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Biomass Resource as a Potential Renewable Energy in Vietnam

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Abstract: Fuel and energy resources are the basic resources to meet the socio-economic development needs of the country, which country is rich in this resource is the best prerequisite basis for meeting the input of economic system, but also pose many challenges in politics and national security. Vietnam is located in the humid tropical region of the Southeast Asia monsoon, with diverse fuel-energy resources such as coal, oil and gas, hydroelectricity and renewable energy sources like solar energy. Biomass energy, geothermal energy, marine energy is solar and biomass energy. However, the reality of economic development in recent years shows that the fluctuations in fuel and energy are quite complicated, besides the export of coal and crude oil, we still have to import processed oil products transformer and electricity. The question is how can Vietnam's fuel and energy resources not only meet the needs of socio-economic development in the coming years, but we can also export these resources under energy form and finished products, adapting to market fluctuations.

Index Terms: Biomass energy, conversion technology, biomass resources, biodiesel production

I. INTRODUCTION

The source of fuel and energy of our country, first of all, is coal. Coal mining and utilization in Vietnam has a long history, since the French arrived in Vietnam hundreds of years ago, the level of exploitation, use and export is increasing. In terms of reserves, as of January 1, 2005, the total coal reserves sought exploration of about 6.14 billion tons. The decline in crude oil production will have to be replaced and offset by other potential energy sources to meet the growing demand of the economy. For gas, the ability to exploit will increase, the period of 2011-2015 will reach from 10.7 billion m3 to 19 billion m^3. Regarding hydroelectricity, according to the evaluation of recent studies, our country's hydro-economic potential is about 75-80 billion kWh, with a corresponding capacity of 18,000-20,000 MW. In which economic potential of 10 main river basins is about 85.9% of the river basins in the country. Thus, the total economic and technical reserves of the main river basins are over 18,000MW, allowing the corresponding power output of about 70 billion kWh. According to the forecast of hydropower development plan in the PDP VII up to 2020, the entire economic-technical potential reserves of large hydroelectric plants will be fully exploited, thus hydroelectric energy from rivers will no longer be able to exploit.For small hydroelectric power, with a capacity of less than or equal to 30MW, according to the potential assessment we have about 1,000 more exploitable points and a total capacity of about 7,000MW, now these points have been identify and reach technical potential. In fact, there are 114 projects, with a total capacity of about 850 MW, basically completed, 228 projects with a capacity of over 2,600 MW under construction and 700 projects in the research phase. In addition, micro hydropower projects with capacity of under 100kW are suitable for remote areas, places with rugged terrain that can be self-sufficient on small power grids and households have been exploited. Regarding solar energy, the geographical position of Vietnam lies in the limit between the equator and the Tropic of Cancer, which is in the inland area with sunlight shining year round, especially in the Southern region. With the total number of sunny hours in the year ranging from 1,400-3,000 hours, the total annual radiation volume is about 230-250 lcal / cm2 / day gradually increasing from North to South, with this result, it can be assessed that Vietnam There is great potential for solar power. However, at present, the exploitation and use of this energy source are still limited, especially for electricity generation, hot water heating and drying ... one of the basic reasons is the price of this energy source. With other energy sources that are less competitive in the market, on the other hand, the incentive mechanism for solar power usage and people's awareness are still limited. In the future, when the exploitation of other energy sources has reached the limit, the solar energy source is a great potential.

Biomass energy, located in the humid tropical region of Southeast Asia compared to many other countries, Vietnam's biomass is growing fast, so we have a diverse and developed agriculture. Many exported products in the world over the years have proved that such as rice, coffee, cashew ... the source of waste from agricultural products is huge, this is the potential for us to use energy. On the other hand, biomass energy is also used from livestock wastes, municipal organic waste and other organic wastes. According to a review of recent studies, the potential and capacity of solid biomass energy extraction for energy and electricity generation in Vietnam can reach 170 million tons and achieve an output of 2,000 MW depending on the price. Actual exploitation of this source of energy in Vietnam has been developing, but at a small scale and in households, in the future this is also a large and potential source of energy in Vietnam.

