



DEDINI

INDÚSTRIAS DE BASE

27th ISSCT CONGRESS

**COGENERATION – A NEW SOURCE OF INCOME
FOR SUGAR AND ETHANOL MILLS, OR...
BIOELECTRICITY: A NEW BUSINESS !!!**

VERA CRUZ, MEXICO, 11th MARCH, 2010

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DEVELOPMENT VICE PRESIDENT

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ENERGY ENGINEERING MANAGER

BIOELECTRICITY: A NEW BUSINESS!!!

1. MAXIMIZING SURPLUS BIOELECTRICITY PRODUCTION IN SUGAR AND BIOETHANOL MILLS

2. TECHNOLOGICAL TRENDS IN BIOELECTRICITY PRODUCTION

3. BIOELECTRICITY: A NEW BUSINESS TO SUGARCANE SECTOR

BIOELECTRICITY: A NEW BUSINESS!!!

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SUGARCANE – THE AGRIENERGY VIEW

SUGARCANE ENERGY FOCUSED VISION

1 T CLEAN SUGARCANE $\cong$ 1,2 T INTEGRAL SUGARCANE



1,2 OIL BARRELS



1 T-FIELD
 1718×10^3 KCAL

JUICE TOTAL SUGAR 153 KG
BAGASSE (50% MOISTURE) 276 KG
STRAW (*) (15% MOISTURE) 165 KG

→ 608×10^3 KCAL

→ 598×10^3 KCAL

→ 512×10^3 KCAL

1718×10^3 KCAL



1 OIL BARREL
 1386×10^3 KCAL

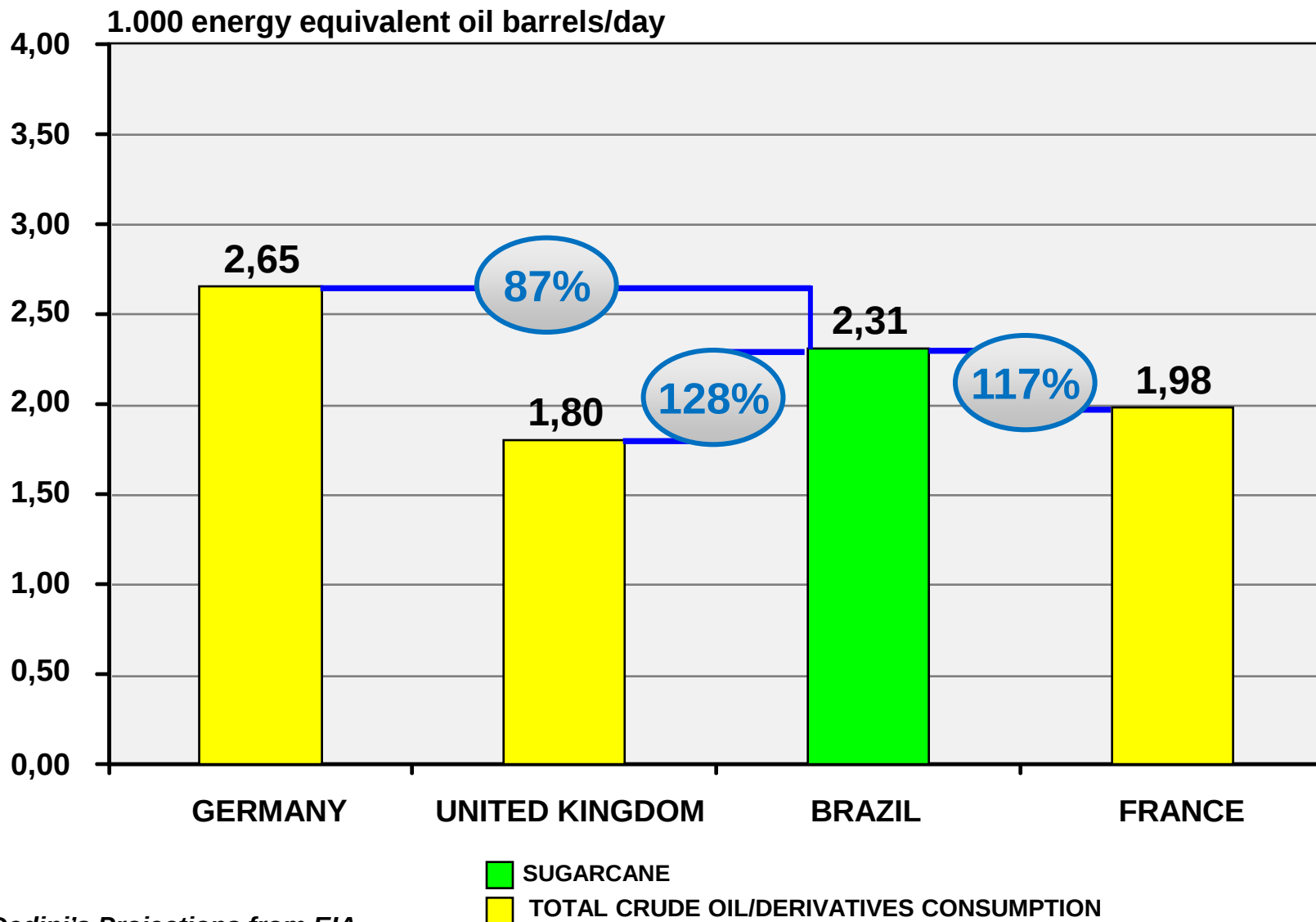
SUGAR CANE IS PURE ENERGY	1/3 FROM SUGAR JUICE	SUGAR: THE CHEAPEST FOOD (IN KCAL) IN THE WORLD	SEASON 2008/09	SEASON 2010/11
		BIOETHANOL: CLEAN AND RENEWABLE ENERGY	648.000 b/d	770.000 b/d
	1/3 FROM BAGASSE	CLEAN AND RENEWABLE ENERGY	648.000 b/d	770.000 b/d
	1/3 FROM STRAW	CLEAN AND RENEWABLE ENERGY	648.000 b/d	770.000 b/d
TOTAL			1.944.000	2.310.000
			ENERGY EQUIVALENCE	

(*) ~~CANE TRASH~~, i.e., STRAW = TOPS, LEAVES, STRAW

SUGARCANE – THE AGRIENERGY VIEW

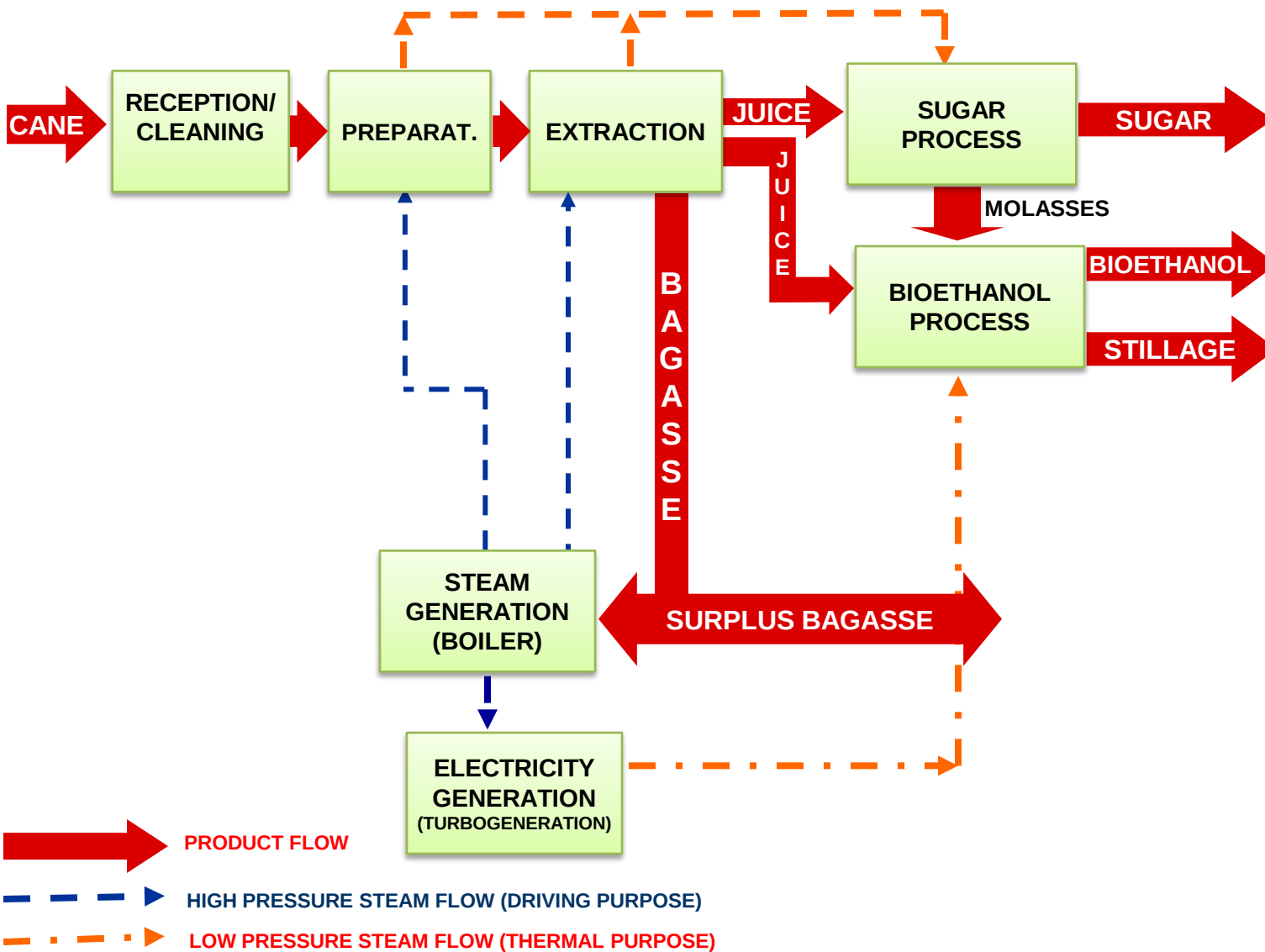
BRAZILIAN SUGARCANE - TOTAL ENERGY CONTENT

