

2nd Biomass & Pellets Update Asia
Engineering aspects of a pellet production facility
Possible association to cogeneration with ORC



Victam Asia 2012

THE COMPANY

- **PRODESA** is a Global partner for complete WOOD PELLET plants, BIOMASS dryers and BIOMASS fueled CHP.
- **PRODESA** supplies turn key plants to treat several products and wastes, in the following areas:
 - Thermal drying processes
 - Biomass pelletizing
 - Biomass CHP
 - Gas treatment

PRODESA staff consists of a professional team that allows our company to cover all the stages of our projects:

- Process engineering
- Basic and detailed engineering
- Laboratory analysis
- Manufacturing
- Erection and commissioning
- Maintenance
- Technical after-sales assistance

0.- THE OBJECTIVE: EXCELLENCE

THREE DIFFERENT QUALITIES



0.- THE OBJECTIVE: EXCELLENCE

QUALITY PARAMETERS

Quality parameters	Unit	DINplus	ENplus-A1	ENplus-A2	EN-B
Diameter	mm	$4 \leq D \leq 10$	6 (± 1) and 8 (± 1) ⁴	6 (± 1) and 8 (± 1) ⁴	6 (± 1) and 8 (± 1) ⁴
Length	mm	$\leq 5 \times D$	$3,15 \leq L$ ≤ 40 ¹	$3,15 \leq L$ ≤ 40 ¹	$3,15 \leq L$ ≤ 40 ¹
Bulk density	kg/m ³	-	≥ 600	≥ 600	≥ 600
Net calorific v.	MJ/kg	≥ 18 *	$16,5 \leq Q \leq 19$	$16,3 \leq Q \leq 19$	$16,0 \leq Q \leq 19$
Moisture	w-%	≤ 10	≤ 10	≤ 10	≤ 10
Fines	%	≤ 1	≤ 1 ²	≤ 1 ²	≤ 1 ²
Mechanical durability	%	$\geq 97,7$ *	$\geq 97,5$	$\geq 97,5$	$\geq 96,5$
Ash	%	$\leq 0,5$ ³	$\leq 0,7$ ³	$\leq 1,5$ ³	$\leq 3,0$ ³
Ash melting behavior (DT)	°C	-	≥ 1200	≥ 1100	≥ 1100

I.- WOOD PELLETS MANUFACTURING



I.- Wood pellets manufacturing: DEBARKING

- For all shapes of logs
- Capacities up to 100 ton/h
- Very low residual content of bark
- Minimum fiber loss
- Very low maintenance required
- Continuous operation 24 hours/day



I.- Wood pellets manufacturing: DEBARKING



I.- Wood pellets manufacturing: DEBARKING



I.- Wood pellets manufacturing: CHIPPING

- Rotor diameter up to 2.800 mm
- Capacities up to 1.500 m³/h of woodchips
- Continuous operation 24 hours/day



I.- Wood pellets manufacturing: CHIPPING



I.- Wood pellets manufacturing: wood chips milling

- Powered up to 560 kW
- Very low maintenance required
- Continuous operation 24 hours/day



I.- Wood pellets manufacturing: wood chips milling



I.- Wood pellets manufacturing: SCREENING

Disc Screen



Vibrating conveyor and metal detector



I.- Wood pellets manufacturing: WET PRODUCT STORAGE



I.- Wood pellets manufacturing: THERMAL DRYING

1.- Drum dryer
High temperature



2.- Belt dryer
Low temperature



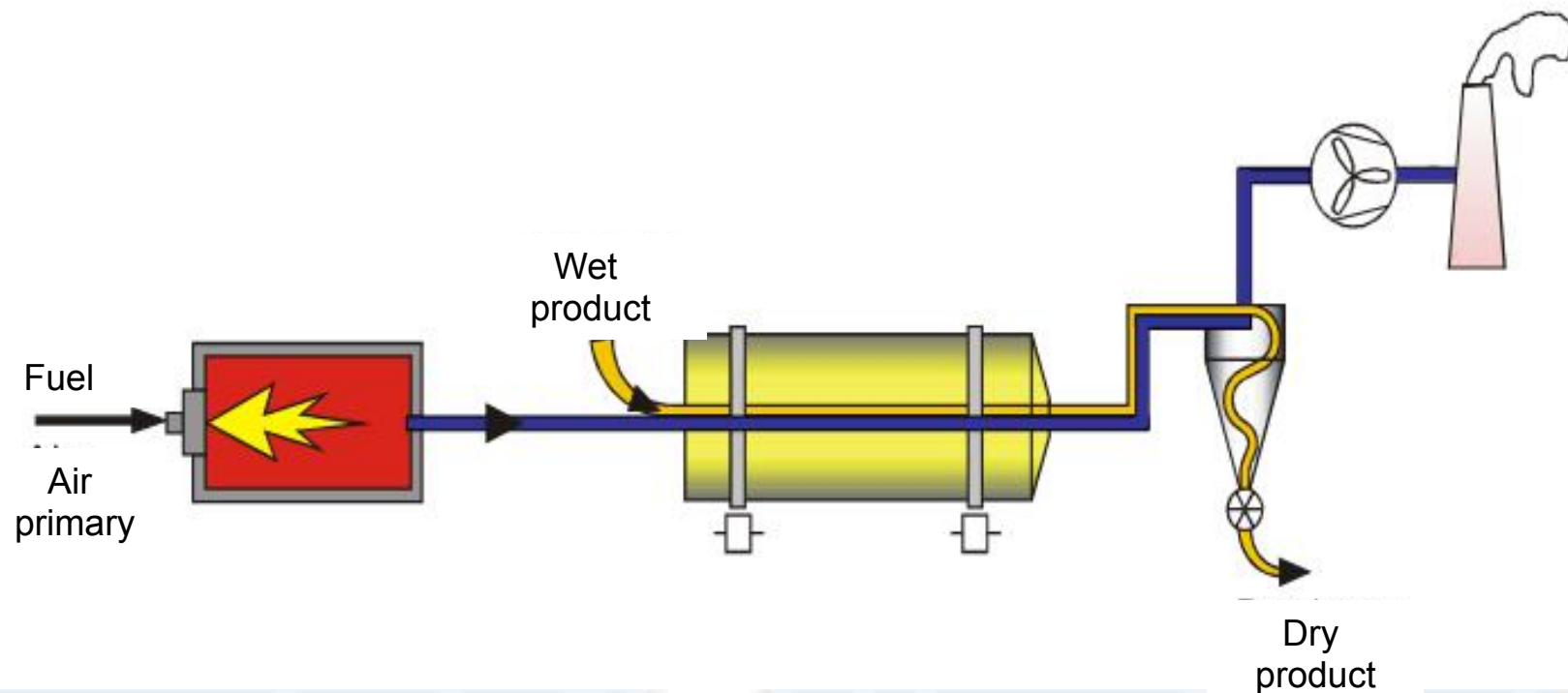
Drying technology under the license of



I.- Wood pellets manufacturing: THERMAL DRYING

1.- Drum dryer. High temperature.

