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Opotunities for the Development of Biomass energy

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Abstract: Biomass is an organic material that stores sunlight as a chemical energy. When burned, this chemical energy is released as heat. What we today call biomass has been heating homes and buildings around the world for thousands of years. In fact, biomass continues to be a major source of energy in developing countries. Wood is still the largest source of biomass energy in the world. The real environmental and energy security benefits of biomass will arise when humans use large amounts of biomass to produce electricity, heat and other biofuels, thus reducing the use of chemical fuels. jelly. The carbon cycle is the principle behind biomass technology. As plants grow, they absorb CO2 in the environment and store it through photosynthesis. The same amount of CO2 is released when plants naturally decompose or burn. That means biomass does not contribute to greenhouse gas emissions. Unlike other renewable energy sources, biomass can be turned directly into liquid fuels - biofuels - for vehicles (cars, trucks, buses, airplanes). , train). The two most common types of biofuels are ethanol and biodiesel.

Index Terms: sustainable development, environmental perspective, biomass, renewable energy

I. INTRODUCTION

Bioelectricity is the use of bimomass to produce electricity. There are six major bioelectric systems in the world including direct biomass burning, co-combustion, gasification, anaerobic digestion, pyrolysis and small bioelectric systems, modules. It is estimated that by 2020, the world's bioenergy output will be over 30,000 megawatts (MW). The United States is the world's largest producer of biomass, with more than 350 bioelectric plants producing more than 7,500 megawatts of electricity each year, enough to power millions of homes and create 66,000 jobs. These plants use waste from paper mills, sawmills, agricultural byproducts, foliage from fruit orchards. The US Department of Energy forecasts that the advanced technologies currently being developed will help biomass power industry produce over 13,000MW in 2010 and create 100,000 more jobs. Biomass energy accounts for 4% of total energy consumed in the US and 45% of renewable energy. Most bioelectric power plants in the world use direct combustion systems. They burn biofuels directly to create steam. That steam is captured by a turbine and the generator then turns it into electricity. In some industries, steam from power plants is also used for manufacturing or to heat buildings. These power plants are called combined heat - power plants. For example, wood by-products (sawdust) are commonly used to produce both electricity and heat in paper mills. Many coal-fired power plants can use co-firing systems to significantly reduce emissions especially sulfur dioxide. Copper combustion involves the use of biomass as an additional source of energy in highly efficient boilers. With just a few minor changes, coal-fired power plants can use co-firing systems. Therefore, its development potential in the future is huge.Gasification systems use high temperatures and a rare oxygen environment to turn biomass into a gas - biogas or biogas (a mixture of hydrro, CO and methane). This gas provides fuel for gas turbines to produce electricity. There are also some power plants that use a slightly different cycle. Biomass fuel is transformed into pressurized, hot gases in the gasification chamber. They are cleaned (remove impurities) to avoid corrosion of the electricity, electricity production system. Next, clean gases are burned with the air in the combustion chamber before entering a turbine to generate electricity. The heat coming out of the gas turbine is fed into a heat exchanger chamber to heat cold water, which is supplied to households.

Decomposition biomass produces methane which can be used as energy. At landfills (where composting organic materials such as manure, vegetables, straw ...), wells are drilled to extract methane from decomposing organic matter. Then, the pipes from each well will transport the gas to a central place for filtration and cleaning before burning. Methane can also be produced from biomass through a process called anaerobic digestion. Anaerobic digestion involves the use of bacteria to decompose organic matter under hypoxia conditions. Methane can be used as a fuel in many ways. Most facilities burn it in a boiler, produce steam to produce electricity or use it for industrial purposes. Methane can also be used as fuel in fuel cells. Fuel cells act like batteries but do not need to be recharged. It generates electricity as long as fuel is available. In addition to gas, liquid fuels are also produced from biomass through a process called pyrolysis. Pyrolysis occurs when biomass is heated in the absence of oxygen. After that, the biomass transforms into a liquid called pyrolysis oil. Pyrolysis oil can be burned like gasoline to produce electricity. A bioelectric system using

pyrolysis is currently commercialized in the United States.In summary, biomass is an attractive source of energy for the following reasons:

+ First of all, this is a renewable energy source if people can guarantee the speed of replacement planting.

