Green Economy Guideline Manual

2014

EY
Building a better working world

Food and Agro processing

ISKANDAR REGIONAL DEVELOPMENT AUTHORITY

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Foreword

Malaysia's commitment to sustainable development is articulated through its national development plans including the "Tenth Malaysia Plan, The New Economic Model" which underlines the long term development framework for Malaysia. At the Earth Summit in 1992, Malaysia pledged to keep at least 50% of its land area as forest cover, and has maintained its commitment with forest cover in 2012 being at 56.4% of total land area.

Leaders of governments at the United Nations Conference on Sustainable Development (Rio+20, Rio di Janeiro, 2012) resolved to act on addressing challenges in achieving sustainable development through the development of 'Green Economy' in their countries. The Government of Malaysia at Rio+20 re affirmed its commitment to sustainable development, and its voluntary reduction commitment (announced at the15th meeting of Conference of Parties, Copenhagen, 2009) of greenhouse gas emissions intensity of GDP by upto 40% by 2020, compared to 2005 levels. Our Prime Minister has also launched our Low Carbon Society Blueprint (at the 18th meeting of Conference of Parties, Doha, 2012) as our commitment to building a green economy at Iskandar Malaysia.

Climate change is no longer a myth but a reality that affects all of us. The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) has stated that an increase of 0.85°C in the global average surface temperature could wreak havoc upon our environment. Earlier in 2014, Malaysia experienced one of its worst dry spells, triggering the Malaysian cabinet to consider calling a state of emergency in 15 areas in Malaysia that had not experienced rainfall in more than 20 days.

We have developed this Green Economy guidelines (GEG) manual which provides a checklist for businesses to address areas of procurement, operations and supply chain management in order to minimize impact on the environment. The development of these guidelines included consultations with ministries and government agencies, business associations, local bodies, international agencies

and IRDAs own business teams.

The goal of the GEG manual is to help businesses and industries to study, evaluate, adopt and inculcate environmentally sustainable economic behavior leading to building a prosperous, resilient, robust and globally competitive green economy in Iskandar. This is in line with IRDA's vision of becoming a "Strong and Sustainable Metropolis of International Standing". The LCS Blueprint has 3 main themes – Green Economy, Green Community and Green Environment. This manual is an output of the first theme and focuses on the **food and agro processing industry**.

We hope businesses in Iskandar in the food and agro processing industry will find these guidelines relevant and useful in evaluating and adopting more innovative and sustainable practices, contributing to Green Economy in Iskandar.

In closing, I would like to thank and congratulate all parties involved in the production of this manual. I would also like to make a special mention of the advice and support given by the Working Group to the IRDA team and consultant Ernst & Young's Climate Change and Sustainability Services team in putting together this manual.

Y. Bhg. Datuk Ismail Ibrahim
Chief Executive IRDA

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Glossary

AD	Anaerobic digestion
AFV	Alternative Fuel Vehicles
ATMS	Automated Transfer Management System
BEMS	Building Energy Management Systems
BOD	Biochemical oxygen demand
CDP	Carbon Disclosure Project
CFL	Compact fluorescent lighting
COD	Chemical oxygen demand
CSPO	Certified Sustainable Palm Oil
CSR	Corporate social responsibility
EcoDEX	Eco design for Sustainable Product Development and Introduction
ESG	Environmental, social and governance
FAO	Food and Agriculture Organization
FDA	United States Food and Drugs Administration
FGV	Felda Global Ventures
F&A	Food & Agro processing
GBI	Green Building Index
GDP	Gross Domestic Product
GGP	Government Green Procurement
GHG	Greenhouse gases
HRV	Heat Recovery Ventilation
HVAC	Heating, ventilation and air-conditioning
ICT	Information and communications technology
IM	Iskandar Malaysia
IRDA	Iskandar Malaysia Development Authority
KeTTHA	Malaysia's Ministry of Energy, Green

	Technology and Water
LDV	Light duty vehicles
LED	Light-emitting diode
LEED	Leadership in Energy and Environmental Design
LEP	Light-emitting plasma
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MATR	Malaysia Automotive Technology Roadmap
MHE	Mechanical Handling Equipment
MSPO	Malaysian Sustainable Palm Oil
NAP	National Automotive Policy
POME	Palm Oil Mill Effluent
RSPO	Roundtable on Sustainable Palm Oil
TSS	Total suspended solids
UN	United Nations
VOC	Volatile organic compounds

Food & Agro processing Industry

1. Industry Overview

The Food & Agro processing (F&A) industry involves transforming raw ingredients into food or of food into other forms. The industry utilizes clean, harvested crops or animal products to produce marketable and often food products with long shelf-life.

The industry plays a vital role in the world economy, accounting for approximately 4.7% of the Gross Domestic Product (GDP) (BMI, 2014; World Bank, 2014). The growth of this sector has outpaced overall economic growth except in 2012. This could explain the strong interrelationship between growth in F&A industry value and GDP (Figure 1).

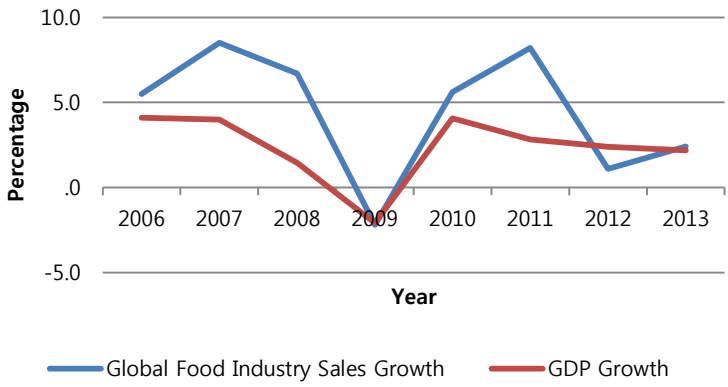

Figure 1: Growth rate of food industry and GDP

In Malaysia, processed food contributed to a total of RM14.2 billion in 2013. This places Malaysia as one of the largest food products producers in the region. This industry generates approximately 2.75% of GDP (MIDA, 2014). Among the main export products of Malaysia are cocoa, dairy products, palm-oil based products and cereal.

