

PRÜDESA
GROUP



Your **experts**
in biomass pelleting



WORLD
BIOENERGY
ASSOCIATION

BIOENERGY
INTERNATI♥NAL

Developing pellet production
in Central and South America





BAGASSE





BAGASSE

- Cellulose: 45 – 55 %
- Hemicellulose: 20 – 25 %
- Lignin: 18 – 24 %
- Ash: 1 – 8 % (most frequently 1-5 %)
- LHV: 15,208 kJ/kg (Wood pellets is >16,5 GJ/ton)



A) Countries where the price of electric energy is high

- Cogenerations to produce electricity and steam
PRE-DRYER



BAGASSE

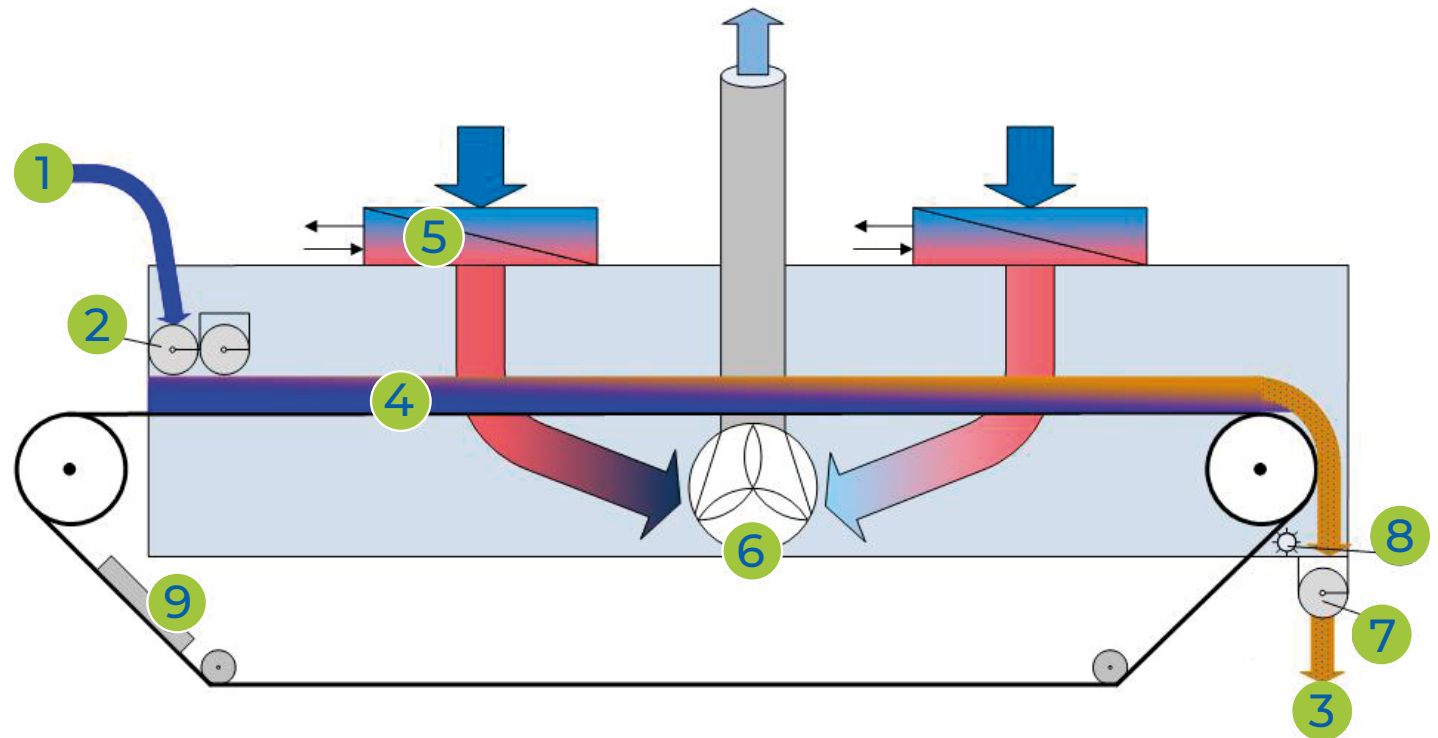




SINGLE LAYER DRYING SYSTEM

- 1 Wet biomass
- 2 Feeding screws
- 3 Dry biomass
- 4 Product layer
- 5 Heat exchangers (air heaters)
- 6 Exhaust fan
- 7 Discharge screw
- 8 Belt cleaning system (dry, brush)
- 9 Belt cleaning system (wet)