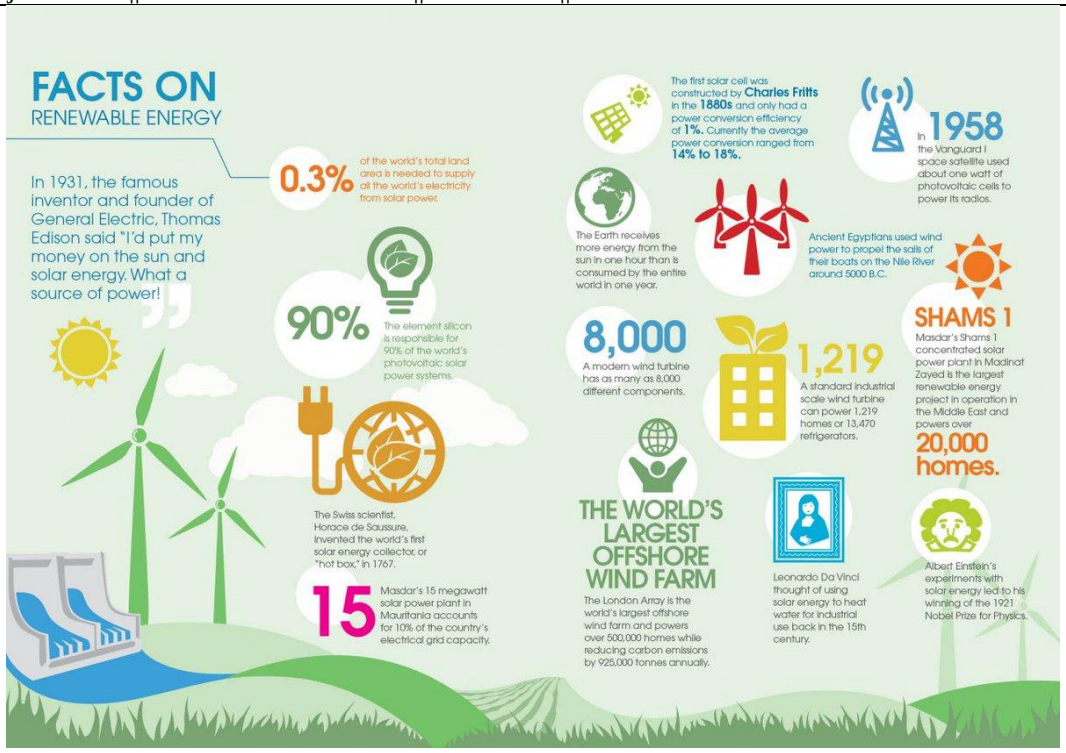

Fig 1. Renewable energy sources

Wind energy, with characteristics located in the humid tropical region of Southeast Asia, has a coastline of more than 3,000 km, the territorial sea is 3 times larger than the continent, according to the survey, Vietnam is a country. There is potential for wind power. Currently there is no exact data to assess the exact wind energy potential, but various preliminary assessments give the figure of Vietnam's wind energy potential ranging from 1,785MW-8,700MW, with It also provides over 100,000 megawatts (World Bank forecasts), so compared to the potential of hydropower, Vietnam's wind energy source is plentiful. There are also views that wind energy is not only in coastal areas, but also in mountainous areas of Vietnam, especially among valleys along rivers and streams. We have started to deploy some projects to exploit this energy source in Ca Mau, Ninh Thuan and some island districts are unable to bring the electricity from the mainland, the fact that exploiting wind power shows the price.Thus, from 2011-2030, Vietnam's economic growth under GDP targets fluctuated between 7-8.6%. The targets of the branches also did not have big breakthroughs, for agriculture, forestry and fishery ranged from 2-3%; industry-construction at 7.5-9.3%; service sector fluctuated between 8-9.3%. Thus, after each 5-year cycle period, steady growth, requiring an energy response, must grow accordingly. Regarding the forecast of energy use demand, the study also showed that for the baseline scenario, the period of 2010-2030 electricity and total oil products accounted for a large proportion throughout the period. The electricity consumption rate will increase from 15.2% in 2010 to 32.1% in 2030, while coal consumption will decrease slightly from 20.1% to 18.2%, gas use will increase from 1%. to 1.6%, oil products increased from 33.7% to 40.6%, for non-commercial energy decreased from 28.9% to 7.5% for the 20-year period from 2010 to 2030.Research and develop mining technology - effectively processing diversified and abundant biomass resources of Vietnam with scientific researches that have contributed methodologies, additional basic research databases on biomass resources. Developing technology for sustainable processing and processing biomass in energy saving, developing bioenergy production for sustainable development, combating climate change.The integration of gasification and utilization of combustion heat will ensure a conversion efficiency of 40-50% for a plant with a capacity of 30-60 MW. However, at present, BIG / CC technology only stops at the testing stage. In addition, the production of synthetic gas from biomass allows the production of methanol and hydrogen, in the future they can all become transportation fuels.The process of pyrolysis is mainly used for bio-oil production, if using pyrolysis flash allows conversion of biomass into raw biofuel with efficiency up to 80%. Bio-oil can be used in engines and turbines or its use as a raw material for refineries is also being considered. However, the problems of transition and the use of bio-oil products still need to be studied such as low thermal stability or engine corrosion. Currently, bio-oil can be improved by reducing the amount of oxygen and removing the alkaline by hydrogen and the catalytic cracking of the oil for use in certain applications.

