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ENERGY / MALAYSIA

Biogas as a sustainable energy solution for Southeast Asia

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The recent advent of a circular economy highlights the importance of anaerobic digestion and biogas. Anaerobic digestion is a process where large organic matter is broken down into small molecules in the absence of oxygen. During this process, biogas is produced, which consists of 60-70 per cent methane and 30-35 per cent carbon dioxide, with the remainder being traces of hydrogen sulphide. Among the many bioenergy options available, the uniqueness of biogas lies in the fact that it can be produced not only from energy crops, but also organic waste matter.

Indonesia and Malaysia are two of the main palm oil producers in the world and supply nearly 90 per cent of all global oil palm demand. Research conducted by the Center for International Forestry Research (CIFOR) and the International Institute for Applied Systems Analysis (IIASA) projected that palm oil production in Indonesia would increase 124-197 per cent over the years 2010 to 2030.

Lately, the European Union's plan to phase out the use of palm oil by 2030 has brought the sustainability of the oil palm industry into the limelight. However, what has been less covered is the enormous energy and carbon reduction potential of the biomass side products produced by the oil palm industry, one of which is palm oil mill effluent (POME).

POME is a perfect feedstock for anaerobic digestion as one tonne of POME generates 28 cubic metres of biogas. Indonesia and Malaysia produce about 95 million and 60 million tonnes, respectively, of POME during palm oil processing each year, which translates into a huge biogas opportunity for the region. By 2016, 54 palm oil mill owners had adopted digester technologies while the other 38 used covered lagoon systems to capture biogas in Malaysia. The biogas captured in Malaysia palm oil industry is generally used for renewable electricity generation, especially since the feed-in tariff for biogas was revised in 2014.

Other than power generation, biogas can be upgraded to biomethane and used as vehicle fuel or even injected into the natural gas grid as renewable gas. In Malaysia, the Energy Commission introduced a Third Party Access system in 2017 that allows third party to have access to and utilise gas facilities such as pipelines. This opens up the possibility for the integration of renewable gas into the national gas supply system in the future under terms and conditions.

Aside from POME, animal manure and other organic waste can also act as feedstock for biogas production. A study conducted by Oklahoma State University, the Institut Teknologi Nasional in Indonesia and other collaborators estimated that the annual electricity potential of biogas from cattle, pig and poultry waste in Indonesia amounted to 80 TWh, which is more than sufficient to replace diesel fuel in the power sector by 2030. A similar study by the Universiti Tenaga Nasional in 2016 gave an estimate of 10 TWh from animal manure and 5 TWh from POME in Malaysia by 2020, which represents about 15 per cent of natural gas replacement used in the power sector. According to the Sustainable Energy Development Authority (SEDA) of Malaysia, the current installed capacity of electricity feed-in from biogas in Malaysia is 220.86 MW, which generates just 1.7 TWh per year. Such a huge potential gap is drawing attention from energy giants such as Engie to look to investing in the Indonesia and Malaysia biogas markets.

Unlike other renewable sources, such as solar, wind and hydropower, biogas relies on a feedstock supply that is stable and can form the basis for predictable commercial scale production. However, the cost of biogas feedstock varies. POME can be sourced at zero cost, while animal manure has an opportunity cost, not to mention also the logistical constraint of feedstock transportation. Furthermore, when biogas is upgraded to biomethane to increase its value, it lacks cost-competitiveness compared to fossil fuels. The only exception is when biogas is used for power generation, with a feed-in-tariff. These factors continue to discourage long-term investment in the industry.

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Even though biogas from anaerobic digestion was commercialised more than 10 years ago in Southeast Asia, a new approach is needed to promote the industry by engaging large industrial players to create partnerships to establish a specialised value chain for scaling-up. Government support has a vital role to play, in terms of mandates, policies and regulations, if the biogas industry is to grow and mature in the region. One good practice to study is the Green Gas Initiative in Europe. This is a joint commitment among the gas transmission system operators of Belgium, Denmark, France, Germany, the Netherlands, Sweden and Switzerland to "green" the gas grid through biomethane integration.

It is undeniable that biogas possesses enormous potential in Southeast Asia, especially given that the tropical climate provides the perfect conditions for anaerobic digestion. Harnessing the benefits of biogas while preventing harmful greenhouse gases from escaping into the atmosphere could also contribute to countries' Nationally Determined Contribution goals as pledged under the Paris Agreement. Doesn't that make biogas the best epitome of killing two birds with one stone?

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