- Capacities up to 50 ton/h of water evaporation
- High quality of the final product
- Widely extended technology
- Low energetic consumption
- Complete automatic control of the process



I.- Wood pellets manufacturing: THERMAL DRYING

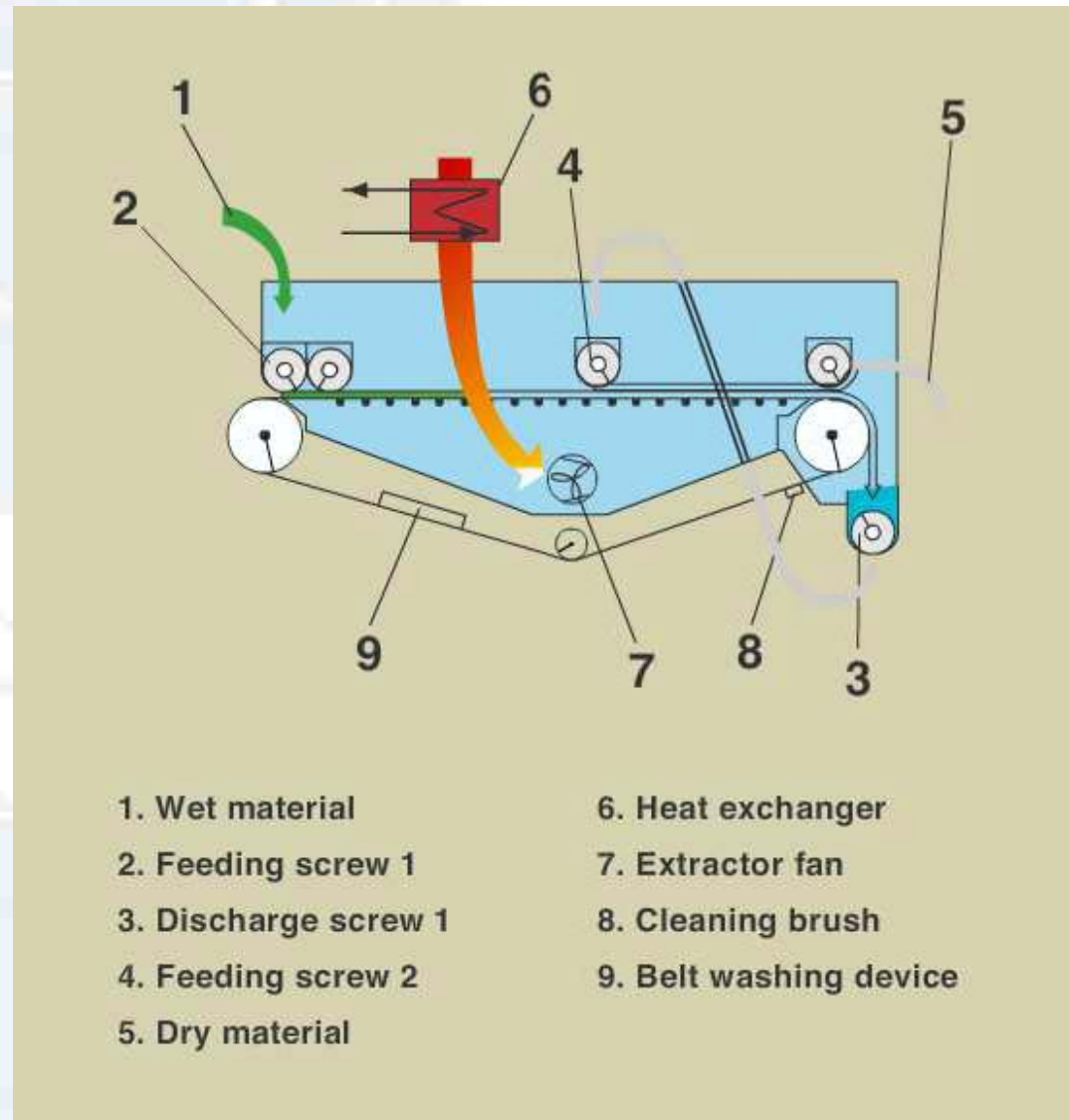
1.- Drum dryer. High temperature.



I.- Wood pellets manufacturing: THERMAL DRYING

2.- Belt dryer. Low temperature.

- Capacities up to 20 ton/h of water evaporation
- Capable to use residual low temperature energy
- Very low emissions
- Modular design
- High quality of the dry product
- Minimum fire risk
- Continuous operation



I.- Wood pellets manufacturing: THERMAL DRYING

2.- Belt dryer - USE OF LOW TEMPERATURE RESIDUAL ENERGY

- **HOT WATER**
 $\leq 120^{\circ}\text{C}$

- **LOW PRESSURE STEAM**
1.2 – 2 bar abs

- **HOT AIR**
Dry air $< 120^{\circ}\text{C}$



I.- Wood pellets manufacturing: THERMAL DRYING

2.- Belt dryer - MODULAR DESIGN



I.- Wood pellets manufacturing: THERMAL DRYING

2.- Belt dryer - COMPONENTS



I.- Wood pellets manufacturing: THERMAL DRYING

2.- Belt dryer. Low temperature.



- Vielsan (B)
- Hot water from an ORC 90°C/70°C
- 2 x 205 m²
- 2 x 10 ton/h evaporation

