

# MALAYSIAN BIOMASS INDUSTRY ACTION PLAN 2020

Driving SMEs Towards Sustainable Future



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BIOMASS INDUSTRY ACTION PLAN 2020:  
Driving SMEs Towards Sustainable Future

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# MALAYSIAN BIOMASS INDUSTRY ACTION PLAN 2020

Driving SMEs Towards Sustainable Future



## About MIGHT

Malaysia Industry-Government Group for High Technology (MIGHT) is an independent and non-profit organisation driven by more than 100 members drawn from the public and private sectors. The synergies arising from these engagements form the basis for efforts in prospecting cutting-edge technological know-how and opportunities that can be nurtured into viable businesses for wealth creation.

As Malaysia embarked on its drive to advance its industries' base from basic manufacturing in the 1970s into high technology industries in the 1990s, MIGHT was launched by YAB Tun Dr. Mahathir Mohamad, the fourth Prime Minister of Malaysia on 22 February 1993, to address urgent needs to respond to the effects of globalisation and trade liberalisation on the country's future economic growth whilst accelerating the use of high technology.

In order to integrate the role of the private sector in national development as well as explore the idea of fostering partnerships between industry and government, the Science Advisor's Office proposed the formation of an entity that would carry out 'prospecting' activities. Prospecting is defined as research and harnessing of technologies for the creation of business opportunities.

This led to the foundation of the entity named Consortium of Investors for Prospecting (CIP) which was backed by the Malaysian Business Council (MBC) and the National Council for Scientific Research and Development (NCSRD). The formation of the CIP paved the way for industry and government to work together to promote business development anchored on science and technology. It was a historic milestone and MIGHT was to emerge from this powerful union.

Over the years, it has become the referral centre for both public and private entities seeking independent advice & strategic analysis on market-driven priority technology research areas for investment and businesses.

Looking into the future of Malaysia, MIGHT collaborates with numerous key stakeholders in developing the eight strategic areas identified by the Malaysian Foresight Institute under its purview to ensure a sustainable and vibrant future for Malaysia – namely in Transportation, Environmental Management, Food Security, Future Energy, Medical & Healthcare, Plantation Crops and Water Security.

## MIGHT'S KEY ROLES

MIGHT have been mandated by the Malaysian government to execute the following:

1. Explore and promote the development of high technology industries through strategic harnessing and application of science and technology for nation building and nurturing of home-grown technology for industrial uptake.
2. Develop, implement and manage the National Foresight program for identification of technology priority areas for research & development and industry advancement.
3. Implement, manage and coordinate industry competency audit and performance evaluation of research & development activities.
4. Managing and operating the "Technology Depository Agency"
5. Secretariat for the Malaysia Aerospace Council
6. Secretariat for the Global Science and Innovation Advisory Council (GSIAC)

## ENABLING TOOLS AND PLATFORMS

Tools MIGHT strives for its objectives mainly via industry-government consensus building and smart partnership between entities in the public, private and academic sectors. Within 20 years, MIGHT has changed Malaysia's industrial landscape by ensuring a successful implementation of the country's technology road-mapping and high technology industry strategizing.

To lead the efforts, MIGHT has created the Lead Members platform in March 2009. Each of these lead members plays a key role in collaborating to develop a strategic national agenda for Malaysia. Currently, the members are:

- Petronas
- Sime Darby
- Telekom Malaysia
- Bank Pembangunan

MIGHT has further developed a strong global alliances with Centres of Excellence around the world to further Malaysia's high technology interests, including with the United States, South Korea, Germany, Australia and others.

## The Patron of MIGHT



We know that innovation is critical in ensuring prosperity and promoting both environmental and societal well-being. My Government is committed to advancing Science, Technology and Innovation and making it the driver for economic development and sustainability. This requires bold steps to build and leverage science and technology and harness the existing strengths of our nation

This will follow from developing innovative industries and leveraging on our rich biodiversity resources in particular palm oil, while at the same time making sure of our sustainable future. We need to generate high value economic activities by connecting our cities



**YAB Dato' Sri Haji Mohd Najib bin Tun Haji Abdul Razak**  
Prime Minister of Malaysia



**SCIENCE ADVISOR TO THE PRIME  
MINISTER OF MALAYSIA**

**Prof Emeritus Dato' Sri Dr. Zakri Abdul Hamid**



“ While recognizing the significance of the challenges faced in Malaysia and beyond, there are indications that Malaysia is rising to the occasion. Example of sustainable practices provides an optimistic note that solution exists in transitioning to sustainable development. While the challenge remains in implementing these solutions on wider scale... ”



## **JOINT CHAIRMAN OF MIGHT**

**Tan Sri Datuk Dr. Ahmad Tajuddin Ali**

---

“ There remain large untapped potential in the development of the green technology industry in Malaysia. The growth potential of green technology, such as conversion of renewable resources from biomass into higher value products is unlimited, with prospect and expectations to contribute significantly to the country’s transformation into a high value added economy. Entrepreneurship, financing, capacity building and technology applications provide transformative solutions moving forward. ”



## PRESIDENT AND CEO OF MIGHT

Mohd Yusoff Sulaiman



Biomass to energy and bio-based products has been at the forefront in Malaysia due to the current push towards sustainable development, environmental awareness and climate change, notwithstanding the main driver being the economic returns from this lucrative business. To realise the potential of the industry it is truly that we focus our effort towards the creation of high value products and greening the industry. Application of technology and R&D that is supported by the higher technology development strategy is crucial to initiate market entry and use of newly developed technologies and practices.

Towards these goals, Malaysia have put in place initiatives like the 5th Fuel Policy and the National Biomass Strategy, while MIGHT itself came up with the Malaysian Biomass Initiative under the Global Science and Innovation Advisory Council (GSIAC), chaired by the Right Honourable Prime Minister. This initiative brought about the formation of MYBiomass which is now spearheading the biomass industry in converting biomass into high value chemicals. MIGHT also initiated working relationships back in year 2010 with the European Union in executing the EU-SWITCH Asia project on biomass, which was among the first activity in addressing sustainable consumption and production for the biomass industry in Malaysia with the objective to enhance stakeholders awareness and driving innovation in the biomass industry.

Realising the need for the Small and Medium Enterprises (SMEs) to be involved in the biomass industry, MIGHT, jointly with the Biomass SP, initiated the Malaysian Biomass Industry Action Plan, with the objectives of proposing actions/interventions to close the gap in the local value chain of biomass utilisation through providing

opportunities for SMEs and entrepreneurs to participate in biomass utilisation by high value products and align it to the global sustainable production agenda. To complement this initiative, a biomass economic benchmarking study has also been carried out to look into the potential value creation from the various biomasses in Malaysia. This Malaysian Biomass Industry Action Plan 2020 provides a focus for a strategic coordinated approach and actions among the key stakeholders to develop biomass for energy production and production of bio-based products, moving forward towards 2020. This Report has been developed to identify the potential of the Malaysian Biomass industry and sets out how this potential could be achieved through consensus efforts and joint actions involving broad stakeholders from industry, government, financial institutions and other relevant institutions and associations.

MIGHT places great importance on harnessing private-public partnership between industry and government in catalysing the growth of this biomass industry, from setting common direction for the biomass industry, towards cohesive implementation and realisation of the targeted goals. While the government helps to create conducive ecosystem for the industry to become globally competitive, the private sector must drive the growth of the sector, directed by market needs. We hope together, we can identify market niches where our industry players can be developed and nurtured to become a reputable industry leader. Finally, I would like to extend my appreciation to everyone involved in the preparation of this Malaysian Biomass Industry Action Plan 2020 report and wish all in the biomass industry continued success.



## AMBASSADOR AND HEAD OF THE DELEGATION OF THE EUROPEAN UNION TO MALAYSIA

H.E. Luc Vandebon

The European Union's (EU) growth strategy is based on three key drivers: smart, sustainable and inclusive growth. For EU policy makers and industry, sustainable development has strategic implications for future competitiveness and success. It is therefore essential to reduce energy demand, increase reliance on renewable energy sources, diversify energy sources and enhance international cooperation.

The EU has been closely collaborating with Malaysia in various sectors contributing towards sustainable development. A number of our projects targeted sustainable consumption and production (SCP) practices, with topics ranging from eco-labelling and green procurement to renewable energy and energy efficiency, solid waste management and others. The EU Biomass-SP project with the Malaysian Industry-Government Group for High Technology (MIGHT) has addressed the issue of sustainable production of biomass.

Solid biomass and biogas play key roles in the EU strategy in achieving a 20% renewable energy share by 2020. The biomass energy from wood, wastes and agriculture allows countries to cut their dependence on fossil fuels, cut greenhouse gas emissions and stimulate economic activity. Globally, the continuously growing demand for biomass led to a steady increase of SMEs in the biomass industry.

However, along with new economic opportunities, use of biomass also brings sustainability risks that need to be managed. The Biomass-SP project helps Malaysian SMEs to take advantage of these new opportunities without compromising sustainability.

The Malaysian Biomass Industry Action Plan 2020 is one of the key outputs of this project. I hope that it will become a useful tool and will contribute towards the aspiration of the Malaysian Government to harness green growth and increase SCP practices in the biomass sector as well as utilise and deploy green technologies in this country.

**PRESIDENT OF MALAYSIA BIOMASS  
INDUSTRIES CONFEDERATION and  
TECHNICAL ADVISOR OF BIOMASS-SP**

**Dato' Leong Kin Mun**



“ I would like to thank all the relevant participating biomass stakeholders and all partners who have contributed their ideas and knowledge towards the completion of the Malaysian Biomass Industry Action Plan 2020, an action-based Plan derived from multi-stakeholders consultative process focusing on biomass SMEs development in Malaysia championed by MIGHT. My sincere appreciation also goes to the European Union (EU) - Switch Asia Programme for funding the BIOMASS-SP project which has successfully created a new landscape of biomass industries in Malaysia. ”

## ACKNOWLEDGEMENT

This Malaysian Biomass Industry Action Plan 2020 is the culmination of four years' activities by the Malaysian Industry-Government Group for High Technology (MIGHT), undertaken jointly with the Biomass-SP (European Union-Malaysia Biomass Sustainable Production Initiative), a project funded by the EU SWITCH-Asia programme between March 2010 – October 2013.

We wish to acknowledge the continuous input and experience sharing from our partner: the European Biomass Industry Association (EUBIA), the Danish Technological Institute (DTI) and the Association of Environmental Consultants and Companies of Malaysia (AECCOM), as well as the relentless support and contributions of all Biomass stakeholders from both the government, industry and research institutes/universities for their invaluable support and inputs towards preparation of this report:

- The Ministry of Energy, Green Technology, and Water (KETTHA); the Ministry of Science, Technology and Innovation (MOSTI), the Ministry of Plantation Industries and Commodities (MPIC), the Ministry of Natural Resources and Environment (NRE) for the continuous dialogues and advice on overarching policies relevant to the biomass industry.
- The Malaysian Palm Oil Board (MPOB), Malaysian Timber Industry Board (MTIB), Forest Research Institute Malaysia (FRIM), National Kenaf and Tobacco

Board, the Standards and Industrial Research Institute Malaysia (SIRIM), Malaysian Nuclear Agency, Universiti Putra Malaysia (UPM) for the statistical data and research papers on biomass and biomass products.

- The SME Corporation Malaysia (SME Corp), Malaysian Investment Development Authority (MIDA), Association of Banks in Malaysia (ABM), Bank Pembangunan Malaysia Berhad, and the Malaysian Green Technology Corporation (MGTC) for working closely with us in identifying the gaps and opportunities in the industry ecosystem.

Finally, we would like to commend the Small and Medium Enterprises (SMEs) who have been forthcoming in their views, concerns and aspirations for the Biomass industry in general and who have actively contributed their share of industries perspectives in making this report as all-encompassing as possible.

SWITCH-Asia is a regional environment programme aiming to promote the adoption of the principles of sustainable consumption and production (SCP) among SMEs and consumer groups in Asia.

MIGHT is a non-profit public-private organization under the Prime Minister's Department with national mandate to advance the development of strategic and high-technology industries in Malaysia for future competitiveness.





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## EXECUTIVE SUMMARY

The Malaysian Biomass Industry Action Plan 2020 (MBIAP) is an industry-wide initiative led by MIGHT to spearhead the positioning of the nation's Biomass industry towards high value creation as well as the adoption of Sustainable Production practices in Malaysia. Biomass industry in Malaysia is a growing industry that has the potential to tap into the local and regional biomass resources to bring in new investments, technologies and develop talents. Four sub-industries have been identified that can contribute significantly to wealth creation for the nation namely; Bio-Energy, Green Chemical, Bio-Fertilizers, and Bio-Composites/Materials.

The main stakeholder focus in MBIAP is the Small and Medium Enterprises (SMEs) where the biomass industry offers a plethora of opportunities and serves as a new platform for Malaysian SMEs to venture into and grow their businesses. Involvement of SMEs is crucial to drive innovations, develop and internalize local know-how and technologies, as well as creating more employment opportunities. Presently, the participation of SMEs in this industry is limited to low-value added economic activities that do not fully optimize the potential of the biomass feedstock and sustain competitiveness over the long-term. Positive intervention measures therefore need to be put in motion to steer the SMEs towards the main objective of high value creation via Sustainable Production. It is estimated that the high value utilization of biomass resources in Malaysia alone is able to generate added value of RM10-15 billion per annum.

The scope of intervention under MBIAP will cover the whole value creation chain of major sources of biomass in Malaysia namely, palm biomass, woody biomass, rice husks and straws, kenaf and municipal solid waste. The components in the value creation chain include biomass availability, transport and logistics, technology and human capital, relevant policies and law, investment and financing,

marketing and branding as well as local and export markets. This plan strives to close the existing gaps along this value chain through the mapping of the key enablers and proposing the strategic actions accordingly.

### Three primary strategies are proposed in MBIAP:

1. Unlocking biomass feedstock for downstream utilization via optimizing the efficiencies of resource utilization upstream at the plantation and milling stage
2. Smart utilization of biomass for high value production via commercialization and scaling-up of local know-how and expertise and setting of market-focused Biomass Smart Hubs.
3. Positioning Malaysia as regional and international biomass hub via establishing the nation as the focal point for internal and external biomass stakeholders in aspects such as trading, logistics, technology, engineering, equipment, standards development, investments and finance

The mobilization of biomass resources towards higher value utilization is expected to have positive social, economic and environmental spill-over effects for the nation in terms of more domestic and foreign investments, stimulating development in rural areas and adoption of sustainable practices by the industry players. The large-scale use of biomass feedstock for downstream manufacturing as an alternative to fossil-based resources will also elevate Malaysia's status and commitment in addressing the issue of climate change at the global level.

This Biomass Industry Action Plan 2020 aims to provide a common direction and concerted strategy and action plan to drive the growth of Malaysian SMEs into higher value-added activities.





# INTRODUCTION



## 1. INTRODUCTION

Conversion of biomass waste into high value products is not something new to Malaysia. The first success story in biomass conversion can be traced back to the 1990s where a large amount of rubber wood waste from replanting of rubber trees was transformed into high value rubber wood furniture for the export market. This success was achieved by the concerted efforts of relevant government agencies, research institutions and the SMEs from the furniture industry.

This success story highlights the fact that what was once considered as agriculture waste can be converted into

high value products with the combination of strategic vision, research and development, supportive government policies as well as an enterprising industry sector.

Malaysia is now looking at opportunities in creating high value products and unlocking the economic potential from a wide array of biomass waste such as palm waste, paddy waste, wood waste, municipal solid waste, sewage waste and other types of agricultural waste. Figure 1 provides a non-exhaustive view of biomass waste and volume generated annually in Malaysia.

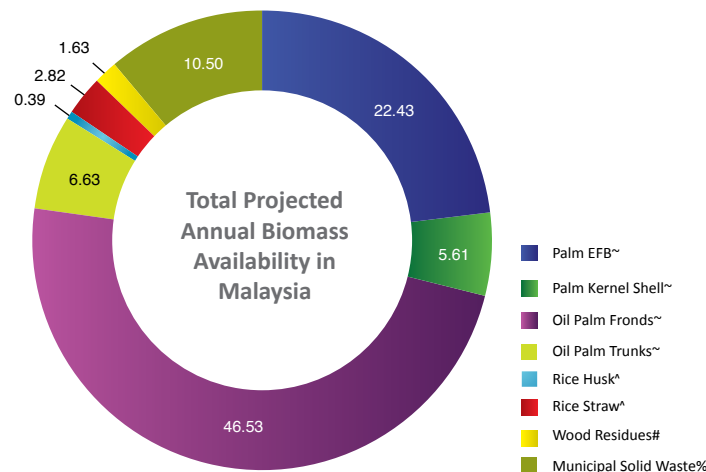


Figure 1 Total Projected Annual Biomass Availability in Malaysia (Million Metric Tonnes)\*

Note: \*Biomass availability in wet weight.

