raízen

Reduction of energy consumption in manufacturing

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Maracaí Unit

Optimization scenarios

- **1- Get better performance on juice thermal regenerators;**
- **2 - Utilization of Platular exchangers to recover energy from flash tank;**
- **3- Energy recovering via Heat Exchangers from V3 and V5 Vapours;**
- **4- High gravity Broth fermentation with high Ethanol content on Beer;**
- **5- Use of V2 Steam on A-Massecuit Pans**
- **6- Use of Eletrical Drives on Milling Process**
- **7- Use of Trash**

Maracaí Unit

Overview



Maracaí Unit



Maracaí Unit

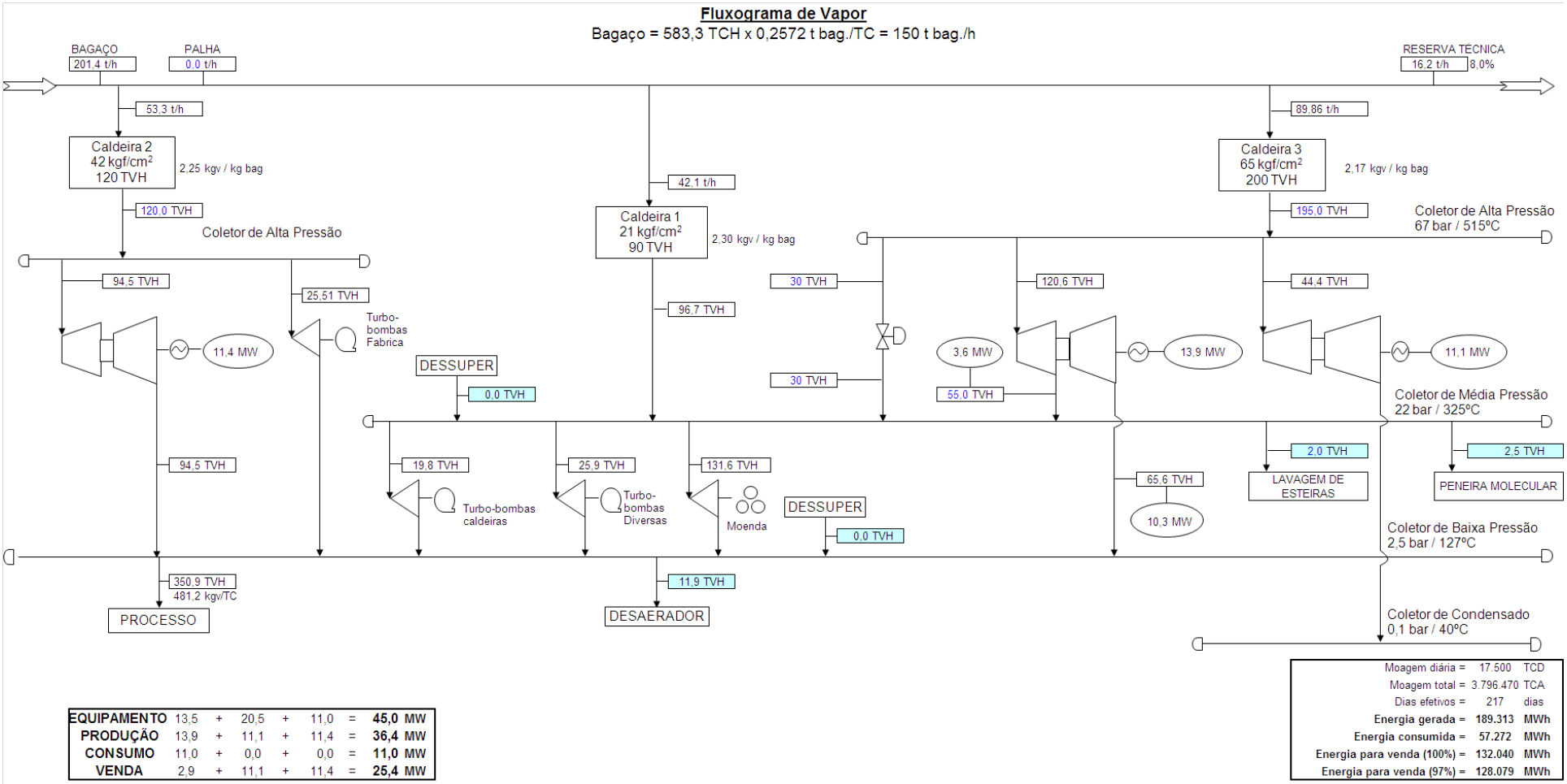
Raízen

- **Foundation: 1957;**
- **Milling capacity: 17.500 tons/day;**
- **Sugar production: 1.600 tons/day;**
- **Ethanol production: 600 m³/day;**
- **Installed Power Generation: 22,5MW**