+ Biomass is more uniformly distributed on the Earth's surface than other energy sources (fossil fuels ...) and can be exploited without requiring complex modern techniques. complex and expensive.

+ It creates opportunities for localities, regions, and countries around the world to ensure that their energy supply is independent.

+ This is an alternative to fossil energy, helping to improve the climate change situation that threatens the Earth.

+ It can help local farmers in difficult times of harvest and job creation in rural areas.

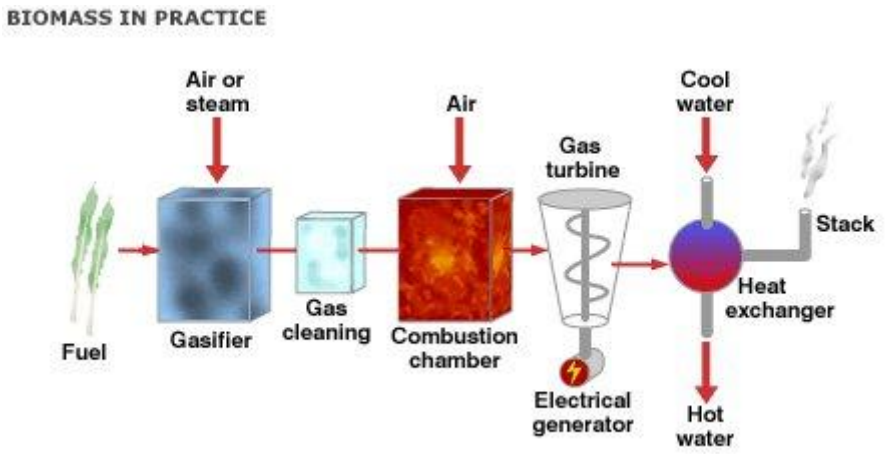

Figure 1. Biomass transformation for electrical energy

II. BIOMASS ENERGY

Biomass fuel used in India accounts for about 30% of the total fuel used in this country, being the most important source of fuel used in over 90% of rural households and about 15% of households Urban, especially useful for families with cattle. Currently many biogas plants have been built in India.The biofilter is a facility that combines biomass conversion equipment and processes to produce biomass fuels, electricity and chemicals. The concept of a biofilter is similar to today's refineries that produce a lot of fuels as well as oil products. Industrial biofilters have been considered the most promising path to the creation of a new, bio-based industry in the United States. By producing many products, a biofilter can take advantage of the various components of biomass, while maximizing the value gained from biomass. Such a plant can produce one or more high-value, low-volume chemicals and a liquid fuel for low-value, high-volume transport. At the same time, the plant also produces electricity and heat for internal use and perhaps excess electricity for sale. High-value products enhance profits, high fuel volume to meet national energy demand and power generation to avoid greenhouse gas emissions as well as reduce costs. The US National Renewable Energy Laboratory is implementing the Biomass Program, involving six major biofinery refinery projects. These projects focus on new technologies to combine the production of biomass fuels and other products in the same facility.

A. Liquid fuel

- Bio-ethanol (Gasohol): Includes Bio-methanol, Bio-ethanol, Bio-butanol ... Among these bio-petrol types, Bio-ethanol is the most commonly used biofuel in the world because of its the ability to produce on an industrial scale from sugar-containing raw materials such as sugarcane, sugar beet and starch-containing raw materials such as cereals, potatoes, cassava ... Biogas containing ethanol with higher octane value than gasoline is usually dynamic. The muscle gets hotter quickly. However, the machine also wears more quickly, especially rubber gaskets. The disadvantage of Ethanol is dehumidification, so gasoline-ethanol contains a lot of water, making it difficult to "fix", rust metal, wear away plastic (plastic), so it is necessary to change materials for the engine, right Regular vehicle maintenance. Ethanol tanks must also be made of special metals, and transportation is more difficult than regular gasoline.