SUGARCANE ENERGY VIEW – COMPARATIVE - 2010



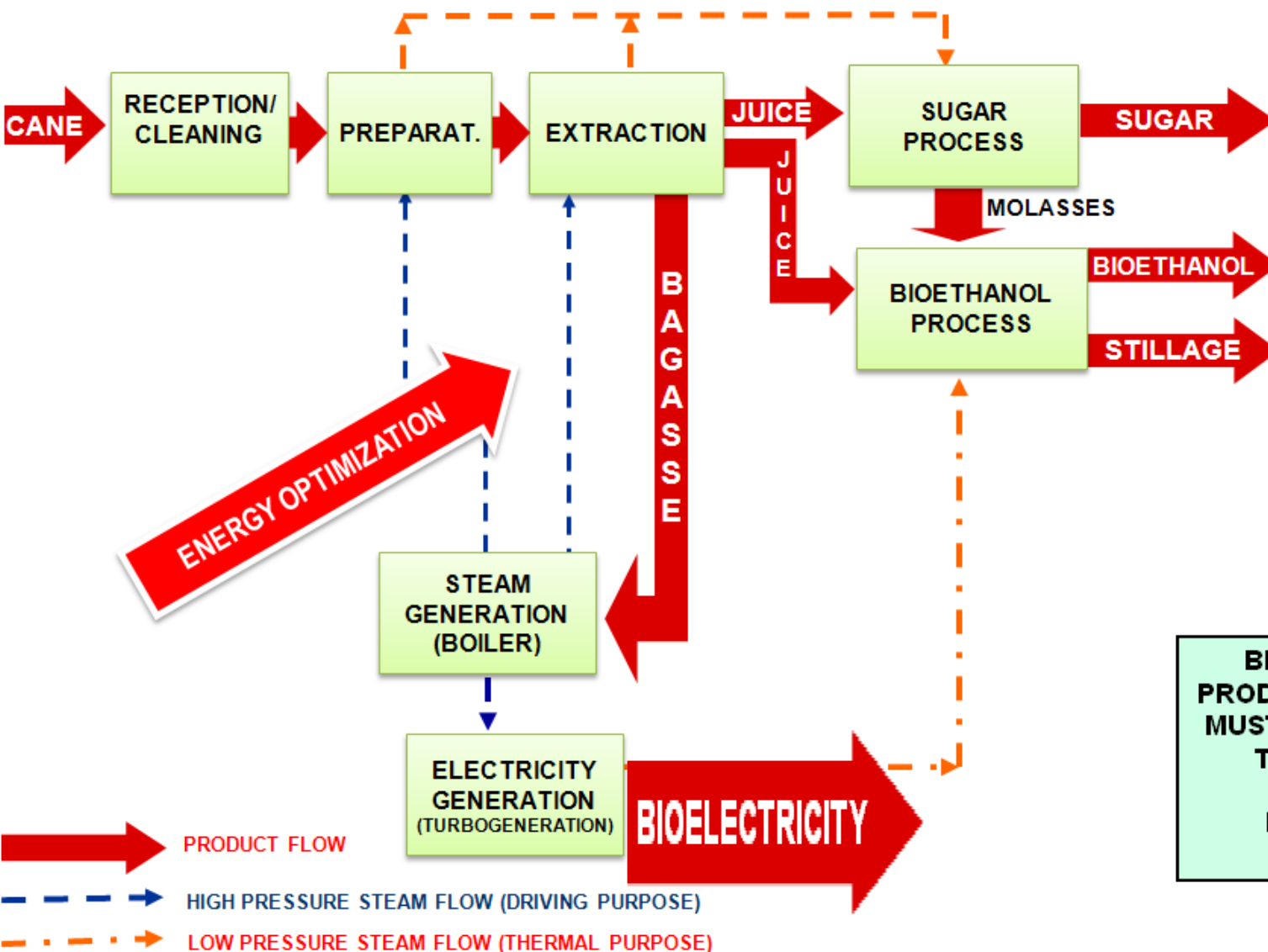
BIOELECTRICITY TRADITIONAL PRODUCTION TECHNOLOGY

PRODUCTION FLOWCHART – SUGAR, BIOETHANOL AND SURPLUS BAGASSE



BIOELECTRICITY TRADITIONAL PRODUCTION TECHNOLOGY

PRODUCTION FLOWCHART – SUGAR, BIOETHANOL AND SURPLUS BIOELECTRICITY



**BIOELECTRICITY
PRODUCTION PROCESS
MUST BE INTEGRATED
TO SUGAR AND
BIOETHANOL
PRODUCTION
PROCESS.**

DEDINI'S CONTRIBUTION TO THE SUGARCANE INDUSTRY

DEDINI SUPPLIES	QTY
COMPLETE BIOETHANOL MILLS (TURNKEY - BRASIL)	108
SUGAR/BIOETHANOL PLANTS (EXPORT)	29
COGENERATION PLANTS	114
BAGASSE BOILERS	1 255

DEC/2009

WORLD'S GREATEST SALES VOLUME

MAXIMUM SURPLUS ENERGY PRODUCTION INCREMENTAL INNOVATIONS

**OBJECTIVE:
MAXIMUM
SURPLUS
ENERGY**

(=)

**MAXIMUM
UTILIZATION OF
AVAILABLE
ENERGY AT THE
MILL**

(-)

**MINIMUM
INTERNAL
ENERGY
CONSUMPTION
AT THE MILL**

MAXIMUM SURPLUS ENERGY PRODUCTION

MAXIMIZING SURPLUS BIOELECTRICITY USING
MORE ADVANCED AVAILABLE TECHNOLOGIES

**MILLS IN OPERATION -
PREDOMINANT SOLUTION (>80%)**
21 BAR – 500 KG STEAM/T CANE
PREPAR./EXTRACT. STEAM
TURBINE DRIVE

**TOTAL
SURPLUS
BAGASSE
UTILIZATION**

**42 ► 65
BAR**

**ELECTRIC
DRIVE +
MODULAR
DIFFUSER
UTILIZATION**

**0
Mw**

**4,9
Mw**

**8,7
Mw**

**26,5
Mw**

**34,8
Mw**

**39,3
Mw**

**40,7
Mw**

**USE PRESSURE
REDUCTION NEEDS TO
PRODUCE EXTRA
POWER**

**HIGHER
PRESSURE
STEAM
21 ► 42
BAR**

**LOWER INTERNAL
PROCESSES
CONSUMPTION
500 ► 400
Kg S/TC**

INITIAL CONFIGURATION

NEW MILLS

REF.: 500 T CANE/HOUR =
= 12.000 T CANE/DAY
≅ 2 MM T CANE/CROP



ELECTRIC DRIVE TO KNIVES/SHREDDER



ELECTRICAL / MECHANICAL DRIVE (VIA PLANETARY GEARBOX AND FREQUENCY INVERTERS) TO DEDINI MILLING UNITS



DEDINI MCD-01 - 6 MILLING TANDEM 56"x100" AT U.S. SUGAR – ELECTRO-HYDRAULIC DRIVE TO MILLING UNITS – 28.000 TCD – BIGGEST CRUSHING CAPACITY IN THE WORLD

