

BIOMASS

GREEN, CLEAN AND SUSTAINABLE FUEL SOURCE

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Overview

The pressing global issues of climate change and dwindling fossil fuel reserves pose significant challenges to our energy landscape. In this context, biomass emerges as a sustainable and promising solution. Biomass, a renewable energy source derived from organic materials, is gaining increasing global attention. By converting organic matter such as straw, bagasse, and wood chips into energy, biomass not only contributes to reducing greenhouse gas emissions but also ensures national energy security.

Vietnam, with its abundant agricultural and forestry resources, possesses a significant biomass potential. However, the efficient exploitation and utilization of this resource remain limited.

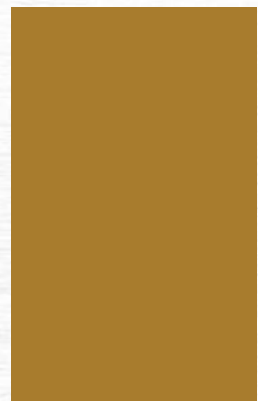
This report aims to provide a comprehensive overview of biomass, including its definition, types, energy conversion processes, and an assessment of the potential and challenges of developing this energy source in Vietnam.



I. Biomass Overview

Biomass is biological material derived from plants, industrial crops, and agricultural residues (such as rice husks, straw, bagasse, wood shavings, and paper waste). These materials contain chemical energy, which plants store through photosynthesis.

Biomass can be converted into various forms of energy, including heat, electricity, and biofuels (such as ethanol and biodiesel). With its rapid renewability and vast potential, biomass plays a crucial role in reducing dependence on fossil fuels, mitigating greenhouse gas emissions, and promoting a circular economy.





Solid Biomass: The most common form of biomass, including briquettes, pellets, wood chips, and ground husks. It is derived from agricultural and forestry residues (such as rice husks, bagasse, coffee grounds, straw, and wood scraps) or industrial and household solid waste (paper, food waste, and other organic materials).

Liquid Biomass: Biomass can be converted into liquid fuels such as methanol and ethanol for use in internal combustion engines.

Gaseous Biomass: Biomass can be produced through the processing of industrial waste and wastewater in treatment plants. Bacteria decompose organic matter to produce biogas (primarily methane and carbon dioxide). The methane produced in this process can be collected and used as a biomass energy source.

Comparison of Biomass and Fossil Fuels

Factor	Biomass 	Fossil Fuels 
Renewability	Renewable – Produced from plants and organic waste.	Non-renewable – Takes millions of years to form.
Carbon cycle	Can balance CO ₂ through plant absorption.	Releases CO ₂ without natural reabsorption.
Greenhouse gas emission	Lower emissions compared to fossil fuels.	High emissions, contributing to climate change.
Feedstock	Agricultural residues, waste,..	Coal, oil, natural gas,..
Cost	Cost varies depending on technology and supply. May be lower in the future.	Relatively low cost, but supply is declining and prices are volatile.
Environmental impact	Sustainable fuel source, reduces pressure on natural resources.	Causes environmental pollution.

II. Benefits of Biomass

For Businesses

- **In production:** Biomass can be used directly or indirectly as fuel in boilers to generate the necessary energy.
- **Cost savings:** Biomass is cheaper than coal, so the cost of producing steam using biomass fuel can help businesses save up to 40% on fuel costs compared to using fossil fuels.
- **Sustainable resource:** Biomass is a renewable resource, ensuring a continuous supply of fuel for factories and enterprises during operations. Biomass is also considered a green alternative to coal in industries, helping businesses achieve sustainable development goals.



For the Environment

- **Reduced CO2 emissions:** Biomass stores CO2 during growth and releases it during combustion, thus recycling carbon in the atmosphere and minimizing the greenhouse effect.
- **Reduced waste:** By utilizing seemingly useless waste as a valuable fuel, biomass significantly reduces emissions. The electricity generation process using biomass can reduce emissions by 14% to 90% compared to fossil fuels.

