ENERGY MANAGEMENT IN RAW CANE SUGAR FACTORIES:
REPORT ON AN ISSCT ENGINEERING WORKSHOP

By

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Abstract

An engineering workshop was held from 7–11 October 2002 in Berlin, Germany; 68 delegates from 12 countries attended the workshop on energy management in raw cane sugar factories. This paper attempts to provide a general overview of activities undertaken during that workshop, which consisted of three days of 12 technical sessions with presentations and discussion plus two days of factory visits. Topics covered during the technical sessions included: energy conservation from cane yard to extraction plant, in the boiling house and in refineries, improvement of efficiency of boiler plant and turbo generator, improvement of calorific value of bagasse, the use of bagasse as well as alternative boiler fuels. Two sessions were devoted to the efficient utilisation of steam and electrical power. Topics on new technologies and processes for energy economy, equipment and control systems for energy management were also touched upon.

Introduction

Under the auspices of the Engineering Section of the ISSCT, a workshop on ‘Energy management in raw cane sugar factories’ was held at the Technical University of Berlin, Germany, from Monday 7 to Friday 11 October 2002.

The workshop consisted of three days of technical presentations and discussions with two days of visits to two beet sugar factories. A total of 58 presentations were made during the workshop by some of the 68 registrants from 12 countries. As is usual with ISSCT workshops, no formal papers from the participants and no proceedings of the workshop were produced, so as to encourage informal exchanges of ideas and discussions.

Objectives

The overall objective of the workshop was to review and discuss all aspects of energy management in raw cane sugar factories. This included identifying ways to maximise power generation and reduce demand in sugar mills, to increase the power available for export.

Opening session

The welcome address was delivered by Prof. Lutz-Gunther Fleischer, head of the Berlin Sugar Institute, which hosted the workshop, followed by the chairperson with a brief detail of the workshop arrangement, and by Mr Pedro Avram, Chairman of the German Section of ISSCT, who introduced the first session.

Mr. John Komen (Australia) outlined some considerations for the cane sugar industry on cogeneration for electricity export: modified pricing structures to make use of the available bagasse in countries where the cost of power production based on hydro or fossil fuel is low; the role of the government as facilitator to make the enterprise viable through legislation; arrangements for ad-hoc, or continuous supply during the crushing season only as well as for year-round supply; separate corporate entities for the sugar and power producing companies, with product exchange agreements regulating the supply of bagasse and condensate to the co-generator, and steam and electricity to the miller.

In Brazil, incentives have been given to the sugar sector to co-generate electricity, and sugar factories were striving to achieve 190 kWh/t cane and an annual export of 20 000 GWh to the national grid.
Energy conservation from cane yard to extraction plant

The principal speaker for this session was Prof. Peter Rein (USA). He pointed out that, if power generation is to be maximised, trash and tops must be used as fuel. However, whether the trash will be separated in the harvester or at the factory will depend on the costs of harvest and transport. Processing cane with the trash removed requires less power in cane preparation and milling, increases the capacity, reduces the quantity of C-massecuite as well as the total massecuite produced, and reduces the steam required for sugar processing. Since diffusion plants require much less energy than conventional mills, more energy is available for export. With the advent of the low-energy, two-roll mills, an additional option is provided for a new energy-efficient factory.

Presentations in this session dealt with: two-roll mills which use about 30% less energy than the traditional six-roll mills; electro-mechanical drives with variable frequency speed control having a substantially higher efficiency than electro-hydraulic drives; replacement of inefficient steam engines and turbines by efficient prime movers to minimise energy use in milling; the use of pinch technology to show that a diffuser leads to a larger quantity of bagasse available for steam generation, but requires more process steam than milling; a prototype trash separation plant developed by Sugar Research Institute (Australia), in which the billeted cane is separated pneumatically from the associated trash at a rate of 150 t/h with a high level of trash separation (90% trash recovery) and a low level of cane loss (< 1%).

Energy management in boiling house

- The principal speaker in this session was Dr Ross Broadfoot (Australia). He pointed out that there is scope for large reductions in steam usage on the pan floor if low pressure vapours are utilised instead of exhaust steam for pan boiling. The challenges included:
  - The generally discontinuous nature of pan boiling.
  - The large temperature differences (40–45°C), between the supplied steam and the massecuite to provide adequate circulation.
  - The effect of change in cane quality on the boiling process throughout the season.
  - The high capital cost of pan, centrifugals and dryer as a deterrent for factories to install surplus capacity.
  - The millers’ primary objective of sugar recovery rather than steam economy.