I.- Wood pellets manufacturing: DRY PRODUCT STORAGE

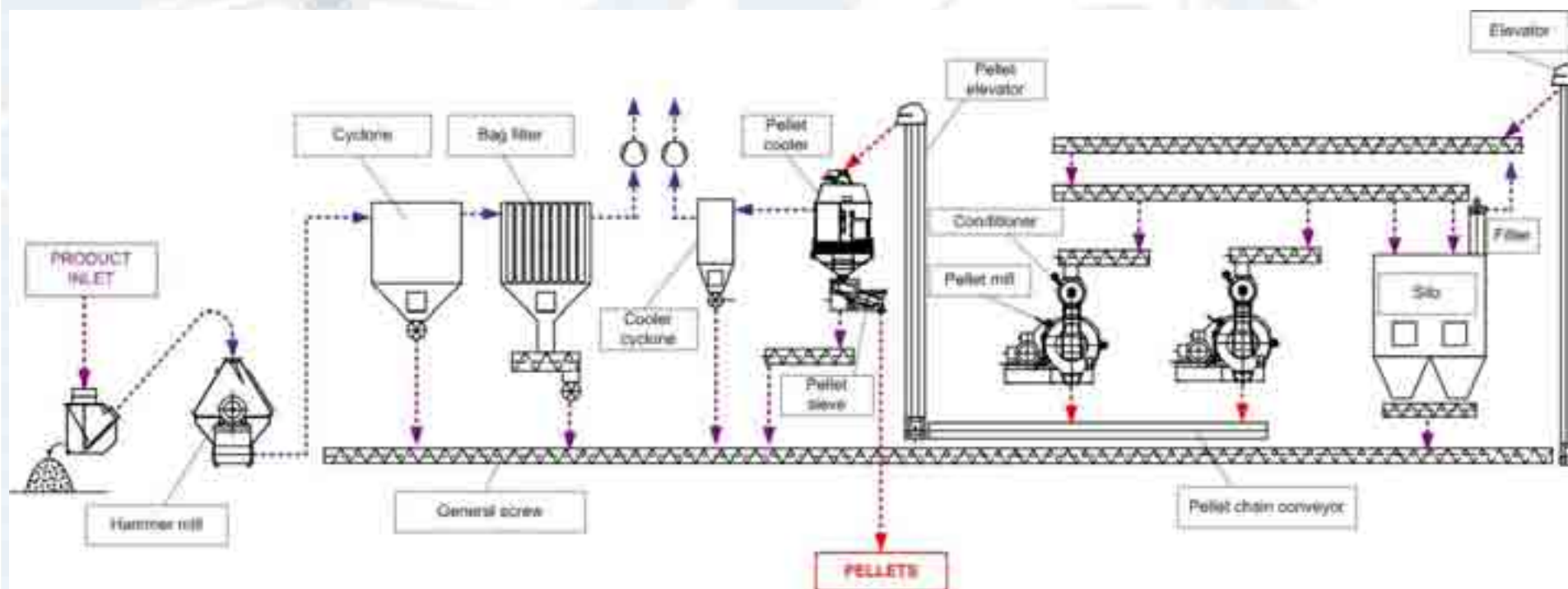
- ✓ Moisture content homogenization
- ✓ Flexibility in working hours: drying vs pelletizing
- ✓ Mechanical durability



PELLET QUALITY



I.- Wood pellets manufacturing: MILLING and PELLETIZING



I.- Wood pellets manufacturing: MILLING

Pneumatic product infeed



I.- Wood pellets manufacturing: MILLING

Hammer mill



I.- Wood pellets manufacturing: MILLING

Pneumatic product outlet



I- Wood pellets manufacturing: PELLETIZING



I- Wood pellets manufacturing: PELLETIZING

Die and rollers



I- Wood pellets manufacturing: PELLETIZING



I- Wood pellets manufacturing: PELLET COOLING AND SCREENING



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PRUDES A

I.- Wood pellets manufacturing



I.- Wood pellets manufacturing



I.- Wood pellets manufacturing



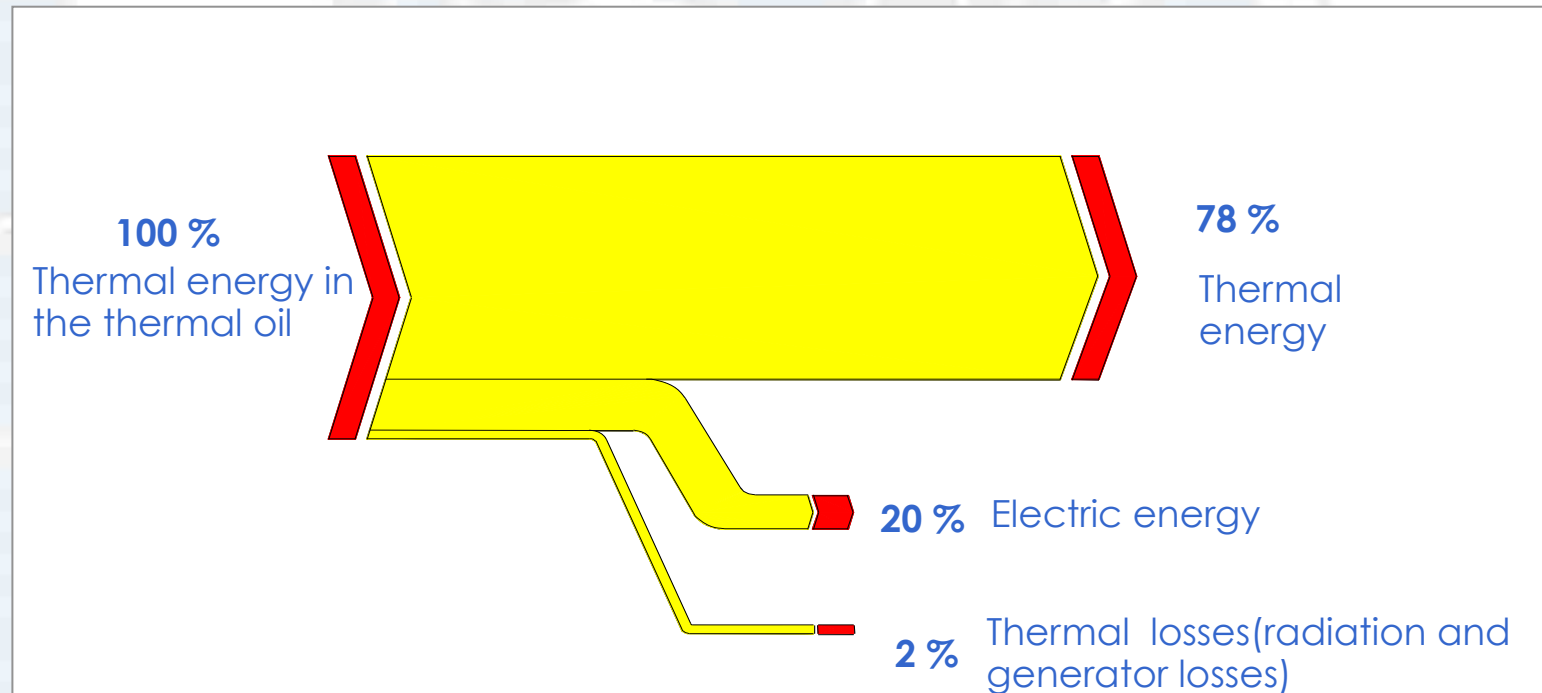
I- Wood pellets manufacturing: BAGGING LINE