~Availability of oil palm biomass in 2012.

^Malaysia's paddy and rice production in 2012 was 2.82 and 1.93 million metric tonne, respectively. 1 kilogram of rice grain harvested is accompanied by 1 kg of paddy straw while rice husk constitutes 20% total rice produced.

#Residues from primary wood processing activities i.e. sawnwood and plywood mills in 2012 with the recovery rates of 52% and 50%, respectively with the availability factor of 20%

%Municipal solid waste availability in 2012

Early efforts in harnessing the value of biomass were focused on the generation of combustion-based heat, steam and electricity as a way to address the issue of waste disposal in agriculture and milling activities. This included co-generation power plants for electricity through the utilization of mesocarp fibers in palm oil mills, rice husk in rice mills, off-cuts and sawdust in timber mills for heat and power generation.

By the turn of the millennium, concerns about energy security and the impact of changing climate associated with the use of non-renewable resources have led to the realization that biomass is no longer a waste but a valuable resource. At the same time, the advancement of green technologies has also enabled conversion of biomass to valuable intermediate and end products such as solid, liquid and gas bio-fuels; high quality bio-composites, bio-fertilisers as well as green chemicals, industrial sugars, and polymers as alternative to fossil-based products.

## 1.1. Current Scenario of the Malaysian Biomass Industry

Over the last decade, government policies in promoting the renewable energy sector as well as in addressing waste disposal issue have encouraged active participation of large plantation companies and SMEs in the industry. Formal and informal linkages between industry players and other stakeholders are shaping up and aligning within the industry, coupled with on-going positive developments such as introduction of new technologies, wider market access and increased investment deals.

Nevertheless, many of these activities are still confined to low value-added conversion of the biomass to downstream products. The industry still faces many issues and challenges that require institutional intervention to drive the industry towards the high value-add phase of its life-cycle. At the macro-level, the problems faced by the industry can be broadly described as below

### 1.1.1. Limited Participation by SMEs in Biomass Utilisation to High Value Products

A number of strategic actions and initiatives in recent years have facilitated institutional efforts to drive the Malaysian biomass industry forward towards higher value creation. Currently, these measures are fairly skewed towards the engagement and participation of big plantation players (for supply of feedstock and investment), government agencies (as facilitators) and foreign companies (for technologies and market access of end-products).

Involvement of SMEs in the industry, while growing, faces many hurdles. For example, SMEs have cited long-term access to feedstock, adoption of high value-added technologies, access to financing as well as entering high value markets as some of the challenges they encounter in growing their developing ventures. As the backbone of the national economy, the participation of SMEs in the biomass industry can be crucial to drive innovations, to develop and localise currently cutting-edge know-how and technologies and to create more employment opportunities within the industry.

### 1.1.2. Low-Value Products from Biomass

Existing low value biomass products in Malaysia such as fibres, compost, fuel and fuel pellets are generic products or commodities, which can be easily displaced by other substitute products. Due to low entry barriers for new entrants, biomass SMEs face competitive pressure in terms of pricing and market access. Businesses will therefore exit the biomass industry as rapidly as they enter the industry; and the local biomass industry will not be sustainable over the long-term.

The main constraint faced by local players in creating market entry barriers against future competition is the lack of access to technological know-how in

converting the biomass feedstock into high value differentiated products. There are currently several initiatives to employ biorefining technologies to convert biomass into high value products such as biofuels, green chemicals, and bio-polymers. However, most of these ventures involve expensive imported technology and large scale investments, which are beyond the capabilities of many local SMEs.

Admittedly, a limited number of start-ups and SMEs have been successful in venturing into high value niche markets such as the production of specialty chemicals such as polylactic acid (PLA), carboxymethyl cellulose (CMC) and engineered products such as erosion control blanket from biomass feedstock. In most cases, the SMEs work closely with universities and research institutions to commercialise the latter’s R&D know-how.

**1.1.3. Gaps in the Biomass Value Chain**

In order to develop the biomass industry in Malaysia, there is a need to view the whole industry from the complete value chain perspective i.e. the components or nodes of the industry and their linkages as shown in Figure 2.

Each of these nodes needs to exist and to be developed to work in sync with each other in order to drive the industry forward. Presently there are many gaps along the value chain that need to be bridged. Briefly, these gaps include:

- a. Access to long-term supply of biomass for downstream utilization

- b. Access to technologies and know-how; as well as human capital
- c. Strategic new policies that are consistent with existing ones
- d. Access to funding from banks and investors
- e. Certification and product labelling to meet international market requirements and sustainability standards

These gaps need to be addressed with the right measures and actions from the government as well as industry stakeholders to ensure that the creation of high value products from the available biomass feedstock along the value chain proceeds as smoothly and sustainably as possible.

**1.1.4. Lack of Positive Communication**

Although successful conversions of low value biomass feedstock to high value products have been demonstrated by SMEs, these ventures are often not widely broadcasted or publicly communicated. On the other hand, failed biomass ventures tend to be highlighted, giving the perception that biomass ventures are not technically and economically viable. Additionally, the production, movement, and utilisation of biomass resources in Malaysia are currently neither tracked, monitored, nor publicly reported. Such data and figures, together with accurate case studies illustrating both success and failure projects need to be made available to stakeholders such as entrepreneurs, potential investors, financiers as well as government agencies to assist in their assessments of various biomass ventures and initiatives.



Figure 2 Biomass Industry Value Chain Nodes

## 1.2. Global and Local Biomass Opportunities for SMEs

In general, the biomass industry creates value from biomass feedstock as a substitute for non-sustainable raw materials for the production of intermediate and end products such as energy, chemicals, fertilisers and materials. As shown in Figure 3; the products from biomass can be categorised into the following product groups:

1. **Bio-Energy** – solid pellets, liquid biofuels and biogas/syngas
2. **Green Chemical & Bio-Polymers** – oxo-alcohols, lactic acid, PHA etc.
3. **Bio-Fertilisers** – compost, soil conditioner, soil stabiliser
4. **Bio-Composites** – composite wood, engineered lumber, eco-products, etc.

Among the global and local opportunities for SMEs to participate in the biomass industry are:

- **Production of biomass fuel pellets for export market to European Union, China, Japan & South Korea** – As part of the global commitment to address the climate change problem, many developed

nations specifically the EU, South Korea and Japan are gradually switching to heat and power generation from biomass. The recent nuclear incident in Fukushima, Japan has also been a major setback for the positioning of nuclear power as a ‘zero-carbon’ power source. China is also gradually switching into more biomass as a part of its commitment to use renewable energy for its power generation mainly to reduce the impacts of its coal power generation sector on air pollution and the health of its population.

As a result, there is increasing demand for biomass fuel pellets and briquettes for power generation as well as home heating. Currently, export of pellets made from EFB to EU countries faces many constraints such as compliance to their wood pellets-based standards, their negative perception of the palm oil industry, as well as the high shipment costs and associated risks. In contrast, China, Japan and South Korea are much nearer to Malaysia with lower entry barriers for Malaysian EFB pellets. There are already SMEs supplying pellets to these markets on a small scale. These small players need to group together possibly via facilitation by the government to fully exploit this

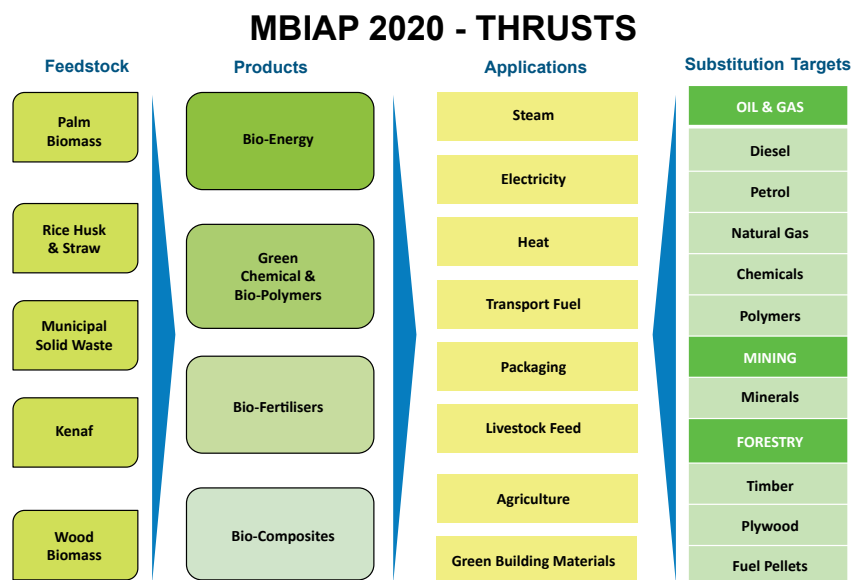


Figure 3 Products from Biomass Feedstock vs. Non-Sustainable Feedstock

potential, and to achieve better economics of scale and negotiating power.

The total demand of biomass fuel pellets in these three countries by 2020 is projected to in the region of 16 million tonnes. This translates to total market potential of RM4.8 billion annually based on the current price of fuel pellets at about RM300/tonne. There will also be economic spill-over effects to other sectors such as the biomass equipment fabrication and trading, transport and logistics, as well as the supporting services.

Participation of SMEs in the biomass fuel pellets export sector faces a number of potential risks, viz:

- As a commodity business, it is a relatively low-value added activity;
- There is price and supply competition pressures from other global exporters;
- There is the issue of sustainability regarding palm biomass feedstock availability; as well as
- Technical issues concerning the high content of chloride and ash in EFB pellets, making it less favourable against wood pellets in the global market.
- In-situ production & consumption of biogas – Production of biogas from high-carbon content wastes such as POME and organic MSW is relatively simple and the technology is already well-proven. However, this opportunity is still not fully exploited due to many unresolved hurdles that require coordinated efforts from the government and relevant stakeholders.

As of end of 2012, it was reported that under EPP 5 (Developing Biogas Facilities at

Palm Oil Mills); 57 biogas plants had been commissioned within palm oil mills with another 15 mills under development. With a total of 426 mills, there are still 354 mills (83%) without any biogas utilisation facilities. This translates to an investment potential of nearly RM2.5 billion in such facilities that can benefit SMEs supplying and trading in biogas equipment as well as technology providers and construction companies.

As for organic MSW, due to the high composition of organic materials in our MSW, there is also opportunity for the fabrication, supply and trading of biogas equipment to convert the waste into biogas in centralised facilities such as wet markets, food courts and canteens. Theoretically, the amount of food waste generated in Peninsular Malaysia is estimated at approximately 4.4 million tonnes (wet) per annum and this corresponds to an estimated 145,000 m<sup>3</sup> of biogas per annum which translates to 3.6 terajoule of energy. This is based on an anaerobic digestion trial runs conducted by Universiti Putra Malaysia (UPM) and biogas cleaning technology from Germany and India.

- **Manufacturing of bio-fertilisers –** Malaysia imports approximately 3-4 million tonnes of chemical fertilisers worth RM3-5 billion a year for its commercial agriculture activities. The oil palm sector which is the largest plantation sector in Malaysia consumes about 75% of this total import. Malaysia therefore is highly reliant on external sources of chemical nutrients for our agricultural sector and is therefore exposed to the global price volatility of these commodities as had been experienced in 2007-2008. In addition, the use of chemical fertilisers depletes soil

In 2010, Sindora Berhad invested in an RM36mil bio-fertiliser plant with a daily production capacity of 80-120 tonnes. The plant will utilise EFB and POME from the mill operations to produce bio-fertilisers that will partly substitute the use of chemical fertilisers in oil palm plantation. It is estimated that there will be about 40% savings in the cost of fertilisers; while the fertility of the soil will be much better preserved with the use of the bio-fertiliser.

productivity, contributes to groundwater pollution, etc.

The production and use of bio-fertilisers by the oil palm sector will not only benefit the SMEs in terms of business opportunities but it is advantageous to the former who will thus be less reliant on imported nutrients. This can happen in two ways:

1. By the recovery and recycling of inorganic nutrients (e.g. P, K, Mg) from biomass (e.g. boiler ash) into the bio-fertiliser products; and
- 2.. The use of compost and beneficial microbes to improve the efficiency of nutrient uptake by the crops.

It has been demonstrated by some SMEs venturing into the production of bio-fertilisers that the use of chemical-based compound fertilisers can be reduced by 25-30% by the application of the bio-fertilisers. This translates to savings of about RM 0.9 – 1.5 billion to the nation in the import of chemical fertilisers while shifting part of the investment and value of the fertiliser industry back to local enterprises. There will also be opportunities over the long-term for SMEs to export the bio-fertiliser as well as the know-how to other agriculture-based nations.

- **Bio-composites as green building construction materials.**

The green building industry is very much driven by the concerns on climate change and potential energy savings over the life cycle of the buildings. Many developed as well as developing nations such as Malaysia have already developed their own green building standards to guide their local building industry. One of the criteria in these green standards is on the use of building materials made from sustainable resources such as biomass and recycled materials. The use of bio-composites made from materials such as kenaf fibers, rice husks, oil palm trunks and recycled plastics will therefore contribute to the certification of the green buildings.

There is potential for Malaysian SMEs to venture into the manufacturing of bio-composites for the export market. Possible products include wall and decorative panels, decking timbers as well as furniture.

Malaysia should target to gain competitive advantage in this sector, by developing its capacities in areas such as product certification according to internationally recognised eco-labelling schemes, carbon footprinting of its products and international branding, optimised use of its biomass feedstock as well as talents and innovations in green product design.

- **Green chemicals**

Many years of the Malaysian's investment in research and development within universities and research institutions has yielded much technological know-how and patents in converting biomass waste into high value green chemicals and substances for the global market. Some of this R&D has been commercialised such as the production of carboxymethyl cellulose (CMC) from EFB.

There are still many similar R&D outputs within the universities and research institutions that can be exploited by SMEs using biomass as the feedstock to produce these high value niche products. More importantly, these products have much higher value-added potential compared to the conversion of biomass to commodity-based products such as fibres, fuel pellets and compost.

- **Eco-products**

SMEs also have opportunities to venture into manufacturing where biomass can be converted into niche eco-products that serve specific industrial and consumer markets. These include the production of EFB pulp and downstream specialty paper or packaging products, engineered erosion-control fibermats as well as green lubricants. These eco-products are typically highly differentiated with high content in terms of engineering, design and branding.

### 1.3. Objectives and Scope of MBIAP

There is an urgent need for a specific Biomass Industry Action Plan for the development of the SME sector in this industry to significantly strengthen and to further grow this industry forward in view of the substantial potential for the participation of SMEs in this industry sector.

The overall objective of this Biomass Industry Action Plan is to formulate intervention strategies and specific action plan to develop and promote SME stakeholders in adopting Sustainable Production via participation in the Malaysian biomass industry. This strategic plan envisions the creation of domestic and export markets for biomass products; establishment of strong linkages between various stakeholders in the industry (i.e. the government ministries and agencies, private enterprises, industry groups, research institutions, financiers and NGOs); for the commercialisation of indigenous technologies developed by local research institutions and universities as well as positioning Malaysia in the world map as a green hub in this region.

**The specific objectives of this strategic plan are as follows;**

- **Provide opportunities for the participation of SMEs and entrepreneurs in the biomass value chain.** There is a need to ensure the participation of SMEs and entrepreneurs in the industry as these players can help to drive innovations as well as create niche markets for the industry that big players may miss out on;
- **Propose actions and intervention measures to close the gaps in the value chain of biomass utilization in Malaysia.** Some of these gaps that require urgent intervention include the inconsistent supply and pricing of biomass feedstock, lack of economical collection, aggregation, pre-processing and transport of the biomass, low success rate of financing and funding for biomass projects, need for effective enforcement of standards for biomass feedstock and end products, as well as lack of domestic market demand to pull the value chain forward;

- **Identify SMEs, industry players and stakeholders to secure their participation in the proposed actions and measures.** This action plan is based on the concept of empowering existing and future industry players and stakeholders to drive the industry forward. The government and its agencies are only expected to coordinate the resources and facilitate the adoption and implementation of the actions and measures. This is more effective than relying solely on the government and its agencies to push the industry forward;
- **Ensure that development of biomass industry is in parallel with equitable distribution of wealth.** The wide distribution of biomass resources means that this industry offers a good opportunity to include the communities in the rural areas as part of the value creation chain as well as its beneficiaries. There is also an opportunity to create jobs in areas such as collection, aggregation, pre-processing and transportation of biomass resources to the downstream users.