Drying from top to the bottom of the product layer



USE OF LOW TEMPERATURE THERMAL ENERGY

HOT WATER $\leq 125^{\circ}\text{C}$
One, two or three stage
heating. Glycol fro freeze
protection

LOW PRESSURE STEAM
1,2 - 2 bar abs

HOT AIR
Dry air or exhaust gases
 $< 120^{\circ}\text{C}$

Possibility to combine
**EXHAUST GASES +
HOT WATER**



WASTE HEAT SOURCES IN THE SUGAR CANE FACTORY

CONDENSER WATER 40-60°C (104-140°F)

Replacing the cooling towers

ASH WATER FROM WET SCRUBBER 50-65°C (122-149°F)

Waste heat for pre-heating of drying air or pre-heating of hot water cycle

RESIDUAL CONDENSATES AND STEAM 60-85°C (140-185°F)

e.g. from evaporators

STEAM BOILER or CHP FLUE GAS 120-140°C (148-284°F)

Direct for recovery of superheating and increase of dew point, followed by condenser for latent heat

HOT WATER or LPSTEAM FROM CHP

Back pressure or bleed-off steam from turbine

BLOW DOWN WATER FROM BOILER 100-200°C (212-392°F)

Waste water can be used in plate heat exchanger for final stage heating of hot water as a heat source for the belt dryer





TECHNICAL DATA OF BAGASSE PRE-DRYER

Drying surface: 46 m² · 442 m²

Length of drying unit: 15 m · 75 m

Width of belt: 6 m or 7.2 m

Width of drying unit: 10 m · 15 m

Water evaporation: 1t/h up to 30t/h (per unit)

Drying Temperature: 55°C · 110°C

Thermal efficiency: 0.6 kWh/kg – 1 kWh/kg of water evaporation depending on heat source and ambient temp

Evaporation per m² drying surface: 30 kg/h m² @ 60°C drying temperature up to 60 kg/h m² @ 100°C drying temperature