III. Sources to create Biomass



Wood and agricultural products

Biomass is produced from agricultural residues such as sugarcane bagasse, hay, corn, natural grasses, hemp, palm oil, straw, plant residues, dry leaves, wood scraps, paper, etc.



Forestry and wood industry residues

Trunks, branches, leaves, and sawdust or wood shavings obtained from wood processing. This biomass is often used as fuel in industrial boilers.



Livestock waste

Manure and sludge from livestock farms can be converted into gas or burned directly to generate heat and produce energy



Solid waste

Biomass can also be produced from waste generated by households, businesses, and industries (excluding inorganic materials like metals and plastics). Therefore, biomass can help reduce the waste burden on the environment. However, some solid waste is not suitable for biomass (such as metal and plastic waste).



Biogas

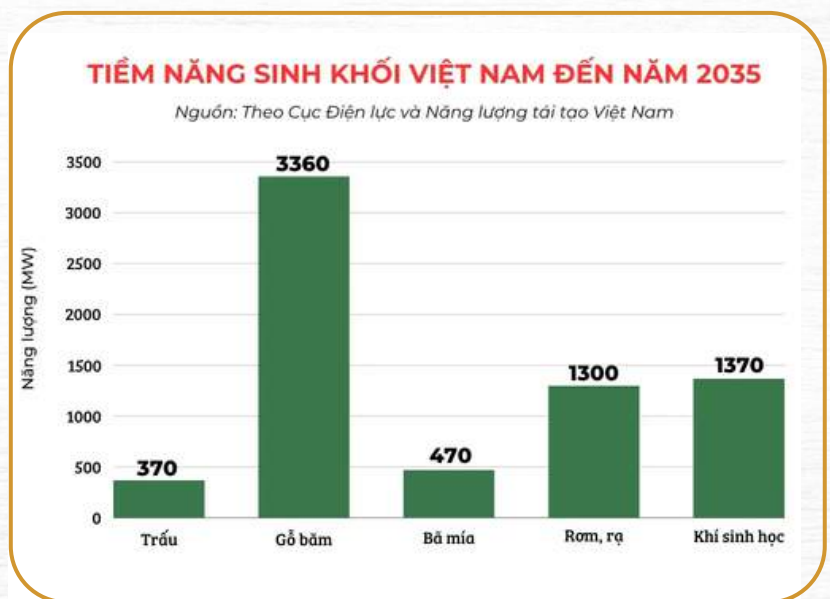
The treatment of industrial waste and wastewater in tanks at sufficiently high temperatures produces gas that can be used as biomass fuel.

IV. The Biomass market in Vietnam

In recent years, biomass has been the primary fuel source for the paper industry in Vietnam, accounting for approximately 45% of the total fuel consumption. Coal follows with a 30% share, while the remaining percentage is attributed to other fuels such as oil and natural gas. Estimates suggest that Vietnam has a biomass reserve of about **170 million tons**. Leveraging this significant biomass energy potential can not only reduce Vietnam's reliance on traditional energy sources like coal and petroleum but also mitigate carbon emissions, reduce pollution, and provide economic benefits to farmers participating in the bioenergy value chain.

Opportunities

As an agricultural country, Vietnam possesses substantial biomass energy potential. The primary types of biomass in Vietnam include firewood, agricultural residues, livestock manure, municipal waste, and other organic waste. Studies have shown that the potential for biomass energy and electricity generation from these sources is approximately 134 million tons, capable of generating 698–781 MW of electricity.



Biomass potential in Vietnam by 2035

Challenges

- **Modern boiler technology:** Developing biomass energy requires overcoming challenges related to modern boiler technology. This involves significant investments in training highly skilled personnel to design and operate biomass-fired boilers.
- **Biomass pricing:** Another challenge is the lack of control over biomass prices. The scattered and dispersed supply of raw materials contributes to this issue. However, given its wide range of applications, biomass is worth investing in and developing.
- **Policies:** Inadequate policies supporting the development of biomass energy in Vietnam have hindered the widespread adoption of this energy source.

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and leaves a positive legacy for generations to come.*



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