The types of biomass covered under this strategic plan are:

- Palm biomass (EFB, MF, PKS, OPF, OPT)
- Wood biomass
- Municipal Solid Waste (MSW)
- Rice husk & straws
- Kenaf

These biomass resources are selected based on following factors:

- Availability in large quantity, thus making large scale utilization economical (EFB, OPF, MSW);
- Contribution to environmental degradation (POME, MSW in landfills, paddy straws seasonal burning in field);
- Potential for high value utilization in downstream manufacturing (kenaf, rice husks, PKS, EFB, OPT);
- Economic mobilization in rural areas (kenaf, paddy straws)





**MALAYSIAN**  
Biomass Outlook



## 2. MALAYSIAN BIOMASS OUTLOOK

### 2.1. Malaysian Biomass Availability

The biomass availability in Malaysia can be categorized into three different sectors, biomass from agriculture, forestry and waste. Table 1 provides an overview of biomass categories available from the three sectors.

cultivated for its fiber and woody core, with similar potential industrial applications to cotton and jute. The Malaysian National Timber Industry Policy (NATIP) recognizes kenaf as potential raw material alternative to timber for products like plywood and composites. Kenaf is fast growing; yielding two harvests per year at approximately 15-20 tonnes

**Table 1 Categories of Biomass in Malaysia**

Sector	Biomass Category	Biomass Type	Description
Agriculture	Primary crop	Woody biomass	Kenaf, bamboo, etc.
		Sugar, starch, oil	Jatropha, sago waste, OPT juice
	Secondary agriculture residues	Solid agricultural residues	Empty fruit bunch (EFB), mesocarp fibre, palm kernel shell (PKS), paddy straw, husk
		Wet biomass	Palm oil mill effluent (POME), sago sludge, pig/cattle/chicken manure
Forestry	Primary forest residues	Woody biomass	Residues from cultivation and harvesting/logging activities (off-cuts, branches, etc.)
	Secondary forest residues	Woody biomass	Wood chips, saw dust
Waste	Primary residues	Landscape waste	Biomass residues from maintenance activities (green and woody cuttings)
	Tertiary residues	Organic waste (from household)	Organic household waste i.e. food waste, waste papers, etc.
		Organic waste (from industry)	Food processing residues from trade, markets, etc.
	Tertiary residues	Solid biomass (from industry)	Woody fractions from construction, demolition, bulk transport activities
		Wet biomass	Sewage sludge

Cultivation of dedicated crops for energy or bio-based products, although not yet widespread, is also an emerging activity. For example, jatropha and algae have been identified both by the government as well as some entrepreneurs as potential feedstock in Malaysia's renewable energy technology roadmap.

Malaysia is also currently exploring new types of commercial crops such as kenaf, a hardy crop

per hectare (dry weight). The fibre makes up about 20% (3-4 tonnes per yield) of the plant. At present, Malaysia produces an average 200 tonnes of kenaf fibre very month.

#### 2.1.1. Biomass from agriculture land and by-products

Figure 4 provides the growth of agricultural sector in Malaysia based on hectareage from 2000-2010. In 2012, the agricultural sector in Malaysia consisted

of 6.6 million hectares (20% of total land area) where commercial crops such as oil palm rubber, pepper, and tobacco, represented 77% of the total crops.

The main sources of biomass residues from agricultural sector in Malaysia come from the

regular maintenance of crops in the field as well as their processing activities. The data in Figure 4 clearly indicates that the cultivation of oil palm is expanding while the other commercial crops are either declining or stagnant. Table 2 shows the potential of biomass residues that can be derived from palm oil plantation, based on 2012 data.

**Table 2 : Biomass Potential from Palm Oil<sup>5</sup>**

Biomass Type	Description	Site of Production	Quantity (Mt/year)
Fronds	Leaves of oil palm tree: - From pruning activities annual pruning 10.40 tonnes/ha at 4.35 million plantation area	Plantation	45.24
	- From re-planting activities, 14.47 tonnes/ha *0.089 million hectares replanting area in 2012		1.29
Trunks	Tree trunks 74.48 tones/ha. *0.089 million hectares replanting area in 2012	Plantation	6.63
Empty fruit bunches (EFB)	Remains after removal of oil from palm fruits - From the 429 palm oil mills operating at total capacity of 101.96 Mt of FFB, Estimated EFB = 22% x 83.09 Mt	Mill	22.43
Palm kernel shells (PKS)	Remains after palm kernel oil extraction	Mill	5.61
Mesocarp fibre (MF)	Remains after oil extraction from mesocarp	Mill	13.76
Palm oil mill effluent (POME)	Liquid by-product from sterilization and milling process of FFB (67% per ton FFB)	Mill	66.27

Source: Malaysian Palm Oil Board (2011)



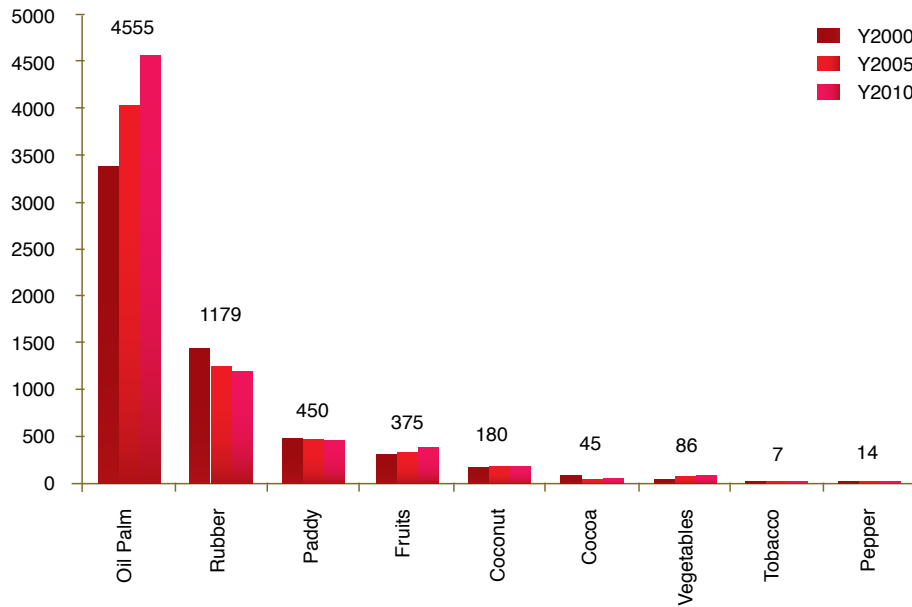


Figure 4 – Malaysia’s Agriculture Land Use 2000-2010 (thousand hectares)

Source: Wong, L.C.Y., (n.d.), *Development of Malaysia’s Agricultural Sector: Agriculture as an Engine of Growth? ISEAS ‘Conference on the Malaysian Economy: Development and Challenges’, 25–26. January 2007, ISEAS Singapore.*

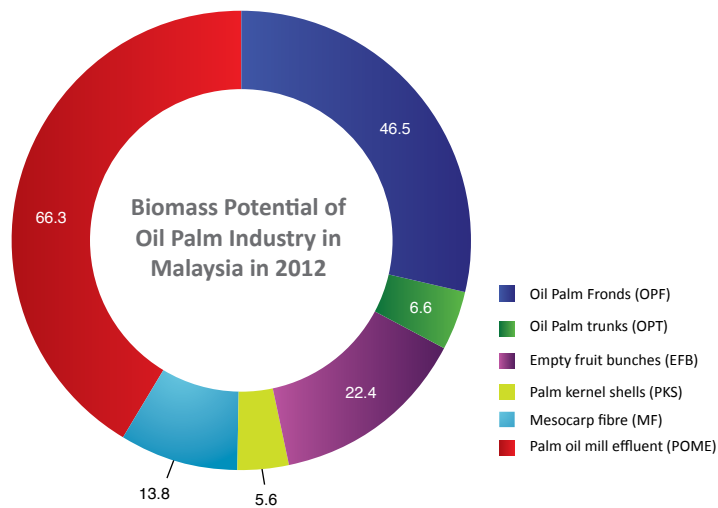


Figure 5 Biomass Potential of Oil Palm Industry in Malaysia in 2012 (Million Metric Tonnes)\*

Source: Malaysian Palm Oil Board (2011)

Note: \*Biomass availability in wet weight.

Table 3 illustrates the potential of rubberwood residues up to 2012. 80% of rubberwood comes from the smallholders whose locations are scattered. Therefore, the availability factor of the biomass from the field is assessed at 50%. In

addition, although the amount of residues from processing mills is high, there is already some form of utilization of these residues amongst the different industries i.e. furniture, energy, agriculture, etc.

**Table 3 Rubberwood residues (Peninsular Malaysia)<sup>7</sup>**

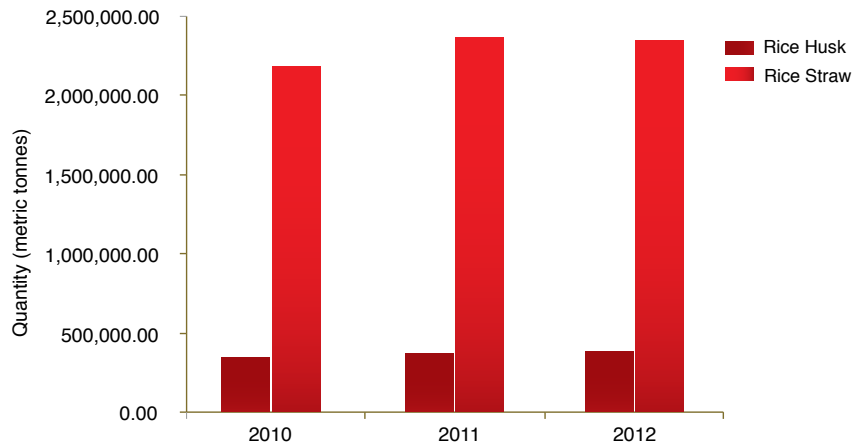
Year	Rubberwood from field (Mm3)	Rubberwood from field (Mt)	Log production (Mt) +	Surplus fr. field (Mt) #	Surplus fr. mills (Mt) ~	Total surplus (Mt)
1998	8.636	4.75	0.95	1.9	0.09	1.99
2000	8.745	4.81	0.96	1.93	0.09	2.02
2002	6.808	3.74	0.75	1.5	0.07	1.57
2004	4.939	2.72	0.54	1.09	0.05	1.14
2006	6.588	3.62	0.72	1.45	0.07	1.52
2008	8.981	4.94	0.99	1.98	0.1	2.08
2010	6.082	3.35	0.67	1.34	0.06	1.4
2012	3.207	1.76	0.35	0.71	0.03	0.74

Source: Koh M.P & Hoi W.K (2003) Sustainable Biomass for Energy in Malaysia: Other Biomass, Country Report for Biomass Energy in Asia – A Study on Selected Technologies and Policy Options. AIT, Thailand

Note: + 20% of the tree is converted to logs  
 # 50% of the logging residues is available  
 ~ 9.62% of processing residues is available

Another significant resource of biomass feedstock from agriculture is rice husk and paddy straw. Malaysia produces some 2.2-2.3 million tonnes rice every year. Rice husk, the outer covering of the rice grain obtained as a result of the milling process,

constitutes 20% of the total rice produced. A study also shows that every kilogram of rice grain harvested is accompanied by 1 to 1.5 kg of paddy straw. The production trend of rice husk and paddy straw biomass is illustrated in Figure 6.



**Figure 6 Biomass Potential from Paddy and Rice Production (Metric Tonnes)\***

Note: \*Based on latest available data from the FAO STAT

**2.1.2. Biomass from forestry**

At present, large quantities of residues resulting from the logging activities are left in the forests due to difficulties in extracting and transporting these residues from the forests. Meanwhile, residues from wood processing are also high. Malaysia currently has 1,019 saw mills and 181 plywood/ veneer factories with product yields of about 52 and 50%, respectively. Table 4 illustrates projected

most commonly used application of wood residues from saw mills and plywood factories in Sarawak.

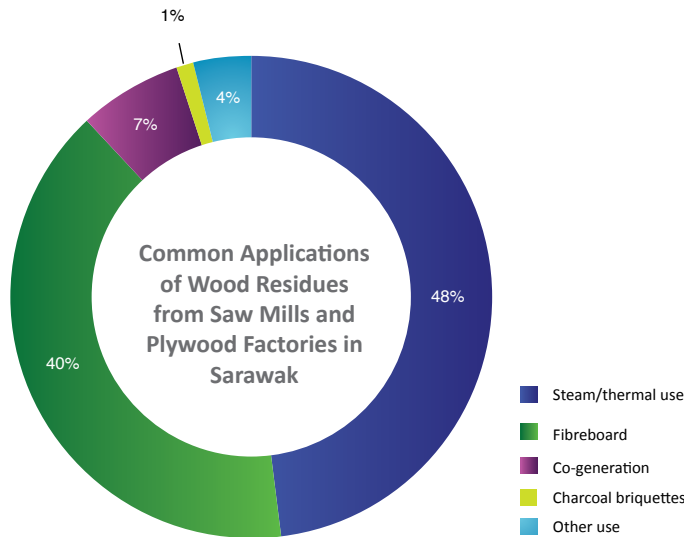
**2.1.3. Biomass from municipal solid waste**

Biomass from municipal solid waste (MSW) remains the most underutilized of the biomass resources in Malaysia today. Presently, 89% of total waste is disposed off in landfills. Household

**Table 4 Projected Mill Residues from Wood-Processing Activities in Malaysia in 2012**

Processing Type	Production (million m3)	Assumed Recovery Rate (%)	Mill Residues (million m3)
Sawnwood Milling	3,391	52	3,684
Plywood Milling	4,450	50	4,450

Note: \*Based on latest available data from the FAO STAT



**Figure 7 Common Applications of Wood Residues from Saw Mills and Plywood Factories in Sarawak**

Source: According to survey conducted by T.C.Wong in Kemena Wood Industry Park in Sarawak

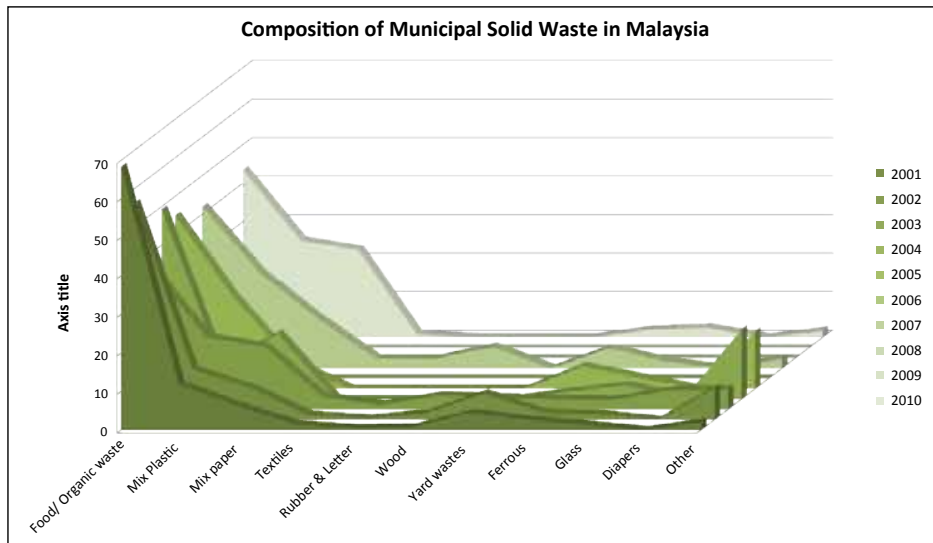
mill residues from the biggest wood processing activities i.e. sawnwood and plywood milling in Malaysia in 2012. Nevertheless, almost 75-80% of residues generated from wood processing activities are reutilized. For example, Figure 7 illustrates the

or domestic waste makes up the largest source of waste followed by industrial and commercial. In the domestic waste portion, food and organic waste form the largest component, ranging from 40-70% as shown in Figure 8.

**Table 5 Percentage of waste generated in Malaysia from the various sources in 2010**

Sector	Weight (%)
Domestic	49
Industrial	24
Commercial	16
Construction/Institutional	9
Landscape	2

Source: MOSTI (2010) Renewable Energy Technology Roadmap



Source: Dr. K.H. Chua, Endang Jati M.S., Dr. Y.P. Leong (2011) Sustainable Municipal Solid Waste Management and GHG Abatement in Malaysia. 15th International Conference on ISO & TQM (15-ICIT). July 2011. UNITEN, Kajang

**Figure 8 Composition of Municipal Solid Waste in Malaysia**

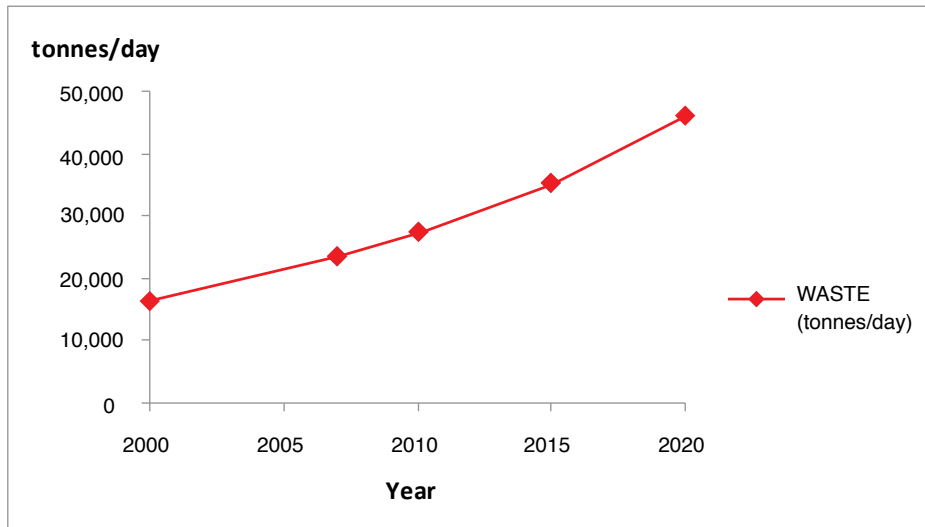
The MSW in Malaysia tend to have higher moisture content due to the country’s tropical climate and regular rainfall, ranging from 52.6 to 66.2%.

in Malaysia is estimated at 10.5 million tonnes every year; whereby population growth and rapid urbanization is expected to increase the MSW generation to up to 24 million tonnes by 2020.