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Initial Scenario



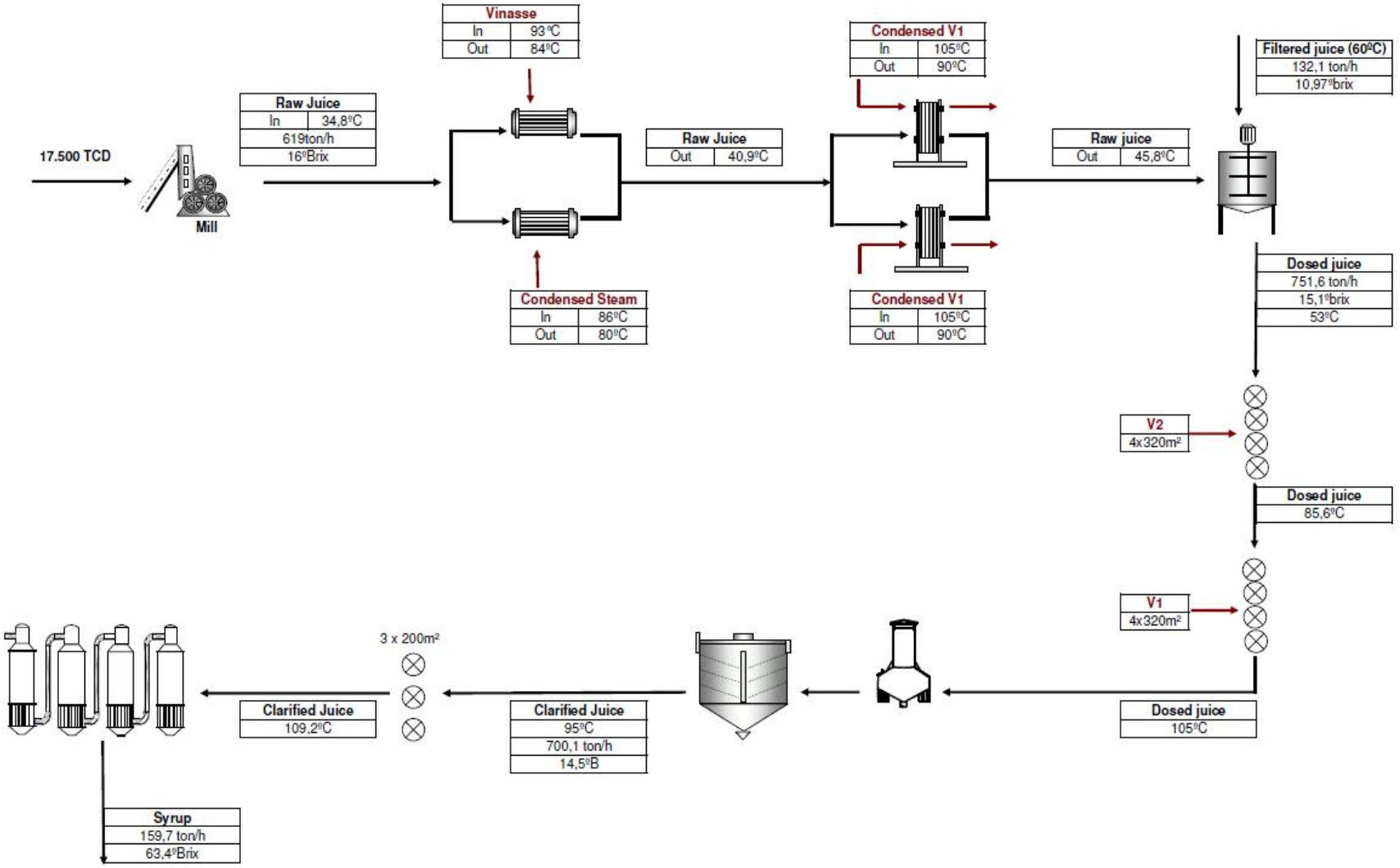
Maracaí Unit

Overview - Nowadays

Parameter	Value	Unit
Process Steam Cons. (Exausted Steam)	**481**	**Kgv / ton of cane**
Energy for sale to Grid	**128.000**	**MWh**
Syrup	**63**	**ºBrix**
Alcohol content - Beer	**9,96**	**ºGL**
V3, V5, flash vapor?	**Not used**	**-**

