9th Green SUGAR SUMMIT

Context Setting Presentation

Date: 10th September 2024

HICC, Hyderabad

Overview of Indian Sugar Industry

- Sugar Industry is one of the most energy-intensive industries in the country.
- Average operational days – 150 days/annum
- India has around 534 sugar mill in operation with different capacity ranging from 600 TCD to 20,000 TCD.
- Sugar Industry utilizes both Steam and electricity produced from bagasse fired cogeneration plants for its operation.
- Installed cogeneration capacity is ~8 GW.

GHG Emission intensity : Sugar Industry

Emission intensity of Indian Sugar Industry with only sugar production scenario

- Bagasse cogenerated electricity - 90 – 142 kg $CO_{2\text{-eq}}$/MWh
- Sugar Production - 324 to 410 (with CG) / 622 to 842 kg $CO_{2\text{-eq}}$/MT

Alternative use of byproducts of sugar industry contribute to negative emissions and lower the overall GHG EI by 13-15%.

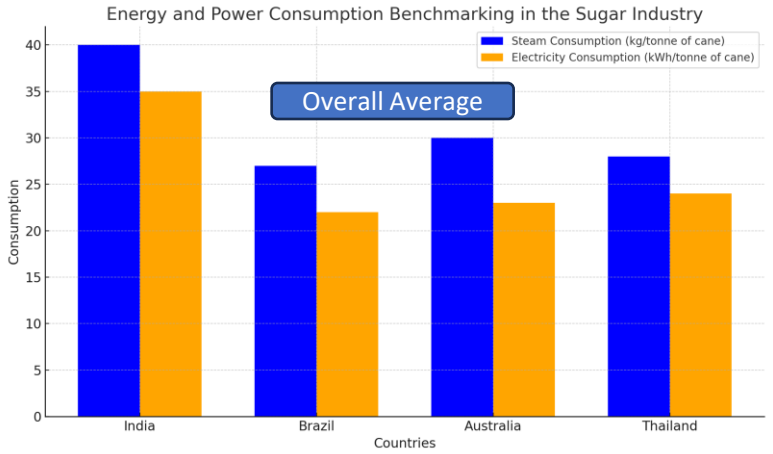
Source: *Life cycle assessment of sugar and electricity production under different sugarcane cultivation and cogeneration scenarios in India*

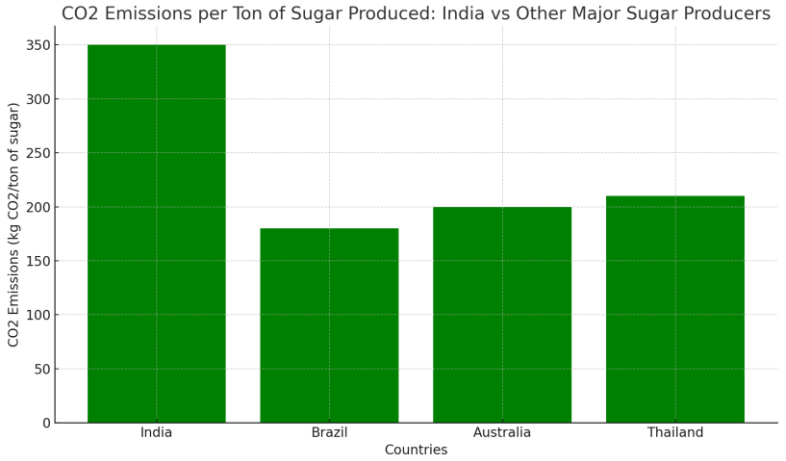
- Sugar plant byproducts – Bagasse, Molasses, Press mud, Spent wash
- The sector has advanced - in cogeneration technology with Bagasse as fuel
- Government policies enabling
  - Ethanol production from Molasses as feedstock under Ethanol Blending Program (EBP)
  - Compressed Biogas (CBG) from Press mud and Spent wash under National Bioenergy program (NBP).