II. POTENTIAL OF WASTE GENERATION IN VIETNAM

The source of biomass is plentiful and varied, but suitable for fuel production is only fat oil. Biochemical studies on the formation of organic compounds in plants, including fatty oils, allow a clearer picture of the pathway to making biomass fuels. Accordingly, biomass energy can be formed in four ways as follows:

Sugar, starch, cenllulose compounds, through fermentation, can produce alcohol. Alcohol is dried (after removing water called ethanol, with a content of C2H5OH above 97%) to mix with gasoline, called gasohol, or biofuel.

Fatty oils are separated from the triglyceride structure by a transesterification reaction to form methyl esters or ethyl esters of fatty oils, and used as diesel fuel, called biodiesel.

Other parts of plants such as branches, debris, leaves ... are dried, grated, added additives and pellets for use as charcoal. Studies are also underway to convert their cellulose compounds into shorter-chain cellulose compounds, fermenting microorganisms to make alcohol, using them asbiofuel, or converting them directly into a hydrocarbon form, called sulfur. In Vietnam, biomass-based energy is currently being used in four ways: Direct use as coal, firewood, straw, straw is used as fuel; Biogas from straw, livestock waste; Bioetanol from cassava, sugarcane, corn and Biodiesel from oilseeds, fish, animal fat. The most common ones are direct use and biogas. Other types are still in beta. Biomass is all organic matter capable of biodegradation, vegetation, animals, terrestrial microorganisms, underwater, other organic substances and also waste biomass, biomass of forestry, agriculture, industry and daily life.

Biomass from agro-forestry waste: mainly Lignocellulosic biomass including cellulose, hemicellulose and lignin, small amounts of pectin, protein, chlorophyll, and inorganic waxes and minerals. Organically structured fibrous cellulose with amorphous form easily decomposed by enzymes. Hardwood has a lot of cellulose, rice, straw, leaves have hemicellulose with most mannose in soft bodies, xylose sugar in hardwood of agricultural waste. In contrast to cellulose, hemicelluloses are easily hydrolyzed. Herbaceous plants have the lowest lignin, soft woody plants have more lignin so the structure is stable, less permeable, chemical resistant, biodegradable.

