

TERMS OF REFERENCE (TOR)

SUPPLY AND INSTALLATION OF A BRIQUETTING PLANT TO PREPARE, PROCESS AND CONDITION THE AGROFORESTRY RESIDUES AND OTHER RESIDUES OF AGRICULTURE AND FORESTRY ORIGIN

A. GLOSSARY OF TERMS

Biomass	Material that is derived from living, or recently living biological organisms. In the energy context it is often used to refer to plant material, however by-products and waste from livestock farming, food processing and preparation and domestic organic waste, can all form sources of biomass.
Brash	Low density forestry material consisting of tops of trees and small branches.
Briquette	A small block of wood used for fuel, not longer than 50cm. It is produced from a compacting or densification process to increase the low bulk density of biomass to high density (from 150-200 kg/m ³ to 900 to 1300 kg/m ³).
Energy Density	The amount of energy stored per unit volume (volume energy density) or mass (mass energy density) of a fuel.
ENplus	Certification program to secure the supply with standardised high-quality wood briquettes for end-users that can be fired in solid fuel ovens without disturbances and with low emissions, according to European Standard EN 14961-3.
LHV	Lower Heating Value (also known as Net Calorific Value is the amount of energy per mass unit of fuel that can be extracted from such fuel and transferred in a process of combustion. It is measured in kWh/kg or kcal/kg
MC	Moisture Content is the percentage of water in the weight composition of a solid biomass fuel

B. BRIQUETTING PLANTS

Biomass origin and storage

The composition of the biomass will be mainly:

Lot 1: Branches issued of the pruning of *Pinus pinea* 60%, round logs and branches from *Pinus brutia* 10%, round logs and branches from *Quercus calliprinos* (10%), branches issued from pruning of olive trees, apple trees and other (20%).

Lot 2: Round logs and branches from *Pinus brutia* 70%, round logs and branches from *Quercus calliprinos* (10%), branches issued from pruning of olive trees, apple trees and other (20%).

The biomass collect area will be no more than 10 km around the unit and conveyed to the unit and crushed in chips (10-40 mm) before stock.

Space availability

The chips for briquetting will be kept in the storage areas of a shed. The available surface areas for the briquetting plant unit are:

Areas	Max. Surface available (m ²)
1. Fresh wood (round logs, branches..) area	200
2. Wood Chips storage area (stockpiles)	1.400
3. Chipping, conveying, drying, briquetting, packaging area, offices, others area	1.500

Output

Each briquetting plant unit (each lot) shall transform around 500 tones of biomass/year.

The requirements for the product properties are taken from **EN 14961-3** and are further specified in terms of properties and the raw material.

The origin of raw material for the production of wood briquettes follows **EN 14961-3**, no chemically treated raw materials and no waste wood are allowed.

As a reference, the raw material for the production of wood briquettes will mainly be:

- Whole trees without roots
- Stemwood
- Logging residues
- Bark
- Chemically untreated wood residues

The minimum requirements for the essential quality parameters are:

Property	Unit	
Dimensions	mm	500 (maximum length)
Moisture	%	≤ 10
Ash	% ^{a)}	≤ 15
Particle density	g/cm ³	≥ 0,9
Additives	% ^{a)}	≤ 2
Calorific Value	MJ/kg (kWh/kg)	≥ 15,3 (≥ 4,25)
Nitrogen	% ^{a)}	≤ 0,5
Sulphur	% ^{a)}	≤ 0,04
Chlorine	% ^{a)}	≤ 0,03

Table 1. Specification of CEDRO Briquettes

Limit values for the content of trace element:

Property	Unit	
Arsenic	Mg/kg ^{a)}	≤ 1
Cadmium	Mg/kg ^{a)}	≤ 0,5
Chromium	Mg/kg ^{a)}	≤ 10
Copper	Mg/kg ^{a)}	≤ 10
Lead	Mg/kg ^{a)}	≤ 10
Mercury	Mg/kg ^{a)}	≤ 0,1
Nickel	Mg/kg ^{a)}	≤ 10
Zinc	Mg/kg ^{a)}	≤ 100

Table 2. Specification of trace elements

The produced briquettes shall be conveniently packaged in sacks or equivalent packaging not exceeding 25kg. Packaging material shall be sealed, water proof, and enable long term outdoor/indoor storage. The process and all material requirements for packaging should be delivered in this tender, for 1 seasons' expected packaging needs. Details and recommendations for future season's packaging process is to be delivered by the Contractor to the beneficiaries.

