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Erasmus+

Forestal del Maestrazgo

Process of biomass to the final consumer

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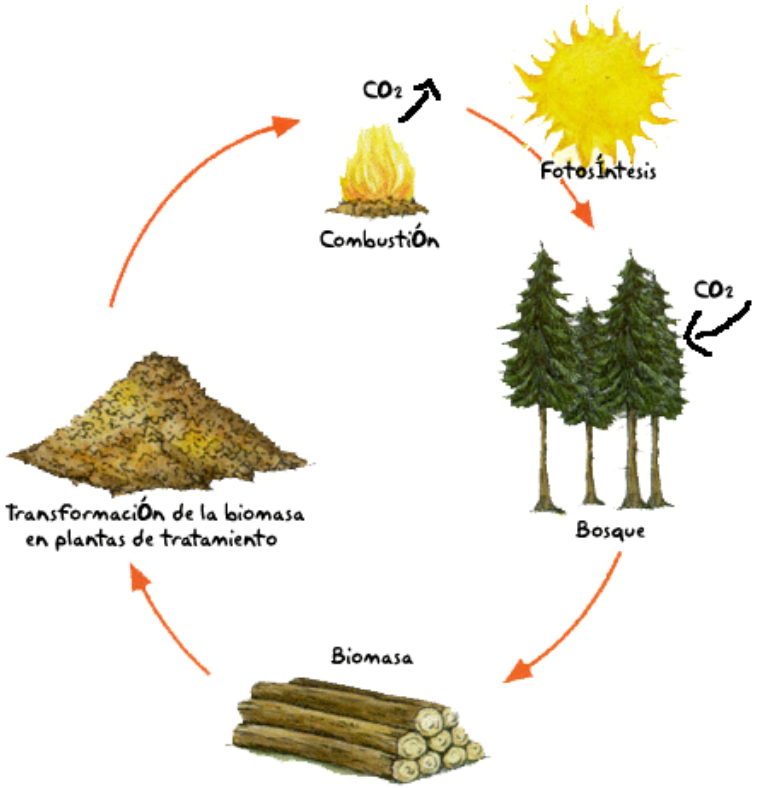
I FIRA ENERGIES RENOVABLES ATZENETA

31th October 2015

Forestal del Maestrazgo

Forestal del Maestrazgo

- Biomass cycle



Forestal del Maestrazgo

- Forestry Sector

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Forestal del Maestrazgo

- Forestry sector
- Forestry forwarder

Forestal del Maestrazgo

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- Forestry sector

Forestal del Maestrazgo

- Forestry sector
  - Biomass

Forestal del Maestrazgo

- Forestry sector
  - Biomass

Forestal del Maestrazgo

- Biomass
  - Wood chip classification plant

Forestal del Maestrazgo

- Biomass
  - Wood chip classification plant
  - Wood chip G50

Forestal del Maestrazgo

- Biomass
  - Wood chip classification plant
  - Wood chip G30

Forestal del Maestrazgo

- Possible wood chip transportation

Forestal del Maestrazgo

- Possible wood chip transportation

Forestal del Maestrazgo

- Possible wood chip transportation

Forestal del Maestrazgo

- Possible wood chip transportation

Forestal del Maestrazgo

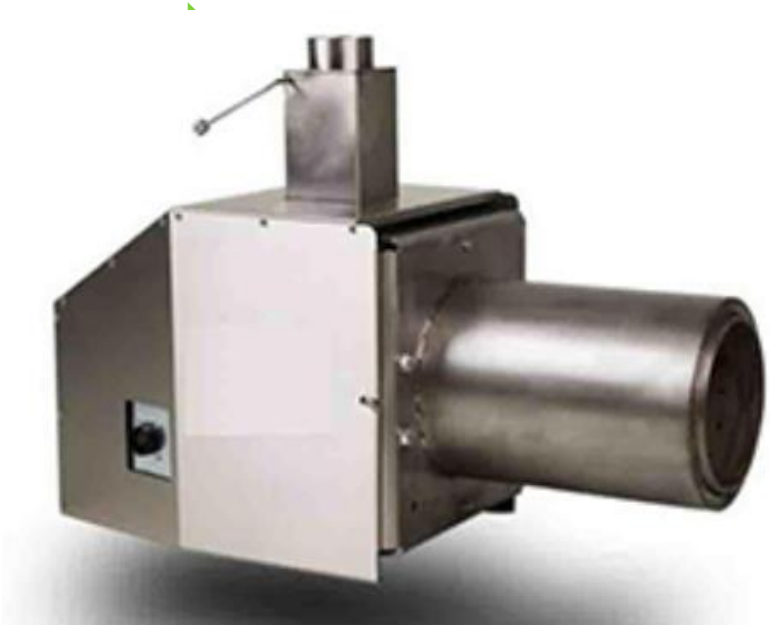
- Biomass Installations
  - Pellet stoves

- Power between 6 and 15 kW
- Municipal Offices
- Meeting acts of medium size
- Houses up to 140 m^2

Location: Forestal de Maestrazgo Offices

Forestal del Maestrazgo

- Biomass Installations
  - Pellet burner



Biomass burner

Replacing fossil fuel boiler
(Coal, oil, propane)

Depending on the boiler type and exhaust gas chimney, a force ventilation must be placed

Not every boiler admits a biomass burner

Forestal del Maestrazgo

- Biomass Installations
  - Pellet burner
  - example:
  - Pellet Burner Sanctuary of “la Balma” (Zorita del Maestrazgo).
  - Fuel substituted propane.
  - Installed power 150 kW.
  - Manual cleaning of the combustion chamber
  - Savings achieved about 50%.

