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ABOUT THE WOOD SAWDUST – ONE OF THE MOST IMPORTANT RENEWABLE ENERGY SOURCES

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ABSTRACT: Wood pellets have only become an important part of this boom in the past few years. Owners of large coal-fired power stations in Europe started searching for a way to fulfill the new regulations and to find a solution for the declining economic relevance of traditional coal-fired power stations due to their high carbon dioxide emissions. The answer was to give the old dirty giants a green coat of paint by “co-firing” regular coal power plants with wood pellets. The idea of using wood as a renewable source was backed by environment organizations. More recent pellet investment projects as well as facilities currently under construction show that the production of wood pellets is being outsourced by the energy firms to companies specialized in wood pellet production. These firms are 100-percent focused on sourcing the raw material, operating the wood pellet production plant and handling the logistics for transporting the renewable resource.

Keywords: biomass, wood pellets, briquetting, sawdust, renewable-energy, environment

1. INTRODUCTORY NOTES

Wood pellets belong to the biomass group of renewable-energies and are gaining in importance to fulfill the European’s renewable-energy targets ^[1,2,10]. The European Commission decided to reduce Europe’s greenhouse-gas emissions by 2020 to 20 percent below their 1990 level and to set a goal of moving Europe to 20 percent renewable energy by 2020 ^[4, 5, 7, 9]. This decision initiated the boom of renewable-energies in Europe ^[2, 8, 9].

Increasing dependence on a worldwide level of energy resources is that the interest for other energy sources to increase. At the present time, biomass seems to be the most affordable and cost-effective source of renewable energy. Unlike wind energy and solar, investments necessary for the exploitation biomass are best. Modern biomass fuel technology means process the biomass matter with a series of advanced transformation technology into the alternative fuel (solid form, liquid form, gas form), those bio-fuels are used in power generation, vehicle fuel, heating stoves, etc. The solidification formation bio-fuel refers to the biomass briquettes products, the briquette industry started in the 1980s, during the last few years, the briquette industry has been developing very fast: the technologies are much mature nowadays, the production and application have formed a certain scale ^[6, 8].

Biomass energy production is beneficial to the environment preserving ecosystems and assuring sustainable future. We need to make sure biomass energy is produced in sustainable and ecologically safe way, with little or no pollution to air, water or soil. Biomass is a solution to growing pollution problem and can become a significant energy source in the future, being a sustainable and renewable energy source. According to ^[10], but generally valuable in the literature, the main advantages of biomass energy production are:

- » Sustainable source – Biomass energy uses organic material and waste for its production. Crops and residues in agriculture and forests are sustainable source of biomass. Managing the resources is important to assure sustainability principles.

- » Renewable source – crops, wood, agricultural residue, can be harvested year after year. Unlike fossil fuel reserves biomass reserves will always be available.
- » Reducing pollution – biomass combustion process emits far less greenhouse gasses into the air than in fossil fuel combustion process. In the process of “gasification” no pollution gasses are emitted into the air.

Also, according to [10], the main disadvantages of biomass energy production are:

- » Resource management – If not managed correctly, forests and land can be used to grow energy crops instead for food production.
- » Direct and indirect CO₂ emission – combustion of biomass can contribute to higher carbon concentration in the air.

Trees take CO₂ from the atmosphere during their whole life. This CO₂ is released when the trees are burnt or during natural decay. Moreover, carbon is produced through planting, harvesting, processing and transporting of timber, as well as through the manufacture and delivery of wood pellets. Even so an estimated net reduction in CO₂ emissions of 90% or more compared with fossil fuels is achieved with wood pellets. [13]

Biomass refers to substances which occur organically and can be used to generate energy. There are a variety of types of biomass, the most popular being wood. A biomass system uses the energy generated when burning wood pellets (or briquettes), wood chips or logs in a biomass boiler to generate heat and/or energy. [10-12, 16] This can be used to power hot water systems, central heating or to heat spaces.