Need for Energy Management in Indian Sugar Industry

- As per latest information, the sugar industry is considered a potential candidate to be notified under a future PAT cycle, as it is considered an energy-intensive sector.
- 10,000 Toe is the threshold level of annual energy consumption for each sugar plant
- Annual energy consumption of sugar industry is about 20.28 Million MTOE – equals to **Annual Energy consumption of Maharashtra State**
- Energy efficiency in Indian sugar industry is less than other major sugar producing countries.
- Water consumption for electricity 209–354 m^3/MWh and sugar production 768 – 1040 (with CG) , 1458 – 2097 m^3/MT
- Improving energy efficiency
  - Helps to minimise the sugar production cost
  - Make Indian sugar industry globally competitive

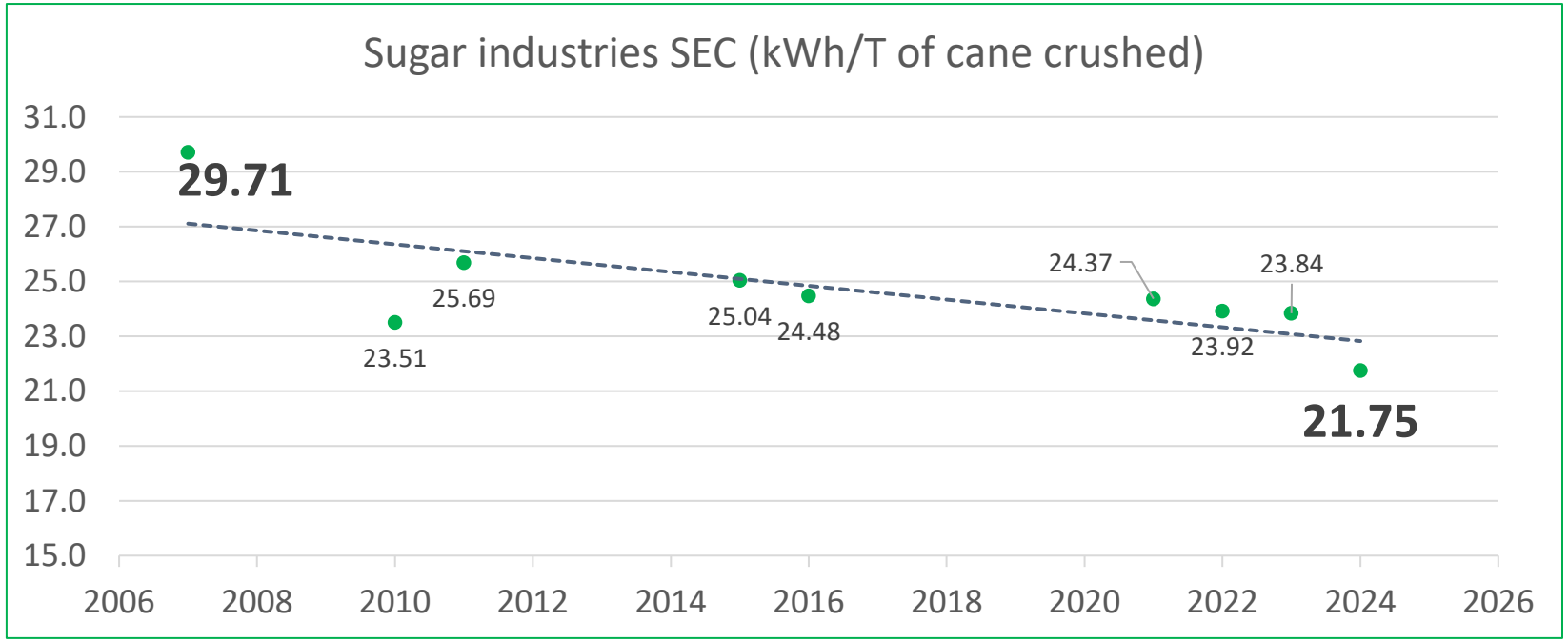
*The Indian sugar industry offers good potential for energy saving. The estimated energy saving potential in the Indian sugar industry is about 20%. This offers potential of about 650 MW of electrical energy – **NSI**.*