The state of Johor, in particular, plays a great role in this industry. In 2012, *the Star* has reported that Johor contributed 32.6% of the total fruits production in the country, 15.6% of the total vegetable production in the country and an astonishing 70.5% of the total ornamental fish production in the country. Furthermore, Johor is already

the largest producer of chicken, goats and cows and is still aiming to expand the industry in the next five years (Tan, 2013). With the government of Johor committed to expanding this industry, businesses in Iskandar Malaysia (IM) can latch onto the government's goals and benefit from the expansion planned ahead.

In addition, Malaysia's food and agro processing industry can also delve into the *halal* food sector. As Malaysia's *halal* food certification is globally recognized, Malaysian F&A manufacturers has ample opportunities to tap into this market with its niche expertise. Coupled with Malaysia's *halal* certification and the growing awareness of *halal*-certified food being a new benchmark for quality, hygiene and safety (Food Export Association of the Midwest USA, 2011), the F&A industry in Malaysia is poised to contribute more significantly to the economy.

The government has also showed support through its Budget 2014. It has allocated up to RM9 billion for development of high commercial value agricultural programs, which includes cocoa and oil palm. In line with this support, Iskandar Malaysia Development Authority (IRDA) is looking to expand into agricultural biotechnology field to value-add its products. As such, the IRDA is encouraging the creation of center of

excellence for this industry, particularly in the field of food technology, *halal* testing and certifications and molecular marker discovery.

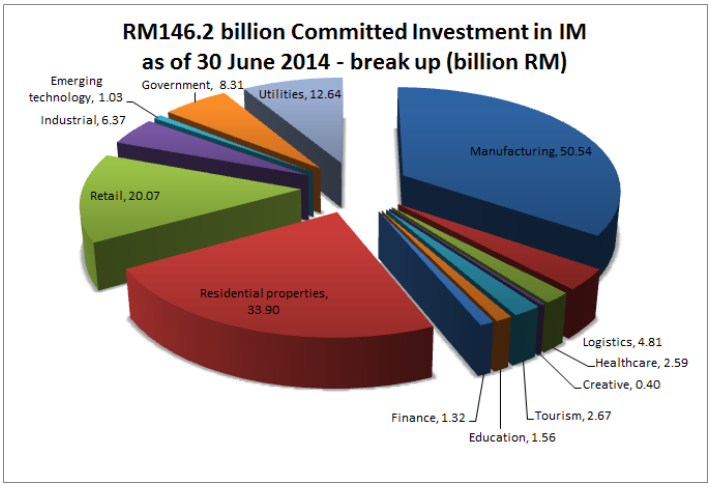

Figure 2: Cumulative committed investment in IM (Low & Kasmuri, 2014)

1.1. Environmental Impacts

The F&A industry poses several environmental consequences, including energy use during processing and operations, waste issues and Greenhouse gases (GHG) emissions from logistics and distribution. The Food and Agriculture Organization (FAO) reports that fossil fuel consumption for agriculture activities ranges from 11.1 GJ/ha to 20.4 GJ/ha, depending on the GDP of the country. In the US for example, energy intensity in 2007 stood at 18 GJ/ha or 2.2 GJ/tonnes (for corn) (Food and Agriculture Organization, 2011).

Process heating and cooling systems in F&A operations have great energy requirements to maintain food safety and quality. Motor-driven operational machinery also requires substantial amounts of energy to function. As seen in Figure 3, processing and distribution account for the majority of the demand for energy. *The Environmental Progress & Sustainable Energy* journal publishes that in Malaysia, the sector accounted for 14% of total manufacturing energy consumption in 2006, a substantial amount considering the industry's GDP contribution (Ali, Saidur, Hasanuzzaman, & Ward, 2012).

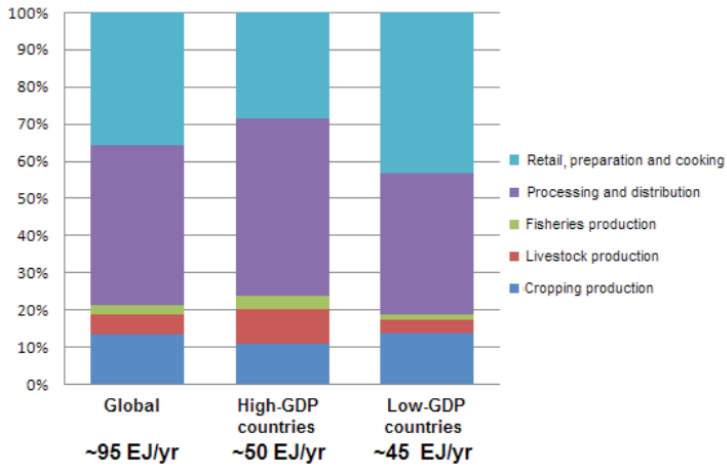

Figure 3: Global share of energy consumption from food supply chain (Food and Agriculture Organization, 2011)

Waste from food processing is also an area of concern, and is divided into three main categories: wastewater, solid organic waste and inorganic waste. For wastewater, primary issues are biochemical oxygen demand (BOD); chemical oxygen demand (COD); total suspended solids (TSS); excessive nutrient loading (nitrogen and phosphorus) compounds pathogenic organisms from animal processing; and residual chlorine and pesticide levels (UNIDO, 2012).

Organic waste includes by-products of processing such as seeds, skin, bones etc. from raw materials that are end-

products of processing operations. UN FAO suggests that approximately one third of food produced for human consumption goes to waste, equating to more than 1.3 billion tonnes per year. This stems from all phases of the F&A industry, from post-harvest to retail and consumption (FAO, 2011).

Inorganic waste includes packaging materials, ranging from plastics, glass, cardboard etc. According to UN FAO, the F&A industry alone accounts for 50% of global consumer packaging. If the beverage industry were included, this proportion would rise to 69% (FAO, 2011).

Logistics has a significant impact within the sector, as processed food is often shipped long distances, frequently by airfreight that is regarded as highly GHG intensive (WEF, 2009). Although GHG emissions from transportation are important, some of the results from life cycle analyses suggest that transportation does not have significant environmental impact, accounting for 11% of total carbon emissions associated with food production in aggregate (Boye and Arcand, 2012). However, major food processing companies are considering logistics as one of the key options for mitigating GHG emissions, after waste and energy use issue, due to the availability of greener options in the

logistics sector.