Figure 9 and 10 shows the projected growth of MSW volume in Malaysia. Total waste generation

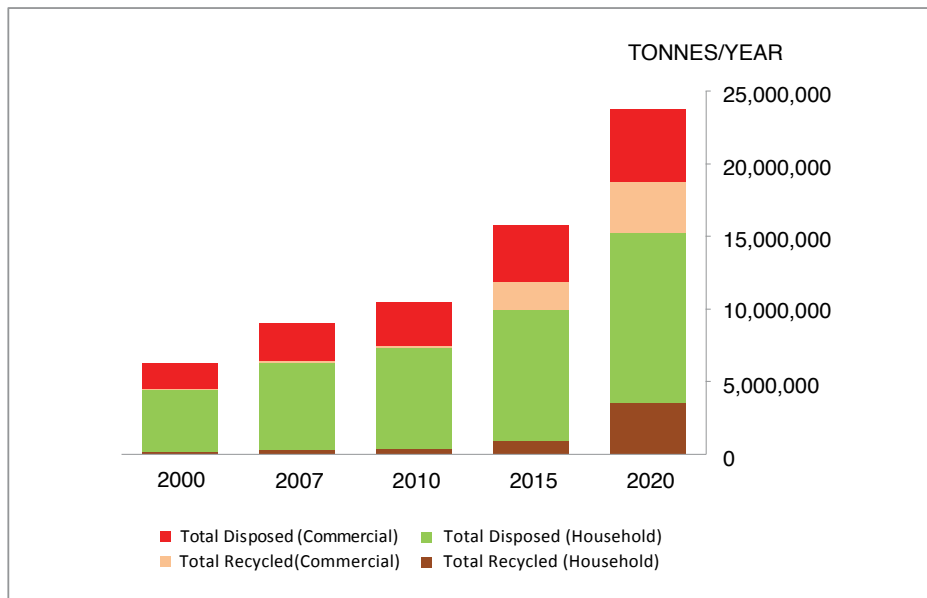






Source: JPSPN and PEMANDU Lab

Figure 9 Waste Projection in Malaysia 2000-2020 (Tonnes/Day)



Source: JPSPN and PEMANDU Lab

Figure 10 Household and Commercial Solid Waste with Recycling Projection for Malaysia

## 2.2. Cost of Biomass

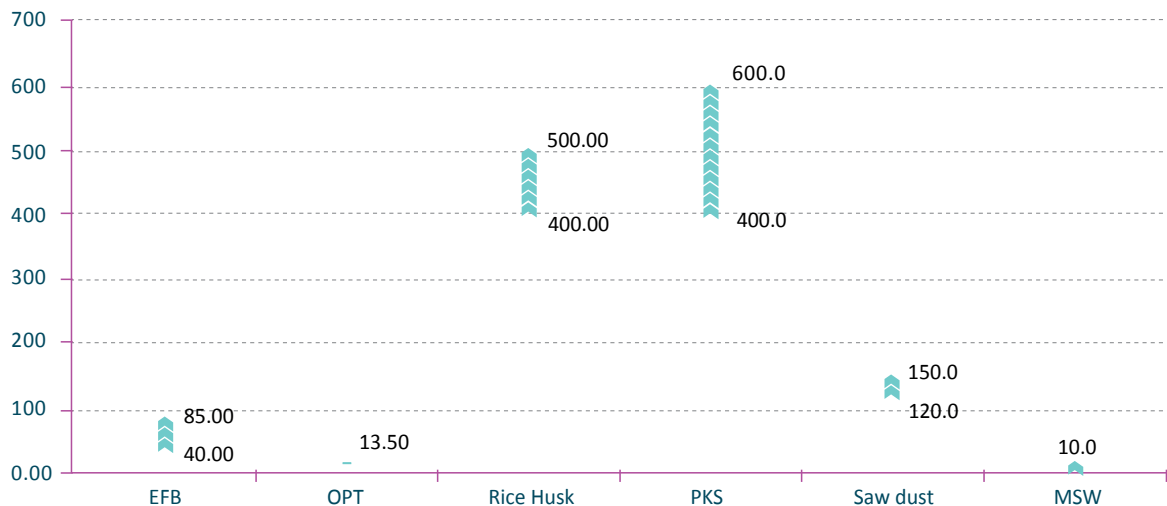
Figure 11 provides an overview of the range of the acquisition costs paid by SMEs to access biomass feedstock, consisting of the price paid to the suppliers of biomass and the transportation cost to their manufacturing facilities. The data is obtained from a preliminary survey on the SMEs to investigate their access to biomass.

The acquisition cost is heavily dependent on the transportation cost due the physical characteristics of biomass such as low density, high moisture content and rapid decomposition. This is expected to lead to a future need to pre-process the biomass at its source. In the case of palm biomass, the remote locations of many of the mills are also a contributor to the high cost of transportation.

The figure shows that current acquisition cost for oil palm biomass (EFB, OPT) is comparatively low compared to other forms of biomass. Taking Johor state as an example, EFB cost fluctuation can be in a range of RM 40 – 400 per ton due to large

variation in mill locations and mode of collection and transportation available, while OPT has a wider band range of RM 30 – 450 per ton. These numbers are not absolute and may vary in different parts in Malaysia, as well as due to seasonality changes. Both rice husk and PKS on the other hand, have higher acquisition cost predominantly due to current demand of the PKS as supplementary fuel in high-energy industries such as the manufacturing of cement, ceramics and rubber gloves. Rice husk is also in high demand as filler material for the production of bio-composites for the building materials industry.

It can also be that PKS and rice husk simply show larger cost variance due to locations where they are available and needed as compared to other sources. In general, the large cost variance for biomass is due to the fact that there is no generally accepted price in the buying/selling of biomass; the price is very much dependent on the negotiations between the two parties.



Source: MIGHT - Biomass-SP Interview with small & medium enterprises in biomass venture

Figure 11 The Range of Acquisition Cost of Selected Biomass in Malaysia in RM/Tonne (Wet)

### 2.3. Current Status of Biomass Utilization in Malaysia

Table 6 provides the major types of biomass commonly found in Malaysia and the various types of end-products that can be produced from each type of biomass.

In the case of palm biomass, one of the major breakthroughs happened in the 1990s where successful research into mechanical shredding and fiberizing of palm EFB opened up wide opportunities for the utilization of the EFB biomass. This ranged from outright sale of the long and short EFB fibres, pelletizing to solid fuels, manufacturing of fibre mats, pulp and packaging materials as well as feedstock for bio-conversion processes. Before this, the utilization of EFB was only confined to low-value field mulching and composting, besides combustion for steam and electricity generation for the oil mills.

Government's strong action to promote renewable energy particularly through the introduction of

Fifth Fuel Policy in 2001 followed by the Renewable Energy Act 2011 has also led to increased biomass utilisation for both electricity and thermal generation. As of October 2013, there is a cumulative total of 60.84 MW from biomass plants (including biogas plant) in operation to supply electricity to the grid; with 76% of the capacities being from oil palm biomass. The breakdown of the operational capacity is as follows:

- Biogas (POME) : 5.38 MW
- Landfill gas : 3.16 MW
- Solid Waste Biomass: 8.90 MW
- Oil Palm Biomass: 43.40 MW

On top of the above installations, there is an estimated 400 MW of biomass power generation capacity from mesocarp fibres which is used for self-consumption in the palm oil mills and for surrounding plantation housing.

**Table 6 Available Biomass-Based Products and Their Commercialisation Stage in Malaysia**

	PELLETS	BIOFUELS	BIOGAS	GREEN CHEMICAL	BIOFERTILISERS	BIOCHAR	BIOCOMPOSITES	OTHERS
EFB	EFB Pellets	Bioalcohol	Syngas	Industrial Sugars/ Chemical	Organic Compost	Carbon Fibers	Fibreboard	Pulp Fibremat
PKS	Coal substitute					Activated Carbon		
OPT	OPT Pellets	Bioalcohols	Syngas	Industrial Sugars/ Chemical	Organic Compost	Biochar	Engineered lumber	
OPF	OPF Pellets	Bioalcohols	Syngas	Industrial Sugars/ Chemical	Organic Compost	Biochar		Phytochemicals
PKC	PKC Pellets			Biopolymers				Animal Feed
POME		Bioalcohols	Methane	Biopolymers	Organic Compost			
SAW DUST	Wood Pellets	Bioalcohols	Syngas	Industrial Sugars/ Chemical	Mushroom Cultivation	Biochar	Fiberboard	
RICE HUSK							Biocomposite	Silica Aerogel
PADDY STRAW	Straw Pellets							
KENAF							Biocomposite	
SAGO WASTE	Fuel Pellets	Bioalcohols	Methane	Biopolymers				Animal Feed
MSW	RDF Pellets		Methane		Organic Compost			
SEWAGE								Phosphate Recovery

LEGEND ■ Commercialised ■ Development Stage ■ Potential

There are also many Malaysian SMEs venturing into the production of fuel pellets and briquettes from palm and wood biomass for the export market. These solid fuels are used either for small-scale home heating or large-scale power generation. Current markets include Europe, China, Korea and Japan as these countries strive to reduce their carbon footprint in their economies. Other similar products being explored by the SMEs include bio-char, torrefied pellets and activated carbon as these products are able to generate more value per unit feedstock than the fuel pellets.

Another promising biomass sub-sector that shows growth potential is the production of 'green' products such as:

- **Eco-products** – pulp & paper fibers, biodegradable packaging materials
- **Bio-composites** – fiberboard, particleboard, chipboard, plywood, biomass-plastic composite, engineered lumber
- **Green materials and green chemicals** – biochar, activated carbon, green fuels and chemicals, polymers, etc.

Some of these ventures have already reached the commercialization phase. For example, there are at least two companies in Malaysia producing pulp and paper products from EFB fibers. A few companies are using ground rice husk to mix with recycled plastics to manufacture high end biocomposite products for the building industry; while one has stated its intention to go into large-scale manufacturing in Vietnam where there is an abundance of rice husks and large market potential.

However due to lack of data on production, sales and consumption, it is difficult at this stage to gauge the current status in this sector. There are many press reports on joint ventures and pilot-scale production being setup in Malaysia to investigate both the technical and financial viability; whether these ventures will take off into full-scale production remains to be seen. It is likely that the green chemical products segment

will grow and dominate the Malaysian biomass industry in the near future with the eco-products segment trailing in second. This may probably see the biomass feedstock being split into two types:

- The 'clean' biomass such as mesocarp fibers, EFB, PKS, kenaf, rice husk and straw that will be utilized for the production of high value green chemicals and eco-products; and
- The 'dirty' biomass such as POME and MSW that will be used for power generation via either the biological or thermal pathway.

An insight into the potential products that could be derived from the various resources is provided by Table 6; some of which are currently already in the market. Some of these potentials may not be commercially realizable for various reasons but until a full techno-economic evaluation is carried out, all these potential products should not be dismissed at the present moment.

Currently, the majority of biomass ventures in Malaysia (operational or under planning) are too focused on a single source of feedstock i.e. palm EFB whether for power generation, biochemical production or eco-products manufacturing. This has put a high future demand on EFB and thus contributes to the perceived feedstock scarcity and future price escalation of this feedstock.

One interesting view from some industry players is the idea of multiple biomass feedstock for downstream utilization. All biomass in reality, is composed of fundamentally similar major components i.e. cellulose, hemicellulose, lignin, minerals (ash) and some trace amount of phytochemicals. The majority of the downstream utilization mechanisms of biomass require only one or more of these components, rather than all of the components. It is therefore possible, in principle for manufacturing and production processes to utilize different biomass feedstock containing the same components required. The challenges lie in the upgrading of existing processes or developing new processes while optimizing the conversion efficiency and final product quality.

## 2.4. Competitive Position of Malaysian Biomass Industry

An analysis of the competitive position of Malaysia's biomass industry within the context of national, regional and global trends is important to determine the current and future directions of the industry. This will provide guidance to the need for development of strategic actions and measures, especially concerning the participation of SMEs in this sector. The inputs for the analysis are derived from multiple sources i.e. stakeholders' engagement sessions (SMEs, public-listed companies (PLCs), government-link companies (GLCs), government

### 2.4.1. Strengths

- a. **Availability of biomass** - With its tropical climate and high soil fertility, Malaysia is well-positioned to generate large volumes of biomass within a relatively small land area. It also has a well-developed commercial agriculture sector such as rubber, oil palm and rice that produce large concentrated supply of biomass that was previously considered as waste. Moreover, the types of biomass

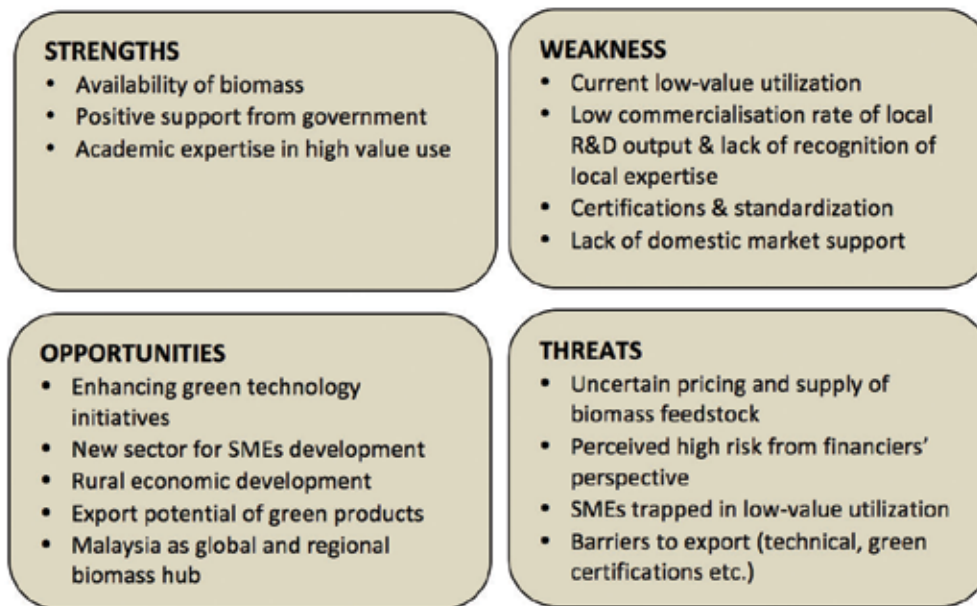


Figure 12 Competitive Position of Biomass Industry in Malaysia

ministries and agencies, research institutions and universities, financial institutions, industry groups etc.) and literature review of published studies and reports. These inputs are then consolidated into broad categories outlining the multiple dimensions of this competitive position as illustrated in Figure 12.

available are also very diverse; ranging from lignin-based biomass (tropical wood), starch-based biomass (tapioca, sago), and fibrous biomass (EFB, kenaf, paddy straw and husk).

- b. **Positive support from government** – Among the existing policy drivers that have a positive impact on the development of Malaysia's biomass industry are the National Biotechnology Policy 2005, the National

Biofuel Policy 2006, the National Green Technology Policy 2009, the Renewable Energy Act 2011, The National Biomass Strategy 2020, Bioeconomy Transformation Programme, and the SME Master Plan 2012-2020. These policies, while not entirely focused on biomass per se; will impact the industry by creating the demand and pricing for biomass.

- c. **Academic expertise in high value use** – Malaysia’s R&D efforts to utilize and create value from biomass resources have long been aggressively pursued by the research institutions such as the Malaysian Palm Oil Board (MPOB), Forest Research Institute of Malaysia (FRIM), and Standards and Industrial Research Institute of Malaysia (SIRIM), universities as well as GLCs, with the strong support by the government via the provision of public R&D funding. These measures have been successful in generating new patents and innovations as well as creating a pool of talented researchers with the right technical know-how and skills for the local biomass sector.

