Present Status on Biomass Energy Research and Development in Vietnam

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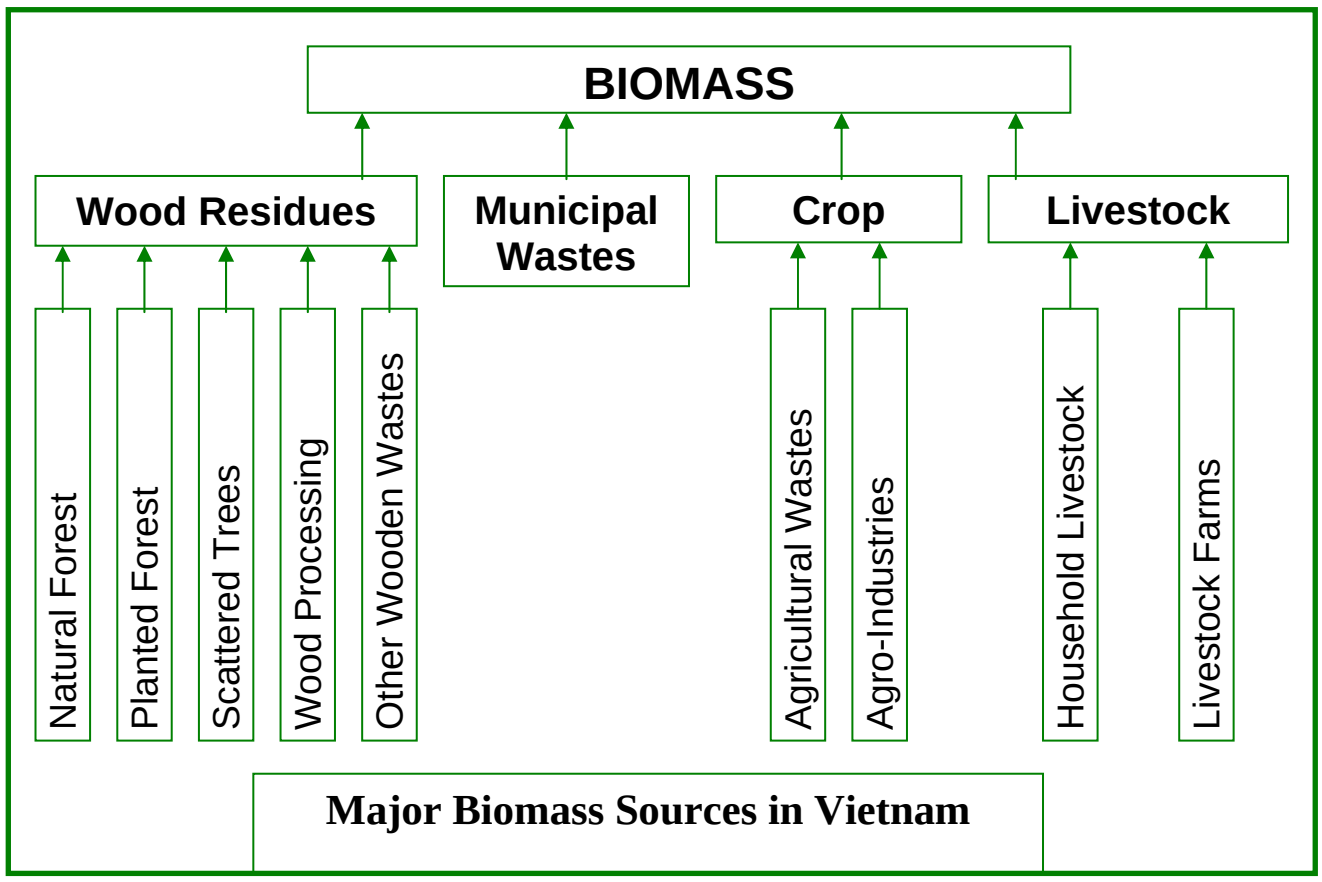
I. Overview on Major Biomass Sources in Vietnam

Vietnam possesses abundant biomass resources which can be more efficiently utilized to supply an important part of the fuel and electricity needs of the country.

Major biomass sources in Vietnam include (i) wood residues, (ii) municipal wastes, (iii) crop residues, and (iv) livestock wastes.



