ENHANCING PLANT EFFICIENCY AND PROFITABILITY THROUGH ENERGY SAVING

Mohammad Awais Qureshi Advisor Emeritus
Shakarganj Mills Limited, Jhang, Pakistan

INTRODUCTION

Top priorities of major industries

Cost Reduction, Quality Assurance, Energy Optimization, Customer satisfaction and Adapting Eco-Friendly Manufacturing Methods are the top priorities of major industries today. In Processing Industries, Energy cost is one of manufacture the major component of the Production. This can be controlled through sensible energy use. Sugarcane is an energy crop containing about 4,500 MJ Energy per ton of cane. 1,800 MJ is lost in boiler flue gases and 750MJ is dissipated to atmosphere through cooling tower /spray ponds etc. Energy Spent for the production of sugar is about three times of energy contained in sugar.

Two Major Energy Partners in Sugar Mills

Power Plant for Energy Generation both Steam & Electricity from Bagasse

Attention of Engineers is invited for efficient production / use of steam and electricity during operation thus the energy save could be used for useful / profitable purpose.

Process plant consumption of Steam & Electricity

The Juice heaters, evaporators and vacuum pans are the major users of low pressure process steam. Commercially available / well designed equipments and appropriate use of energy do play their role in savings. Controlling steam leaks two could result in appreciable savings.

Tips for Cost Reduction
Boiler / Power Plant

Low Bagasse Moisture

01 point reduction in bagasse moisture improves boiler efficiency by about 0.6 point.
Conventional Bagasse dryer or concentration of distillery spent wash could be considered to trap the dissipated energy through boilers stakes.

Low excess air of Boiler.

20 Points reduction in excess air is equivalent to 01 point improvement in boiler efficiency.
O_2 analyzer can be installed at the flue gas duct to monitor the excess air.

Low Boiler Flue Gas Temperature.

Boiler efficiency increases by about 01 point for every 15^{o} C reduction in stack gas temperature.
Economizer can be installed to reduce the flue gas temperature.

Feed Water Temperature.

10^{o}C rise in feed water temperature increases boiler efficiency by 1% Rise in Deaerator temperature as well as of condensate can help to increase feed water temperature.

Fouling of Boiler

Soot layer of just 3 mm thick increases fuel consumption by 2.5% due to rise in stack gas temperature. Proper soot blower help to reduce the soot from the external side of boiler tubes.

Scaling of Boiler

A Scale of 01 mm thickness increases fuel consumption by 03 % in boiler firing.
Proper chemical dozing, based on feed and boiler water analysis help to reduce scaling from inside oiler tubes. If necessary chemical cleaning could be adopted.

Air Heater temperature

Rise of 20^{o} C air temperature by air heater increases boiler efficiency by 1 %. Boiler F.D fan suction temperature can be raised by flue gas heat exchanger for increase of air temperature.

High Pressure Boiler

Boiler efficiency rises 10% after installing boiler of 65 Barg at 500 ^{o}C instead of 25 Barg 300^{o}C.

High Pressure TG-Set
Steam consumption is reduced to 4Kg/kWh instead of 6Kg/kWh on condensing mode of Turbine by raising the steam pressure 65 Barg, 500 ^{o}C instead of 25 Barg 300^{o}C.

Waste Heat Recovery Power Plants
Installation of Low Pressure TG-Set in series with back pressure can generate extra power from exhaust steam @11Kg/kWh.

Power Factor Improvement
300 kWh can be saved from a Power generation of 5 MW by improving the power factor from 0.85 to 0.90 at 11 KV Generation.

Boiler Blow down Water Heat Recovery
Heat of the Blow down water can be extracted by placing heat exchanger in its path. Recovered energy can be used for Boiler Feed Water Heating, about 2 to 5% energy saving can be accomplished.

Biogas integrated gasification gas turbine

(BIGGT TECHNOLOGY)
Potential exists to enhance electricity export from 115 kwh / tc to 275 kwh/tc i.e an increase of 19%. According to an estimate if total bagasse of Marius and South Africa is passed through above process 1600 gwh and 5900 gwh respectively could be annually exported Research work in various Countries is in hand to overcome difficulties in sugar industry. Lab level studies were in hand at UET Lahore a couple of year ago. Apart from power export process steam consumption could be increase 54 to 66%

Sugar Mills & Process House

Mill Drives
Replacement of mill steam Turbines by Electric Motors saves energy by 30%

Heat recovery of Process Condensate and Vapors
To conserve heat, condensate and vapor of process house could are a good resource in saving energy by 0.6% on cane.

Insulation of Bare hot Surfaces Thermal insulation has low thermal conductivity. It delivers the following benefits

Reduce energy consumption
Offers better process control
Workers protection from burns
Insulation is said to be poor if the surface temperature is 20^{o}C above the ambient temperature.
Insulation can reduce the energy loss by 90%
Insulation should be regularly surveyed to replace and repair well in time

Trend of reducing Mill Rollers
Installation of two rollers mill by replacing conventional four or six roller mills can help to save 47% energy as claimed commercially.

Automation of Plant
Automation of Mills, Boiler, Evaporators and Pans are a logical approach to save energy resulting low steam consumption on cane. Only in vacuum pan 20 to 30% steam saving can be done through automation and improvement in condensation system.

Turbines operation at designed back pressure

Approximately 5 % steam consumption of the turbine increases if back pressure exceed by 0.5bar from its designed back pressure.

Installation of steam traps
Effective separation of steam/ vapor from condensate improves the efficiency of thermal system by 0.5%.

Juice Evaporation
The evaporation of clear cane juice to syrup and ultimate crystal sugar is a key factor in sugar processing

Conventional Multiple effect arrangements (Tipple Quad and Quaint) deserved to be modified
Following film evaporators with syrup birx of 66 to 68 degrees could be adopted to reduce the steam load at the vacuum pans / Availability of recently developed low temperature modules, in the market could be interested

Switching bold to Fine Grain Sugar
The industry should insists on boiling fine grain sugar to save an appreciable amount of energy.
Steam consumption of process house will reduce 6 to 7% on cane by installation of falling film evaporators and effective vapor bleeding

besides reducing the loads on condensation system.

Plant Operation by Skilled / Competent Staff

Regular Operation
Operating mills at the designed capacity with regularity in operation starting from cane feeding, automated milling control, Boiler instrumentation, maintained live /exhaust steam pressure, controlled evaporation and crystallization process do lead to enhance output at the reduce cost.

Basic Equipment Requirement
Balancing, aligning and regular check on vibration of moving equipment do help in a big way in cost reduction, through reduced downtime and low spare consumptions.

Training of Operation / Maintenance Staff
The attention must be made to train operating and maintenance staff to adopt the latest technologies available. Workshop/refresher courses must be a regular feature to polish the knowledge / skills of the operating hands

Concluding Remarks
This talk is just a bird eye view of Enhancing Plant Efficiency and Profitability Through Energy Saving

The purpose of the workshop can only be achieved if the experience of various delegates will shared in this forum.

The clarity of subject can only be achieved when a chance of thorough discussion is provided both to the delegates and speakers.

No question is a silly question as there is always a hidden logic behind the question. Whatever comes to the mind must be posted to the speakers.

The questions must be crisp and to the point. Unrelated remarks are needed to be avoided.