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Initiatives and Efforts Towards Greening Malaysian Furniture Industry

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ABSTRACT

Energy generation and consumption contributes to greenhouse gas emission. Manufacturing sector in Malaysia accounts for about 40% of total energy consumption. Total amount of CO₂ emissions from manufacturing industries in Malaysia was reported at 53 million metric tons in 2013. For that reason, Malaysia needs to move to a greener economy, which implies meeting development and environmental sustainability. This includes economic aspect and also activities that might cause impact to the environment. Therefore, application of green technology is a must in Malaysia. Malaysian government has been consistent in promoting green technology and practices in various sectors. Malaysia is blessed with rich natural resources and its wood based furniture industry is known to be one of the contributors to the national economy. Malaysian furniture industry is taking initiatives to enhance productivity besides addressing the needs to 'green' the manufacturing process. This is an important step to develop its image globally as to promote environmental friendly furniture manufacturing. Malaysian Furniture Promotion Council (MFPC) has identified three main criteria as to characterize Malaysian furniture as environmentally friendly, which includes material from sustainable sources, minimal waste generation and conformance with health and safety standards. Efforts made by Malaysian government recognized green technology as the driver of economic growth that has flourished the furniture manufacturing into global green products, thus enabling the industry to stay competitive with other major world furniture producers.

Key words: Green technology, Malaysian furniture industry, incentives, sustainable development

INTRODUCTION

Scientific evidence show that greenhouse gas (GHG) emissions from human-related activities affects Earth's climate (Leggett, 2011). Under current circumstances, avoiding the runaway climate change becomes the main vision and mission of both scientific research and international governmental and non-governmental development of climate policy. It has always been regarded sufficient to prevent climate change if the global temperature increase can be limited to 2°C over the pre-industrial average (Held and Soden, 2000; Karl and Trenberth, 2003; Lenton, 2011; Rogelj *et al.*, 2009).

Greenhouse gas (GHG) emissions in terms of carbon dioxide (CO₂) equivalent increases at an average rate of around 1.5% per annum from year 1970-2004. Out of this, CO₂ emissions from the burning of fossil fuels rose at the rate of nearly 2% per annum (Rogner *et al.*, 2007). The need for energy from developing countries is more prevalent than the developed countries. Energy consumption in developing countries has grown 4 times larger over the past 30 years and is anticipated to continuously increase in coming years (Congress of the United States, 1991; Wolfram *et al.*, 2012).

The increase of energy consumption is necessary and desirable, as energy is the main core for country's economic growth and to improve living standards. Energy consumption of Malaysia has always been an important issue as the country moves forward to achieving status as high income nation by 2020. Based on projections, Malaysia's electricity production is expected to rise from 87 thousand GWh in 2005 to 315 thousand GWh in 2030, in which the annual growth rate is about 3.5-4.5% (Tan *et al.*, 2013). Out of that, the energy required by the manufacturing/industrial sector accounted 40% from total energy consumption in Malaysia. This is followed by transportation sector (38%) and residential and commercial consumption (13%) (Ponniran *et al.*, 2012; Ramli and Munisamy, 2013).

Since early 1980s, Malaysia's manufacturing industry has been recording tremendous growth. It contributes almost 80% of overall country's export and Malaysia's manufacturing industry is the 17th largest in the world (Jamil, 2014). Amongst manufacturing industries, electricity generation is the most energy intensive sector (328toe/M-RM) and generates about 0.367 T-CO₂/M-RM for highest energy intensity and high carbon emission category. On the other hand, for the low energy intensity and low carbon emission category, the furniture sectors ranked the highest for the energy intensity at 50toe/M-RM and generates about 0.266T-CO₂/M-RM (Chik and Rahim, 2012). This means that in order to produce 1 million Malaysian Ringgit of electricity, about 50 toe of energy was used and it generates 0.266 T-CO₂ of CO₂ emission.

GREEN CONCEPT FOR MALAYSIAN MANUFACTURING INDUSTRY

Malaysia's government is committed to maintain, preserve and enhance its manufacturing sector through various initiatives. However, direct and indirect energy consumption contributes to CO₂ emission that harms the environment. In 2013, total amount of CO₂ emissions from manufacturing industries was 53 million metric tons or 20% of total CO₂ emission in Malaysia (266 million metric tons) (Wahid *et al.*, 2013; YCharts, 2014).