Pellets and briquettes production increased in Romania mostly after the country inclusion in EU. This was and still is mostly related with the new markets in Europe. Currently, there are many pellet producers in Romania, but information about their production capacities is scarcely accessible. In general, most of the production of large companies is sold on western European markets. Small producers sell also on the Romanian market in the limit of their stocks (most of the production is realized from wood processing residues), based on pre-established contracts. [14]

Wood has been the dominant fuel and has a long tradition in Romanian rural areas based on its availability, sustainability, environmentally friendly and renewable natural resource characteristics. Romania has a significant forestry potential of wood and plant to support the production of pellets and briquettes in terms of quality and protection to meet the requirements and standards. In the year 2013, the production capacity in Romania pellets was about 480.000 tones, of which 360.000 tones were made by the four large companies' pellets and briquettes. The remaining 120,000 tons were made by small producers who had the main market domestic standards but their quality is significantly lower. Today there are in Romania recorded over 28 producers of pellets and briquettes. [15, 16] Their number is increasing in proportion with a 80% manufacturers of pellets. Production forecasts for 2014 are about 740,000 tons pellets/year because on the market entered other two factories. The domestic consumption is increased by approx. 20%. This growth estimate above is based on the fact that it expects a significant increase in the price per cubic metro gas, petroleum products and electricity, making the pellets and briquettes very competitive products. According to estimates made by governmental sources, 2020 in Romania there will pellets and briquettes production capacity which will exceed 1.2 million tons / year. [15, 16]

Sawdust is by-product from wood sawing process. Actually, sawdust doesn't have much application because of its low burning efficient. However, by pressing the saw dust into pellets, it becomes a kind of high quality biofuel product – sawdust pellets or wood pellets [8, 10, 11, 16].

2. TYPE BIOMASS FUELS

More and more cities are seeking solutions in order to produce thermal energy from renewable sources. According to a survey conducted by the Ministry of Environment and the Ministry of Economy, biomass (wood waste, pulses and/or livestock) represents the most affordable and durable resource to produce heat and electricity [3, 7, 8]. Biomass comes from many different sources, but the most common sources of biomass are: [3, 7, 8]



Figure 1. Reducing Carbon Emissions [13]

- » Sustainable forest harvesting and residue,
- » Agricultural residue like wheat straw and energy crops,
- » Animal, municipal and industrial waste.

Therefore, type biomass fuels include agricultural waste (straw, animals human dung, husks of all kinds – of grapes, walnut, etc.), wood and wood waste (hubs, sawdust, paddles, chips), energy crops (poplar, willow, willow trees, seed and rape) and solid waste in the municipality [8, 10]. Organic material, such as crops, agricultural and forest residues and waste are easily obtained and available for biopower production. The briquettable materials include, also, the waste wood, chips and dusts from the wood and paper working. In this sense, a lot of companies have as object of activity the recycling and the recovery of wastes or scraps. In these circumstances sawdust will represent raw material for the manufacture solid fuel (briquettes, pellets). It has become more and more important for companies to find low-cost methods of recycling their waste materials. This is especially true if these waste materials have high energy content and we want to take them back into the energy cycle. A number of companies have switched from furnace oil to biomass briquettes to save costs on boiler fuels. The use of biomass briquettes is predominant, where coal and furnace oil are being replaced by biomass briquettes. A number of units are also using biomass briquettes as boiler fuel [10–12].

Wood pellets are made through the chopping, drying and pressing of wood, thus obtaining a 100% natural, additives and residues free product, with no harmful emissions generated from combustion. Also, they are a solid fuel with low moisture content, obtained from sawdust, wood chips or wood waste. Resins and binders existing naturally in the sawdust, retain compact the pellets. [13]

The wood pellets can be used industrially or domestically, by anyone who wants to optimize heating costs and increase comfort level. [13] Overall, the wood pellets are:

- » clean and easy to transport, distribution and storage,
- » a sustainable, reliable and renewable energy source,
- » low priced,
- » easy to handle, convenience transport,
- » high efficiency and energy saving, good quality,
- » a competitive performance level in all stages of production, transport, storage and end use,
- » an easy way to reduce electricity consumption,
- » environmentally clean, i.e. when burnt the ash produced can be used in the garden as a fertilizer.

Wood sawdust is a kind of common seen biomass. The furniture factory, woodworking factories and the like are main sawdust producers. The sawdust generated by these manufacturers usually irregular shape and size, and even contains small wood brick. Wood sawdust is a renewable natural