Maracaí Unit

Nowadays



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Energy Generator



Hair Pin Heat Exchanger



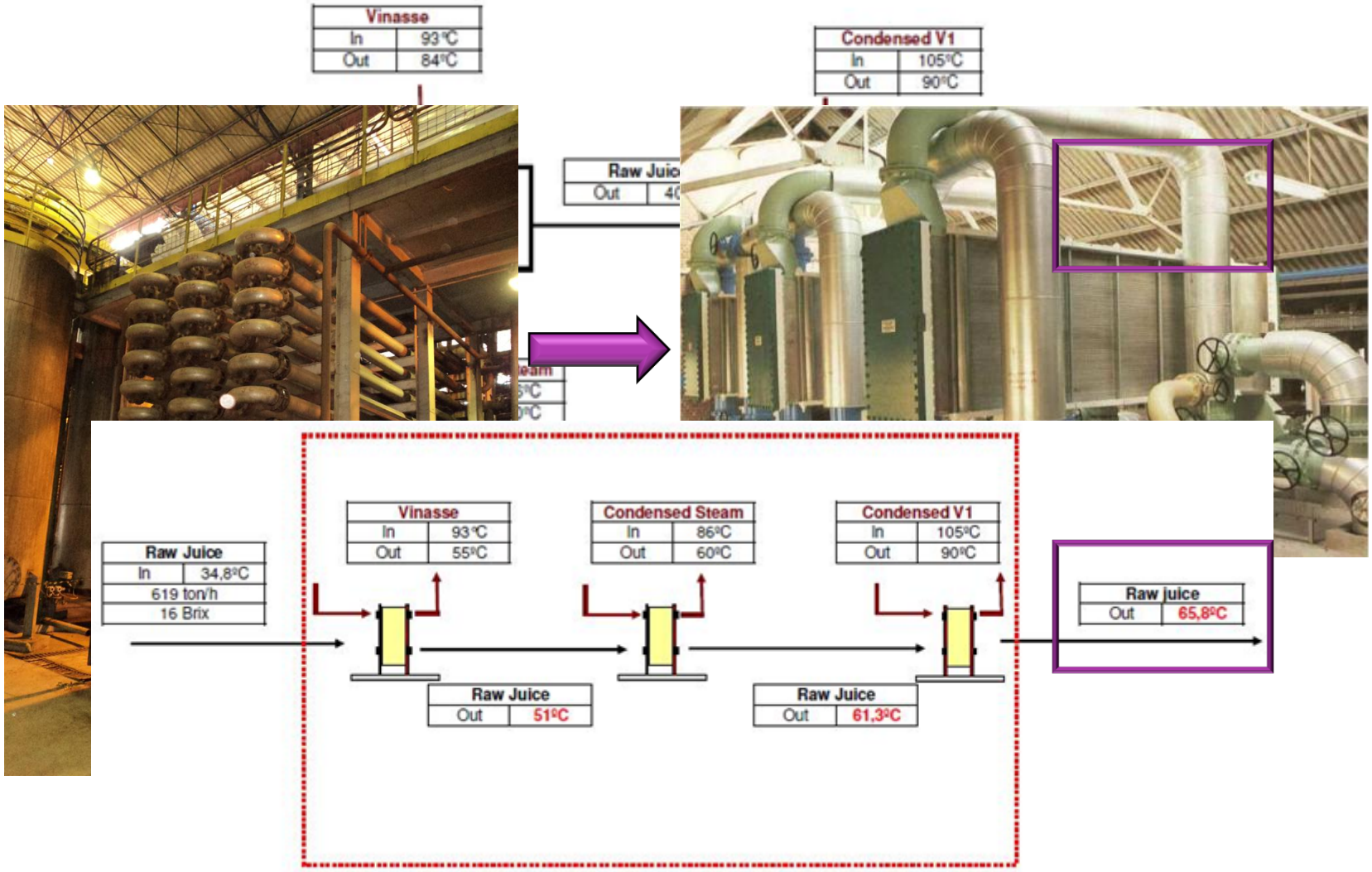


Plate Heat Exchanger

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First Scenario

- **Use of Plate/Platular Heat Exchangers instead of Hair Pin type.**
- **Review Juice Lines/Flows from parallel to series.**