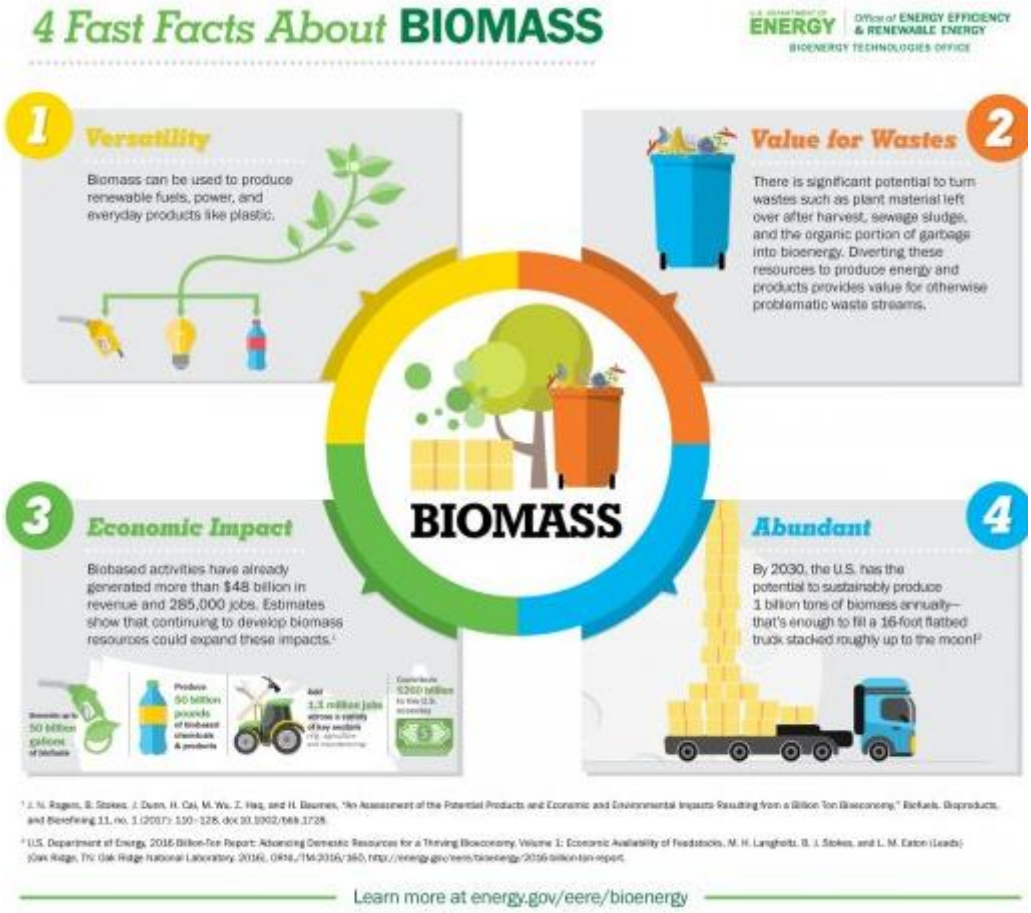

Fig. 2. Sources of biomass materials

Biomass from livestock waste: Animal manure includes organic matter, moisture and ash. When decomposing CH4 aerosols, CO2, and organic matter are stable for soil and biogas fuel. The project 2010 has specifically evaluated the characteristics of biomass in Yen Lac - VinhPhuc area with the rate of waste biomass generation, the ratio of TS dry matter, the ratio of VS volatile substances, C / N ratio, biogas birth rate of biomass of cow dung, pig, water hyacinth, tapioca processing waste water[40]. Appropriate anaerobic decomposition occurs when the C / N range of 25-30 can yield up to 20-30 l of gas / kg of cattle manure, pig manure with C / N of 12-15 is collected as 40-60l / kg, water hyacinth C / N is 12-25 births 0.3- 0.5 liters / kg, rice straw has a C / N ratio from 48 to 117 births 1.4-2liter gas / kg of raw materials. Estimated livestock waste biomass in 2010 is over 145 million tons / year.The amount of urban solid waste generated has been studied in Hanoi and Ho Chi Minh City from 2004 to 2009, at the rate of 0.85 kg / person / day and 0.75 kg / person / day. Meanwhile, this ratio in Dong Nai, Ba Ria - Vung Tau, HaiPhong, Da Nang and Hue respectively 0.73; 0.7; 0.74; 0.72 and 0.6. This rate is expected to increase rapidly to over 1.3 kg / person / day in 2025. Study on the potential of methane generation from the landfill of Nam Son - Soc Son - Hanoi and Thuy Phuong - Hue for conclusion air berries up to 280 liters CH_4 / kg VS from domestic waste at landfills. Research on clean development mechanisms and sustainable technologies to reduce the greenhouse gas emissions of landfills for major cities in Vietnam has been addressed, with a focus on solutions to convert waste into energy. The results of the study on the potential of methane gas production from food processing waste obtained experimental results reached 0.35m3 CH_4 / kg COD.