Heat source: Hot water, Steam, Hot and dry gas

Temperature of heat source: 60°C · 120°C

Inlet moisture content: up to 75% water content

Outlet moisture content: <20% water content is possible

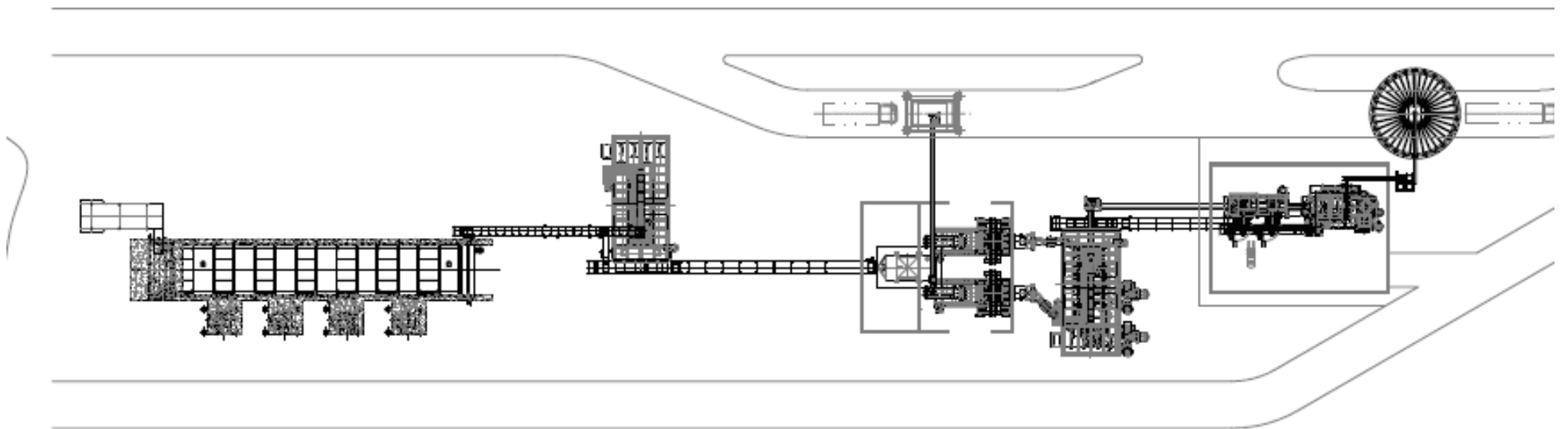
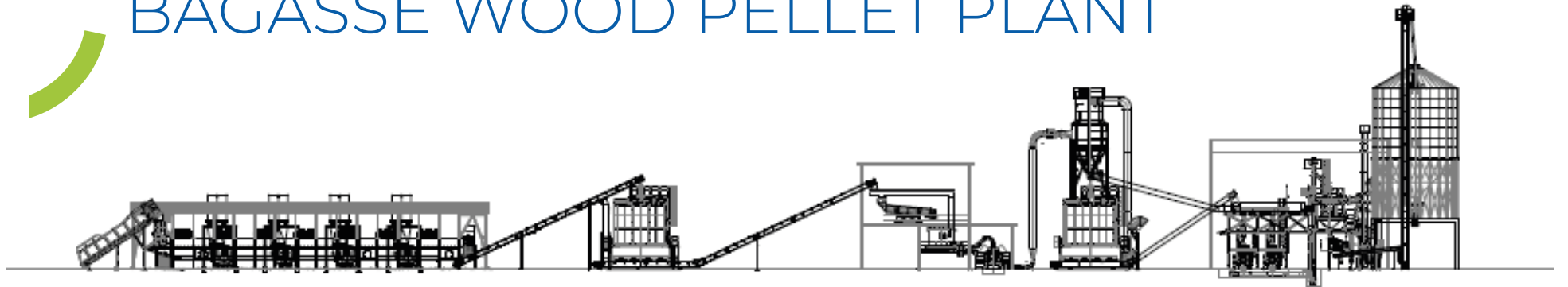


A) Countries where the price of electric energy is low

- Fuel for heat to be used in the sugarmill
- Agro industries to produce compost
- Sold to pulp and paper
- Animal feed
- Bagasse pellets:
 - Energy value
 - Animal feed