As manufacturing industry in Malaysia grows, the government has to ensure its trading policies and regulation are followed besides ensuring sustainability and safety of the environment. Therefore, Malaysian government is committed to reduce carbon emission up to 40% by the year 2020, compared to the carbon emission levels recorded in 2005 (ABN News, 2014). For that reason, Malaysia needs to move to a greener economy, which implies meeting development and environmental sustainability, which will take into consideration not only economic but also environmental criteria. With that in mind and also to ensure national development and improving the living standards of populations, as well as the increasing concerns on global warming issues that closely associated with CO₂ emissions, the concept of 'greening' is currently gaining popularity among scientific research community and governments' on policy making (Ramli and Munisamy, 2013).

Green technology (greentech) or clean technology (cleantech) is the usage of any technology related to environmental science, green chemistry, environmental monitoring and electronic devices

to conserve the natural environment and resources and thus reduces the climate changes (Merseyside Connected Business Support, 2014). In Malaysia, the National Green Technology Policy, introduced in 2009, defines green technology as the development and application of products, equipment and systems used to conserve the natural environment and resources, which minimizes the negative impact of human activities (Ministry of Energy, Green Technology and Water, 2012). The product, equipment and systems must satisfy the following criteria:

- Minimize the deterioration of environment
- Relates with zero or low GHG emission
- Not harmful to human health and promotes healthy and improved environment for all forms of life
- Conserves the use of energy and natural resources and
- Promotes the use of renewable resources

The National Green Technology Policy indicates the way forward to ensure environmental sustainability besides to promote healthy business culture amongst businesses and industries for continuous economic growth.

EFFORTS TOWARDS SUSTAINABLE MANUFACTURING

Today, businesses are facing intense competition, regulatory requirements and community pressures. Thus, staying ahead and keeping up with the challenges is a daunting task and it requires concerted effort. Nevertheless, businesses could improve competitiveness by improving environmental performance to conform to environmental regulations, besides addressing customers' environmental concern and reducing environmental impact of its product and service activities (Smith and Perks, 2010).

Promoting green technology and practices in industries is important as it leads to sustainability and helps to conserve the environment. Many businesses and other organizations realized the importance of sustainability to remain competitive in the global market. Challenges of established principles and consumers' expectation in ensuring sustainability often includes type of products, knowledge, manufacturers' policies and local resources (Valipoor and Ujang, 2011).

Additionally, sustainable awareness reduces organization's climate risk, dependence on limited resources as well as improving relationship with stakeholders, investors, customers and employees (Browne and Tobin, 2013). Currently, in order to upscale environmental efforts, Malaysia emphasis on imposing and scheming the environmental load during manufacture of product (Al Khidir and Zailani, 2009). Generally, the green efforts or initiatives can be divided into four separate groups (Anbumozhi and Kanda, 2005):

- **Broad guiding principles:** This refers to having common principles and statements of intent across organizations as this is seen as first step to create policy direction and framework for action
- **Process based management systems:** This involves creating common, structure management systems approach across organizations that highlight the production procedure

regarding the management of environmental risks and issues. This would assist to identify opportunities for improvements over time. An example of a well-known process based environmental management system is the ISO 14001

- **Performance based systems:** This step refers to having minimum performance criteria that must be met by organizations. This system may include technical criteria, codes of conduct or best practices and other performance guidelines. An example of a voluntary program with clear performance standards is public disclosure of industrial pollution
- **Process-based systems with performance elements:** This system refers to creating a mixture system that combines structured management system approach with specific performance requirements. Performance requirements may include existing standards or codes, development of new standard or code or through encouragement or requirement for individual companies to establish specific performance targets

FURNITURE MANUFACTURING INDUSTRY IN MALAYSIA

Manufacturing sectors that incorporate green technology and practices in its production, allow them to meet sustainable environmental requirements in the future. Malaysian furniture industry is known to be innovative and efficient to ensure that it remains competitive and meets global demand. The industry has successfully transformed into an internationally recognized multi-billion ringgit industry from its initial traditional, domestic cottage-based manufacturing in 1980s (Malaysian Furniture Promotion Council, 2005).

Performance of Malaysia's furniture manufacturing industry: In 2013, Malaysia was the eighth largest furniture exporter in the world and ranked third in Asia with the products exported to more than 180 countries around the world (Malaysia External Trade Development Corporation, 2011a). The success of Malaysia's furniture industry has always associated with the abundance of natural resources i.e., rubberwood. Realizing this, the Malaysian government has set an annual growth target of 6.5% for furniture industry. This growth percentage will eventually allow the industry achieve export value of RM53 billion by the year 2020 as outlined in National Timber Industry Policy 2009-2020 (MPIC., 2009).