I- Wood pellets manufacturing: PELLET SILOS

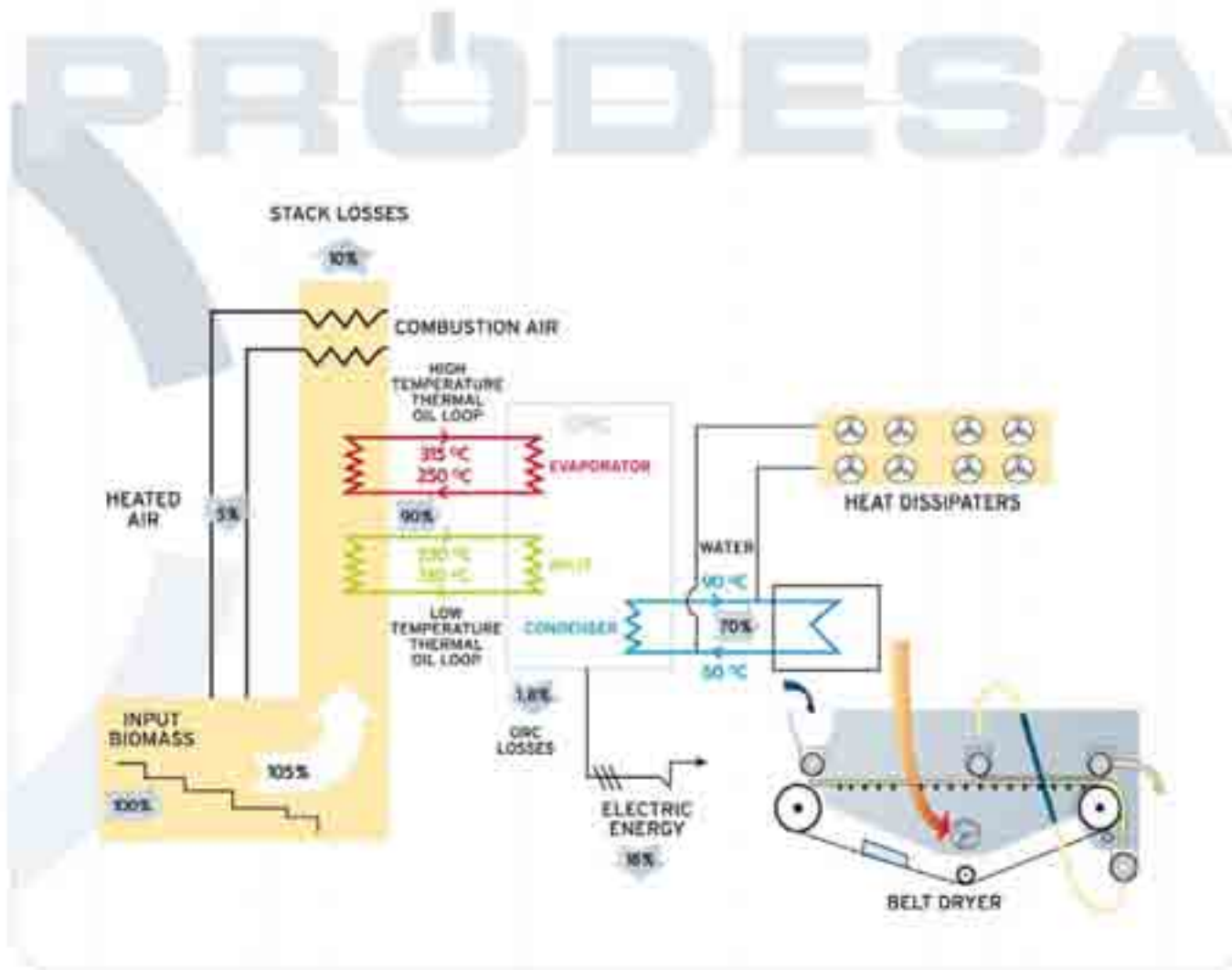


II.- CHP: ORC COGENERATION

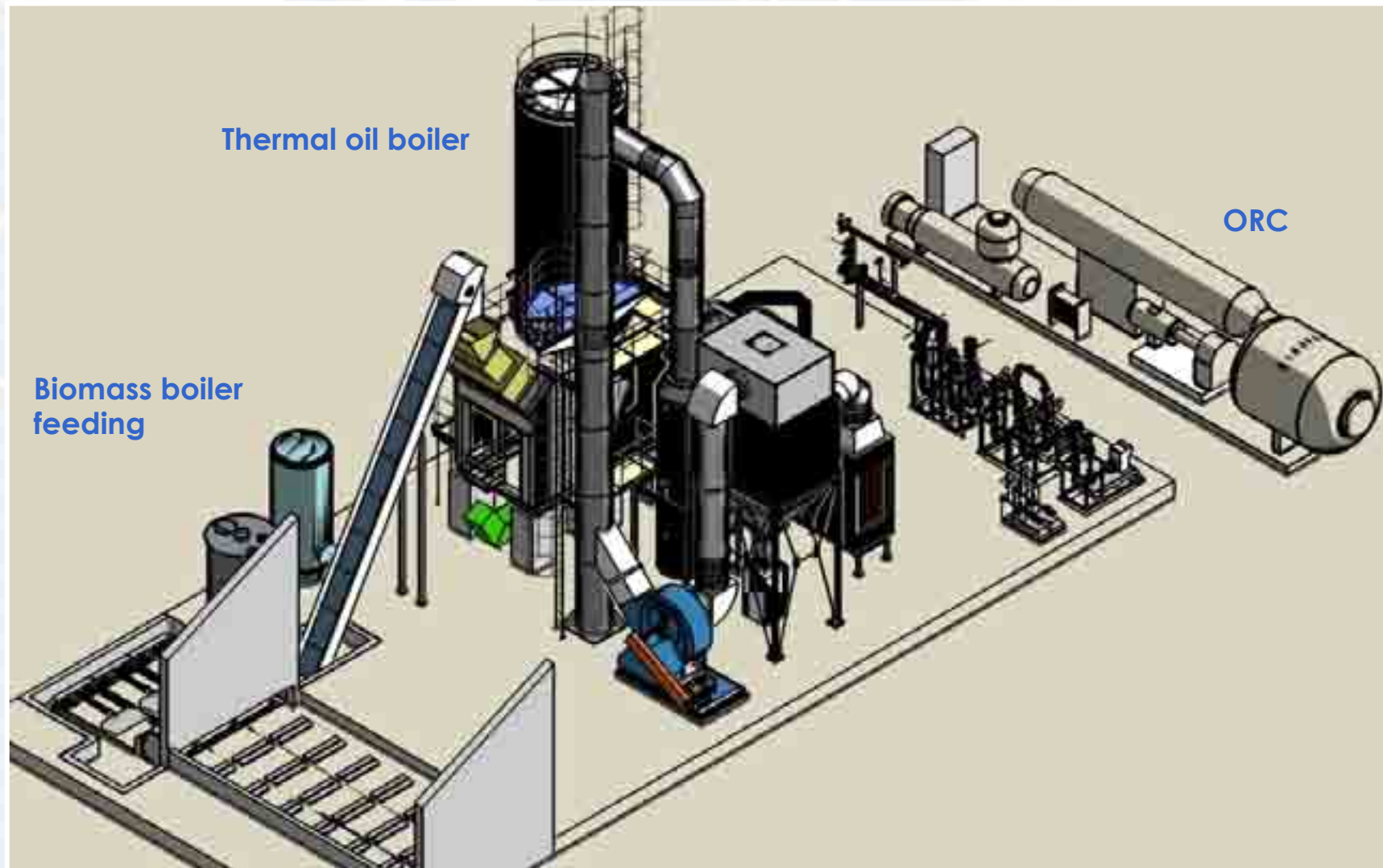


- Net electric efficiency: close to 20%
- Total energetic efficiency: 98%

II.- ORC COGENERATION: WOOD PELLETS MANUFACTURING



II.- ORC Cogeneration: Scheme



II.- ORC Cogeneration: Scheme



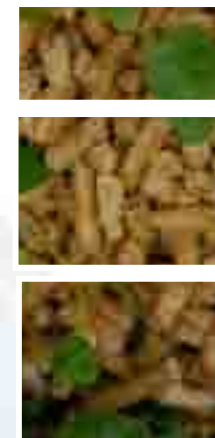
Thermal oil boiler



ORC

Pellets production associated to an ORC cogeneration

CONSIDERATIONS	
Moisture of raw material	50%
Ambient temperature	10 °C
Working hours	7500 hours/year



ORC MODEL	GROSS ELECTRIC POWER	THERMAL POWER	PELLETS PRODUCTION	
