



WORLD BIOGAS ASSOCIATION

Market Report



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Foreward

This is an interesting case study for the development of biogas. Japan is an extraordinarily industrialised and urbanised country yet with rich traditions in animal husbandry and the exploitation of relatively small amounts of arable land. The nation is facing the challenge of decarbonisation established by its climate change commitments at a time when its trust in nuclear power was undermined by the 2011 disaster. So interestingly Japan is starting its biogas investments virtually from zero- the industry is still small scale but the potential is significant in such a large economy.

I have faith that the Japanese economy will adopt biogas on a much larger scale as its experience and trust in the technology grow. I hope to be able to report in some years' time on how this has happened. Meanwhile, this report gives the situation today and the potential. I hope you enjoy the read.

David Newman
President, World Biogas Association

Overview

In the aftermath of the Fukushima Daiichi Nuclear Disaster in March 2011, Japan underwent a significant shift in energy policy. Nuclear power plants were shut down for safety checks and modifications. To maintain energy supplies, import of fossil fuels was increased in the short-term along with implementation of policies to boost renewable energy generation in the long-term. The increased imports have resulted in a short-term increase in greenhouse gas emissions in Japan, which the Government is determined to bring back down by increasing the proportion of renewable energy in the energy mix. Japan is a signatory to the Paris Climate Accords and has committed to a GHG reduction target of 26% by 2030 compared to 2013.

The renewable energy industry has benefited from this significant shift in energy policy, especially from the generous power purchase prices under the Feed-in Tariff (FIT) introduced in July 2012 and tax incentives for renewable energy investments. As a result, commercial solar plants saw 40-fold growth, wind and wood biomass saw moderate growth whilst hydro and geothermal have undergone marginal growth. Whilst the biogas industry is still underdeveloped in Japan, it has the support of the government and a great potential to grow and contribute to Japan's energy security, greenhouse gas mitigation targets as well as adding to the sustainability of its waste management programmes.

Current status

- **176 digesters** (2019) with a total capacity of 62MW are currently operating in Japan under the Feed-in Tariff (FIT) scheme. An additional 80MW have been approved and are in the process of being constructed and commissioned¹.
- **There are 6 biogas upgrading plants** currently operating (2019). All of these are installed on waste water treatment plants and utilise the biomethane as transport fuel².
- **There are 2,200 wastewater treatment plants** in Japan³ of which 104 have operating biogas digesters as of May 2018⁴. Annual wastewater treatment volume is 15,500million m³ but current utilisation rate of sludge is limited at 32% (biogas 15%, agriculture 10%, dewatered sludge fuel 7%).

⁴Ministry of Land, Infrastructure, Transport and Tourism
<http://www.mlit.go.jp/common/001248618.pdf>

¹Ministry of Economy, Trade and Economy

²IEA task 37 (2017) Upgrading Plant List
<http://task37.ieabioenergy.com/plant-list.html>

³Ministry of Land, Infrastructure, Transport and Tourism
<http://www.mlit.go.jp/common/000233247.pdf>

- **The total number of agriculture-based biogas plants in Japan is estimated at 100**, of which around 70 are located in Hokkaido⁵. Hokkaido has large dairy farms; agricultural land per farmer is 29ha or 10 times the national average, and the region produces more than half of Japan's milk.
- **In addition to single farm digesters, there are examples of centralised digesters** for food waste digestion being installed by municipalities and by cooperatives on behalf of farmers. Data on the exact number of digesters operating are not available.
- **The Japanese FIT does not demand heat usage as a condition for electricity purchase**. As such use of heat from biogas plants is limited to heating digesters.
- **Digesters in Japan tend to be small** in size. The average installed capacity of electricity generation plants is 350kW, which is smaller when compared to some of the other industrialised countries like the UK where the average capacity is close to 1MW⁶. This is due to the virtual absence of those larger municipal solid waste processing biogas plants which would raise the average installed capacity as in other industrialised countries. Nearly 80% of waste collected in Japan is incinerated rather than recycled.
- **Feedstock trends are shifting** from the traditional livestock excreta and sewage sludge, to a combination of sewage sludge and food waste including industrial waste and food scraps⁷.

