PJSRR (2015) 1(1): 33-39

Pertanika Journal of Scholarly Research Reviews
http://www.pjsrr.edu.my/

Renewable Energy Policy Status and Challenges of POME-Biogas Industry in Malaysia

Wong, SIEW YIEN,[a]Amir, HAMZAH SHARAAI,[b*]Faradiella, MOHD KUSIN,[a]
& Mohd, MANSOR ISMAIL,[c]
[a]Department of Environmental Sciences, Faculty of Environmental Studies, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia
[b]Department of Environmental Management, Faculty of Environmental Studies, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia
[c]Institute of Agricultural and Food Policy Studies, Unirversiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia
[*]amirsharaai@upm.edu.my

Abstract – Palm oil can be considered as a mainstay in the regional development and economic growth of Malaysia. It is an important raw material for local industries and as an export product. Most recently, palm oil has been referred to as a promising feedstock for the production of biofuel which could lead Malaysia towards a low carbon society. With the growing concern towards the increase of energy demand and global warming, the conversion of palm biomass to biogas for power generation has then been recognized as a feasible option in response to the mentioned problems. Nevertheless, various constraints have come in the way to slow down the biofuel production. Therefore, this paper presents an overview on the existing renewable energy (RE) policy and its current programme status, as well as to identify the challenges facing the Malaysian palm oil mill effluent (POME) and biogas industry in order to propose appropriate measures for further improvement of the programme.

Keywords: Biogas, energy demand, energy policy, palm biomass, renewable energy

Introduction

Global warming has become one of the prominent global issues and its impacts towards human health and environment have always captured the attention of people around the world. Global warming can be ascribed by a substantial emission of greenhouse gas (GHG) into the atmosphere through fossil fuel combustion. In addition to the rapid growth of population and urbanization in the country, the GHG emission rate has become higher as this significant development in the country would require a greater amount of energy consumption for power generation. This condition is more obvious in the United States and China, as both countries have been identified to be the world's largest and second largest energy user, respectively (IEA, 2010). In comparison, Malaysia is reported to be the third largest energy consumer in ASEAN countries and it is anticipated that the per capita power consumption will further escalate as the country becomes more developed (IEA, 2013).

Since 1990, every nation has started to do some negotiations regarding the carbon emission issue and has promised to reduce more carbon content into the atmosphere by maximizing the RE utilization. However, this is merely a blatter rather than a promise as the global carbon emissions at the moment have increased to 65% compared to that in 1990 (Global Carbon Project, 2014). In the current trend of 370 hundred million tons of carbon emissions, it is predicted that the global carbon emissions will hit 432 hundred million tons by 2019, of which 127 hundred million tons of the carbon emissions will be mostly contributed by China (Global Carbon Project, 2014). The rapid increment rate of carbon

emissions should has struck the nations' senses back to reality and it should have served as a vital reminder for all parties to play their parts in response to the concerned global problem.

In fact, many countries have implemented various regulations or incentives in favour of RE particularly bioenergy derived from biomass resources such as POME biogas. The intention is obvious, which is to alleviate the carbon emission rate and the dependency on the main fossil energy resources such as natural gas, coal and oil in electricity generation, as well as to achieve the goals of environmental protection and economic advancement. Nevertheless, the result is not very promising as many challenges have been found in the RE industry. Therefore, this review on the existing RE policy and current programme status could be feasible in identifying challenges and loopholes confronted by the industry so that appropriate alternatives could be developed to ensure a sustainable RE development. This paper focuses on the POME-biogas aspect of bioenergy and challenges for the POME-biogas development in Malaysia.

Government policies related to RE and POME-biogas production

Overview of Malaysian RE Plans

Energy policies and relevant programmes have been adopted in Malaysia since 1949, but virtually, they were executed actively only after and up to 2000. Within the period of 2001 to 2010, the Third Outline Perspective Plan (OPP3) under Vision 2020 emphasised on managing both non-renewable and RE resources to accommodate the demands for a rapid economic growth and minimizing pollution and waste generation on the environment was established. Along the same line, the Eighth Malaysian Plan (8-MP) (2001-2005) focused on the initial phase of OPP3 by introducing RE especially biomass as the fifth fuel into the existing energy sources so that 5.5% of the country's electricity derived from RE can be achieved by 2020 (EPU, 2010). Then, the Ninth Malaysian Plan (9-MP) (2006-2010) continued the efforts built up during 8-MP in strengthening the initiatives for energy efficiency (EE) and RE with a variety of fiscal and monetary incentives (Jalal & Bodger, 2009). Subsequently, the Tenth Malaysian Plan (10-MP) (2011-2015) and National Green Technology Policy (2009) emphasised the creation of new opportunities and stronger incentives for investments in RE projects to boost the growth of green economy and sustainable energy supply (EPU, 2010). As for the recently announced Eleventh Malaysian Plan (11-MP) (2016-2020), the country will emphasize "green growth" in society, which aims to ensure that the environment is facing the least impact whilst conserving natural resources through the aspects of energy-efficient lifestyle and stressing more on 3Rs (i.e. Reduce, Reuse and Recycle) in households and the industrial sector, and improving the current educational systems (EPU, 2015).

