



Renewable Power Generation Using Cashew Waste

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Excelling Steaming Solutions

Agenda



- Current practices in the Cashew Industry
- Opportunities and their evaluation
- Case study: Actual installation



Cashew Fruit



Cashew Nut



Cashew Nut Shell



Cashew Nut Shell Liquid (CNSL)



De Oiled Cake (DOC)

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Journées Nationales des Exportateurs de Cajou de Côte d'Ivoire

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12-14 Feb, 2020
Radisson Blu Hotel
Abidjan, Cote d'Ivoire



Cashew Fruit



Cashew Nut



Cashew Nut Shell



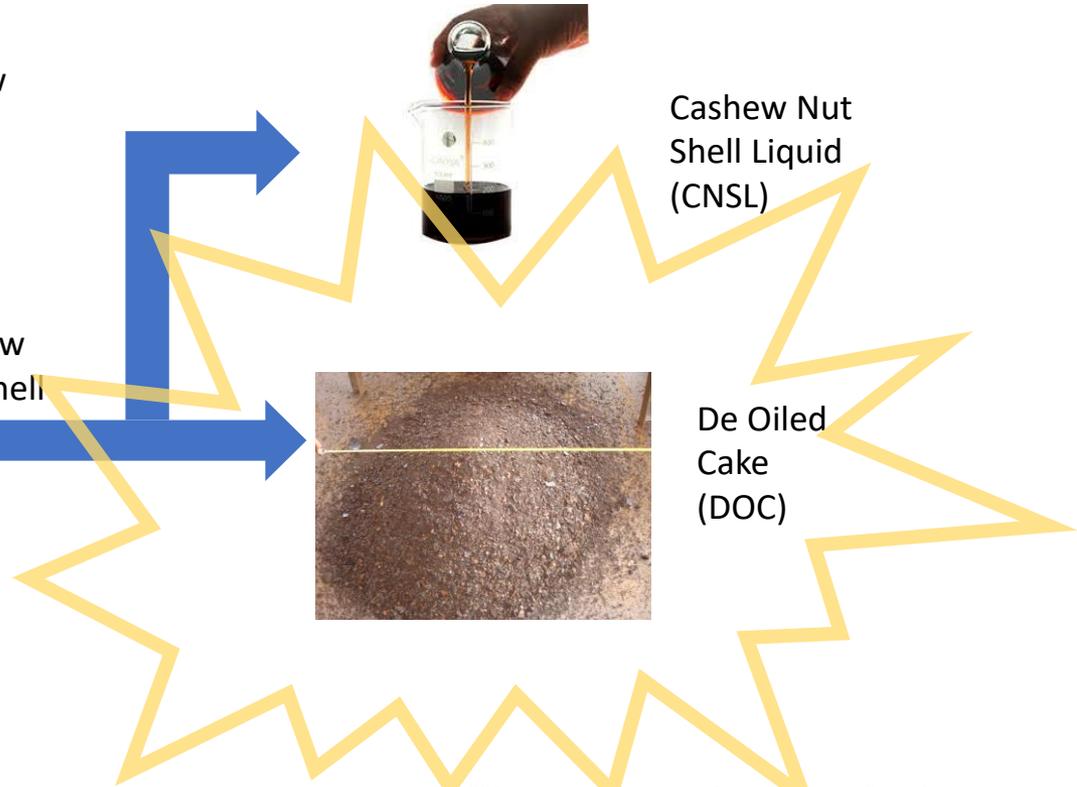
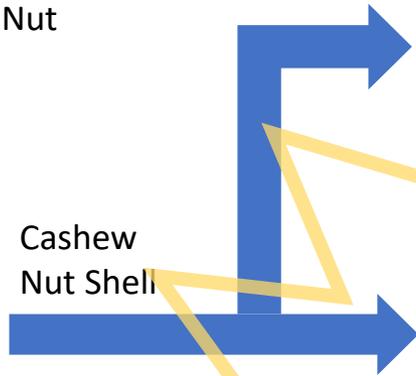
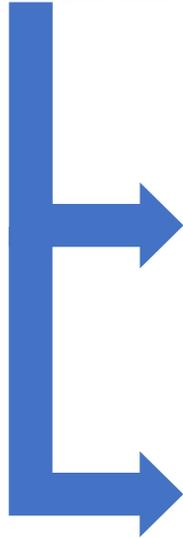
Cashew Nut Shell Liquid (CNSL)