Potential

- **Food waste:** Japan has an extensive system of food waste collection and recycling. In 2014, 19.5 million tonnes of food waste was generated in Japan of which 83% was from manufacturers, 10% from restaurants, 7% from retailers and 1% from wholesalers. Food Waste recycling law limits the food recycling method to feed, fertiliser, fuel (biogas and carbonisation) and oils & fats. Of among 170 registered food waste recycling plants, 108 are composting followed by 55 to animal feed production. Only 9 are biogas plants (total exceeds 170 as some plants have multiple recycling methods)⁸.

⁵Epower insight from METI data

⁶ADBA (2017) UK market report 2017

<http://adbioresources.org/adba-market-policy-reports/adba-market-report-july-2017/>

⁷JETRO (2015) Japanese biomass market overview

https://www.jetro.go.jp/ext_images/_Events/Idn/Japan_biomass_market_overview.pdf

⁸Ministry of Agriculture, Forestry and Fisheries

http://www.maff.go.jp/j/shokusan/recycle/syoku_loss/attach/pdf/161227_6-2.pdf

- **Livestock manure:** Currently 90% of livestock manure in Japan is composted. If digested, livestock manure from cattle, pigs and poultry would have a potential to generate 1.65GW of energy for the farms in addition to the organic fertiliser.
- **Wastewater treatment facilities:** Currently only 5% of wastewater treatment plants in Japan have biogas digesters. It is estimated that 93MW of energy could be generated from adding on digesters to sewage treatment plants.
- **Urban digestion:** High-rise buildings with “urban biogas systems” that recycle food waste are being implemented. This is seen as a potential growth market within the highly urbanised parts of Japan⁹.

Drivers

- **Energy security** – Japan has very limited oil and natural gas reserves. Post 2011, when nuclear power production was stopped, Japan had to increase its imports of energy. In 2016, 91.7% of energy consumed in Japan was imported, raising concerns about secure and stable energy supply. For energy security, Japan has been working hard on developing domestic energy sources including renewable energy¹⁰.
- **Energy strategy** – Renewable energy is an integral part of the long-term energy strategy of the Japanese Government. In 2016, the energy mix of Japan constituted of 89% fossil fuel (coal, oil and natural gas), 7% renewable energy, 3.3% hydroelectricity and 0.8% nuclear power. The government targets to increase the proportion of renewable energy to 22–24% of estimated 1065 billion kWh generation target by 2030. This will include 3.7–4.6% energy generation from biomass¹¹.
- **Greenhouse gas emission mitigation targets** – Post the Fukushima Daiichi Nuclear disaster, resulting in the closure of nuclear reactors and an increase in fossil fuel based energy generation, greenhouse gas emissions of Japan increased from 1.303 billion tonnes CO₂ eq. in 2010 to a peak of 1.41 billion tonnes CO₂ eq. in 2013. Even though they reduced to 1.307 billion tonnes CO₂ eq. in 2016, there is a lot of work left to be done. Under the Paris Agreement, Japan committed to achieving 26% reduction in emissions by 2030 compared to 2013

levels, i.e. approximately 1.042 billion tonnes CO₂ eq. as 2030 emissions¹². Japan intends to achieve this target by increasing renewable energy production and improving energy efficiency.

- **Feed-in Tariff (FIT)** – As part of Japan’s efforts to increase the share of renewables in the energy mix, a Feed-in Tariff scheme was introduced in July 2012. FIT for biogas-generated power can be sold at JPY39 [USD 35 cents] per kWh at a fixed price for 20 years. The Japanese FIT is amongst the world’s highest offered for renewable energy generation and considered quite attractive. The FIT scheme is funded via a surcharge collected from electricity users¹³.
- **Agricultural strategy** – The Ministry of Agriculture, Forestry and Fisheries (MAFF) has laid out an intention to promote use of biogas as a heat source for agricultural production sites and public facilities, as well as the upgrading of biogas to replace town gas and expand use of biogas as vehicle fuel¹⁴.
- **Aging sewage infrastructure** – Among 440,000km sewer lines and 2200 sewage plants, 25% and 50% are used over their originally projected lifespan. In an effort to fund maintenance costs, Ministry of Land, Infrastructure, Transport and Tourism amended the Sewerage Act envisaging the use of sludge for fuel and fertiliser.