Undeniably, these implemented Malaysian Plans would have opened up many opportunities to the industry to further explore the RE development notably on palm biomass and POME biogas-derived energy where the biomass resources are generally recognized to be highly abundant in the country. Furthermore, it is projected that the country's policies and regulation in terms of environmental governance will get improved in line with the execution of the mentioned Plans. However, these Plans do not seem to go far enough and there is no specific explanation or declaration on how the environmental legal framework and principles (in RE context) can be further reinforced which commonly found in most of the relevant environmental policies and regulations. The Plans are more likely to be a little over generalisation and this has led to a poor and unclear comprehension among the nations and RE players towards the country's current and future environmental governance issues which the Plans do not portend well as a foundation for action. Nevertheless, relevant authorities should not remain overly passive but they need to take initiatives while conserving the environment. Meantime, the policy makers should really be urged to develop more concrete and specific strategies that could attain the environmental objectives targeted in the Plans.

POME-biogas development and National Key Economic Area

Since the Malaysian palm oil industry is considered as one of the biggest contributors to the national economy because it has reportedly contributed RM53 billion in the country's Gross National Income (GNI) (NKEA, 2013), its activities are then being further advocated to a certain extent. Up to 2015, 443

palm oil mills are in operation at present compared to 439 palm oil mills in 2014 (MPOB, 2015). As the development of palm oil mills are in line with the increase of economic growth, eight core Entry Point Projects (EPPs) have been implemented by the Palm Oil National Key Economic Area (NKEA) programme to boost a higher economic status in the country by 2020. As stated in the EPP 5 under the eight core EPPs, the government aimed to achieve the biogas facility installation in all palm oil mills in Malaysia by 2020 (MPOB, 2012). However, based on the data documented by MPOB in 2014, only 67 out of 439 palm oil mills were recorded to have involved in biogas activities in Malaysia (Loh et al., 2014). With less than 20% of the palm oil biogas plants installed in Malaysia, a question on the practicality of EPP 5 is asked. However, it is optimistic that the number of biogas plants will increase in the near future as the generation of palm biomass is anticipated to increase from 80 million dry tonnes in 2010 to 110 million dry tonnes by 2020, and this will definitely initiate more new wealth creations in the industry, if the National Biomass Strategy 2020 is comprehensively executed. Therefore, the implementation of biogas plants should be imposed but under a strict and comprehensive control of environmental management strategy as this implementation could bring a win-win situation to both the country and environment such as 1) reduce cost of production by using in-house energy production, 2) mitigate GHG emissions (carbon credits), and 3) extension of biofuel market by upgrading biogas to a practical transport fuel on roads.

POME-biogas development, Clean Development Mechanism and Small Renewable Energy Program
Apart from NKEA, a scheme namely Clean Development Mechanism (CDM) under Kyoto Protocol has also been established which aims to facilitate developing countries to achieve sustainable development through the sales of certified emission reductions (CERs). In 2002, Malaysian government has ratified Kyoto Protocol, and biogas projects are eligible for this CDM programme. With the establishment of CDM, more investment opportunities for the public are created to involve in the GHG emission reduction projects. It is also beneficial to palm oil industry by capturing biogas to earn CER revenue as well as to prepare the industry to meet an increasingly stringent sustainability requirement in future.