Materials from biomass have been used for thousands of years, such as wood, bamboo, neohouzeaua, leaves, rattan to build houses, items in the life of people from the beginning to soot, silk, cloth, and handicrafts. The main structure of biomass is cenllulose, hemicenllulose, lignin. These substances account for over 70% and are the main raw materials for the non-oil materials industry. Today, environmentally friendly materials that are of interest under the name of "green composites" have been researched and manufactured to serve the creation of many high quality materials in a low carbon economy. Based on scientific evidence, researchers from the Institute of Applied Materials Science (KHVLUD) of the Vietnam Academy of Science and Technology conducted research and initially gained success in manufacturing materials and energy from biomass sources.Regarding biomass fuels, scientists have perfected the technology of producing biodiesel from vegetable oil in Vietnam and gave good results when applied to cars, motorcycles and generators. The Institute's exploration research results show the ability to convert biomass into gasoline-like hydrogen carbon (nano) on the nano-structure metal oxide catalyst, opening up the ability to produce fuels from plants. of mangroves or products of sand protection forests such as poplar forests without biotransformation.

III. TECHNOLOGIES FOR CONVERTING BIOMASS ENERGY

Biomass can be converted into useful energy forms using a number of different processes. Factors affecting the selection of conversion technology are: types and quantity of biomass materials, technical requirements of products, economic conditions as well as other factors for implementation of each project. Biomass can be converted into three main product categories, of which two related to energy are electricity / heat and transport fuel, another is chemical materials.

Converting biomass into energy is done using two main technologies: thermal and biochemistry. In addition, there is another form to convert biomass into energy that is bio-gasoline production. However, bio-gasoline is not yet popular, but with increasing pressure on reducing emissions, reducing environmental pollution, especially in big cities, will change to the use of bio-fuels. in the near future[35]. Currently, there are four forms of thermal conversion: burning, pyrolysis, gasification and liquefaction. Biochemical transformation consists of two main forms: digestion and fermentation.

Converting biomass into bio-energy through: biogas, ethanol, biodiesel biogas, syngas is a sustainable low-carbon growth model. The survey investigation is linked to specific technology development: 1) Experimental determination of metabolism and influencing factors; 2) Develop an optimal problem; 3) Establishing calculation and experiment models, establishing optimal technological factors; 4) Compatibility testing; 5) Carry out technical research and design of biomass conversion equipment based on: heat transfer, mass transfer, hydrodynamic process. The device is studied and designed according to the principles of heat transfer, mass transfer and forward and reverse phase contact, through fixed or suspended layers for converting biomass into bio-energy and creating a calculation basis. transform scale, put research results into practice.

A. Research - develop gasification technology

In addition to waste biomass conversion to create compressed, pressed, direct burning fuels, waste gas gasification is an effective and environmentally friendly way to produce energy, convert solid biomass into gas fuel, less air pollution than coal burning due to low sulfur, application for generator engine, fuel combustion for boiler. The optimum working temperature of 700^oC has been found, the amount of oxygen is limited to not completely burn solid fuel. Synthetic gas is flammable fuel gas including H_2, CO, CH_4, CO_2, nitrogen, sulfur

(small amount, depending on input), alkali and tar compounds are high calorific fuel sources. Air supply location, temperature, air and secondary feed rate affect the composition of syngas. When there is CO reduction reaction and water needs to burn / supply secondary heat. Concentrations of CO_2, CO, H_2 and CH_4 increase with the concentration of O_2 of the inlet air and how to maintain air flow. The composition of synthetic gas differs when the rate of secondary gas flow changes. With heat recovery and waste gasification and combustion technology, the KC03.DA02 project, under Program KC03, has researched, designed and manufactured waste incinerator systems and emission control for urban and industrial areas with the result of building mathematical models to determine the elements of the source: humidity (internal and external), calorific value, ratio of raw materials (C, H, N, P, S) and volatile substances, ash / residue, alkali metal content, cellulose / lignin / hemicellulose ratio to the calorific value and thermal yield of the device.

The optimal problem in industrial solid waste combustion has been developed to control emissions according to environmental standards with the proposal of mixing waste with different calorific value, gas supply and transfer regime. change garbage into heat, fuel-saving heat, control air pollution to serve urban waste treatment, save fuel for the system and have modeled the optimal calculation of technology and data sources to control get the process of realization and reduce pollution of emissions. A system of energy research and biomass research equipment funded by NEDO is installed in Cat Que village - HoaiDuc - Hanoi and the project "Research and improve the process of biomass gasification technology for business Industry "is being developed to create an alternative energy source of 10kW capacity for food processing enterprises from available waste biomass.

