

Japan becoming an international biomass energy hub

Growth in the use of renewables, particularly biomass, is one of the effects of the 2011 earthquake and tsunami in Japan that also dealt a blow to the country's nuclear power industry.

Kathryn Wortley reports from Tokyo.

Japan is set to surpass its renewable energy targets well before its 2030 deadline, aided by a booming biomass sector benefiting from favourable government programmes and private sector investment. Of Japan's total generated electricity expected in 2030, the Japanese government pledged that 22–24% of it would be sourced from renewable energy, of which 3.7% to 4.6% would come from biomass. And, according to energy experts, the country's blossoming biomass market and industry is making a major contribution towards those targets.

Japan's total generated electric power from biomass reached 2.3% of overall output in the 2018–19 fiscal year, boosting the country's share of electric power produced by renewables to 16.9%, according to the Ministry of Economy, Trade and Industry (METI).

With biomass' share of total generated electric power forecast to hit 2.8% by the end of fiscal 2020 and capacity for biomass 'well over what is needed for the 2030 target,' the total power generated by renewables could reach the lower end of the 2030 target range (22%) as early as the mid-2020s, according to the Institute of Energy Economics, Japan (IEEJ).

In calendar year 2019, Japan's biomass power generation capacity, encouraged by a feed-in tariff (FiT) scheme reached 2.1 GW, an increase of 39% year-on-year, according to METI. The number of biomass plants and projects under development increased by 73 over the period, to reach 411.

Post-2011 energy policy

The rapid growth is due to the seeds of a basic energy policy penned in the wake of the Great East Japan Earthquake and Tsunami of 2011. This outlined a



Wood chips from domestic forests are the main fuel for small woody biomass projects in Japan
Photo: Pixabay

need for greater self-sufficiency, economic efficiency and environmental responsibility following the destruction of a large swathe of northern Honshu and widespread disruptions to the region's power supply.

This, along with the associated accident at Fukushima Daiichi Nuclear Power Plant, prompting its collapse, as well as the shutdown of the country's nuclear power plants and a drop in consumer confidence in nuclear power, encouraged the Japanese government to review its renewable energy policy.

Indeed, as an immediate response to the crisis, Japan used reserve power plants – liquified natural gas (LNG), coal and oil – and boosted energy conservation efforts before introducing a system of FiTs in July 2012 to accelerate green energy growth.

In woody biomass, FiTs depend on plant capacity and fuel type. Since 2012, plants of more than 2 MW that are powered by forestry thinning output have received the highest FiT for a term of 20 years, at Y32/kWh, followed by plants of

more than 2 MW that use roundwood, at Y24/kWh, and plants using construction debris, at Y13/kWh. In 2015 and 2016, new FiTs for smaller plants were introduced, namely Y40/kWh for plants up to 2 MW powered by forest thinning, and Y24/kWh for plants up to 2 MW using roundwood, again with a term of 20 years.

Annette Bossler, managing director of USA-based Main(e) International Consulting and Senior Market Intelligence Expert at FutureMetrics, said the high FiTs introduced for small biomass power generation plants are designed to promote rural economic development. Demand for small volumes of woody biomass from local sources drives forest management and conservation, helping protect nearby settlements from natural disasters like landslides while creating employment, she noted.

Fuel of choice

Indeed, domestic, easily attainable biomass is the fuel of choice for many plants and projects in Japan, a country that is 67% forested, according to non-profit Japan for Sustainability. With such natural resources available to vast areas of the country, Japan's national and local governments have heavily promoted biomass, including through the launch of 'Biomass Towns' that act as best practice examples utilising this form of renewable energy for power and heat, as well as fertiliser.

One is Shimokawa, in northern Hokkaido, (Japan's northernmost main island) where about 90% of the municipality is forested. Before the introduction of biomass, the town relied on fossil fuels for heating during local snowy winters. With support from the public and private sector, Shimokawa now operates renewable forestry management based on the principle of not cutting faster than growth and replanting after cutting, which creates a steady supply of woody biomass chips.

These are used to fire boilers that heat about 40% of local facilities, including hot springs, day-care centres and public housing.

In Tokyo, the metropolitan government switched from fossil fuel to biomass energy in July 2019 to supply its two administrative buildings with 80% of their electricity needs. The 30 GWh of biomass energy consumed annually is supplied by Hitachi Zosen, which buys energy

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produced by waste power incineration plants within and outside the capital, as part of Tokyo's efforts to achieve net zero carbon dioxide emissions by 2050.

Local schemes

More businesses are also thinking locally. Ricoh is among the firms in Japan adopting the use of biomass in its operations. At its Eco Business Development Centre, in Shizuoka Prefecture, woody biomass fuels the entire air conditioning and hot water systems, reducing annual kerosene consumption. With support from the municipal government, the centre sources its woody biomass from a local forestry business that processes timber from forest thinning efforts into woodchips.