Availability of Major Biomass Sources in Vietnam (2000)

No.	Agro-Industries residues	Biomass amount (million tons)	Primary Energy Content (GJ)	% of total (basing on GJ)
1	Wood Sawmills' Residues	3.1	35,960	2.6
2	Firewood	12.4	186,000	13.4
3	Municipal wastes (combustible part)	0.015	57	~0.0
4	Paddy straw	61.9	866,600	62.6
5	Rice husk	5.6	63,840	4.6
6	Maize husk	4.8	60,000	4.3
7	Cassava stem	0.6	7,500	0.5
8	Cane trash	1.5	18,750	1.4
9	Bagasse	5.0	36,050	2.6
10	Peanut shells	0.1	1,250	0.1
11	Coconut shells & leaves	5.8	104,400	7.5
12	Coffee Husk	0.3	4,670	0.4
	Total	**101.1**	**1,385,077**	**100.0**
13	Biogas production of animal dung	2.0 billion m^3	40,000,000	

II. Potential Resources for Energy Generation from Biomass Residues

As in most Asian countries, biomass energy plays a major role in National Energy Balance, especially in the rural areas in Vietnam. Biomass provides 60-65% of the total amount of primary energy consumed in Vietnam (EVN, WB and COWI, 2001).

	1995		1998		2001	
	KTOE	%	KTOE	%	KTOE	%
Total En. consumption	210086	100	23618	100	27980	100
Tradable Energy	8074	38.29	10552	44.89	13300	47.5
Biomass En.	13012	61.71	13060	55.31	14680	52.5

Total Energy consumption (source: Statistical Yearbook 1995, 1998 and 2001)

(KTOE = 10^3 ton oil Equvi.)

The largest part of biomass energy is used for household energy needs in the countryside where 75% population lives in but only 80% of which has access to grid power.

Energy consumption in the rural areas

	1995		2001		
	KTOE	%	KTOE	%	
Total En. consumption	14501	100	14680	100	Consumption demands increased, but due to the rapid urbanization the total En. Consumption stay the same
Biomass En.	13012	90	13060	89	

90% of total biomass is used in for household energy needs (cooking, heating water and domestic space heating) in countryside. However, biomass so far in rural areas has been used inefficiently in traditional stoves (less than 10%). The utilization of biomass in industrial sector has not been popular. Therefore, the contribution of biomass in the entire energy supply in Vietnam has not been corresponded with its potential.

Capacity of biomass sources

	2000		2010	
	TWE x10^3	%	TWEx10^3	%
Forestry and timber industry	22000	62.5	32200	62
Waste from farming	8976	24.5	1122o	26
Waste from livestock	4224	13	5920	12
Total Biomass	35200	100	49340	100

(Source: Project KC.07.04.04 Biomass potential in period 2000- 2010)

III. Potential and utilization of electricity produced from biomass

1. Wood residues:

On average, the percentage of wood residues (compared to the initial input volume) for the sawmills in Vietnam is 60%, i.e. to produce 1 m^3 of lumber; the wood residues generated in the plant would be 1.5 m^3.

In 2000, sawmills in Vietnam produced about 2.95 million m^3 of lumber. Wood log consumed by the sawmills would be 7.38 million m^3, and generated residues could be 4.4 million m^3. Around 0.5 m^3 wood residue generated in the sawmill is capable of generating about 120 kWh of electricity (Mohanty & Oo, 1997). Assuming that all wood residues of 4.4 million m^3 could be used for electricity production, around 1,060 GWh would be generated.

2. Paddy straw:

In Vietnam, paddy straw is used for multi purposes, therefore only a part of paddy straw generated annually could be used for electricity production. Assuming that 20% of paddy straw (i.e. 12.4 million tons) can be concentrated for power generation and the specific consumption of paddy straw is 2.6 kg/kWh (Singh & Koonar, 1986), and the electricity production from paddy straw could be 4,770 GWh.

3. Rice husk:

Rice husk produced as residues from the rice milling industry can be used as fuel for electricity and heat production. A part of generated energy (electricity and heat) can be consumed by rice mill for milling and for mechanical paddy drying. The excess electricity could be sold to the grid.

There are more than 100,000 rice mills available, distributed all over the country. About 99.9% of existing rice mills are in small scale (the milling capacity is less than 10 tons/shift or 30 tons/day on paddy basis). More than 70% of these small rice mills are located in the North of Vietnam.

The large-scale rice mills (>10 tons/shift) are estimated to be more than 100 with total capacity of 6,075 tons/shift, 70% of which are located in the South of Vietnam, mainly in the Mekong River Delta. Numbers of rice mills having the design capacity of 40 tons/shift and higher are only 58, of which 46 mills are distributed in the Mekong River Delta. The list of 58 biggest rice mills with a total capacity of 5,048 tons/shift is shown in Annex 5.