Forestal del Maestrazgo

- Biomass Installations
  - Pellet boiler

- Replacing other boilers or new facilities
- Confined Space
- Automatic cleaning
- Control up to 4 hydraulic circuits
- Recommended for medium or low potencies
- Family houses mainly

Forestal del Maestrazgo

- Biomass Installations
  - Pellet boiler
    - Example:
      - Replacing diesel boilers Hostal Casa Baltasar (Zorita del Maestrazgo) – Bar-restaurant 200 m^2, 16 double rooms
      - Replacing old boilers of 69 kW and 34kW
      - Boiler trademark Hargassner Classic 60kW model
      - 1000 l buffer tank with instant ACS
      - Estimated savings approx. 50%

Forestal del Maestrazgo

- Biomass Installations
  - Wood Chip boiler
  -

- Replacing conventional boiler and new facilities
- Required storaging space for wood chips
- Savings up to 70% compared to fossil fuels
- Higher initial investment

Forestal del Maestrazgo

- Biomass Installations
  - Wood Chip boiler
    - Example: Replacing diesel boilers by wood chip boiler
    - Hostal El Guerrer / City Hall (Todolella)

Forestal del Maestrazgo

- Biomass Installations
  - Wood Chip boiler
    - Example: Replacing diesel boilers by wood chip boiler
    - Hostal El Guerrer / City Hall (Todolella)

- Replace of 2 gasoil boilers of 150 and 50 kW
- 85% Efficiency

- Roca wood chip boiler power 150 kW
- 90% Efficiency

Forestal del Maestrazgo

- Biomass Installations
  - Wood Chip boiler
    - Example: Replacing diesel boilers by wood chip boiler
    - Hostal El Guerrer / City Hall (Todolella)

- Automatic cleaning of the ash
- Flame backflow preventer
- Estimated investment
  - 50.000€

Forestal del Maestrazgo

- Biomass Installations
  - Wood Chip boiler
    - Example: Replacing diesel boilers by wood chip boiler
    - Hostal El Guerrer / City Hall (Todolella)
    - Location of a nearby silo of approx. 30 m^3
    - Wood chip supply with a truck with pneumatic cuba

Forestal del Maestrazgo

- Biomass Installations
  - Wood Chip boiler
    - Economic feasibility study

REQUIRED GASOIL CONSUMPTION

Consumo gasóleo (litros):	15.000	litros/año
PCI gasóleo:	10,24	kWh/litros
Consumo gasóelo (kWh):	153.600	kWh/año
Rendimiento caldera gasóleo:	85%	
Energía cedida a la instalación:	130.560	kWh/año

REQUIRED CHIP CONSUMPTION

Consumo astilla (kg):	**41.448**	**kg/año**
PCI astilla:	3,50	kWh/kg
Consumo combustible (kWh):	145.067	kWh/año
Rendimiento caldera astilla:	90%	
Energía necesaria:	130.560	kWh/año

GASOIL CONSUMPTION & COSTS

Consumo de gasóleo:	15.000	litros/año
Coste del gasóleo:	0,84	€/litro
Coste anual de gasóleo:	**12.600**	**€**

CHIP CONSUMPTION & COSTS

Consumo estimado de astilla:	41.448	kg/año
Coste de la astilla:	0,100	€/kg
Coste anual del astilla:	**4.145**	**€**

Forestal del Maestrazgo

- Biomass Installations
  - Wood Chip boiler
    - Economic Feasibility study
    - Annual increase of 3%

	Año 1	Año 2	Año 3	Año 4	Año 5	Año 6	Año 7	Año 8	Año 9	Año 10	Ahorro total
Coste Gasóleo (€)	12.600	12.978	13.367	13.768	14.181	14.607	15.045	15.496	15.961	16.440	
Coste Astilla(€)	4.145	4.269	4.397	4.529	4.665	4.805	4.949	5.098	5.250	5.408	
Ahorro astilla vs Gasóleo (€)	8.455	8.709	8.970	9.239	9.516	9.802	10.096	10.399	10.711	11.032	96.930 €

- Estimated investment € 50,000
- Payback period 5.5 years
- Possible Subventions not included

Forestal del Maestrazgo

- Wood chip burner in Morella
- Starting Facts
- Pig farm
- Number of mothers: 100
- Old coal boiler
- Annual consumption 10 tons approx.

Forestal del Maestrazgo

- Wood chip burner in Morella
- Insatisfaction with present installation:
  - Manual loading of the combustion chamber
  - Danger of overheating of the boiler
  - Great GHG emissions to the atmosphere
  - Controversy with coal combustion in boilers.
  - *RITE "the use of solid fossil fuels in heating systems of the buildings in the scope of this regulation from January 1, 2012 shall be prohibited."*

Forestal del Maestrazgo

- Wood chip burner in Morella
- Previous installation.

Forestal del Maestrazgo

- Wood chip burner in Morella
- Pellet burner installation.
  - Adapting the boiler door.