			metric TON/H	metric TON/YEAR
CHP-4	424 kW	1844 kW	1,77	13.290
CHP-6	617 kW	2600 kW	2,50	18.750
CHP-7	727 kW	3060 kW	2,94	22.058
CHP-10	1001 kW	4100 kW	3,94	29.550
CHP-14	1317 kW	5350 kW	5,14	38.565
CHP-18	1862 kW	7850 kW	7,82	58.650
CHP-22	2282 kW	9630 kW	9,59	71.948
CHP-27	2830 kW	11700 kW	11,65	87.375
CHP-30	3340 kW	15150 kW	15,08	113.100

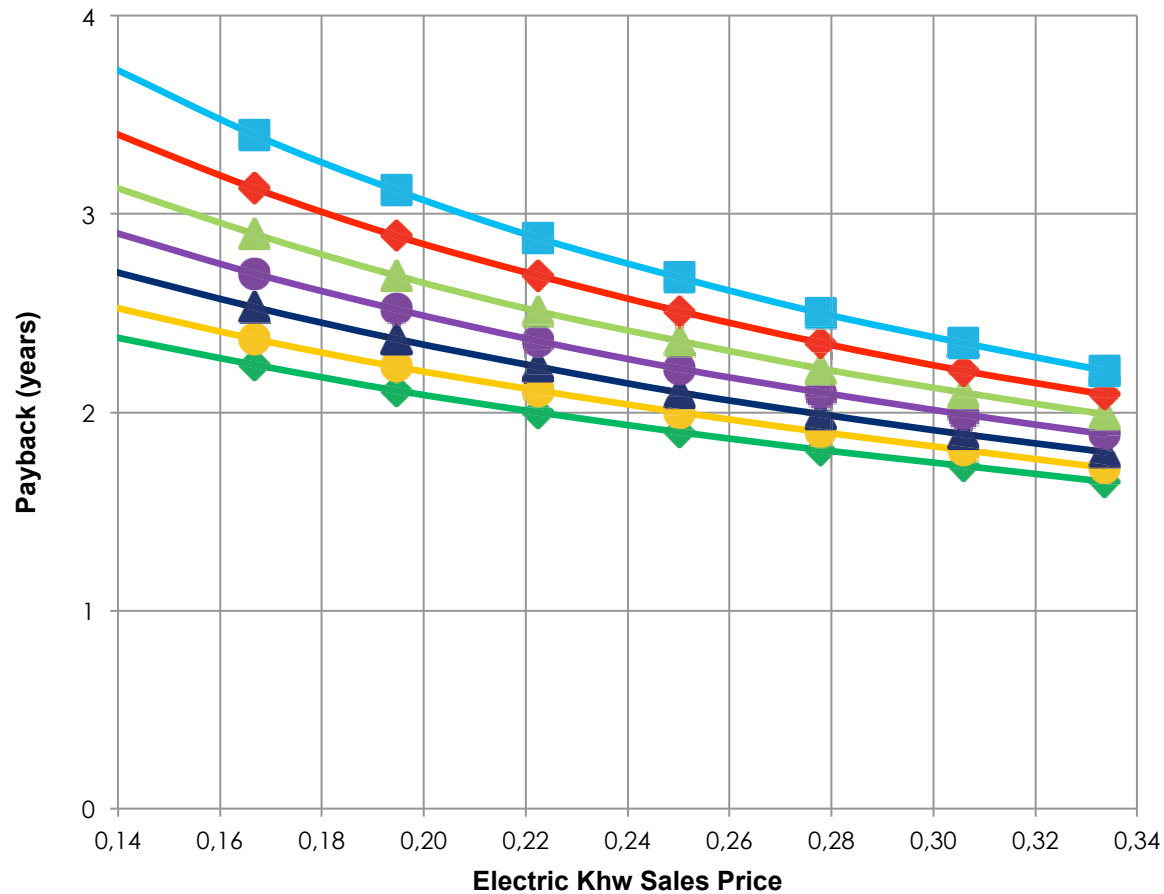
III.- ECONOMICAL STUDY: Pellets production associated to an ORC cogeneration

PROCESS DATA	
Raw material	Sawdust @ 50% H2O
Fuel	Barks and forest biomass
Pellets output	Storage silos + Bagging and wrapping line
Working hours	7.500 hours/year



