

# COMPARATIVE STUDY BETWEEN THE USE OF DISTRICT HEATING AND INDIVIDUAL HEATING SYSTEMS, BASED ON BIOMASS, IN AN INLAND RURAL TOWN OF THE PROVINCE OF CASTELLÓN

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# INTRODUCTION

Local government  
of Vistabella del  
Maestrazgo

**Case of success: Serra**

Forestry Waste  
Management

**BIOMASS HEATING SYSTEMS**

# BIOMASS HEATING SYSTEMS

Installations:

- Residential applications
- Industrial applications
- District heating



# DESCRIPTION OF THE INSTALLATION



# DESCRIPTION OF THE INSTALLATION



# ENERGY DEMAND

- No energy consumption information
- Study of the building enclosures, windows and doors
- Natural ventilation



## School's building

Thermal power loss	Power (W)
Building enclosure	28,534.19
Windows and doors	10,456.50
Ventilation	18,259.96
<b>TOTAL</b>	<b>57,250.64</b>

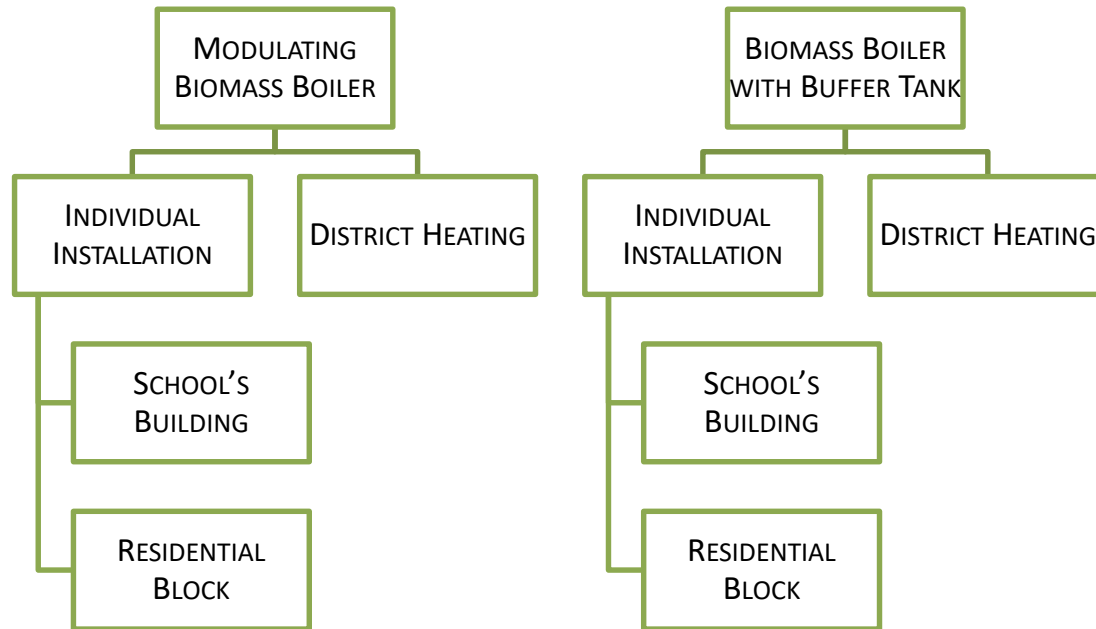
$$E = 34,914.99 \text{ kWh/year}$$

## Residential block

Thermal power loss	Power (W)
Building enclosure	12,992.97
Windows and doors	9,040.77
Ventilation	3,886.80
<b>TOTAL</b>	<b>25,920.54</b>

$$E = 38,935.33 \text{ kWh/year}$$

# BIOMASS BOILER



TYOLOGY AND QUALITY OF THE FUEL  
HIGH EFFICIENCY AND LOW EMISSIONS  
HIGH AUTOMATIZATION LEVEL

MODULAR SYSTEMS  
DISTRIBUTOR'S AVAILABILITY  
COST OF THE SYSTEM AND GRANTS

# MODULATING BIOMASS BOILERS

## ➤ School's building:

BIOCALORA KP62 + 100 L  
HOPPER + FEED AUGER

## ➤ Residential block:

BIOCALORA KP22 + 100 L  
HOPPER + FEED AUGER



Producer/Model	Max Power [kW]	Min Power [kW]	Efficiency [%]	Fuel	Cleaning	Cost [€]
Biocalora/KP62	61	18.3	91.2	Pellet – Olive Stone	Automatic	11,053 €
Biocalora/KP22	28.5	8.55	90.9	Pellet – Olive Stone	Automatic	9,063 €



# MODULATING BIOMASS BOILERS

➤ District heating:

2 x FROLING P4 48



Producer/Model	Max Power [kW]	Min Power [kW]	Efficiency [%]	Fuel	Cleaning	Cost [€]
2 x Froling/P4 48	96	14.4	85.4	Pellet	Automatic	30,433 €

