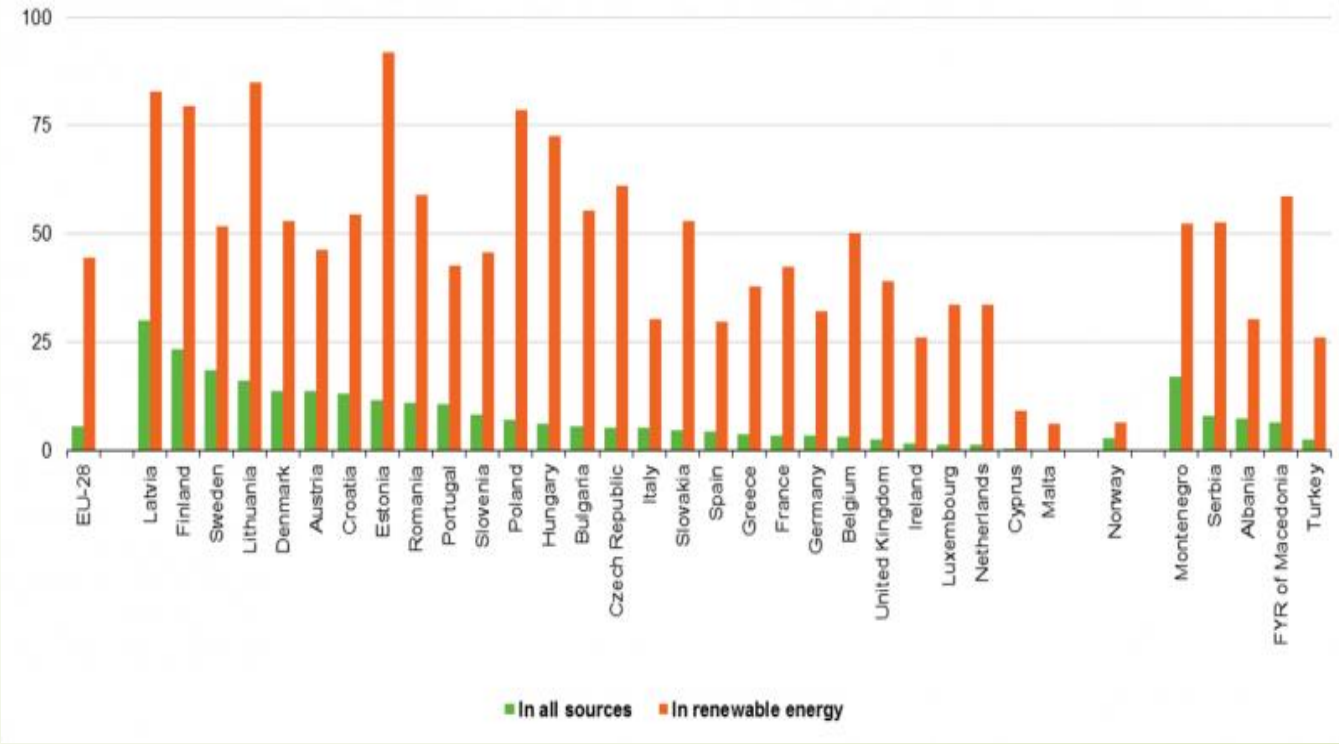
Integration of a biomass-based heating system in Tass-Puszta

