



**PERMANENT
M&V Plan
Wood Products Factory Biomass Cogeneration
Project**

In Romania

Developed within the project Performance Risk Management for Energy Efficiency through
Training – PERMANENT – IEE/08/657/SI2.528420

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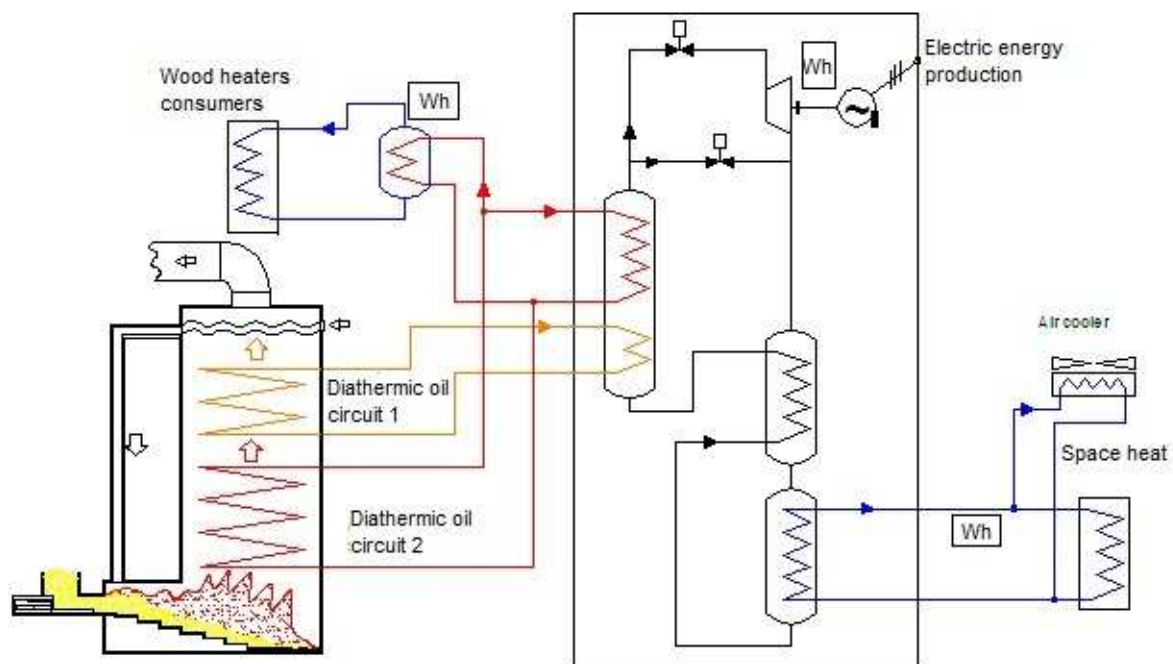
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1. Description

The wood products factory is situated in a forested region of Romania. Heat for the plant is currently produced by gas fired boilers and electricity is imported from the grid. Heat is used for drying wood and heating production halls and offices. Gas and electricity are purchased from the local suppliers.

An ESCO installed a wood waste fired cogeneration unit producing up to 4.5 MW of heat and 1 MW of electricity. A simplified plan of the system is shown below.

COGENERATION UNIT INSTALATION



2. Savings Determination Approach

IPMVP Renewable Option B will be used (IPMVP Volume III August 2003) to determine savings. This method is the same as IPMVP Vol I, 2010 Option B, but allows direct measurement of savings from measurements of produced energy.

Measurement will encompass only the new cogen unit, measuring wood burned, and heat and electricity produced.

3. Calculation Method

Cost avoidance attributable to this project will be directly derived from metered output of the cogeneration plant and measured wood consumption. Cost avoidance will be determined in two parts: electrical and fuel, as presented below.

Electrical Cost Avoidance

All electricity produced by the cogeneration plant will be used inside the factory. Therefore cogeneration production displaces purchases from the grid at the marginal price paid to the electricity supplier. There are no special demand charges from the utility for its provision of standby capacity to cover periods when the cogen unit is unavailable. **Avoided electrical cost** will be calculated as:

$$= \text{Measured electricity generated} * \text{current marginal price of electricity}$$

Fuel Cost Avoidance

Since all heat produced by cogeneration will reduce the need for gas consumption in the factory's gas boiler, **avoided gas cost** will be calculated as:

$$= (\text{Measured heat produced} \div \text{gas boiler efficiency}) * \text{current marginal price of gas}$$

Gas boiler efficiency is tested monthly in the plant and is consistently 70% for most load levels. These tests are performed using the same type of steam meter that will be used for the cogeneration heat output, and the utility's gas meter.

