ENVIROPOL
AN ISO 45001:2018 CERTIFIED

DE Carbonization through Bagasse Dryer For Captive Cogeneration Plants of Sugar Mills

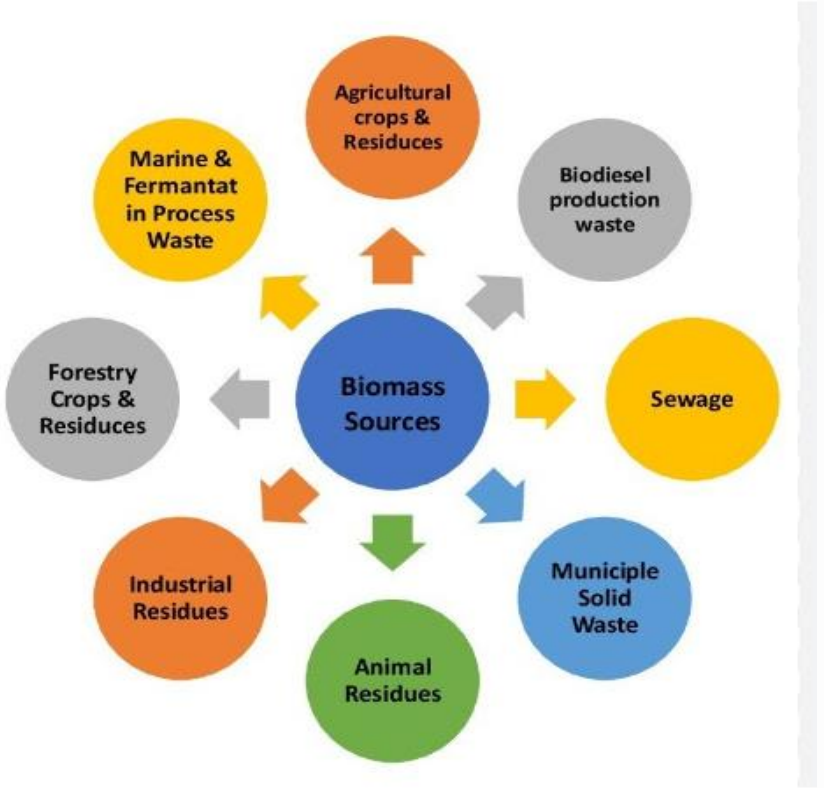
:By Mr. Rajesh Verma

BEE & FCDO-ASPIRE Workshop – Best Practices in Energy Efficiency in Sugar Sector
21.03.2024

Why is the demand growing for Biomass Drying ???

FOR HEALTY ENVIRONMENT

- Net Zero Carbon emissions by 2070
- Mandate to replace fossils fuels by 20 %
- Usage of biomass for other applications
- Biomass densifications
- Sharp increase in price of Bagasse/ Biomass



Biomass Type.....

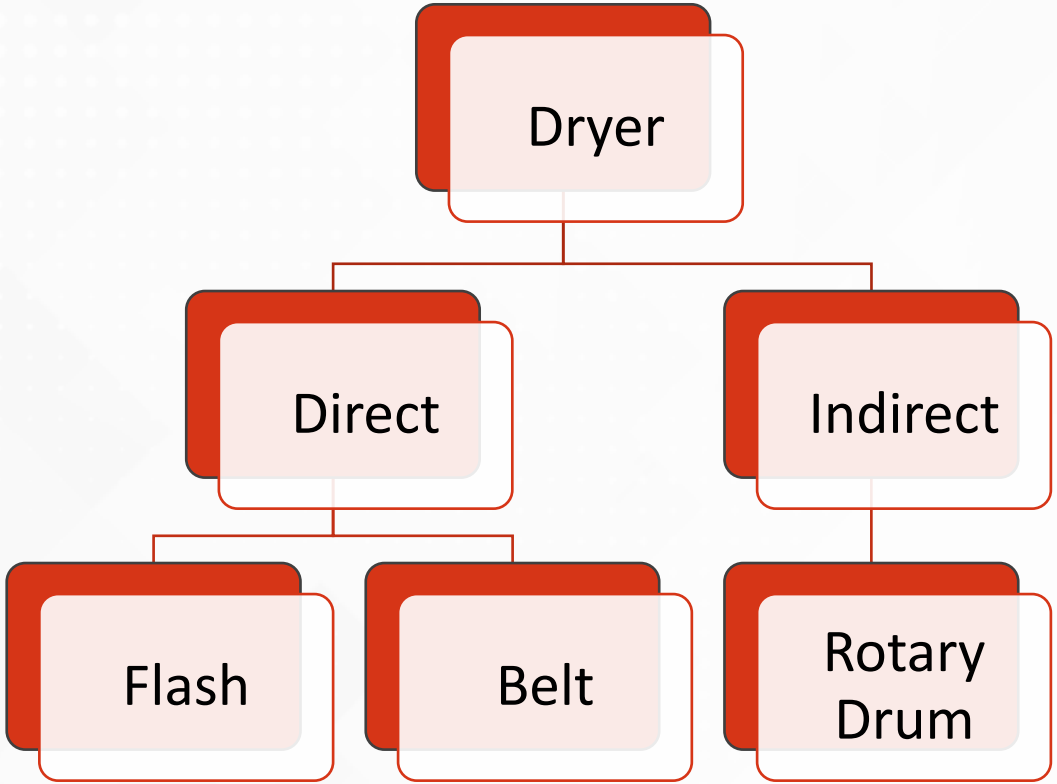
FOR HEALTY ENVIRONMENT

WOOD	SUGAR CANE	OTHERS - Primary	OTHERS -Secondary
Chipper dust	Bagasse	Coffee Husk	Tamarind Shell
Saw dust	Mill Bagasse	Groundnut Shell	Corn waste
Screen/ Knots rejects	Bagasse Pith	Coconut Shell	Julia flora
ETP Filter Cake	Horkel Pith	Coconut Fiber	
Bark		Rice Husk	Coir waste
Match stick waste	Cane Trash	Rice Straw	Mango seed
MLSS		Wheat Straw	

