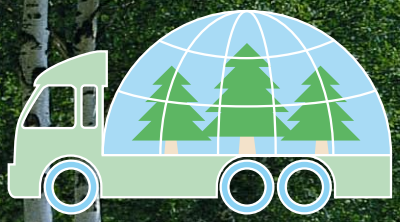
Biomass Energy

Curbing Global Warming by Increasing the Economic Value of Forests



The Significance of Liquid Fuel Production from Woody Biomass

Masayuki Kamimoto
Research Coordinator for Environment & Energy

Biomass - Carbon Neutral

Japan is a country poor in energy resources and has flourished by consuming large quantities of cheap fossil fuels. However, with the emergence of global warming as a serious concern in the late 1980's, we entered into a new era when it is necessary to use a balanced combination of fossil fuels, atomic and renewable energy. The need is evident to increase renewable energy as a middle/long term measure in order to attain a low-level emission of greenhouse gases.

Biomass is a renewable energy derived from animal and plant organic matter. Though it generates carbon dioxide when utilized, the biomass was created from solar energy, water, and carbon dioxide, and so does not increase the earth's net volume of carbon dioxide. In this respect, biomass is said to be "carbon neutral" (Fig. 1).

Woody Biomass with High Carbon Fixation

There are enough biomass resources in the world, 1.2×10^{10} kL/year (crude oil equivalent), to cover the world's demand (1×10^{10} kL/year) (World Energy Assessment: http://stone.undp.org/undpweb/seed/wea/pdfs/chapter5.pdf). Owing to rich forests, Japan's biomass has the potential to meet a part its primary energy needs. Biomass can generate not only electric power and heat directly by burning, but can also be efficiently converted to gas and liquid fuels. On this merit, biomass is considered a more appropriate energy to transport if compared to other renewable energies.

Biomass from waste, such as black liquor (the liquid waste produced after fiber extraction), food and agricultural waste, and sewage sludge, are the types of biomass used most in Japan at present (Fig. 2). Up to now, one had to pay for the disposal of waste, so this method is very economical too.

Ethanol is produced from corn in the United States and from sugar cane in Brazil, 8 million kL and 12 million kL respectively, and mixed with gasoline for wide use in automobiles. It is now being investigated to use ethanol or ETBE (Ethyl Tertiary-Butyl Ether), an octane-boosting agent, to mix with gasoline in Japan.

Woody biomass, such as forests, will be important in the future. If we can better manage the forests, more biomass can be utilized and carbon fixation will be increased.

Sustainable Growth of Forests and the Utilization of Woody Biomass

In the beginning, first firewood and charcoal, then coal and oil, were the principal energy sources of mankind. The reason why firewood and charcoal was replaced by coal and oil is because the energy density of the former is low, a lot of energy is needed to collect them, and so it became economically infeasible.

At the National Institute of Advanced Industrial Science and Technology (AIST), the production of fuels from woody biomass

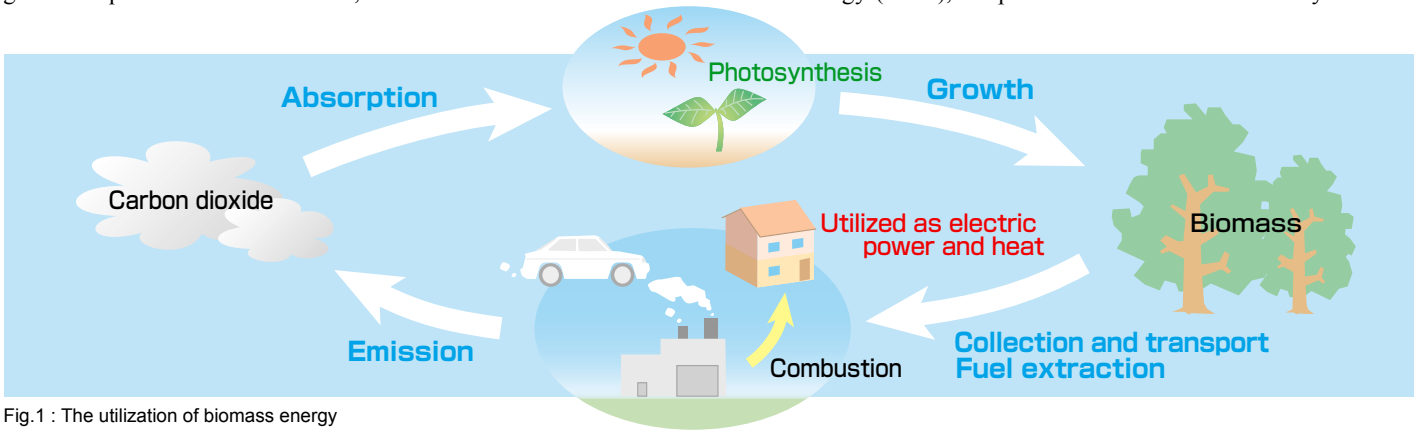


Fig.1 : The utilization of biomass energy

Biomass Technology Research Center Actively Working with Having Its Base of Operations in the Chugoku Region

Akira Yabe
Director, AIST Chugoku

The Biomass Technology Research Center was founded and initiated its activities in October 2005, with a planned term of six and a half years and having its base of operations in the Chugoku Center. About half of the over 100 staff of the Chugoku Center belong to the Biomass Technology Research Center. There are two key reasons why the Biomass Technology Research Center was established in the Chugoku Center.

