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CONSIDERATIONS ON THE WOOD WASTE BURNING IN BIOMASS PLANTS

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ABSTRACT:
This paper shortly presents the international and Romanian legislation about biomass exploitation in biomass boilers and the advantages of using renewable sources of energy for the environment protection.
Aspects related to wood and wood powder burning in a powder fuel plant with reduced emissions of atmospheric pollutants. There are also analyzed the advantages gained by the societies who replaced the fossil fuels, used in firing plant, with biomass.
KEYWORDS:
Romanian legislation, biomass exploitation, reduced emissions of atmospheric pollutants

1. INTRODUCTION

Starting with the developing of industrialization, the energetic balance has changed, the emissions of the greenhouse effect gases increased and the result is the continuous rising of global temperature.

At the Vienna Convention were first enumerated the substances which could modify the ozone layer, as:

- carbon containing substances: CO, CO_2, CH_4;
- nitrogen containing substances : N_2O;
- halogens containing substances: , (partial) halogenated parafines.

In figure 1 is shown the structure of the greenhouse effect gases, in which the carbon dioxide has the great statistical weight.

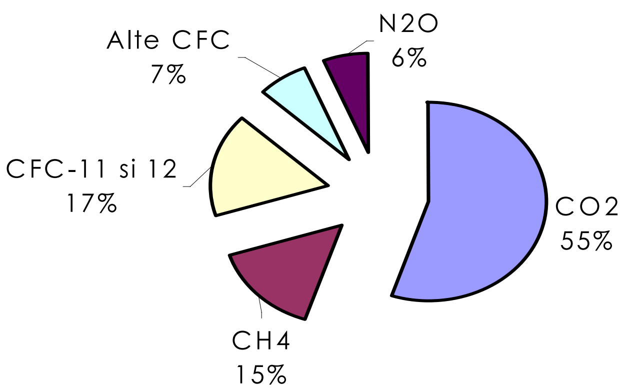

Figure 1. Statistical weight of greenhouse effect gases

Over the past several decades, rising concentrations of greenhouse gases have been detected in the Earth's atmosphere. It has been hypothesized that the continued accumulation of greenhouse gases could lead to an increase in the average temperature of the Earth's surface and cause a variety of changes in the global climate, sea level, agricultural patterns, and ecosystems

In 1997, at Kyoto was ratificated the agreement (Kyoto Protocol) to reduce the CO_2 emission with 5% till 2008-2012, comparative with 1990 year.

It was also established that the developed countries should create facilities for the countries in developing to get access to alternative technologies [1]. To replace coal plants, generators build more natural gas plants, extend the life of existing nuclear plants and dramatically increase the use of renewables in the more stringent reduction cases, particularly biomass and wind energy systems, which become more economical and higher carbon prices [2].The cost of renewable energy technologies should reduce in time, particularly if there is increased activity in this area by way of integrated green technology best practice.

Emission reductions can come from a wide range of cogeneration projects, as well as large industries efficiencies, fuel switching and particular agricultural practice. Power industry is in a great measure responsible for the CO_2 emissions: 79% from the total amount of CO_2 atmospheric emission, comparative with clearing(18%) or other industries(3%).The emissions of CH_4(26% from the total amount) and N_2O (9% from the total amount) have also important values[3].

With the help of CO_2 equivalents, which take into account the specific greenhouse potential of each gas, the effect on the climate of emitted greenhouse gases can be estimated in a comparable way. In Germany (table 1), CO_2 released during energy production alone contributes to 80% of greenhouse gas emissions, followed by methane from waste management, agriculture and natural gas supply, as well as N_2O from agriculture and the chemicals industry. Under the obligations of the Framework Climate Convention and the Kyoto Protocol, emissions of greenhouse gases must be reduced. Regulations such as the Energy Conservation Ordinance, the Renewable Energy Sources Act, the climate protection agreement between the government and the private sector all play their part, as do measures such as integrated transport plans and energy conservation technologies. Emissions of the greenhouse gases listed above have been reduced 19% since the baseline year 1990 (1995 for fluorinated gases). However, the share of CO_2 as a percentage of emissions has increased[4].

Table 1. Greenhouse emissions in CO_2 equivalents according to source category in ktone.