Sugar Cane Based Biomass- Moisture ,Ash and GCV

Parameter	Units	Bagasse	Bagasse Wet Pith	Bagasse Pith	Cane Trash
Total moisture	%	48-52	63	50.0	18 -20
Ash on Dry basis	%	2.5	4.1	4.5	18
GCV on Dry basis	k cal /kg	4540	4000	4035	4400
GCV on ARB	k cal /kg	2180-2360	1580	2020	3520-3620

Prevailing -Type of Dryers for biomass



Prevailing -Type of Dryers

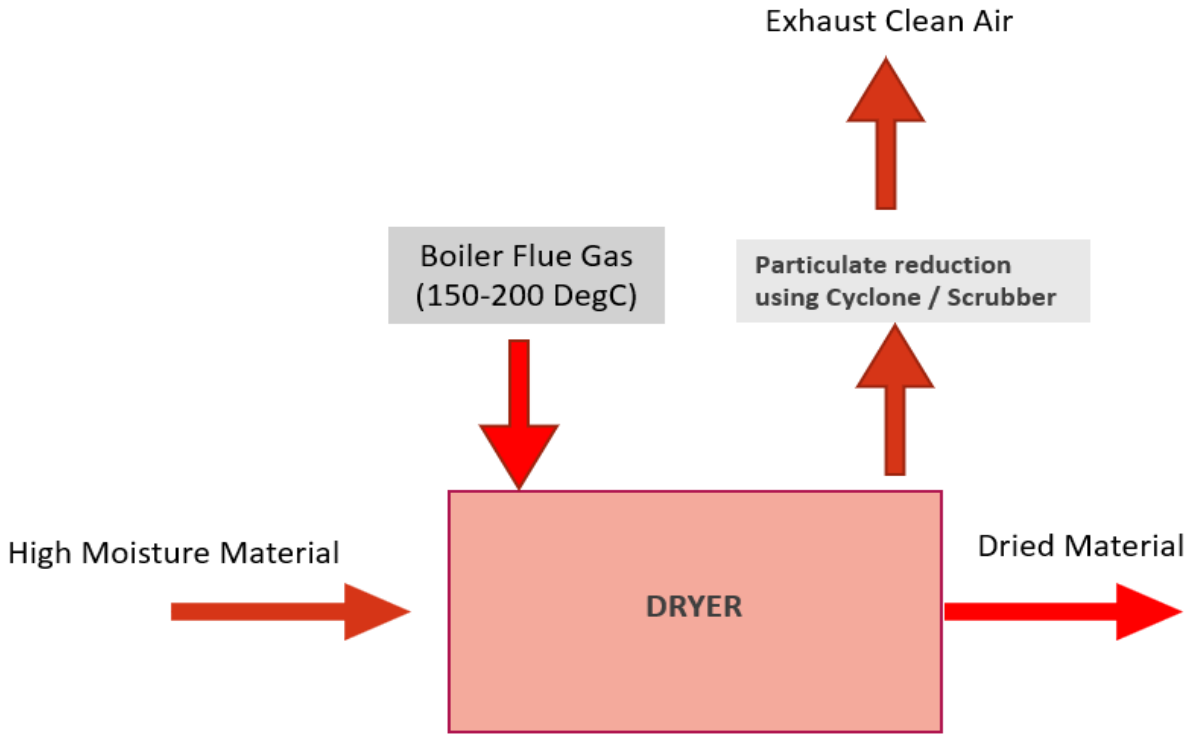
Flash Dryer

Belt Dryer

Rotary Dryer

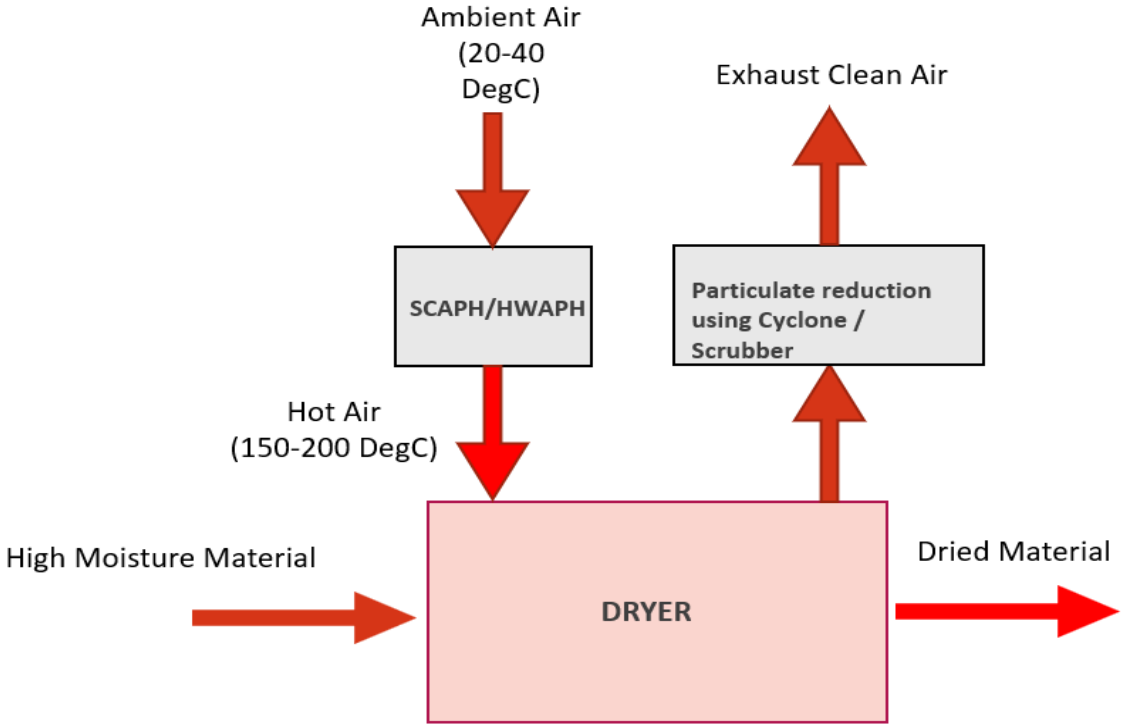
Common Heat Sources available for Drying