Economic downturn proves to be challenging to the industry, however, it remained competitive due to strong global demand for wood based furniture. Business-friendly environment also contribute to the success of the industry as the government provides tax exemption (pioneer status companies) and investment tax allowance. Coupled with good quality products and demand, Malaysian furniture industry continues its growth internationally.

Figure 1 depicts the major timber product exports from 2009-2013. The total export value of wooden furniture in 2013 amounted to RM 5.74 billion. This was the biggest export item with a share of 78.9%, followed by seats and their parts (9.3%), metal furniture (7.5%), parts of furniture (3.7%), plastic furniture (0.3%) and others (0.3%) (Malaysian Timber Council, 2013).

Green technology in furniture manufacturing: Malaysian furniture industry is taking initiatives to enhance productivity besides addressing the needs to 'green' the manufacturing process. This is an important step to develop its image globally and to portray Malaysian-made furniture as being sustainable. The Malaysian Furniture Industry Council (MFIC) has been

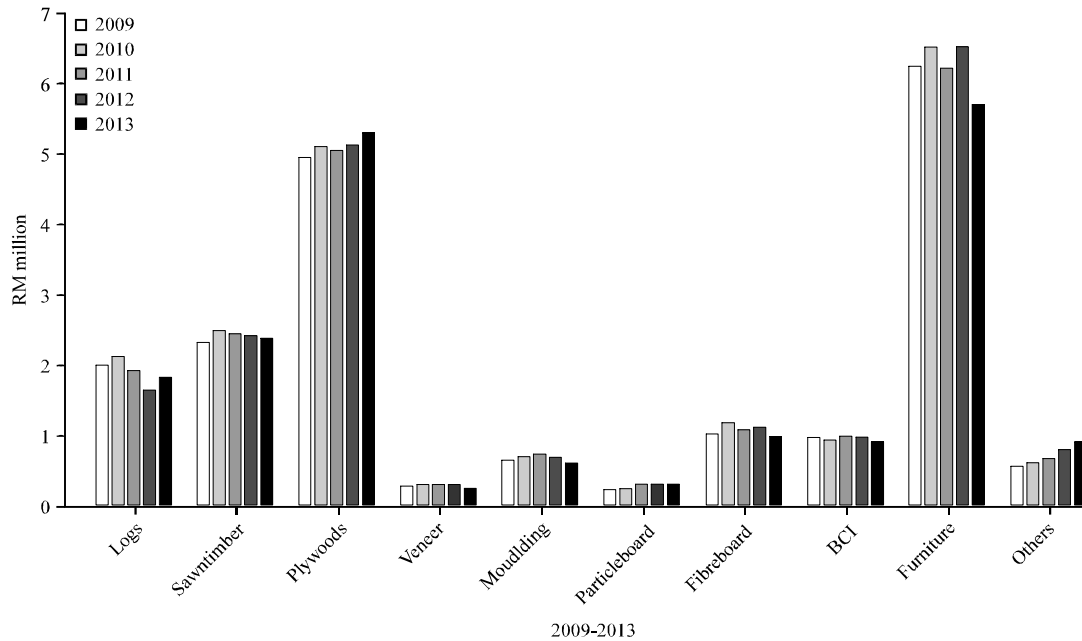


Fig. 1: Malaysian Export of Major Timber Products (2009-2013), Source: Malaysian Timber Council (2013) Annual Report

promoting this agenda, with majority of its members are currently using rubberwood as raw materials for furniture production. Rubberwood was generally considered as waste about 20-30 years ago (Chen, 2011).

Furniture manufacturing companies can practice and apply green technology in its facility and manufacturing processes. This includes projects that involve solar panels for energy generation, green building and water and waste management. Producing clean power or steam supply through recovery of heat generated during manufacturing process proves to be beneficial and promote energy efficiency (Asian Legal Business, 2014). Based on that, Malaysian Furniture Promotion Council (MFPC) has highlighted 3 main criteria used to define green Malaysian furniture (Chen, 2011):

- **Material from sustainable sources:** Wood and fabric used in furniture manufacturing must be from sustainable sources. Timber must be obtained from forest areas certified under Sustainable Forest Management (SFM) or from forest plantation. Additionally, encouraging the use of palm wood from oil palm tree and rubber wood, which would otherwise be burnt or deposited on landfill that might cause air pollution
- **Minimal waste:** Waste minimization can be achieved through good design, finishing and quality. It can also be achieved through compliance with environmental regulation and requirements. The use of water-based stains and glues, recycled carton boxes and biodegradable plastic bags promotes better use of resources
- **Conformance with health and safety standards:** Pre-and post-treatment of timbers and the use of chemicals (for protection purposes or to increase the dimensional stability of wood

based products) should be conformed to health and safety regulation and requirements. This is to avoid health risks to humans as excessive exposure to chemicals is harmful to health