Atena Georgiana Mouhanna
Vasile Alecsandri University of Bacau

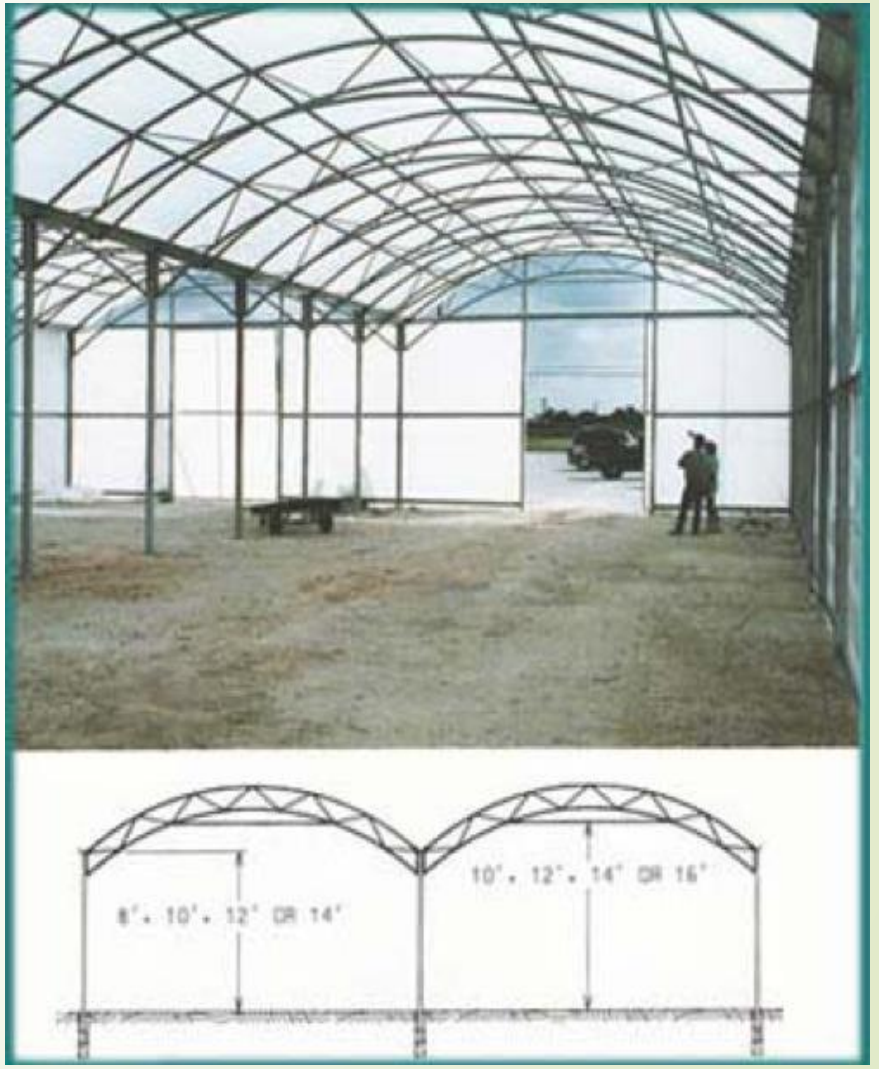
The biomass capacity

- Biomass as a substitute source of polluting fuels
- Definition of de biomasa
- Types of biomass based fuels