Forestal del Maestrazgo

- Wood chip burner in Morella
- Pellet burner installation.
  - Placing the burner

Forestal del Maestrazgo

- Wood chip burner in Morella
- Pellet burner installation.
  - Placing storage.

Forestal del Maestrazgo

- Wood chip burner in Morella
- Pellet burner installation.
  - Starting up.

Forestal del Maestrazgo

- Wood chip burner in Morella
- Pellet burner installation.
  - Starting up.

Forestal del Maestrazgo

- Wood chip burner in Morella
- Pellet burner installation.
  - consumption
  - 90 kg / day of pellet
  - € 0.24 / kg
  - 21 € / day
  - Approximately operating 180 days year
  - € 3,780 / year

Forestal del Maestrazgo

- Wood chip burner in Morella
- Pellet burner installation.

REQUIRED COAL CONSUMPTION

Consumo carbón:	9.800	kg/año
PCI carbón:	8,00	kWh/kg
Consumo carbón (kWh):	78.400	kWh/año
Rendimiento caldera gasóleo:	85%	
Energía cedida a la instalación:	66.640	kWh/año

REQUIRED PELLET CONSUMPTION

Energía necesaria:	66.640	kWh/año
PCI pellets:	5,00	kWh/kg
Consumo combustible (kWh):	78.400	kWh/año
Rendimiento caldera pellets:	85%	
Consumo pellets (kg):	**15.680**	**kg/año**

COAL CONSUMPTION & COSTS

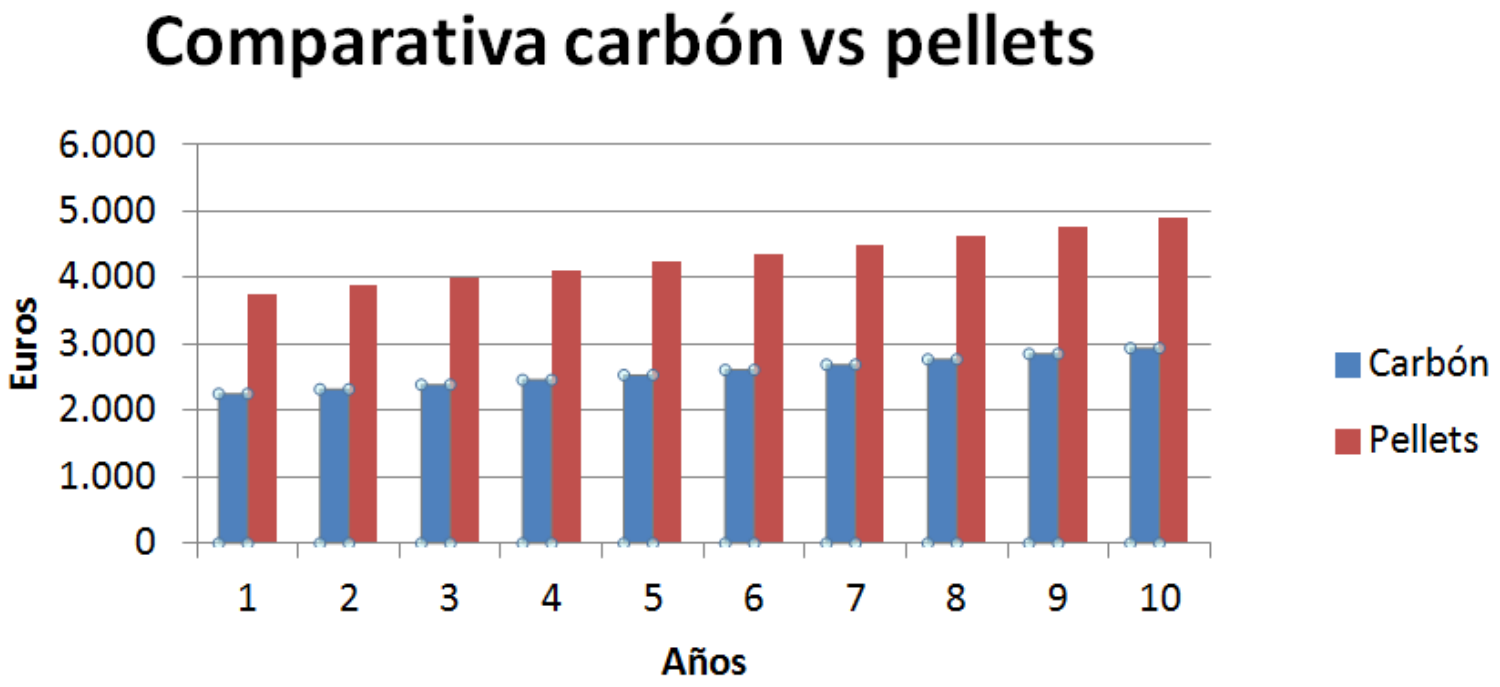
Consumo de carbón:	9.800	Kg/año
Coste del carbón:	0,23	€/kg
Coste anual de carbón:	2.254	€

PELLETCONSUMPTION & COSTS

Consumo estimado de pellet:	15.680	kg/año
Coste de los pellets:	0,24	€/kg
Coste anual de los pellets:	3.763	€

Forestal del Maestrazgo

- Wood chip burner in Morella
- Pellet burner installation.
  - Evolution of coal /pellet costs