In order to ensure the sustainability of environmental and energy supply in Malaysia, the government also launched a programme known as Small Renewable Energy Power (SREP) on 11th May 2001 to encourage a wider use of RE resources in power generation where the generated electricity is suggested to be connected to a power grid whenever possible (Anuar et al., 2005). In 2002, another project namely BIOGEN Project funded by the Malaysian government, United Nation Development Program (UNDP), Global Environment Facility (GEF) and private sectors was introduced as a compliment to SREP programmes (PTM, 2001). This project plays a role primarily in reducing the GHG emissions from fossil fuel combustion, and it exploits biomass as a highly potential source for energy generation. Under the SREP, it is suggested that all the small power plants are encouraged to sell the electricity produced to Utility through the Distributed Grid System where the biomass and biogas plant operators can enjoy the RM 0.3184/kWh through the Feed-in Tariff (FiT) system (SEDA, 2014). However, the achievement is rather disappointing because less than 4% of the electricity generated from RE resources is being captured. This limit of grid connection of biogas plants can be ascribed by a limit set by the FiT system under the Renewable Energy Act 2011, of which the FiT system is only applicable in Sabah and Peninsular Malaysia but not in Sarawak due to the presence of the state's own legislation and regulations governing exclusively on their electricity supply (RE Act 2011). Moreover as in the palm oil industry, palm oil mills which have enough power generated from the combustion of their own biomass resources especially fibre and shell, the millers found that this would not be a big deal to the mills even if the electricity produced from the biogas plants is not connected to grid.

Challenges for POME-biogas plant development

Although the development of POME-biogas plants in Malaysia has come a long way through the years, a few significant challenges have been found to have hampered its development, for example, high costs of investment including plant construction, and lack of required knowledge and technical expertise.
Financial constraint

The financial barrier can be considered the main stumbling block in implementing a biomass power plant and POME-biogas plant in Malaysia. At present, majority of the biomass industry players are still facing difficulty in getting feedstock from biomass producers who are mostly private plantations. Thus, when they try to apply for a commercial loan, they have to present the field supply agreement on a long term basis and this is apparently not possible for them to secure. Compared to the biomass industry players, POME-biogas industry players are more concerned with the investment cost of the POME treatment system in the mill, and the construction cost of closed anaerobic digestion tank is found to be comparatively higher than the conventional way of POME treatment in the mill known as anaerobic ponding system. From this point of view, both cases have shown that these biomass and biogas industry players are indeed struggling on solving the financial problems. The POME-biogas systems currently in use in Peninsular Malaysia are found to be more developed compared to those located in East Malaysia (especially in Sarawak) in terms of infrastructure developments, legal implications and tariff deliberations. The lack of infrastructures for feed-in capability into power grids, gridlines availability issue and the long distance between the location of palm oil mills and power grids in the State are the significant factors that resulted in a low possibility of biogas implementation. In other words, the biogas industry players in East Malaysia would require greater efforts and funding to invest the biogas facilities in their mills.

Besides, the lack of support from the government and the relevant authorities on the related RE technology adoption at the current market has resulted in a slower growth of biogas plant development in Malaysia. The relevant stakeholders believe that these projects could have high risk when the new RE technology of POME-biogas is adopted. Moreover, a long payback period has also bothered the stakeholders to finance the projects, and it gradually makes the RE technology not commercially viable in Malaysia. In addition, when a high capital is needed, smallholders will definitely find it unattractive to make such an investment. This is where the government should come in with more viable financing schemes. Therefore, the cooperation among the government, private sectors and institutions is important in developing such projects because the financial assistance from each authority can support a high initial cost and enough capital to adopt appropriate RE technology in plants. With respect to this economic issue, the understanding and trust among the financiers and investors are vital because any misunderstanding and lack of communication related to RE among the groups will lead to a low participation of national financiers.

Availability of technical expertise

Advanced technologies are required to ensure the biogas digesters and maintenance activities going all well and to reduce extra expenses on repairing the machines as time passes. Hence, personnel with good skills are most needed to monitor the related technologies under a careful supervision. However, what makes it difficult is that Malaysia is facing a shortage of professional technicians in the country. Therefore, maintenance activities to address technological monitoring are difficult. Furthermore, some of the local conversion technologies available in local universities are still at the lab level, and this situation has indirectly affected the development of the biogas power plant as many entrepreneurs are not fully confident to use local technologies. Unlike Malaysia, many western countries have technologies that are always developed and commercialized up to industrial practice. Their technologies can even developed to the extent of proposing policy implementations of certain related models. When the Malaysian government is taking the initiative to implement and rely on the western technology in Malaysia, it might not be reliable due to differences found in management and required knowledge which demanded highly skilled personnel and careful maintenance. Furthermore, the capital-intensive initiative requiring huge costs to cover such imported technologies to the country is unsustainable. Thus, an overview on the existing biogas systems in Malaysia will enhance the wastes management measure as well as to be served as a reference in providing basic guiding principles for policy makers and researchers. Nevertheless, the information on biogas production system in Malaysia is rather limited due to the lack of systematic analysis and outdated periodic documentation, and this again has slowed down the research progress.