CURRENT GREEN ACTIVITIES IN MALAYSIAN FURNITURE INDUSTRY

The decrease of forest resource supply encouraged wood-based product manufacturers to explore potential resources to ensure continuous supply of raw materials (Ismail *et al.*, 2012). A total of 80% of the furniture manufactured in Malaysia is made of rubberwood (Ministry of International Trade and Industry, 2011). Malaysian government has allocated RM 1.08 billion in 2013 national budget for the replanting of unproductive oil palm and rubber trees to ensure sufficient raw material supply for the furniture industry (PERKASA, 2013b).

In addition to addressing sustainable and green manufacturing, issues on waste management is also equally vital and it has been noted in the National Green Technology Policy. Minimizing waste generated during furniture manufacturing is important as the volume and wastage rate of particular raw material acts as an indicator of waste problems that need to be addressed. This can then be overcome by improving the process and adopting green technologies and practices. Like other industrial processes, furniture manufacturing also generates significant amount of waste from wood processing, panel production, wood preservation and from the use of paints and varnishes (European Commission, 2013).

The use of alternative raw materials other than timber for furniture production such as agricultural waste which includes rice husk, coconut trunks and oil palm biomass (trunks, empty fruit bunches and fronds), kenaf and sawdust to produce composite boards and furniture parts has heightened amongst furniture industry players. In 2012, investments of RM 339.3 million was recorded in this sub-sector (Malaysian Investment Development Authority, 2012b). Numerous research has been published on the application of oil palm biomass, kenaf and sawdust for the production of particle boards (H'ng *et al.*, 2009, 2011a, b; Chai *et al.*, 2011). The results are encouraging and few activities being carried out by the authorities to promote the use of particle boards made from oil palm biomass and kenaf in the furniture industry.

To enhance the utilization of waste, furniture manufacturing industries in Malaysia has been producing high-quality engineered wood products using agricultural waste. Natural fiber materials from agriculture waste such as oil palm biomass (oil palm trunks and empty fruit bunches), coconut trunk fiber and rice husks are often used for the production of briquettes, particle boards and fiber boards, which are used in the manufacture of furniture (Malaysian Investment Development Authority, 2012a).

The use of palm wood as an alternative source of furniture manufacture is gaining popularity. Furniture manufacturers are currently experimenting the use of palm wood as side panels and for the surface of tables, chairs and cabinets. The use of palm wood prevents conventional wood obtained from forest trees felled as source of timber. Besides that, oil palm empty fruit bunches are also known as an alternative to produce value-added products such as particle boards and flatboards due to their physical properties (PERKASA, 2013a; Nasrin *et al.*, 2008). Nevertheless, the use of palm wood poses challenges as there is insufficient technical knowledge of the characteristics and application of the wood. Furniture manufacturer must also deal with the softness of the palm wood due to the loosely bound nature of oil palm trunk fiber and long kiln drying process (Malaysian Palm Oil Council, 2012).

Apart from that, Forest Research Institute Malaysia (FRIM) through many years of hard work has developed, produced and patented a green technology for drying rubber wood using high temperature drying system (HTD). This excludes the need of chemicals used for the rubberwood prior to drying. Furthermore, the technology enhances stability of rubberwood after drying and able to reduce processing cycle time by more than 75%. This technology is one of the solutions to Malaysia's furniture manufacturers and sawn timber trade industry over the stringent regulation and requirement for exporting eco-friendly product, imposed by developed countries on the use of borates as wood treatment chemical to treat rubberwood. European Union (EU) has classified borates as "Repro-toxic Category" under the Dangerous Substance Directive 67/548. To diversify the use of HTD technology FRIM will conduct research on timber species such as *Acacia* and oil palm lumbers (Forest Research Institute Malaysia, 2013).

PROMOTING GREEN TECHNOLOGY DEVELOPMENT

Malaysian government recognized green technology as the driver for economic growth. It provides vast opportunities and potentials in terms of economic generation, technology innovation and wealth creation. Green technology has vast applications across different sectors such as energy production, manufacturing, services and transportation. Application of green technology can create opportunities for economic growth by contributing to fiscal consolidation, enhancing productivity achieved through efficiency in the use of natural resources and creating new markets for green goods and services (Malaysia External Trade Development Corporation, 2011b).