Surplus – 40.7 Mw

CANE PROCESSING – MINIMUM ENERGY CONSUMPTION



DEDINI-BOSCH'S MODULAR CHAINLESS DIFFUSER

EXPANDABLE | NO CHAINS | LOWER MAINTENANCE | LIGHTER SOLUTION

THE 1st IN OPERATION IN BRAZIL AND THE 1st COMMERCIAL IN THE WORLD

SEPTEMBER/08 – NOROESTE MILL – 12.000 TCD (→ 15.000 TCD) Surplus: 40,7 Mw 13



**JUICE TREATMENT AND
CONCENTRATION – MULTIPLE EFFECT
FALLING FILM EVAPORATION SYSTEM**



**REGENERATIVE HEAT
EXCHANGER**



**DEDINI FALLING FILM
EVAPORATOR**



**DEDINI-BOSCH CONTINUOUS
VACUUM PAN**

**Surplus
40,7 Mw**



**JUICE TREATMENT AND
CONCENTRATION – MULTIPLE EFFECT
FALLING FILM EVAPORATION SYSTEM**



**REGENERATIVE HEAT
EXCHANGER**



DFS – DEDINI FERMENTATION SYSTEM

**Surplus
40,7 Mw**



OPTIMIZED FERMENTATION & DISTILLATION

MAXIMUM SURPLUS ENERGY PRODUCTION

BAGASSE TO POWER GENERATION – MAXIMUM ENERGY UTILIZATION



DEDINI AT BOILER



DEDINI AZ BOILER

BAGASSE BOILERS

UP TO 225 T STEAM/H / 70 BAR / 530°C / 89% POWER EFFICIENCY (LHV)

Surplus: 40,7 Mw

MAXIMUM SURPLUS ENERGY PRODUCTION

MAXIMIZING SURPLUS BIOELECTRICITY USING
MORE ADVANCED AVAILABLE TECHNOLOGIES

**MILLS IN OPERATION -
PREDOMINANT SOLUTION (>80%)**
21 BAR – 500 KG STEAM/T CANE
PREPAR./EXTRACT. STEAM
TURBINE DRIVE

**TOTAL
SURPLUS
BAGASSE
UTILIZATION**

42 ► 65
BAR

**ELECTRIC
DRIVE +
MODULAR
DIFFUSER
UTILIZATION**

65 ► 100
BAR
400 ► 300
Kg S/TC
AUTOMATION

**0
Mw**

**4,9
Mw**

**8,7
Mw**

**26,5
Mw**

**34,8
Mw**

**39,3
Mw**

**40,7
Mw**

**50,7
Mw**

**USE PRESSURE
REDUCTION NEEDS TO
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**HIGHER
PRESSURE
STEAM**
21 ► 42
BAR