1. The Chugoku region has been rich in woody biomass resources.
2. The Chugoku region has taken an active role in the utilization of biomass.

Both the population and the principal economic indices, such as industrial shipping in the Chugoku region, are about 7% of the country of Japan. However, its lumbering sector manages 16% of the total in the country due to its calm waves and busy marine transport in the Seto Inland Sea, and is rated the top in the country among the 8 local Bureaus of Economy, Trade and Industry. Primarily, imported lumber from Canada and Northern Europe is processed and sawmill wastes can produce approximately 1% of Japan's energy consumption if we take advantage of this resource for the whole country. Furthermore, from the Middle Ages to the Taisho era, the whole Chugoku mountainous district, including the Izumo region, produced 80% of the national iron by the traditional iron manufacturing method, "Tatara", using iron sand. The "Tatara" method requires large quantities of charcoal, and 15 tons of charcoal, or approximately 1 ha of forest, is required for one cycle. Assuming 60 annual cycles and the felling of one part of the forest with a 30-year cycle (the usable age of broadleaf trees for charcoal is 30 years), about 1,800 ha (corresponding to a circle of 2.5 km radius) of forest area is required for one "Tatara" installation. As there were more than 30 "Tatara" installations in Chugoku region, it can be seen that this region has used a great deal of forest resource energy.

In the industrial cluster plan of the Chugoku Bureau of Economy, Trade and Industry, there is a plan to create a well-grounded recycling-based and sustainable eco-friendly society with the utilization of biomass as an important key technology. Furthermore, the Biomass Project Center was founded at Hiroshima University and the "Experimental Study on Developing a Regional System for Biomass Energy" of the New Energy and Industrial Technology Development Organization (NEDO) is underway in the Yamaguchi Prefecture and Maniwa City, Okayama Prefecture. And other organizations such as the Industrial Research Institute of Tottori Prefecture are giving high priority to the utilization of biomass. Now, with the challenge of biomass utilization in the Chugoku Region having begun, the contribution of our Biomass Technology Research Center to the local region is strongly anticipated.

The Chugoku Center is spearheading the "Biomass Council." In this council, 40 participating organizations aim at the promotion and creation of a biomass utilization project by focusing on the active exchange of opinions. As a method to achieve this end, the Biomass Technology Research Center will present an economic simulation model of a biomass utilization system, which would be applicable to many kinds of biomass energy utilization systems, and customize it according to the needs of each region. The policy of Biomass Technology Research Center is to promote the practical use of biomass by estimating the concrete economic aspects and environmental effects, and by clarifying the necessary research and development themes and issues. A system analysis has currently been initiated for the biomass utilization needs not only of the Chugoku region, but also all of Japan and Southeast Asia.

With the aim of becoming COE of biomass research in the world, the Biomass Technology Research Center has the objective to increase its contribution to the local area by fostering cooperation between industry, the academic world, and governmental services.

is an important theme of our second term research strategy. If we can establish the technology to utilize woody biomass by converting it into fuels with high added value, rather than simply burning it, a large quantity of woody biomass from unused trees, sawmill wood waste, and the discarded lumber from construction, can be effectively utilized.

If we can elevate the economic efficiency of woody biomass, the economic value of the forest will also increase. As a result we can achieve a real carbon neutral where there is a cycle of tree felling, tree planting, forest thinning, etc., which will contribute substantially to the prevention of global warming.

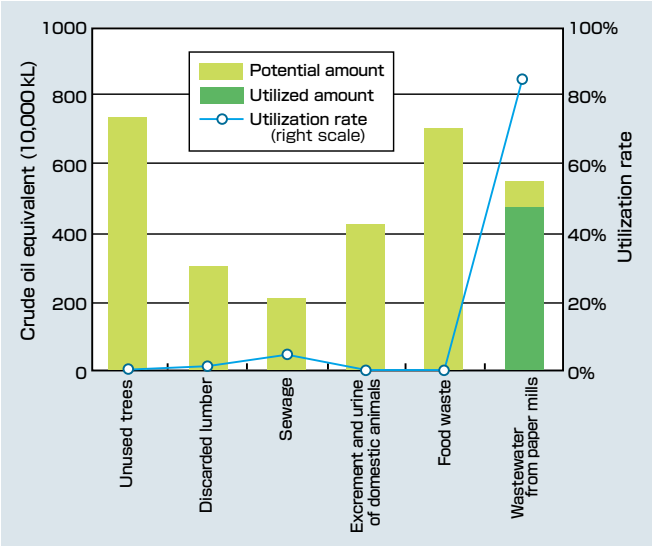


Fig.2 : Examples of utilization amount and potential amount estimations of biomass energy in Japan
Utilization rate = Utilized amount (electric power generation + heat)/Potential amount (Source: Agency for Natural Resources and Energy)