B. Research on exploiting and processing methane biomass

Research on fermentation technology, anaerobic decomposition of organic waste sources with the topic of Vietnam Academy of Science and Technology "Biogas model to improve treatment of high-carbon pollution sources and credit fund applications carbon in environmental protection (2009 - 2010). Results of biogas collection from livestock waste are combined from plants, especially with water hyacinth[24]. Water hyacinth and other organic biomass such as cassava starch production waste. Pre-treatment of lignocellulosic biomass minced / crushed, soaked with wastewater (taken from the output of the biogas tank), treated with 1% caustic soda, weak acid, treated with heat, enzymes and then added to the raw material Anaerobic decomposition device has a markedly increased effect on gas production. Research cooperation funded by Japan New Industrial and Technical Energy Organization (NEDO) (2011 - 2012) when combined yeast has received methane conversion from cassava production waste with CH_4 biogas yield 380l / kgVS, methane gas has a content of 52% CH_4, 43.4% CO_2 gas other 4.7% used for generators, replacing 90% of fuel DO used in the traditional way. In addition, waste oil, palm oil and biodiesel have also been tested to show the effectiveness of replacing fossil fuels well, improved emissions, and good performance.

Fermentation of methane biomass of waste water with a load of 1kg COD / m^3 / day transferring waste into biogas to heat and generate electricity for the point project in NguyetDuc Commune - Yen Lac - VinhPhuc (2009 - 2010) and Minh Duong Food Company (2012 - 2013). Wastewater after anaerobic decomposition, further treatment with anaerobic system enhances, good separation of liquid solid system of post-treatment waste (sand/sludge filtration) allows to receive waste stream with COD lower than 400mg/l. In order to effectively apply wastewater treatment methods with biofiltration technology or measures, stable bio-waste and wastewater treatment ponds meeting environmental standards QCVN14-2009, low cost. Applying methods are used to reduce greenhouse gas emissions such as AMS.III method. D (recovery of CH4 for manure management system), AMS.III.E (gasification combustion control, thermo-mechanical reduction CH_4), AMS. III.F (Biological treatment of controlled biomass CH_4), AM0010 (CH_4 emission reduction for livestock waste management systems), AMS.III.H (CH_4 recovery from wastewater treatment system), AMS. III.I (replacing CH_4 non-aerobic anaerobic wastewater treatment system with CH_4 reducing aerobic treatment system), AMS.R (CH_4 collection from small-scale agricultural production), AMS.Y (Separation solid - liquid, livestock waste treatment reduced CH4), AMS. IC (using thermal energy from renewable energy), collecting biogas, treating waste, taking advantage of gas generation to reduce to 0.476t CO2 / emission (pig) / year Compared to no treatment to see the potential of waste biomass conversion has contributed greatly to combating climate change. Fermentation of methane gas versus ethanol yield shows the ratio of methane/bio-ethanol from lignocellulose biomass of corn and rice, about 1.15; 1.07 high methane energy generation rate, less energy input, low anaerobic investment, production of environmentally friendly, environmentally friendly methane gas with little harm.

C. Study on technology of trans fat ester removal into biofuel

The amount of waste oil and grease in Vietnam that has not been managed is the source of food insecurity and environmental pollution. With the main characteristic of the free fatty acid content (FFA) in high acid index waste oil, the study found the appropriate technology that can be removed by the esterification

reaction with the thermally reactive ethanol H2SO4 Reaction level from 50-70°C[42]. The optimum found conditions were: molar ratio of ethanol / FFA = 50/1, 5% catalyst of H_2SO_4, 70°C after 2 hours of reaction time, acid index of original waste oil decreased from 25.2 down to 1.8 mg KOH/g oil. For ester displacement reaction, the optimal efficiency of step one is 84.1% achieved when molar ratio of ethanol/oil = 9: 1, 70°C, 120 minutes. Meanwhile, the efficiency of step 2 reaches 99.5% provided ethanol/oil = 9:1; 70°C, 60 minutes. The process of testing the process of washing anhydrous biodiesel with Truc Thon bentonite and clay adsorbent, MgSiO3 and purifying through microfiltration ceramic filter applied to the production process of biofuel from grease and waste using low ethanol waste generation. This orientation was confirmed when synthesizing nano-catalyst ZrO2 Vanadium doped by hydrothermal method in alkaline environment, at 190^{o}C, for 24 hours collecting catalytic monoclinic crystal structure, spherical particles, size 15 ÷ 20 nm. V/ZrO2 material has good catalytic ability in the synthesis of Biodiesel from waste oil and ethanol. The survey results of some factors affecting biodiesel synthesis with ZV catalyst samples (1% V/ZrO2 doped sample) were found at 70°C, 12% catalyst, oil / ethanol volume ratio was 1:12, the 7-hour time to get biodiesel is 83%; increasing the ethanol utilization rate and reaction time to 8 hours, the efficiency was over 96%, the catalyst was reusable. The study comparing FAME methyl ester and FAEE when using ethanol, the results showed that it is possible to use the same device to perform methylation or methylation (FAME, FAEE), using ethanol has many outstanding advantages. Environmental friendly opens up a wide range of applications for waste oil collection businesses to convert waste biomass into biodiesel to serve the needs of businesses. Besides, the research results of ethanol production technology from cassava production and research and production of bio-blending additives E5 and diesel fuel were implemented and tested.