**LOWER INTERNAL
PROCESSES
CONSUMPTION**
500 ► 400
Kg S/TC

INITIAL CONFIGURATION

NEW MILLS

STATE OF THE ART

REF.: 500 TCH =
= 12.000 T CANE/DAY
≈ 2 MM T CANE/CROP

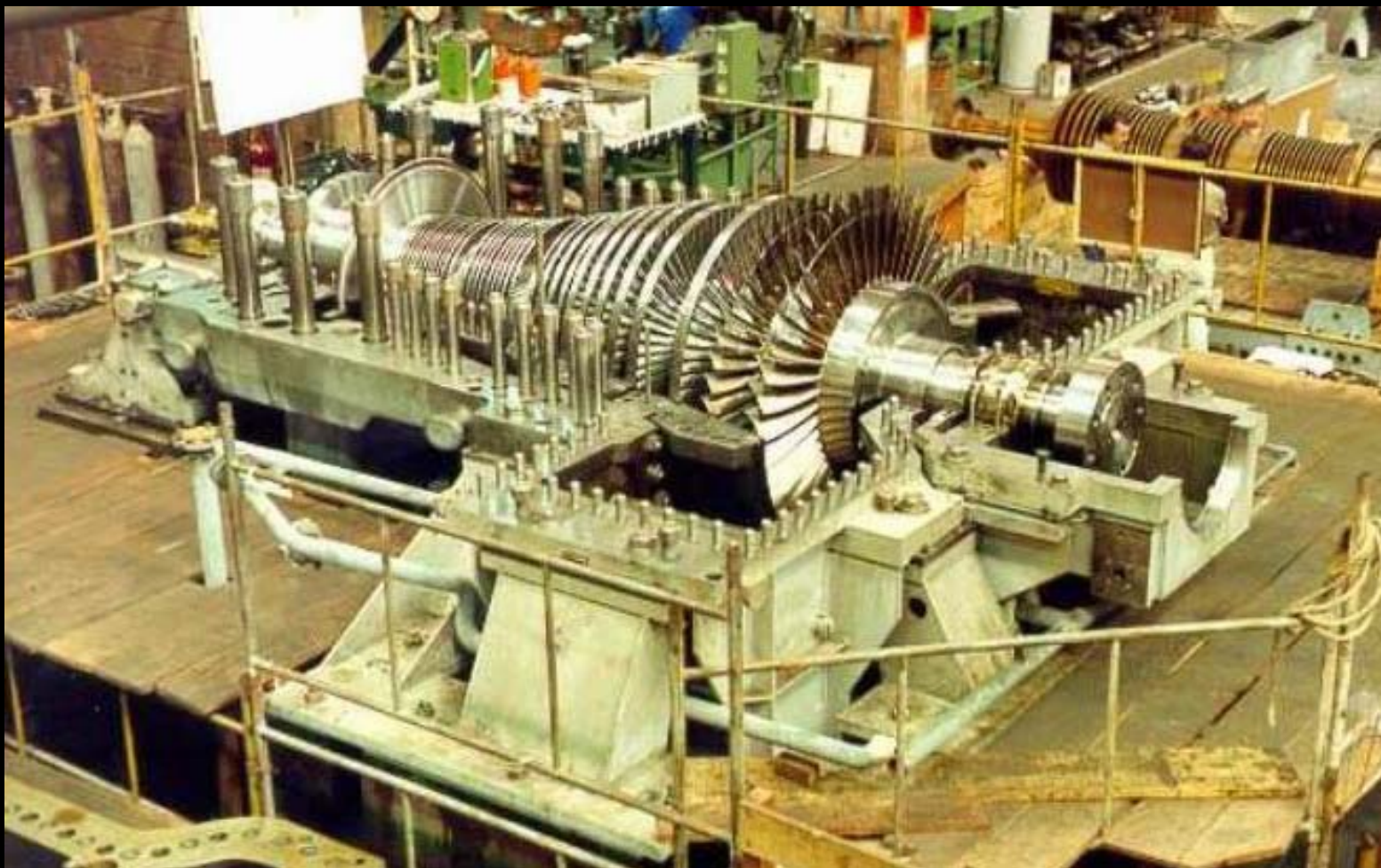


**OPTIMIZE THE MILL TO MAXIMUM
SURPLUS BAGASSE AND 100%
(EXCEPT RE-START) BAGASSE
UTILIZATION AS A BOILER FUEL**

Surplus – 50,7 Mw



**DEDINI AT™ SINGLE DRUM BOILER
INSTALLED AT COSAN GROUP - 100 BAR**



**CONDENSATION TURBINE WITH CONTROLLED EXTRACTION,
ACCORDING TO BOILER SPECIFICATIONS**

Surplus: 50,7 Mw



**DEDINI-SIEMENS SPLIT FEED DISTILLATION
(PARTIAL) AT LAGINHA MILL**

**Surplus:
50,7 Mw**



COSTA PINTO MILL – COSAN GROUP



SÃO MARTINHO MILL

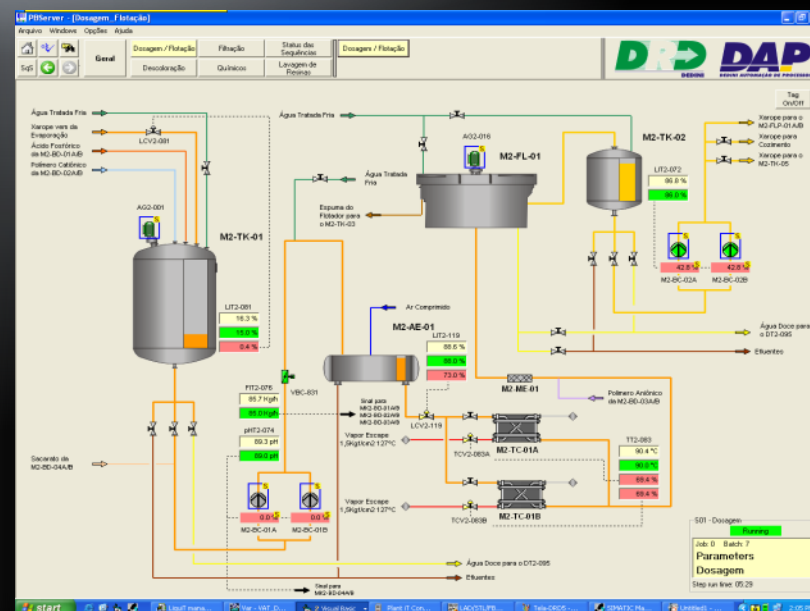
**DEDINI-VAPERMA MEMBRANE SYSTEM APPLIED TO DISTILLATION/DEHYDRATION TECHNOLOGY
LOWER ENERGY CONSUMPTION**

TECHNOLOGY BEING INTRODUCED IN BRAZIL – DEMO PLANT AT COSAN GROUP/ S. MARTINHO MILL

**Surplus:
50,7 Mw**

DAP

DEDINI AUTOMAÇÃO DE PROCESSOS



**DEDINI TOTAL MILL AUTOMATION CONTROL
(M E S LEVEL)**

MAXIMUM SURPLUS ENERGY PRODUCTION

MAXIMIZING SURPLUS BIOELECTRICITY USING
MORE ADVANCED AVAILABLE TECHNOLOGIES

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42 ► 65
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DRIVE +
MODULAR
DIFFUSER
UTILIZATION**

65 ► 100
BAR
400 ► 300
Kg S/TC
AUTOMATION

0

Mw

4,9

Mw

8,7

Mw

26,5

Mw

34,8

Mw

39,3

Mw

40,7

Mw

50,7

Mw

**USE PRESSURE
REDUCTION NEEDS TO
PRODUCE EXTRA
POWER**

**HIGHER
PRESSURE
STEAM**
21 ► 42
BAR

**LOWER INTERNAL
PROCESSES
CONSUMPTION**
500 ► 400
Kg S/TC

**BIOGAS
AS A FUEL
+
MULTIFUEL
BOILER**

55,7

Mw

INITIAL CONFIGURATION

NEW MILLS

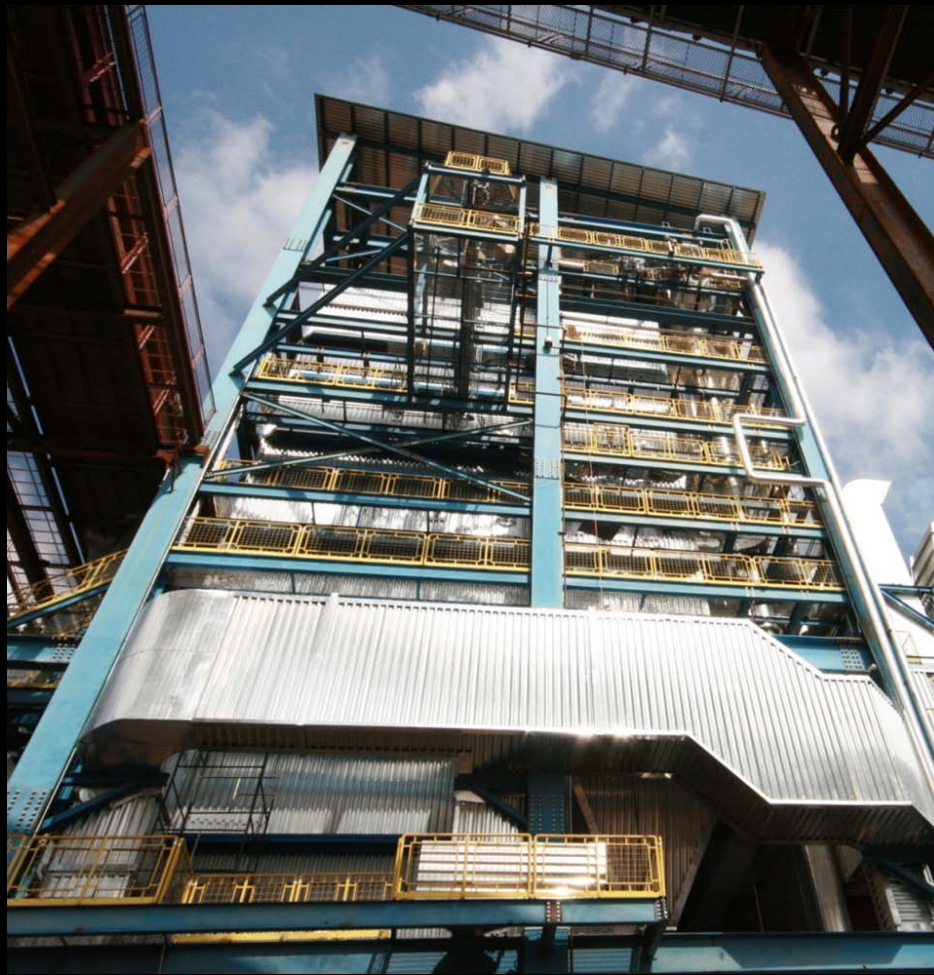
STATE OF THE ART

REF.: 500 TCH =
= 12.000 T CANE/DAY
≈ 2 MM T CANE/CROP



**DEDINI METHAX PLANT – AT SÃO JOÃO MILL – S. J. BOA VISTA
BIOGAS/BIOMETHANE PRODUCTION VIA STILLAGE BIODIGESTION
BIOGAS/BIOMETHANE UTILIZATION AS A BOILER FUEL**

Surplus – 55,7 Mw



**DEDINI MULTIFUEL BOILER – BAGASSE, STRAW AND BIOGAS UTILIZATION AS FUELS
UP TO 400 TS/H – 120 BAR – 540°C – 89% POWER EFFICIENCY (LHV)**

**DEDINI AT™ SINGLE DRUM BOILER – 100 BAR - COSAN GROUP
Surplus – 55,7 Mw**

BIOELECTRICITY: A NEW BUSINESS!!!

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2. TECHNOLOGICAL TRENDS IN BIOELECTRICITY PRODUCTION

3. BIOELECTRICITY: A NEW BUSINESS TO SUGARCANE SECTOR

MAXIMUM SURPLUS ENERGY PRODUCTION

•Straw.

•Biogas.

AVAILABLE ENERGY

•Bagasse.