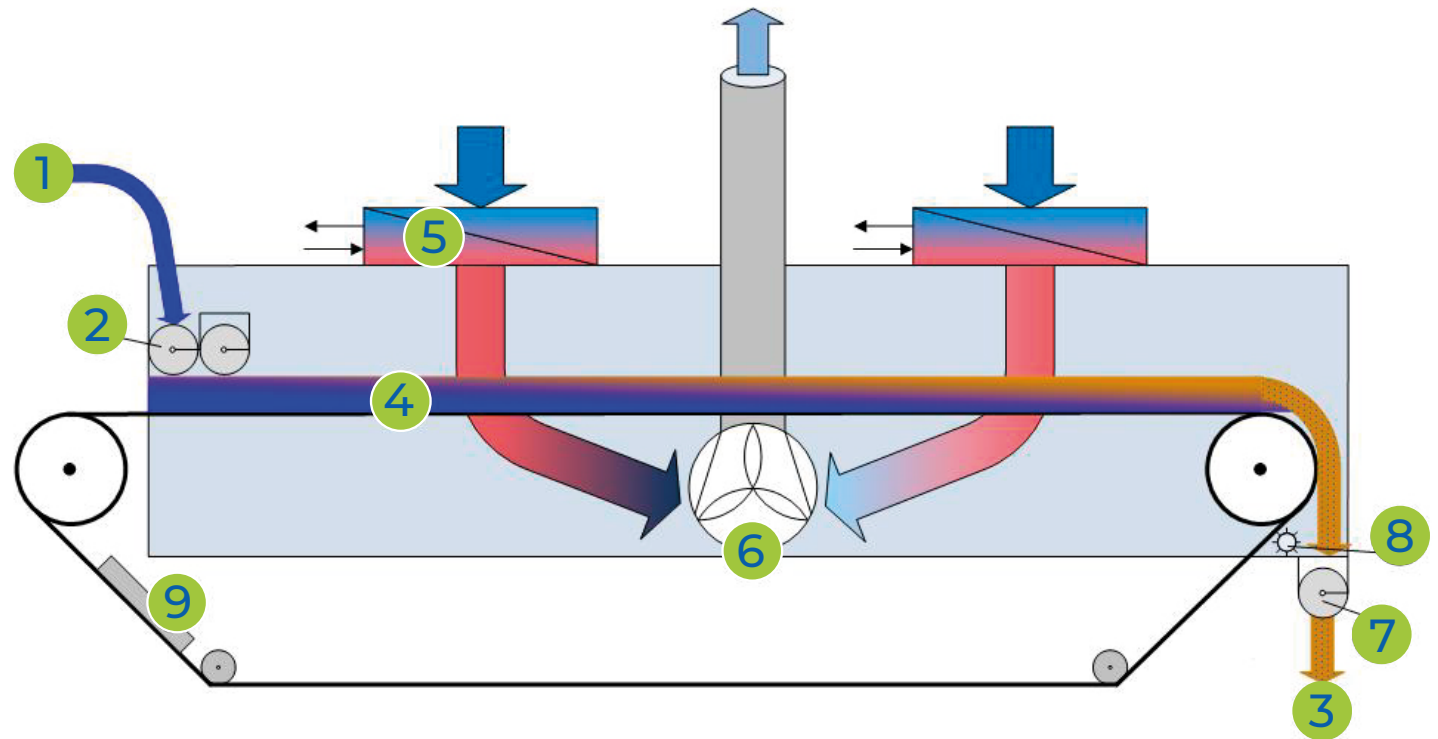
BAGASSE WOOD PELLET PLANT



DRYING SYSTEM

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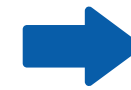
Drying from top to the bottom of the product layer