Boiler Flue Gas (waste Heat)- Low temp Drying



Common Heat Sources for Drying

Hot –Waste water /Steam



BAGASSE DRYER

Gaining while Greening

New dimension- in Drying Technology

Prolonged Cogeneration

Fuel Saving

PAT
EScerts
& Carbon
Credits

Flue Gas Cleaning

Improved Boiler Operations & Efficiency

Stage-1 : Flash Dryer- How it works ??

FOR HEALTY ENVIRONMENT

GAS TRAIN

Boiler

↓

Biomass Dryer →

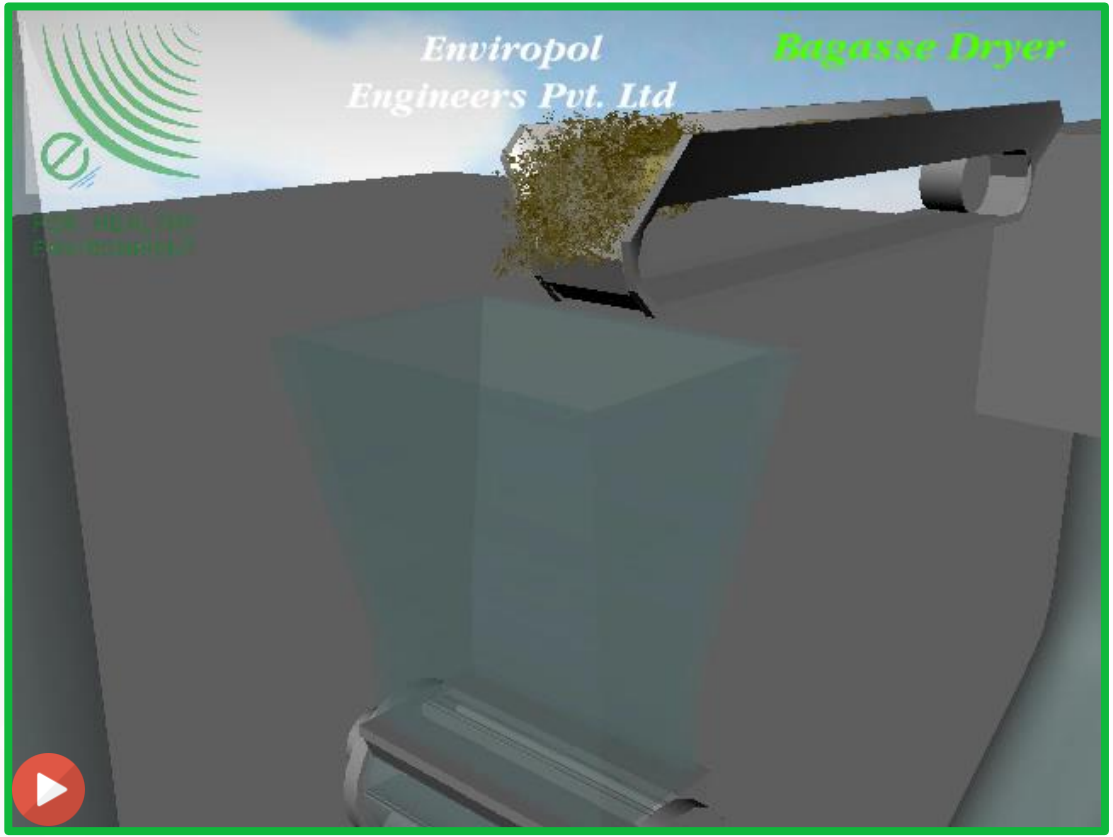
↓

APCD

↓

Stack

Flash Dryer ™



Special Features – Enviropol Flash Dryer

FOR HEALTY ENVIRONMENT

- Regulated Feeding
- Short residence Time
- High reduction in Moisture
- High efficiency Cyclone
- Higher heat Transfer
- Corrosion/erosion Resistant
- No air infiltration

Performance Results from Dryer

FOR HEALTY ENVIRONMENT

Particulars	Improvement (%)
Moisture Reduction	20-27
Fuel Saving	06-10
Excess Air Reduction	20-30
Carbon Emission Reduction	09-12
Increase in dried Bagasse GCV	18-24
Increase in Boiler Thermal efficiency	09-12
Reduction in CO Concentration	80-90
Reduction in Particulate matter	90-95
Reduction in flue gas volume due to temp drop	30-35

Few of our Installations…

FOR HEALTY ENVIRONMENT

80 TPH Boiler

50 TPH Boiler

100 TPH Boiler

Few of our Installations…

70 TPH Boiler

210 TPH Boiler

90 TPH Boiler

Transport of Wet and Dry Bagasse...