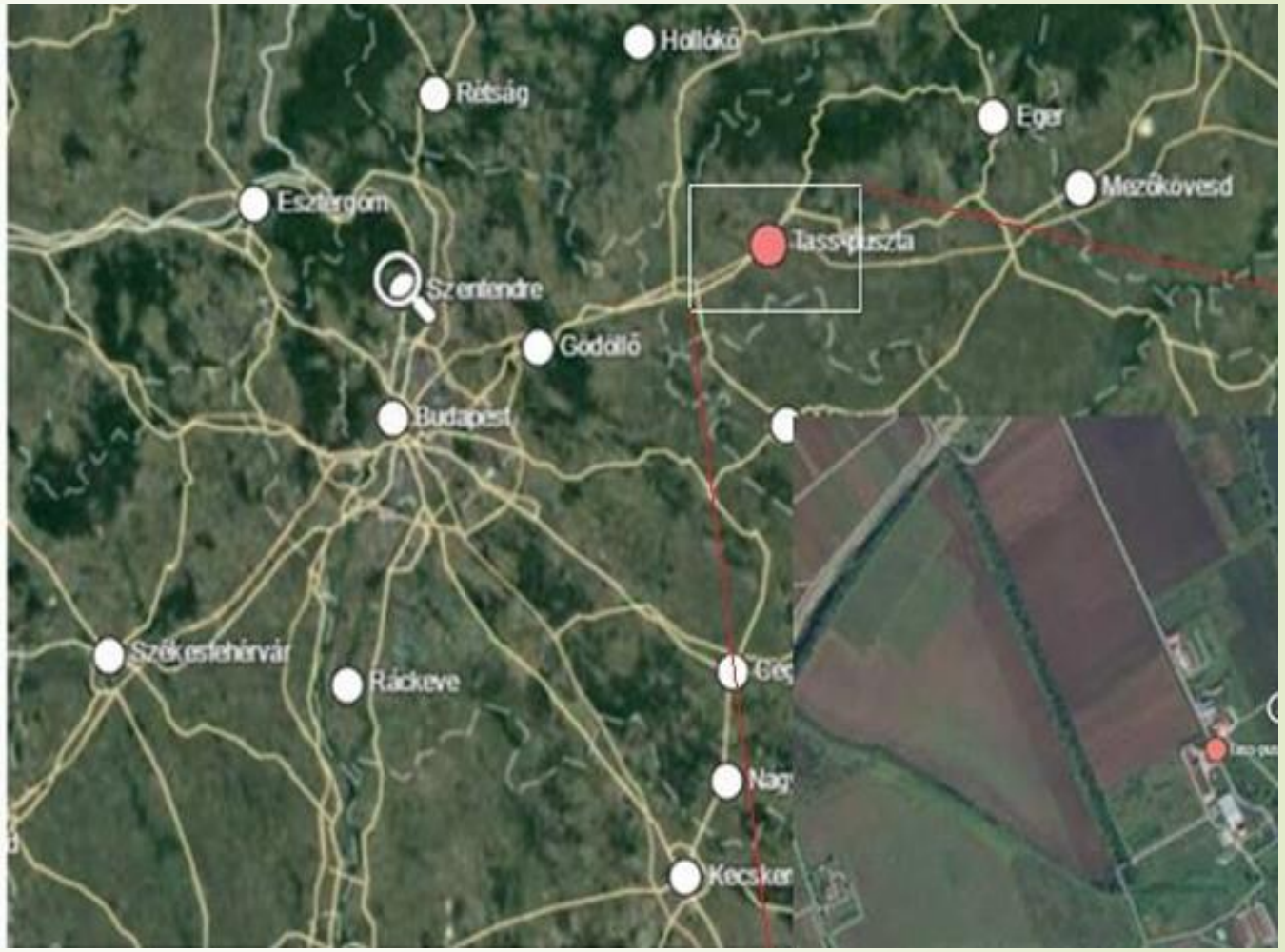
Characteristics and components of greenhouse