#### 2.4.2. Opportunities

- a. **Enhancing green technology initiatives** – A well-developed biomass industry will create the value chain necessary to support various initiatives on green technology such as and renewable energy, energy efficiency, green building, green procurement, green chemicals, etc.
- b. **New sector for SMEs development** – The development of biomass industry in Malaysia can serve as a new sector to increase the participation of local SMEs in the economy, in line with the SME Master Plan 2011 objective of increasing SMEs contribution to GDP from 32% to 41%. More importantly, this can be achieved via encouraging SMEs to switch to sustainable production practices in line with the national and global sustainable development agenda.
- c. **Rural economic development** – Within the value chain of the biomass industry, there will be many opportunities for the participation of communities and businesses from the rural areas as that is where the biomass originates from. This can take place in two ways:
- The creation of upstream economic activities such as collection, aggregation, pre-treatment and transport of biomass;
  - The siting of biomass manufacturing plants in rural areas so as to be near to the biomass resources.
  - Creation of economic value and employment opportunities in rural areas is important to mitigate the excessive migration of population into urban areas.
- d. **Export potential of green products** – The demand for sustainable materials for the production of green products has intensified over the last five years. Multinational corporations (MNCs) are increasingly looking for these materials to be incorporated into their products as part of their strategies in consumer branding and long-term business sustainability. For example, both Coca-Cola and PepsiCo have separately announced that their pilot programs to introduce ‘green’ bottles made from bio-based raw materials for their drink packaging. Sustainable materials are also being increasingly used in building construction, car manufacturing and many consumer products.
- e. **Malaysia as global and regional biomass hub** - Malaysia, with its availability of biomass and sufficient knowledge capacity to absorb new technologies is in an ideal position to attract biomass technologies and investments as a global and regional biomass hub. A 2011 report by Frost & Sullivan noted that the South East Asian market for green feedstock is expected to reach USD34.8 billion by 2016. The report also

noted that 'being rich in agricultural resources, South East Asia is a natural destination for many chemical manufacturers'. In addition, Malaysia also possesses the competitive advantage of having a strong manufacturing base, a growing services industry and talent pool to support large-scale biomass ventures as well as a good track record and experience in attracting high-quality investments into the country.

### 2.4.3. Weaknesses

- a. **Current low-value utilization** – The majority of the existing utilization of biomass resources in the country is in the production of low value-add or commodity-based products with low entry barriers, where internal and external competitors can easily enter the supply chain and compete with existing players, making the industry unsustainable over the long-term.



- b. Low commercialisation rate of local R&D and lack of recognition of local expertise** – In its efforts to attract foreign investments in the country in the biotechnology and green technology sector, Malaysia runs the risk of becoming too dependent on imported technologies. Most, if not all of these technologies are patented; therefore local companies are not able to replicate them in the near future.

While there have been many efforts by the government to promote commercialization of local R&D outputs and exploit local patents, the success rate has not been encouraging as the ‘last-mile’ hurdle remains. This refers to pre-commercialization efforts such as the early stage funding, establishment of up-scaling facilities and consolidation of local know-how and expertise. This is more so for biomass R&D where early investments in pilot plants, testing facilities and human resources is considerable as compared to other types of commercialization ventures.

Nevertheless, in the case of utilisation of biomass for high value green chemicals where commercial-scale production requires large-scale biorefining technology, and where no local technologies are available in the commercial scale, it may be imperative that overseas technology partners are brought in to ‘kick start’ the value chain, provided the financials are appropriate.

- c. Certifications and standardization** – In order to successfully market Malaysia’s biomass-based products to overseas markets, compliance with technical standards and sustainability certification is an important factor that needs to be addressed within the biomass industry. The lack of systematic recognition of biomass products with regards to performance quality and sustainability means they are not differentiated in the market, hence rendering the added value to little or no use when compared to conventional fossil-based products.
- d. Lack of domestic market support** – In cases where certification such as eco-labelling is in place, the lack of available green procurement initiatives in Malaysia has led many SMEs to perceive that there is no potential domestic market for biomass products and to set up biomass ventures as an export-based business. Engagement with potential local buyers as stakeholders also indicated that many are discouraged by the perception of green products as expensive or lacking in quality, while some are not aware of their local availability.

#### 2.4.4. Threats

- a. Uncertain pricing and supply of biomass feedstock** – Uncertainty in the pricing of biomass as feedstock for downstream utilization is a major barrier to the biomass industry. Due to many unresolved issues such as price uncertainty, impacts of biomass removal on crop yields, lack of public information in the supply and utilization of biomass as well as technical standards on biomass feedstock, biomass businesses are not able to secure long-term supply of biomass. Therefore, even though there is an “apparent abundance of biomass” in Malaysia, its actual availability and accessibility for the prospective buyers remains low.
- b. Perceived high risk from financiers’ perspective** – In addition to the lack of access to biomass feedstock, local financiers also lack the capacity to understand the different types of biomass ventures especially concerning the viability of the technologies to be adopted, the technical nature of the products as well as the potential niche markets involved and their commercial value. The lack of clearly identified and transparent financial, technology and market information signifies a high risk venture, which tend to be avoided in corporate financing.
- c. SMEs trapped in low-value utilization** – Most SMEs who venture into the biomass industry are still stuck in their low value-added business



model with minimum application of high value-added factors such as technical know-how, appropriate technologies, product design and branding. This exposes the industry to potential competition from neighbouring countries that are also rich in biomass resources. As illustrated in Figure 13 above, end products that are of high value typically require the use of distinctive technologies (production of biosugar, pulp and CMC), design (food trays) or engineering know-how (erosion control fibremats).

- d. **Barriers to export (technical, green certifications etc.)** – The biomass industry in Malaysia will eventually need to face up to the fact of having to comply with ‘green’ barriers put up by importing countries due to issues such as land use change, loss of biodiversity, alleged discrimination of natives etc. These issues need to be addressed early in order to prevent businesses and investors in the biomass

industry from getting caught unexpectedly in an unfavourable position. Additionally, new sustainability criteria are also being developed that will put pressure on exporting countries. These criteria may include compliance with and demonstration of life cycle analysis (LCA), product carbon footprint and water footprint documentation.

## 2.5. Challenges and Barriers to the Biomass Industry

Figure 13 provides an overview of the challenges faced by the Malaysian biomass industry from the value chain perspective i.e. from the sourcing of raw materials to the end markets. The challenges are also color-coded into three categories (strong, moderate and mild) to differentiate challenges that need to be addressed urgently and those that require more long-term strategic measures. Detailed description to these challenges and barriers are given in Appendix I.

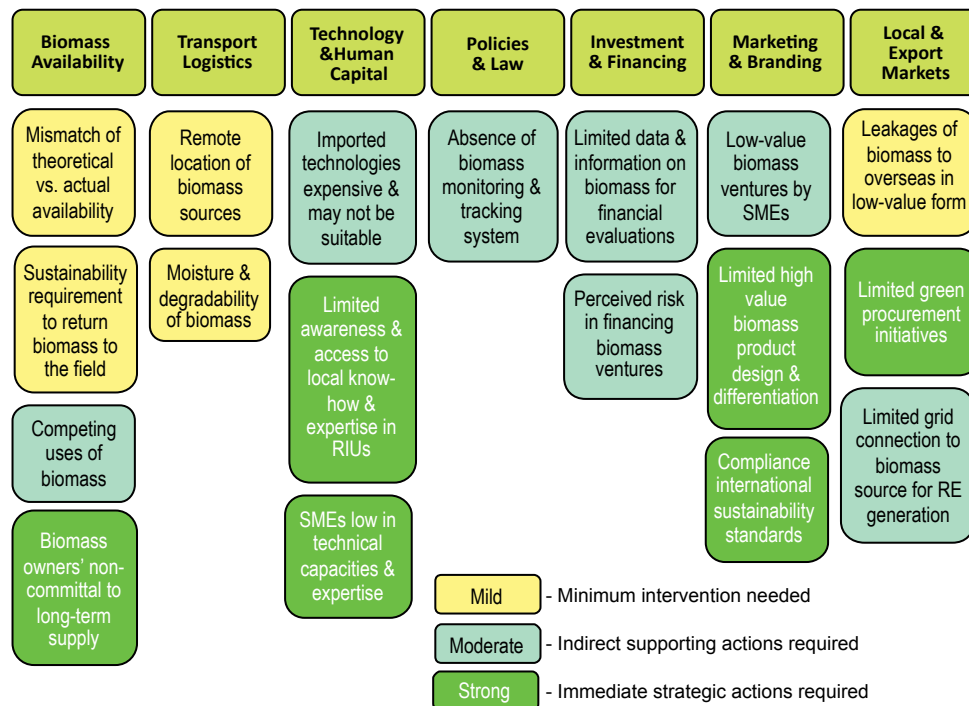


Figure 13 Macro Challenges Faced by Biomass Industry in Malaysia





**OPTIMISING MALAYSIAN**  
Biomass Industry



### 3. OPTIMISING MALAYSIA BIOMASS INDUSTRY

The availability of different types of biomass in Malaysia offers the industry many opportunities to utilise the feedstock for high value creation. The value of biomass feedstock for downstream production can be classified into four different categories of products; Bio-Energy, Green Chemicals & Bio-Polymers, Bio-Fertilisers and Bio-Composites & Bio-Materials. This section describes the value of each category, the market drivers and potential as well as what are the gaps that need to be addressed to optimise the overall biomass market for Malaysia.

#### 3.1. Bio-Energy

Conversion of biomass into energy sources can take place via three pathways i.e. solid fuels (chips, compressed pellets, briquettes, torrefied pellets); liquid biofuels (biodiesel, bioethanol); and biogas (methane, syngas).

Solid fuels are demanded for heat and power generation on both large and small scale basis. For large-scale biomass power generation, the current installed capacities are reported at 60.84 MW under the FiT scheme, with another 111.19 MW under development. Additionally, many manufacturing facilities that consume large amounts of heating such as cement plants and glove factories have also switched to the use of solid biomass as part of their (major) fuel source in response to rising fossil-fuel prices. The solid biomass fuels being utilised at the moment are either palm kernel shell (PKS) or EFB in its raw form.

There are a number of small-scale producers of biomass pellets mainly from wood waste that export the pellets to overseas markets where it commands a relatively high price of RM200-300 per tonne. Pellets from EFB biomass still face a number of technical challenges that have yet to be resolved such as high potential of breakage during shipment as well as high content of chloride and ash that can damage the boilers. This is mainly due to the fact that many boilers used in importing countries are designed based on the use of wood-based biomass fuels. Therefore, the adoption of EFB pellets by overseas markets is still slow.

In this plan, liquid biofuels refer to the second generation biofuels i.e. the conversion of ligno-cellulosic materials into liquid fuels. The development of (second generation) liquid biofuels in Malaysia is still at its infancy. Most projects are still in the pre-planning and feasibility evaluation stage due to the risks and challenges in upgrading the technologies from lab scale to commercial scale production. The conversion pathway can be either biological i.e. fermentation or enzymatic or thermochemical i.e. liquefaction. Currently there are a number of joint ventures between the large plantation companies with technology providers from US, EU and Korea who are looking into this area of development.

The potential use of liquid biofuels for local transportation in Malaysia is less attractive due to subsidies on diesel and petrol, rendering the biofuels uncompetitive unless they are also subsidised which is an extremely unfavourable prospect. Additionally, the conversion of biomass into bio-chemicals and bio-polymers via similar conversion pathways is more economically favourable and desirable due to the high demand for these renewable materials from developed nations and the premium price they command.

Biogas is another form of bio-energy sources keenly promoted by the government especially from the palm oil milling industry. Based on the data reported by EPP 5 (Developing Biogas Facilities at Palm Oil Mills), the whole palm oil milling industry is able to generate up to 261 MW of power from its biogas resource and annually displaced 15 million tonnes of CO<sub>2</sub>-e from being emitted (based on FFB yield in 2009). Small-scale in-situ biogas production for heating and cooking from organic solid waste can also be implemented in communities as well as agricultural farms therefore reducing reliance and additional energy needed to transport LPG as currently practiced.

The main gap in the capture and utilization of biogas from the palm oil industry is the last-mile electricity connection to the national grid. Most of these mills

are located faraway inside the oil palm plantations, therefore investment in the connection facilities is expensive. As such, other prospects need to be explored such as the piping or bottling of biogas for local communities' consumption, or the use of biogas as energy source in the mills to free up the mesocarp fibres for downstream higher value utilization. As for the small-scale in-situ production and consumption of biogas from organic waste, there is a need to address issues such as getting buy-in and participation of local communities, fire and explosion safety, as well as availability of the appropriate technology and hardware.

### 3.2. Green Chemicals & Bio-Polymers

The production of green chemicals and bio-polymers from biomass are ventures that require large-scale investments and the use of advanced technologies. Moreover, the demand for these end-products is mostly overseas driven by the need to substitute fossil-based products. As such, efforts by the Malaysian government in this area are focused on promoting foreign and domestic investments to exploit availability of biomass resource. This is mainly spearheaded by government agencies such as the Malaysian Biotechnology Corporation (BiotechCorp) and MIGHT under their respective mandates.

The value from these investments is in the form of stimulating the local economy, creating high-

knowledge employment opportunities as well as positioning Malaysia as a green chemical hub in this region. The challenges in these ventures lies in the technical feasibility of using local biomass such as EFB as feedstock for the imported technologies, the economic well-being of the overseas markets for the end-products and how to ensure that these investments will advance the biomass industry in Malaysia.

Another important area of development in this category is the commercialisation of local R&D outputs into biomass conversion technologies that can compete with imported technologies. For nearly two decades, significant efforts and investments have been made on biomass R&D by universities and research institutions. The results of this investment come in the form of patents, technical know-how and more importantly human capital development. There is a need to exploit these outputs to develop Malaysia's own indigenous biomass technologies to benefit the local biomass stakeholders. There is a need to re-evaluate and develop the right commercialisation model for this type of industry due to the high financial and human capital investment required for these types of ventures. Demand for these green chemicals and bio-polymers are usually from overseas markets so facilitation and promotional strategies for these products must target for export to the countries concerned.

#### MYBiomass – Conversion of Biomass to High Value Green Chemical

In moving up the biomass value chain and creating new green chemical industry, a special purpose vehicle under the Malaysian Biomass Initiative (MBI), MYBiomass Sdn. Bhd. was endorsed by the Honourable Prime Minister of Malaysia during the Inaugural Meeting of Global Science and Innovation Advisory Council (GSIAC) on May 17th 2011, in New York, United States. Initiated by MIGHT, MYBiomass Sdn.Bhd is a joint-venture company together with Felda Global Ventures Holdings Berhad and Sime Darby Berhad to pioneer high value green chemicals biorefinery through coordinated aggregation. Efforts undertaken by MYBiomass have underlined its new 360° public-private business model by bringing together the upstream players, technology providers and offtakers for a viable business ventures. The benefits derived will not only stop at the large corporations, technology providers and off-takers, but this win-win 360° approach will also bring on-board local SMEs and rural community into the equation.

### 3.3. Bio-Fertilisers

The value of bio-fertilisers lies in the potential to reduce the use of imported chemical fertilisers for our agricultural sector. For example, it has been reported that fertilisers make up of 60% of the cost of FFB production in the field while contributing to about 30% of greenhouse gases emission. More critical but less difficult to quantify is the environmental impacts of the leaching of chemical fertilisers into ground water sources.

The development of a local bio-fertiliser sub-industry would be able to reduce the dependence of the agriculture sector especially the palm oil industry to the global supply and price movements of chemical fertilisers while stimulating SMEs' participation and increasing employment in this sector. Furthermore, participation of the government in this sector will also reduce its cost in providing fertiliser subsidies to smallholders and farmers. It may also eventually be viable for successful Malaysian SMEs to export their expertise and services to develop bio-fertiliser ventures in other agriculture-intensive countries.

A number of gaps need to be addressed in realising this potential:

- Technical capacities of SMEs need be enhanced to shift from compost production to high value-added biofertilisers
- Human capital knowledge in relation to the application and long-term impacts of biofertiliser need to be strengthened and further developed

- Benefits of using biofertiliser to complement the chemical fertiliser need to be disseminated to planters, farmers and smallholders. This may also includes recovery initiative of biomass boiler ash to recover and recycle the mineral nutrients back to the field.
- Specific standards and criteria for biofertiliser need to be developed to regulate and ensure optimum industry applications.

### 3.4. Bio-Composites & Bio-Materials

The demand for 'green' materials such as bio-composites, eco-products and other bio-based materials are driven by a number of factors. These include the introduction of green building standards in many countries and associated financial incentives, green branding and marketing by major global brands, shift in consumer environmental awareness and purchasing preferences, as well as the developed and developing countries' commitment to reduce their national carbon footprints.

This biomass sub-industry depends less on the volume of feedstock but relies more on the application of technical know-how, product design and innovation, compliance with eco-labelling standards and certification to compete in the global market. These products are usually differentiated to meet niche market demand and therefore can command a price premium and are not easily substituted. A small number of SMEs are already operating in this sphere, with production facilities to manufacture products such as composite decorative panels, decking timbers, speciality papers and industrial thickeners.