**OBJECTIVE:
MAXIMUM SURPLUS
ENERGY**

(=)

**MAXIMUM
UTILIZATION OF
AVAILABLE ENERGY
AT THE MILL**

(-)

Use pressure reduction needs to produce extra power

**MINIMUM INTERNAL
ENERGY CONSUMPTION
AT THE MILL**

Steam Generation

Boilers with high:

- Pressure
- Temperature
- Energy Efficiency

Adequate high efficiency condensation/ extraction turbine

Bagasse/Straw Gasification

•Combined Cycle Utilization

Mechanical/ Electrical Generation/ Consumption

Steam Turbines

- compatible to boilers
- high efficiency
- multiple stages, condensation/ extract.
- turbines change to electric/ electro-hydraulic drives

Juice Extraction

•Electro-hydraulic Milling Units/Modular Chainless Diffuser

Process Consumption

Low steam/ energy consumpt. processes to produce sugar and bioethanol

Process Consumption

Split Feed/ Membrane technology utilization to dewatering/ distillation

IMPACT OF TECHNOLOGY

INCREMENTAL INNOVATIONS

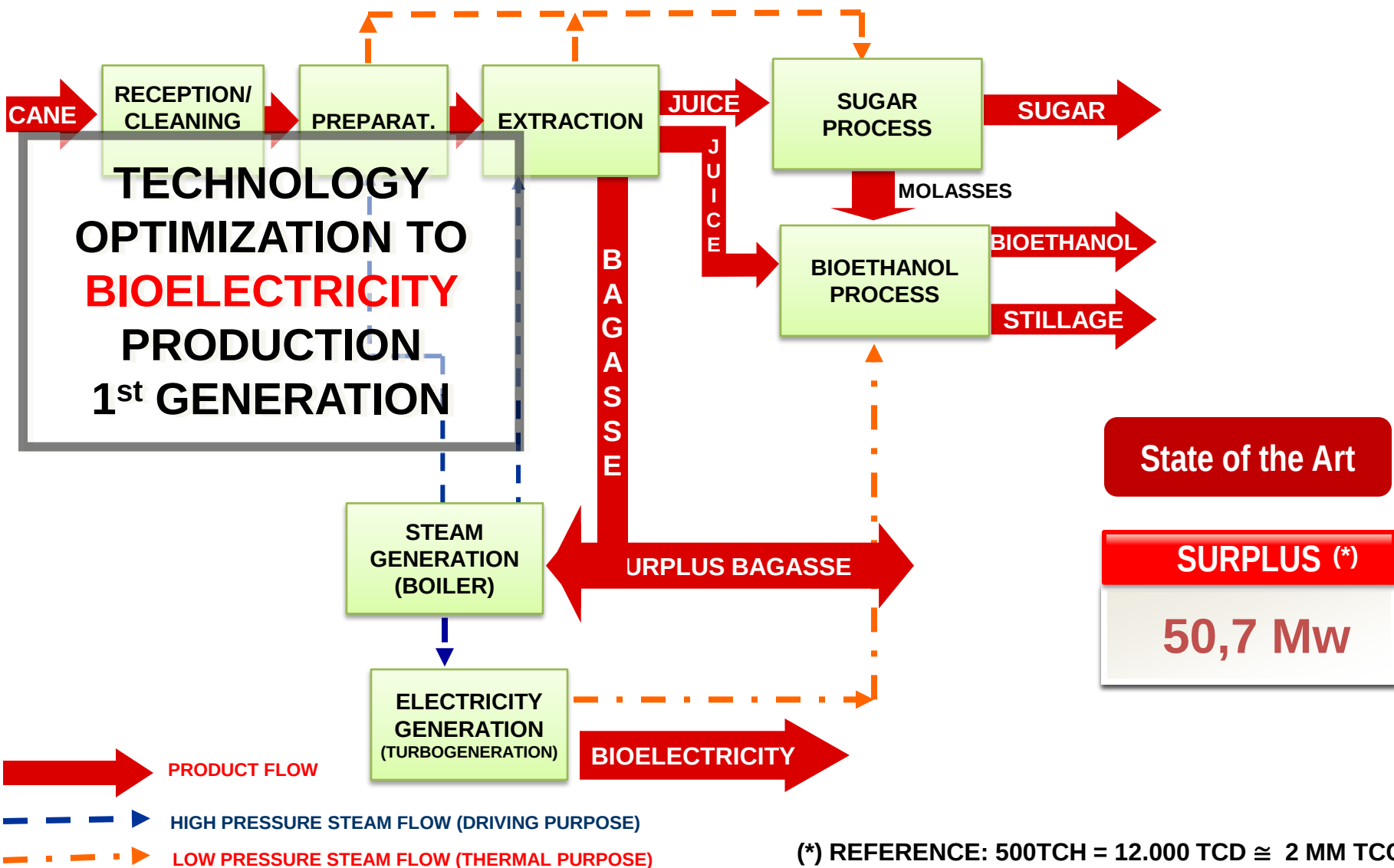
DISRUPTIVE INNOVATIONS (BREAKTHROUGH)

TECHNOLOGICAL HIERARCHY

1st GENERATION TECHNOLOGY

2nd GENERATION TECHNOLOGY

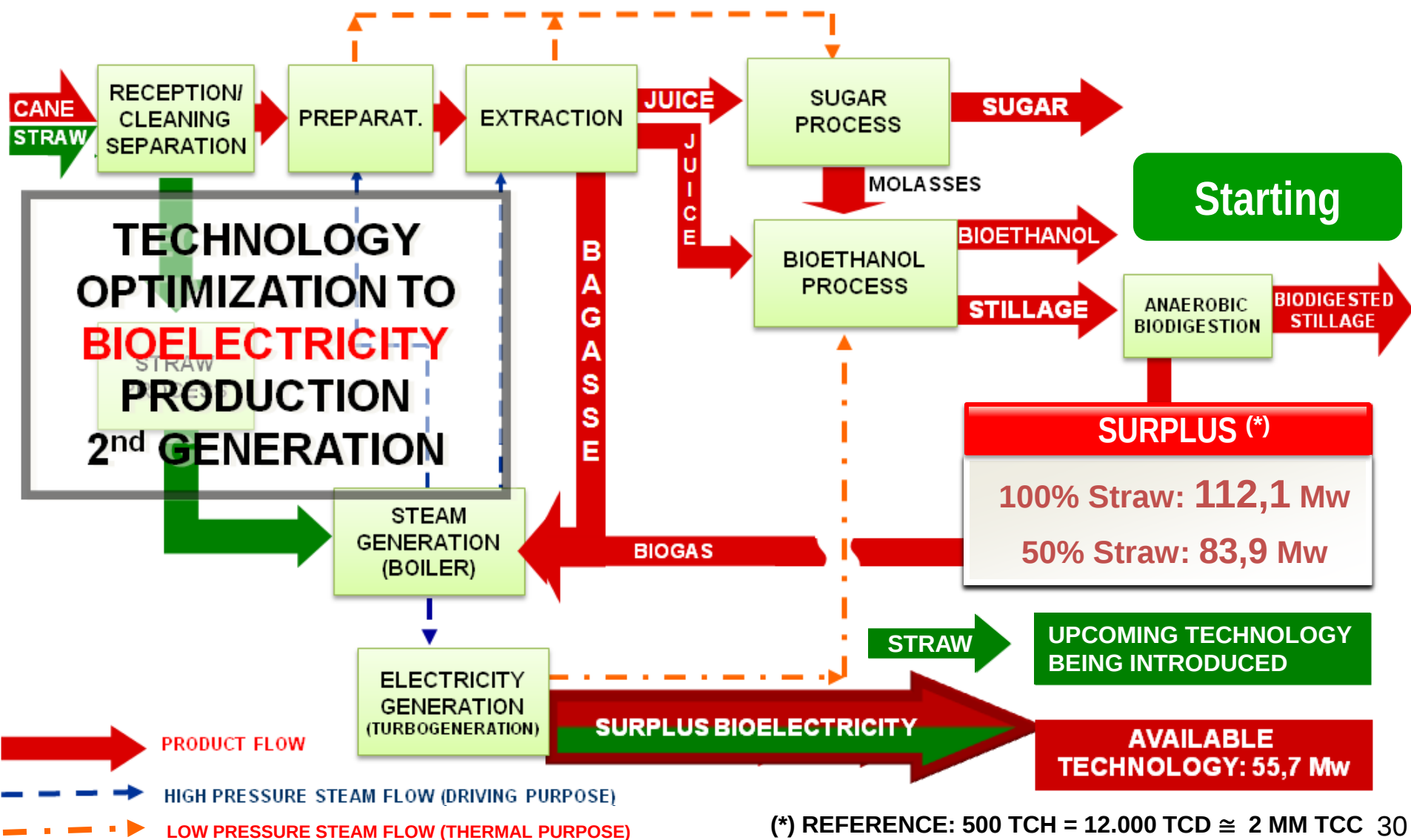
3rd GENERATION TECHNOLOGY



HIGH IMPACT UPCOMING TECHNOLOGIES

BIOELECTRICITY ADVANCED PRODUCTION TECHNOLOGY

PRODUCTION FLOWCHART – SUGAR, BIOETHANOL AND SURPLUS BIOELECTRICITY



STRAW PROCESS – MAXIMUM ENERGY UTILIZATION

**Integral (billets + straw)
Cane Harvesting**



**Integral Cane Unloading
in a Cane Feed Table**



**Straw Separation and
Cleaning System**



Rotary Screen



Boiler



Straw Conveyor



Straw Chopping

SYSTEM AND EQUIPMENT FOR STRAW UTILIZATION AS A FUEL, SUCH AS: INTEGRAL SUGARCANE CLEANING SYSTEM AND STRAW SEPARATION, HANDLING SYSTEM, STRAW CLEANING AND SAND SEPARATION, CHOPPING AND BOILER FEEDING.