Waste wood from the factory will be used to fire the cogeneration plant's boiler. This wood would otherwise be sold to other companies in the region. No energy value is attributed to this waste wood. However the burning of it in this plant reduces revenue of the factory, and therefore represents a cost increase of the cogeneration project. **Lost wood revenue** will be determined as:

$$= \text{Waste wood consumed} * \text{current price of wood sales}$$

Combining these three elements, **net cost avoidance**:

$$\begin{aligned} &= \text{Measured electricity generated} * \text{current marginal price of electricity} \\ &+ (\text{Measured heat produced} \div 0.70) * \text{current marginal price of gas} \\ &- \text{Measured wood consumed} * \text{current price of wood sales} \end{aligned}$$

This calculation is shown in the sample savings report attached.

4. Metering and Accuracy

Heat production will be measured by a new steam meter having accuracy of $\pm 2\%$ at full scale. Electricity production will be measured by a new meter with accuracy of $\pm 0.5\%$ of reading.

Wood consumed by the cogeneration boiler will be measured by the weighing device on the same wood loading vehicle that is used for wood sales. Though energy content of the wood may vary with moisture content and wood type, this is not a factor in sale of wood, so not a factor in determining the lost revenue associated with the wood burning. The wood measuring system has an accuracy of $\pm 5\%$ of reading.

Given the meter accuracies used in computing savings, the overall accuracy of cost avoidance reports is expected to be $\pm 4\%$.

5. Monitoring

Steam and electric meter readings will be recorded on the first day of each month at 8:00 AM by cogeneration plant staff. These staff will be trained to read the meters by manufacturers' representatives.

Each load of wood is weighed and the value entered into the plant log book. The total mass inserted into the boiler feed system each month will be totalized by the cogeneration plant operator at 8:00AM on the first day of each month.

6. M&V Budget

The initial cost of measurement equipment and installation is 20000 lei. Yearly cost of M&V will be 6000 lei.

7. Quality Assurance

Steam and electricity meters will be calibrated before installation and be re-calibrated every 12 months. The wood loader scale is calibrated annually. Meter calibration will be supervised by the plant engineer. Calibration certificates will be kept in the plant engineer's office.

All meter data and savings reports will be confirmed by the plant engineer and filed in his office.

8. Energy Savings Report

Biomass Cogeneration Plant at a Wood Products Factory In Romania

Reporting Period: January 1 - December 31, 2009

The avoided cost for 2009 was 5 030 000 lei (conservatively rounded to 3 significant digits).

Measured data, and calculations in accordance with the M&V Plan dated Sept 23, 2008, are shown on page 2.

Biomass Cogeneration Cost Avoidance 2009									
	Electricity Avoidance		Gas Avoidance				Wood Lost Revenue		Net Cost Avoidance (lei)
	Measured Electricity Production (MWh)	Electricity Cost Avoidance @ 340 lei/MWh	Measured Heat Production (MWh)	Boiler Gas Avoided		Gas Cost Avoidance @ 1.1 lei/m ³	Measured Wood Consumption (tonnes)	Wood 'Cost' @ 4.7 lei/tonne	
				MWh	m ³				
	A	B	C	D	E	F	G	H	
		A * 340		C / 0.70	D*1000/10	E * 1.1		G * 4.7	B + F - H
Jan	744	252960	1945	2778	277814	305596	44469	209004	349551
Feb	672	228480	1984	2834	283414	311756	45096	211951	328285
Mar	744	252960	2987	4267	426729	469401	61157	287438	434924
Apr	720	244800	2692	3846	384571	423029	56433	265235	402593
May	744	252960	4048	5782	578214	636036	78133	367225	521771
Jun	624	212160	3676	5251	525129	577641	65222	306543	483258
Jul	744	252960	4470	6386	638586	702444	84899	399025	556379
Aug	744	252960	3749	5356	535614	589176	73359	344787	497348
Sep	720	244800	3707	5296	529614	582576	72687	341629	485747
Oct	744	252960	2688	3840	383971	422369	56365	264916	410413
Nov	720	244800	1800	2572	257200	282920	42159	198147	329573
Dec	360	122400	1228	1754	175371	192909	16238	76319	238990
Total	8280	2815200	34974	49962	4996229	5495851	696217	3272220	5038832