Barriers

- **Grid capacity** – Though demands for biogas plants are increasing, the largest obstacle is grid capacity. Most of the open capacities were already taken by solar, and seven out of ten power utilities in Japan have constraints to accept additional renewable power to their grids. There is, however, an exception for plants less than 50kW whereby no power utilities refuse grid connections¹⁵.
- **Digestate application** – Japanese livestock feedstock largely depend on imports as agricultural land area available for crops is small. Dairy cattle farmers in Hokkaido are exceptional and harvest grass and corn from their own grounds. This is why Hokkaido has the largest number of biogas plants in Japan. Digestate in most places in Japan needs further treatment: solids are composted while nitrogen and phosphorus are removed from the liquids before they are released to rivers or public sewers.

¹⁰ JETRO (2015) Japanese biomass market overview

https://www.jetro.go.jp/ext_images/_Events/Idn/Japan_biomass_market_overview.pdf

¹¹ METI (2018) Japan’s Energy, 20 Questions to understand the current energy situation, 2017

http://www.enecho.meti.go.jp/en/category/brochures/pdf/japan_energy_2017.pdf

¹² Embassy of Japan in the United States of America (not dated) Japan’s INDC <https://www.us.emb-japan.go.jp/english/html/indc-ghg.html>

¹³ International Energy Agency (2017) Feed-in Tariff for renewable electricity and solar PV auction

<https://www.iea.org/policiesandmeasures/pams/japan/name-30660-en.php>

¹⁴ MAFF (2016) Basic plan for the promotion of biomass utilisation

<http://www.maff.go.jp/e/policies/env/attach/pdf/index-4.pdf>

¹⁵ Epower insight

- **Lack of support for biomethane** – Gas to grid regulations have been announced by gas utilities but biogas upgrading plants are limited to a few experimental cases due to many conditions set by the industry, and lack of economic incentives compared with power generation under FIT.

Outlook

“While biogas (converted from animal manure, food wastes and sewage sludge) is mainly used for power generation in Japan, the government aims to extend its utilization as regional heat sources including agricultural production sites and public facilities.

Ministry of Agriculture, Forestry and Fisheries, Japan

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“Japan’s PV capacity increased by 36GW since 2012. Biogas will be the next ‘big thing’, in light of its waste volume as well as economic incentives under FIT. If 10% of cattle and swine farmers in Japan adopt anaerobic digestion, there is a potential to build 7000 biogas plants. If 10% of organic waste recycling companies and sewage plants follow, another 300 can be added.

In the next few years it is expected that municipal waste and waste from industries will start to be processed by anaerobic digestion instead of incineration, adding further capacity.

In order to boost growth in the industry, increased awareness on the benefits of anaerobic digestion and increased use of digestate is needed.”

Epower Corp.

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Case studies

Bio Energy Corporation¹⁶

Inputs: 130 tonnes of food waste per day from 590,000 people.

Outputs: The facility generates 26,880 kWh/day of electricity for about 2,600 households and 2,400 m³ per day of gas for about 2,000 households. The electricity is under a power purchase agreement with Tokyo Electric Power and gas is sold to Tokyo Gas. The facility also mitigates 7,080 tonnes per year of CO₂ emissions.

What is unique: The Bio Energy plant is Japan’s first gas to grid agreement with Tokyo Gas in 2010. It is also the largest food waste biogas plant in Japan and is located on a reclaimed island near downtown Tokyo. The plant started operations in 2006, and joined the FIT from 2016.

Nakagami Farm¹⁷

Inputs: swine manure.

Outputs: 30kW power plant under twenty-year power purchase agreement with Chubu Electric Power.

What is unique: This plant started operations with 20kW power, as the smallest commercial biogas plant in Japan under the FIT. The plant opened a new market for under 50kW biogas plants, which can be installed anywhere in Japan with no grid constraints.

¹⁶ Bio Energy Corporation (not dated) Facility introduction
<http://www.bio-energy.co.jp/introduction/>

¹⁷ Epower communication

Special thanks to



We’re only a phone call or e-mail away

Have a question about membership?

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Seeking advice? Want to get connected to influential

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