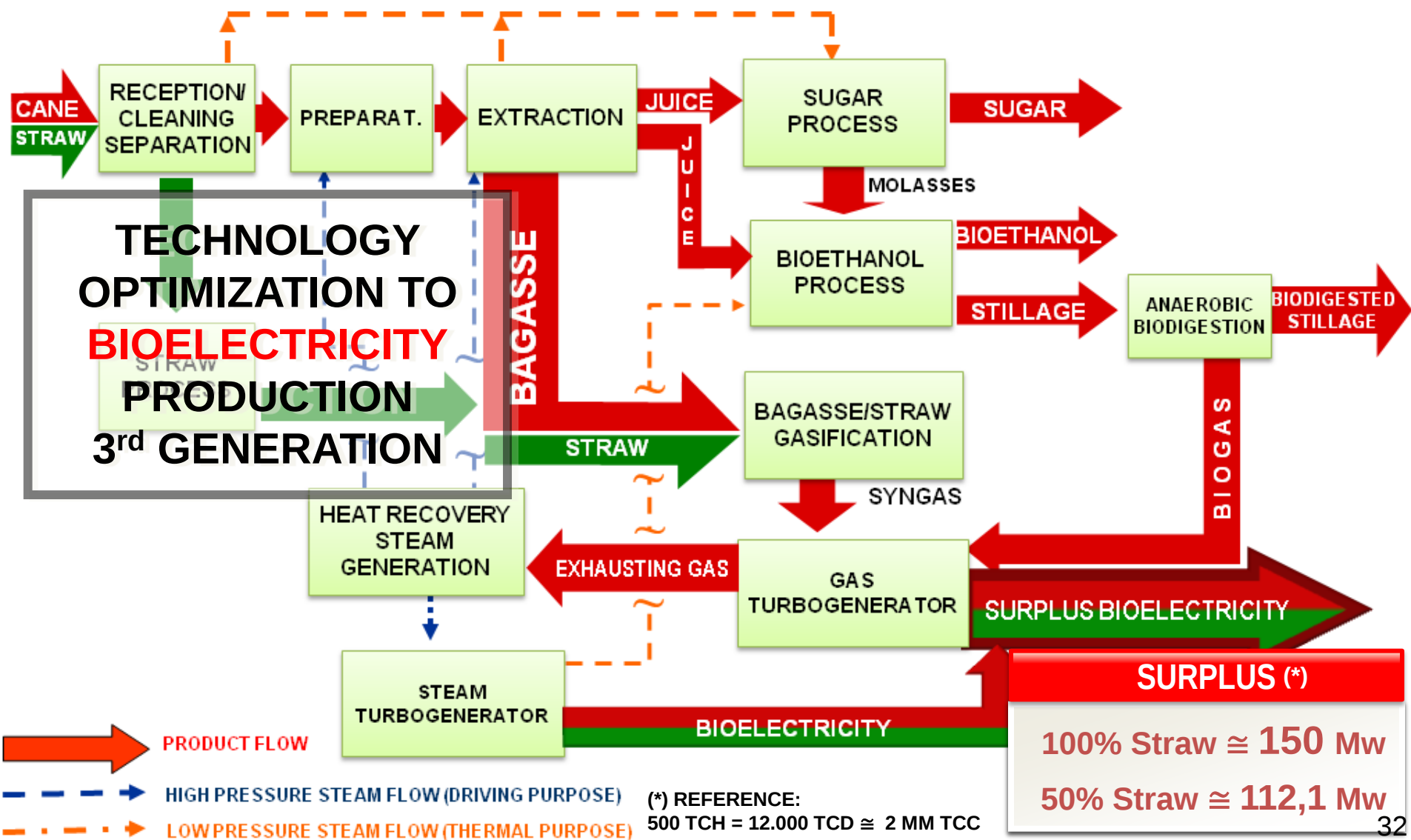
DEDINI STRAW PROCESS

Surplus: 100% Straw = 112,1 Mw / 50% Straw = 83,9 Mw

HIGH IMPACT UPCOMING TECHNOLOGIES – THE NEW GENERATION

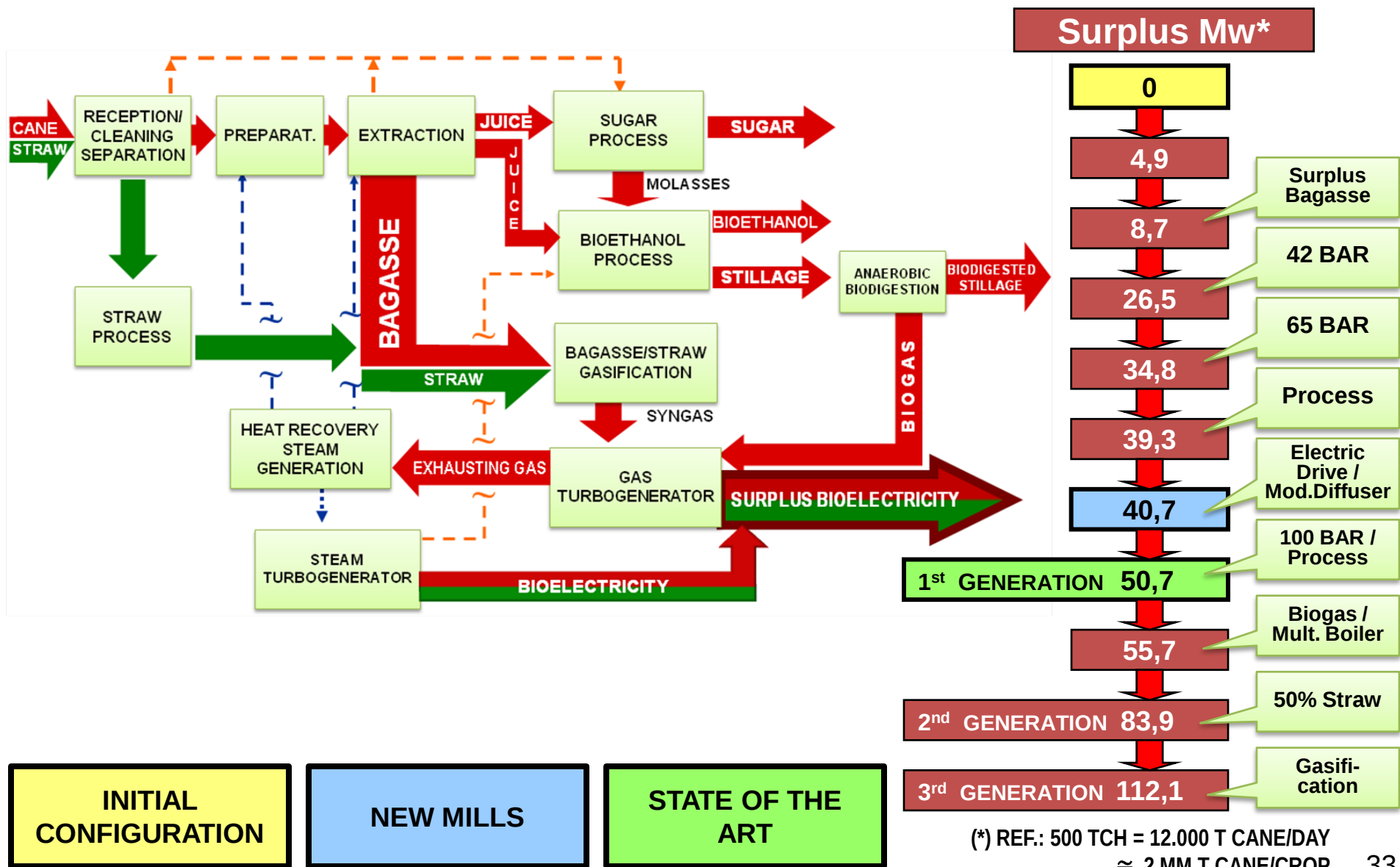
SUPER ADVANCED BIOELECTRICITY PRODUCTION TECHNOLOGY

PRODUCTION FLOWCHART – SUGAR, BIOETHANOL AND SURPLUS BIOELECTRICITY



MAXIMUM SURPLUS ENERGY PRODUCTION

MAXIMIZING SURPLUS BIOELECTRICITY USING MORE ADVANCED TECHNOLOGIES



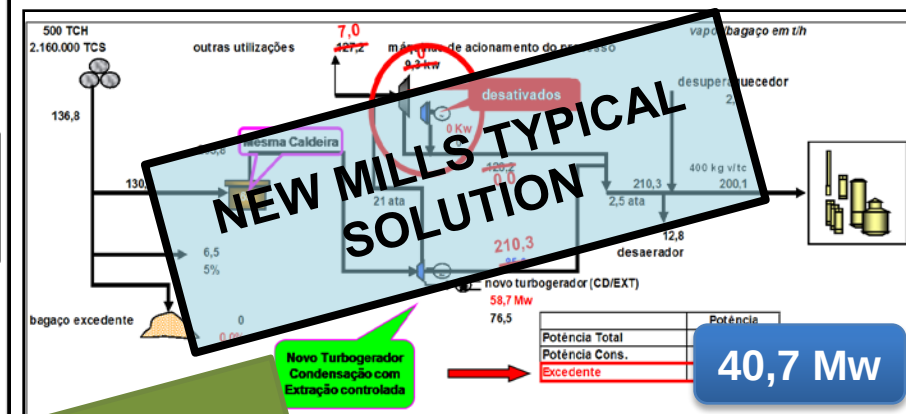