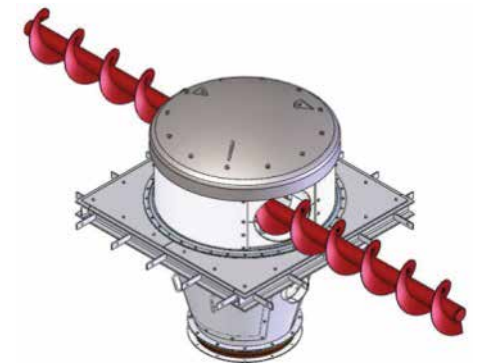


DRY PRODUCT STORAGE

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



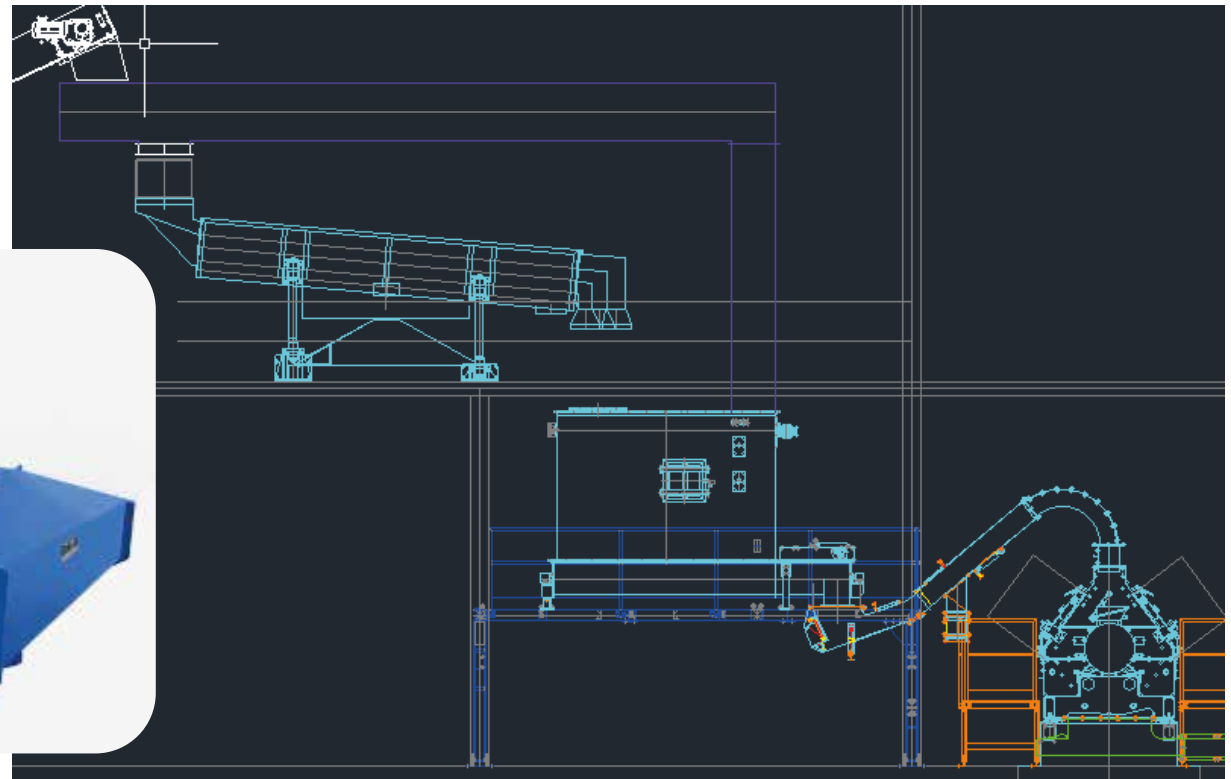
PELLET
QUALITY



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SCREENING FOR INORGANICS





WOOD PELLETS PRODUCTION • Milling Line





WOOD PELLETS PRODUCTION • Milling Line





WOOD



	Units	Standard	I1 industrial		I2 industrial		I3 industrial	
Origin and source	Only accepted	EN 14961-1	1.1 Forest, plantation and other virgin wood, 1.2.1 chemically untreated wood residues		1.1 Forest, plantation and other virgin wood, 1.2.1 chemically untreated wood residues		1.1 Forest, plantation and other virgin wood, 1.2.1 chemically untreated wood residues	
Sampling		EN 14778						
Quality check								
Sample preparation		EN 14780						
No water damage			None		None		None	
No burned/charred pellets			None		None		None	
Additives (composition, mass)	weight% ar	EN 14961	< 3% additives		< 3% additives		< 3% additives	
		OFGEM	sustainability proven for UK		sustainability proven for UK		sustainability proven for UK	
Physical parameters			Limit	Tolerance	Limit	Tolerance	Limit	Tolerance
Diameter	mm	EN16127	6 to 8	within range	6 to 10	within range	6 to 12	within range
Length ≤50 mm	weight %	EN16127	99,9%	within range	100%	within range	100%	within range
Length ≤40 mm	weight %	EN16127	99%	within range	99%	within range	99%	within range
Water content	weight% ar	EN 14774	≤ 10 %	0,5% absolute	≤ 10 %	0,5% absolute	≤ 10 %	0,5% absolute
Bulk (apparent) density	kg/m3	EN 15103	≥ 600	2% of limit	≥ 600	2% of limit	≥ 600	2% of limit
Maximum bulk temperature	°C	EN15234-2	≤ 60	1°C	≤ 60	1°C	≤ 60	1°C
Net calorific value at constant pressure	GJ/ton ar	EN 14918	≥ 16,5	0,3 GJ/ton	≥ 16,5	0,3 GJ/ton	≥ 16,5	0,3 GJ/ton
Ash content	weight% DM	EN 14775	≤ 1,0%	10% of limit	≤ 1,5%	10% of limit	≤ 3%	10% of limit
Elementary composition								
Cl	weight% DM	EN 15289	≤ 0,03%	0,01% absolute	≤ 0,05 %	0,01% absolute	≤ 0,1 %	20% of limit