Forestal del Maestrazgo

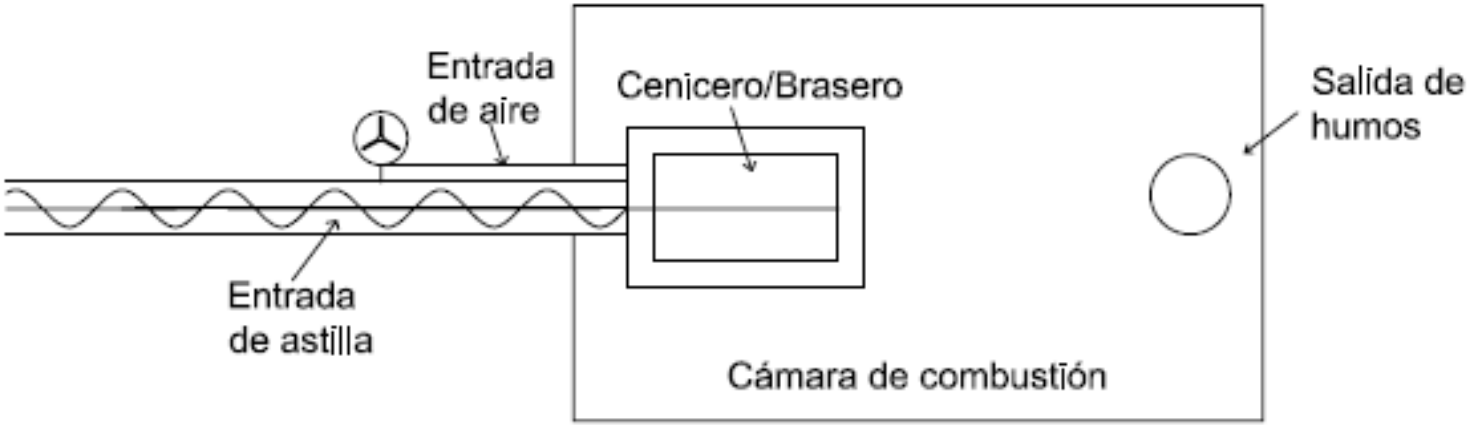
- Wood chip burner in Morella
- Installation wood chip burner.

Forestal del Maestrazgo

- Wood chip burner in Morella
- **Installation chip burner.**
  - Prototype

Forestal del Maestrazgo

- Wood chip burner in Morella
- Installation chip burner.
  - Current Installation



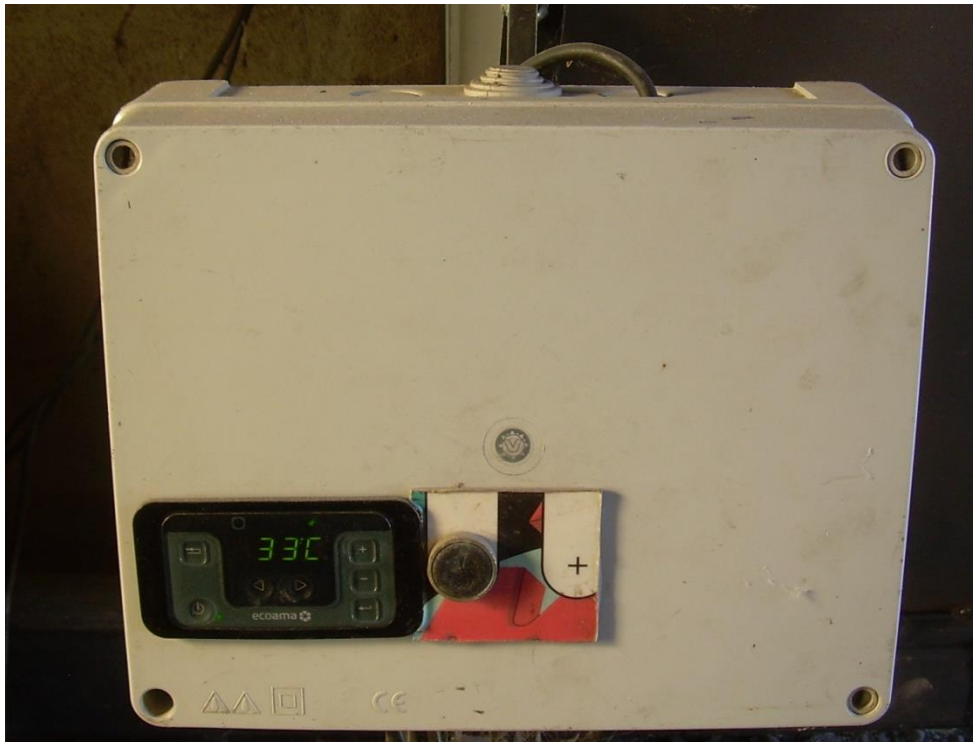
Forestal del Maestrazgo

- Wood chip burner in Morella
- Installation chip burner.Installation:

  Current installation

Forestal del Maestrazgo

- Wood chip burner in Morella
- Installation chip burner.
  - Current installation



Forestal del Maestrazgo

- Wood chip burner in Morella
- Installation chip burner.
  - Current installation

Forestal del Maestrazgo

- Wood chip burner in Morella
- Installation chip burner.
  - Current installation
  - Amount of fuel

Forestal del Maestrazgo

- Wood chip burner in Morella
- Installation chip burner.
  - Current installation
  - Combustion control

Forestal del Maestrazgo

- Wood chip burner in Morella
- Installation chip burner.
  - Current installation
  - Combustion control

Forestal del Maestrazgo

- Wood chip burner in Morella
- Installation chip burner.