Transport of wet bagasse

Transport of dry bagasse

Case Study : – Innovative Bagasse Dryer in HP Cogen Boiler

FOR HEALTY ENVIRONMENT

BAGASSE FIRED HP BOILER

Parameter	Design Value	Units
Fuel	Bagasse	
Moisture in Mill Bagasse	50	%
Steam Evaporation [MCR]	80	TPH
Steam outlet Pressure	87	Ksc
Steam outlet temperature	515	°C
Feed Water Temperature from HP heater to Economizer	180	°C
Draught system	Balanced- FD & ID Fans	
Flue gas temperature at APH out	145	°C
APC Device	ESP	
Back end Equipment	Economizer& APH	

DESIGN INPUT PARAMETERS		
Description	**Unit**	**Value**
Boiler Steam Generation Capacity	TPH	80
Bagasse Dryer Capacity	TPH	31
Bagasse moisture at inlet	%	49
Temperature of inlet flue gas (*)	Deg C	**140**
Quantity of inlet flue gas	m^3/sec	60
Particle size distribution		Standard
Quantity		1 Set
DESIGN OUTPUT PARAMETERS		
Predicted moisture in Bagasse at outlet	%	39.5±0.2
Predicted flue gas temperature at outlet	Deg C	70±2
Predicted pressure drop across dryer	Mmwc	135±10

Data Collection-Avg. data from 4 tests

For Healthy Environment

Parameter	Boiler- Design	With Dryer	Units
Steam Generation	80	*71 /87	TPH
Main Steam Pressure	86	86	kscg
Main Steam Temperature	515	517	°C
Feed water Temperature	180	186	°C
Flue gas outlet temp	133	72	°C
Fuel	Bagasse	Bagasse	
Moisture Content	48-50	38.0	%
GCV of Fuel	2375 - 2270	2825	Kcal/kg
Fuel Temperature to Boiler	30	50-65	°C

(*) On the day of testing, steam demand was only 71 TPH on 24 hrs. average basis. However the Boiler steam generation capacity enhanced to about 87 TPH on account of reduced moisture in bagasse

Performance Results---

BCML- PERFORMANCE WITH DRYER

Parameter	Without Dryer in operation	Energy Gains with Dryer	Increase/ Reduction
Bagasse Moisture	47.63 %	38 %	9.63 pp [20%]
Bagasse GCV	2375 kcal/kg	2810 kcal/kg	18%
Boiler Thermal Efficiency	70 %	76 %	6 % point
Steam Economy Upgrade	2.4 -2.5	3.1- 3.2*	11-12%
Flue Gas Temp to Stack	133°C	72°C	61°C
Excess Air Reduction			~20%
CO_2 Reduction			33-35 t/CO2e/day
SPM reduction in FG			80- 90%
NOx reduction est.			15-20%
N2O reduction est.			5-10%

(*) Considering reduced weight of bagasse after dryer.

R.O.I

If we follow the power generation route, the net saving works out to INR 1, 12,390per day considering current power tariff of INR 3.0 /kWh to the grid.

The savings, on account of sale of bagasse to other industry is calculated to INR 92,400per day considering the current rate of bagasse as INR 1750 / Ton.

The above figure represents a Return on Investment well within less than 500 working days.

Short Video of BCML installation during commissioing

FOR HEALTY ENVIRONMENT

Common Fears /Queries in the Mind of End Users before Installation

FOR HEALTY ENVIRONMENT

- Fire Hazard
- Jamming /Choking
- Temp Range of heat source
- Loss of Volatiles Matters
- Weather to install in suction/Pressure
- Operations and Maintenance
- Adaptability of dried bagasse
- Return on Investment
- Operations and Maintenance
- Decarbonization –Carbon Credits and Es certs
- Outlet Emissions

HYBRID DRYER

BAGASSE DRYING & FLUE GAS CLEANING

Innovative Hybrid Model of Bagasse Dryer

FOR HEALTY ENVIRONMENT

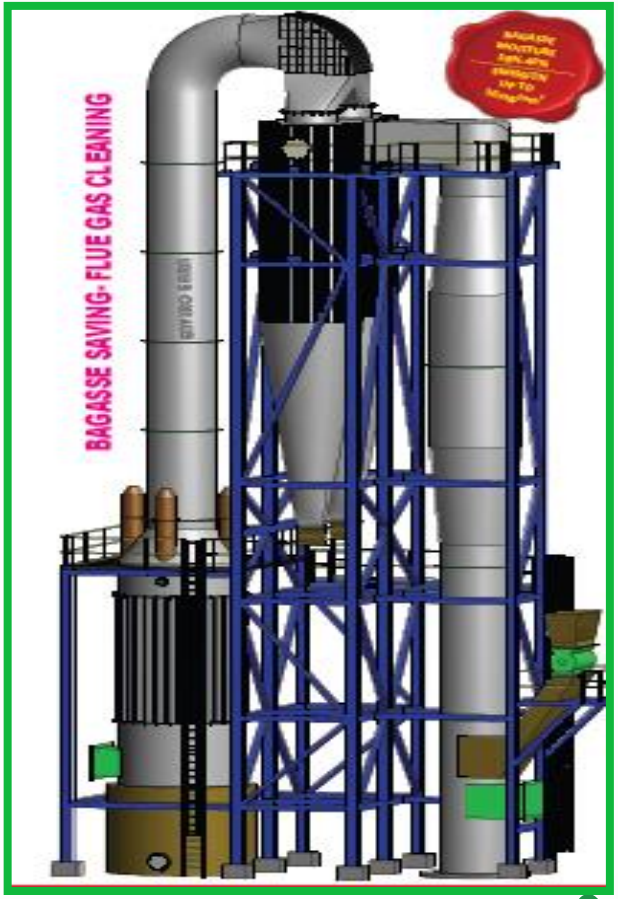
Milled Bagasse Moisture reduced to 38-40 % from 50 %