Rapidly growing F&A sector exacerbates environmental concerns. The sector is expanding at a Compound Annual Growth Rate (CAGR) of 4.4% globally and is expected to increase by 5.5% in CAGR from 2014 to 2018. Market value (in terms of sales) in 2018 will be approximately USD4.6 trillion, which is a 24% increase (Figure 4) from USD3.9 trillion in 2014.

The Malaysian F&A industry possesses a unique competitive advantage of processing halal food that caters to large communities locally as well as worldwide. The *halal* status certification program will establish Malaysia as a key global exporter of halal food products. Malaysia is also the second largest producer of palm oil in the world, and is responsible for processing palm oil and palm oil-based products. Palm oil production and halal F&A production are key advantages that contribute to the Malaysian F&A industry's growth.

Image 1: Ketupat for Hari Raya celebration

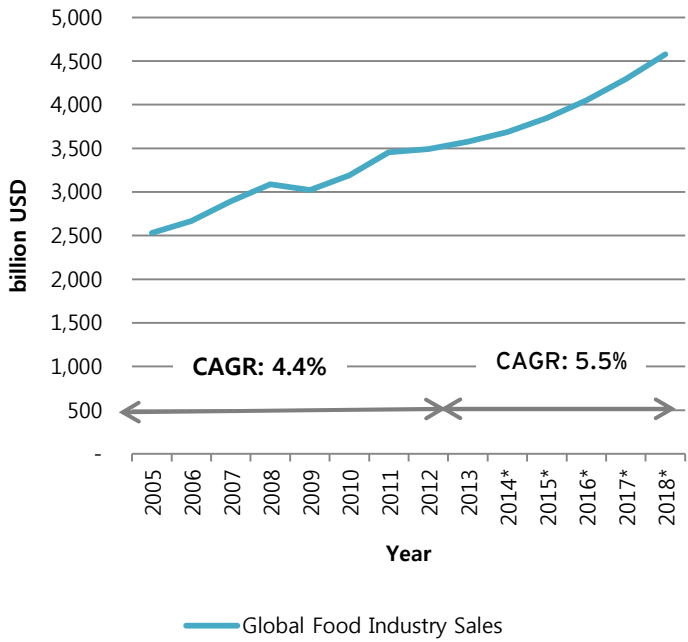

Figure 4: Global food industry sales (BMI, 2014)

(*forecasted data)

Given the current industry trends, additional action will need to be taken to mitigate issues related to waste, energy use and GHG emissions of the food processing industry sector over the medium to long term. In order to identify greening opportunities in the sector, the guideline concentrates on identifying and prioritizing greening options that are pursued by the leading companies in the sector (Table 1).

Company	Food Sales (in billion USD)	Key Green Initiatives
Pepsico Inc.	37.6	• Packaging Waste & Recycling • Using Recycled Water • Energy efficient fleet
Tyson Foods Inc. (10/1/12)	31.6	• Water efficient systems • Energy efficient fleet and equipment • Sustainable Packaging
Nestle (U.S. & Canada)	27.2	• Lightweight packaging • Water efficient equipment
JBS USA	21	• Pen Sprinklers in feed yards • Low-impact & lightweight packaging • Uses renewable energy
Anheuser-Busch InBev	16	• Clean fuels for fleet operations • Recyclable Packaging

Table 1: Leading companies and their green initiatives

(Food Processing, 2013)

2. Identifying Green Growth Opportunities

This guideline looks at a typical food processing industry value chain to identify areas for intervention. Areas of intervention can be divided into 3 major areas, from addressing waste issues, energy consumption to emission from logistics.

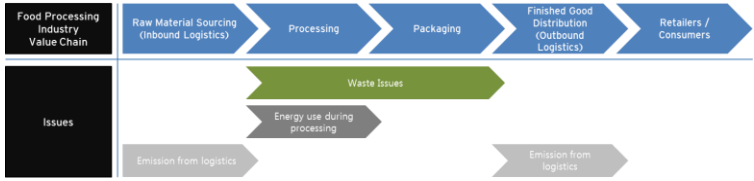

Figure 5: Typical value chain of the food processing industry

2.1. Areas of Intervention

Optimizing plant processes for energy efficiency is essential considering the energy use from this sector as outlined in the previous section. Operations that require intervention are process for heating, cooling and refrigeration (IFC, 2012) which have the greatest energy requirements in food manufacturing with over 75% of the sector's energy use (US EPA, 2007). Refrigeration and heating account for 50% and 15% of the electricity consumption at processing sites

respectively (Carbon Trust, 2012).

As briefly mentioned in the previous section, waste issues associated with the food processing industry sector are wastewater, organic and inorganic materials. Wastewater, if improperly disposed, can contaminate local water streams. The enforcement of local wastewater regulations and escalating sewage charges has called for action in the food processing industry. Organic and inorganic waste disposal raises landfill and land contamination issues, and companies can opt to reduce and reuse waste.

The significant proportion of international distribution and transportation of processed food products indicates the need to green this sector. Emissions from logistics from inbound to outbound transportation, such as air and sea freight can remain extremely high if operations are not improved.

Separately, a major issue of palm oil production is environmental degradation. For economic benefit, many native forests are cut down to make space for growing oil palm. This is mostly done through burning, which emits substantial amount of GHG.

2.2. Potential Options

Based on the identified areas and analysing options pursued by leading corporations in the industry, this guideline suggests the following measures to be implemented in order to mitigate the environmental issues from this sector.

Areas of Intervention	Options	
Warehousing & Operations	Facility Efficiency 1. HVAC Efficiency 2. Lighting Efficiency 3. Measurement of Environmental Indicators 4. Improving energy efficiency in warehouse operations 5. Improve refrigeration efficiency 6. Improve steam generation and distribution efficiency	
Waste	Wastewater	• Wastewater Management
	Organic	• Reduce organic waste
	Inorganic	• Reduce packaging waste
Transportation, Distribution & Logistics	• Increasing Utilization of AFVs • Modal Shift	
Deforestation	• Increasing production without expansion	

Table 2: Potential options for the industry (EY Analysis)

3. Recommended Action for Strategic Direction and KPIs

For prioritized actions outlined in the previous section, the current section will provide detailed activities for industries to mitigate the identified environmental impacts.

3.1 Facility Efficiency

Improving energy efficiency in manufacturing facilities can play a significant role in minimizing environmental impact considering its contribution to GHG emissions in the industry, accounting for approximately 10% - 35%.

