

# The Biomass Boom

Professor **Koichi Fujie** identifies the elements behind the biomass boom in Japan, discusses the various issues facing the nation with regards to promoting biomass utilization, and highlights the contribution Japan could make to biomass projects overseas.

**J**apanese agriculture used to revolve around biomass. Firewood from the surrounding forests was used for fuel, and cows and horses were used to plough the fields to grow crops such as rice and barley. After the harvest, straw and rice husks were used as fuel, or to make straw bags and rush mats so that nothing was wasted. Even livestock manure was used as compost with straw and fallen leaves so that everything was used effectively.

However, everything changed in the early stages of Japan's period of high economic growth. The turning point came in 1960. Then Prime Minister Ikeda initiated a plan to double the national income, and the changes which ensued marked a clear shift away from the use of biomass, with cattle and horses soon replaced by tractors and mechanized cultivators, and LPG (liquefied petroleum gas) soon entering the kitchens of even agricultural households. Farmers needed a cash income to purchase



Japan has rediscovered the tradition of using straw and grain husks in compost or for making bags and mats.

electric appliances and farm machinery, but few farmers could afford this with only their farm income by selling rice or barley, so many farmers either took second jobs or made ends meet by growing additional cash crops other than rice and barley. Dependence on fossil fuels increased as chemical fertilizers, agrichemicals and heating systems for PVC greenhouses became increasingly important to make agricultural production more efficient. This was a global trend, so that the proportion of biomass utilization as an energy source decreased as per capita energy consumption increased.

However, the price of oil—an energy source that had seemed so cheap and inexhaustible—rose dramatically during the oil shock of the 1970s. The period after the energy crisis saw a biomass boom. On a recent trip to Indonesia to do some biomass research, I happened to see a small old plant that was still producing ethanol, and which the locals informed me had been donated by Japan after the energy crisis. But in Japan biomass was forgotten as soon as an oil reserve was established.

More than twenty years later, biomass is again receiving attention as a result of the Kyoto Protocol that came out of the Convention on Climate Change Third Conference of Parties (COP3) and the steep increases in the price of crude oil in recent years. This time the issue is not just an energy problem, there is also the additional factor of curbing emissions of greenhouse gases to consider.

In 2002, a “Biomass Nippon Strategy” was approved by the Cabinet to be developed as a national project. Since then, there has been a growing trend in regional areas to try to use biomass more effectively, with 159 local municipalities having joined the

“Biomass Town” program as of September 29, 2008. In many cases the local people have a strong desire to receive subsidies.

## The Need for Biomass Resources

There are three elements behind the current biomass boom and the increasing need for biomass resources.

The first element comes from the perspective of the problem of processing waste. For example, this approach tries to use what would otherwise be waste materials from livestock excrement, food processing, sludge or sewerage as biomass. The second element comes from the perspective “we have so much of it we cannot not use it.” In other words, this approach tries to use biomass effectively in a way it has not been used so far. The third element comes from the perspective of food security, or of effectively utilizing fallow fields or abandoned farms. This approach actively tries to create feed crops and resource crops.

The advantage of using biomass is that it reduces emissions of greenhouse gases, as I stated at the outset. The idea is to use biomass for fuel because carbon dioxide emissions from biomass are carbon neutral, and so do not count towards emissions totals. Second, utilizing biomass solves the problem of waste disposal, and helps to revitalize regional communities (by creating employment as a result of introducing biomass projects into a regional area, for example). Third, biomass utilization makes it possible to create agricultural infrastructure. For example, introducing biomass facilities can transform the load on the environment due to large volumes of livestock waste into an advantage. Fourth, in terms of forestry management, effectively managing the ecology can also benefit environmental preservation. In addition to these benefits, utilizing biomass can also create significant value if it can produce net energy and lead to real world benefits.

## Biomass Development

There are several issues facing Japan with regards to promoting



### **Biomass facilities can transform the load on the environment imparted by livestock waste into an advantage.**

biomass utilization.

The biggest issue is cost. As I said earlier, farmers have taken second jobs in order to seek a cash income and as a consequence no longer have the time necessary to gather and use biomass. As a result, there is currently a real issue in terms of whether it is financially worthwhile to cultivate, collect, and produce biomass. Secondly, there is the problem of striking a balance between the amount of energy produced by biomass and the amount of energy that needs to be invested in biomass production. That is, the energy coming out must be greater than the energy that is put in. At this point it is not sufficiently clear just how much energy needs to be invested for bio-ethanol production.

In other words, the advantages of utilizing biomass and the question of how to best manage the social costs have not been fully worked out. We should not think of biomass in terms of separate categories—simply thinking of biomass as a readily available substitute fuel, or as a way of processing waste or preserving and managing ecosystems. Instead, it is crucially important that we start thinking about biomass as a means for bringing about a sustainable society that has a healthy recycling infrastructure. Therefore we have to verify the value of biomass utilization and promote its utility for the society of the future if it is preferable.

## **Overseas Plantations**

In Indonesia, for example, factories are being constructed at a rapid rate, with the aim of creating large volumes of bio-ethanol from cassava. Local expectations towards bio fuels including the production of biodiesel fuel (BDF) from jatropha are extremely high.

In these palm oil plantations, investigations have found that about three or four tons of palm oil (the raw material for making biodiesel fuel) can be produced per hectare of palm plantation. Similar results have been found for bio-ethanol. These calculations do not include the fuel required for cultivation and production, so the actual net figures are likely to be even lower. Even supposing all of the fossil fuels consumed in Japan were to be replaced by biodiesel, this would require the land of four to five times the area of Sumatra (the largest island in Indonesia) for palm plantations, which is clearly not a realistic possibility. Full-scale adoption as a biomass fuel for developed countries is close to impossible.

So, what should we do?

In Indonesia, for example, the government has initiated a policy with the aim of using biofuels as much as possible domestically, without relying on fossil fuels. The idea is to use biomass assets effectively in order to establish local, independent energy systems and self-sufficient societies. This is something that developed nations such as Japan should support with technical assistance or institution-building so that developing countries can promote effective utilization of biomass by themselves. Increasing the usage of energy from biomass sources in developing countries helps to reduce the global demand for oil and also reduces greenhouse gas emissions, regardless of where it takes place.

The key to success is the question of whether self-sufficient systems can be created locally. It is also important to gain foreign capital by exporting palm oil produced at the plantations, but that is not the only issue. Another key point is the question of how to create systems that lead to regional revitalization by gaining an environment-friendly energy supply, while ensuring that local partners protect the local environment. Developing technologies, and designing and evaluating systems can be achieved with the cooperation

with developed countries, but adjusting and introducing them to local conditions can be difficult. We need to introduce systems that can be executed in terms of the culture of the local region, the autonomy of the system and the suitability for local conditions. We also need to work toward the development of a system in which the local people collect biomass and start using these assets. In this sense, it is important that technology transfer relating to biomass utilization involve a set of three functions: local culture, social science, and technical systems engineering.

There is another pragmatic problem with biomass projects in developing countries. Large amounts of greenhouse gases (such as methane) are released from the effluent and wastes from plantations. Introducing systems that capture these gases and convert them into fuel would reduce greenhouse gas emissions and provide a source of cheap fuel. Such contribu-



**A man carries charcoal produced from agro-forestry waste. Charcoal in Japan is used for everything from fuel to soap.**

tions would enable developing countries to save money while developed countries would earn emission credits from the clean development mechanism (CDM). These kinds of technologies could be introduced immediately, and this issue deserves urgent consideration as part of Japan's assistance policies. ■

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