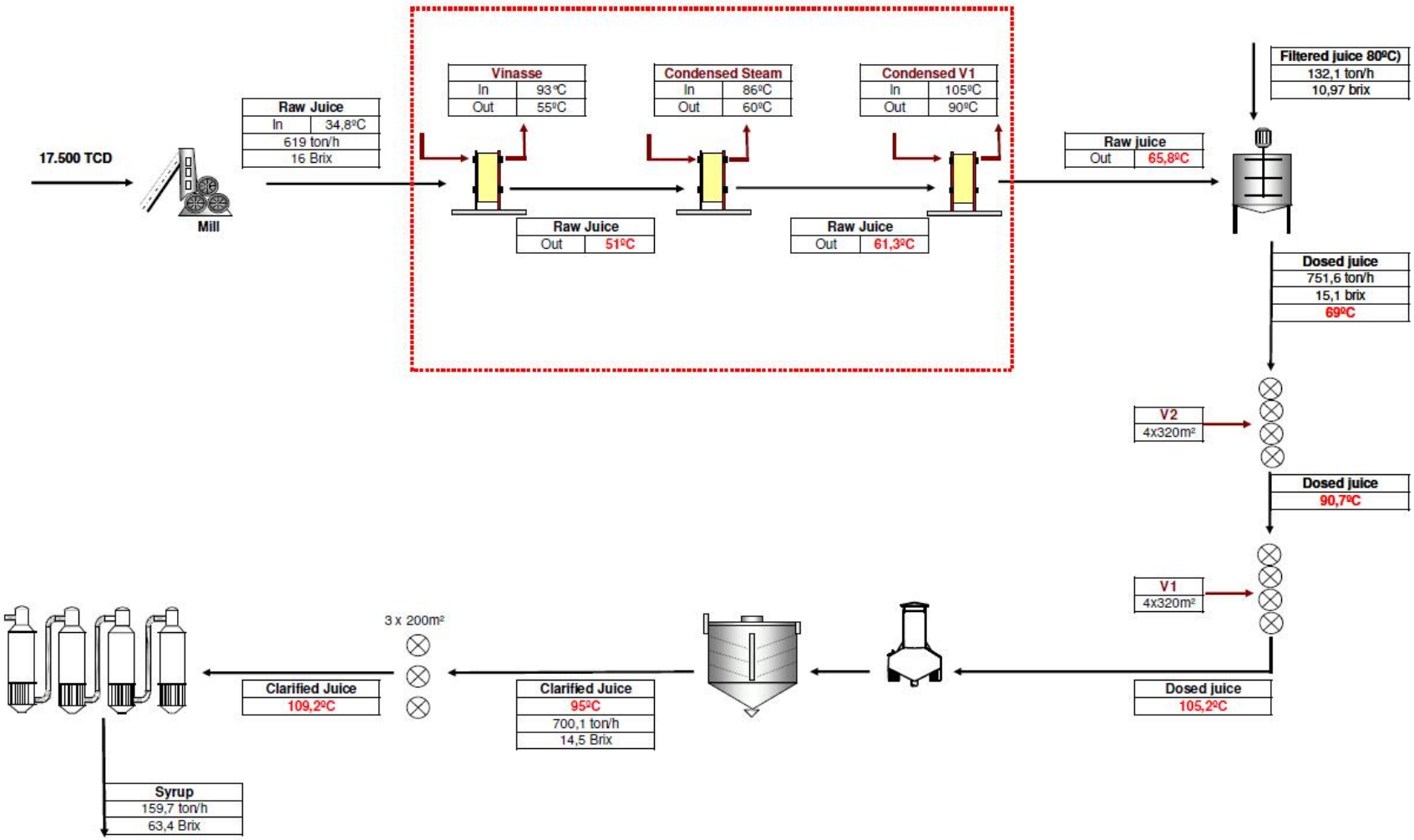
Maracaí Unit

First Scenario

Parameter	Value	Unit	Reference Value
Process Steam Cons. (Exausted Steam)	463	Kg / ton of cane	481
Energy for sale	134.374	MWh	128.000
Syrup	63,4	Brix	63,4
Alcohol content in wine	9,96	GL	9,96
V3, V5, flash vapor?	Not used	-	Not used