- Biodiesel (BioDiesel): Biodiesel can be used instead of diesel because it is similar in quality to diesel fuel but not produced from petroleum but produced from vegetable oil or fat. animals with ester conversion (transesterification). Oils [also known as methyl (or ethyl) ester (FARME) fatty acids are mixed with sodium

hydroxide and methanol (or ethanol) to produce biodiesel and glycerine with ester metabolism.

- Ethanol (or ethyl alcohol): Ethanol is a liquid, colorless, transparent, flammable fuel. Ethanol is used as an additive for gasoline, with the aim of increasing octane and greenhouse gas emissions. Water soluble and biodegradable ethanol. Ethanol is produced from biomass with a high cellulose content (like corn), through fermentation at a dry kiln or wet oven. In both of these kilns, yeast residue (wort) is produced and supplied to livestock on farms.

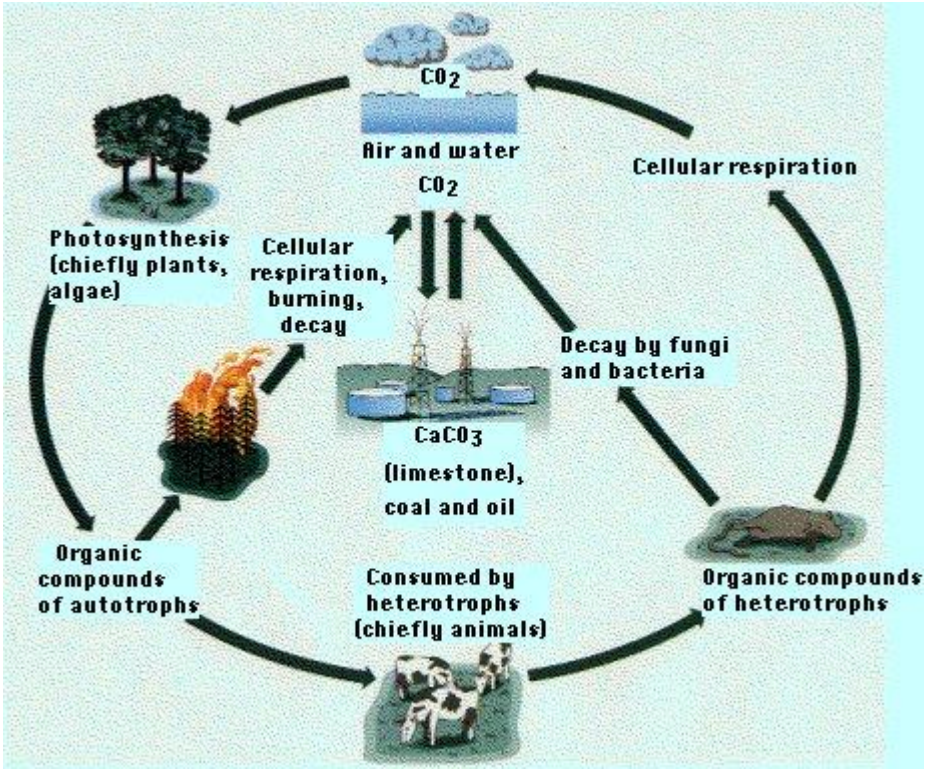

Figure 2. Carbon circle for biomass

B. Biogas

Biogas is a mixture of methane gas (CH4) and some other gases arising from the decomposition of organic matter in an anaerobic environment. The main components of Biogas are CH4 (50-60%) and CO2 (> 30%), the rest are other substances such as N2, O2, H2S, CO ... hydrolyzed in the anaerobic and catalytic environment by heat From 20- 40ºC, the low calorific value of CH4 is 37.71.103 KJ / m3, so biogas can be used as fuel for an internal combustion engine. In order to use biogas as fuel, biogas must be treated before using to create an explosive mixture with air. H2S gas can corrode parts in the engine, its product SOx is also a very toxic gas. Steam has a small content but significantly affects flame temperature, fire limit, low calorific value and air/fuel ratio of Biogas.Vietnam has many different energy resources from coal to oil and gas, coal and hydropower. However, these natural resources are not endless and are in danger of being exhausted. Therefore, in recent years, the Government has encouraged the research and use of renewable energy sources, both diversifying energy sources and contributing to environmental protection, including solar and biomass energy. biomass (or energy from organic material - biomass). Biomass comes in many forms: wood, forestry products such as sawdust, agricultural waste such as straw, manure, energy crops (sugarcane, willow).

According to experts, using biomass will provide new opportunities for agriculture and forestry in Vietnam. Also according to studies, our country can produce 170 million tons of biomass, if put into use, it will contribute to reduce CO2 emissions into the environment very effectively. As one of the leading brewers in Vietnam, VBL prioritizes the application of energy-saving and environment-friendly technologies, towards sustainable development. In order to reduce the amount of CO2 released into the environment, over the years, VBL has implemented many solutions including reducing fuel loss, modernizing equipment and using renewable energy, including biomass and biogas. In 2014, VBL reduced 0.58 kg of CO2 emissions per HL beer through a program of saving and using energy efficiently as well as the application of new technologies in production. Producing and using biomass energy is simpler than the forms of hydrogen fuel / fuel cell, LPG.