Termination of CDM and inefficient environmental tool application

As aforementioned, the CDM programme could further facilitate the biogas development through the sales of CERs where the profits could actually be used to recover part of the operating cost. However, after the announcement of its termination at the end of 2012, only those CDM developers whose projects were accepted before 31st December 2012, were allowed to sell their CERs to the Europe's Emissions Trading Scheme until the mid of 2015 (CDM, 2014). This also means that CDM projects that were accepted after 2012 have a difficulty in financial support to run the biogas system in the mills as they cannot sell their CERs. Correspondingly, the termination of the programme would also denote that the improvement of the present anaerobic digestion technology is prompted to stop moving forward as there will be no enforcement on the current increasingly stringent sustainability requirement which is supposed to be adopted in the plants to manage the wastes. Moreover, there are no rigorous restrictions and/or standard technology in treating POME in the country and this situation has resulted in an establishment of an unclear biogas development schedule among the majority of palm oil companies. This trend is believed to be the main driving force of an uncontrollable of GHG emissions in the atmosphere. Therefore, it is suggested that the continuity of the CDM programme should be taken into consideration by the government so that the POME-biogas players are incentivized and thus attracting them to invest in the initiative.

However, under certain circumstances where no subsidy is provided by the government, biogas industry players might confront a bigger financial issue. Therefore, the efficient use of environmental tools in the companies could be a feasible solution to them. Environmental tools such as Life Cycle Assessment (LCA) and Environmental Life Cycle Costing (ELCC) could be employed in the relevant palm oil mills to evaluate the performance of their mills and plants from the environment and economic aspects, in terms of their life cycle perspective (raw materials extraction to end-of-life process). With the employment of these tools, palm/biogas industry players can determine the possible environmental impacts that could arise throughout the entire life cycle of biogas production system (by using LCA) while evaluating the efficiency of their financial management of which each unit process of the biogas production system should be allocated with appropriate amount of capital (by using ELCC). Consequently, palm/biogas industry players could avoid unnecessary expenses on environmental remediation by referring to the results computed from the assessments. This self-governance system could possibly reduce their high operating and environmental costs while attaining a sustainable environment in their mills and plants. Nonetheless, the majority of the palm companies are not familiar and have no experience on using the mentioned approaches in their mills and plants. Therefore, the relevant authorities should train their employees on the related course which will definitely be a credit to the companies and environment in the near future.

Debate on loss of biodiversity and climate change

The rapid emerging of palm biomass industry in the country for economic advancement has caused an active clearance of land for oil palm plantations to boost a higher yield of productions. This has gained attention from environmental groups such as Greenpeace and Friends of the Earth who strongly criticized that the related projects have triggered a severe threat on biodiversity loss especially those involved endangered species including the orangutans, Sumatran tigers and elephants (Buckland, 2005). Moreover, many other environmentalists also claimed that the deforestation for palm oil cultivations has caused a significant production of CO_2 emission (Karousakis, 2007; Stern, 2006). Nevertheless, a study reported by Tan et al. (2009) stated that an oil palm plantation can actually assimilated a number of 64.5 t $ha^{-1}y^{-1}$ of CO_2 whereas only 42.2 $tha^{-1}y^{-1}$ of CO_2 is assimilated by a rainforest. Hence, if the oil palm plantation could qualify as planted forests, this agri-industry-based activity can actually contribute towards biodiversity conservation efforts as well as facilitating carbon sequestration (carbon sink) and GHG reduction. This is because most of the oil palms planted in the country are on forest peripheries, of which majority of the palm oil developers have starting to commit or have already committed themselves in implementing good agricultural practices in the fields.

Conclusion

Most policies would give a general picture on the status of RE management in Malaysia and the necessity to provide detailed information, realistic and conducive regulatory frameworks on RE

management and energy recovery is commonly been treated carelessly. Hence, despite a huge number of current RE policies and frameworks that have been strongly promoted to attract developers and investors to get involved in the field, the current biogas development in Malaysia is still considered very discouraging compared to other countries such as Germany, Denmark and China as many of the palm oil mills in the country are having difficulty in financial acquisition. The limiting factors such as high investment cost, new technology, skilled personnel and termination of CDM programme are forcing oil palm companies to adjust their RE strategy. Consequently, this has led to an increment of reluctance level among the millers to venture into higher efficiency technologies in the mills. However, it is believed that a comprehensive RE Policy, effectively application of relevant environmental tools and a long term commitment associated with an effective cooperation from the government and related stakeholders can lead to a rapid growth of RE development and to create a sustainable biogas market in the country.