Maracaí Unit

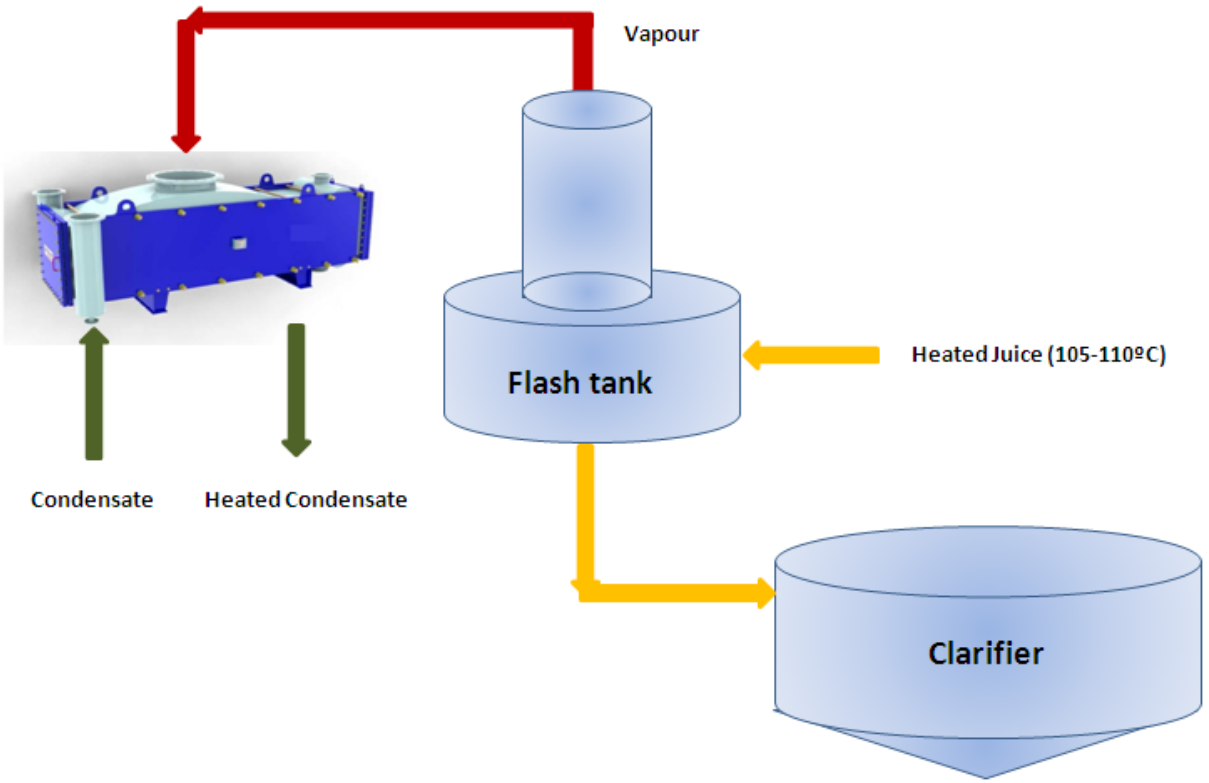
First Scenario Balance



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Second Scenario

- **Heating demineralized water and condensate from Cogen turbine with Flash Tank vapour**
- **Use of Platular Heat Exchanger**



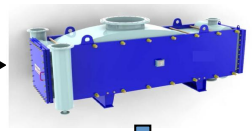
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Second Scenario

- **Heating demineralized water and condensate from turbine with Flash Tank vapor**

Flash tank vapor	6,5tonn/h
Enthalpy	539kcal/kg
Vapour Temp	98,0ºC

Condensate from Total cond Turbines	77m³/h
´+ Desmi Water from Water treatment	
Average Temperature Inlet	45,0ºC



Average Temperature for feeding Boilers	90,5ºC

- **Decreases the use of steam to pre-heat water to boliers**

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Second Scenario

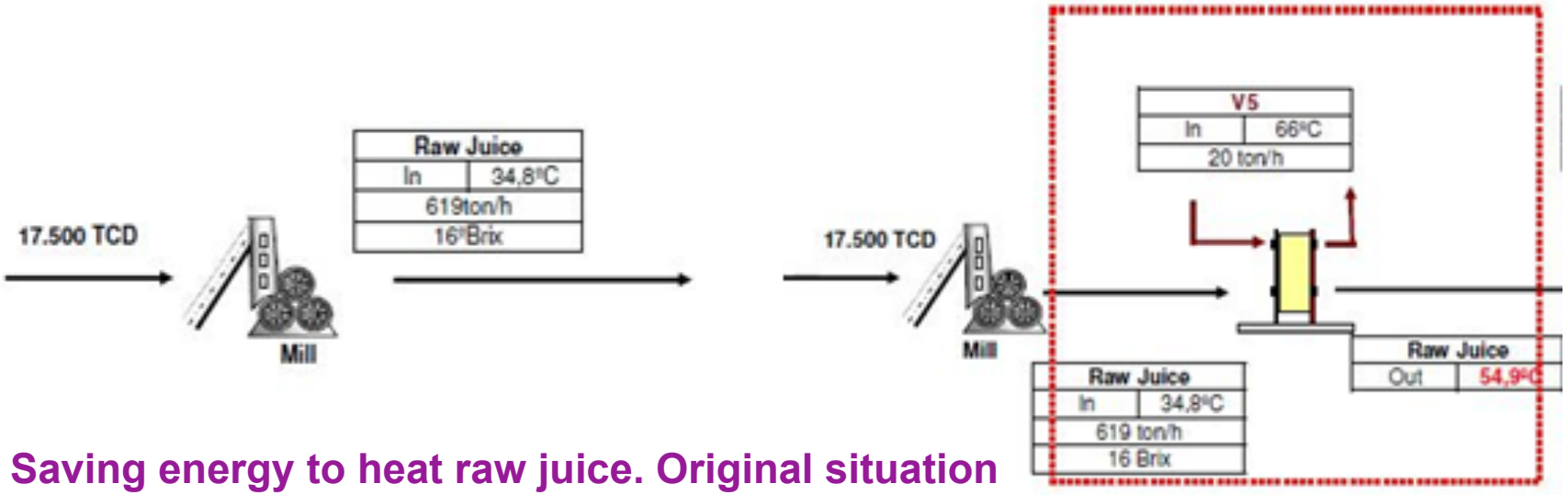
Parameter	Value	Unit
Process Steam Cons. (Exausted Steam)	463	Kg / ton of cane
Energy for sale	137.643	MWh
Syrup	63,4	ºBrix
Alcohol content in wine	9,96	ºGL
V3, V5, flash vapor?	Flash only	-