N	weight% DM	EN 15104	≤ 0,3%	0,05% absolute	≤ 0,3 %	10% of limit	≤ 0,6 %	10% of limit
S	weight% DM	EN 15289	≤ 0,15 %	0,01% absolute	≤ 0,2 %	20% of limit	≤ 0,4 %	20% of limit
Trace elements								
As	mg/kg DM	EN 15297	≤ 2	0,064 absolute	≤ 2	0,064 absolute	≤ 2	0,064 absolute
Cd	mg/kg DM	EN 15297	≤ 1	0,06 absolute	≤ 1	0,06 absolute	≤ 1	0,06 absolute
Cr	mg/kg DM	EN 15297	≤ 15	0,032 absolute	≤ 15	0,032 absolute	≤ 15	0,032 absolute
Cu	mg/kg DM	EN 15297	≤ 20	0,043 absolute	≤ 20	0,043 absolute	≤ 20	0,043 absolute
Pb	mg/kg DM	EN 15297	≤ 20	0,033 absolute	≤ 20	0,033 absolute	≤ 20	0,033 absolute
Hg	mg/kg DM	EN 15297	≤ 0,1	0,0046 absolute	≤ 0,1	0,0046 absolute	≤ 0,1	0,0046 absolute
Zn	mg/kg DM	EN 15297	≤ 200	5,43 absolute	≤ 200	5,43 absolute	≤ 200	5,43 absolute
Fines ≤ 3.15 mm (round hole sieves)	weight% ar	EN15210-1	≤ 4 %	1% absolute	≤ 5 %	1% absolute	≤ 6 %	1% absolute
Durability	weight% ar	EN 15210	97,5-99%	0,5% absolute	97,0%-99%	0,5% absolute	96,5%-99%	0,5% absolute
Particle size distribution (square hole sieves)		EN15149-2						
% < 3.15 mm	weight %	EN 16126	>99%	1% absolute	>98%	1% absolute	>97%	1% absolute
% < 2.0 mm	weight %	EN 16126	>95%	2% absolute	>90%	2% absolute	>85%	2% absolute
% < 1.0 mm	weight %	EN 16126	>60%	5% absolute	>50%	5% absolute	>40%	5% absolute



TABLE 1 PFI Fuel Grade Requirements

	Residential/Commercial Densified Fuel Standards See Notes 1 - 3		
Fuel Property	PFI Premium	PFI Standard	PFI Utility
Normative Information - Mandatory			
Bulk Density, lb./cubic foot	40.0 - 46.0	38.0 - 46.0	38.0 - 46.0
Diameter, inches	0.230 - 0.285	0.230 - 0.285	0.230 - 0.285
Diameter, mm	5.84 - 7.25	5.84 - 7.25	5.84 - 7.25
Pellet Durability Index	≥ 96.5	≥ 95.0	≥ 95.0
Fines, % (at the mill gate)	≤ 0.50	≤ 1.0	≤ 1.0
Inorganic Ash, %	≤ 1.0	≤ 2.0	≤ 6.0
Length, % greater than 1.50 inches	≤ 1.0	≤ 1.0	≤ 1.0
Moisture, %	≤ 8.0	≤ 10.0	≤ 10.0
Chloride, ppm	≤ 300	≤ 300	≤ 300
Heating Value	NA	NA	NA
Informative Only - Not Mandatory			
Ash Fusion	NA	NA	NA