- The greenhouse frame
- Roofing material



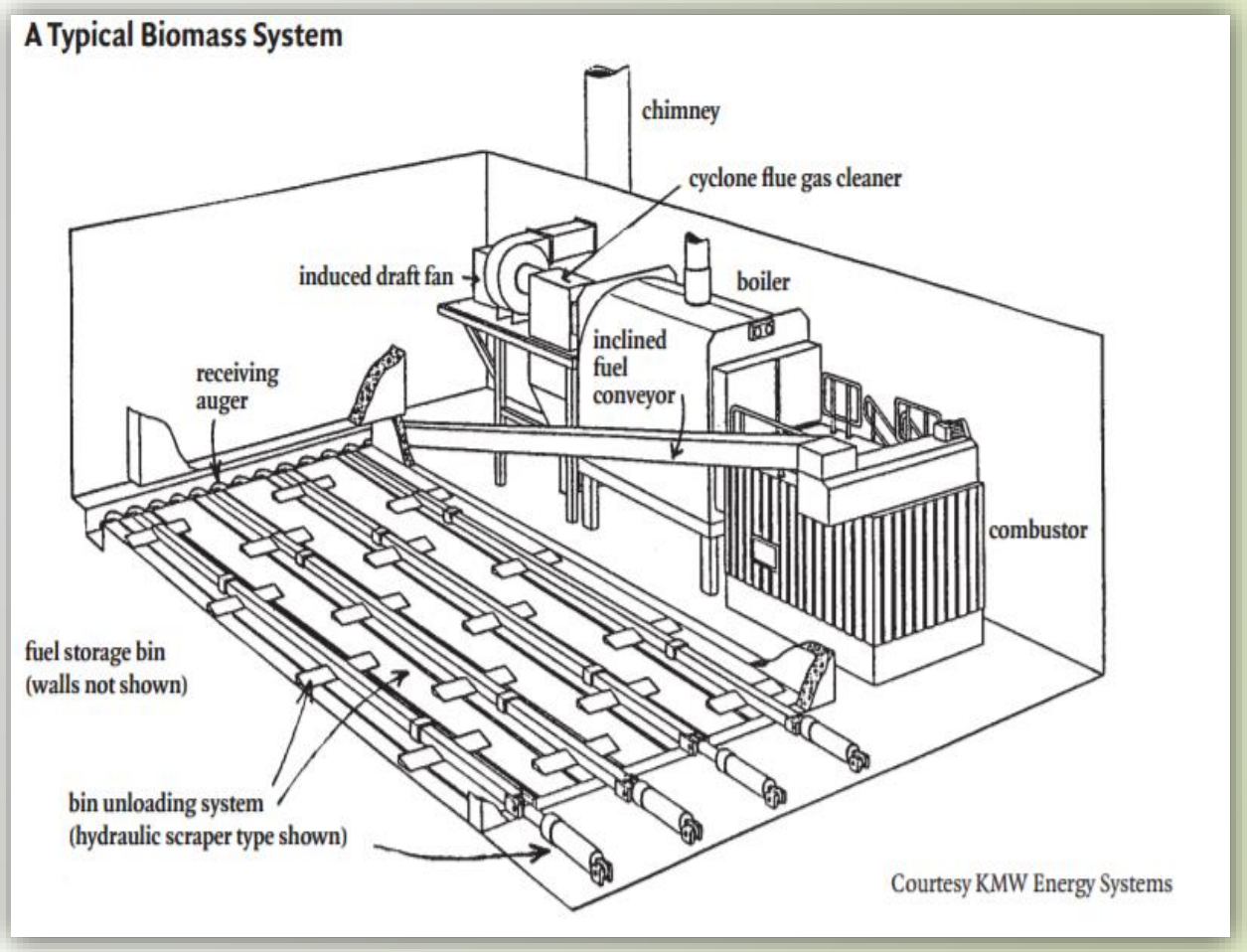
Introduction

- Objectives of the paper
- Location



Elements of the heating system

- Boiler
- Water pump
- Expansion tank
- Water tank
- The fuel storage tank
- Pipelines



The boiler

- GILLES HPK-RA

Gilles HPK-RA	160
Output power(kW)	160
Length (mm)	2620
Width (mm)	935
Height (mm)	1785
Weight (kg)	2463

Pierderile energetice ale serei

Type of loss	Value(W)
Structural thermal losses	128,034.25
Thermal losses through ventilation	30,600
Total losses	158,634.25

Boiler of 160 kW

Pump dimensioning

- Linear pressure losses $h_l = \lambda \frac{l}{d} \cdot \frac{v^2}{2g}$ = 1.196 bar
- Local pressure losses $h_s = \Sigma \xi \frac{v^2}{2g}$ =0.68 bar
- Totalul pierderilor = 1.876 bar

Pump 2 bar

Expansion vessel

- **The expansion vessel is a pressure regulator. Any system using fluids (gases or liquids) under pressure is equipped with an expansion vessel.**

400 L capacity

Water tank

- The tank is considered to have a (3-5) higher flow rate than the pump flow because the tank must have the capacity to independently pump the pump within 5 minutes.
- Pump flow = 0.01 m3 / s = 600 l / min
- Then the tank flow will be = 5 × 600 = 3,000 l