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Third / Fourth Scenarios

•**Heating raw juice with V5 vapour**

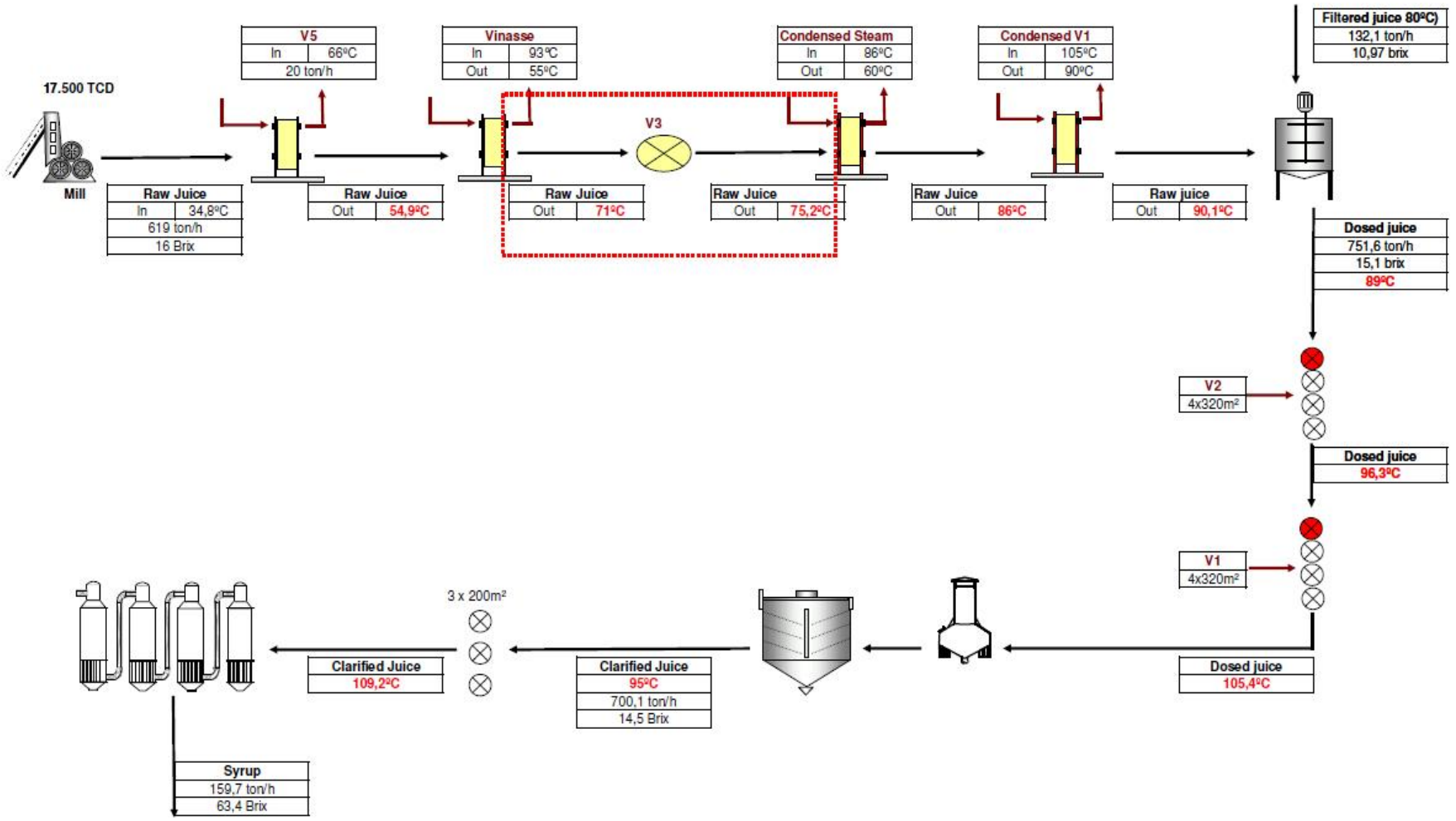
-For use of V5, considered Platular Exchanger as a Total Condenser on the last effect of Evaporation set.
-Use of Multijet Vacuum system to remove incondensables/remaining V5 out of process and ensure vacuum performance?