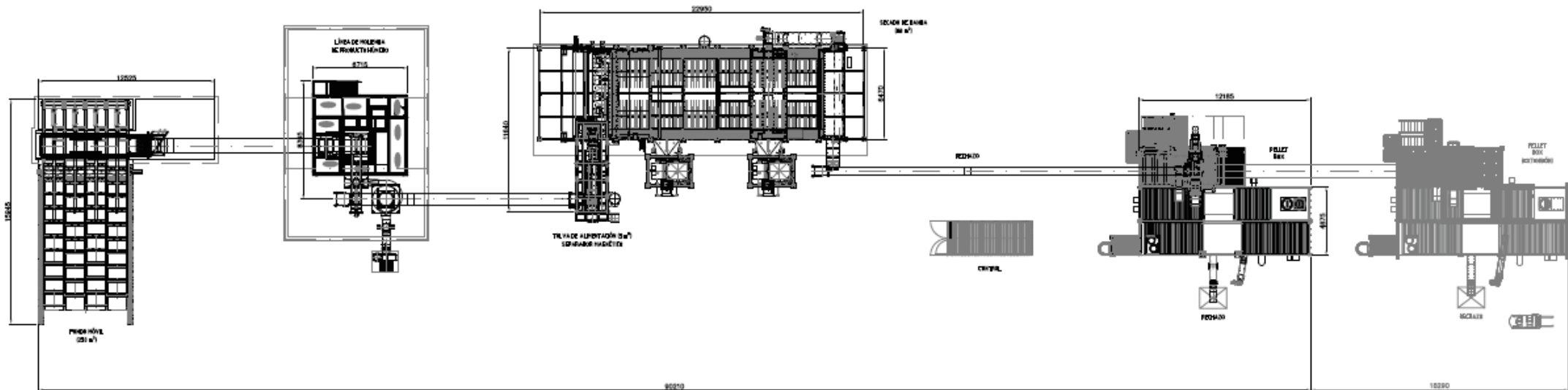




- Generally local markets, not export
 - For industrial applications
 - For heating appliances
- Logistics/economics to a port are normally difficult. Limits Exports
- Capacities below 2 mton/h → Generally very difficult feasibility
- Capacities in between 2 and 5 mton/h
- Capacities over 5 mton/h