When using Ethanol 20, B20 does not need to change engine, can be used for existing cars. There is also no need to change existing storage and distribution systems. Biomass energy and mineral fuel can be used together. Technology for producing biomass energy is not complicated and can be produced on a small scale (household) to a large scale. Fuel consumption, engine power are similar to those used for mineral oil. Many studies on energy balance have shown:

From one unit of petroleum energy, 0.87 units of gasoline energy or 2.05 units of ethanol energy are produced. From 1 unit of petroleum energy (used for plowing, cultivating, tending, transporting to processing), it will generate 1.2 units of biomass energy. If you add the by-products (waste, by-products), then create 2-3 units of biomass energy. Thus, the output energy balance is positive. Currently, biomass energy prices are still high due to small production and high raw material prices. Large-scale production with new technology will reduce costs. If gasoline does not compensate, biomass energy costs are lower. It can be affirmed that biomass energy will bring many benefits.

III. THE ELECTRICITY FROM BIOMASS

There are many techniques to convert biomass energy into electricity. However, there are some popular methods such as direct-fired or conventional steam approach, pyrolysis, biomass gasification, anaerobic digestion, electricity production from waste landfill emissions, ...

A. Direct-fired, Conventional Steam Boiler

These are two common methods of generating electricity from biomass energy that applicated in most biomass power plants. Both types of systems directly burn bioenergy-feedstock to create steam for rotating generator turbines. These two methods are distinguished in the internal structure of the combustion chamber or furnace. At the direct combustion system, biomass is transferred from the combustion chamber bottom and the air is provided at the bottom of the furnace base. Meanwhile, in the conventional boiler method, the draft is transferred into the furnace from above but the biomass is still downloaded to the bottom of the furnace. Traditional direct burning systems are a pile system (two-chamber combustion chamber) or stoker boiler. The hot air was then transferred to a turbine and turned the turbine blades, operating the generator rotor.

When used for direct burning, biomass must be dried, cut into pieces, and pressed into charcoal.

When the preparation is completed, the biomass is fed into the kiln/boiler to generate heat/steam. The heat generated from the heating process, in addition to providing generator turbines, can also be used to heat plants and other construction works, it is exploited to maximize efficiency. This type of plant is also known as a combined heat-energy plant (Combined Heat Power - CHP), which is used to utilize heat and steam to maximize the energy potential created, avoiding wasting energy.