De Oiled Cake (DOC)

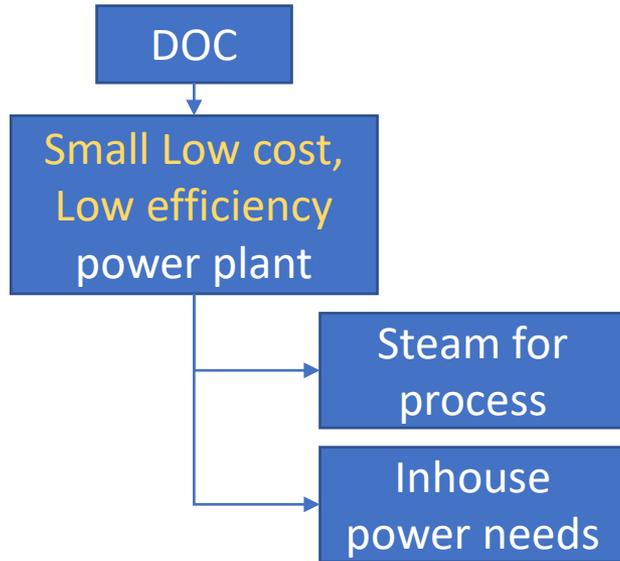
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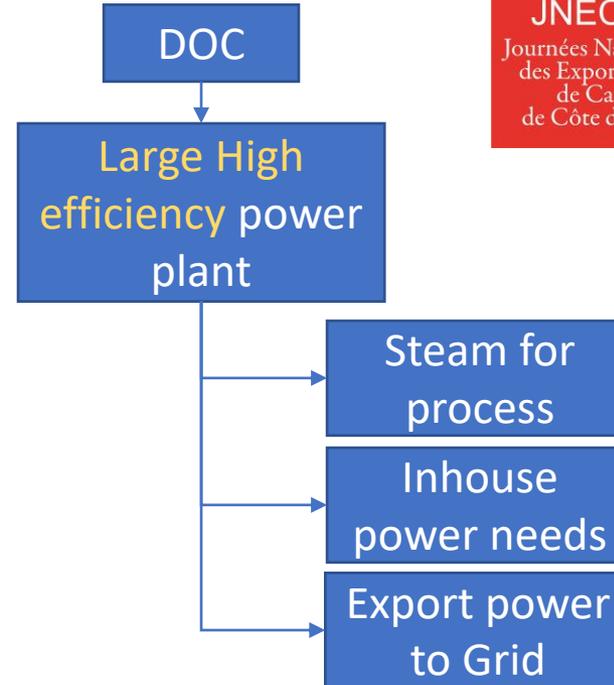
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Small Plant



- Cost savings:
 1. DOC disposal
 2. In house power requirements

Large Plant



- Cost savings:
 1. DOC disposal
 2. In house power requirements
- Additional revenue from power export

- Current practices common today...
 1. Land fill
 2. Organic manure

- Cashew De-Oiled Cake (DOC) As fuel for Process Steam / Power Generation
 1. Good calorific value 4600 to 5000 Kcal/Kg
 2. Low Sulphur < 0.1%
 3. Low Ash < 2 to 3%
 4. Low moisture < 9%

Typical



- Characteristics as a fuel

PROXIMATE ANALYSIS	% by weight	ULTIMATE ANALYSIS	% by weight
Moisture	8.85	- Carbon	42.37
Volatile Matter	68.03	- Hydrogen	5.66
Ash	2	- Nitrogen	0.93
Fixed Carbon	21.12	- Sulphur	0.16
		- Moisture	7.18
		- Ash	2.52
		- Gross calorific Value	5000-5056 Kcal/kg