Providing conducive environment for green technology development has been highlighted as one of the main thrust in the National Green Technology Policy. The introduction and implementation of economic instruments with the support of monetary and fiscal measures is essential to heighten green technology development in Malaysia (Ministry of Energy, Green Technology and Water, 2012).

Various incentives are made available to targeted industry players to intensify potential producers and users of green technology. This includes eligible companies for activities related to green technology in furniture manufacturing such as utilization of renewable energy, energy conservation/energy efficiency, reduction of greenhouse gas emission, import and purchase of machinery components, waste recycling environmental protection storages and treatment and disposal of toxic/hazardous waste.

Financial and incentive supports are offered in terms of soft loans, pioneer status, tax and import duty exemptions, which are managed by agencies such as Malaysian Investment Development Authority (MIDA) and Malaysian Green Technology Corporation (GreenTech Malaysia). The former, MIDA is the principle agency that focuses on the promotion of manufacturing and service sectors in Malaysia. The function of MIDA include but not limited to create opportunities and good environment for companies to invest in manufacturing and service sectors, besides assisting implantation of projects as it provides information on investment opportunities and facilitate companies, which are looking for joint venture partners (Malaysian Investment Development Authority, 2013). The latter, GreenTech Malaysia is an organization under the purview of Ministry of Energy, Green Technology and Water, 2012. Its purpose is to catalyze green technology deployment in Malaysia as an engine of socio-economic growth (Malaysian Green Technology Corporation, 2013).

Table 1 lists some the various incentives provided for green technology development and can be applied in furniture manufacturing. The incentives provided in the table below might be changed according to any new rules and regulations imposed by the government from time to time.

Table 1: Some of the incentives for green technology development in Malaysia

Activity	Description	Organization responsible
Funding	<p>Green technology financing scheme</p> <p>This scheme offers 60% guarantee of the financing amount and a rebate of 2% on the interest/profit rate charged by the financial institution. It is available until 31 December 2015 or upon reaching a total financing approval amount of RM3.5 billion whichever is earlier. Its purpose is to facilitate the growth of local green businesses. Scheme are channeled to GreenTech Malaysia which conducts the initial screening and certification prior to applying financing from financial institution. GreenTech Malaysia and Credit Guarantee Corporation Malaysia Berhad (CGC) are the agencies tasked with administering the scheme. GreenTech Malaysia is responsible for the promotion, assessment, certification and monitoring of producers and users of green technology under the scheme, while CGC administers the guarantee and rebate payments. Producers and users of green technology are entitled to maximum financing of RM 50 million per company and RM 10 million per company, respectively</p>	Green Tech. Malaysia and CGC
Environmental management	<p>Storage, treatment and disposal of toxic and hazardous wastes</p> <p>This incentive is to encourage the setting up of proper facilities to store, treat and dispose of toxic and hazardous wastes. Companies that are directly involved in these three activities in an integrated manner qualify for pioneer status in which the success applicant can enjoy income tax exemption of 70% of the statutory income for a period of 5 years. Also, investment tax allowance of 60% on qualifying capital expenditure incurred within a period of 5 years</p>	MIDA
Environmental management	<p>Waste recycling activities</p> <p>This incentive is to encourage waste recycling activities within company. It includes recycling of agricultural wastes or agricultural by-products, recycling of chemicals and the production of reconstituted wood-based panel boards or products. The incentive for Pioneer Status includes income tax exemption of 70% of the statutory income for a period of 5 years. Also, investment tax allowance of 60% on qualifying capital expenditure incurred within a period of 5 years. The allowance can be offset against 70% of the statutory income in each year of assessment. Any unutilized allowances can be carried forward to subsequent years until fully utilized</p>	MIDA
Energy conservation	<p>Companies providing energy conservation services</p> <p>Company that provides such service are eligible for the following incentives:</p> <p>(a) Pioneer Status with income tax exemption of 100% of the statutory income for period of 10 years. Unabsorbed capital allowances as well as accumulated losses incurred during the pioneer period can be carried forward and deducted from the post pioneer income of the company or</p> <p>(b) Investment Tax Allowance (ITA) of 100% on the qualifying capital expenditure incurred within 5 years. The allowance can be offset against 100% of the statutory income for each year of assessment. Any unutilized allowances can be carried forward to subsequent years until fully utilized. The companies must implement their projects within 1 year from the date of approval</p>	MIDA
Energy conservation	<p>Companies undertaking conservation of energy for own consumption</p> <p>Companies which undertake conservation of energy for own consumption are eligible for ITA of 100% on the qualifying capital expenditure incurred within 5 years. The allowance can be offset against 100% of the statutory income for each year of assessment. Any unutilized allowances can be carried forward until fully utilized</p>	MIDA