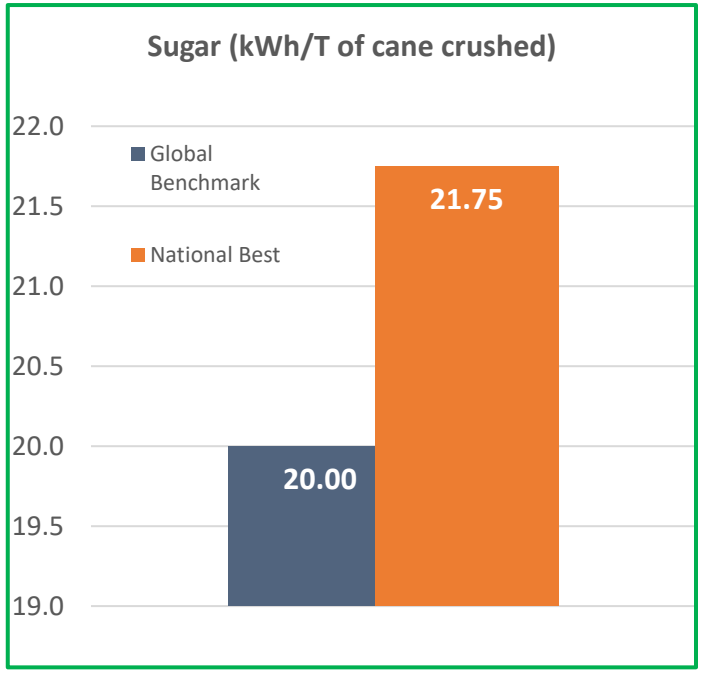




Source: ISMA, UNICA, IEA, FAO, GSA

Trends in SEC Reduction in last two decades– Sugar Sector (**Based on *CII Energy Award Data)***





- **SEC of some of the large sugar industries are close to Global SEC.**
- **Major driver is the incentive in exporting the excess power to consumers.**
- **Installation of high-pressure co-generation systems, process optimization, automation of control systems are some of the other drivers.**

SEC Reduction (considering 2014 as base year): 7.0%

Source: CII Energy Award Data

Best practices for Energy Efficiency Improvement

Cogeneration and Steam Optimization

- Higher efficiency, reduced fuel consumption, and potential revenue from selling surplus electricity to the grid.

Process Optimization

- Evaporation & Crystallization –Multi-effect Evaporators, Mechanical vapor recompression (MVR) Systems
- Waste heat recovery

Improving electrical energy efficiency

- Use of VFD, energy efficient motors and efficient gear boxes

Conduct regular energy audits to identify energy losses and optimize them

Energy management system and Automation of process

Cogeneration and Steam Optimization

- Cogeneration and Steam Optimization
  - Most of the sugar factories in India, cogeneration units work at very low cycle efficiency.
  - Moisture content of bagasse – important factor for improving pressure and temperature
  - Moisture of bagasse is to be brought down to as low as possible by use of waste heat going out of chimney – Bagasse Dryer

Boiler Pressure, ata	Cane crushed/hr, MT	Bagasse produced, MT	Steam Produced, MT	Power Potential, MW	Power plant Efficiency, %
67	1	0.3	0.7	0.14	18%
87	1	0.3	0.7	0.17	21%
110	1	0.3	0.7	0.20	24%
125	1	0.3	0.81	0.23	29%
140	1	0.3	0.84	0.28	35%
160	1	0.3	0.87	0.32	40%
225	1	0.3	0.96	0.40	50%

Source: Bio-Energy from Indian Sugar Industry: A Sustainable Renewable Energy Future (ijert.org)

Mechanical Vapor Recompression (MVR)

- MVR involves compressing vapor to a high pressure and temperature using a mechanical compressor
  - Can be used to heat the process fluid which generated more vapor
  - It allows continuous energy recovery
  - commonly used in industrial processes such as evaporation and distillation.
  - Very effective in sugar industries
  - Several Indian sugar mills have integrated MVR technology into their operations, particularly focusing on reducing energy costs associated with evaporation

Implementation of MVR led to energy savings of over 30% compared to conventional evaporation systems