Figure 14 Biomass & Recycled Plastic Composite



Figure 15 Biomass Fibre-Based Specialty Papers

The gaps that need to be addressed in further promoting this biomass sub-industry in Malaysia include:

1. Compliance with international eco-labelling and sustainable certification requirements
2. Increase the technical capabilities and human capital of SMEs in 'soft' areas such as product development and design, production technologies, branding and marketing
3. Participation and collaboration of SMEs with researchers to develop innovative products and solutions to meet market demand, specifically for export markets









**MAPPING KEY ENABLERS**  
of Biomass Industry



## 4. MAPPING KEY ENABLERS OF BIOMASS INDUSTRY

In order to convert the various forms of biomass feedstock into high value products, all the nodes in the entire biomass value chain needs to be in sync with each other to grow the industry. Figure 16 gives an overview of the value chain (top row) within the context of biomass available (left column) and end-products (right column). Within this framework are the key enablers that need to be developed in order to grow this industry in Malaysia.

Some of these key enablers focus on specific type of biomass or end-products while a few others cut across the different nodes of the value chain. This framework can serve as the basis for the development of recommendations and implementation strategies for this strategic plan. A detailed description of each key enabler is provided in Appendix II.

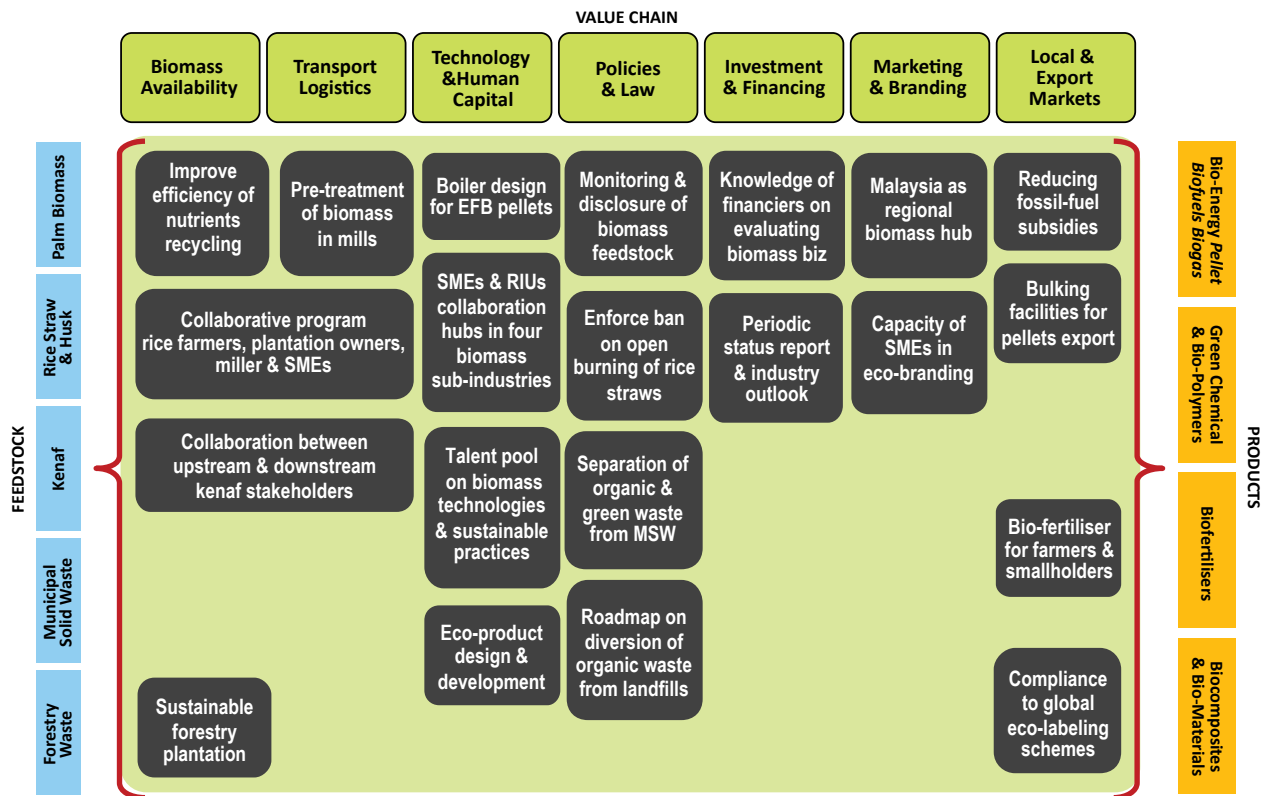


Figure 16 Mapping of Key Enablers in Biomass Industry



**STRATEGIC RECOMMENDATIONS  
AND ACTIONS**



## 5. RECOMMENDATIONS AND ACTIONS

The Malaysian government can implement a range of strategies and actions to capitalise on Malaysia’s global competitive position and to create enablers to eliminate the challenges and hurdles facing the local biomass industry. Figure 17 provides an overview of the recommended three-pronged strategies across the entire value chain of the biomass industry.

The development of these strategies and actions are based on the following guiding principles:

1. Facilitate the participation of SMEs in the biomass industry
2. Promote the adoption of Sustainable Production practices in Malaysia
3. Direct and diversify the local biomass industry towards high value-added production; and
4. Contribute to the socio-economic equality development for the rural population in Malaysia

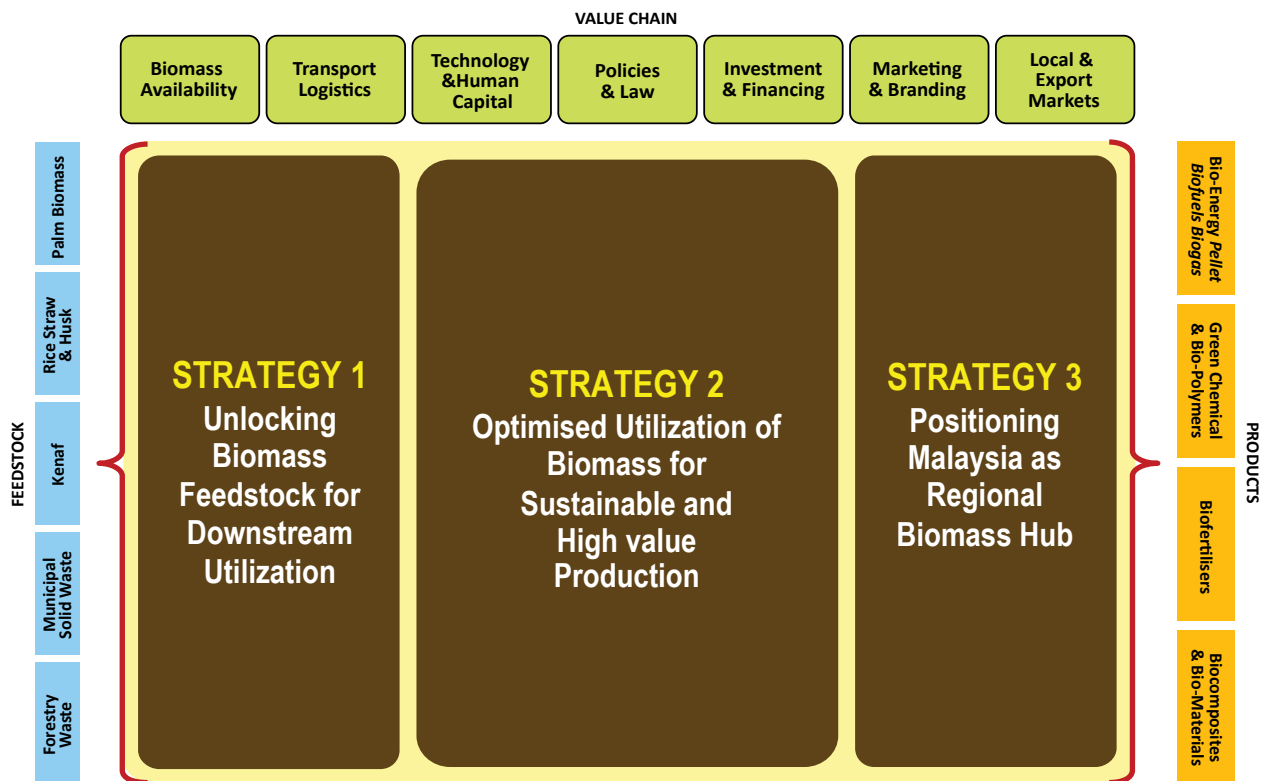


Figure 17 Recommended Strategies for Biomass Industry Value Chain in Malaysia

## **STRATEGY 1: UNLOCKING BIOMASS FEEDSTOCK FOR DOWNSTREAM UTILISATION**

While Malaysia does have an abundance of biomass from its agricultural sector, unlocking the biomass to downstream users is an issue that needs intervention and targeted actions from the government. There is a need to reorganize and improve the efficiency in the upstream utilization of biomass in order to free up more of biomass feedstock for downstream applications.

Actions recommended under this strategy are:

### **1.1 Improving the biomass-to-energy efficiency of rice and palm oil mills**

This will reduce the consumption of biomass upstream and make available more feedstock for downstream utilization. Current energy utilization in rice and palm oil mills is low in efficiency as mills have excess energy from the combustion of biomass that was once considered as waste. The inefficient burning of biomass therefore solves the problem of excess waste from accumulating at the mills.

With the rising demand and pricing for biomass, there is now a financial incentive for mills to become more energy efficient and thus, sell or utilize the excess biomass for higher value uses. Improvement in the EE in mills can be achieved by various means such as boiler refurbishment, heat insulation, heat and energy recovery as well as better energy management of the mill processes. This will also translate to more business opportunities for SMEs in this sector, such as boiler manufacturers, thermal technology providers and energy consultants.

It is proposed that a specific EE programme is developed to provide rice and palm oil mills with technical assistance in EE improvement, financial incentives and funding assistance schemes to implement the EE projects.

### **1.2 Optimizing the efficiency nutrient recycling to field**

In paddy fields and oil palm plantation, the return of biomass nutrients to the field is crucial in

maintaining the fertility and sustainability of the soil for subsequent planting.

In the oil palm sector, this takes the form of EFB mulching while in paddy fields, the straws are burned in the field. Hence, plantation owners and farmers are reluctant to reduce the amount of biomass to be returned to the field, even though there is increasing demand for the biomass downstream.

A new approach is needed to unlock the biomass from the field and yet maintaining the fertility of the soil. In the palm oil sector, this is already taking place in the in-situ production of compost from EFB and POME. Some plantation owners have even ventured into the production of bio-fertilisers, thereby reducing the consumption of chemical fertilisers in their field as well. This effort should be formalised via an industry-wide optimization programme to eventually replace the practice of mulching. In addition, nutrients from the ash of mill boilers should be considered to be returned to the field. Such initiative will provide additional opportunities for the participation of SMEs in biomass composting and bio-fertiliser production sub-industry.

### **1.3 Sustainable fuel switching in rice industry**

In Malaysia, biomass residues from rice production such as rice husk and paddy straws amount to about 500,000 and 2,000,000 tonnes, respectively, every year. Currently, the rice husks are used for generation of heat and power at the rice mills while paddy straw is left to decompose or burnt in the fields to recycle the nutrients. The burning of paddy straws also causes seasonal air pollution problem at the plantation areas.

There is opportunity for the rice planting and production industry to adopt sustainable practices to conserve energy and nutrients without compromising the rice yield. Figure 18 provides an illustration of the switch required to take place for the sustainability concept to work.

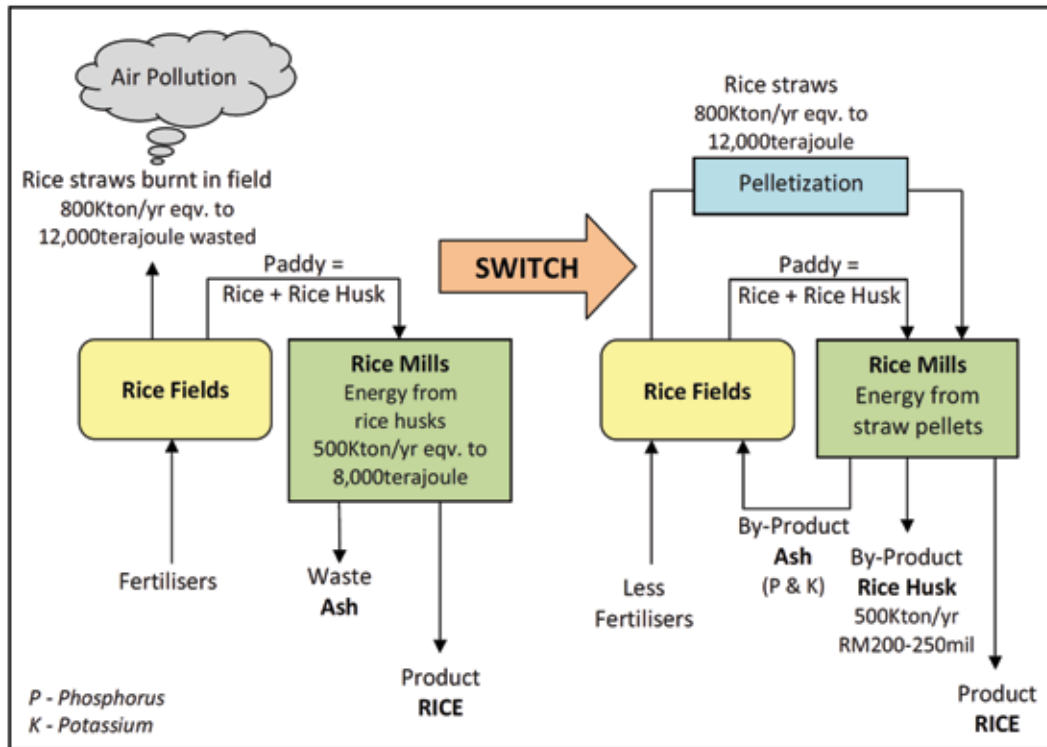


Figure 18 Possible switch to Sustainable Production of Rice and Biomass Products

This initiative, if achievable for the whole industry is able to unlock about 500,000 tons of rice husks annually worth RM200-250 million for downstream utilization such as for production of bio-composites, high-strength concrete and aerogel. This will generate additional income for the rice industry while ensuring the rice husk biomass is utilized

smartly. A concerted effort between relevant stakeholders such as farming cooperatives, millers, and biocomposite manufacturers is essential to transform the rice production sector to be more sustainable and to generate added revenues from high value-added activities.

Recognising the abundance of waste from rice industry in Kedah, Composite Technology Wood Sdn. Bhd. (CT Wood) tapped into the potential of wood polymer composite (WPC) industry by turning rice husk into wood alternative. Utilising up to 6000-7000 kg/month rice husk, the company produces up to 12,000 feet/month (1 ft = 1 kg product) biocomposite in the form of decking, flooring, fencing, etc. with price ranging from RM 70 – 220/m<sup>2</sup>.

In addition to solving the issue of waste disposal of rice husk from rice mills, the usage of rice husk biocomposite in buildings also complies with the Green Building Index (GBI).

#### 1.4 Diversion of organic waste from landfills

The organic component of MSW has the potential to be utilised as solid fuels in the form of refused-derived fuel (RDF) or for biogas generation. MSW in Malaysia has high proportion of organic waste ranging from 40% to as high as 60%. Current waste management practices generally dispose all the mixed waste into landfills; contributing to the release of the greenhouse gas methane, as well as reducing the lifetime of landfills.

Organic waste from household kitchens, markets, food courts, food & beverage industry as well as landscape waste from local councils should be separated at source and diverted away from the landfills and utilised for composting or as a source of renewable energy whether for large-scale power plants or small-scale in-situ biogas generation.

Facilities that produce large amount of organic and food waste such as supermarkets, wet markets, food courts and food manufacturers should be mandated by the local authorities to set-up small-scale biogas production units to convert the waste into biogas for use by the facilities themselves. Such measures will reduce the organic waste loads to landfills, reduce methane release to atmosphere, lower the energy costs of the facilities and also provide business opportunities for SMEs in biogas technology and equipment supply.

#### 1.5 National management and monitoring of biomass resource

Presently, the uncertain pricing of biomass feedstock has caused general unwillingness among mill owners to commit to long-term contracts to supply biomass to SMEs. Without the assurance of long-term supply contracts at known prices, financiers and investors are not able to develop accurate cash flow projections and risk profiles to finance such ventures by the SMEs.

It is proposed that intervention action be taken to manage our national biomass resources i.e. to compile, monitor and publish data of the production, movement and utilization of major biomass such as EFB, MF, PKS, OPT, kenaf, MSW, rice husk and straws so that the data can be utilized by interested parties to make their projections on the availability, supply and pricing of these resources.