REQUIRED COAL CONSUMPTION

Consumo carbón:	9.800	kg/año
PCI carbón:	8,00	kWh/kg
Consumo carbón (kWh):	**78.400**	**kWh/año**
Rendimiento caldera carbón:	85%	
Energía cedida a la instalación:	66.640	kWh/año

REQUIRED CHIP CONSUMPTION

Consumo astilla (kg):	**22.400**	**kg/año**
PCI astilla:	3,50	kWh/kg
Consumo combustible (kWh):	78.400	kWh/año
Rendimiento caldera astilla:	85%	
Energía necesaria:	66.640	kWh/año

COAL CONSUMPTION & COSTS

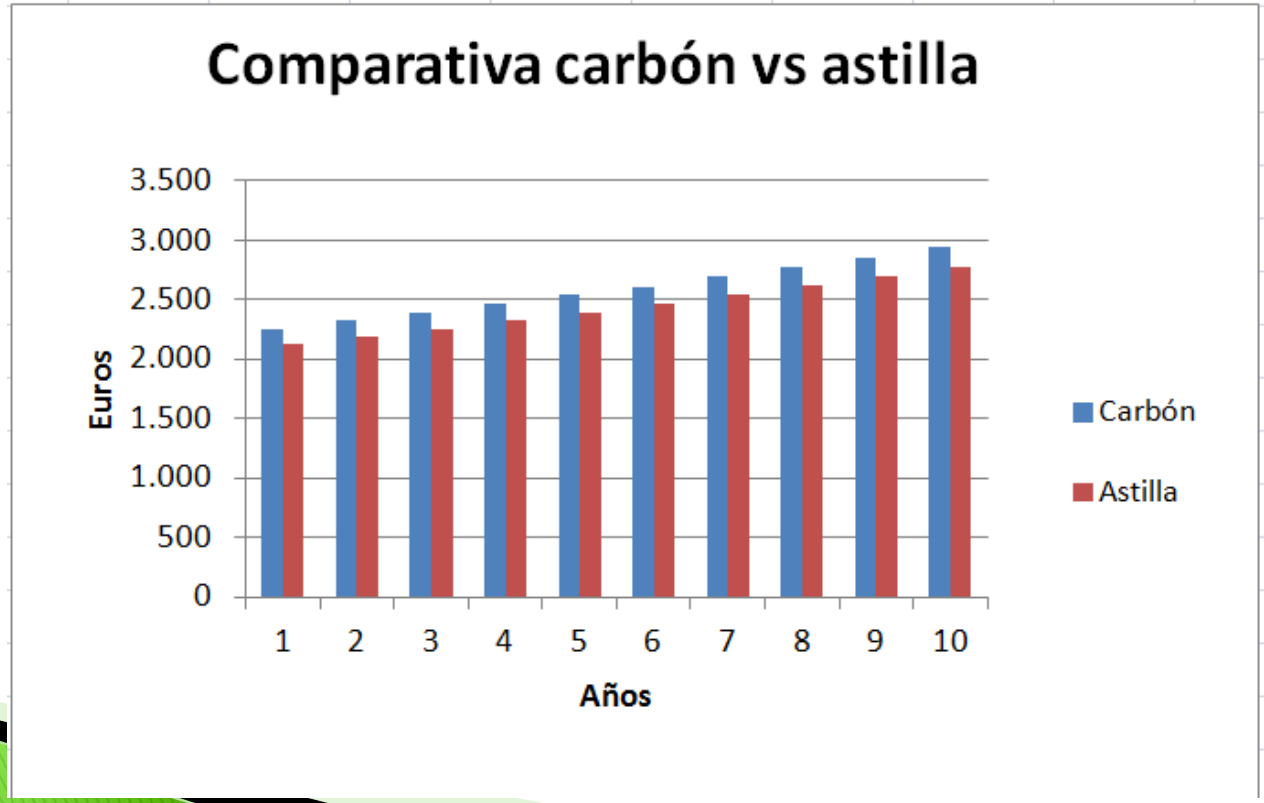
Consumo de carbón:	9.800	kg/año
Coste del carbón:	0,23	€/kg
Coste anual de carbón:	2.254	€

CHIP CONSUMPTION & COSTS

Consumo estimado de astilla:	22.400	kg/año
Coste de la astilla:	0,095	€/kg
Coste anual del astilla:	2.128	€

Forestal del Maestrazgo

- Wood chip burner in Morella
- Installation chip burner.
  - Evolution of coal /wood chip costs