B. Pyrolysis

Pyrolysis is the process of burning biomass at very high temperatures and biomass decays in an oxygen-deficient environment. The problem here is that it is very difficult to create a completely oxygen-free environment. Normally, a small amount of oxidation still occurs and can produce some unwanted by-products. In addition, this technology requires a high heat source and very expensive. The process of burning biomass produces pyrolysis oil (pyrolysis oil), coal or synthetic gas (char & syngas). These products can be used similarly to petroleum to generate electricity. Thus, the pyrolysis process does not produce ash or energy directly, but it transforms k into higher quality fuels. This process begins with drying biomass to maximize combustion efficiency, similar to direct burning. When cooled, pyrolysis oil is liquid, brown, and is used as a gasifier fuel.

C. Biomass gasification

Solid biomass can be converted into gaseous form, called syngas. This gas can be supplied to cycle turbines associated with CCGT (Combined Cycle Gas Turbines) or other conversion techniques like coal-fired thermal plants.

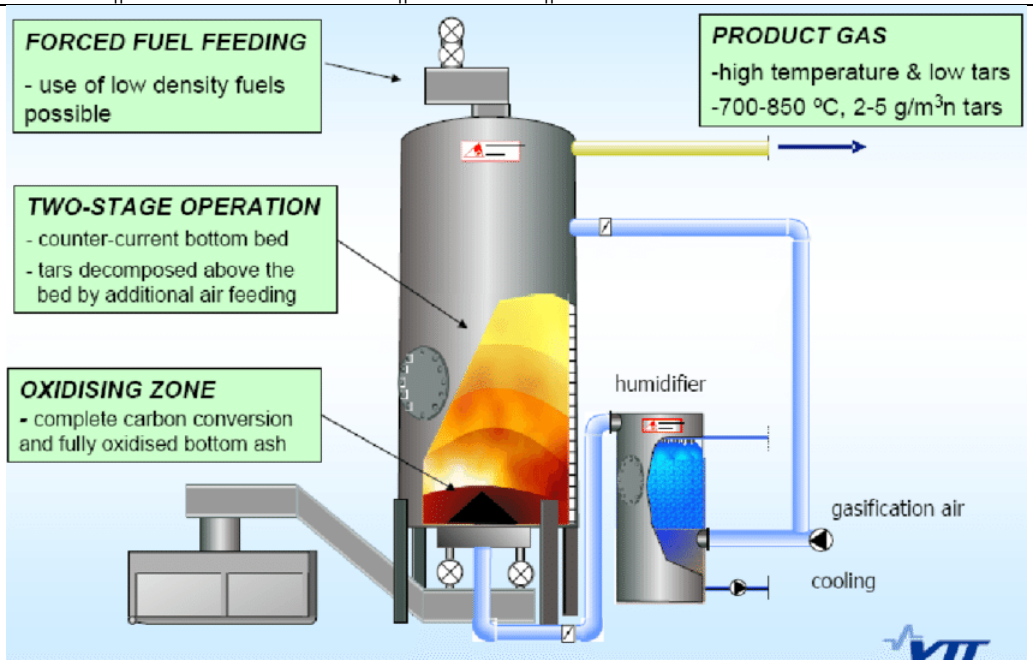

Figure 3. Gasification process

Biomass energy plays a huge role in this era, applying biomass energy is necessary and urgent for each country.

However, how to apply nature to be able to timely restore the supply capacity requires each country to have specific and serious research.Currently, due to the pressure of finding a new alternative energy source, people are increasingly abusing the production of biomass energy from food crops, notably using corn for biofuel production. (Brazil, America), this will cause instability in food supply to the world. In addition, some places abandon food crops or cut down some forests to grow energy crops, which both cause ecological imbalance, and create unpredictable consequences for biodiversity, while the amount of energy the amount of that amount is not enough to balance it.In fact, in every country the use of energy is inevitable, the amount of energy consumed more and more for development is of course, but remember, when all actions just serve for the purpose of not only man but also all actions have to go with sustainable principles for nature. That will help the people not face to face with many challenges from nature.