This can be achieved by implementing a range of technologies, from improved heating, ventilation and air-conditioning (HVAC), lighting efficiency, monitoring (enabled by Building Energy Management Systems (BEMS) and Smart Metering) to implementing sustainable building designs.

3.1.1. HVAC Efficiency

Action: Installing efficient HVAC systems

According to Carbon Trust (CarbonTrust, 2002), a 1^{o}C decrease in internal building temperature results in 10%

energy consumption savings which would automatically lead to decrease in GHG emissions. Recommended actions that can improve energy efficiency include (University of Twente, Unilever, 2013):

- Insulation: If some rooms are too hot or too cold, inadequate air sealing or insufficient insulation could be the cause. Cavity wall insulation is used to reduce heat loss by filling the air space with material that inhibits heat transfer. It is often used in doors, which are the primary culprits of air leaks in the building. Adding additional insulation (double-glazing) around the interior of the building and installing air curtains will also contribute to reducing energy usage.

- Infrared Assessment: To identify areas of energy wastage, infrared imaging is a valued tool in identifying problems related to energy loss, inadequate insulation, inefficient HVAC systems, radiant heating, water damage on roofs, and much more. Conducting an infrared inspection on leak tightness and coldness infiltration can detect potential areas for additional insulation. Professional energy auditors can be employed to

carry out this process.

- Heat Recovery Ventilation (HRV): HRV is an energy recovery ventilation system which uses heat exchangers to heat or cool incoming fresh air, recapturing 60%-80% of the conditioned temperatures that would otherwise be lost. Instead of opening a window for ventilation, the HRV system is able to provide fresh air without any heat loss or gain. In climates such as Malaysia with warm, humid weather, HRVs can also remove humidity before it enters the air ducts to keep the interior comfortable and prevent the HVAC system from having to work harder. These products can be purchased from major retailers in Malaysia.

- Alarm for warehouse doors: Alarms of annunciators indicate when doors are open and prevent unwanted heat loss or gain. This simple yet efficient measure has proven to be very cost effective in many cases.

- Green façade and roofs: Vegetation or plant cover on roofs over a water-proof membrane is known to reduce building heating and cooling needs. In

addition, it can retain rainwater for other uses if an efficient drainage system is installed. This measure qualifies for Leadership in Energy and Environmental Design (LEED) points.

Action: Maintaining efficient HVAC systems

Dirt and neglect are the top causes of heating and cooling system inefficiency and failure. It is important to have a qualified technician perform regular maintenance on the HVAC system every year. Maintenance activities include (US EPA, 2009):

- Lubricate moving parts. Electrical devices that lack lubrication can cause friction in motors and increase the amount of electricity consumption. Lack of lubrication can also cause equipment to wear out more quickly, requiring more frequent repairs or replacements.

- Check the condensate drain in the air-conditioner. If plugged, stagnant water in the drain may damage the industrial complex, affect indoor humidity levels, and breed bacteria and mold.

- Inspect, clean, or change the air filter in your

central air conditioner. A contractor can demonstrate how to do this for company maintenance staff to do so on a more regular basis.

- Clean the air-conditioner blower components and coils. Proper airflow over the coils allows your system to run efficiently, reducing energy costs and lengthening equipment lifespan.

- Check the central air conditioner refrigerant charge and adjust it if necessary to ensure it meets manufacturer specifications. Too much or too little refrigerant charge can damage the compressor, reducing the shelf life and increasing costs.

Action: Glazing

Transparent and clear glass panes used in buildings are prone to increase the heat gain inside buildings and hence additional air conditioning (higher capital and operating costs) becomes necessary. Proper selection of glazing properties helps improving energy efficiency in buildings as a good glazing will reduce solar heat gain from both direct and diffuse solar radiation (BSEEP, 2013). Better glazing efficiencies can be achieved by taking into consideration the following key factors (and other considerations as deemed

appropriate for the building)

- Choosing the glazing with appropriate visible light transmission, low solar heat gain coefficient
- Single and double glazing low-E value coatings
- Reduction of glazing area, where possible

Action: Wall insulation

Malaysia has a mild climate with outdoor dry bulb temperatures reaching 26.9^{0}C during day time and 24^{0}C during night time. Heat is both conducted from the outside into the building and as well as from inside of the building to the outside. While the impact of insulation on building energy reduction may not be very significant, the effect on reduction in peak cooling load is certain. A feasibility study on the economics of insulation materials should be done before embarking on the installation of insulation systems (BSEEP, 2013).

Action: Roof Insulation

Energy efficiency brought about by different types of roofs varies for each type, operating hours and the space immediately below the roof. Ideally an insulated roof during

day time to prevent heat gain and non-insulated roof during night time to cool the building would be the most appropriate one for Malaysian climate. However, business needs (office / hospital / warehouse / cold storage), occupant comfort, wind velocity, rains, etc. are the key decisive factors in determining the roof type and materials used. In a simulation study carried out while developing *The Building Energy Efficiency Technical Guideline for Passive Design (2013)* suggests that provision of 25mm of insulation provided maximum incremental savings. Keeping in mind that electricity tariffs in Malaysia are bound to increase with time, businesses need to evaluate the energy consumption, return on investment, business needs of roof insulation and proceed accordingly.

Action: Zoning and Infiltration control

Zoning is the process of positioning air-conditioned spaces in a building in a coherent fashion such that wastage of conditioned air is minimized. In general it is done by locating rooms according to the leakage flow of air-conditioned air from the coldest room will benefit other spaces before it completely escapes out of the building.

Zoning the most air-conditioned areas at the core of the

buildings surrounded by comparatively lesser air-conditioned areas, optimizing window areas, converting glazed areas to opaque, etc. are among the widely practiced techniques to achieve energy efficiency.

Infiltration is the process of out-door air entering the air-conditioned space introducing sensible and latent (moisture) heat into the building, which increases the energy requirements. Sealing cracks in walls, window panes, controlling window/door operation with sensors, door pumps, and air curtains could be adopted to minimize infiltration losses. Please refer to *The Building Energy Efficiency Technical Guideline for Passive Design (2013)* for case studies on various scenarios of simulation conducted for more information on avoiding infiltration losses.