Process steam consumption could be reduced by operating the pan stage with low pressure vapour, and by reducing steam/vapour usage through improvements to batch pan design, continuous pans, stirred pans, improved feed systems, better use of jigger steam, high Brix liquor, preconditioned molasses feed and pan stage supervisory control.

The main points raised by other speakers concerning changes in process procedure included:

- The use of standard liquor and high wash syrup for sugar washing in centrifugals, and the benefit of seed magma for optimised continuous crystallisation
- The use of syrup with high dissolved solids, heating instead of dilution of feed syrup, reduction of centrifugal wash water, efficient cooling crystallisation with massecuite conditioning, to ensure maximum sugar yield.
- Assisted pan circulation saves boiling energy but requires its own energy: mechanical stirrers for batch pans need 1.0 to 2.2 kW/m³ of pan capacity, whereas jiggers using incondensible gases represent ‘free’ energy for A and B pans, and 0.25 kW/m³ for C pans.

Some energy-efficient methods raised were:

- An Australian experience in syrup storage at Tableland syrup mill, to ensure constant production and off-crop processing at the host mills.
- The use of energy-efficient jet condensers in India in place of rain-type condensers with vacuum pumps.

The combination of a rotary dryer and a downstream fluidised-bed cooler, which results in a reduced energy consumption for the drying and cooling of sugar.

Energy conservation in refineries

This session was chaired by Dr Ross Broadfoot (Australia). Delegates heard details of energy management experience in refineries presented by various speakers from the United Arab Emirates, India
A stand-alone cane sugar refinery in Dubai achieved major energy savings through: conversion to high-pressure evaporation, use of low-pressure vapour for melt heating, reduction of electricity consumption, on-site generation of electricity, and maximum recovery of condensate for steam generation. Thus, steam consumption per tonne sugar had been reduced from 1.20 to 0.62 tonnes, and electricity per tonne sugar from 75 to 42 kWh.

A plantation white sugar mill in India achieved a reduction of 6% steam consumption attributable to the change to continuous vacuum pan.

As pointed out in a presentation (UK), the theoretical steam consumption for a refinery suggested to be 0.33 tonnes steam per tonne of sugar depends largely on pan and centrifugal yields. Pan yield is over 55% crystal % massecuite and centrifugal yield (batch) is over 90% giving an overall yield of white sugar higher than 50% in massecuite. In practice, overall yields can be as low as 30%. Pan yield may be limited by: massecuite flow considerations, achievable Brix, pan circulation limits, higher temperatures increasing solubility, high supersaturation, short boiling times and dilution of massecuite with pan steamings. Centrifugal yield (batch) can fall from 95% to 80% with poor plough action and high wash water dissolving product sugar.

**Improvement of efficiency of boiler plant and turbo generator**

The introduction to this session was by Mr Luis Verdugo (Guatemala). Co-generation in Guatemala has led to the replacement of old equipment to enable reduction of specific steam consumption of turbo-generators from 18 to 10 kg/kWh and process steam consumption to about 400 kg/t cane for raw sugar production. This was followed by presentations by speakers from Sweden, UK, Germany and Brazil.

Development of gasification technology paves the way to fully exploit the potential for producing 40 000 MW or 300 TWh/year of electricity with a world-wide annual production of 1200 million tonnes of sugar cane from 80 countries in the world. A state-of-the-art wood-fuelled gasification combined cycle plant of 8 MW (project ARBRE), has been constructed in UK. It contains an atmospheric pressure circulating fluidised bed gasifier coupled to a tar-cracking vessel. After cooling and cleaning, the energy-rich gas is subsequently compressed and fired in a gas turbine. Development work for project ARBRE and also for bagasse and trash has been carried out in a 2 MW thermal gasification pilot plant. Subsequently, the conceptual engineering of a gasification system integrated into a Brazilian sugar mill was described.

Copersucar, in conjunction with Termiska Processor AB Sweden (TPS), has analysed the alternatives of Biomass Integrated Gasification-Gas Turbine (BIG-GT) into mill integration; using assumptions of:

- BIG-GT plant: based in GELM-2500 gas turbine.
- Heat recovery steam generator, pressure/temperature (bar/°C): 82/480, 22/300 and 2.5/saturated.
- Initial mill process steam consumption: 500 kg steam/t cane.

