

Development of Oil Palm Biomass and Biogas Database

Noorshamsiana Abdul Wahab¹; Nur Eliyanti Ali Othman^{1*}; Zawawi Ibrahim¹; Stasha Eleanor Rosland Abel¹; Aisyah Humaira Alias¹; Mohamad Azri Sukiran^{1*}; Nurul Adela Bukhari¹; Soh Kheang Loh¹ and Astimar Abdul Aziz¹

¹Malaysian Palm Oil Board (MPOB), 6 Persiaran Institusi, Bandar Baru Bangi, 43000 Kajang, Selangor, Malaysia.

*E-mail: nureliyanti@mpob.gov.my; azri@mpob.gov.my

INTRODUCTION

The oil palm industry is a vital component of Malaysia's agricultural sector, contributing significantly to the nation's economy. As a leading global producer of palm oil, Malaysia generates substantial amounts of oil palm biomass (OPB) during replanting, harvesting, and processing activities. This includes empty fruit bunches (EFB), palm mesocarp fibres, palm kernel shells (PKS), palm oil mill effluent (POME), oil palm fronds (OPF) and oil palm trunks (OPT). OPB has been recognised as an important economic resource that offers a beneficial influence on the economic growth of the country rather than as a low-value waste. OPB can be turned into highly valuable products, which will bring in additional revenues for the nation. This abundant biomass has the potential to be a valuable resource for various industries, ranging from energy production to the development of innovative and sustainable products (Abas *et al.*, 2011).

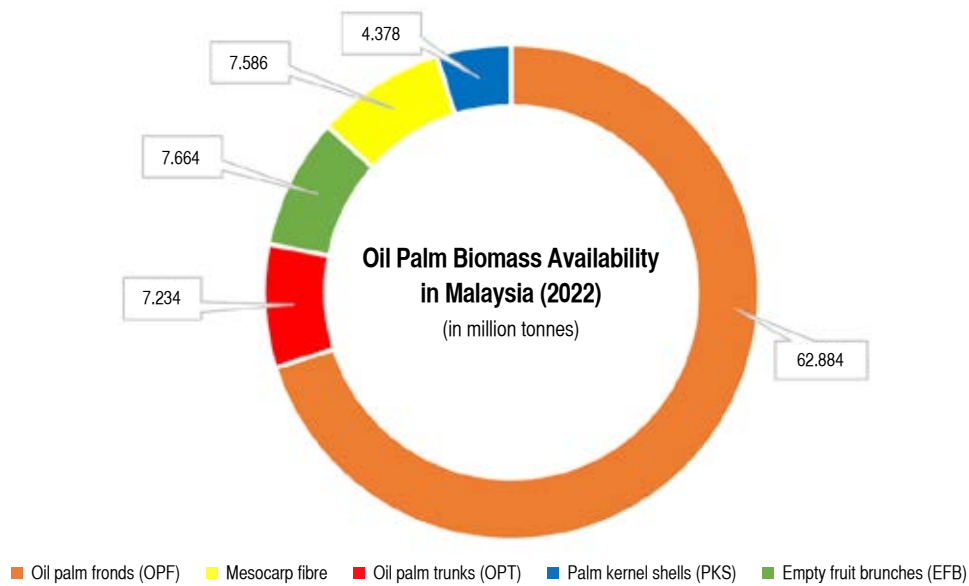
As the oil palm industry expands, the generation of OPB is expected to increase. This growth raises important considerations for biomass management, environmental protection, and development of sustainable practices within the industry. In 2022, it was recorded that the total area of oil palm plantation was 5.67 million hectares and the estimated availability of OPB was about 89.746 million tonnes (dry weight) (Parveez *et al.*, 2023; MPOB, 2023). From over 450 palm oil mills in Malaysia, an estimated 93.65 million tonnes of fresh fruit bunches (FFB) were processed annually, which produced 60.87 million m³ of POME (Parveez *et al.*, 2023; MPOB, 2023). POME produces biogas through anaerobic digestion, where microorganisms break down and convert the organic matters into primarily methane and carbon dioxide. Biogas/methane can be captured and used as a renewable energy source while mitigating environmental impact. The wide range of OPB can be sourced from the field during

replanting and pruning activities, as well as from the milling processes at palm oil mills. The most abundant OPB source comes from OPF, which accounts for around 70% of the overall OPB, as shown in *Figure 1*.