Vietnam's demand for energy is increasing rapidly, in line with economic growth and population growth. The energy output of our country continues to rise. In 2005, nearly 27 million tons of oil were consumed, expected to increase to nearly 37 million tons in 2010 and 51 million tons in 2020. Of which, the industry has the highest rate of energy use accounting for 46 %, transportation accounted for 35%, trade in services accounted for 12%, agriculture accounted for 1% and other industries accounted for 6%. Vietnam is a country that is endowed with nature, meeting all the energy resources. However, the ability to exploit, process and use energy resources is limited. According to an analysis of the situation of economic development and energy supplies, it is expected that in the coming time (up to 2020) our country will continue to have to import petroleum products, while oil prices are always under pressure. To solve this problem, many researches on biofuel production have been conducted: diesel production from soybean, sesame, waste oil; ethanol production from sugarcane, maize, rice, cassava, etc. The research and production of clean fuels used for transportation have been assigned to a number of agencies such as Petrolimex, Petro Vietnam, Technical University. Da Nang and had encouraging initial application results. A number of research institutions, including Ho Chi Minh City University of Technology, have prepared, tested to prove that ethanol can replace gasoline used as fuel for internal combustion engines, or to research Metyl esters using making biodiesel in a single laboratory.

The Research Institute of Beer and Beer NGK has also conducted a research project to use ethanol as an alternative fuel for some engines and give positive results on the production and use of this fuel. APP Company for several years has prepared, tested and manufactured lubricants based on the use of chemical vegetable oils. The Ministry of Science and Technology has assigned APP Company to lead the state-level independent project: "Studying technology for producing biofuels mixed with ethanol and some compounds of plant origin". The company has successfully researched in the laboratory and is preparing to test for vehicles on a large scale.The Food Industry Institute has been assigned to chair a state-level research project on the production of fuel ethanol from agricultural waste by enzyme and microbiological technology.

Petroleum additive company (APP), SaiGon Petro, Lam Son ThanhHoa Sugar Cane and Sugar Joint Stock Company, etc. attended many international conferences on biofuels with extensive relations with foreign organizations. are operating in the field of bioenergy and have plans to test preparation, proceed to production at appropriate scale and put into use testing. In 2007, the construction of industrial alcohol plants for biofuel production was kicked off in the South. Inside:

- Vietnam Bio Alcohol Joint Stock Company has invested in constructing an industrial alcohol factory with a capacity of 66,000 m3 of alcohol per year in DakLak province. To ensure a stable source of raw materials, the company has plans to deploy Tiboca starch plant on 4,000 hectares of project land.
- Bien Hoa Sugar Company and Singapore's Fair Energy Asia Ltd Company signed a memorandum of understanding on August 15 to cooperate in investing in the construction of a bioethanol factory with a capacity of 50,000 tons of raw alcohol per year. The plant will be built in an industrial cluster west of the Vam Co Dong river in ChauThanh district, TayNinh province.
- Petrosetco Company (Vietnam) and Itochu (Japan) are implementing a project of about 80-100 million USD to build a plant with a capacity of 100 million liters of ethanol per year from cassava raw material. The factory is expected to be located in HiepPhuoc Industrial Park, Ho Chi Minh City. It is expected that 99.8% of products

will be supplied to the market for mixing with biofuel.