Forestal del Maestrazgo

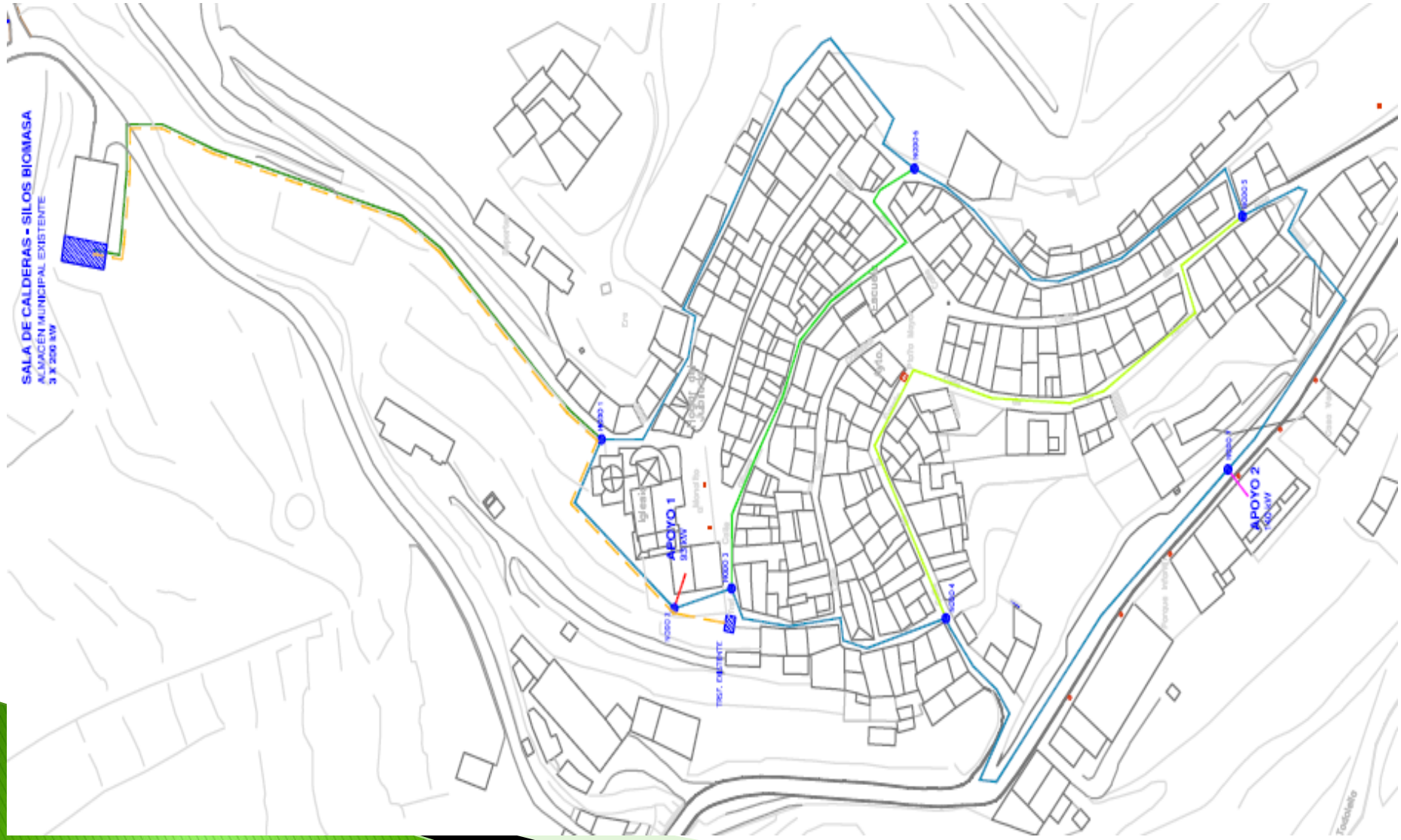
- Current situation in Valencian Region
- Difficulties from the authorities for forest harvesting
- Grants for extraction of fire biomass
- No promoting the consumption of biomass locally
  - New livestock facilities prefer GLP

Conclusions

- Reduction of GHG emissions
- Cost savings up to 70%
- Increased need for spaces
- Sustainable, local and economic energy

District Heating in Todolella Municipality (Castellón)

Descripción del proyecto



Project Description

- Biomass boiler => 800 kW
- 1000 meters of pre-insulated pipe distribution
- 55 points of consumption
  - power stations with production of hot water and heating