DRIVER FOR OIL PALM BIOMASS AND BIOGAS DATABASE DEVELOPMENT

Although it was projected under the National Biomass Strategy 2020 that harnessing an additional 20 million tonnes of OPB for higher-value products could potentially contribute an additional RM 30 billion to the gross national income by 2020, it has yet to be materialised. One of the significant factors contributing to this shortfall is inability to secure a stable supply of the required biomass materials due to a lack of current and accurate OPB availability and accessibility data in Malaysia. More often than not, rough information is estimated using theoretical formulas. Mostly, available information sources are limited, outdated, and insufficient. Due to the lack of such data and statistics, commercialisation of palm biomass-based products is often slow and perceived as uneconomical. Addressing this issue is essential for revealing the full potential of OPB and promoting innovation in its utilisation. The need for a comprehensive and up-to-date database concerning OPB (including biogas from POME) arises over the years as many parties started to realise that accurate information is crucial for making informed business decisions. The industry players in particular had conveyed their concerns to the government about the difficulty in attaining such reliable up-to-date information.

In responding to this imperative, the Ministry of Plantation and Commodities (KPK) and Ministry of Natural Resources and Environmental Sustainability (then Ministry of Natural Resources, Environment and Climate Change) through the Malaysian Palm Oil Board (MPOB) initiated



Source: MPOB, 2023.

Figure 1. The availability of oil palm biomass in 2022.

projects under the 12th Malaysia Plan (RMKe-12) to develop and establish the *Oil Palm Biomass and Biogas Database*. Specifically, under the National Biomass Action Plan 2022-2025, the proposed initiatives were to establish a biomass database and propose licensing of OPB, which have been identified as crucial steps to facilitate commercialisation of OPB. The aim is to provide updated biomass information as references mainly to industry players. These initiatives are expected to address the challenges faced in the supply chain and unlock the potential economic benefits outlined in the national policy, *i.e. Dasar Agrikomoditi Negara 2021-2030*. The development of this database is anticipated to not only deliver accurate data to various industry stakeholders but also serve as a useful guideline for long-term planning in commercialisation of OPB products.

OIL PALM BIOMASS AND BIOGAS DATABASE

Initially, the database development involves a comprehensive collection of data from OPB owners, covering production, utilisation, and future untapped potential. This kind of information serves as a valuable resource for industry stakeholders, enabling them to make informed decisions, increase and optimise resource utilisation, and contribute to the sustainable and efficient management of OPB for various applications. Compilation of data for the database development involves both qualitative and quantitative data, including:

1. Availability of oil palm biomass and biogas (annual basis).
The database identifies and quantifies current availability of various oil palm biomass from mills and plantations covering biomass resources like EFB, palm mesocarp fibres, PKS, POME, OPF and OPT.
2. Utilisation and commercialisation of OPB-based products.
The database captures data related to the utilisation and commercialisation of bio-products and bioenergy derived from OPB. It tracks the status of various applications of OPB, such as biogas/methane trapping facilities, bio-char, bio-pellets, bio-composites, bio-chemicals, and other value-added products that have penetrated the market.

Synthesis of database from time to time is possible based on requirement such as OPB accessibility, greenhouse gas (GHG) emissions, reduction potential, and effective deployment strategies can be formulated, providing valuable insights into sustainable and environmentally conscious practices to be adopted by the oil palm industry. This kind of assessment will be dependent on data availability where restricted information needs to be observed strictly. One of the key features emphasised for the database is to ensure data security through online collection system. Licensees will be provided with secure login credentials to access the system, ensuring only authorized personnel with traceable interactions as shown in *Figure 2*. This streamlined approach not only

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enhances confidential data protection but also simplifies users' experience, promoting widespread adoption by the industry. The summarised dashboard page, as shown in *Figure 3*, will appear after licensees log in, prompting them to fill in all the necessary information diligently. Based on MPOB licensing records, it is estimated that approximately 451 palm oil mills and nearly 5000 oil palm plantation owners will be involved in the collection of OPB availability data. The database system is still in the process of development and improvement. The system will need to undergo fine-tuning and trial runs.