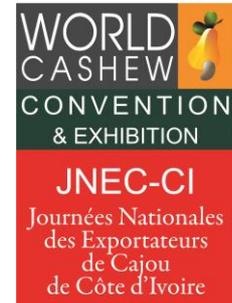
Typical


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Parameter	Case 1 (Small)	Case 2 (Medium)	Case 3 (Large Actual)
Raw Cashew fruit processed	40 Tons per day	60 Tons per day	144 Tons per day
DOC generated	20 Tons per day	30 Tons per day	72 Tons per day
Boiler parameters:	45 Kg/cm ² , 445 °C		
Steam generated	6 Tons per hour	9 Tons per hour	33 Tons per hour
Power generated	0.9 MW	1.4 MW	6 MW

Costs and Payback



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Parameter	Units	Case 1 (Small)	Case 2 (Medium)	Case 3 (Large Actual)
Cashew raw fruit	TPD	40.0	60.0	144.0
DOC qty	TPD	20.0	30.0	72.0
Power generation	MW	1.7	2.5	6.0
In house Power consumption	MW	0.7	1.0	2.4
Surplus power	MW	1.0	1.5	3.6
Capital investment (machinery + civil)	mUSD	1.5	2.3	5.4
Scenario 1				
Cost of Power	\$/kwhr	0.16	0.16	0.16
Cost saved by in house power generation	\$/hr	106.7	160.0	384.0
Straight payback in hours	hrs	14,062.50	14,062.50	14,062.50
Straight payback in years (Assuming 6k hrs/yr)	years	2.3	2.3	2.0
Scenario 2				
Cost of Power	\$/kwhr	0.10	0.10	0.10
Cost saved by in house power generation	\$/hr	66.7	100.0	240.0
Straight payback in hours	hrs	22,500.00	22,500.00	22,500.00
Straight payback in years (Assuming 6k hrs/yr)	years	3.8	3.8	3.2