Source category	Substance	1990	2000
Energy related emissions	CO_2	986832	831759
	CH_4	37273	18594
	N_2O	11375	10702
	Share of total emissions	84,7%	86,9%
Industrial processes	CO_2	27668	26149
	CH_4	0	0
	N_2O	25420	5089
	Share of total emissions	5,1%	4,4%
Agriculture	CO_2	-	-
	CH_4	33700	25315
	N_2O	48698	41189
	Share of total emissions	6,7%	6,7%
Waste management	CO_2	-	-
	CH_4	39768	16674
	N_2O	1240	1240
	Share of total emissions	3,4%	1,8%

The solution to CO_2 emission limitation and control of greenhouse effect could be found by the identification and exploitation of renewable sources of energy. Using biomass in firing plants, the CO_2 emission is reduced or even annulated, and biomass is defined as a "clean fuel" because the amount of evacuated CO_2 is equal with the amount of CO_2 used by the plant in the photosynthesis reaction during its life. Governments typically also include growth of renewable energy in their overall emissions policy framework. Trading schemes aimed at encouraging the development of renewable energy generation reduce emissions of greenhouse gases (by displacing fossil-generated electricity) and also deliver other benefits, such as reduced line losses and infrastructure costs in the electricity grid, and strategic diversification of energy supply[5].The statistics for the European Community shows in 1995 that 5,4 % of the energy was obtained from the renewable sources and 3,1% from biomass, and for 2010 is prognoses 11,5% of energy from renewable, and 8,1 % from biomass[6].

Till the government agreement HG 443/2003, in Romania didn't exist a legislation on the energy production from renewable sources, which means that there are not many power plants based on biomass, the applications limits to domestic house and water heating.

2. WOOD WASTE UTILIZATION IN FIRING INSTALLATION

The biomass represents the biodegradable fraction of the products or plants, industrial or urban waste [7]. Designing an effective and durable biomass policy is a challenge. The good news is that from an environmental perspective, an increased use of biomass must be part of the solution. Unlike direct sunlight and wind, biomass contains molecules. It is the only renewable source that can be used for making physical products. Moreover, biomass has its own built-in storage system. As a result, it can provide energy on demand, unlike intermittent energy resources like wind and sunlight. The bad mews is that plant matter, has many end-uses: food, feed, medicine, textiles, construction, chemicals, fuels, fertilizer. Incentives must be designed that encourage the best end-use rather than simply anointing one above the others. Another piece of bad news for biomass is that its cultivation and harvesting can have significant and potentially negative environmental impacts. Policies directed at harnessing sunlight and wind power can focus simply on the conversion process, but biomass policies must be more sophisticated and comprehensive, taking account the cultivation process as well[8].

In Europe, the high cost of landfill acts as one incentive for those who generate wood waste to separate it from other wastes, with legislative requirements and public or governmental pressure providing further drivers. The costs vary according to the value of the land and the length of the time until closure the landfill. Landfill tax makes up over half of this cost, and in many cases is set to increase. The gate fee for recycling, on the other hand, ranges from approximately 8-33 U.S.$/ tone, a significant saving when compared with the cost of disposal landfill-35-103 U.S.$/tone.

The grade of wood waste material has a direct effect on the potential it has[9]. In Europe, there are three tiered A-B-C classification system for wood waste typically used:

- A-wood waste being derived from untreated wood materials used as a feedstock material to manufacture particleboard or used as a fuel for heating purposes and for electricity generation;
- B-wood waste from engineered panel products used as a fuel for heating purposes and for electricity generation;

- C-wood waste from timber products treated with preservatives- no uses were identified.

The Romanian legislations allow the exploitation of 16 billion m^3 of wood/year, from which 10 bill m3 for industrialization purpose. For Romania, who detains a forester fond about 6,3 billions hectares, the biomass seems to be the reneweable sources of a great potential and also a national objective.

In table 2 are presented some of the most common wood waste found in Romania and their characteristics.

Many different technologies for combustion of wood waste exist, as do various wood-fuelled heating applications, ranging from simple fireplaces to fully automated pellet-fired boilers. In Europe most A-waste wood was accepted as a fuel source.

Table 2. The characteristics of the most common wood waste found in Romania

Characteristic	Splinter	Birch bark	Soft wood bark	Wood powder	Wood dust	Wood chips
Humidity(%)	40-55	45-55	50-65	45-60	45-60	5-15
Caloricity[MJ/kg]	6-10	7-11	6-9	6-10	6-10	13-16
Ash contain(%)	0,5-2	1-3	1-3	0,4-0,5	0,5-2	0,4-0,5
Hydrogen contain (%)	5,4-6	6,2-6,8	5,7-5,9	6,2-6,4	5,4-6,4	6,2-6,4
Sulphur contain (%)	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Nitrogen contain (%)	0,3-0,5	0,5-0,8	0,3-0,5	0,1-0,5	0,1-0,5	0,1-0,5

A biomass plant consists of a wood waste store, a boiler, with a boiler great, an ash separator and a system for handling bottom and fly ash.