Saving energy to heat raw juice. Original situation 34,8ºC – Recovering energy 55ºC that would be supplied by V1/V2 OR Exausted Steam Addition

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Third/Fourth Scenarios



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Third/FourthProposition Expectative

- **Heating raw juice with V5 vapor**

Parameter	Value	Unit
Process Steam Cons. (Exausted Steam)	444	Kg / ton of cane
Energy for sale	144.062	MWh
Syrup	63,4	Brix
Alcohol content in wine	9,96	GL
V3, V5, flash vapor?	Flash, V5	-

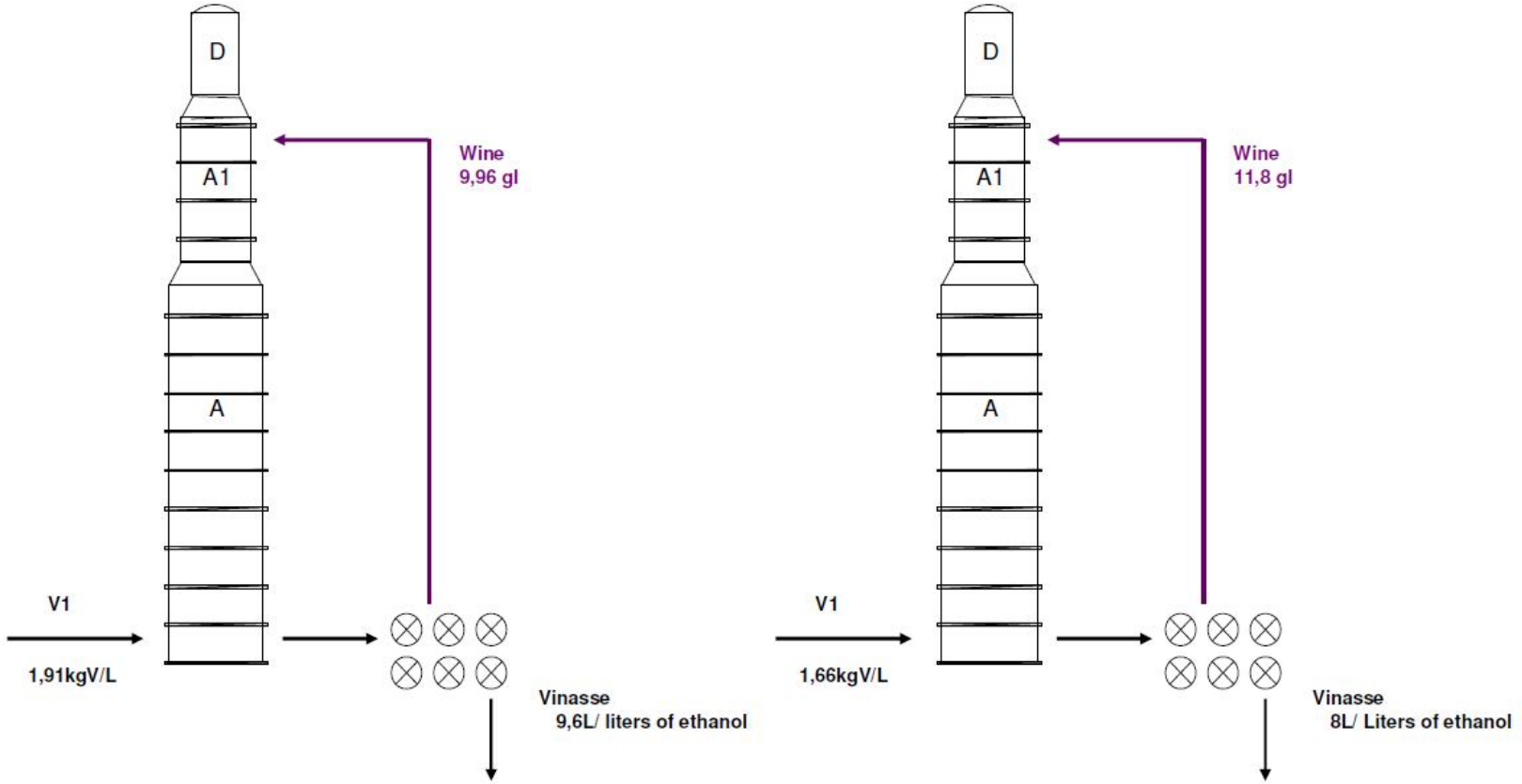
Heating raw juice with V3 vapor

Value	Unit
442	Kg / ton of cane
145.818	MWh
63,4	Brix
9,96	GL
Flash, V5, V3	-

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Fifth Scenario

- **Increase the wine alcohol content to 12 ºGL using Chiller to keep fermentation´s temperature.**



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Fifth Scenario

- **Tests runned at Cosan-Bom Retiro Mill (2007). Pilot Plant COSAN/Dedini**



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Fifth Scenario

- **Increase Beer´s Ethanol content for 12 ºGL**

Parameter	Value	Unit	Value
Exhausted Steam	434	Kg / ton of cane	481
Energy for sale	148.000	MWh	128.000
Syrup	63,4	Brix	63,4
Alcohol content in wine	12	GL	9,96
V3, V5, flash vapor?	Flash, V5, V3	-	Not used

Reduction in vinasse production: 40m³/h. Reduction of energy consumption by 95.450 kWh in the season with pumping disposal vinasse to the Fields