Table 1: Continue

Activity	Description	Organization responsible
Energy generation	<p>Energy generation activities using renewable energy resources</p> <p>Companies undertaking generation of energy using biomass, hydropower (not exceeding 10 MW) and solar power that are renewable and environmentally friendly are eligible for the following incentives:</p> <p>(a) Pioneer Status with income tax exemption of 100% of statutory income for 10 years. Unabsorbed capital allowances as well as accumulated losses incurred during the pioneer period can be carried forward and deducted from the post pioneer income of the company</p> <p>(b) Investment tax Allowance of 100% on the qualifying capital expenditure incurred within a period of 5 years. This allowance can be offset against 100% of the statutory income for each year of assessment. Any unutilized allowances can be carried forward to subsequent years until fully utilized</p>	MIDA
Energy generation	<p>Generation of renewable energy for own consumption</p> <p>Companies which generate energy from renewable resources for its own consumption are eligible for the Investment Tax Allowance of 100% on qualifying capital expenditure incurred within a period of 5 years. This allowance can be offset against 100% of the statutory income for each year of assessment. Any unutilized allowances can be carried forward to subsequent years until fully utilized</p>	MIDA
Environmental management	<p>Incentives for the utilization of oil palm biomass</p> <p>Companies that utilize oil palm biomass to produce value-added products such as particle board, medium density fiberboard; plywood; and pulp and paper are eligible for the following incentives:</p> <p>New companies:</p> <p>(a) Pioneer status with income tax exemption of 100% of statutory income for 10 years. Unabsorbed capital allowances as well as accumulated losses incurred during the pioneer period can be carried forward and deducted from the post pioneer income of the company</p> <p>(b) Investment Tax Allowance of 100% on the qualifying capital expenditure incurred within a period of 5 years. This allowance can be offset against 100% of the statutory income for each year of assessment. Any unutilized allowances can be carried forward to subsequent years until fully utilized</p> <p>Existing companies that reinvest:</p> <p>(a) Pioneer Status with income tax exemption of 100% of the increased statutory income arising from the reinvestment for a period of 10 years. Unabsorbed capital allowances as well as accumulated losses incurred during the pioneer period can be carried forward and deducted from the post pioneer income of the company</p> <p>(b) Investment Tax Allowance of 100% on the additional qualifying capital expenditure incurred within a period of 5 years. The allowance can be offset against 100% of the statutory income for each year of assessment. Any unutilized allowances can be carried forward to subsequent years until fully utilized</p>	MIDA

Source: Ministry of energy, green technology and water (2012)

CONCLUSION

Environment related issues are becoming more prevalent among public and many have now realized the need and importance of its protection, conservation and care. Furthermore, industries and companies have already started to act on the green measures with the aim to incorporate green practice in its manufacturing processes and to create sustainable products. With government efforts

and the initiatives, the Malaysian furniture industry has taken steps for a better, clean and 'green' furniture manufacturing that can be further developed to ensure its competitiveness in the global market.