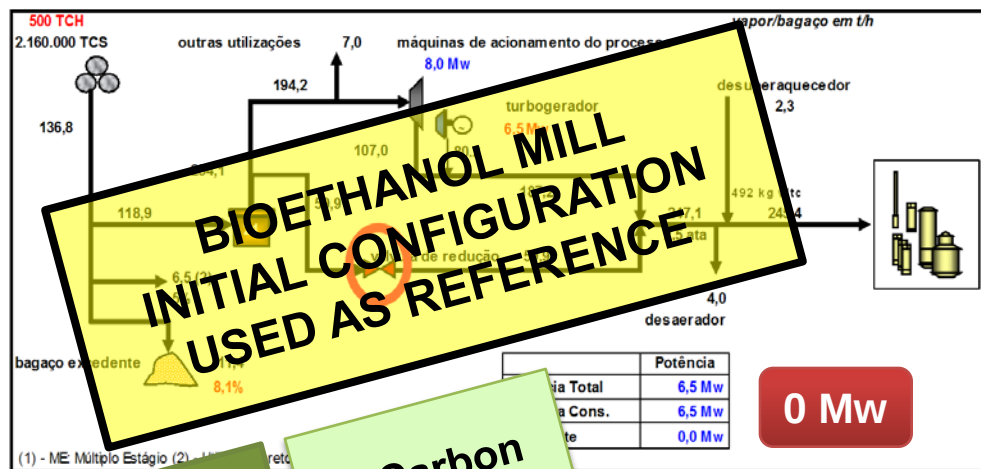
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BIOELECTRICITY: A NEW BUSINESS TO SUGARCANE SECTOR



Payback 4,9 years

+ Carbon Credits 4,5 years

Payback 4,6 years

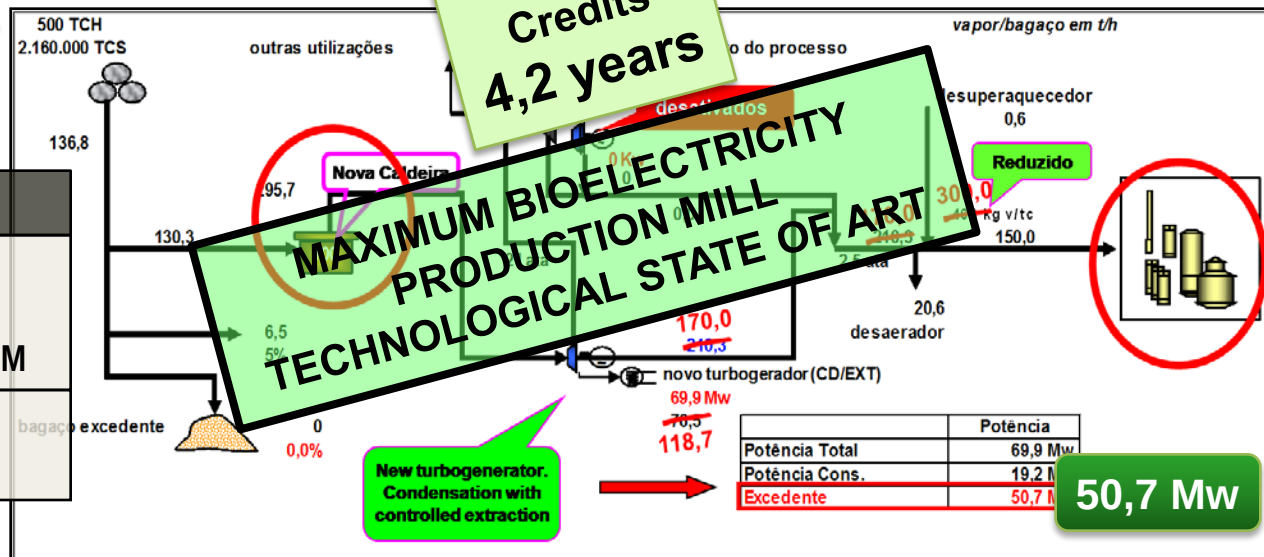
+ Carbon Credits 4,2 years

ALTERNATIVE CHOICE

REVAMP TO (RETROFIT)

ASSUMPTIONS	
CAPEX:	R\$ 3000 / R\$ 3500 per kWh
OPEX:	BAGASSE = 0
	Δ MAINT/ Δ OPERAT= MINIMUM
INCOME: R\$ 140 / MWh	
R\$ 50 / tCO2	