3.1.2. Lighting Efficiency

Action: Daylight harvesting

Malaysia being located close to the equator, with lesser seasonal variation has reliable day light available for about ten hours a day. Natural daylight harvesting is amongst the most efficient method to improve energy efficiency in buildings because diffused light is not much affected by the sun appearing in the sky/hiding behind the clouds. To

achieve better utilization of daylight harvesting, appropriate tropical climate daylight harvesting techniques need to be deployed to gain the optimum benefits.

- Utilizing daylight to combine with artificial lighting is a simple, efficient way to reduce lighting.

- Analyzing the location, layout and orientation of windows (west / east), Incorporating skylights into roofing and utilizing transparent weather-resistant material that can maximize natural light passage is one of the key measures to maximize use of daylight.

- Skylights that can be operated to open and close can additionally lead to savings in energy used for ventilation or cooling.

- Solar heat gain minimization, glare protection, deep daylight penetration, uniform daylight distribution, etc., needs to be investigated thoroughly, and addressed before implementation of a well-designed daylight harvesting system to optimize performance.

Action: Switching to energy-efficiency lighting

In 2010, the British Broadcasting Corporation carried out a quantitative energy analysis and identified solid-state light-emitting plasma (LEP), light-emitting diode (LED) and fluorescent lighting as the most energy-efficient sources without compromising on performance (BBC, 2011).

LED is one of today's most energy-efficient and rapidly-developing lighting technologies. LEDs are "directional" light sources, which mean they emit light in a specific direction unlike traditional light sources which emit light and heat in all directions. For this reason, LED lighting is able to use light and energy more efficiently in many applications. Residential LEDs use at least 75% less energy, and last 25 times longer, than incandescent lighting (US Department of Energy, 2014).

As a cheaper alternative, high efficiency Compact Fluorescent Lighting (CFL) consumes only 25% of the energy of an incandescent bulb and lasts nine times as long, or up to 7 years. (Tufts University, 2014). Aside from its lower cost, CFL bulbs are known to be versatile. They can be applied nearly anywhere where incandescent lights are used, and are particularly suitable for area lighting.

Figure 6: Comparison of Lighting Types

Action: Optimizing lighting performance

Many minor steps can be taken to improve lighting performance. For example, regular cleaning of light bulbs can also improve energy efficiency, as two years' worth of accumulated dust can reduce luminosity by as much as 50% and increase operating costs by 15% (Carbon Trust, 2007).

Utilizing daylight in combination with artificial lighting is another simple yet efficient way to reduce energy costs. Analyzing the location, layout and orientation of windows (west / east) can maximize the natural light passage.

To supplement this, motion sensors can also help to optimize

lighting usage in a facility. Sensors switch off lights when an area is not occupied, and may also dim lights according to the required output (University of Twente, Unilever, 2013).

Action: Installing shades

Shades are primarily used to reduce solar heat gain, widely practiced across the world and Malaysia as well. External shades are being replaced by advancements in glazing technologies and internal shades are still the most economical solution (but with regular maintenance / replacement). Different types of horizontal and vertical shades are utilized; however thermal comfort, brightness control, glares protection, privacy, view out, and durability are the key factors that need to be considered before the installation of shades. Please refer the *Building Energy Efficiency Technical Guideline for Passive Design (2013)* for more information on application of shades, various pros and cons.

Action: Applying for building certifications

Industry associations can play a vital role in providing guidelines and standards on building energy measures. In Malaysia, companies can consider applying for the Green Building Index (GBI), which assesses new and existing

buildings for their environmental performance according to a range of key criteria.

IM has set out in its Green Building Road Map to utilize the GBI as a rating tool for buildings in the region to promote sustainability in the built environment. In July 2013, a luxury condominium in IM, Molek Pine 4, became the second residential project in the country to achieve the highest GBI rating.

Key Performance Index	Objective	Ease of implementation
Energy savings from measures to increase efficiency	Higher	Easy
Cost savings from measures to increase efficiency	Higher	Easy
Amount and % of reduction in carbon emissions in weight	Higher	Moderate
Building certifications (e.g. GBI)	Lower	Moderate

3.1.3. Improving Energy Efficiency in Warehouse Operations

Aside from managing energy consumption in facilities, it is important to optimize efficiency in operations that takes place in warehouses. In this section, this guideline looks extensively at maximizing efficiency in Mechanical Handling Equipment (MHE) as warehouse operation is mainly enabled by MHEs.

Optimizing warehouse layout can reduce distance travelled and energy used by MHE. Also, avoiding peak charging hours for electric forklifts can reduce energy consumption. Utilizing hydrogen fuel cell forklift can be a viable option to reduce electricity use in warehouses, as it requires shorter charging hours and as the battery performance degradation is lower than electric forklifts. Therefore, fuel cell-powered forklifts are more productive and shorter charging hours provide electricity cost savings (Inbound Logistics, 2008).

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Energy savings from MHEs	Higher	Moderate

In this section, this guideline provides measures to reduce energy consumption in facilities and to lower GHG emissions. Areas to target are HVAC and lighting, where most of the energy is consumed.

Facility efficiency is principal to a green economy, and this is acknowledged by both the Malaysian Federal government as well as IM. Malaysia follows the Low Carbon Cities Framework & Assessment System, developed by **the Ministry of Energy, Green Technology and Water (KeTTHA)**, which recommends specific carbon reduction solutions in buildings and infrastructure. Malaysia has also launched the **Green Building Index (GBI)** to rate commercial and residential buildings. Both buyers and builders of green buildings stand to benefit from this scheme. Some of the benefits that businesses could enjoy include:

- Investment Tax Allowance for purchase of Green Technology Equipment
  Businesses could receive tax allowance of up to 100% of qualifying capital expenditure in relation to approved green technology projects or acquisition of green asset

- Income Tax Exemption on the use of Green Technology Services and System
  Businesses could receive tax exemption of up to 100% for a period of 5 years in respect of the use and provision of green technology services and systems

More information on incentives can be found at GBI website, KeTTHA website and Malaysia Budget 2015 speech by YAB Dato' Sri Mohd Najib Tun Abdul Razak. Relevant website links can be found at the end of the manual.