Storage container for wood chips

- It is underground
- It is interconnected with a hydraulic transport system to the combustion chamber
- It is automated by controlling the feed rate of the fuel boiler (wood chips in this case)

Pipeline network

- Conductele se întind pe o suprafața de 800m2
- Sunt din oțel
- Necesarul de lungime s-a calculat folosind următoarea formulă

$$l = \frac{Q}{\bar{q}_l} = \frac{158{,}634}{60} = 2{,}643\ m$$

Economic analysis

Plant costs

Denumire	Unitate	Cost (€)	Cost Total (€)
Boiler GILLES HPK-RA 160 kW	1	€ 20,000.00	€ 20,000.00
Steel Pipes (1 meter)	2,400	€ 8.28	€ 19,875.00
Expansion vessel (400 l)	1	€ 680.00	€ 680.00
Tank (3000 l)	1	€ 2,300.00	€ 2,300.00
Accessory	NA	€ 1,500.00	€ 1,500.00
Plant	NA	€ 1,000.00	€ 1,000.00
Maintenance	1	€ 200.00	€ 200.00
VControl valve	3	€ 150.00	€ 450.00
Pump (2 bar)	1	€ 230.00	€ 230.00
Transport charges	NA	€ 620.00	€ 620.00
Burghiu de transport al așchiilor	1	€ 2,440.00	€ 2,440.00
TOTAL GAS HEATING			€ 49,295.00
THE BUDGET OF EXECUTION OF MATERIALS			€ 49,295.00
13% OF GENERAL COSTS			€ 6,408.35
6% OF INDUSTRIAL BENEFITS			€ 2,957.70
SubtotalL			€ 58,661.05
21% VAT			€ 12,318.82
TOTAL COST			€ 70,979.87

Considerations	
The total cost	€ 70,979.87
Estimated energy production	797,440 kW
Annual energy los	0,5%
The cost of wood chips	0,04€/kW
Fuel cost	0,059€/kW
Annual price increase of chips	0,4%
Annual increase in fuel price	3,5%
Discount	4,02%
Maintenance costs	€ 456
Investment period	20 ani
Funding	35%

Fluxul de numerar

Year	Energy Production (kWh/year)	Wood chip cost (€/year	Gasoil cost (€/year)	Estimated savings (€/year)	O&M cost (€)	Cash flow (€)	Cumulative cash flow (€)
0							
1	€ 797,440.00	€ 31,897.60	€ 47,048.96	€ 15,151.36	€ 456.00	€ 14,695.36	€ 14,695.36
2	€ 793,452.80	€ 31,865.62	€ 48,452.19	€ 16,587.13	€ 456.00	€ 16,131.13	€ 30,826.49
3	€ 789,485.50	€ 31,832.05	€ 51,316.55	€ 19,484.50	€ 456.00	€ 19,028.50	€ 49,854.99
4	€ 785,538.00	€ 31,798.50	€ 52,631.05	€ 20,832.50	€ 456.00	€ 20,376.50	€ 70,231.49
5	€ 781,610.30	€ 31,764.60	€ 53,931.10	€ 22,166.50	€ 456.00	€ 21,710.50	€ 91,941.99
6	€ 777,702.20	€ 31,730.24	€ 55,216.80	€ 23,486.56	€ 456.00	€ 23,030.56	€ 114,972.55
7	€ 773,813.68	€ 31,695.40	€ 56,488.39	€ 24,792.99	€ 456.00	€ 24,336.99	€ 139,309.54
8	€ 769,944.60	€ 31,660.12	€ 57,745.80	€ 26,085.68	€ 456.00	€ 25,629.68	€ 164,939.22
9	€ 766,094.87	€ 31,624.39	€ 58,989.30	€ 27,364.91	€ 456.00	€ 26,908.91	€ 191,848.13
10	€ 762,264.39	€ 31,588.20	€ 60,218.80	€ 28,630.60	€ 456.00	€ 28,174.60	€ 220,022.73
11	€ 758,453.06	€ 31,551.64	€ 61,434.69	€ 29,883.05	€ 456.00	€ 29,467.05	€ 249,489.78
12	€ 754,660.79	€ 31,514.60	€ 62,636.80	€ 31,122.20	€ 456.00	€ 30,666.20	€ 280,155.98
13	€ 750,887.48	€ 31,477.20	€ 63,825.40	€ 32,348.20	€ 456.00	€ 31,892.20	€ 312,048.18
14	€ 747,133.04	€ 31,439.30	€ 65,000.00	€ 33,560.70	€ 456.00	€ 33,104.70	€ 345,152.88
15	€ 743,397.37	€ 31,401.10	€ 66,162.30	€ 34,761.20	€ 456.00	€ 34,305.20	€ 379,458.08
16	€ 739,677.38	€ 31,362.30	€ 67,310.60	€ 35,948.30	€ 456.00	€ 35,492.30	€ 414,950.38
17	€ 735,978.90	€ 31,323.26	€ 68,446.03	€ 37,122.70	€ 456.00	€ 36,666.70	€ 451,617.08
18	€ 732,299.00	€ 31,283.81	€ 69,568.40	€ 38,284.59	€ 456.00	€ 37,828.59	€ 489,445.67
19	€ 728,637.50	€ 31,243.97	€ 70,677.83	€ 39,433.86	€ 456.00	€ 38,977.86	€ 528,423.53
20	€ 724,994.30	€ 31,203.75	€ 71,774.40	€ 40,570.65	€ 456.00	€ 40,114.65	€ 568,538.18