REFERENCES

- ABN News, 2014. M'sia calls on fast-growing developing nations to prioritise climate action. ABN News, Asian Broadcasting Network (ABN), September 24, 2014. <http://news.abnxc.com/2014/09/msia-calls-on-fast-growing-developing-nations-to-prioritise-climate-action>.
- Al Khidir, T. and S. Zailani, 2009. Going green in supply chain towards environmental sustainability. *Global J. Environ. Res.*, 3: 246-251.
- Anbumozhi, V. and Y. Kanda, 2005. Greening the production and supply chains in Asia: Is there a role for voluntary initiatives? IGES Kansai Research Centre Discussion Paper No. KRC-2005-No.6E, Institute for Global Environmental Strategies (IGES), Japan.
- Asian Legal Business, 2014. A greener Malaysia. Thomson Reuters, Asian Legal Business, March 1, 2014. <http://www.legalbusinessonline.com/features/greener-malaysia/64714>.
- Browne, P. and P. Tobin, 2013. Sustainable Design for Furniture and Wood Products. In: Green Design, Materials and Manufacturing Processes, Bartolo, H., P.J.S. Bartolo, N.M.F. Alves, A.J. Mateus and H.A. Almeida *et al.* (Eds.). CRC Press, UK, ISBN-13: 9781138000469, pp: 11-20.
- Chai, L.Y., P.S. H'ng, C.G. Lim, K.L. Chin, M.Z. Jusoh and E.S. Bakar, 2011. Production of oil palm trunk core board with wood veneer lamination. *J. Oil Palm Res.*, 23: 1166-1171.
- Chen, E., 2011. Furniture industry rooting for eco standard. *Green Purchasing Asia*, Issue 2, July 2011, pp: 58-59. http://issuu.com/greenpurchasingasia/docs/gpa_july_2011.
- Chik, N.A. and K.A. Rahim, 2012. The impact of Malaysian industrial energy use in carbon dioxide emissions. Proceedings of the 3rd International Conference on Business and Economic Research, March 12-13, 2012, Bandung, Indonesia, pp: 1565-1582.
- Congress of the United States, 1991. Energy in developing countries. OTA-E-486, NTIS Order No. PB91-133694, Washington, DC., USA., January 1991. <http://ota.fas.org/reports/9118.pdf>.
- European Commission, 2013. Environmental aspects of the furniture sector. European Commission, February 4, 2013. http://ec.europa.eu/enterprise/sectors/furniture/environment/index_en.htm.
- Forest Research Institute Malaysia, 2013. FRIM offers world class chemical-free wood treatment. Forest Research Institute Malaysia (FRIM), Ministry of Natural Resources and Environment, June 21, 2013.
- H'ng, P.S., B.N. Khor, N. Tadashi, A.S.N. Aini and M.T. Paridah, 2009. Anatomical structures and fiber morphology of new kenaf varieties. *Asian J. Sci. Res.*, 2: 161-166.
- H'ng, P.S., A.N. Lee, C.M. Hang, S.H. Lee, A. Khalina and M.T. Paridah, 2011a. Biological durability of injection moulded wood plastic composite boards. *J. Applied Sci.*, 11: 384-388.
- H'ng, P.S., S.H. Lee, Y.W. Loh, W.C. Lum and B.H. Tan, 2011b. Production of low formaldehyde emission particle board by using new formulated formaldehyde based resin. *Asian J. Scient. Res.*, 4: 264-270.
- Held, I.M. and B.J. Soden, 2000. Water vapor feedback and global warming. *Ann. Rev. Energy Environ.*, 25: 441-475.
- Ismail, M., R. Jegatheswaran, M. Shukri, M.K.M. Roslan and K. Izran, 2012. Market assessment on the potential of Oil Palm Empty Fruit Bunch (OPEFB) particle board in Malaysia's wood-based industries. *Pertanika J. Trop. Agric. Sci.*, 35: 581-592.