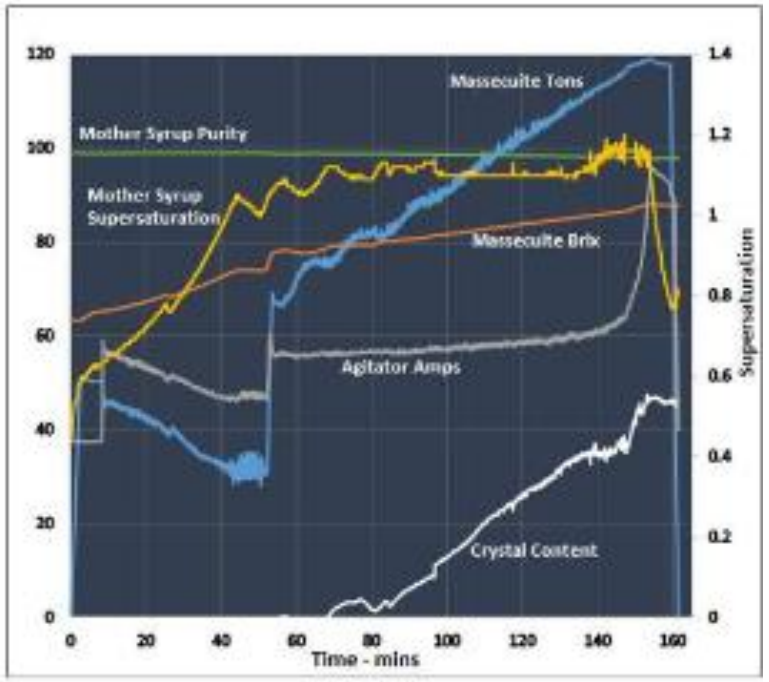
Can recover and recycle >97% of water used for process

Lowers GHG emissions, contributing to a smaller carbon footprint

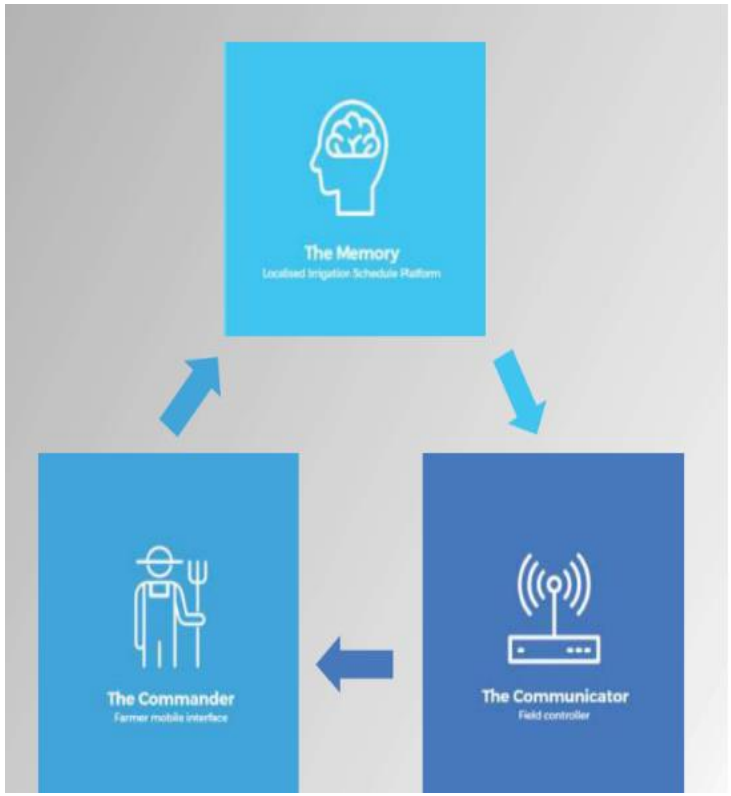
Source:Mechanical Vapor Recompression, MVR, Evaporative Concentration

Sugar factory automation and optimization

- Technologies available for process optimization
  - AI/ML
  - Optimal tuning of PID controller
  - Digital twin solutions for optimizing crystallization process
- Automation helps to
  - visualize, control and optimize the process operations
  - Lowering energy consumption
  - Improving quality
  - Reducing inventory cost



Use of IOT for increasing the yield and Savings – Water, Energy and Carbon



Localised Irrigation Schedule Platform

Cloud-based database that uses weather forecasting and farm-specific data to produce irrigation schedules.