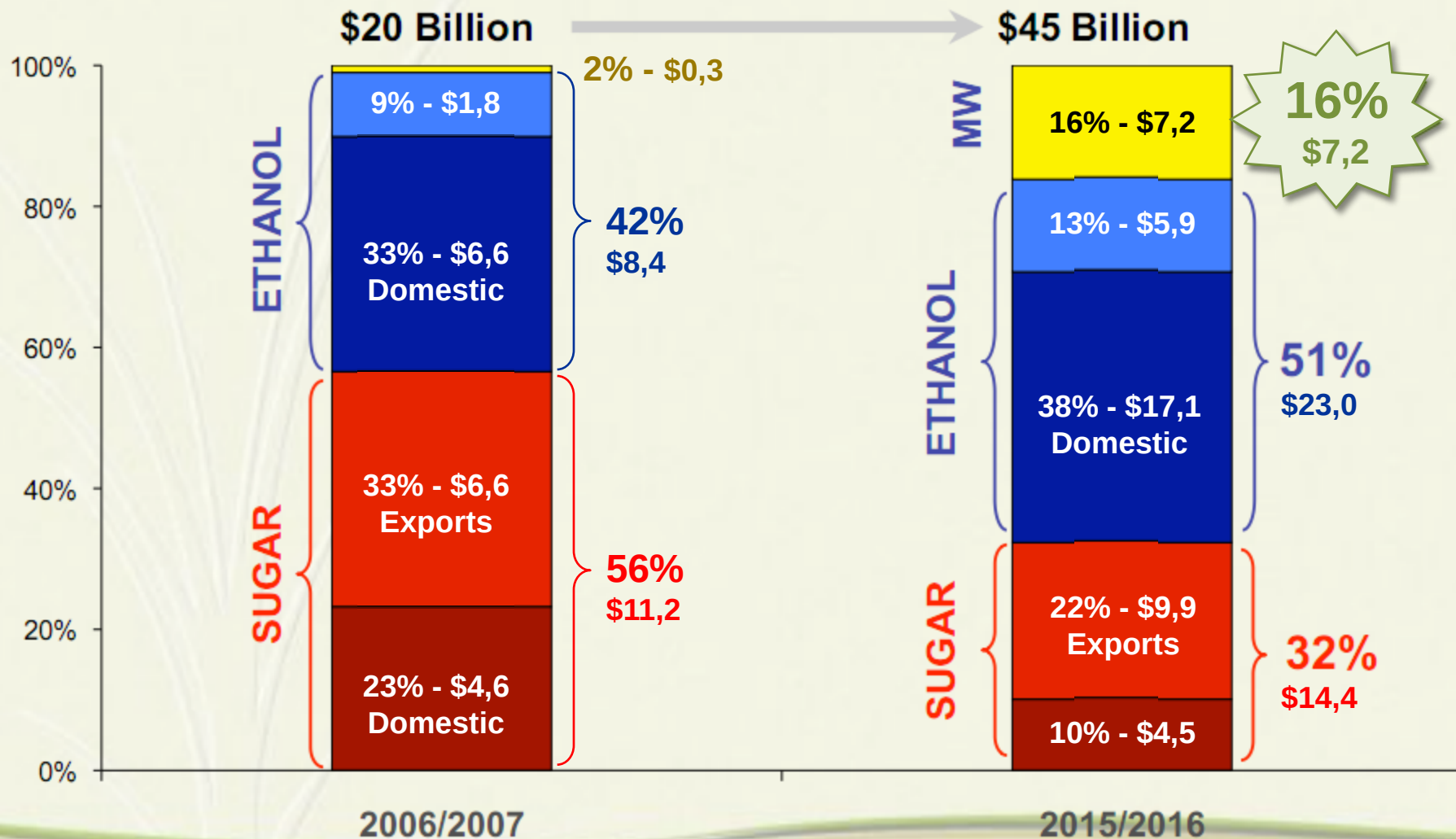
REF.: US\$1 = R\$1.80



CHANGES IN REVENUE PROFILE IN SUGAR & BIOETHANOL & BIOELECTRICITY MILL

DIVERSIFICATION OF REVENUES - US\$

unica

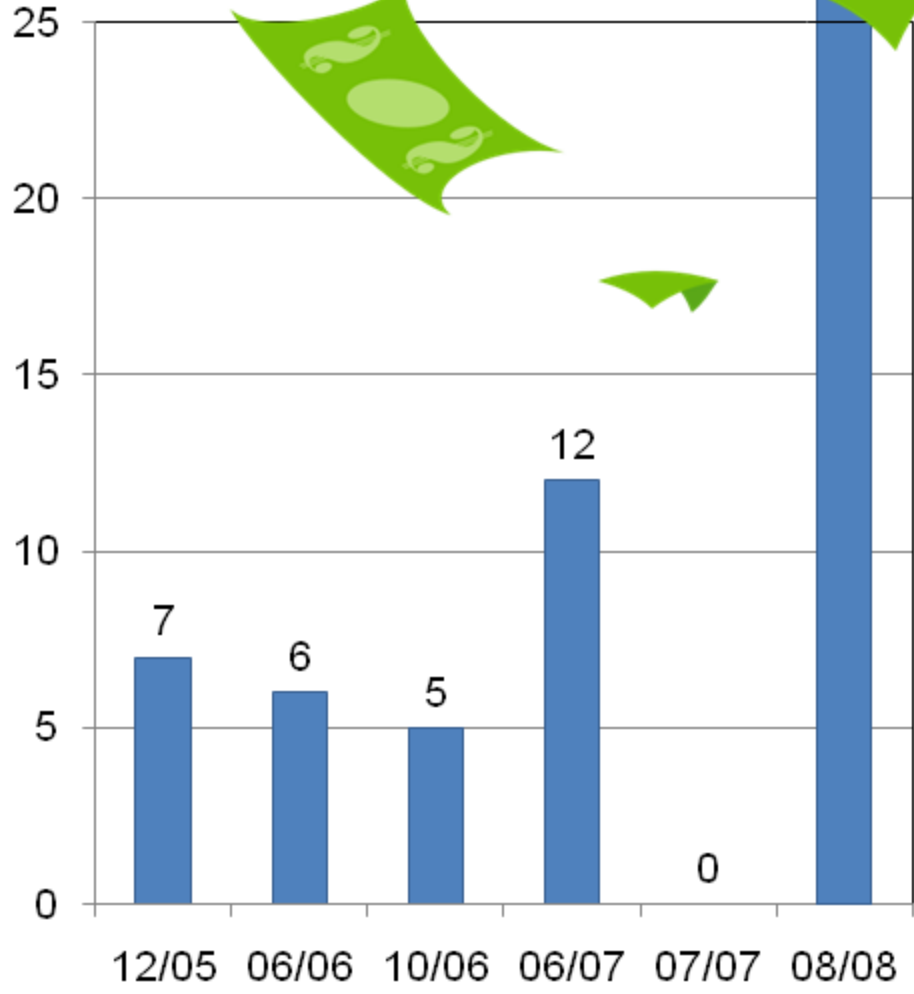


BIOELECTRICITY: A NEW BUSINESS IN SUGARCANE SECTOR

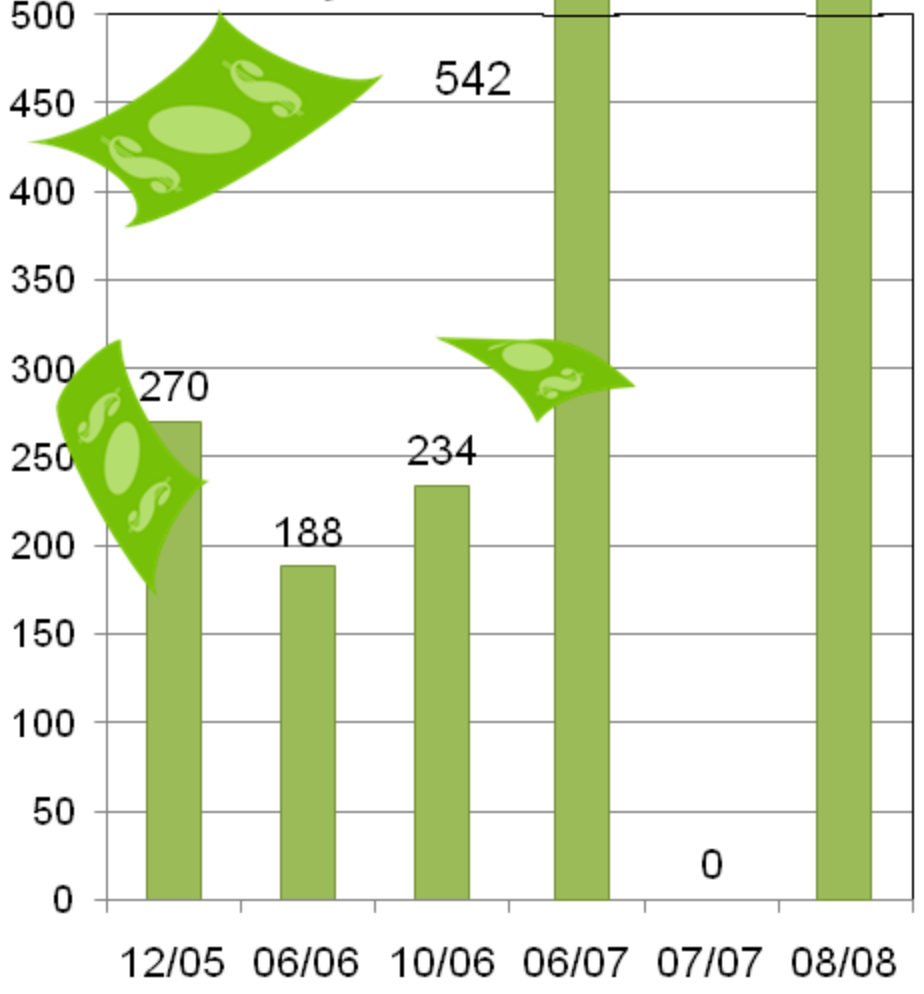
BIOELECTRICITY AUCTIONS: A GROWING INTEREST OF THE SUGARCANE MILLS

2385 Mw

Auction Winner Mins



Installed MW





International Society
of Sugar Cane
Technologists

**THANK YOU
FOR YOUR ATTENTION**

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INDÚSTRIAS DE BASE

DEDINI S/A INDÚSTRIAS DE BASE

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