Figure 2. Wood pellets manufacturing



Figure 3. Solid fuel by woods

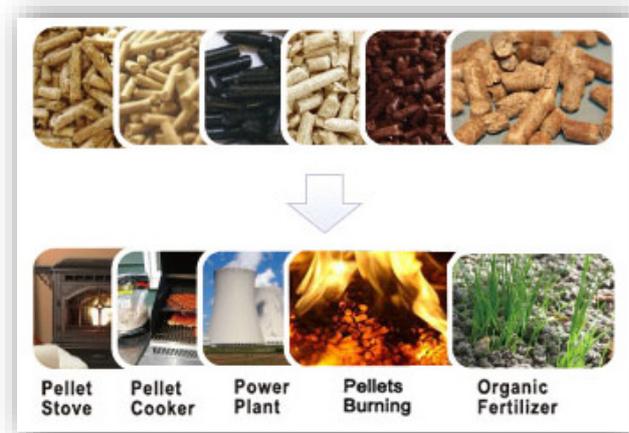


Figure 4. The wood pellets uses

material that can be made into solid biomass fuel like briquette or pellet. There is a kind of sawdust briquette press that can produce both sawdust briquettes and pellets. The pellets can be used in home heating stove or industrial boiler, while briquettes are mainly used in industrial boiler. The woody pellets can be used industrially or domestically, by anyone who wants to optimize heating costs and increase comfort level.

Wood, one of the most important renewable energy sources in its possession Romania, it is not operated. The potential of wood is not used in systems thermal power plants in Romania, due to a lack of technology and legislation. Romania has made many steps humble about capitalization of wood and other wood products and pulp for the production of thermal power in both centralized thermal systems, as well as personal. This fuel is ignored despite environmental and economic advantages.

Specialists in the field say that should be reconsidered potential wood and wood pulp, which can be used as a source of real power [1-4]. Scientists have pulled signals over two major components, namely reducing energy consumption which polluting the atmosphere, on the one hand, and reducing energy consumption due to quick of the reserves of fossil fuels.

Although Romania has the great advantage to hold an important source of renewable raw material, this is which has not previously been used, and we talking about the bulk of lingo-cellulose's biomass, which enables the development of technologies for recouping and national efficiency, directed at converting thermal energy [1-4].

3. WOOD SAWDUST BRIQUETTE OR PELLET EMERGING

With the world population grows and the modernization of the city and towns, one of the city's problems has become more significant every year—the garbage processing. The garbage has two resources: the domestic garbage and the industry waste. The wood processing plants create large quantities of wood residue waste in the daily production, now a large part of the sawdust are used to make compressed wood board for furniture producing and wood briquette for the heating stoves and fireplaces [1-4].

Wood is a natural product which – highly compacted as a briquette or pellets – almost takes on the burning behavior of coal. Owing to their great density wood briquettes has a higher calorific value than the same quantity of firewood. They can be used instead of coal or wood in domestic solid-fuel stoves as well as in industrial furnaces [10-12].

A popular biomass briquette emerging in developed countries takes a waste produce such as sawdust, compresses it and then extrudes it to make a reconstituted log that can replace firewood. It is a similar process to forming a wood pellet but on a larger scale. There are no binders involved in this process. The natural lignin in the wood binds the particles of wood together to form a solid. Burning a wood briquette is far more efficient than burning firewood. Moisture content of a briquette can be as low as 4%, whereas green firewood may be as high as 65%.

The extrusion production technology of briquettes is the process of extrusion screw wastes (straw, sunflower husks, buckwheat, etc.) or finely shredded wood waste (sawdust) under high pressure when heated from 160 to 350°C. The quality of such briquettes, especially heat content, is much higher comparing with other methods like using piston presses.

Sawdust briquettes have developed over time with two distinct types: those with holes through the center, and those that are solid. Both types are classified as briquettes but are formed using different techniques. A solid briquette is manufactured using a piston press that compresses sandwiched layers of sawdust together. Briquettes with a hole are produced with a screw press. The hole is from the screw thread passing through the center, but it also increases the surface area of the log and aids efficient combustion.

Biomass briquettes, mostly made of green waste and other organic materials, are commonly used for electricity generation, heat and cooking fuel. The companies promote the use of sawdust briquettes for heating. It is a totally organic. Solid fuel with low moisture from waste wood left after processing (sawdust, wood chips or bark), wastes are crushed, dried up at a rate of 10% and then plants with special presses. Resins and binders existing naturally in the sawdust briquettes are

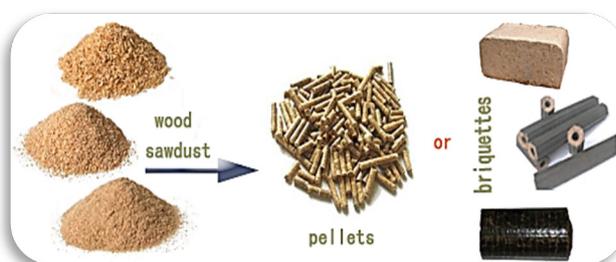


Figure 5. Process of converting the wood wastes into briquettes or pellets

designed to keep them compact and therefore do not contain additives. Using waste wood as sawdust resulted from processing wood in sawmills and furniture, we obtain a valuable product, respecting nature.