IM aims to be an internationally recognized sustainable metropolis, and has imposed a building rating system alongside GBI for their new developments to identify and monitor building sustainability. Businesses should refer to **IRDA's** Low Carbon Society Blueprint and Actions for a Low Carbon Future that promote adoption of green building designs and features. Some of the benefits that businesses stand to receive from the policies include:

- An adjustment to tax rate on fixed asset tax
- Tax incentives on green development
- Low interest loans for energy-efficient building projects
- Subsidy for adopting photovoltaic power (Iskandar Regional Development Authority, 2014)

More information on incentives available from IRDA can be found at www.irda.com.my.

3.1.4. Improve refrigeration efficiency

Considering the fact that food processing industry is one of the largest users of refrigeration technology and its contribution to energy use, refrigeration efficiency must be enhanced (Carbon Trust, 2012).

Action: Maintaining optimum temperature

Increasing storage temperature from -25^{0}C to -20^{0}C can save 10% to 15% of the refrigeration energy (Carbon Trust, 2012). Keeping an optimum temperature for different product requirement can reduce energy requirement for refrigeration. Actions below will ensure that temperatures are kept at minimum.

Action: Checking for leaks and improve insulation

Bubbles on sight glasses indicate leaks in the system. Although most common areas of leaks are seals, joints and mechanical valves, whole system should regularly be inspected. Failure in managing leaks will lead to environmental costs as more power is needed to keep the temperatures down. Also, ensuring that suction lines and

door seals are adequate can minimize warm air entering and cold air escaping the equipment.

Action: Controlling lighting

Lighting will increase the cooling requirement in the equipment due to heat generated from lighting. Industries should ensure that lights are turned off outside operating hours. Utilizing automatic, built-in censor lighting system will enhance efficiency and minimize cooling requirements.

Action: Minimizing air exchange

Air exchanges can account up to 30% of the total heat load as the cool air escapes and warm air enters (Carbon Trust, 2012). Ice build-up on storeroom walls are indicators of air exchange. Doors should remain closed and strip curtains or self-closing doors can mitigate any loss.

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Energy use from refrigerators	Lower	Moderate
Average temperature in refrigerators	Lower	Easy

Number of inspection carried out per year	Higher	Easy

3.1.5. Improve steam generation and distribution efficiency

Steam supply includes generation from boilers and combined heat and power (CHP) plants, where CHP is a viable option for food processing industry especially in plants which have high heat and power demand for more than 5,000 hours a year (IFC, 2012). Energy use can be reduced from steam supply in boilers in a number of ways outlined by (Neelis, 2008):

Action: Improving process control in boilers

This action aims to monitor optimum oxygen levels in the combustion zone. Using an optimal mixture of CO_2 and oxygen readings, it is possible to optimize fuel and air mixture for combustion, which can enhance energy efficiency.

Action: Improving insulation and regular inspection, maintenance of boilers

These measures ensure that boilers are operating at its peak performance with less power and heat requirements. Energy

saving from insulation is estimated to be approximately between 6% to 26% when installed with heater circuit controls(Neelis, 2008). Without proper maintenance, condensate return systems and burners may get out of adjustment or wear out. Also a poorly maintained boiler can consume up to 10% more energy (Carbon Trust, 2012).

Action: Introducing CHP

CHP is a viable option that can be adopted by food processing industries, as it provides opportunities in utilizing fuel for power generation and capturing heat to produce steam (IFC, 2012). CHP is more energy efficient than conventional power plant as it takes advantages of losses by reutilizing waste heat.

Action: Ensure Efficient Steam Distribution

Efficiency must be enhanced in the process of steam distribution. Installing removable insulation reduces the energy load required for operations. Leaks should be minimized, measured and maintained with regular inspection. This reduces cost as less generated steam is wasted.

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Energy use from steam generation	Lower	Moderate
Improvement in energy use through maintenance	Higher	Moderate
Improvement in energy use from insulation	Higher	Moderate
Monitoring / maintenance frequency	Higher	Easy

To reduce energy consumption from the food processing sector, this guideline has identified refrigeration and heat processing efficiency as the main area for intervention. The key is to continuously monitor and carrying out regular inspection to identify areas of inefficiency. The following section will outline the options to mitigate GHG emissions from the sector.

3.2 Waste

3.2.1 Wastewater Management

One of the most important environmental issues within the food processing industry is wastewater management. Since water is used in almost every process, from food cleaning, sanitizing, peeling, cooking, to cooling, reducing and managing wastewater is a major area of concern and interest.

Action: Reducing wastewater using BOD / COD level

BOD and COD levels are key measurements used to determine water pollution. In order to reduce BOD level in the water stream, effluent load should be reduced and managed to prevent large amount of waste from entering the wastewater. Developing effective effluent load system and constant measurements on BOD/COD level can minimize the risk of water pollution (IFC, 2012). Nestle, a global food processing company, has efficiently monitored and removed more than 90% of COD amount in the water discharged in the past 3 years (Nestle Sustainability Report, 2013).

Wilmar International, a global palm oil manufacturer, monitors and treats all effluent and wastewater before discharging into the natural waterways. Effluent ponds next

to their mills collect wastewater generated by milling activities. The organic materials in the wastewater are then broken down by natural activities of aerobic and anaerobic bacteria. This process eliminates the need to add chemicals before the water is discharged (Wilmar, 2014).

Action: Separating hazardous or toxic contaminants from water

Toxic materials such as pathogens, suspended solids, nitrogen, and phosphorus should be removed and separated before wastewater is discharged into water stream. Separation can be done by advanced wastewater treatment practices such as membrane applications, disinfection, and charge separation (UNIDO, 2012). Membrane application uses semi permeable membranes to separate water from contaminants while disinfection practice uses chlorine to remove pathogens from water. Charge separation separates uncharged clean water molecules from charged contaminants.

Action: Eliminating toxic materials through dry methods

Toxic ingredients can be eliminated by using air classifiers and magnetic separators to remove toxins from wastewater (IFC, 2012). By using dry methods, it is possible to both

reduce cost and minimize treatment time.

Action: Reviewing process lines and operations

Operation lines should be constantly reviewed to identify opportunities to reduce wastewater and minimize water and toxic chemical usage (IFC, 2012). For example, as mentioned above, dry methods can be used to wash raw materials instead of water. By reviewing process lines, it is important to identify areas where contamination of water and consequent treatment can be minimized. Review process can significantly improve cost-saving and reduce time-consuming treatment. Nestle significantly reduced amount of wastewater. In the past decade, Nestle reduced wastewater by 45% due to effort of reusing and minimizing water usage from every level of operations (Nestle Sustainability Report, 2013).