The process changes to reduce process steam consumption to 340 kg/t cane (partial integration) and 280 kg/t cane (full integration) were detailed. In the latter case, it would be possible to generate 291 kWh/t cane. However, it will probably take another 20 years before gasification technology finds widespread use.

Small steam turbines are highly inefficient with a high steam consumption; the solution to the problem is to electrify these drives.

**Improvement of calorific value of bagasse**

The subject was reviewed by Mrs Lynne Wong Sak Hoi (Mauritius). Fuel values of bagasse are influenced principally by the moisture content and, to a much lesser extent, by its ash and soluble solids contents. Mill run bagasse has a gross calorific value (GCV) of about 9000–10 000 kJ/kg as compared to a GCV value of 19 605 kJ/kg for bone-dry, ash-free and Brix-free bagasse. Cane fibre exhibits a higher GCV (> 10%) than cane pith, which was attributed to its higher lignin content.

The calorific value of bagasse could be improved by reducing the ash content in cane through the supply of good quality cane, and reducing the moisture in the bagasse through appropriate milling practices and drying by waste heat from flue gases.

The introduction was followed by a presentation (Mauritius) on the importance of fibre quantity and quality (moisture, ash level and fibre/pith ratio) on electricity produced, with seasonal variations in...
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GCV value of bagasse. It was commented from the floor that, in South Africa, the fibre/pith ratio in bagasse as well as the GCV value increased as the season progressed.

A forced draft flash dryer installed in an Indian mill, resulted in a seven-unit drop in bagasse moisture with 6.3% bagasse saving and 5.7% increase in steam generation. Concern had been expressed as to the corrosion problem occurring when flue gas is used for bagasse drying. However, experience in India had shown that despite the use of mild steel and the low temperature of flue gas (70–75°C), no corrosion problems were encountered for the three years that the dryer had been in use.

**Alternative boiler fuels**

The subject was launched by Dr Mike Inkson (UK). He stressed that alternative fuel is relevant to a cane sugar factory only when it runs out of bagasse and if it co-generates for the grid. The problems of using fossil fuels (coal, oil and gas) arise when co-firing one or more of them in the bagasse boiler. Boiler energy losses range from 30–40% mainly as stack losses depending on the characteristics of the fuel.

Dr Inkson outlined the suitability of using other fibrous fuels such as wood, grain husks/stalks, vegetable oil residues and cane trash, namely: their specific energy value in terms of GCV, the ash characteristic determining the clinkering/slagging/fouling as well as the erosion potentials of the fuel and the mechanical handling properties of the fuel.

Questions and discussion from the floor included the following: since it is the volumetric flow rate of the fuels that is being measured instead of the mass, and bulk density of the fuels differs, the feeding inlet of the boiler as well as the air volume have to be adjusted to suit the fuel being used.

Based on the maximum ash content tolerated by the boilers, it is believed that 20–25% of trash would be acceptable. Concern was expressed as to the burning of molasses and mud in the boilers; however, it would seem that South African factories do not face any problem with burning of filter mud added back to bagasse in a diffuser.

The session also touched on the aspect of possible fuel source in cane tops, green leaves, dry trash and roots which are normally left in the field. It was shown that, compared to bagasse, the cane field residues (CFR) have a <10% lower GCV and >5% higher ash content. About 9500 kWh of electricity could be exported to the grid from combustion of 25 tonnes CFR obtained per hectare.

**Efficient utilisation of steam**

This session was chaired by Mr Pedro Avram-Waganoff (Germany), who mentioned that, by employing available technologies, it would be possible to reduce process steam demand from 500 to 300 kg/t cane. These technologies include:

- Moving-bed cane diffusers for juice extraction.
- High pressure steam boilers (85 bar, 525°C) with extraction-condensing turbo-generators and fully electrified factory drives with frequency converters.
- Falling film-evaporators and plate heat exchangers allowing vapour bleeding from all effects.
- Continuous vacuum pans for all products.
- Seed magma produced in dedicated batch pans.
- Continuous centrifugals.

To illustrate the effects of incorporating all these technologies, the design of a 24 000 TCD cane sugar factory producing plantation white sugar was presented. The factory co-generates 35 kWh/t cane during the 150 days crushing season and 77 kWh/t cane from excess bagasse in the intercrop.