The most common type of combustion unit iin use is a grate-fired boiler, where the grate is the burning platform for wood waste. Other configurations of grate-fired boilers include reciprocating grate, stepped grate and rotary grate systems. The wood waste, which is supplied by companies from the wood industry, is taken from the store to the boiler by conveyor belt. An idea for a much better utilization of the energy of the fuel is directing the steam from the biomass boiler to the central turbine.

3. WOOD BIOMASS AT COOP LEMNUL ORADEA, A ROMANIAN COMPANY FOR WOOD EXPLOITATION

The important forester fund detained by Romania, leads to the developing of the primary processing of wood and furniture industry, both great producers of wood waste, which could be used as biomass fuel. There are many advantages which claim for this exploitation of wood waste as: the sparing of fossil fuels, reduced CO_2 emission, avoiding environment pollution determined by the wood waste storage in non adequate places.

The Romanian Company, Coop Lemnul Oradea, a furniture producer, is using sown wood, which need to be dried. The thermal energy obtained from the biomass burning is used both to dry the sawn wood and to heat during the cold seasons. In 2001-2002 the company replaced the old boilers, running with liquid fuel with new ones, running with wood dust, collected in a discharge hopper.. The new boilers have O_2 and CO analyzers to control the burning, which have to be complete. The main characteristics of these new biomass boilers (ASTMN C 1000), are presented in table 3.

The effective thermal capacity of the boilers is 1 Gcal/h, and the fuel is 15 mm wood splinters with 20 % maximum humidity and with a caloric power of 3500 kcal/h. The chemical composition of the wood waste and splinter is: carbon-48,2-49,9%, hydrogen-5,9-16,9, oxygen-43-45%.

Table 3. Main technical characteristics of ASTMN C 1000 biomass boiler from Coop Lemnul Oradea Company

Parameter	U.M.	Value
Effective output	Kcal/h	1.000.000
Calorific net efficiency	%	83
Wood splinters consumption	Kg/h	355
Outlet roast gases temperature	^0C	250
Maximal working pressure	Bar	2,94

Fuel charging is done from a main store placed outside of the plant, using a metallic tube, deposited in a storage hopper and and introduced in the boiler furnace. There are three ventilating fans: one for the primary air, circulating at the bottom of the biomass boiler to carry away the wood dust, and the second, for the fuel burning.

The Aerotecnica Sperandei (Italy) boiler is the an horizontally one, fitted with a automatic burner at the bottom and with three rings for the roast gases, provided with furnace and boiler casing and an wet inversion chamber made of stainless steel. At the down side of the boiler is a big burning chamber, designed for wood splinter and waste. The rousted gases are collected in a gas channel and evacuated through a blowing furnace, at 12 meters high, and with a diameter of 700 mm. Between the boiler and the blowing furnace MC 36 multicyclone collector is displaced, more then 95% of the ashes being retained in bunker placed under the cyclone. In 2001 analysis for the pollutant emissions from the Aerotecnica Sperandei boiler were done. The analyses were performed with a Triple Plus (Crowcon Instruments LTD) analyzer, fitted with electrochemical sensors. The results of the measurements are presented in table 4, comparative with the legal values (Ord.462/ 1993).

Table 4 . Comparison among the measured and the legal values of the pollutant emissions for the Aerotecnica Sperandei coiler from Coop Lemnul Oradea Company

Pollutant	U.M.	Obtained values	Maximum admitted values (Ord 462/1993)
CO	mg/m^3	Under detection limit	250
NO_x	mg/m^3	2,54	500
SO_2	mg/m^3	Under detection limit	2000
Ashes	mg/m^3	14,1	100

As it could be seen, the measured values of the pollutant emissions are under the admissible limits.

4. CONCLUSIONS

- utilization of biomass as a renewable source of energy, has no contribution to the global warming effect;
- the incomplete burning of the wood waste produce volatile organic compounds, CO and at higher temperature, N_2O. This impediment could be avoided using O_2 and CO analyzers.

Biomass is not very well promoted in Romania, even if, at international level, the interest for finding new methods to decrease the greenhouse effect is in continuously increasing[10].

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