Depending on used biomass energy technologies, around 1.8 to 2.8 kg of rice husk are necessary to produce 1 kWh of electricity (IEPF, 1994 and Mohanty & Oo, 1997). If all the rice husk from rice milling sector could be concentrated, the total rice husk would be around 5.6 million tons, which could generate around 2,200 GWh of electricity (assuming that the specific rice husk consumption is 2.5 kg/kWh), equivalent to 8.3% of the total electricity production of Electricity of Vietnam (EVN) in the year 2000.

Potential Resources for Electricity Production from Wood and Agro-Industries Residues in Vietnam

	Agro-Industries residues	Estimated amount of residues	Installable Power (MW)	Produced Electricity (GWh)
1	Wood Residues	4.4 million m^3	180	1,060
2	Paddy straw	12.4 million tons	600	4,770
3	Rice husk	5.6 million tons	440	2,200
4	Bagasse	2.9 million tons	150	410
5	Biogas	200 million m^3	300	40
	Total		**1,670**	**8,480**

4. Bagasse:

In 2000, sugar mills in Vietnam have processed 8.8 million tons of sugar cane or 78,200 TCD (i.e. the average operating days is 113 days/year). Surveys indicate that the average bagasse to sugar cane ratio by weight is 0.33 for the sugar mills in Vietnam (Enerteam, 1997). Accordingly, the bagasse generated in the sugar sector could be 2.9 million tons (25,800 tons/day).

The surveys conducted at several sugar mills in Vietnam show that utilization of around 7 kg of bagasse could cover the heat demand of the plant and could produce 1 kWh of electricity (Enerteam, 1997 and 1996). Assuming that all 2.9 millions bagasse could be used, the technical potential for power generation from bagasse in Vietnam can be estimated at 410 GWh in the year 2000.

5. Biogas

As stated in 2.1.4, the livestock farm sector in Vietnam is concentrated to small individual household farms; therefore the big biogas plants which can be incorporated with electricity generation are not many. Assuming that only 10% of biogas potential in Vietnam (i.e. around 200 million m^3 per year) could be used for electricity production with a specific biogas consumption of 0.6 to 0.7 m^3/kWh (United Nations, 1980), the potential for electricity production from biogas would be 300 GWh. Accordingly, the installable power could be 40 MW

At present, there are 3 sugar plants selling electricity to EVN based on separately negotiated PPAs. They are:

- BOURBON which negotiated with EVN in 1998 and now is selling 14 MW to EVN at tariff of 4.04 UScent/kWh.
- Son La sugar plant sells about GWh/year at 400-440 VND/kWh, and
- La Nga sugar plant will sell 1.5 GWh/ year at tariff of 400 VND/kWh (*Exchange rate in 1999 is 1 US$ = 12 000 VND*).

There are 2 technologies for biomass energy in Vietnam as

- Biomass Combustion Technology
- Biomass Gasification Technologies

IV. Barriers towards Dissemination of Biomass technologies in Vietnam

1. Technical obstacles

- Lack of the technology and appropriate equipment for biomass production improvement, biomass material handling and biomass energy application: bio-fuel, bio-power and bio-products.
- Lack of expert and experience to carry out different research on technology and equipment developments of biomass utilization.
- Lack of updated information on biomass energy technologies for end-users.

The widespread dissemination of biomass energy technologies in Vietnam is very limited. The several workshops and seminars on biomass technologies were organized in Vietnam, but they are mainly for government officers, researchers and engineers, not for the potential biomass power producers. Furthermore, until now there is not any pilot project which demonstrates the feasibility of a biomass power project, its advantages and disadvantages which will obviously convince the power investors on the benefits of the biomass power projects.

2. Socio-economical problems

- Biomass resources are scatted around the country, which cause the difficulties in management, collection and transportation.
- Biomass and biomass energy have not been commercial in Vietnam.
- Lack of finance/capital availability for the advanced technology of biomass energy application.
- Lack of incentive policy for the utilization of the production from biomass (bio-fuel, biomass energy).
- Low prices of electricity and other traditional fuels in comparison with cost of biomass energy.
- Lack of an adequate policy and regulations to purchase power from small power producers
- The biomass and bio-fuel have not been considered and invested as much as an efficient solution for hunger-eradication, poverty alleviation, natural conservation and environmental protection.
- Traditional habits of biomass utilization which is inefficient and harmful to human’s health and environment.

V. Institution and Policy for Development of Biomass Energy in Vietnam

a. Up to 2000, Vietnam still develops the power sector based on the conventional power sources: hydro power, coal-fired and gas-fired power plants. The renewable energy sources were disparaged that to be not reliable and more expensive than the others.
b. In recent years, Vietnam has “open the doors” for the development of renewable energy technologies in general, and of the biomass technologies in particular.