V.- CHP APPLICATION: WOOD PELLET PRODUCTION WITH ORC Economical Study I

**CHP - 14
PAYBACK vs ELECTRIC Kwh SALES PRICE**

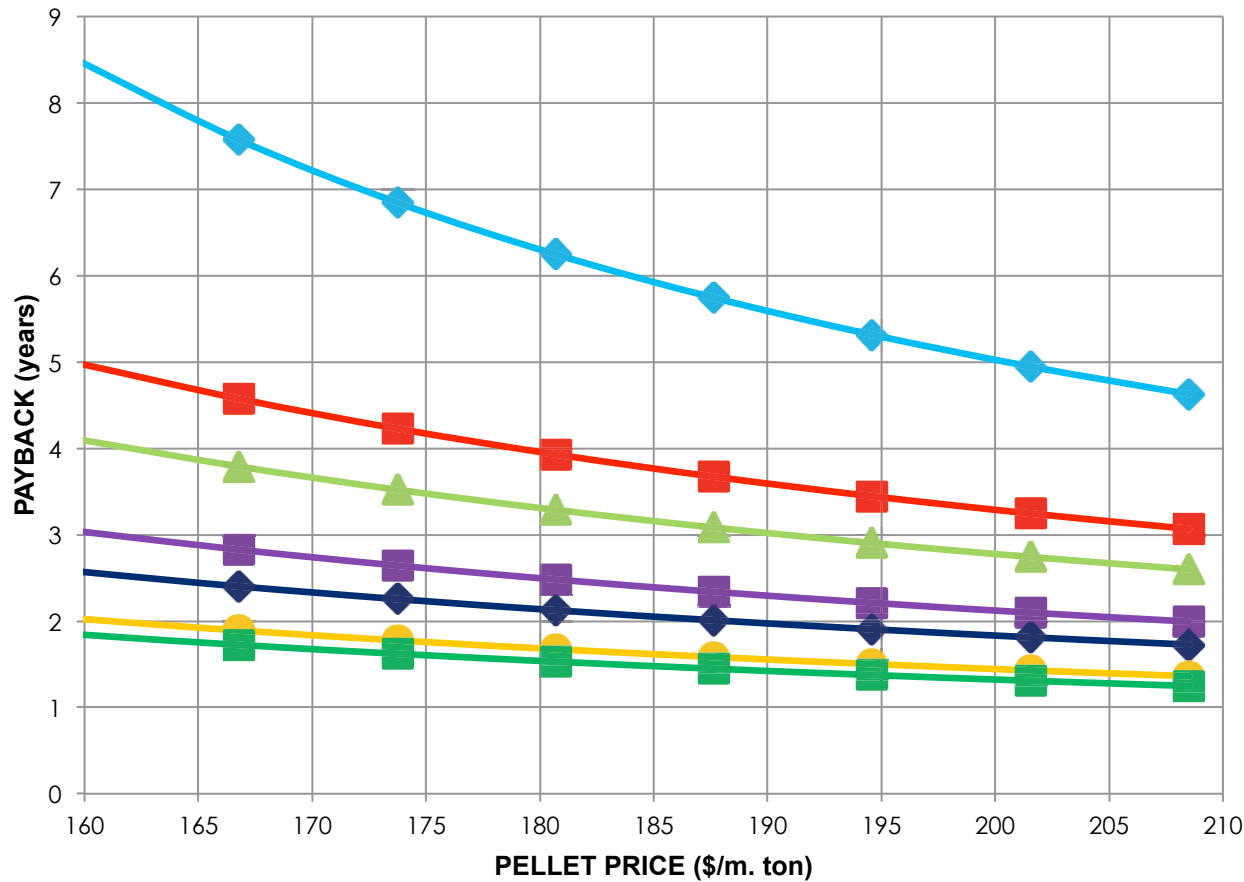


ASSUMPTIONS	
Fuel LHV	5.040 BTU/lb (3,2 kW/kg)
Raw material cost	33.36 \$/m.ton
Electricity cost	0,1 \$/kWh
Pellet price	167 \$/m.ton
Amortization period	10 year
Interest rate	4%



III.- ECONOMICAL STUDY: Pellets production associated to an ORC cogeneration

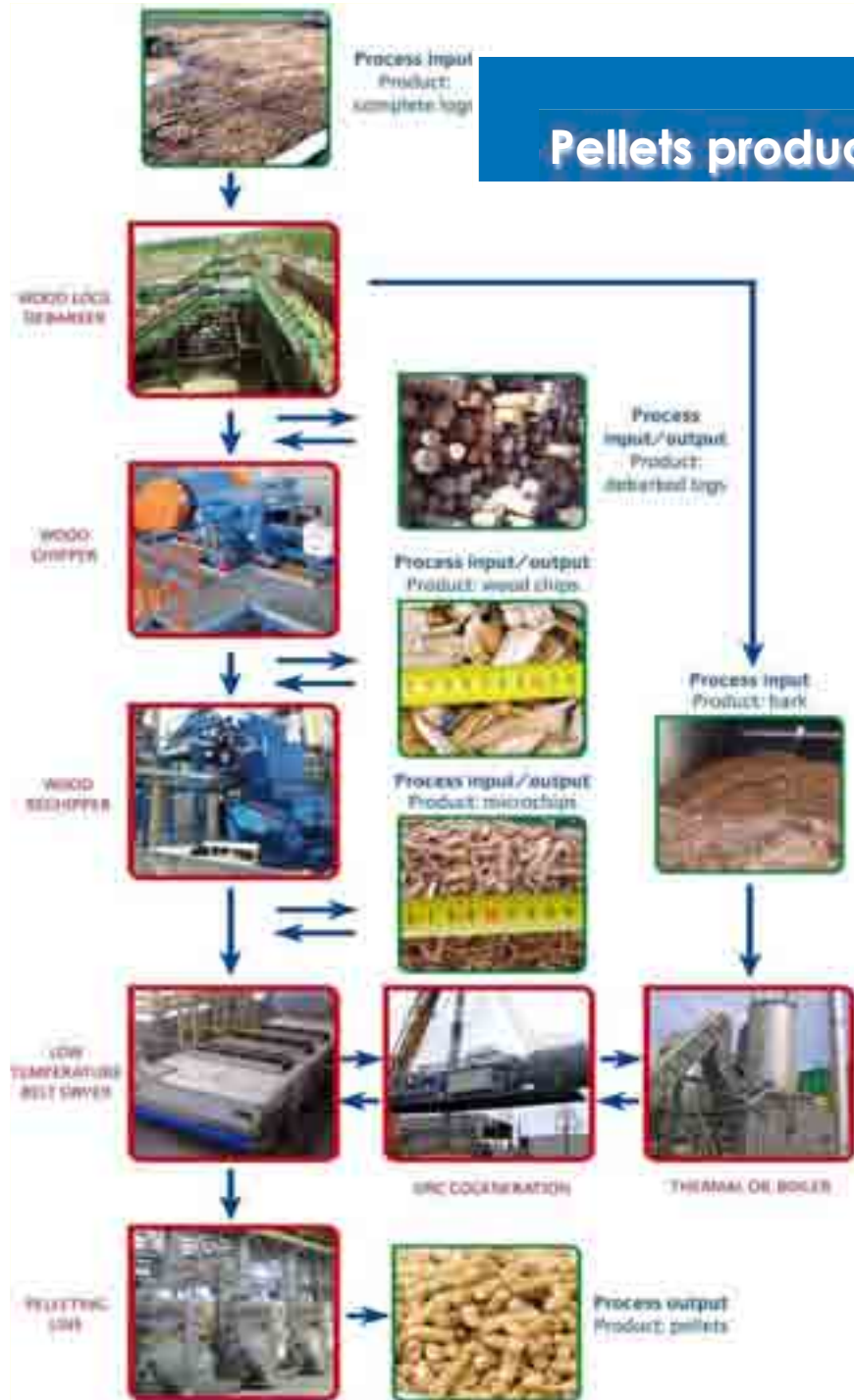
PAYBACK vs PELLETT PRICE



HYPHOTESIS	
Fuel LHV	5.040 BTU/lk (3,2 kW/kg)
Fuel cost	16 \$/m.ton (7.24 \$/MW)
Raw material cost	33.36 \$/m.ton
Electricity cost	0.1 \$/kWh
Electricity sales price	0,166 \$/kWh
Amortization period	10 year
Interest rate	4%