The delegates subsequently heard presentations on:

- Plans to reduce process steam consumption in a Brazilian sugar factory by installing falling film evaporators, plate and platular heat exchangers, and changes in vacuum pan set-up.
- A 30% reduction in steam consumption achieved at Harwood mill in Australia from 670 to 490 kg/t cane, and further to 430 kg/t cane with strategies planned for 2004.
- Steam economy by recovering heat from low quality steam and vapour using heat exchanger that requires low temperature difference, and by recovering waste heat from seal water, condensate and vinasse.
Software developed in Australia based on the Rillieux principles, for the planning of efficient use of process steam in juice heating, evaporation and pan boiling.

Pinch technology introduced as a means for optimising thermal energy networks.

A chemical based on polyacrylic acids having the properties of preventing scale formation as well as a chemical cleaning agent used in conjunction with caustic soda were introduced.

Export of electricity to the grid by Mauritian sugar factories has increased from 15 kWh/t cane in 1992 to 52 kWh/t cane in 2001. One factory exported 112 kWh/t cane with 80 bar extraction-condensing generator set. Study shows an increase of electricity export of:
- 18 kWh/t cane for every 100 kg of steam saved in process.
- 11 kWh/t cane for every unit rise in fibre % cane.
- 1.0 kWh/t cane for every unit reduction in moisture % bagasse.

Efficient utilisation of electrical power

The principal speaker in this session was Mr Siegfried Pusch (Germany) who gave a comprehensive overview of the philosophy underlying the choice of electrical installation in sugar factories, since the efficient use of electrical power depends on the planning of the power supply and the distribution systems, and the right sizing of fans, pumps and motors. The installations overviewed included generators, medium-voltage switchgear, distribution transformers, low-voltage switchgear, low-voltage sub-distribution boards, drives, control systems, cabling systems and operator control and visualisation systems.

This was followed by a presentation on the use of frequency controlled variable speed drives (inverters) in place of regulators or control valves in a Mauritian sugar factory, which showed an annual energy savings of 37% on an induced draught fan, 30% on a boiler drum water level control, 165 000 kWh on a boiler feed water pump, and equipment to an export value of US$8000. Inverters on the electric motor driving the pump used to control juice level in the first effect evaporators led to a decrease in mean power consumption from 24 kW to 7 kW, representing a 72% reduction and an annual saving of 51 000 kWh.

This was reiterated by Mr Pusch’s subsequent presentation on variable-speed AC drives (pulsed width modulator type), which have now become the state-of-the-art, and are replacing the variable-speed DC drives with numerous associated advantages. He then gave an estimate of energy-saving through the use of variable-speed drives for pumps and fans, of energy-saving motors and distribution transformers, through the improvement in power factor of underloaded motors by installation of capacitor equipment. The right choice of centrifugal drive is also important as it consumes about 10% of the total power required in a beet factory producing white sugar.

Other presentations included:

- A comparison of power consumption by continuous and batch centrifugals (installed power 50 kW compared to 300 kW). The power drawn per tonne of massecuite by continuous centrifugals was low (0.5–0.6 kW/h) and did not vary appreciably compared to batch (1.2–3.1 kW/h), not taking into account the higher rate of washing necessitated in the case of continuous machine).

- Changes brought to a Nicaraguan sugar mill from 3500 TCD to 6000 TCD included the switch from low pressure steam turbines to electrical motors for cane knives, low pressure steam turbine mill drives to hydraulic and electrical drives for the mills and a new boiler with variable frequency drives for pumps and fans.

New technologies/processes for energy economy

This session was presided over by Dr Boris Morgenroth (Germany). He pointed out that the average cane sugar mill achieved a power production of 10–20 kWh/t cane to cover its own processing needs.

With current awareness, reduction in process steam consumption from some 500 kg/t cane to 200–300 kg/t cane, coupled with the installation of high pressure boilers with back pressure extraction in condensing turbines, a power production of 100–120 kWh/t cane is now achievable, and could be further increased to 200–300 kWh/t cane by combining technologies such as flue gas drying of bagasse, fluidised bed gasifiers linked with combined gas and steam turbine cycles, and modified waste heat recovery system.
The workshop participants then heard presentations on:

- On-line near infrared spectroscopic (NIR) analytical systems developed in Australia for constituents analyses in prepared cane, juice, sugar as well as bagasse. The bagasse analysis system provides information on pol, fibre, dry matter and ash contents in bagasse useful for bagasse quality assessment and steam management with the potential benefits of better boiler station control and actual fibre-based extraction performance.