- Jamil, A., 2014. Malaysia's manufacturing sector stages rebound. The Malaysian Reserve, July 21, 2014. <http://themalaysianreserve.com/main/news/corporate-malaysia/6083-malaysias-manufacturing-sector-stages-rebound>.
- Karl, T.R. and K.E. Trenberth, 2003. Modern global climate change. *Science*, 302: 1719-1723.
- Leggett, J.A., 2011. China's greenhouse gas emissions and mitigation policies. Congressional Research Service, USA., July 18, 2011. <http://fpc.state.gov/documents/organization/169172.pdf>.
- Lenton, T., 2011. 2°C or not 2°C? That is the climate question. *Nature*, Vol. 473. 10.1038/473007a
- MPIC., 2009. NATIP: National Timber Industry Policy 2009-2020. Ministry of Plantation Industries and Commodities (MPIC), Putrajaya, Malaysia, ISBN-13: 9789839196566, Pages: 128.
- Malaysia External Trade Development Corporation, 2011a. Furniture: Industry profile. <http://www.matrade.gov.my/en/foriegn-buyers-section/69-industry-write-up--products/621-furniture>.
- Malaysia External Trade Development Corporation, 2011b. Green technology. <http://www.matrade.gov.my/en/foriegn-buyers-section/70-industry-write-up--services/555-green-technology-services>.
- Malaysian Furniture Promotion Council, 2005. The Malaysia furniture industry. http://www.mfpc.com.my/index.php?option=com_content&view=industry&ordering=1.
- Malaysian Investment Development Authority, 2012a. Industries in Malaysia: Wood based industry. Malaysian Investment Development Authority (MIDA), Malaysia.
- Malaysian Investment Development Authority, 2012b. MITI report 2012. Malaysian Investment Development Authority (MIDA), Ministry of International Trade and Industry Malaysia, Kuala Lumpur, Malaysia, pp: 1-105.
- Malaysian Green Technology Corporation, 2013. Corporate information. http://www.greentechmalaysia.my/content.asp?zoneid=1&cmscategoryid=350#.VI_NBtKUffJ.
- Malaysian Investment Development Authority, 2013. About MIDA. <http://www.mida.gov.my/home/about-mida/posts/>
- Malaysian Palm Oil Council, 2012. Global Oils and Fats Business Magazine. Vol. 9, Malaysian Palm Oil Council, Malaysia, pp: 16-17.
- Malaysian Timber Council, 2013. MTC annual report 2013. Malaysian Timber Council (MTC), Malaysia, pp: 24-30. <http://mtc.com.my/wp-content/uploads/2014/11/MTC-AR-2014-14-smaller.pdf>.
- Merseyside Connected Business Support, 2014. Environmental technologies. <http://www.merseysideconnected.org/resources/sectors/environmental-technologies>.
- Ministry of Energy, Green Technology and Water, 2012. Incentives for Green Growth in Malaysia. 1st Edn., Ministry of Energy, Green Technology and Water, Putrajaya, Malaysia, pp: 2-5.
- Ministry of International Trade and Industry, 2011. MITI weekly bulletin. Ministry of International Trade and Industry (MITI), Kuala Lumpur, Malaysia, Volume 131, March 1, 2011, pp: 1-19.
- Nasrin, A.B., A.N. Ma, Y.M. Choo, S. Mohamad, M.H. Rohaya, A. Azali and Z. Zainal, 2008. Oil palm biomass as potential substitution raw materials for commercial biomass briquettes production. *Am. J. Applied Sci.*, 5: 179-183.
- PERKASA, 2013a. Palm wood-Extensive research and development had contributed to the new uses of palm trunks. Sarawak Timber Industry Development Corporation (STDIC), Sarawak, Malaysia, pp: 10-11.
- PERKASA, 2013b. RM53 billion export earnings for timber sector by 2020. Sarawak Timber Industry Development Corporation (STDIC), Sarawak, Malaysia, pp: 12-13.

- Ponniran, A., N.A. Mamat and A. Joret, 2012. Electricity profile study for domestic and commercial sectors. *Int. J. Integr. Eng.*, 4: 8-12.
- Ramli, N.A. and S. Munisamy, 2013. Technical efficiency and eco-efficiency in the manufacturing industry: A non-parametric frontier approach. *Int. Rev. Bus. Res. Pap.*, 9: 1-11.
- Rogelj, J., B. Hare, J. Nabel, K. Macey, M. Schaeffer, K. Markmann and M. Meinshausen, 2009. Halfway to Copenhagen, no way to 2°C. *Nat. Rep. Climate Change*, 3: 81-83.
- Rogner, H.H., D. Zhou, R. Bradley, P. Crabbe and O. Edenhofer *et al.*, 2007. Introduction. In: *Climate Change 2007: Mitigation of Climate Change*, Metz, B., O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (Eds.). Chapter 1, Cambridge University Press, Cambridge, UK., ISBN-13: 9781139468640, pp: 99-116.
- Smith, E.E. and S. Perks, 2010. A perceptual study of the impact of green practice implementation on the business functions. *S. Afr. Bus. Rev.*, 14: 1-29.
- Tan, C.S., K. Maragatham and Y.P. Leong, 2013. Electricity energy outlook in Malaysia. *IOP Conf. Ser.: Earth Environ. Sci.*, Vol. 16. 10.1088/1755-1315/16/1/012126
- Valipoor, S. and B. Ujang, 2011. Challenges of sustainable design in Malaysian furniture industry. *Int. Proc. Chem. Biol. Environ. Eng.*, 12: 60-64.
- Wahid, I.N., A. Abd-Aziz and N.H. Nik-Mustapha, 2013. Energy consumption, economic growth and CO₂ emissions in selected ASEAN countries. *Proceedings of the Malaysian National Economic Conference (PERKEM) VIII-Public Policy in the Era of Economic Transformation: Challenges and Future Directions*, June 7-9, 2013, Johor Bahru, Malaysia, pp: 758-765.
- Wolfram, C., O. Shelef and P. Gertler, 2012. How will energy demand develop in the developing world? *J. Econ. Perspect.*, 26: 119-138.
- YCharts, 2014. Malaysia carbon dioxide emissions. http://ycharts.com/indicators/malaysia_carbon_dioxide_emissions.