# BIOMASS BOILERS WITH BUFFER TANK

## ➤ School's building:

BIOCALORA SERIE 2000 B-ESSENTIAL  
50 kW + 1000 L BUFFER TANK

## ➤ Residential block:

BIOCALORA SERIE 2000 B-HOME  
25 kW + 700 L BUFFER TANK



Producer/Model	Max Power [kW]	Min Power [kW]	Efficiency [%]	Fuel	Cleaning	Cost [€]
Biocalora/S2000 Basic B-Essential 50 kW	50	25	90.1	Pellet	Semiautomatic	5,289 €
Biocalora/S2000 Basic B-Home 25 kW	25	12	90	Pellet	Semiautomatic	4,313 €

# BIOMASS BOILERS WITH BUFFER TANK

➤ District heating:

BIOCALORA KP82 +  
700 L HOPPER + FEED  
AUGER + 2200 L BUFFER  
TANK



Producer/Model	Max Power [kW]	Min Power [kW]	Efficiency [%]	Fuel	Cleaning	Cost [€]
Biocalora/KP 82	80	24	90.1	Pellet – Olive Stone	Automatic	14,347 €

# COMPARISON

- Buffer tanks are always recommendable
- Less power = less cost
- Quicker start with buffer tanks



**IT'S BETTER  
TO USE  
BUFFER  
TANKS**

Alternatives	Individual installation	Centralized installation
Modular boiler	20,116 €	30,433 €
Boiler with buffer tank	11,009 €	15,762 €

# OTHER EQUIPMENT

➤ Storage systems:



Volume school's silo	6 m <sup>3</sup>
Volume residential block's silo	5.1 m <sup>3</sup>
Volume district heating silo	7.1 m <sup>3</sup>

➤ Heat exchanger:



Power school's exchanger	60 kW
Power residential block's exchanger	30 kW
Power district heating exchanger	80 kW

# OTHER EQUIPMENT

## ➤ Conduction systems:

- Copper pipes: diameter in function of pressure losses.
- Expansion vessels:
  - School = 150 liters
  - Residential Block = 80 liters
  - Both = 220 liters
- Radiators of cast iron: 5, 10 and 15 elements.
- Pumps:
  - Before/after heat exchanger.
  - One for every installation.

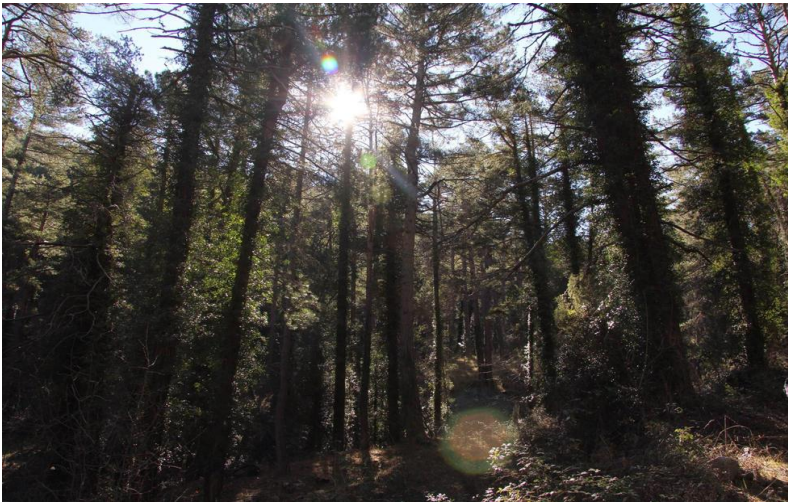


# ENVIRONMENTAL IMPACT

FORESTRY WASTE  
MANAGEMENT



IMPROVEMENT OF FOREST ECOSYSTEM  
CREATION OF A MYCOLOGICAL RESERVE  
PRODUCTION OF BIOMASS FOR SELF-CONSUMPTION  
FIRE PREVENTION

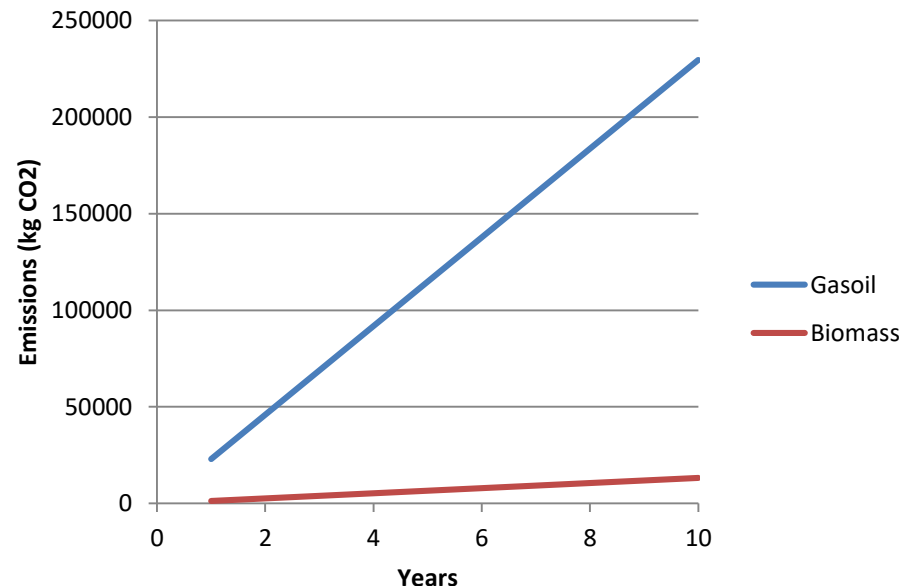


# ENVIRONMENTAL IMPACT

- Noise impact:
  - Anti-vibration feets
  - Noise audit

- Air pollution and greenhouse gas emissions:

- Gasoil:  
22,967.45 kgCO<sub>2</sub>/year
- Pellet:  
1,329.31 kgCO<sub>2</sub>/year





# SOCIAL AND RURAL DEVELOPMENT

- Energy security:
  - Energy independence
  - Fight against energy poverty
  
- Economic development:
  - Economical saves
  - New jobs (direct and indirect)
  
- Reversing rural exodus:
  - Attraction of new young families
  - Better quality of life
  - Creation of social spaces
  - Ecotourism

# ECONOMICAL ANALYSIS

## Individual installations

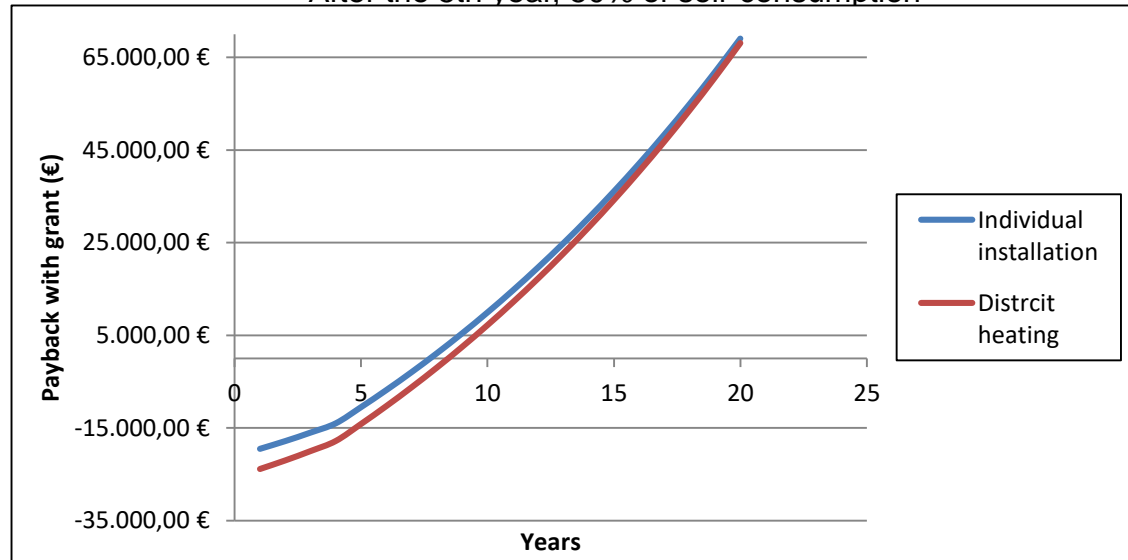
TOTAL SCHOOL'S INSTALLATION	12.108,05 €
TOTAL RESIDENTIAL BLOCK	14.429,68 €
<b>MATERIAL EXECUTION BUDGET</b>	<b>26.537,73 €</b>
13% OF GENERAL EXPENSES	3.449,90 €
6% OF INDUSTRIAL BENEFITS	1.592,26 €
SUBTOTAL	31.579,90 €
21% IVA	6.631,78 €
<b>TOTAL BUDGET</b>	<b>38.211,68 €</b>

## District heating

TOTAL DISTRICT HEATING	32.295,74 €
<b>MATERIAL EXECUTION BUDGET</b>	<b>32.295,74 €</b>
13% OF GENERAL EXPENSES	4.198,45 €
6% OF INDUSTRIAL BENEFITS	1.937,74 €
SUBTOTAL	38.431,92 €
21% IVA	8.070,70 €
<b>TOTAL BUDGET</b>	<b>46.502,63 €</b>

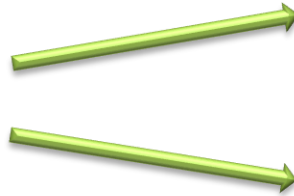
Estimated energy production	73850,32 kWh/year
Annual energy losses	0,50 %
Pellet cost	0,035 €/kWh
Gasoil cost	0,0605 €/kWh
Pellet annual increase	0,50 %
Gasoil annual increase	3,75 %
Discount rate	3,50 %
O&M Cost	182 €/boiler
Investment period	20 years
Grant	45 %

\* After the 5th year, 50% of self-consumption



# CONCLUSIONS

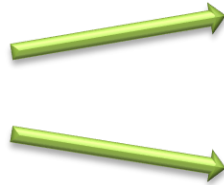
Biomass heating systems



**Positive effects over social and rural development**

**Fight against climate change**

Comparison between systems



District heating has less **operation and maintenance**

**Small viability differences**

Economic viability



It depends on **local government's resources**, although the project is viable

# THANK YOU FOR YOUR ATTENTION

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