Field Controller

Executes irrigation commands, acts as a weather station and deals with power outages.

Farmer Mobile Interface

Mobile app that allows the farmer to view and modify irrigation schedule

Site Name	Energy savings	Water savings	CO_2 savings
	kWh/crop cycle/acre	%	kg CO_2/ crop cycle/acre
IFFCO	347	43	274
EID Parry	579	72	457

RE Integration- opportunities in Sugar Industry

Rooftop Solar PV Systems

- Opportunity to install on factory buildings, warehouses, and other infrastructure
- lowering energy costs, especially during non-crushing seasons
- Indian government offers financial incentives for rooftop solar under its various schemes

Solar PV Integration with Cogeneration Plants

- Opportunity to produce power during daytime and save bagasse
- Ensures a more consistent power supply throughout the year.
- Make the sugar mill more energy self-sufficient and reliable. PPA Model available

Solar-Powered Irrigation for Sugarcane Fields

- solar-powered irrigation pumps offer a sustainable alternative to diesel-powered pumps.
- Minimize operational costs
- PM-KUSUM Scheme

Solar-Powered Warehousing and Cooling

- Sugar mills also operate warehousing and cooling facilities for storage
- Minimize operational energy cost
- Can be explored with energy storage options

Indian Carbon Market – Opportunities for Sugar Industry

- Indian Carbon Market is designed to drive emission reductions in the energy and GHG intensive sectors
  - setting emission targets and establishing a market for Carbon Credit Certificates
  - the system encourages the adoption of cleaner technologies, energy efficiency measures, and investments in low-carbon projects, thus contributing to India's overall climate goals.
- Under this, certain industries or manufacturing facilities, known as obligated entities, are assigned GHG reduction targets by the Central Government and the facilities have to comply with the emission targets.
- It aims to create a market-based approach to achieve cost effective GHG emission reductions by facilitating trade of Carbon Credit Certificates (1 CCC = 1 T CO_2e reduction).

- India's Carbon Credit Trading Scheme, 2023 was notified by the Government of India on 28 June 2023 under the Energy Conservation Act, 2001.
- Benefits of CCTS
  - Financial incentives
  - Energy efficiency improvements
  - Sustainability and Brand image
  - Compliance with international market regulations
  - Boosting competitiveness
  - Encouraging innovation – long term sustainability

CCCs can serve as a financial tool and a driver for sustainability in the sugar industry, encouraging more energy-efficient and environmentally friendly practices.

What Sugar industry should aim for?

To become more sustainable

Energy efficient

Carbon Positive

Sustainable agriculture practices

Circular economy with waste reduction

Market Competitiveness

CII Net Zero Program

Ready-made tools & resources for scope 3 emissions inventorization

Focused & individual handholding for every organization

Strategies for GHG emissions reduction (scope 1 &2)

- Showcase climate leadership through corporate actions
- Commitment to climate resilient development
- Preparedness for a carbon constrained future
- Outperform voluntary and mandatory requirements
- Enhance brand value, reputation and market expansion
- Transparency and communication among stakeholders

Companies committed for the Net – Zero program

Galaxy
Global Supplier to Global Brands

NEULAND
WHERE OPPORTUNITY BECOMES REALITY

SUVEN
PHARMA

SAGAR
CEMENT

CUMI CARBORUNDUM UNIVERSAL LIMITED

NUVOCO
Shaping a new world

Rane
Expanding Horizons

BAJAJ Electricals

IFB
IFB Industries Limited

KANSAI PAINT
NEROLAC

How can CII-GBC support in realizing Net Zero targets?

- Supporting Industry from Inventorization to Net Zero
  - GHG Accounting
  - Detailed Energy Audits,
  - Life Cycle Assessments,
  - GreenCo
  - GreenPro
  - IGBC
  - Green Entrepreneurship Council
  - Low Carbon Technology Roadmaps
  - Facilitating B2B meetings

… and many more!

CII - GREEN ENTREPRENEURSHIP COUNCIL

GreenCo

Indian Green Building Council

GreenPro

Confederation of Indian Industry

9th Green SUGAR SUMMIT

Thank You!

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Section wise Electricity & Steam consumption break-up