- **The Decision of Prime Minister No. 22/1999/QD-TTg dated 13 February 1999** stated that the rural electrification should be implemented in combination between the extension of the national power grid and the development of the local power sources such as small hydro power, wind power, solar power, biomass/biogas power, … based on the evaluation of project costs and other related factors, and on the selection of an optimal alternative.

- **The Decision of Prime Minister No. 95/2001/QD-TTg dated 22 June 2001** also stated that it should classify the rural areas where could be electrified by national power grid, and where should be electrified by using local power sources, of which biomass/biogas power.

- On 22 August 2001, Ministry of Science, Technology and Environment launched a National-level research program “**Research and Selection of Technologies and Equipments to exploit and to use the renewable energy sources in processing of agricultural, forestry and sea products, in rural areas for environmental protection**”. One of three components of the program will focus on research, design and manufacture small scale furnaces/boilers using agricultural wastes and agro-industries residues as fuel.

- In “**Vietnam Energy Development Strategy**” issued by Ministry of Industry (MOI) for submitting to Prime Minister in 2005, renewable energy has been stated as "to boost research and development of new and renewable energies in order to meet the demand of energy utilization, especially in islands, mountainous and remote areas”.

VI. International cooperation in Biomass Energy in Vietnam

- **"Use of Energy from Biomass Wastes**" implemented by Ministry of Agriculture and Rural Development in the framework of Economic Co-operation and technology Transfer Programme among the ASEAN countries with the financial assistance from the Government of Australia (through AAECP-III).

- **Renewable Energy Technologies in Asia – A Regional Research and Dissemination Programme (RETs in Asia):** Two-year research programme (1998-2000) sponsored by the Swedish International Development Co-operation Agency (SIDA). One of three key component of the programme is research and production of high efficiency biomass briquette and briquette stoves.

- "**Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement (PREGA)**" funded by ADB will focus mainly on (i) preparing a portfolio of renewable energy, energy efficiency and greenhouse gas abatement (REGA) projects for financing by diverse sources, including the private and public sectors, multilateral and bilateral agencies, and using specialized mechanisms such as GEF and CDM, (ii) preparing the country studies on policy and institutional aspects relevant to dissemination of REGA technologies, (iii) developing the financial models suited to the needs of the country, for REGA technologies, and (iv) setting up the pilot projects for REGA options and evaluating the performance of such projects.

- "**Development the bio-fuel for the rural areas**" in cooperation with the Holland government. The project aims to establish 10,000 to 15,000 biogas plants for household use in the nest 5 years.

- **"Pre-feasibility study on biomass power generation using appropriate technology in Vietnam"** has been developed from the 2002 in the cooperation with Italian National Agency for new technology, energy and environment. The objective of project is carrying out pre-feasibility on biomass resources for generation of electricity in Vietnam through using appropriate thermo-chemical technologies with identifying places for demonstration of these technologies in the way suitable to the context of Vietnam.

- "**Biomass and Waste for Renewable Energy**" started in January 2004. The project is carried out by 4 universities in Vietnam, Germany, England and Thailand with the main objectives are to establish information system within the universities and raining courses for students in term of biomass utilization development.

- **"The Plan for Bio-fuels Utilization Development"** has been submitted by the MOI. This is a plant producing Ethanol (USA technology) built to 2007 to meet the demand of 300,000 – 400,000 tons of blended diesel per year.

VII. Conclusions and Recommendations:

❖ Conclusions:

1) Vietnam has a big potential for energy production from various biomass sources. Biomass energy potential is incompletely estimated at 1,670 MW by 2000, and could supply 8,480 GWh of electricity annually. The possible major biomass sources likely to be exploited in the near future are rice husk, bagasse and biogas from animal dung. Their potential is 240 MW, and could provide 960 GWh of electricity yearly.

2) There are the barriers which much overcome, especially the lack of policy and regulatory framework to promote the biomass power production, and lack of access to financing for project developers.

3) Vietnam began to attend to the economical effects of the renewable energies in general and biomass energy in particular.

4) Many international financing institutions such as WB, ADB, etc. are supporting Vietnam in research, development and implementation of renewable energy projects.

❖ Recommendations:

1) Vietnam should urgently establish a comprehensive approach, a master plan and an institutional & policy framework to encourage biomass energy production, to improve the access to financing for small power producers.

2) Pushing up the research and manufacturing the biomass energy technologies in Vietnam to reduce their cost.

3) Dissemination of biomass energy technologies in Vietnam through demonstration projects and organizing the workshops, seminars and training courses. It should provide training and business development assistance to businesses and government officers at all levels.

4) It should develop the institutional markets for biomass power plants

5) The private sector participation should be encouraged.

6) Fostering international collaboration for research and development of biomass utilization.