underway. Dorasamy concludes: "Once the turbine reaches its rated speed, we connect the generator to the power grid." The entire commissioning process takes about six to eight weeks.