

FEP5 - Integrated Sugar Complex with Minimum Energy Consumption and Maximum Cogeneration Concept To Commissioning

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Abstract:

Assignment: To design, supply and commission, on turnkey basis, two Integrated Sugar Complexes for HPCL Biofuels Ltd. (HBL). A unit of Hindustan Petroleum Corporation Ltd., a Government of India enterprise and a global Fortune 500 company. Location: Sugauli and Lauriya in the state of Bihar in India.

Brief:

- Available cane : 630 000 tonnes
- Fibre % cane : 16.5%
- Purity of mixed Juice:80
- Basic requirement:Energy efficient plant for maximum cogeneration

Isgec Solution:

3500 TCD Plant with 20 MW Co-gen for 180 days crushing operation - to produce sugar and ethanol following the Brazilian model of sugar production (50% juice used for ethanol production and 50% for white plantation sugar). Minimum energy consumption and maximum cogeneration controlled by an integrated DCS (Distributed Control System) from a Centralised Control Room.

Selection of Chainless Diffuser instead of Milling Train for Juice Extraction



Isgec-Bosch Chainless Cane Diffuser at HBL Plant, India

Description	Units	4 nos. Mills	Chain type Diffuser	Chainless Diffuser
Crushing rate	TCD	3500	3500	3500
Fibre % cane	%	16.5	16.5	16.5
Pol % Cane	%	13.2	13.2	13.2
Imbibition rate	% on fibre	280	320	320
RME (Mittal)	%	96	98.0	98.0
Raw Juice Quality		Base	Lower starch	Lower starch
Bagasse Moisture	%	About 50	About 50	About 50
Pol % Bagasse	%	1.60 - 1.80	1.0- 1.25	1.0-1.25
Power consumption	kWh/t	13-14	11-12	11-12
Capital cost	%	Base	70-80	49-56
Maintenance cost	%	Base	70-80	35-40
Expandability		Very limited expandability	Zero expandability	Easy to expand

Selection of Energy Saving Devices

- **Elimination of live / exhaust steam** for Sulfur Melting, Super heated wash water system, Pan washing, Sugar melting, Molasses Conditioning, Sugar Dryer
- **Low Pressure Heating Module (LPHM) for Diffuser Juice Heating** - by using Low Pressure Vapour
- **Common Condensate Flash Recovery System** - reduction of steam consumption by 2-2.5% on cane
- **Use of Power saving devices**



Condensate Flash Recovery Vessel



LPHM for Cane Diffuser Juice Heating

Selection of High Pressure Boiler for Maximum Cogeneration

Traveling Grate Boiler of 110 t/h, 110 bar, 540°C with 20MW Extraction and Condensing Turbine for Cogeneration

- Power & Fuel Balance of Plant

Parameters	Unit	Value
Moisture of bagasse	%	49–50
Calorific value of bagasse	Kj/Kg	9510
Feed water Temperature	°C	210
Steam Temperature	°C	540
Pressure Steam	bara	110
Steam Enthalpy	Kj/kg	3464
Boiler efficiency	%	70.50
Blow down 2% of steam flow	t/h	2.0
Bagasse required for boiler	t/h	37.4
Bagacillo required for rotary vacuum filter	t/h	0.72
Total bagasse required for plant	t/h	38.12
Bagasse produced	t/h	52.50
Total Surplus bagasse	t/h	14.38
Bagasse saved in 180 days (During Season)	t/season	62 121.00

Parameters	Unit	Value
Power Generation in season	MW	20
Power required		
for sugar plant @ 19 kWh/t cane	MW	2.85
for distillery, water supply, lighting etc	MW	0.7
for TG set and cogeneration plant	MW	2.0
Power available for export in season	MW	14.45
Steam for off-season	t/h	86.4
Power Generation in off-season	MW	17.6
Bagasse required	t/h	32.25
Bagasse required for a day	t/day	774
No. of days for cogeneration in off-season on bagasse	Days	80

Results

Parameters	Unit	Achieved
Crushing rate	TCD	3900
Reduced Mill Extraction	%	97.70
Power consumption of Sugar Plant	kWh/TCH	17.20
Moisture % Bagasse	%	49.20
Reduced Boiling House recovery	%	91.50
Steam Consumption of 75 TCH Process House at 150 TCH crush rate	% on cane	21.90
Sugar Colour	IU	70-80