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Sixth/Seventh Scenarios

- **Acquisition of a new vacuum pan, and adjustments in the evaporation area**
- **Use of V2 vapor for boiling massecuite A**
- **Optimization of the evaporation process to raise the brix of the syrup**
- **Heating clarified juice with V1 Vapor before evaporation**

Parameter	Value	Unit	Value	Reference Value
Exhausted Steam	417	Kg / ton of cane	404	481
Energy for sale	151.403	MWh	153.081	128.000
Syrup	63,4	Brix	68	63,4
Alcohol content in wine	12	GL	12	9,96
V3, V5, flash vapor?	Flash, V5, V3	-	Flash, V5, V3	Not used

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Eighth Scenario

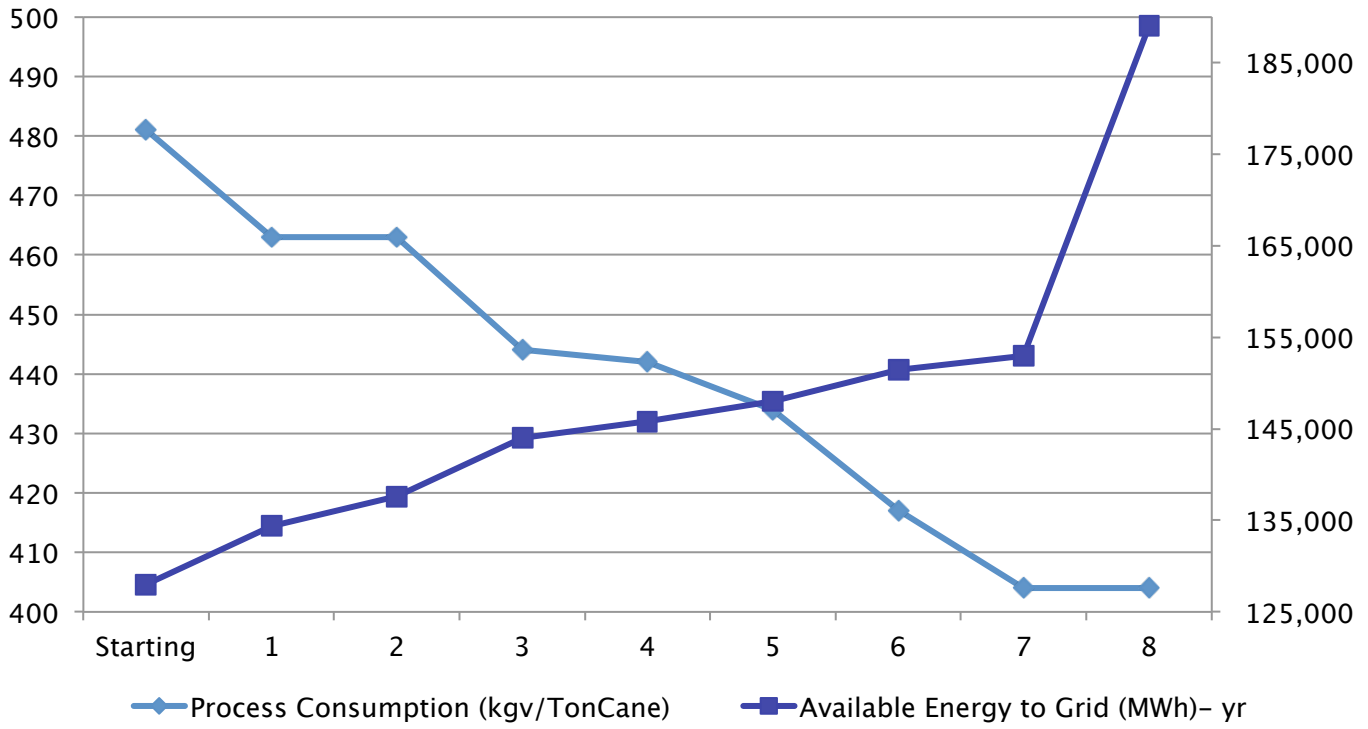
- **Installation of electric motor drives instead of steam turbines for the mill's actuation**

Parameter	Value	Unit
Exhausted Steam	404	Kg / ton of cane
Energy for sale	189.465	MWh
Syrup	68	Brix
Alcohol content in wine	11,85	GL
V3, V5, flash vapor?	Flash, V5, V3	-

Maracaí Unit

Summary

Scenario Opportunities									
Process (kgv/Ton)	481	463	463	444	442	434	417	404	404
MWh-Yr	128.000	134.370	137.650	144.000	145.800	148.000	151.400	153.000	189.000
Contribution (%)	-	4,98	2,44	4,61	1,25	1,51	2,30	1,06	23,53
Scenario	Starting	1	2	3	4	5	6	7	8



Thank you !