- Progress in the development of bagasse gasification technology for eventual increased cogeneration in the Australian cane sugar industry. Phase I of the project had been completed on the economic evaluation of bagasse gasification in a factory under consideration for expansion in its cogeneration capabilities, the study of bagasse char gasification kinetics, development of a continuous feeding device for bagasse and other biomass fuel for pressurised gasification, the design of an experimental reactor for ash characterisation of bagasse as well as trash, and the development followed by the successful trial of a 150 t/h prototype dry cane separation plant delivering 40 t/h cane harvest residues (at 45% moisture) as additional fuel with less than 1% cane lost in the separation process. Phase II of the project includes the development of a 5 MWe Biomass Integrated Gasification/Combined Cycle (BIG/CC) prototype gasification plant.

- A cane separation technology, 40 years old, for splitting sugarcane stalks longitudinally and separating them into: pith, rind and wax, which can be made into value-added products. The concept has a positive influence on the power demand, but no commercial plant has yet been installed.

**New equipment/control technology**

This session was introduced by Mr Bernd Langhans, who emphasised the value of instrumentation and automation of sugar factories. The traditional has given way to fieldbus oriented process control, Programmable logic controllers (PLCs) are now being combined with the highly sophisticated digital signal controller units; fuzzy control, neuro fuzzy algorithms and statistical process control procedures find their way into the operation of sugar factories.

Other issues raised were:

- Viscosity appears to be a reliable alternative to conventional control parameters for sugar boiling, which is the central issue in sugar processing in terms of energy economy and product quality. Since technical sucrose solutions show distinct relationship between viscosity, dry substance content, temperature and purity, an accurate measurement of the viscosity and temperature in concentrated sucrose solutions allows the output of the dry substance content and/or supersaturation.

- Real time availability of laboratory data for process control permits timely intervention in on-line control of sugar manufacturing processes. In this context, investment in laboratory automation has a short payback period. Examples of such an on-line monitoring device were given by a number of speakers, namely measuring alkalinity of limed juice, pol in waste water, pol, Brix and purity of intermediate sugar products. An on-line Energy Management System calculates the thermodynamic performance of the sugar factory; if a problem occurs which affects the energy consumption, the process personnel will be warned. An advanced monitoring system, into which are imported data from the processing stations as well as the laboratory information system, yields calculation results which allow a complete overview about the process including mass, energy and colour balance; it also gives information on process optimisation measures.

**Closing session**

At the final technical session, a representative from each country was elected to present the status of steam consumption and power production in their country. The outcome is shown in Table 1.

Mauritius is committed to the production of electricity for export to the grid. In year 2001, out of a total island consumption of 1660 MWh of electricity, the sugar factories in Mauritius produced 710 MWh, 300 MWh from bagasse and 410 MWh from coal. Three factories produced electricity all year round with bagasse during the crop season and coal during the off crop season and 7 factories produced electricity on a continuous basis from bagasse only during the crop season. The price of the electricity is negotiated between the factories and the Central Electricity Board.
Table 1—Steam and power consumption situation in various sugar producing countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of sugar factories</th>
<th>No. of factories with cogeneration facilities</th>
<th>Steam consumption (kg/t cane or beet)</th>
<th>Total power production (kWh/t cane or beet)</th>
<th>Export power production (kWh/t cane or beet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>30</td>
<td>6</td>
<td>400–600</td>
<td>11–50</td>
<td>0–27</td>
</tr>
<tr>
<td>Brazil</td>
<td>304</td>
<td>172</td>
<td>500</td>
<td>28–80</td>
<td>0–50</td>
</tr>
<tr>
<td>Germany</td>
<td>26</td>
<td>–</td>
<td>170–240</td>
<td>25–35</td>
<td>0–10</td>
</tr>
<tr>
<td>Guatemala</td>
<td>12</td>
<td>7</td>
<td>350–450</td>
<td>45–60</td>
<td>35–50</td>
</tr>
<tr>
<td>India</td>
<td>~504</td>
<td>25–30</td>
<td>400–550</td>
<td>80–85</td>
<td>50–60</td>
</tr>
<tr>
<td>Mauritius</td>
<td>12</td>
<td>10</td>
<td>320–450</td>
<td>32–112</td>
<td>51–70</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>2</td>
<td>2</td>
<td>450–500</td>
<td>45–60</td>
<td>25–35</td>
</tr>
<tr>
<td>South Africa</td>
<td>15</td>
<td>5</td>
<td>480–600</td>
<td>28–40</td>
<td>0–18</td>
</tr>
<tr>
<td>USA</td>
<td>25</td>
<td>2</td>
<td>450–550</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Topics discussed at the conclusion of the workshop included: membership on the Factory Committee, the theme and venue for the next Engineering Workshop. The following themes were suggested: low cost maintenance and predictive maintenance, milling and diffusion extraction, and instrumentation and automation.