Licensees are encouraged to stay informed of any regular updates about the system as work continues towards better efficiency and user-friendliness. Several industry engagement and training sessions will be conducted once the biomass and biogas database system has been fully developed. Eventually, the complete database system developed will go live and be accessible to related industry licensees (biomass owners) for data sourcing, resulted in a committed and deployable online data management solution, *i.e.* by then a significant milestone could be achieved.



Figure 2. The front page of the database system.

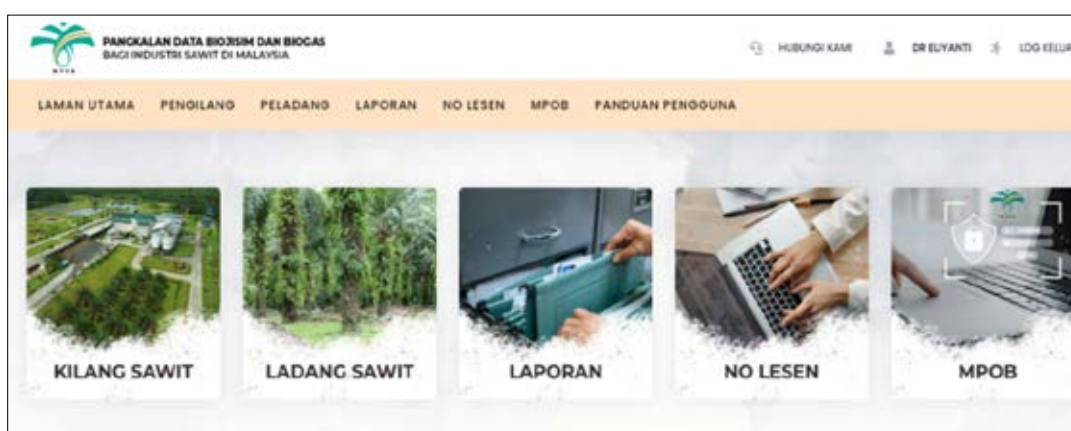


Figure 3. The dashboard of the database system.

BENEFITS OF THE DATABASE SYSTEM

Numerous benefits can be derived from the established database system, both to the industry as well as the government. The following are benefits of the database towards enhancing the perception of the oil palm industry:

1. Provide a transparent and reliable source of information.

The government and industry would get accurate statistics and trusted information about OPB potential for local and overseas market primarily through this system.

2. Facilitate establishment of a systematic collection centre/biomass hub.

The information in the database will gauge if a centralised platform for OPB can be initiated. This platform will streamline the collection and distribution of biomass, ensuring a consistent and reliable supply to potential buyers.

3. Manage and leverage the supply chain.

By providing real-time data on OPB availability, the database will empower industry players to manage and leverage the entire supply chain effectively. This will result in an optimised process for OPB commercialisation to maximise its economic potential.

4. Increase commercialisation of OPB-based products.

Equipping with accurate information, the database can help businesses to make informed decisions on developing and marketing products derived from OPB. This will contribute to an increased commercialisation rate of OPB-based products, fostering innovation and market growth.

5. Achieve social-economic well-being.

The development of the database system aligns with broader economic empowerment strategies. Through

sustainable bioconversion, both economic growth and social development can be accomplished by realising the economic potential of OPB.

CONCLUSION

The development of an effective database system to collect useful information of OPB and biogas is a crucial step towards harnessing the full potential of the abundant resources. The database, once established, will empower industry stakeholders to make strategic decisions, ultimately driving the sustainable development and commercialisation of OPB-based products in Malaysia.

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