COMPONENTS

Data Sheets

Although the briquetting plants may be considered one functional unit that has to provide the final service requirements they consist of several interconnected components. Bidders are requested to provide details and data sheets that clearly show the specifications of the components to be supplied. The UNDP will consider only high-quality briquetting machines.

Components

The machinery shall be composed by the following equipment (all equipment shall have the CE marking (Conformité Européenne):

- Crusher to convert branches and logs into chips (10-40 mm)
 - a. Wood Grinder Crusher with integrated Diesel generator set
 - b. Chipper Capacity : 6"diameter/200mm
 - c. Rotor Size : 500-700mm
 - d. Chip Size : 10-40mm
 - e. Feed Hopper inner Opening : 200x220mm
 - f. Feeding system : Hydraulic feeding
 - g. Dimensions(Hopper discharge) : 130 x140 x 110mm
 - h. Discharge Hood Height : 1800 mm
 - i. Rated Rev. : 1080-1280rpm
 - j. Working efficiency : 4-15 m³/h
 - k. Engine : 18-30hp
- Inclined screw, elevator or conveyor to Convey materials to screen machine
 - a. Belt Conveyor
 - b. Capacity: Min 500t/h
 - c. Rotate speed: 22r per minute
 - d. Motor: 1.1 kW, 380V, 50HZ
- Vibrating screen: a screen or simple mesh should be fitted over the hammer mill to trap any foreign matter such as over size residues, stones or metals.
 - a. Power: 0.75kW
 - b. Output: 1000-2000kg/h
- Hammer mill: to reduce the particle size to 3-5 mm.
 - a. Hammer mill,
 - b. Capacity: 200-500 kg/h
 - c. Size of feeding material: less than 30mm
 - d. Final size after milling: Ø3-5×3-5mm
 - e. Motor: 18-22 kW
- Screw conveyor: to convey wood particles to dryer
 - a. Capacity: 0.5-1.5t/h
 - b. Rotate speed: 32r/min
 - c. Power: 1.5 kW, 380V/50HZ/3Phase
 - d. Speed reducer: 1:10

- **Dryer:** to control the moisture content of the raw material below 12%
 - a. Drying efficiency: expected moisture of raw material is between 20%-50%
 - b. Capacity: 0.6ton-0.8ton/h (after drying)
 - c. Fuel consumption: local biomass waste (up to 50kg/h)

 - **Intermediate storage bin:** the raw material can be held in a storage bin after leaving the dryer. At least 4 hours of production capacity should be held in storage in case of a short breakdown.
 - a. Metallic Silo with 2 m³

 - **Main feed screw:** this screw distributes the material in the storage bin to the machines. The supply should be at least 15% greater than production to ensure that none of the machines are starved of material.
 - a. Screw conveyor : to convey wood particles to dryer
 - b. Capacity: 1.5-2t/h
 - c. Rotate speed: 32r/min
 - d. Power: 1.5 kW, 380V/50HZ/3Phase
 - e. Speed reducer: 1:10

 - **Return feed:** the excess material not required by the machines is returned to the Intermediate storage bin.
 - a. Belt Conveyor
 - b. Capacity: 0.5-1.5t/h
 - c. Rotate speed: 22r per minute
 - d. Motor: 1.1 kW, 380V, 50HZ

 - **Briquetting machine:** to produce briquettes with sizes around 50-60 mm diameter and 300-400 mm in length.
 - a. Capacity: 250-600kg/h
 - b. Motor: 18.5 kW, 380V, 50HZ
 - c. Power of heater: 2.2 kW*2
 - d. Density of briquettes: 1.3 g/cm³
- Heating temperature: 280-350degree
- e. Size of final product: 50*50*500mm

Electric power availability

The power supply in 3-phase, 380V 50Hz, for the motors considered in the components described will be available at the site.