- ◆ CHP-4
- CHP-6
- ▲ CHP-7
- CHP-10
- ◆ CHP-14
- CHP-18
- CHP-22

III.- ECONOMICAL STUDY: Pellets production associated to an ORC cogeneration



CONSIDERATIONS

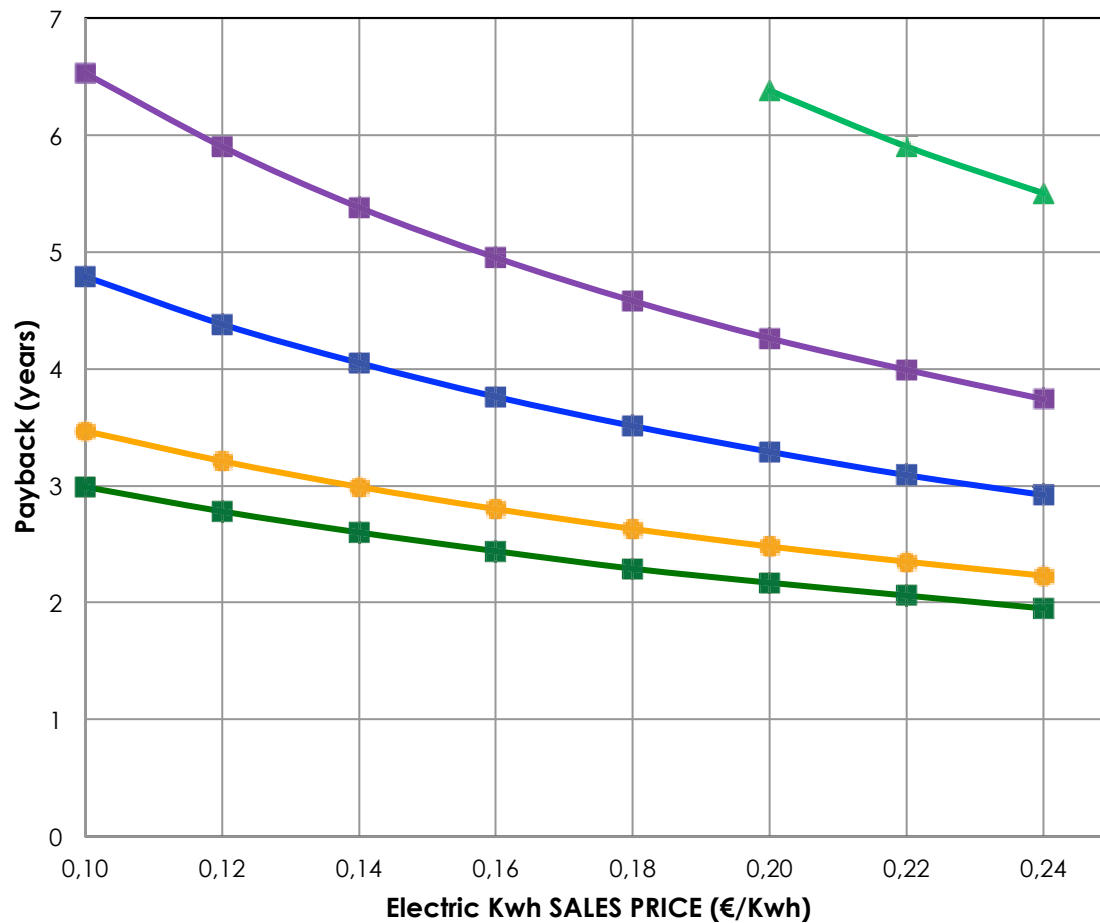
Raw material	Logs @ 50% H ₂ O
Fuel	Bark and forest biomass
Pellets output	Bulk from silos and plastic bags in pallets.
Working hours	7.500 hours/year



PRUDES

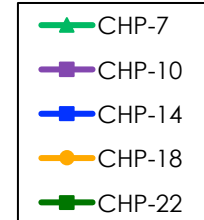
III.- ECONOMICAL STUDY: Pellets production associated to an ORC cogeneration