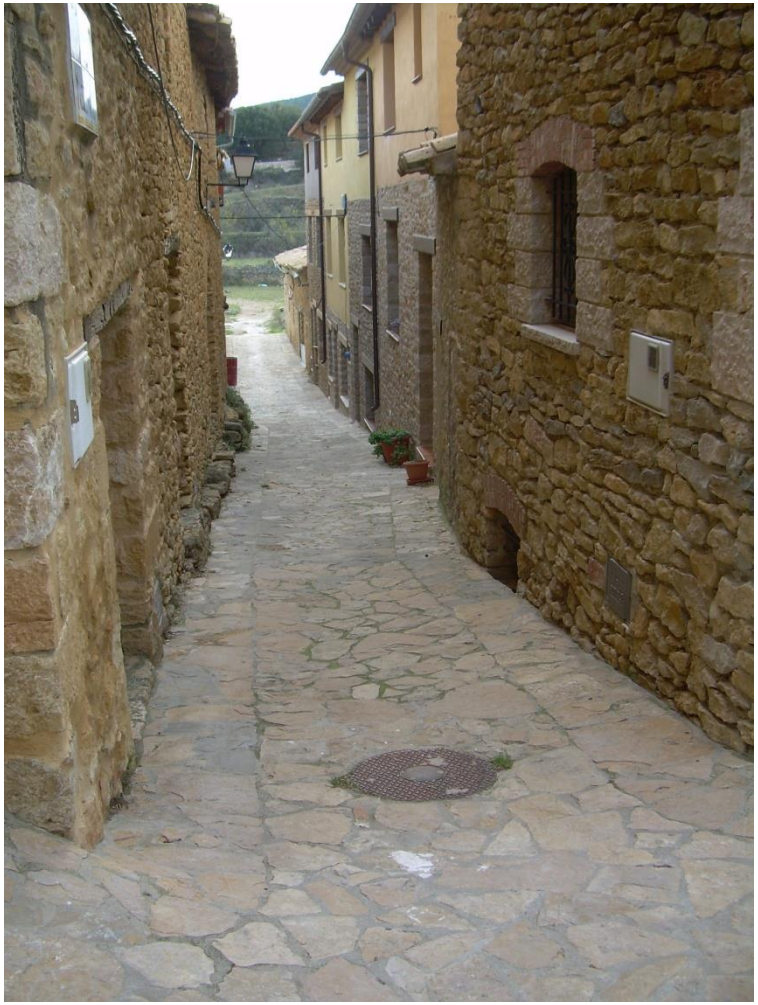
1ª Phase District Heating Todolella

1ª Phase District Heating Todolella

- Installation 102 m of pre-insulated pipes
- 12 points of consumption
- 11 power stations
- 1 purge point

1ª Phase District Heating Todolella

- Initial state
  - very narrow street
  - Slab paving



1ª Phase District Heating Todolella

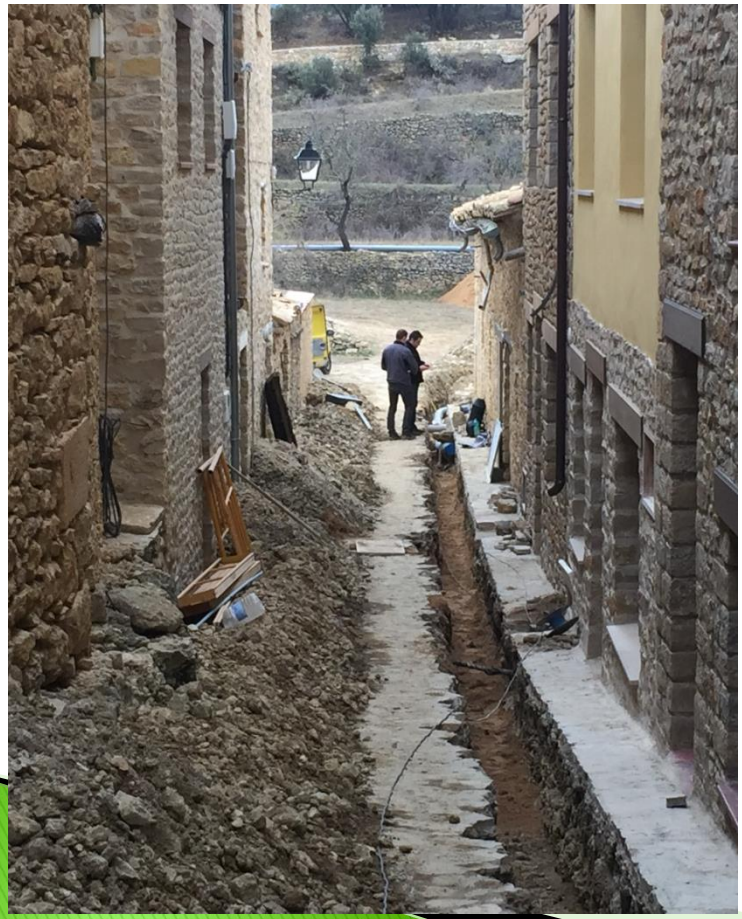
- Initial state
  - very narrow street
  - Slab paving

1ª Phase District Heating Todolella

- Excavation
  - 80 cm deep

1ª Phase District Heating Todolella

- Excavation



1ª Phase District Heating Todolella

- Sand deposit at the bottom of the pipe

1ª Phase District Heating Todolella

- General pre-insulated pipe placement
  - TrademarkREHAU
  - Model RAUTHERMEX DUO 75/ 202 SDR11
  - Polyurethane foam insulation (CFCs free)

1ª Phase District Heating Todolella

- General pre-insulated pipe placement

1ª Phase District Heating Todolella

- Making connections
  - Access point of consumption
  - Pre-insulated pipe installation
    - Trademark REHAU
    - RAUVITHERM DUO SDR11 32+32/150
    - Inner tube PE-Xa