Amortization

- After 4 years, the depreciation values without funding start to be positive, indicating that this project recovers its initial investment after 4 years, and the depreciation with funding is made after 2 years.
- After 4 years, the Net Net Revenues earned positive value, which means that the project will start making a profit after 4 years of the project, and the Net Upgraded Net Income Fund gets positive after 3 years.

Year	Payback (€)	Payback with grant (€)	NPV (€)	NPV with grant (€)
0				
1	€ (56,284.51)	€ (31,441.56)	€ (56,852.43)	€ (32,009.40)
2	€ (40,152.38)	€ (15,310.43)	€ (41,943.80)	€ (17,100.70)
3	€ (21,124.88)	€ 3,718.07	€ (25,029.57)	€ (186.47)
4	€ (748.38)	€ 24,094.57	€ (7,613.75)	€ 17,229.34
5	€ 20,962.12	€ 45,805.07	€ 10,225.60	€ 35,068.60
6	€ 43,992.68	€ 68,835.63	€ 28,417.19	€ 53,260.10
7	€ 68,329.67	€ 93,172.62	€ 46,896.30	€ 71,739.20
8	€ 93,959.35	€ 118,802.30	€ 65,604.00	€ 90,446.20
9	€ 120,868.26	€ 145,711.21	€ 84,487.40	€ 109,330.20
10	€ 149,042.86	€ 173,885.81	€ 103,485.70	€ 128,328.60
11	€ 178,469.91	€ 203,312.86	€ 122,569.39	€ 147,412.20
12	€ 209,136.11	€ 233,979.06	€ 141,687.96	€ 166,530.70
13	€ 241,028.31	€ 265,871.26	€ 160,796.52	€ 185,639.20
14	€ 274,133.01	€ 298,975.96	€ 179,866.04	€ 204,708.70
15	€ 308,438.21	€ 333,281.16	€ 198,861.16	€ 223,703.80
16	€ 343,930.51	€ 368,773.46	€ 217,760.14	€ 242,602.70
17	€ 380,597.21	€ 405,440.16	€ 236,525.08	€ 261,367.60
18	€ 418,425.80	€ 443,268.75	€ 255,141.51	€ 279,984.00
19	€ 457,403.66	€ 482,246.61	€ 273,579.47	€ 298,421.90
20	€ 497,518.31	€ 522,361.26	€ 291,821.69	€ 316,664.10

Conclusion

- Socio-economic impact
- Impact on the environment
- Advantages and disadvantages

- Thank you for your time