Effective coordinated efforts in optimising the exploitation of the national biomass resources to bring some degree of certainty in the biomass supply market is one of the key factors in ensuring healthy competition and growth; as well as giving assurance to the stakeholders as to the long-term viability of the industry.

The Malaysia's first Refuse-Derived Fuel (RDF) Waste-to-Energy Plant was developed by local company Core Competencies Sdn. Bhd. in 2009. Located in Semenyih, Kajang, the RDF plant can process up to 700 tonne/day of waste with a capacity to generate up to 8 MW electricity. As of 2010, the company has accepted 100% of the waste generated by the Kajang Municipality, operating up to 70-85% capacity.

## RENEWABLE ENERGY RESOURCE MAP – SIRIM BERHAD

In lieu of the importance of information relating to the availability of feedstock - whether in the form of physical quantity of biomass or intensity and continuity of solar irradiance and wind strength, The Ministry of Science, Technology and Innovation (MOSTI) commissioned SIRIM Berhad to develop a platform for the compilation and display of various RE Energy Resources that are available in Malaysia. SIRIM Berhad initiated a collaborative effort with Malaysian Palm Oil Board, Malaysian Forestry Research and Development Board, Malaysian Nuclear Agency, University Malaysia Terengganu, Solar Energy Research Institute - University Kebangsaan Malaysia, Department of Veterinary Services and Agency Remote Sensing Malaysia to map out the RE Resources in the country and translate them into a web-based database.

Renewable Energy Resource Map of Malaysia (REMap), completed in 2012, offers an interactive database of the current status of major RE resources; namely Biomass, Wind, Solar, Ocean and Micro Hydro Power. Design with the executives and analysts in mind as users, this database has gathered multiple datasets as well as information reflecting the status of availability of the RE resources into one common platform.

As a start, REMap is confined to providing information from the perspective of spatial distribution as well as estimation of the amount available at a particular site. The current website ([www.myremap.my](http://www.myremap.my)) provides generic maps of several types of RE resources for public viewing. At the same time, the current database is designed to cater for the expansion to enhance its scope of service. Looking forward, the REMap need to be further developed to allow for the SMEs to make full use of the database available.

## STRATEGY 2: OPTIMISED UTILISATION OF BIOMASS FOR SUSTAINABLE AND HIGH VALUE PRODUCTION

The low value-add biomass utilisation currently existing in Malaysia should only be seen as temporary 'low-hanging fruits' and as stepping stones towards higher value utilization of the biomass resources.

A small number of entrepreneurs have successfully achieved high value utilisation of biomass resources via applications of know-how in technology, industrial design and marketing, creating value as high as RM600 – RM15,000 for every ton of palm biomass feedstock. In contrast, low-value biomass commodity-based products such as palm fibers, compost and fuel pellets are between RM100 to RM 400 per ton of the feedstock.

There is a need for a long-term strategy in Malaysia to promote the adoption of technologies for optimised utilization of the palm biomass which meets the triple bottom line of sustainability; economic growth, environmental conservation and social development.

Intervention actions that need to be implemented under this strategy include:

### 2.1. Promoting commercialisation collaborations between plantation companies, biomass SMEs & research institutions via public-private partnership (PPP)

Among the major challenges of utilizing biomass by the downstream industry are the fluctuating and perceived value of raw biomass, the high cost of transporting the biomass from the field to the point of utilization, and the high moisture content and rapid decomposition of the biomass.

There are some SMEs who have successfully collaborated with the plantation owners to jointly develop and link up technologies and equipment for an integrated in-situ biomass utilization projects whether in the production of biomass fuel pellets, compost or biogas power generation.



These enterprising initiatives should be further supported and enhanced by specific measures such as:

1. Biomass grant scheme to encourage collaboration with universities and research institutions to provide know-how and expertise on production of high value products from biomass feedstock. The most important criterion of the scheme is that the project proposer must demonstrate that the venture is able to convert the biomass into high value marketable products
2. Financial incentives such as pioneer status and tax breaks for collaborative ventures that can

the value generation from conversion of biomass to electricity is low compared to high value products, savings in terms of the displacement cost as well as reduction of government subsidies to fossil fuel must be taken into account.

Already, companies in Malaysia especially those from the heavy industry sector such as cement and glove manufacturers are switching from fossil fuel to biomass or co-firing fossil fuel with biomass such as wood chips, wood and empty fruit bunch (EFB) pellets, palm kernel shell (PKS) and refuse-derived fuel (RDF) from municipal solid waste (MSW).

Companies undertaking fuel switching activity are also able to certify their greenhouse gas (GHG)

Waris Nove Sdn. Bhd., a company based in Gebeng, Pahang, in collaboration with Malaysian Palm Oil Board (MPOB) through "Transfer of Technologies (TOT)" programme commercialized the production of Carboxymethyl Cellulose (CMC) from Oil Palm Empty Fruit Bunches (EFB). By removing the lignin in the EFB, the company produces and sells cellulose as a bio-polymer, bio-degradable, tasteless, odourless and non-toxic substance which has various applications for food and non-food industry. Currently, the company is converting 330 tonne/month EFB, generating up to 100 tonne/month CMC at RM8,000.00/tonne, with the potential to produce at full capacity up to 400 tonne/month by 2014.

lead to high value utilization of the biomass resources. For example, current incentives for the biomass sector are given to companies that utilize the biomass to produce any value-added products (particleboard, medium density fiberboard; plywood; and pulp and paper). This incentive should be further enhanced to encourage the companies to upgrade themselves into producing high value products with inputs of locally-sourced technologies.

## 2.2. Promoting renewable energy utilization by energy-intensive industry

In recent years, the increasing costs of fossil fuel have encouraged heavy industries that are traditionally reliant on furnace oil, diesel and LPG to turn to alternative sources for energy. Even though

reduction activities which can be traded as carbon credits. This serves as an additional financial impetus for companies while improving their corporate social responsibility (CSR) image.

Under the government's initiative to promote renewable energy and energy efficiency, companies undertaking to generate energy using renewable resources such as biomass are eligible for income tax exemption under the Pioneer Status under MIDA. While it is agreed that the current development of fuel switching activities is encouraging, further support and promotion is required to spur more companies especially those with the potential magnitude to further reduce the country's greenhouse gas emission to take up fuel switching activities as part of their manufacturing operations for both economical and sustainability factors.

A glove manufacturer in Perak was using up to 7100 litres of heavy fuel oil (HFO) at RM 1.70/litre for heating purposes until the management decided to switch to solid fuel fired thermo oil heater.

Following an initial investment of RM 2 million, the company is using 42 tonne/day wood chip at RM 220/tonne which are sourced from surrounding saw mills. As a result, the company made substantial savings from the fuel switch while playing a role in the global greenhouse gas mitigation efforts.

	BEFORE (RM)	AFTER (RM)	SAVINGS (RM)
PER ANNUM	3,983,100	3,049,200	933,900

**2.3. Developing the capacities of financial institutions in supporting biomass industry**

The development of biomass industry in Malaysia is no longer hampered by the lack of technology, hardware nor market opportunities; but rather the lack of funding to kick-start the ventures, especially among the SMEs. For the SMEs, access to financing remains the main challenge in getting their ventures off the ground despite the readiness of all other components of the ventures such as feedstock, technology and ready customers. In general, loan financing is preferred compared to government grants, equity, venture capital or initial public offering (IPO) due to the speed in obtaining the financing.

Previous engagement with SMEs stakeholders indicated that despite noble efforts by the government to drive the development of green technology in Malaysia via the provision of Green Technology Financing Scheme (GTFS), the uptake was restricted by the stringent requirements of local commercial banks as well business proposals by SMEs lacking in evidence to support strong

management and financial background, experience, and a thorough understanding of the marketplace.

The following measures are proposed to address the existing gaps:

- a. Establishing more focused guidelines to financial institutions on evaluation of loan eligibility of green SMEs and biomass projects
- b. Establishing panel of professional independent evaluators to conduct technology assessment and preliminary due diligence on project viability for the financial institutions.
- c. Establish syndicated funding mechanism at national and regional level to minimise risk exposure to financial institutions, as well as to provide further liquidity in the system.
- d. Setting up of a specific mechanism by government funding agencies to address the gap for green SMEs with less than 3 years track record who failed to obtain commercial financing from the banks

### **STRATEGY 3: POSITIONING MALAYSIA AS GLOBAL AND REGIONAL BIOMASS HUB**

In ASEAN and Asia-Pacific regions, Malaysia is well-positioned to become a hub for biomass industry as the country has the right mix of resources, manufacturing capacity and factors of production as well as potential access to regional biomass feedstock.

The development of this biomass hub should not only be confined to manufacturing but extended to the trading of biomass in a commodity exchange, funding and financing of regional biomass ventures, carbon trading as well as other supporting service industries. The Malaysian government should leverage on these strengths to promote SMEs participation in this sector to accelerate both the wealth creation and re-distribution and environmental sustainability agenda for the benefit of the nation.

#### **3.1. Creating focal point for regional biomass stakeholders**

In order to establish Malaysia as the biomass hub, the country must first be the point of contact for stakeholders from the industry at the national and regional level. For example, large scale conferences and exhibitions, trade visits, and one-stop information centre to carry out continuous research on the biomass value chain should be in place and promoted to draw in these stakeholders to the country.

Attracting regional stakeholders to Malaysia will open up new markets for local SMEs and entrepreneurs to showcase and market their technology, services, equipment and products to tap into potential for exports and joint ventures. The key strengths of Malaysia's biomass industry include a matured manufacturing industry, local availability of biomass,

process know-how as well as skilled labor force in design, engineering and manufacturing.

#### **3.2. Development of technical specifications and sustainability standards for biomass products**

The global demand for 'green' or sustainable products has brought new opportunities to further expand the existing industries into the use of recycled and waste materials to manufacture high value materials and consumer products. At the same time, development of a domestic market for biomass products is also important for biomass SMEs to build up manufacturing capacity and to achieve the economics of scale necessary to compete in the export markets.

Strategic recognition of biomass products via specific technical specifications and sustainability standards will contribute to the strengthening of market confidence and competitiveness of Malaysian biomass products, equipment and services. Technical standards are important to define the specifications and quality of the wide array of biomass products in order to facilitate the trading and export of the products while sustainability certifications are important to ensure that these products will be able to meet possible green procurement requirements by the importing countries.

Additionally, the implementation of sustainability standards such as eco-labelling, carbon footprinting and life-cycle analysis should also be in parallel with the introduction of green procurement initiatives in both public and private sector to ensure the uptake of biomass products in the domestic market.

## CONCLUSION

Malaysia already possesses all the key ingredients to realize a high-growth and high-value biomass industry; abundant biomass availability, homegrown R&D know-how and expertise, strong manufacturing and engineering base, dynamic and innovative SME sector, favorable investment climate as well as policies in place for bio-energy and biotechnology development. What is required and therefore proposed in this strategic plan is the consolidation these ingredients together to steer out clear direction and plan of action for the industry. The sustenance of the future growth of biomass industry in Malaysia requires sound management of the nation's biomass feedstock, positive interventions to steer the industry towards high-value creation and the positioning of Malaysia as a biomass hub regionally and globally.

Malaysia will not only benefit economically from the growth of the biomass industry in terms of more investment and wealth creation; it will also contribute to better wealth distribution for the nation as more value-added activities within the industry will create spillover effects to rural areas where the biomass is generated. There will be environmental benefits too as SMEs move into ventures that utilize biomass as feedstock instead of fossil-based raw materials. This will translate to lower greenhouse gas emissions at two ends of the value chain; from the avoidance in emissions from degradation of unutilized biomass as well as the substitution of fossil-based resources with biomass feedstock. As Malaysia chart

its direction towards a developed nation status by 2020, the nation will also need to take up the global role and responsibility in addressing climate change. The biomass industry will be one of the industries that are able to contribute to this responsibility.

Opportunities are aplenty in biomass industry. Malaysia must therefore galvanize with urgency all the stakeholders' efforts towards a common direction that enables continuity and consistency in joint actions and implementation, involving both industry and government, to spur the growth of the local biomass industry. SMEs, a critical driver of the industry ecosystem, must continue to be guided and nurtured. It is in this context that this Malaysia Biomass Industry Action Plan is produced, with the primary objective to optimize the potentials of the SMEs in the biomass industry that in turn will contribute to economic growth through sustainable production.

Last but not least, a strong local biomass industry will also serve as a platform over the long-run for Malaysia to export and invest its know-how, technologies and expertise to other countries and regions where biomass is also available in abundance. The global biomass industry is presently at the growth phase of the industry life cycle. We must strategize to ride along the front lines of this phase and create another success story for the nation as we have achieved several times in the past.

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Production of renewable energy by transformation of kitchen waste to biogas, case study of Malaysia  
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A Case Study on the Anaerobic Treatment of Food Waste and Gas Formation  
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A Review on Utilisation of Biomass from Rice Industry as a Source of Renewable Energy, Jeng Shiun Lim, Zainuddin Abdul Manan\*, Sharifah Rafidah Wan Alwi, Haslenda Hashim, Process Systems Engineering Centre (PROSPECT), Faculty of Chemical Engineering, Universiti Teknologi Malaysia



# Appendix

## Appendix A: Macro Challenges Faced by Biomass Industry

### 1. Biomass Availability

#### Mismatch of theoretical vs. actual availability

The amount of biomass often reported in literature and news are mostly projections based on the outputs of the main agricultural products e.g. fresh fruit bunches, rice etc. Currently there is no formal mechanism to track and monitor the actual output, consumption and uses of biomass. Moreover, much of this biomass cannot be released by the owners for downstream utilization as there is the need to recycle the nutrients in the biomass back to the plantation. This gives the impression to potential biomass investors and entrepreneurs that there is a lot of biomass available in Malaysia but the actual amount available may be much less.

#### Sustainability requirement to return biomass to field

In the oil palm industry, compliance to RSPO criteria\* requires that biomass recycling strategy be implemented to maintain soil fertility and prevent soil degradation and erosion. As such, plantation owners are compelled not to release the biomass to external parties.

\*Roundtable on Sustainable Palm Oil - Criterion 4.2 & Criterion 4.3

#### Competing uses of biomass

The opening of green markets and advancement of green technologies have made it possible for biomass to serve as substitute feedstock for the production of materials previously made from fossil-based resources. Large corporations are also investing into sustainable use of materials and technologies as part of their marketing agenda. As such, there are more and more ways to use biomass thereby creating competing demands for the feedstock.

#### Biomass owners' non-commitment to long-term supply

Increasing demand for biomass by downstream

manufacturers has led to a sellers' market where owners of biomass e.g. palm oil millers are able to dictate their selling terms. Knowing that there will be increasing demand and hence future price escalation of the biomass, these owners are reluctant to commit to long-term supply of biomass to buyers. Without long-term secured supply and pricing, downstream manufacturers will face problems in sustaining their production as well as getting financing from banks etc.

### 2. Transport and Logistics

#### Remote location of biomass sources

The remote locations of biomass sources such as palm oil mills makes it expensive for the transport of biomass to manufacturing facilities where access to ports, human capital and other forms of infrastructure is important. Engagement of stakeholders from the industry indicates that transport and logistics cost form a major part of the overall cost of biomass feedstock. One option is for the biomass to be converted into a pre-treated form that is economical and viable to be transported out. Alternatively, the manufacturing facilities have to be located beside the mills but this may not always be feasible.

#### Moisture content and degradability of biomass

The situation above is compounded by the fact that tropical-based biomass is high in moisture content (e.g. EFB has 65% moisture) and the warm ambient temperature results in rapid degradation of the material. Without a stable form, it is difficult for sellers and buyers to trade the biomass as the quality of the biomass degrades quickly between delivery and reception points.

### 3. Technology and Human Capital Development

#### Imported technologies are expensive and may not be appropriate

As part of Malaysia's strategy to bring in new foreign direct investment and technologies into the country to



spur the green industry, foreign companies are invited to tap into the biomass feedstock for conversion into high value chemicals and biofuels. Imported technologies are expensive and the technology providers tend to dictate low prices for the biomass feedstock. These technologies are also patented, making them inaccessible to local businesses unless royalties are paid. Moreover, imported technologies are usually based on feedstock from the countries of origin such as wood chips, corn stalks and switch grass. Local biomass such as fibrous nature of EFB and the hardy rice husk may pose additional challenges due to physical and chemical differences.

#### **Limited awareness and access to local know-how and expertise in research institutions and universities (RIUs)**

The government has invested much into the development of know-how and expertise in utilizing local biomass via R&D by the local RIUs. Many of these R&D outputs are ready for commercialization but the take-up rate by local SMEs is slow due to many factors. There is also much expertise in the RIUs that is valuable to the SMEs. There should be more pro-active measures to match genuine businesses with the RIUs to take up these R&D outputs for commercialization.