According to Ricoh's spokesperson Kotaro Honda, the adoption of biomass for energy, which began at the centre in 2016, presented an opportunity for the firm to help prevent natural disasters through forest maintenance, stimulate local economies and reduce carbon dioxide emissions. 'As we move

towards a more sustainable society, we are glad to have been able to implement this sustainable biomass system,' he told *Energy World*.

Also, in recent years, Japan's biomass plants have increasingly been established near paper mills or lumber yards whose by-products are an easily attainable source of fuel, said Bossler. The heat produced can be used in paper manufacturing.

Biomass imports up

Large-scale biomass suppliers have been taking advantage of this rapid market growth. Tokyo-based Eco Green Co, which supplies wood chips to biomass power plants is, for example, planning to triple capacity by 2030 to produce 600,000 tonnes of wood chips per year.

Biomass imports into Japan have also been increasing rapidly to accommodate larger plants. In 2018, imports of palm kernel shells reached 1.3mn tonnes, up from 760,000 tonnes in 2016, according to FutureMetrics. Similarly, wood pellet imports rose from 347,000 tonnes in 2016 to 1.1mn tonnes in 2018.

Facing supply challenges, power

producers have even asked the ministry of economy, trade and industry to accept other solid biomass as acceptable fuel, such as rice husks.

With more 75 MW plants scheduled to open, including Kanda Biomass, in Tokyo, in 2021; as well as Tsuda Biomass, on Shikoku island; Omaezaki Biomass, south-central Honshu, and Ishinomaki Biomass, northern Honshu, all in 2023; Japan's biomass market shows no sign of slowing down. Indeed, Bossler said more than 9mn tonnes of wood pellets might have to be imported to Japan annually by 2025 to meet demand.

But, with greater imports comes the need for improving logistics, to transport palm kernel shells and wood pellets to biomass plants. Importing ports are concentrated in eastern Tohoku (north-east Honshu), Osaka and Fukuoka, presenting the need for storing and transporting wood pellets to avoid spoilage. ●

Heavily forested Yakushima



Yakushima island
Photo: Calderwood Images / Dermot Killoran

As an island nation, with a forested area twice that of the world's average by proportion, Japan's potential for further development of domestic biomass is high, but fragmented land ownership is hampering progress. Of Japan's some 25mn ha of forest, 29% is controlled by the government agencies, 55% is privately owned and 16% is held by municipalities, prefectures and other public entities, according to the Ministry for Agriculture, Forestry and Fisheries.

This woody bounty is not necessarily easily accessible, however, as the projected imports indicate. One example of the challenges of converting Japan forests into reliable biomass supplies is Yakushima, a heavily forested island in Kagoshima Prefecture, on the southern tip of Kyushu, Japan's southernmost main island.

Home to an annual 50 m of rainfall at the coasts and 100 m of rainfall in its mountainous centre, Yakushima's electricity is powered entirely by renewable energy. Huge waterfalls and dams on the island create hydroelectricity on a grid that is owned by the municipality.

Yakushima is also one of the Japanese government's designated Biomass Towns, with the municipality collecting organic household and business waste, which is turned into fertiliser and purchased by local farmers.

However, regarding biomass energy, progress is less strong. Yakushima works under the policy that for every ten trees, three should be cut down to improve the condition and longevity of the forest, said Koji Kihara, a spokesperson in the Tourism and Town Development Department at the Yakushima local government office. But for decades, these trees lay where they were cut until a local biomass initiative was introduced in 2007. And even after that, uptake has been slow.

Only small areas of forest are owned by local people (others are owned by the municipality or are UNESCO World Heritage Sites) which limits profitability and accessibility respectively, and the island is rapidly ageing, with few younger people to do heavy forestry work.

With the island's domestic and business electricity needs covered by hydroelectricity, the market for biomass is also small, with most demand for kerosene-run hot water boilers.

'We have no large companies. And smaller companies are reluctant to move ahead without evidence of success,' said Kihara. To help incentivise the development of biomass for fuel on the island, the local government is working to demonstrate a successful model and educate people about the process.

In the short term, the Covid-19 pandemic is exacerbating the difficulties of developing a vibrant biomass sector. Due to huge reliance on tourism, the island is feeling the strain and the economy is stagnating without visitors.

However, in the longer-term, Yakushima's passion for renewables could signal that it will ultimately develop more biomass energy on a sustainable basis. Yakushima municipal and Kagoshima prefectural governments have, for example, teamed up with local businesses to push electric car uptake, introducing charging sites and purchase incentives. Such enthusiasm for biomass here and across Japan is likely to ensure this country will continue to move away from fossil fuels and nuclear to embrace green energy.