Action: Reducing and reusing water

Dry conveying systems, can reduce the amount of water used during processes that includes air classifiers, magnetic separators and screening devices, for materials with low moisture content (IFC, 2012). Utilizing automatic valves, high water pressure and counter current washing techniques for primary washing can also contribute in reducing water

usage, which in turn can reduce wastewater. Use of recycled water from processes such as washing primary product, can be used for processes such as general factory wash or materials that does not compromise in food safety.

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Amount of water used during processing	Lower	Moderate
Amount of water discharged	Lower	Moderate
Amount of water reused for other processes	Higher	Moderate

3.2.2 Reduce Organic Waste

Food processing not only requires significant amount of energy but also produces large amount of organic waste such as rinds, seeds, skin, and bones from processing operations of raw material. Proper disposal is mandated as such waste can be hazardous to both environment and company's sustainability. With high potential markets for resale of by-products and waste, following actions may be

taken to reduce and properly dispose organic waste (UNIDO, 2012).

Action: Using organic waste as animal feed

The use of waste from food processing in animal feed is becoming one of the popular ways to reduce organic waste. This can firstly be implemented by creating an effective recycling process that separates harmful ingredients and inorganic waste (such as packaging raw materials) from the Us Food and Drugs Administration (FDA) approved and edible organic waste produced from processing raw materials, generally fruit and vegetables. Secondly, after separation, the recycled organic waste may require additional processing in order to be used by farms and other institutions (FDA, 2013). Reducing organic waste as animal feed is a popular option to major food-processing giants including Kraft Foods, and General Mills. Kraft Foods' three Canadian plants achieved zero-waste-to landfill target through reusing organic waste as animal feed (Kraft Foods, 2013).

Action: Composting organic waste

With proper management, organic waste can be kept out of the landfill and instead be composted and added to the soil for nutritional benefit. This is a widely accepted disposal

process because of its low capital investment requirement (ILO, 2011). Organic components are decomposed under controlled condition to maintain the necessary nutrition while removing unnecessary components. Wide variety of fruit, vegetable, and gelatin waste can be composted to reduce organic waste that would otherwise be disposed into landfill. Composting is adopted by global leaders in food processing industry.

Action: Fermenting organic waste

Combination of starch, other organic waste, and alcohol substances can produce eco-friendly energy substances (ILO, 2011). This is often known as a fermentation process, and can be undertaken either directly by the food company or outsourced to other companies. For example, biomass, agricultural waste from corn, can be fermented into ethanol. Potato waste can be used to produce methane while corn starch can be transformed into biodegradable plastic that is used for packaging.

Action: Monitoring storage process

Effective storage system can reduce the amount of loss of raw material that can ultimately generate organic waste (IFC, 2012). Refrigeration system (which is discussed further in

chapter 3-4) and inventory management plays an important role in storage process and should be performed by well trained personnel to minimize potential loss of raw material. Focusing on efficient storage process, General Mills reduced solid waste generation rate by 42% according to its CSR report (General Mills , 2013).

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Amount of organic waste produced	Low	Moderate
Amount of organic waste disposed	Low	Moderate
Amount of organic waste recycled for other processes	High	Moderate

3.2.3. Reduce Package Waste

Packaging initiatives aims to reduce the amount of packaging used for each product, remove hazardous materials from the packaging, and make packaging easy to recycle. The actions outlined in this section will comprise of

reducing volume, weight and recycling. Packaging in food processing industry plays a vital role as all products must be protected from shock, vibration, compression, temperature, oxygen, vapor etc. Innovating packaging not only can reduce environmental impact but also bring cost reduction from enhancing logistics efficiency though lighter weight and reduced volume.

Action: Light-weighting and reducing volume

There are a variety of estimates available on the weight of consumer packaging, which is typically put at around 5% of the total weight of consumer goods shipments (WEF, 2009). Reducing weight and volume directly reduces energy used for transport and can lead to direct cost savings from higher load factor (more shipments per container) and lower shipment costs when charged by weight (in case of air freight).

Action: Using recyclable packaging material

Paper, aluminum, cardboard and plastics are recyclable packaging materials that reduce waste going to landfills. Developing eco-friendly vinyl packaging materials which are biodegradable can also contribute in reducing landfills.

Packaging measures offers both environmental and direct cost savings. Through research and development initiatives, innovations in packaging must be pursued considering its benefits.

Kraft Foods has developed YES (Yield, Ease, Sustainability) pack to reduce waste and conserve resources with the flexible yet durable packaging for dressings (Kraft Foods, 2014). The YES pack replaces bulky rigid jars to film substance and uses 50% less energy for assembly, 50% less landfill space, uses 60% less plastic, 70% lower emissions from reduced weight and volume 99% of the yield.

Nestle has launched a packaging eco-design program, *EcoDEX* (Eco design for Sustainable Product Development and Introduction) which aims to reduce impacts throughout the value chain. In 2012, Nestle has succeeded in using 100% recyclable Forest Stewardship Council-certified cardboard in their Easter eggs. Since 2006 to 2012, the weight of packaging for Nestlé medium and small eggs has reduced by 50% and 35% respectively (Nestle Sustainability Report, 2013).

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Initiatives for sustainable packaging	High	Easy
Use of reusable, recyclable material	High	Easy
Percentage of packaging recycled / reduced	High	Easy
Weight / volume reduced for each packaging	High	Easy

Efficient packaging measures offer both environmental and direct cost savings. Through research and development initiatives, innovations in packaging must be pursued considering its benefits. Malaysia has a National Strategic Plan for Solid Waste Management that emphasizes the 3R's- Reduce, Reuse and Recycle and can be found on the Ministry of Housing and Local Government's webpage, www.kpkt.com.my. The Government of Malaysia seeks to transform the recycling industry into a remanufacturing industry, especially the automotive industry, to improve the

life cycle of products and materials. IM plans to revolutionize the logistics industry by providing competitive supply chain management facilities and services for cost-effective and sustainable goods and service distribution. Companies can take advantage of this emphasis on remanufacturing and use Malaysian remanufactured products for their operations.

3.2.4. Waste-to-energy production

Action: Anaerobic digestion of organic waste

Anaerobic digestion (AD) is a process of breaking down complex organic matter such as carbohydrates, cellulose and fats, usually found in food or agricultural products, into simple compounds in the absence of oxygen. One of the by-products of an AD process includes biogas which can be utilized to generate power.