Any payback under 3 years is considered very lucrative

Actual installation

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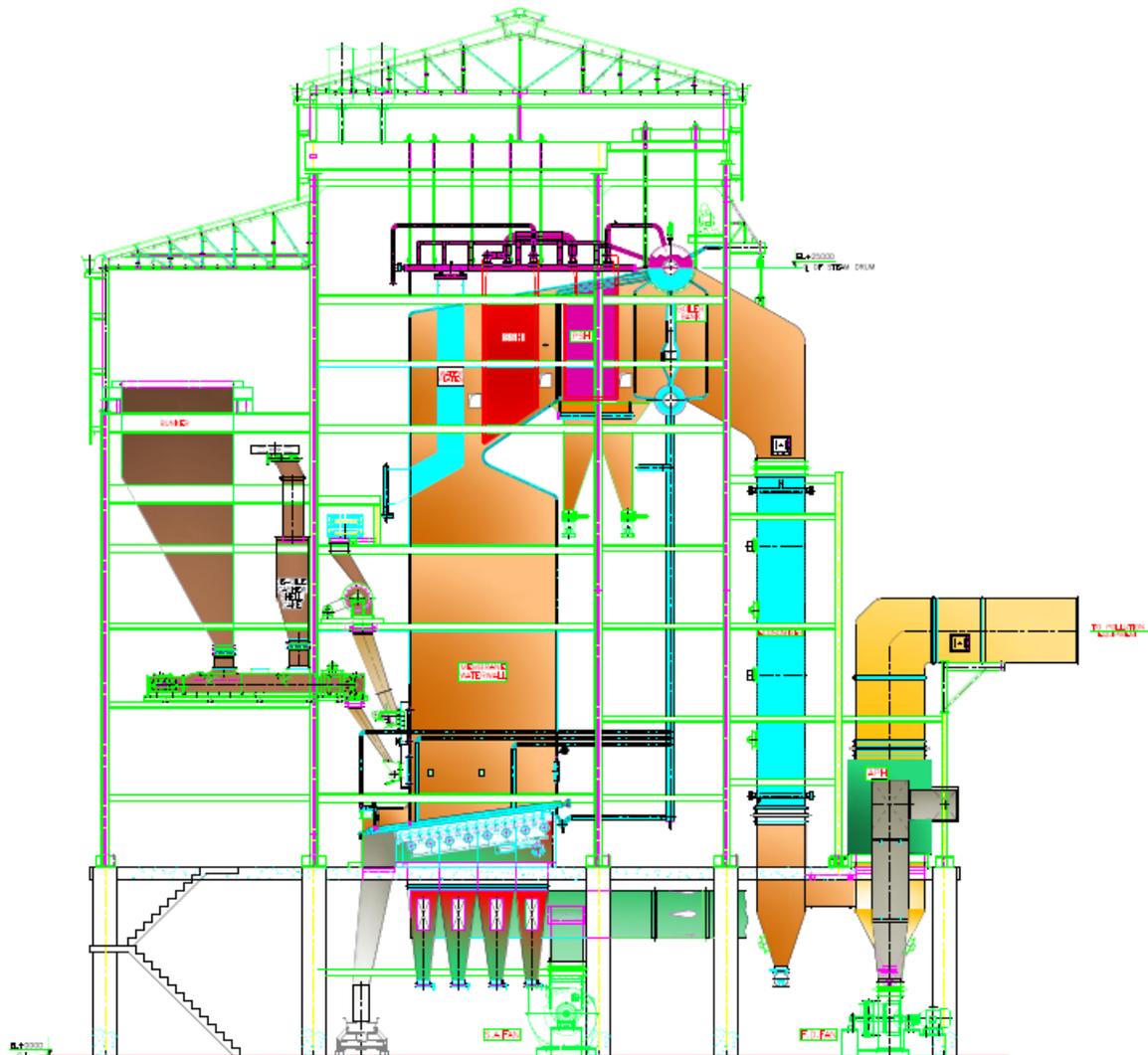


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TYPE:
Bi-Drum Top Supported, Outdoor

FIRING SYSTEM:
Reciprocating grate

CAPACITY : 34 TPH
PRESSURE : 44 bar(g)
TEMPERATURE : 420 ± 5 °C

Fuel flow test station at TTPL factory



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Fuel flow testing in action

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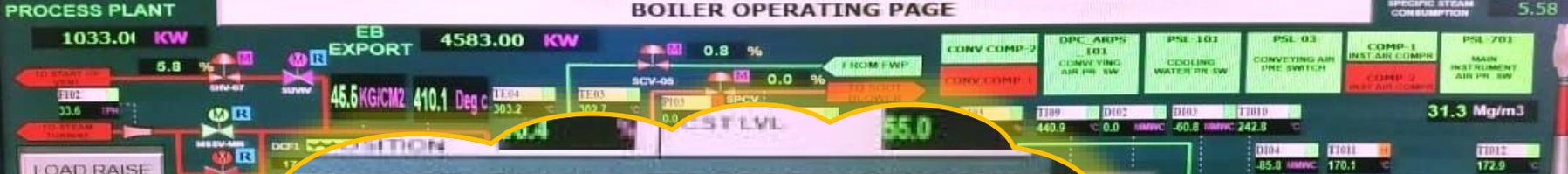




TOWER: X Web System: E ABL 05:10:51:15:113: TDBB High: Greater than 700.00 °C
 ABL 05:10:45:57:113: AHS ASH_CN: SYS1_HOP_LVL_HI
 ABL 05:10:39:46:913: AHS DPC_IVSP_151_CN: SYS5_HOP1_INLETSEAL_PSS:

System: 05-Aug-19 11:19

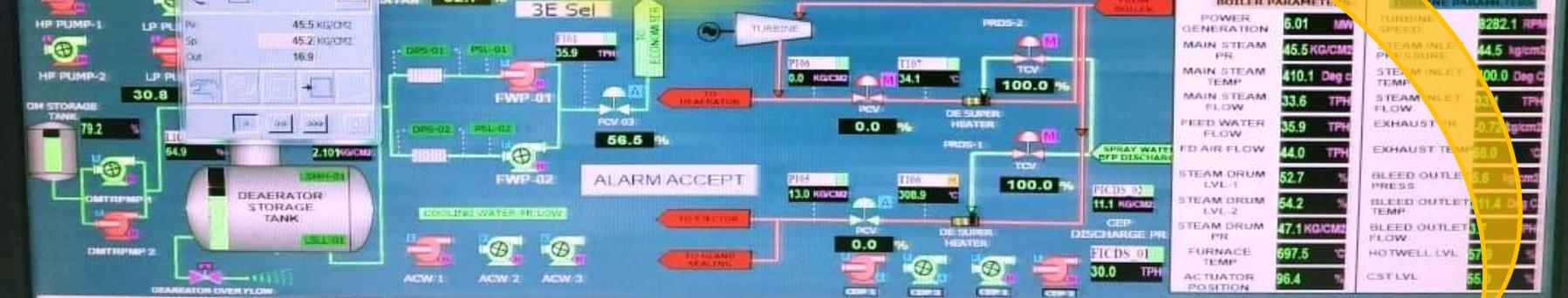
PROCESS PLANT SPECIFIC STEAM CONSUMPTION 5.58
BOILER OPERATING PAGE



TURBINE TRIP

TURBINE OPERATING PAGE

MAIN STEAM PR	EXHIST STEM TMP	TURB SPEED	TG LOAD
45.5 KG/CM2	66.0 °C	8282.1 RPM	6.01 MW



BOILER PARAMETERS		TURBINE PARAMETERS	
POWER GENERATION	6.01 MW	TURBINE SPEED	8282.1 RPM
MAIN STEAM PR	45.5 KG/CM2	STEAM INLET PRESSURE	44.5 kg/cm2
MAIN STEAM TEMP	410.1 Deg c	STEAM INLET TEMP	400.0 Deg C
MAIN STEAM FLOW	33.6 TPH	STEAM INLET FLOW	33.6 TPH
FEED WATER FLOW	35.9 TPH	EXHAUST PR	0.72 kg/cm2
ED AIR FLOW	44.0 TPH	EXHAUST TEMP	66.0 °C
STEAM DRUM LVL-1	62.7 %	BLEED OUTLET PRESS	5.6 kg/cm2
STEAM DRUM LVL-2	64.2 %	BLEED OUTLET TEMP	111.4 Deg C
STEAM DRUM PR	47.1 KG/CM2	BLEED OUTLET FLOW	0.72 TPH
FURNACE TEMP	697.5 °C	HOTWELL LVL	57.9 %
ACTUATOR POSITION	96.4 %	CST LVL	55.0 %

AIR & FLUE GAS SYSTEM WATER & STEAM SYSTEM HP & LP DOSING SYSTEM STEAM SYSTEM GOVERNING SYSTEM TURBOVISORY SYSTEM AIR COOL CONDENSER
 PLANT STEAM SYSTEM ASH HANDLING SYSTEM ESP COOLING WATER SYSTEM LUBE OIL SYSTEM TURBINE TRIP TURBINE OPERATING PAGE

MAIN STEAM FL	MAIN STEAM PR	MAIN STEM TEMP	ED AIR FLOW	FEED WTR FLOW	FURN TEMP	STEAM I/L FL	STEAM I/L PR	STEAM I/L TEMP	EXHIST STE PR	EXHIST STE TMP	TURB SPEED	TG LOAD
33.6 TPH	45.5 KG/CM2	410.1 Deg c	44.0 TPH	35.9 TPH	697.5 °C	33.1 TPH	44.5 kg/cm2	400.0 Deg C	0.72 kg/cm2	66.0 °C	8282.1 RPM	6.01 MW

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Namaste



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