Factory visits

The workshop participants visited two beet sugar factories at Könner and Klein Wanzleben.

Könner sugar factory processes 1.5 million tonnes of beet producing 230 000 tonnes of sugar annually. It is equipped with two boilers (85 bar, 525°C) generating 80 t/h of steam and from coal (50 t/h), a gas turbine (9 MW) and one back pressure steam turbine (20 MW) with extraction at 13 bar and back pressure of 3 bar. The evaporator station consists of ten bodies arranged in seven effects. The electricity consumption is about 15 MW with 5 MW for syrup processing, while the steam consumption is 170 kg/t beet which was amazingly low compared with cane standard.

Klein Wanzleben sugar factory processes 1.1 million tonnes of beet yielding 173 000 tonnes of sugar annually. It is equipped with a seven-stage falling film evaporator with a pre-evaporator and evaporating crystallisation towers are used in the production of raw and white sugars. Vapours from the four-stage evaporating crystallisation towers for raw sugar are used as the heating steam in the five-stage evaporating crystallisation towers for white sugar. All production facilities systems are monitored and optimised by means of a distributed control system from the central control room.

The two factories visited demonstrated that the low steam consumption as achieved by them was possible through more evaporation effects, extensive vapour bleeding from 4th, 5th and 6th effects, the use of continuous pans and falling film evaporators and heat recovery from all streams including condenser water and waste condensate.

Acknowledgments

The excellent organisation of the workshop by the Head of the Berlin Sugar Institute and his staff, and the hospitality shown by the management and the staff of Könner and Klein Wanzleben sugar factories were greatly appreciated by all delegates. The efforts put in by speakers in preparing their presentations and all delegates in participating in exchanges of ideas and experiences are gratefully acknowledged.
GESTION ENERGETIQUE DANS LES SUCRERIES DE CANNE
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MOTS CLÉS: Atelier de l'ISSCT, Gestion Énergétique, Vapeur, Électricité.
Résumé
UN ATELIER sur la gestion de l'énergie dans les sucreries de canne s'est tenu du 7 au 11 octobre 2002 à Berlin en Allemagne; 68 délégués provenant de 12 pays y ont participé. Cette communication passe en revue les travaux de cet atelier qui comprenait trois journées de douze sessions techniques de présentation et de discussion, suivies de deux jours de visites aux sucreries. Parmi les sujets abordés on peut citer la conservation de l'énergie aux stations d'extraction, à l'atelier de fabrication et la raffinerie, l'amélioration de l'efficience des chaudières aussi bien que celle de la valeur calorifique de la bagasse et l'utilisation de la bagasse ainsi que les sources d'énergie alternatives pour les chaudières. Deux sessions furent consacrées à l'utilisation optimum de la vapeur et de l'électricité. Des sujets ayant trait aux nouvelles technologies pour l'économie d'énergie, les systèmes de contrôle dans la gestion énergétique furent aussi abordés.

MANEJO DE LA ENERGÍA EN LOS INGENIOS AZUCAREROS DE CAÑA CRUDA–REPORTE SOBRE UN TALLER DE INGENIERÍA DEL ISSCT
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PALABRAS CLAVE: Taller del ISSCT, Manejo de la Energía, Vapor, Electricidad.
Resumen
DEL 7 al 11 de octubre del 2002 se llevó a cabo un Taller de Ingeniería en Berlín, Alemania, relacionado con el manejo de la energía en los ingenios azucareros de caña cruda, al cual asistieron 68 delegados de 12 países. Este documento intenta proporcionar una visión general de las actividades emprendidas durante dicho taller, el cual consistió en tres días de doce sesiones técnicas con presentaciones y discusiones, además de dos días de visitas a ingenios. Los temas cubiertos durante las sesiones técnicas incluyeron: conservación de la energía desde el patio de cañas hasta la planta de extracción, en la casa de los tachos y en las refinerías, mejora de la eficiencia de la planta de ebullición y turbo-generador, mejora en el valor calórico del bagazo, y el uso del bagazo, así como otros combustibles alternativos. Se dedicaron dos sesiones al uso eficiente del vapor y la energía eléctrica. También se trataron algunos temas sobre nuevas tecnologías y procesos para la economía energética, los sistemas de control y equipo para el manejo de la energía.