PAYBACK vs ELECTRIC Kwh SALES PRICE



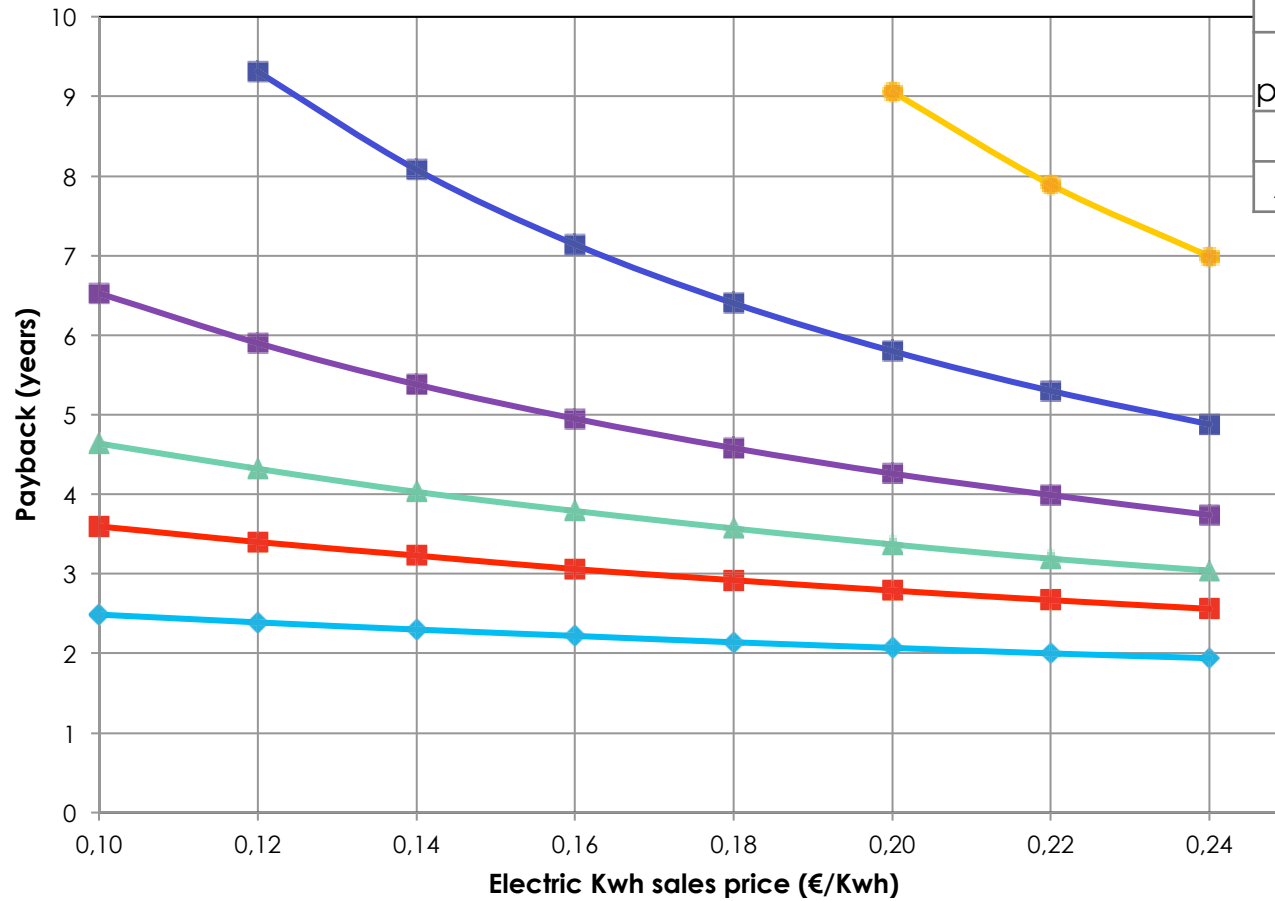
CONSIDERATIONS

LCP fuel	2.800 kcal/kg (3,2 kW/kg)
Fuel price	30 €/ton (9,375 €/MW)
Raw material cost	40 €/ton
Electric buyer price	0,08 €/kWh
Pellet price	150 €/ton
Amortization period	10 years



III.- ECONOMICAL STUDY: Pellets production associated to an ORC cogeneration

CHP - 10
PAYBACK vs ELECTRIC Kwh SALES PRICE



CONSIDERATIONS	
Fuel LCP	2.800 kcal/kg (3,2 kW/kg)
Fuel price	30 €/ton
Electric Kwh buyer price	0,08 €/kWh
Pellet price	150 €/ton
Amortization period	10 años

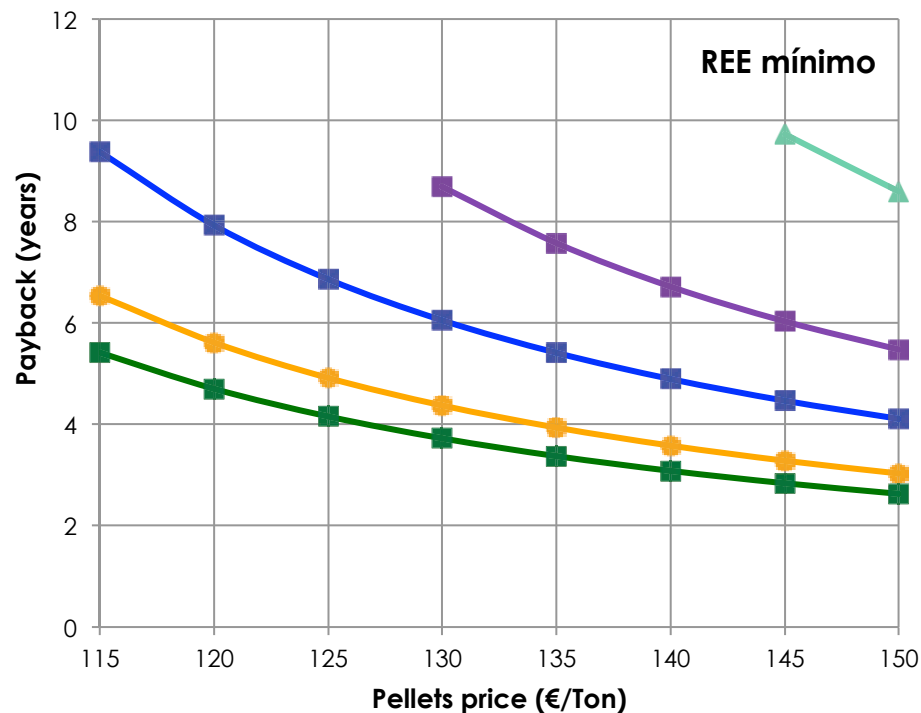
Raw material cost



III.- ECONOMICAL STUDY: Pellets production associated to an ORC cogeneration

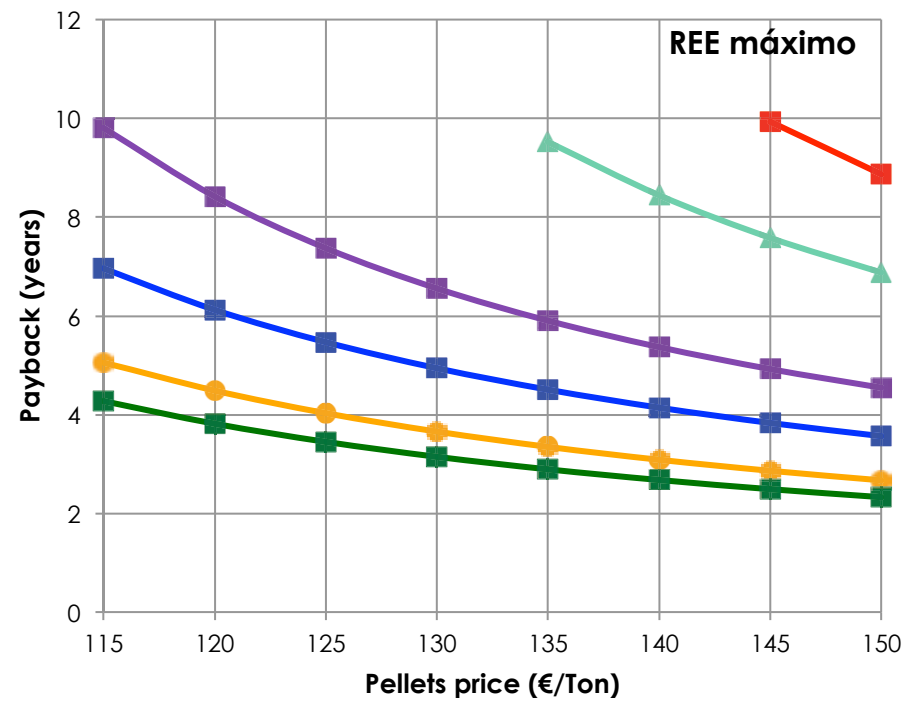
CONSIDERATIONS				
Fuel LCP	Raw material price	Fuel price	Electric Kwh buyer price	Amortization period
2.800 kcal/kg (3,2 kW/kg)	40 € / ton	30 € / ton	0,08 € / Kwh	10 años

PAYBACK vs PELLET PRICE



CHP-7 CHP-10 CHP-14 CHP-18 CHP-22

PAYBACK vs PELLETS PRICE



CHP-6 CHP-7 CHP-10
CHP-14 CHP-18 CHP-22

THANK YOU VERY MUCH FOR YOUR ATTENTION

For further information please contact

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