HYBRID DESIGN

New Age Technology

PATENTED

Emission Up to10 mg/Nm3



First Installation in the World.. *Commercialized in 2019*

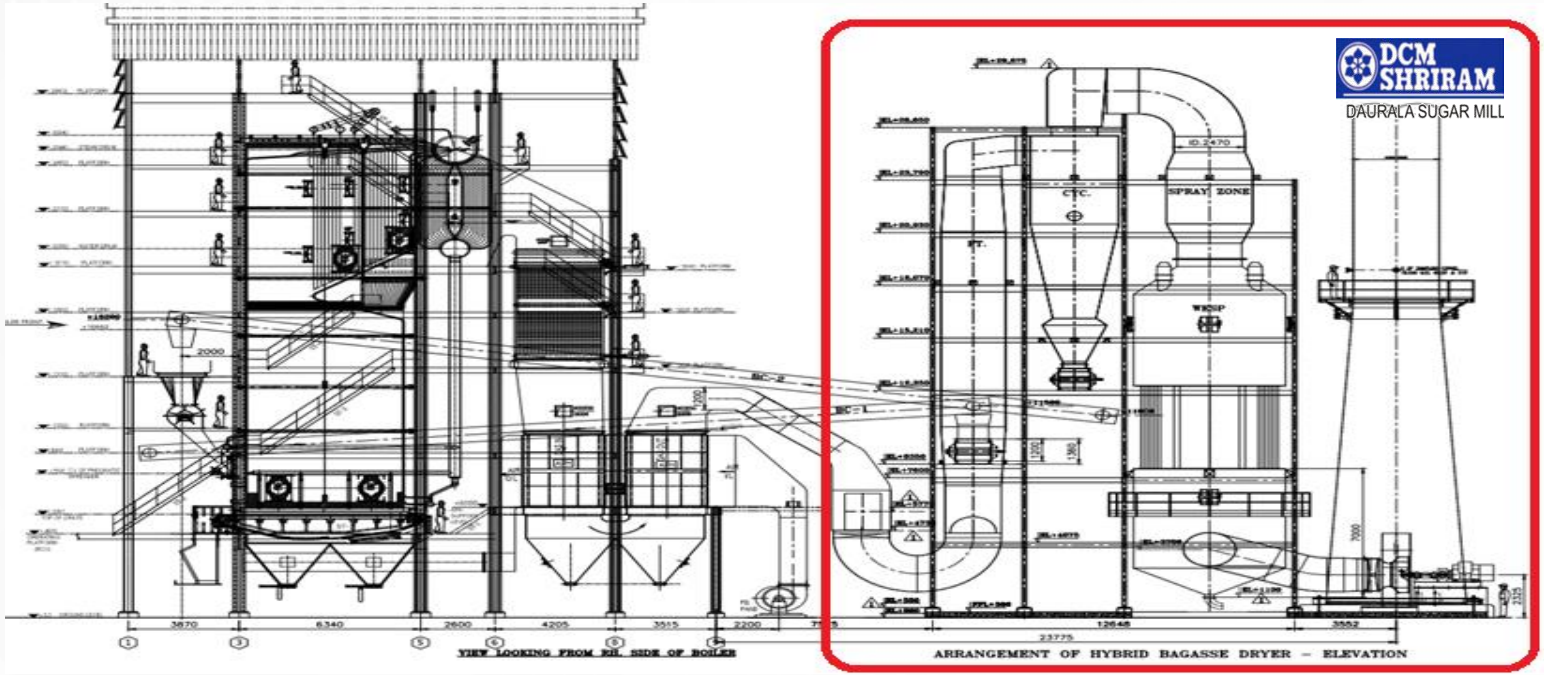
FOR HEALTY ENVIRONMENT

WESP as part of Hybrid Model at DSW

- Gas flow- 220,000 m3/hr @ 140 deg c
- Outlet particulate emissions- < 50 mg/Nm3
- Bagasse Moisture drop - 22 %
- Net Bagasse Saving- 7 %
- Year of Commissioning- 2019

HYBRID DESIGN

Case Study : Innovative Hybrid Model on Cogen Boiler



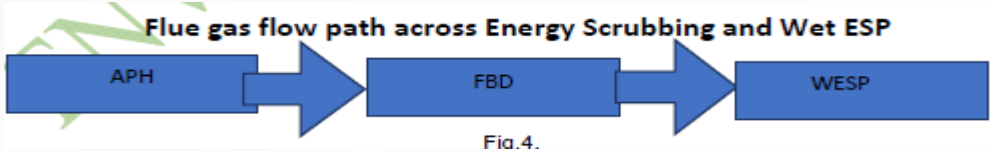
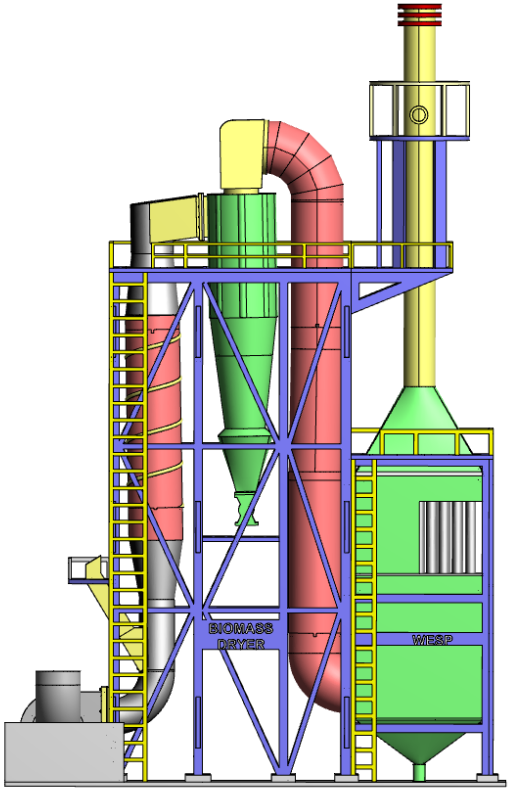


Fig.4.