Soybean: The national soybean area increased from 110,000 ha in 1990 to 124,000 ha in 2000 with an average growth rate of 22.5%. By 2005, there were about 203,600 ha for soybean cultivation, with an average yield. 1.4 tons / ha, an increase of 6.3%, national soybean production reached 291.5 thousand tons, 2.6 times higher than 1990. Nearly 50% of annual soybean production was produced. in the Red River Delta and the Northeast.

Peanut: The area of peanuts of the whole country increased from 200 thousand ha in 1990 to 269 thousand ha in 2005 with an average annual increase of 1.5%. The North Central Coast has the highest cultivated area, accounting for 30% of the country's annual peanut area. Peanut productivity in the period of 1990-2000 achieved an annual growth rate of 4.1%. In 2005, the average yield of the whole country reached 1.8 tons / ha, an increase of 0.74 tons / ha compared to 1990. The highest productivity increase was achieved in the Mekong Delta with 2.3 tons / ha. ha. The growth rate of peanut production in the period 1990-2000 reached 5.3% / year, the output increased by 90% in the above period due to the 57% increase in productivity and 20% increase in the area. More than 50% of the country's peanut production is produced in the North Central and Southeast regions

Coconut: Technically, studies have proven that coconut oil is one of the suitable raw materials for biodiesel production. Coconut tree is a tree capable of growing well in our country. This is an easy-to-grow crop, low production cost, giving farmers a lot of economic value. The total area of coconut plantation in Vietnam in 2005 was about 132,100 ha and the yield was 972,200 tons, the average yield of 7.35 tons of fruits / ha. The two largest coconut growing areas are the Mekong Delta and the South Central Coast region, with areas of 105,000 and 20,000 ha respectively. The output in 2003 was approximately 714,000 and 136,000 tons (based on fruit weight). The coconut growing area of the remaining regions is quite small, negligible in terms of industrial production. The potential coconut growing area in our country is about 220,000 - 250,000 ha, the estimated fruit output is about 1,300,000,000 - 1,440,000,000 fruits / year.

IV. CONCLUSION

Currently, biomass fuel in the world is the fourth energy source, accounting for 15% of total energy consumed worldwide. In developing countries, biomass is often the largest source of energy, accounting for 35-45% of total energy supply. It is no exaggeration to say that biomass fuels play a vital role in meeting the energy needs of the world and Vietnam. Our country has favorable natural conditions such as hot and humid, heavy rain, fertile soil, so biomass grows very fast. Therefore, the source of agricultural and forestry by-products is plentiful, continuously increasing. However, those sources of by-products are considered as natural waste, are wasted, more dangerous, and become a cause of environmental pollution such as burning forests, straw, sawdust in the North. or pouring rice husks into rivers and canals in the Mekong Delta ... biomass fuel is in a short circulation cycle, encouraged by the organizations on sustainable development and the environment to encourage use. Taking advantage of this fuel source will simultaneously provide energy for economic development and ensure environmental protection. The potential of biomass fuel in Vietnam is assessed to be very diverse and has quite large reserves. According to calculations by the Vietnam Energy Institute, the total biomass source is about 118 million tons / year, including about 40 million tons of straw, 8 million tons of rice husk, 6 million tons of bagasse and over 50 million tons of coffee and pods, beans, wood waste. Our country's major biomass sources include timber and crop by-products, including natural forests, planted forests, scattered trees, industrial and fruit trees, and wood waste industry. According to the Institute of Energy - Ministry of Industry and Trade, the potential for energy wood biomass reaches nearly 25 million tons, equivalent to 8.8 million tons of crude oil. Particularly, the potential of biomass energy of agricultural by-products of our country including straw, rice husk, bagasse and other agricultural products is up to nearly 53.5 million tons, equivalent to 12.8 million tons of crude oil. In particular, this energy source will be continuously regenerated and grown steadily over 30 years. Although it is considered as a clean energy source, many benefits are mostly harmless but biomass fuel still has some disadvantages such as unfocused distribution, low calorific value, small specific density, thus very complex contamination when transporting and storing. On the contrary, the price is extremely cheap, most suitable for household size and small and medium industrial models. Therefore, along with perfecting the technology of using fuel, the development of auxiliary technology such as pretreatment, packaging, transportation ... is also one of the factors to be considered when developing biomass fuel.

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