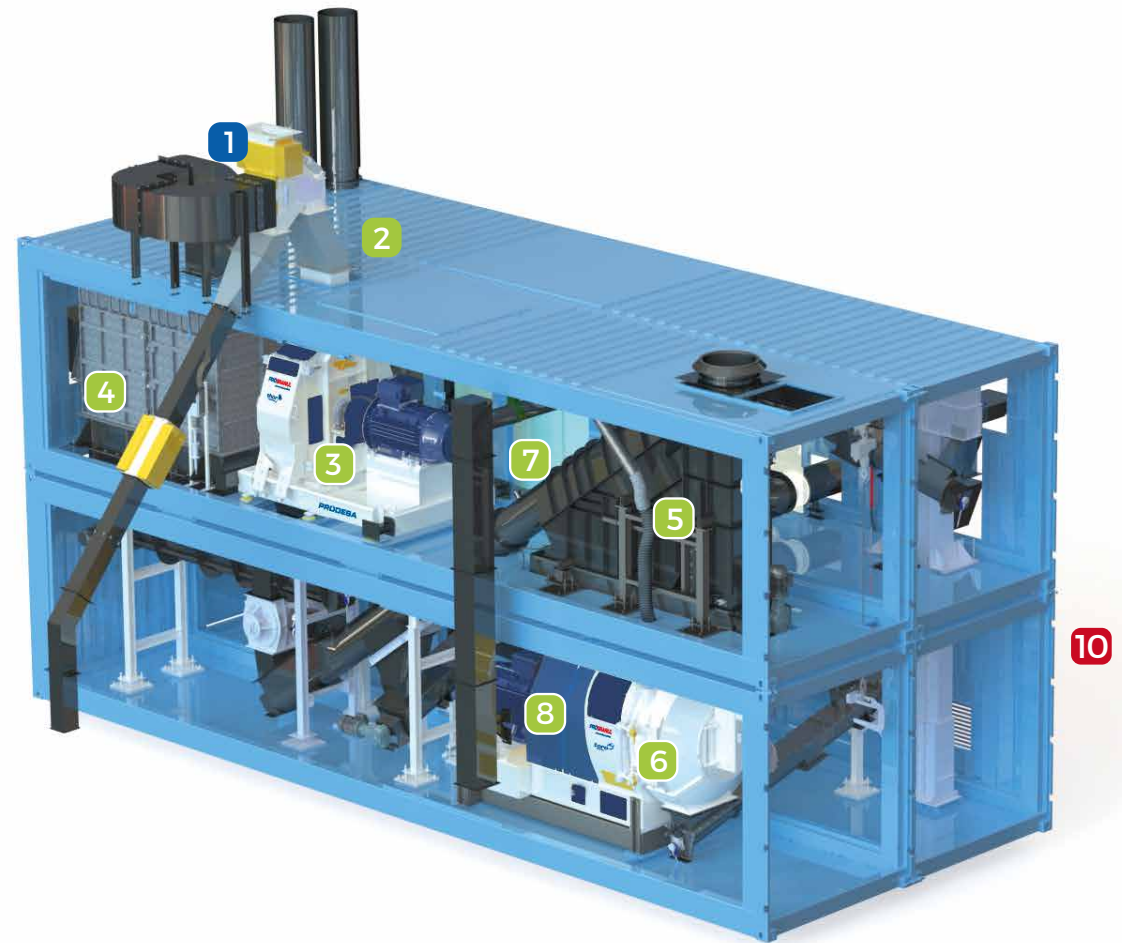
CAPACITIES IN BETWEEN 2 AND 10 mton/h



COMPACT

PelletBOX
by PRODESA

- 1** PRODUCT INLET
- 2** De-stoner
- 3** Hammer mill
- 4** Bag filter
- 5** Pellet mill feeding hopper
- 6** Pellet mill
- 7** Cooler
- 8** Pellet screen
- 9** MCCs and control room
(5th container)
- 10** PRODUCT OUTLET





BENEFITS

COMPACT

MODULAR

RELIABLE

ECONOMICAL

MOBILE

PRE-ASSEMBLED

OTHER BIOMASSES

PEANUT HULLS

- 25 mton/h plant
- Industrial pellets to be blended with Wood





OTHER BIOMASSES



- Agave bagasse, cereal straw, rice hulls, PKS, pomasse, etcetera



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PRÜDESA | **SMART
OPERATIONS**

PROGRANUL
Advanced Pelleting by **PRÜDESA**
▶ FRANCE

PROGRANUL
Advanced Pelleting by **PRÜDESA**

Avda. Diagonal Plaza • Edificio Plaza Center, 20 – 3º floor
50197 Zaragoza (Spain)
TEL. +34 976 459 459
prodesa@prodesa.net

5950 Parkway North Boulevard Cumming
GA 30040 USA
TEL. +1 770 559 5736
prodesa.na@prodesa.net

56 Route de Brezolles
28500 Vernouillet (France)
TEL. +33 (0) 2 37 46 93 30
prodesa.france@prodesa.net

8th floor, Anh Minh Building, No. 36 Hoang Cau, O Cho Dua
Ward, Dong Da District • Hanoi city (Vietnam)
TEL. +84 915 166 399
prodesa.asia@prodesa.net

Ilukstes iela 32-100,
Riga, LV-1082 (Latvia)
TEL. +34 976 459 459
prodesa.baltics@prodesa.net

Polígono Sarda Baja, Nave 28
50830 Villanueva de Gallego • Zaragoza (Spain)
TEL. +34 976 459 459
smart-operations@prodesa.net

56 Route de Brezolles
28500 Vernouillet (France)
TEL. +33 (0) 2 37 46 93 30
prodesa.france@prodesa.net

km.337, N-II
50172 Alfajarín • Zaragoza (Spain)
TEL. +34 976 459 459
progranul@progranul.net

   prodesa.net