Hybrid Model -Bagasse Drying and Flue gas cleaning



DESP can be eliminated with this- Gaining while Greening concept

… Summary of Tests conducted during the season

For Healthy Environment

Average of 4 Tests conducted during the season

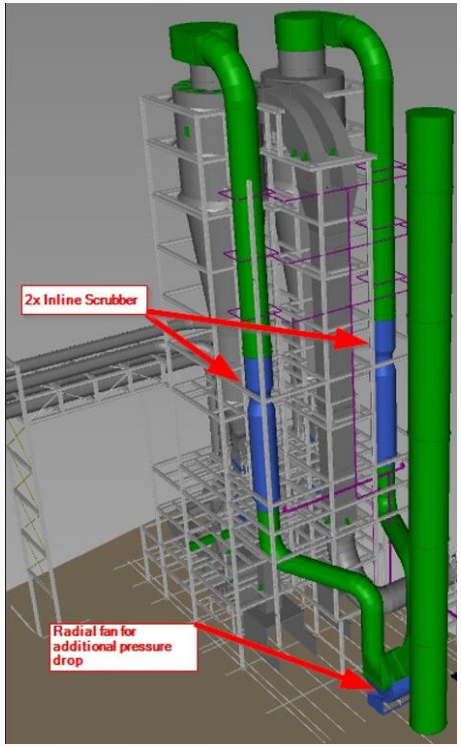
Particulars	Unit	APH outlet-Dryer inlet	Dryer outlet-WESP inlet	WESP outlet-Stack
Flue gas Temp	⁰ C	135	72	68
Bagasse Moisture	%	50	39	-
Particulate in gas Emission	mg/Nm3	4000	195	32-35
Flue gas Draught	mmWC	130	260	280

Major Take Away from Hybrid technology

For Healthy Environment

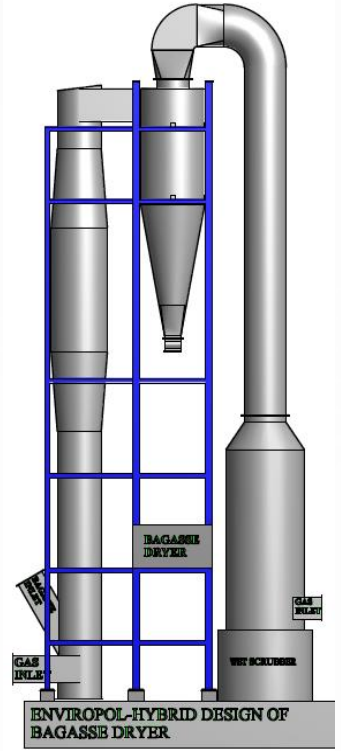
- Flue gas cleaning with Bagasse Drying
- Revenue Generation through bagasse saving
- Smaller foot prints & Compact lay-out
- Capability to reduce emissions <10 mg/Nm3
- Gas Cleaning efficiency >99.5 %
- Significant GHG Emission reduction [offset)
- Low Power consumption
- Substantial Control on aerosols

Dryer Integrated with Mild Scrubber



Optio-1- Inline WS

To keep a check on fugitive emission if any during Dryer Malfunction

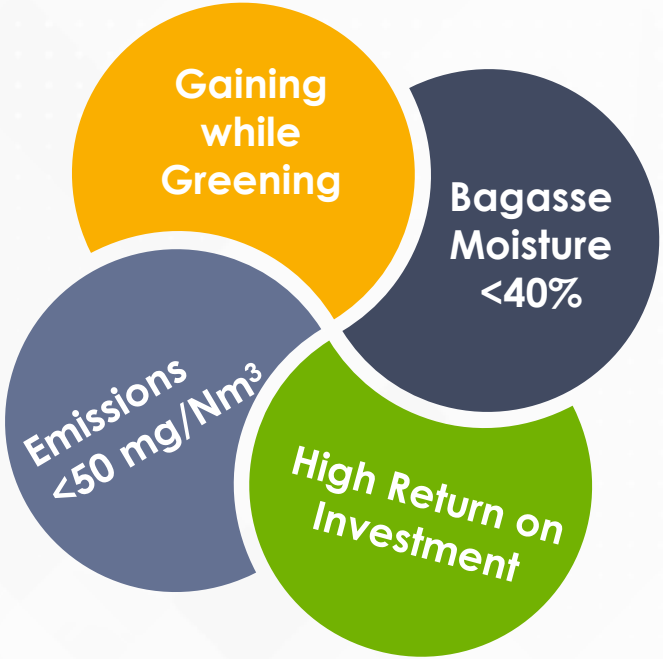


Option-2 –WS-LPD

Hybrid Model– An Overview

FOR HEALTY ENVIRONMENT

Meet Future Emissions Norm With
Return on Capital Investment



Certification & Awards….

ENVIROPOL
AN ISO 45001:2018 CERTIFIED

ENVIROPOL ENGINEERS (P) LTD.

FOR HEALTHY ENVIRONMENT
ENVIROPOL

Most Innovative Energy Saving Product

INNOVATIVE HYBRID DRYER FOR BAGASSE

ENVIROPOL - Hybrid Dryer/WESP is a way forward to make "Air Pollution Control (APC)" a Revenue Generating Model in sugar Industry through innovative integration of Bagasse Drying & Wet Electrostatic Precipitation to generate enormous amount of green & clean Energy.

Our Manufacturing Range

- Hybrid Model-A : Bagasse Dryer+ WESP
- Hybrid Model- B : Bagasse Dryer + WSS

Applications

Sugar & other Biomass based Power Generating Plants

Managing Director

Rajesh Verma

"Gaining while Greening"

Team Members

Unique Features

- Established First of its own kind "Revenue Generating APC model" in the world for Sugar Industry
- Receiving Patent from Government of India (Patent No- 363763)
- Receiving "Industry Excellence Award" from "Sugar Technology Association of India"
- Publications in various National/International Journals including Cogen India/STAI/ISSCT