Being an alternative energy, wood pellets play more and more crucial role in human life. And the influence of them now is beyond the field of green energy. The development of wood pellets will bring us great benefits such as social, environmental and economic benefits. The use of renewable energy has several environmental, economic and societal benefits. Renewable energy sources do not require the use of fossil fuels and, as a result, they do not emit carbon dioxide. By reducing the amount of carbon dioxide that goes into the atmosphere, we are eliminating pollution and increasing our air quality.

- » **SOCIAL BENEFITS:** Slathering wood pellets produces of great assistance to society. Promoting by government authorities all across the globe, wood pellets industry likes great recognition. Not just so, being an emerging industry, wood pellets creating will give you large amounts of jobs, which in certain degree will alleviate the issue of high unemployment, particularly in rural places.
- » **ENVIRONMENTAL BENEFITS:** In recent centuries, the dominance of non-renewable fuels like coal and oil brought serious atmosphere pollution and greenhouse effect. Wood pellets like an eco-friendly resource can improve this case effectively. In other words, wood pellets could possibly be the definite alternative of fossil fuel and do best to atmosphere.
- » **ECONOMIC BENEFITS:** Once we have known clearly, wood is really an alternative energy source. Simultaneously, the distribution of wood is wide around the globe: not just wood, but additionally organic materials like leaves, branches, grass, and lots of many other materials can be found. Only whenever you process these to pellets, moisture contained could be reduced to ensure that to vow our prime efficiency of wood.

The wood pellets are clean-burning, carbon-neutral, and locally produced—a renewable resource grown in sustainable forests. That's as green as a fuel can get. Heating the home with pellets offers three ecological advantages: pellets are sourced locally, they're a renewable resource, and they're carbon-neutral.

New wood-pellet home heating technologies allow customers to easily upgrade their existing oil-fired furnaces and boilers to wood pellets simply by swapping out the burner. Now you can choose a central heating system that's completely automated and environmentally friendly while you save on home heating bills year after year.

4. CONCLUDING REMARKS

Briquetting is a process that biomass is compressed under high pressure and high temperature. The self-bonding of biomass to form a briquette involves the thermo-plastic flow of the biomass. The lignin content that occurs naturally in biomass is liberated under high pressure and temperature. Lignin serves as the glue in the briquetting process, thus binding, compressing the biomass to form into high density briquettes. During this process, no binder needs to be used. So the output briquette is a type of clean and green fuel that is ideal for use in furnaces, boilers and open fires.

Generally the better quality wood is used in the furniture and construction industries leaving very little good quality timber for firewood production. A lot of the time the cost of producing the firewood on a commercial scale is just too high for most to bother with. We found that later in the season that seasoned wood is unavailable due to high demand resulting in the market being flooded with green timber.

Biomass is a renewable energy source because we can always grow more trees and crops, and waste will always exist. When burned, the chemical energy in biomass is released as heat. If we have a fireplace, the wood burn in it is a biomass fuel. Wood waste can be burned to produce steam for making electricity, or to provide heat to industries and homes.

Biomass, unlike any other resource, is available to us in excess. Its abundance is what makes it a useful asset to mankind, and we can never fear its running out. Everywhere has land available for growing biomass. The process of converting biomass into useful energy is a plain process. If biomass is grown on a large scale, it can save tremendous amount of money in importing oil and rural areas become economically more vital and stable. In addition, biomass can be mixed with coal in coal power plants without making any alterations to the plant. Biomass, if used effectively and efficiently, could be a catalyst in the future of earths' renewable energy system. Moreover, it is cheap compared to its rival resources.

Therefore, biomass is seen as an economically viable and environmentally friendly solution to energy generation. Biomass is a financially viable investment as well as being environmentally friendly. Biofuels provide a unique opportunity to address needs ranging from energy independence to environmental sustainability and economic development, with solutions that include the creation of new opportunities and jobs. These demands have led to government initiatives and accelerated research and development at universities and among leaders in the energy industry. The different countries clearly have chosen very different approaches in developing and deploying various bio-energy options. Partly this is caused by the natural conditions (type of resources and crops, climate) and the structure of the energy system, and also by the specific political priorities linked to the agricultural and forestry sectors in those countries. In our current economic climate we are all looking to make positive changes to the way we live financially. At the same time the pressing topic of climate change means that we also need to make environmental changes, and heating is one of the priorities.

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