Many experts hope that biomass gasification will be more efficient than conventional biomass power plants. However, up to now, the process of gasification has not been widely applied in practice but is still at the technical testing stage. The furnaces convert solid biomass into gas that heated biomass in an environment in which solid biomass decomposes into flammable gas. This process is more advantageous than direct burning. Biogas can be cleaned and filtered to classify and separate harmful chemical compounds. Gas products can be used in high-performance generators (in the form of CCGT) - such as a combination of gas and steam turbines - to produce electricity. The performance of these systems can be up to 60%.

D. Anaerobic digestion

This is a biological process in which methane gas is released from the decomposition of organic matter by microorganisms in an oxygen-free environment. This methane can be recovered and used to generate energy. The anaerobic digestion process uses biological wastes such as organic fertilizers and municipal solid wastes. Feces or waste are packed and decomposed by microorganisms and water. This process releases methane in the package, and this gas is fed into another gas container. Since then, methane has been used to power turbines and generate electricity.

At the molecular level, hydrolysis converts organic substances into sugars and amino acids. Fermentation of these materials produces volatile fatty acids. These fatty acids then form hydrogen, CO2, and acetate during Acidogenesis. Finally, the methanogenesis process produces biogas, which consists of 55-70% methane gas, 25-35% CO2 and microelements such as nitrogen and hydrogen sulfide. In an anaerobic environment, methane gas can be recovered and used to power gas turbines or even fuel cells.Microbial growth and biogas production are very slow at normal temperatures. Anaerobic digestion usually occurs naturally when the concentration of moist organic matter in an oxygen-free environment, usually at the bottom of ponds, marshes, peat bogs, animal gut and other Anaerobic areas of landfills. The productivity of this process depends

on the composition and ability of decomposition of waste materials. However, the speed of this process depends on the density of the microorganisms, their growth conditions and the temperature of the fermentation process.

When used as a waste treatment process, the decomposition rate increases quite high in the temperature range of 20-40 degrees C. For urban solid waste, the decomposition rate can be increased in heat. higher level like 50-60 ^{o}C.Anaerobic biodegradable microorganisms are marketed at relatively competitive prices, which are used on farms even on a small scale. Using methane in this way can help reduce bad odors and prevent them from spreading into the air, increasing greenhouse gases and causing fog.

E. Production of electricity from landfill gas emissions

Landfill gas uses the same technique as anaerobic digestion and has the same advantages. Landfill gas is a by-product of solid waste decomposition, with components comprising 50% methane, 45% CO2 and 4% Nitrogen. Moreover, this is also a positive measure to reduce the rate of wasteland use, landfill to convert into electricity[38]. Two ways to acquire landfill include traditional methods such as conventional drilling and push-in. Normally, before the gas recovery, the three-dimensional structure of the landfill is mapped to determine the location of the capacitor and the optimal location for drilling. Traditional drilling methods use conventional drilling techniques with some technical improvements suitable for drilling areas. The pipes can be installed vertically, making gas recovery convenient. The push method uses 3-dimensional maps to find gas wells and can be used for separate drilling positions if necessary.

IV. CONCLUSION

Biofuels are now widely used around the world, accounting for nearly 11% of the world's total consumption (IEA). However, developing countries still have "basic" biomass energy usage rates up to 35% in the domestic energy structure. This ratio is still quite high for the poorest countries in the world, which depend on and burn biomass for cooking, heating and fuel. Although biomass used in industry has a positive impact on the environment, poor ventilation and the use of incinerators (furnaces) with poor performance increase the air pollution in the houses. (indoor air pollution - IAP) and pose a great health risk to people living in rural, underdeveloped areas. Thus, the use of biomass more effectively is also a big problem now in the process of improving the quality of life and human health. Sources of biomass in the water include residues and residues of treated biomass. These include pulp, agro-forestry waste, urban wood waste, municipal solid waste, landfill gas, livestock wastes, land and aquatic crops grown by the owner. weak to harness energy. These varieties are called energy plants. In large quantities, the source of biomass is called biomass. Using wastes is more effective for them to decompose, reducing the risk to the surrounding environment.

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