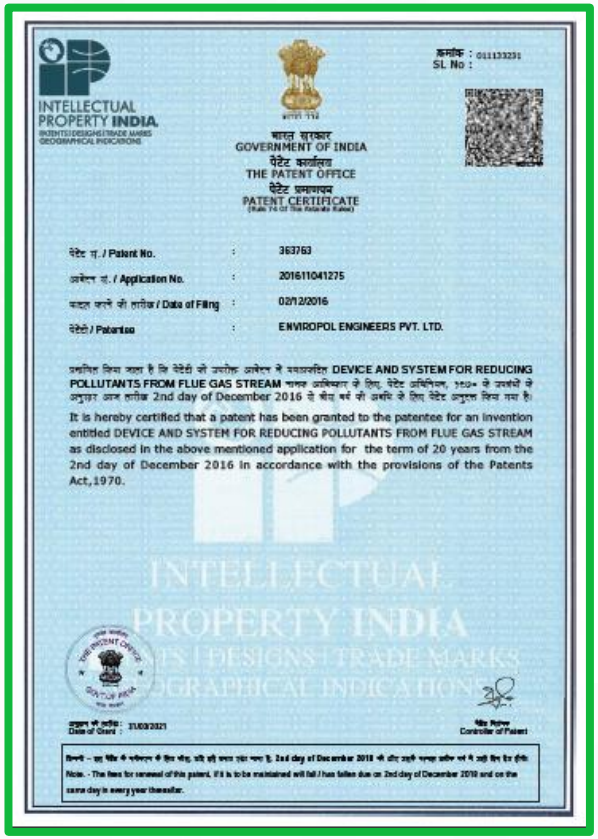
22nd National Award for Excellence in Energy Management 2021

CII
Confederation of Indian Industry

Certification & Awards….

For Healthy Environment

Patent Awarded



INTELLECTUAL PROPERTY INDIA
PATENTS | DESIGNS | TRADE MARKS | GEOGRAPHICAL INDICATIONS

भारत सरकार
GOVERNMENT OF INDIA
पेटेंट कार्यालय
THE PATENT OFFICE
पेटेंट प्रमाणपत्र
PATENT CERTIFICATE

क्रमांक : 011133231
Sl. No :

पेटेंट सं. / Patent No.	:	363763
आवेदन सं. / Application No.	:	201611041275
फाइल करने की तारीख / Date of Filing	:	02/12/2016
पेटेंटी / Patentee	:	ENVIROPOL ENGINEERS PVT. LTD.

प्रमाणित किया जाता है कि पेटेंटी को उपरोक्त आवेदन से संबंधित DEVICE AND SYSTEM FOR REDUCING POLLUTANTS FROM FLUE GAS STREAM भारत अधिनियम के लिए, पेटेंट अधिनियम, १९७० के उपबंधों के अनुसार आज तारीख 2nd day of December 2016 से मौजूद वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled DEVICE AND SYSTEM FOR REDUCING POLLUTANTS FROM FLUE GAS STREAM as disclosed in the above mentioned application for the term of 20 years from the 2nd day of December 2016 in accordance with the provisions of the Patents Act,1970.

दिनांक / Date of Grant : 31/03/2021

पेटेंट नियंत्रक / Controller of Patents

टिप्पणी – इस पेटेंट के संबंधित में देय फीस, यदि कोई अगला पूरा भाग है, 2nd day of December 2018 को और उसके पश्चात प्रत्येक वर्ष में उसी दिन देय होगी।
Note. - The fees for renewal of this patent, if it is to be maintained will fall / have fallen due on 2nd day of December 2018 and on the same day in every year thereafter.

Appreciation from end users

DCM SHRIRAM INDUSTRIES LTD.
UNIT : DAURALA SUGAR WORKS
DAURALA, DISTRICT : MEERUT, U.P. - 250221, INDIA
TEL. (+ 91-1237) 230096, 230099, 230100, FAX : (+91-1237) 230131

Ref. No. SUD

Date : 24.01.2020

TO WHOMSOEVER IT MAY CONCERN

HYBRID – WESP/BAGASSE DRYER

This is to certify that M/s. Enviropol Engineers Pvt. Ltd., Noida have successfully commissioned Hybrid Model of Bagasse Dryer (Bagasse Dryer with integrated Wet Electrostatic Precipitator (WESP) on our 90 TPH Bagasse fired Boiler installed last year.

The performance of Hybrid Dryer has been found satisfactory. It is cleaning the Flue Gases to below 50 mg/Nm³ SPM while reducing the moisture in Bagasse by 11 units (from 50% to 39%).

The WESP Integrated with Dryer is also a High Efficiency Polishing Filter to

BALRAMPUR CHINI MILLS LIMITED

FACTORY : UNIT-BALRAMPUR, VIL & P.O. BALRAMPUR, DISTT : BALRAMPUR, UTTAR PRADESH, PIN-271201
PHONE : 05263-235052, 235053, 235419 • FAX : 05263-235051 • GSTIN : 09AAACB0373G1ZW

Date: 14.04.2021

TO WHOMSOEVER IT MAY CONCERN

This is to certify that M/s Enviropol Engineers Pvt. Ltd., Noida have Design, Engineering, Manufacturing, Supply of Bagasse Flash Dryer system for 80 TPH, Bagasse Fired Boiler at M/s Balrampur Chini Mills Ltd, Balrampur (UP) in the year 2020-21.

The system is running satisfactory since the commissioning.

For BALRAMPUR CHINI MILLS LTD.

AUTHORIZED SIGNATORY

PRESS: OFF: "TMC FORTUNE" 2ND FLOOR, 234/3A, ACHARYA JAGDISH CHANDRA BOSE ROAD, KOLKATA-700 020
TELEPHONE : 2287 4240 • FAX : (033) 2287 3283 • E-MAIL : book@stai.in • Internet Website : http://www.stai.in

CII Award for Most Innovative product of year 2021

CII
Confederation of Indian Industry

22nd National Award for
Excellence in Energy Management 2021

This is to certify that
Bagasse Flash Dryer & Its Hybrid Model
offered by
Enviropol Engineers (P) Ltd
has been recognized as
"Most Innovative Energy Saving Product"
This acknowledgement is based on the evaluation by the panel of judges at the "National Award for Excellence in Energy Management" held during 24 - 27 August 2021.