References

Anuar, A. R., Norasikin, A. L., & Zulkifli, A. R. (2005). Current scenario and future challenges of the oil palm biomass energy. *Sixth National Seminar on the Utilisation of Oil Palm Tree*. Organized by OPTUC, 15-17 December 2003, Kuala Lumpur, Malaysia.

Buckland, H. (2005). *The oil for ape scandal: how palm oil is threatening orangutan survival* (pp. 1-50). Retrieved from https://www.foe.co.uk/sites/default/files/downloads/oil_for_ape_full. pdf

Clean Development Mechanism (CDM). (2014, November 20). United Nations framework convention on climate change. Retrieved from http://cdm.unfccc.int/

Economic planning unit (EPU). (2010). *Tenth Malaysia Plan 2011–2015* (pp. 1-429). Retrieved from https://www.pmo.gov.my/dokumen attached/RMK/RMK10_Eds.pdf

Economic Planning Unit (EPU). (2015). *Eleventh Malaysia Plan 2016-2020* (pp. 159-190). Retrieved from http://rmk11.epu.gov.my/book/eng/Elevent-Malaysia-Plan/RMKe-11%20Book.pdf

Global Carbon Project. (2014, December 15). The Global Carbon Project. Retrieved from http://www.globalcarbonproject.org/

International Energy Agency (IEA). (2013, December 10). Energy statistics. Retrieved from: http://www.iea.org/statist/index.htmS

International Energy Agency (IEA). (2013). (2014, December 10). IEA: Malaysia's energy consumption to record moderate growth in 2014. Retrieved from http://www.nst.com.my/business/todayspaper/iea-malaysia-s-energy-consumption-to-record-moderate-growth-in-2014-1.447079

Jalal, T. S., & Bodger, P. (2009). National energy policies and the electricity sector in Malaysia. *Proceedings of ICEE 2009 3rd international conference on energy and environment*, 7-8 December 2009, Malacca, Malaysia.

Karousakis, K. (2007). *Incentives to reduce GHG emissions from deforestaton: lessons learned from Costa Rica and Mexico* (pp.1-50). Retrieved from http://www.oecd.org/env/cc/38523758.pdf

Loh, S. K., Nasrin, A. B., Nurul Adela, B., Mohamad Azri, S., Muzzammil, N., Daryl Jay, T., Stasha, E. R. A., Mohd Faris, M. R., Lim, W. S. & Choo, Y. M. (2014). *Biogas capture and utilisation from palm oil mill effluent* [Brochure]. Bangi, Malaysia: Perpustakaan Negara Malaysia Cataloguing-in-Publication Data.

Malaysia Palm Oil Board (MPOB). (2009). (2015, August 10). Economics & Industry Development Division: Sectoral status. Retrieved from http://www.mpob.gov.my/en/palminfo/environment/520-achievements

Malaysia Palm Oil Board (MPOB). (2014, November 12). Malaysia Palm Oil Board, NKEA: National biogas implementation (EPP5). Retrieved from: http://www.mpob.gov.my/en/component/content/article/153-demo-content/992-nkea-national-biogas-implementation-epp5

National Key Economic Areas (NKEA). (2013). *National biogas implementation (epp5): biogas capture and CDM project implementation for palm oil mills* (pp. 1-19). Retrieved from http://www.e-kilangmpob.com.my/NATIONAL_KEY_ECONOMIC_AREAS.pdf

Pusat Tenaga Malaysia (PTM). (2013, September 17). Biogen. Retrieved from http://www.ptm.org.my/biogen/index_new.htm

Renewable Energy Act 2011. (2014, November 28). Retrieved from http://seda.gov.my/

Stern, N. (2006). S*tern Review: The Economics of Climate Change*. Cambridge, UK. Cambridge University Press.

Sustainable Energy Development Authority Malaysia (SEDA). (2014, December 12). Feed-inTariff (FiT) rates for biogas. Retrieved from http:// seda.gov.my/

Tan, K. T., Lee, K. T., Mohamed, A. R., & Bhatia, S. (2009). Palm oil: addressing issues and towards sustainable development. *Renewable and Sustainable Energy Reviews*, *13*(2), 420-427. doi:10.1016/j.rser.2007.10.001.