#### **SMEs have insufficient technical capacities and expertise**

Existing utilization of biomass by SMEs is mostly confined to low-value creation such as production of long/short fibers, compost and fuel pellets. One of the reasons is that SMEs lack the internal technical capacities as well as access to external technical capacities to create high value ventures. Engagement with SMEs for this plan identified a number of SMEs who have successfully converted their biomass feedstock into high value products such as fine chemicals, engineering eco-products as well as microbe-enhanced bio-fertiliser.

## **4. Policies and Law**

### **Absence of biomass monitoring and tracking system**

Presently, there is no formal or official system to determine how much of the major biomass is being generated, traded and utilized as well as who are the sellers, traders, buyers and end users. Without such data, the government will not have the information to manage our national resources of the biomass and take positive intervention measures to promote the biomass industry. Malaysia already has such a system in place to monitor and manage our palm oil products stock therefore implementing a similar system for biomass will not be very difficult.

## **5. Investment and Financing**

### **Limited data and information on biomass for financial evaluations**

Banks and financial institutions do not have enough data and detailed information about the biomass industry to make proper financial evaluations of biomass ventures submitted by SMEs. These institutions, being inherently prudent will not take risk in financing ventures without sufficient reliable data and information. There is a need to have periodic publications of biomass data, news and industry outlook from authoritative sources for the long-term benefit of the industry.

### **Perceived risk in financing biomass ventures**

The lack of reliable data and information as highlighted above results in banks and financial institutions having the perception that biomass ventures are risky. There is also lack of information on the potential of the biomass ventures in new markets such as fine chemicals, eco-products, engineered products etc. Another contributor to this perception is that ventures that had failed are not properly analyzed for the causes of the failure. On the other hand, successful ventures are not publicized and promoted via the right channels within the country.

## 6. Marketing and Branding

### Low-value biomass ventures by SMEs

Many SMEs in the biomass industry are involved in the production of low-value commodity products from biomass. These products compete solely on pricing and therefore do not have barriers against new entrants, both within and outside the country. Commodity products such as fibers, compost and fuel pellets can be produced just as easily in neighboring countries for the same market. Instead, there is an urgent need to upscale the SMEs and overall biomass industry to transform these low-value commodities to higher-value products such as bio-fertilizers, specialty chemicals and eco-products.

### Limited high value biomass product design and differentiation

Differentiation strategy should be promoted to the biomass industry to create higher value products. This involves a combination of input factors such as technology, innovations, product design, marketing and branding. There are already some SMEs that have successfully converted their commodity products into specialty papers from pulp, lubricants and fuel additives from waste vegetable oil, fibers and rice husks into composite products etc. Such focus and direction is still lacking in many other SMEs in the industry

### Compliance to international sustainability standards

In order to exploit the green export market, compliance to sustainability standards such as eco-labeling, life-cycle analysis, carbon and water footprinting are important competitive factors. Many SMEs are still not aware of the importance of these standards and will only respond reactively to requests

from buyers. However, in most cases compliance will be expensive and even not possible if these environmental considerations are not incorporated into the manufacturing facilities at the outset.

## 7. Local and Export Markets

### Leakages of biomass to overseas in low-value form

With many biomass ventures presently in the country being low in value, these end-products when exported also generate low revenue for the country. Intervention measures should be taken to plug these leakages. The biomass industry in Malaysia should move towards the strategy of utilizing minimum amount of biomass feedstock to create maximum value from the end products.

### Limited green procurement initiatives

The local market for green products is still not large enough to stimulate more investments and ventures into the biomass industry. This includes both public and private sectors' procurement of green products. As such, some SMEs face additional costs and hurdles in marketing their green products outside the country, and such successes show that these SMEs are internationally competitive. Another risk of such a situation is national economic loss when these SMEs decide to take their high value ventures and know-how outside the country to countries where the green market is more developed and secured.

### Limited grid connection to biomass source for RE generation

One of the hurdles highlighted by the bio-energy sub-sector of the biomass industry is the limited grid connection from the biomass source such as mills to the national grid. This connection requires substantial investment and project developers do not have the fund nor expertise to develop this part of the venture.

## Appendix B : Key Enablers of Biomass Industry

### Improve efficiency of nutrients recycling

The purpose of the current practice of returning biomass to the field (e.g. EFB mulching and paddy straw burning) is to recycle mineral nutrients such as potassium, phosphate and magnesium as well as utilizing carbon in the biomass to preserve the soil quality. This same objective can be achieved more efficiently via the use of compost, biofertiliser, biochar, boiler ash and beneficial microbes instead. This is expected to reduce the amount of biomass required to be returned to the field, resulting in more biomass to be made available for downstream utilization. Plantation companies will also benefit by incurring less logistical costs and resources to return the bulky biomass to fields; and the annual problem of paddy straw burning in the paddy fields can also be avoided.

### Pre-treatment of biomass in mills

Biomass, being high in moisture and susceptible to rapid degradation needs to be stabilized as soon as possible to preserve its value if it is to be traded, stored and used downstream. Pre-treatment at the upstream end is therefore important such as drying, fiberizing and possibly pelleting, baling or packing. Pre-treatment at the upstream end can also exploit the excess energy available from the mills. The treated and stabilized biomass can therefore be conveniently transported, stored and traded without loss in value.

### Collaborative program between rice farmers, plantation owners, millers and SMEs

There is potential for more value creation if there are closer technical and business collaborations between the three important stakeholders in the biomass industry; the plantation owners, farmers or smallholders, biomass producers and biomass SMEs. Presently, stakeholders are only focused on their own part of the value chain, and therefore are unable to fully exploit new value creation opportunities presented by changes in technology, market demand and trends. Collaboration efforts need to be formalized into effective programs to ensure their long-term sustainability.

### Collaboration between upstream and downstream kenaf stakeholders

Presently, the value chain for the kenaf sub-industry is still disconnected. Government efforts are focused only at the agriculture level by encouraging farmers to plant more. Upstream processors (from kenaf stalks to kenaf fibers) are facing challenges in getting large amounts of the biomass from many farmers to process the kenaf cost-efficiently. This supply problem is also affecting other downstream processors as well (from kenaf fibers to biomass composite materials) as they are not able to secure large supply contracts to customers due to the uncertainty in obtaining the fiber feedstock. Downstream processors also face problems in accessing the appropriate technologies and know-how to convert the kenaf fibers into high value end products

### Sustainable forest plantations

The establishment of more sustainable forestry plantations in Malaysia will provide more woody biomass for downstream biomass SMEs to process into products that can be certified as originating from sustainable sources to meet the demand of export markets. Without such certification, the export potential of biomass end-products to high value markets and customers will be limited.

### Boiler design for EFB pellets

One of the concerns of potential overseas buyers for EFB pellets is the high chloride and ash content of this biomass. Steam and heat boilers used in many biomass importing countries are based on wood pellets that have different physical and chemical characteristics from EFB pellets. This technical issue has not been adequately addressed in the current biomass strategy. Joint collaborative studies and demonstration projects need to be developed at the government-to-government (G2G) level; bringing together expertise from both producer and consumer sides to develop or modify boiler designs that are suitable for EFB pellets.

### **SMEs and RIUs collaboration hubs in four biomass sub-industries**

Malaysia needs to develop and possess its own biomass conversion technologies in order to ensure that the biomass feedstock can be fully exploited to benefit the nation and her people. Close and focused collaboration between industries and research institutions/universities is therefore needed in each of the four major sub-industries; namely bio-energy, bio-fertilizer, bio-chemical and bio-composites. Technical know-how from the RIUs needs to be integrated with the expertise in engineering scale-up as well as entrepreneurship and marketing-savvy of biomass SMEs to produce marketable technologies and end-products. Presently, all these resources are scattered in different institutional entities, making integrated development difficult and slow. Collaboration hubs in the four sub-industries are therefore urgently needed.

### **Talent pool on biomass technologies and sustainable practices**

Human capital and expertise in all aspects of biomass industry is required; from upstream sustainable practices, conversion technologies, sustainable certification (LCA, carbon footprint) as well as eco-design and marketing. Awareness and appreciation of sustainable production and consumption practices needs to be developed and inculcated into a new generation of human capital so that the nation can be on par with developed nations where the targeted markets are. We must be careful so as not to indulge in “green washing” as this will not be beneficial to the industry in the long run.

### **Eco-product design and development**

Design and innovation are among the key contemporary factors that can give rise to differentiated products that can gain competitive advantage over products for similar functions. This is especially important for biomass products such as engineered materials and bio-composites as well as eco-products where these differentiating ‘eco-factors’ can command higher demand and price premiums especially in export markets.

### **Monitoring and disclosure of biomass feedstock**

Up-to-date data and information on biomass feedstock is important for stakeholders such as traders, SMEs, investors and financiers to make decision on the viability of biomass businesses. The information includes the sources

of biomass, volume generated, movement, consumption patterns as well as amount exported. This will have the positive effect of stabilizing the price and availability of biomass for SMEs, traders and other downstream users.

### **Enforce ban on open burning of paddy straw**

Current practice of open burning of paddy straw post-harvesting not only creates air pollution problems, it is also a wasteful practice as the energy content of the biomass is not recovered for use. Enforcement of the ban on open burning should be part of the overall strategy to encourage farmers to change their mindset and practice to collect, aggregate and sell the paddy straws for downstream use. On the other hand, technical assistance should also be provided to the farmers to offset the current benefits of open burning such as nutrient and char recycling, pest elimination etc.

### **Separation at source of organic and green waste from MSW**

Municipal solid waste in Malaysia contains high amount of organic and kitchen waste. Another form of the organic waste is the ‘green’ waste from the pruning and landscaping activities by the local councils, developers as well as private households. These wastes can be utilized for small to medium-scale production of biogas (anaerobic) or compost (aerobic). Another benefit from this separation practice is the reduced contamination of recyclable materials (plastics, metals etc.) in the waste stream by the organic waste therefore reducing the resources and costs required to recover and clean the recyclable materials.

### **Roadmap on diversion of organic waste from landfills**

There should be urgency in the development of a proper roadmap to gradually divert the organic waste in the MSW from landfills, therefore prolonging the lifespan of the landfills as well as reducing methane emission from the landfills. Presently, studies are underway in the development of a National Strategic Plan for Food Waste Management in Malaysia. Relevant SMEs from the biomass industry should be part of the stakeholders to be engaged in the development of this plan in order to create socio-economic value from the waste. Adoption of appropriate economic instruments should also be part of the plan to create the right incentives and motivations for the diversion.

### **Knowledge of financiers on evaluating biomass businesses**

Bankers and decision makers in the financial sector should have access to more knowledge and case studies of the biomass industry. In many cases, the markets for biomass products are outside Malaysia, therefore accurate and reliable information is not always easily available. Moreover, there are many different products that can be produced from biomass; some are very technical or niche in nature. Bankers also need to be knowledgeable as well on sustainability issues such as life cycle analysis, carbon footprinting and eco-labeling as these will affect the market demand and competitiveness of biomass products.

### **Periodic status report and industry outlook**

The availability of data and information on the biomass industry should be further strengthened with periodic status reports and industry outlook publications by established organizations. Contents should include latest news on the development of biomass industry in Malaysia and the Asia Pacific region, case studies, market analysis, technologies etc. Such dissemination of information has been successfully used in the USA and EU and it has contributed positively to the progress of the biomass industry in these regions.

### **Malaysia as regional biomass hub**

Malaysia has all the right ingredients ready to position itself as a biomass hub in this region. These include elements such as ready local availability of biomass, investment-friendly policies, mature manufacturing and engineering capabilities, strong SMEs base as well as availability of technical expertise and human capital. Most importantly, the need for a more sustainable development in Asia is also driving the exploitation of biomass for socio-economic development and environmental well-being for this region.

### **Capacity of SMEs in eco-branding**

Malaysian SMEs are traditionally strong in sourcing, production and manufacturing but weak in marketing and branding of their products for high value markets. In the biomass industry, SMEs that are involved in the production of eco-friendly products must be able to build their capacities in strategic branding and positioning of their products to differentiate and compete with regional low-cost producers. Current efforts to develop Malaysian SMEs in branding capacity should therefore be extended to eco-branding as well.

### **Reducing fossil-fuel subsidies**

The reduction of subsidies for fossil-fuel consumption in Malaysia is a contentious economic and political issue. These subsidies nevertheless are among the main hurdles to more widespread adoption of sustainable production and consumption practices in Malaysia such as making the switch to renewable energy sources and improvement of energy efficiency. Gradual reduction of these subsidies is expected to encourage the use of bio-energy (solid biomass fuels, biofuels, biogas) especially by the industries. This issue should be given more emphasis from an economic perspective in the national efforts to develop as a high-income economy

### **Bulking facilities for pellets export**

Under the National Biomass Strategy, one of the low-hanging fruits identified is to export biomass fuel pellets to countries such as Korea, Japan and China where the current demand is high. However, this strategy needs to be complemented with the development of the right infrastructure and facilities to handle the bulk export of biomass pellets. Efficient handling, storage and transport of large volume of pellets will reduce costs for the exporters, preserving the quality of the pellets (minimizing breakage, moisture control etc.) as well as reducing fire & explosion risks associated with the bulking of dry pellets.

### **Bio-fertilisers for farmers and smallholders**

The promoted use of bio-fertilisers by farmers and smallholders will stimulate the demand for the product which in turn will be beneficial for local biomass SMEs in this sub-industry. Use of bio-fertilisers will create a sustainable cycle to preserve the long-term fertility and sustainability of our farming land stock; while reducing the dependency of Malaysia's agricultural sector on imported chemical fertilisers. This effort should include awareness and education campaign to encourage the farmers and smallholders to switch to the use of bio-fertilisers.

### **Compliance to global eco-labeling schemes**

In order to tap into the export market for eco-products; compliance to global eco-labeling schemes is important for biomass SMEs. One global trend that needs to be countered pro-actively is the establishment of direct and indirect 'green' barriers by importing markets that bring more challenges to local SMEs. These issues are new to many SMEs, therefore information and assistance needs to be provided to the players to enhance their competitiveness in these export markets.





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<b>Exus Capital Sdn. Bhd.</b>	No. 1168 Batu 19 Jalan Segamat Tangkak 84900 Johor	T: +606 979 1899 F: +606 978 6988 E: andy.eng06@gmail.com

## G

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<b>Greenearth Intl Holdings Sdn. Bhd.</b>	No. 35 Jalan Sultan Alam Shah (Jln. Morib) Banting Kuala Langat 42700 Selangor	T: +603 3187 3933 F: +603 3181 3396 E: info@greenearthintlholdings.com

## J

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## K

<b>Kenaf Natural Fiber Industries Sdn. Bhd.</b>	Pusat Pengumpulan, Pemprosesan & Pemasaran Fiber Kenaf , (Kenaf Fiber CPMC) , Kg. Air Tawar Tok Bali Pasir Puteh 16800 Kelantan.	T: +609 752 1164 F: +609 743 7076 E: info@kenaffiber.com
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## M

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<b>Master Jaya Environmental Sdn. Bhd.</b>	Wisma Master Jaya 20, Jalan Taming 3 Taming Jaya Industrial Park, Seri Kembangan, 433300 Selangor.	T: +603 8962 6233 F: +603 8962 6211 E: info@masterjaya.com.my
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<b>MFD Resources Sdn. Bhd.</b>	45, Jalan PJU 10/10E , Damansara Damai , Petaling Jaya , 47830 Selangor.	T: +6012 314 7533 F: +603 6141 8752 E: steven5533@gmail.com
<b>Microwell Bio Solutions Sdn. Bhd.</b>	Lot 1384 Kawasan Perindustrian Fasa 1, Bandar Tenggara, 81440 Johor.	T: +607 896 1285 F: +607 896 1342 E: nasa662@yahoo.com
<b>Millennium Partners (M) Sdn. Bhd.</b>	No.3, Jalan PBS 14/9, Taman Perindustrian Bukit Serdang, Seri Kembangan, 43300 Selangor.	T: +603 8945 5988 F: +603 8945 5980 E: william@mpwithu.com
<b>MTS Fibromat (M) Sdn. Bhd.</b>	574C, Jalan Samundra Utara 1, Taman Samudra Batu Caves, 68100 Selangor.	T: +603 6189 9999 F: +603 6189 7559 E: dnng@fibromat.com.my
<b>Myagri Nutribio Sdn. Bhd.</b>	No. 27 Jalan Impian Putra 1/4, Taman Impian Putra , Bangi 43000 Selangor.	T: +603 8925 8681 F: +603 8925 5013 E: myagrigrp@yahoo.com
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<b>Perceptive Profile Sdn. Bhd.</b>	PT 19251 Persiaran Batu Gajah Perdana 10, Taman Perindustrian Batu Gajah, Perdana Pusing 31550 Perak.	T: +605 366 5439 F: +605 366 5139 E: admin@perceptive.com.my
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<b>Rapat Nusantara Sdn. Bhd.</b>	59-2 Jalan 109E Taman Desa, 58100 Kuala Lumpur.	T: +603 7987 2030 F: +603 7987 2060 E: gan525@gmail.com
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