K S Venkatagiri
Executive Director
CII - Godrej GBC

Ravichandran Purushothaman
Chairman, Energy Efficiency Council
CII - Godrej GBC

CII
CII NATIONAL ENERGY AWARD 2021
MOST INNOVATIVE ENERGY SAVING PRODUCT
AWARDED TO
ENVIROPOL ENGINEERS (P) LTD

Excellence Award from STAI

The Sugar Technologists' Association of India
77th Annual Convention & Sugar Expo
Industry Excellence Award
Presented to
Mr. Rajesh Verma
during 77th Annual Convention
Kolkata | 17-18 July, 2019

Summary..

For Healthy Environment

What all a Hybrid Model can Deliver for 20 MW Bagasse Based Cogeneration Plant

Extra Green Energy Produced: 1.2-1.5 MWh

Particulate emissions : 10-50 mg/Nm3

Other Pollutants Reduction…

Stack Flue Gas	Other Pollutants
SO2	Absent
Hg Compounds	Absent
Amino-acid	Countered with Alkaline water scrubbing

Gaseous pollutants Reduction…

Location	GHG Emission Reduction
	tCO2e/m
Additional Green Power	900-1200
N_2O reduction	100-150
Overall Emission reduction	1000-1350

FOR HEALTY ENVIRONMENT

- **With Sugar sector coming under PAT [as per the Min.of Power Notification of May 2023], the increase in specific steam generation in boilers with dried bagasse firing would be availing of EsCerts.**

- **Over & above, the very recent Min. of Power Gazette notification on Carbon Credit Trading Scheme [June 2023] ,the above renewable energy gains can be related to displacement of equivalent imported coal firing in boilers elsewhere. In essence, Flash Biomass Dryer would contribute to EsCerts & Decarbonization.**

Having 15+ Installations of Bagasse Dryers Worldwide, what Opportunity lies for The Sugar Mills




Potential For Replication…

For Healthy Environment

Considering (+) 530 sugar Mills & (+) 10,000 MW of Bagasse based cogeneration presently available in India, Hybrid model of bagasse dryer has a great potential for replication to produce

Additional Clean Green Energy : 2500 GW

Reduction in GHG : + 2.5 million tCo2e

on yearly basis

(considering 170 days of sugar cane crushing season /Year)

Performance Certificate

FOR HEALTY ENVIRONMENT

KIBOS SUGAR & ALLIED INDUSTRIES LTD.

P. O. BOX 3115, KISUMU, KENYA
Post Code 40100,
Tel.: +254 725 652 555 / +254 736 157 777
Email: headoffice@kibossugar.com
KENYA - EAST AFRICA

28/2/2023

Ref: KSAIL/Co-gen/01/2022-23

TO WHOMSOEVER IT MAY CONCERN

This is to certify that M/s Enviropol Engineers Pvt Ltd., Noida have supplied Flash Dryer™ for Bagasse for our 48 and 100 TPH Boilers. The Dryer is running successfully on regular basis meeting the design parameters. The Moisture in mill bagasse is reduced from 49 to 38 ±1% at the rated drying capacity 45 & 25 TPH. We are satisfied with the Installation.

We appreciate their execution methodology and prompt after sales services.

G. SURYANARAYANA MURTY
GENERAL MANAGER

BALRAMPUR CHINI MILLS LIMITED

FACTORY : UNIT-BALRMPUR, Vill. & P.O. BALRAMPUR, DISTT. : BALRAMPUR, UTTAR PRADESH, PIN-271201
PHONE : 05263-235052, 235053, 235419 • FAX : 05263-235051 • GSTIN : 09AAACB9373Q1ZW

Date: 14.04.2021

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The system is running satisfactory since the commissioning.

For BALRAMPUR CHINI MILLS LTD.

AUTHORIZED SIGNATORY

Performance Certificate

FOR HEALTY ENVIRONMENT

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This is to certify that M/s. Enviropol Engineers Pvt. Ltd., Noida have successfully commissioned Hybrid Model of Bagasse Dryer (Bagasse Dryer with integrated Wet Electrostatic Precipitator (WESP) on our 90 TPH Bagasse fired Boiler installed last year.

The performance of Hybrid Dryer has been found satisfactory. It is cleaning the Flue Gases to below 50 mg/Nm^3 SPM while reducing the moisture in Bagasse by 11 units (from 50% to 39%).

The WESP Integrated with Dryer is also a High Efficiency Polishing Filter to capture ultra fine particulate matter.

With space constraints and especially after bagasse drier, this appears to be a good technical achievement in controlling the environment pollution.

AUTHORIZED SIGNATORY

Regd. No. 25-14367, CIN-UI5424PN2000PLC014367 An ISO 9001 : 2008 Certified Company

SHRI GURUDATT SUGARS LTD., Takaliwad

SGSL

| ADD.: Gat No. : 61 / A, Akiwat Takaliwadi Road, Takaliwadi Tal.- Shirol Dist - Kolhapur (MH) Pin Code : 416 1(
| PHONE : +91 231 2686086 | FAX : +91 231 2686000 | WEBSITE : www.sgsl.co.in | Email : gslsugars@gmail.co

Ref.: SGSL / Co-gen/ 47 / 2016-17

Date : 14 / 07 / 2016

TO WHOMSOEVER IT MAY CONCERN

This is to certify that M/s. Enviropol Engineers Pvt. Ltd., Noida have supplied **Flash Dryer™ for Bagasse** for our 70 TPH Boiler. The Dryer is running successfully on regular basis meeting the design parameters. The moisture in Mill bagasse is reduced from 48 to 38 ± 1% at the rated drying capacity of 32 T/hr. We are satisfied with the installation.

We appreciate their execution methodology and prompt after Sales Services.

SHRI GURUDATT SUGARS LIMITED REG. No. 25 - 14367 JAYSINGPUR

CHIEF ENGINEER
SHRI GURUDATTA SUGARS LTD.

Our Offices...

ENVIROPOL
AN ISO 45001:2018 CERTIFIED

Overseas Branches:

- Thailand
- Vietnam
- Philippine
- Indonesia
- Kenya
- Sri Lanka