1ª Phase District Heating Todolella

- Making connections

1ª Phase District Heating Todolella

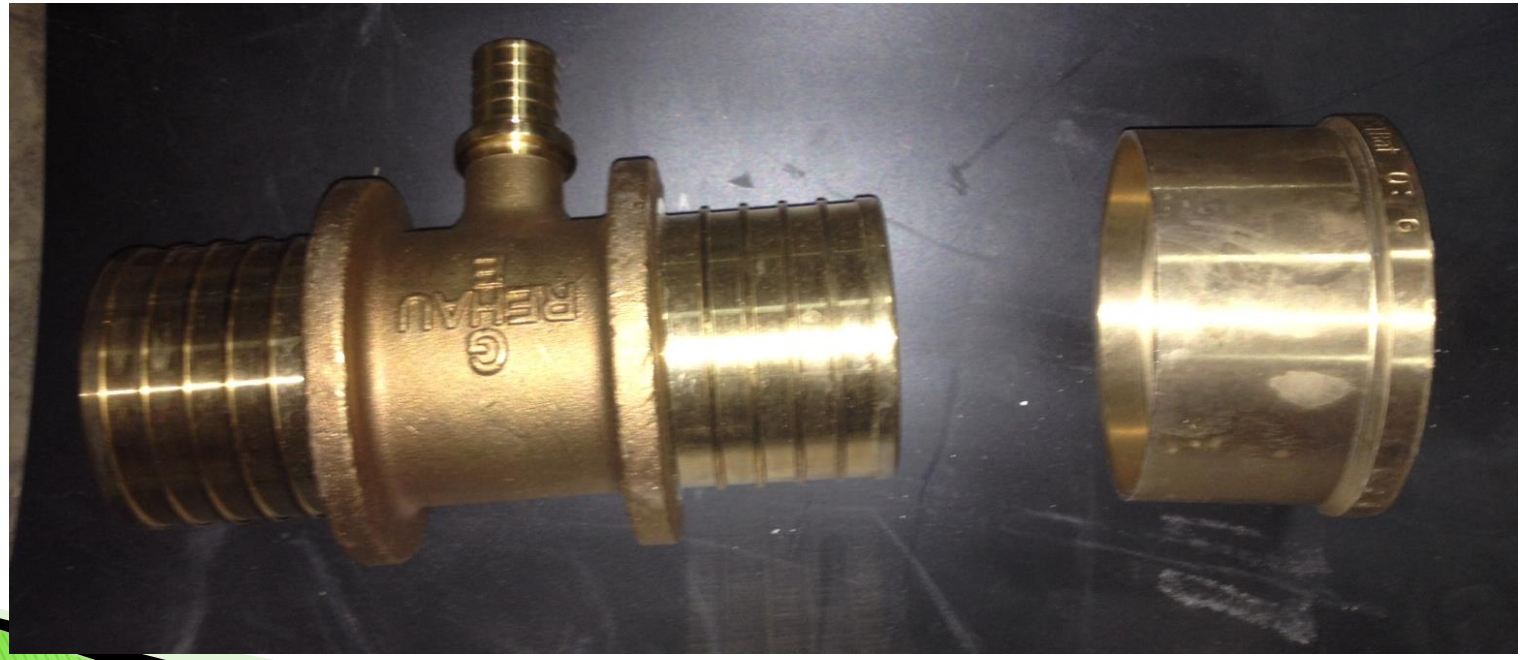
- Making connections

1ª Phase District Heating Todolella

- Making connections
  - Tools

1ª Phase District Heating Todolella

- Making connections
  - Binding accessories



1ª Phase District Heating Todolella

- Making connections
  - Binding accessories

1ª Phase District Heating Todolella

- Making connections

1ª Phase District Heating Todolella

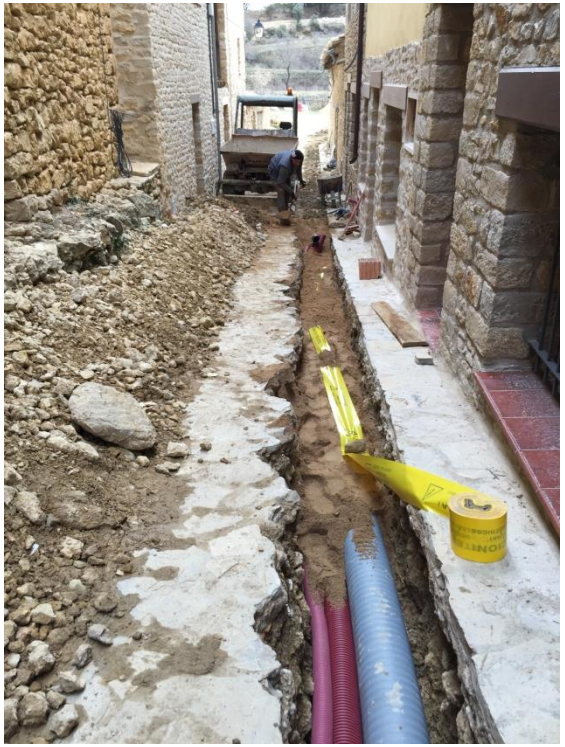
- Power station

1ª Phase District Heating Todolella

- Corrugated tube placement
  - Connection M-bus

1ª Phase District Heating Todolella

- Backfilling



1ª Phase District Heating Todolella

- Backfilling

1ª Phase District Heating Todolella

- Slab Paving

1ª Phase District Heating Todolella

- Slab Paving

District Heating Todolella

- PRESENT STATE
- Phase 1 (Installed)
  - 102m pre-insulated pipes (75mm)
  - 12 points of consumption
  - 1 purge point.
- Phase 2 (currently being installed)
  - Biomass boiler 200 kW
  - 170m pre-insulated pipes (110mm)
  - 94m pre-insulated pipes (75mm)
  - 5 points of consumption.
  - Support of 93kW
- Phase 3 (currently being installed)
  - 110m pre-insulated pipes (75mm)
  - 8 points of consumption.

District Heating Todolella

- Advantages
  - Centralized installation.
  - Less maintenance cost.
  - Higher performance of boilers.
  - Lower installed power.
  - Lower consumption.
  - Shorter repayment of the facility.
  - Lower fuel costs.