Organic wastes from the F&A industry can be used to generate energy, substituting fossil fuel-derived thermal energy. This reduces GHG emissions from the burning of fossil fuels and reduces reliance on a single energy source.

Generally, food waste consists of 30% solids with 88% of volatile solids of the total solids content. Each kilogram of volatile solids can theoretically produce 0.9 cubic meter of biogas. This amounts to around 240 cubic meters of biogas

per tonne of food waste (one cubic meter of biogas is equivalent to 1 litre of diesel fuel (Swedish Gas Center, 2012)). Of the total biogas volume, it is reasonable to assume a 60% energy-generating methane content, which has a heat generating value of 10.5 kWh per cubic meter (Moriarty, 2013). Assuming these literature values, one tonne of food waste could generate 2,520 kWh of heat.

Moreover, in the agriculture setting, oil palm plantation in particular, 70% of waste generated in a Crude Palm Oil mill is empty fruit bunches and Liquid Palm Oil Mill Effluent (POME) (Roundtable on Sustainable Palm Oil, 2014). EFB has potential to become an important source of inputs for organic compost fertilizer. Existing technologies allow these wastes be processed and converted to be sold to the free market. In a conventional Palm Oil mill, 600-700 kg of POME is generated for every ton of processed fresh fruit bunch. The untreated POME causes severe pollution of water waste due to oxygen depletion and other related effects. AD is widely adopted in the industry as a primary treatment for POME. Liquid effluents from palm oil mills can be anaerobically converted into biogas which in turn can be used to generate power through gas turbines or gas-fired engines.

Lafarge Malayan Cement Bhd has developed a project using palm oil kernel shell biomass, a waste product of the palm oil industry, and other waste byproducts to generate energy that replaces fossil fuel-derived energy. PKS now accounts for over 5% of energy consumption in the company's manufacturing operations, and has reduced CO_2 emissions by 60,000 tonnes per year (Lafarge, 2014).

Three types of waste created by food processing industry can be mitigated by the actions outlined in this section. The following section will consider reducing energy use from the industry and the potential options for the food processing industries.

3.3 Transportation, Distribution and Logistics

3.3.1. Increasing Utilization of AFVs

Increasing utilization rate of Alternative Fuel Vehicles (AFV) can mitigate the GHG impacts and pose direct cost fuel cost savings in the sector.

According to UPS, Liquefied Natural Gas (LNG) is one of the most promising alternatives to conventional diesel-powered trucks for long-haul (UPS, 2012). LNG vehicles offer fuel costs almost half those of traditional diesel vehicles, with lower emissions and are becoming more affordable as more of them are manufactured (UPS, 2012). The current market for LNG vehicle is mature and is commercialized (Table 3) (Intelligent Energy Europe, 2010). Therefore, industries should consider investing in LNG vehicles considering its market status and clear economic incentive.

Two types of AFV's in common usage: gas-based systems (LNG/LPG/CNG) and hybrid vehicles. These types of vehicles leverage existing technologies and infrastructure, and (particularly for gas-based vehicles) have an extensive history of development. Second generation biofuels represent an alternative fuel, rather than vehicle type, which

would integrate easily with existing vehicles and infrastructure: however, the technology to efficiently produce second-generation biofuels remains in development. Electric and hydrogen fuel cell vehicles represent a significant departure from existing vehicle technologies, and are being rapidly commercialized. Cost, range and infrastructure currently limits uptake; however, companies should monitor progress in these areas as the technologies are under further development to maximize fleet efficiency.

Consideration should also be given to the specific transportation and regional infrastructure (availability of refueling infrastructure) when determining the viability of AFV's. Companies should evaluate different fuel/technology options available and choose the most appropriate option for their operations.

Type of AFV	Innovation Type	Current Status	Barriers
Liquefied Petroleum Gas; Natural Gas (CNG, LNG)	Incremental	Mass commercialization	Infrastructure
2nd Generation Biofuels	Incremental	Demonstration	Fuel supply
Hybrid	Incremental	Mass-	Cost of

Vehicles		commercialization	battery
Electric Vehicles	Radical	Pre-commercialization	Range Infrastructure
Hydrogen Fuel Cell Vehicles	Radical	Pre-commercialization	Vehicle cost Infrastructure

Table 3: Market maturity of different types of AFVs (Intelligent Energy Europe, 2010)

Action: Increasing LNG vehicle utilization

As an alternative fuel source, the LNG technology has a number of attractive advantages for the logistics sector. Fuel is generally at a lower cost and is widely available; the technology is a proven alternative for long-haul diesel trucks, and current market for LNG vehicle technology is mature and commercialized (Table 3). In some markets, government has played a role in facilitating the uptake of this technology, through reducing fuel excise duties on alternative fuel, improving infrastructure (charging station and network) or subsidizing AFV purchases (South Korea subsidizes electric vehicle purchase up to 40% of the value of the vehicle).

Action: Operating electric light duty vehicles (LDV)

The market for electric-powered vehicle is relatively mature, where only charging infrastructure and range are the main limitations. Electric LDVs are especially well suited for the stop-and-go of pick-up of passengers and delivery operations. With regards to the range issue of electric vehicles, operating LDVs within regional-boundary is a viable option.

Action: Implementing technological innovations

Technological improvements can be a cost-effective approach to promote efficiency and comprises measures such as aerodynamics improvement, eco-chip tuning, speed limiting, additives and telematics systems. For instance, extending the allowable trailer length from 28' to 33' when used in a twin-trailer configuration allows 18% more freight to be hauled on the same trip, maximizing load factor (FedEx, 2013).

Moreover, Panasonic uses technology to transform cooking oil into biodiesel fuel and utilizes it for vehicles involved in the production, procurement and marketing activities. In Tokyo, 100% of vehicles run on biodiesel. Toshiba is increasing its proportion of AFVs in fleet, and reduced CO_2

emissions by 550,302 pounds using a mix of hybrid and fuel-efficient vehicles.

Key Performance Index

Key Performance Index	Objective	Ease of Implementation
CO_2 Emission / distance travelled (CO_2 / t / km)	Lower	Moderate
Proportion of AFV / hybrid in fleet	Higher	Easy
Average distance covered by AFV / hybrid vehicles	Higher	Easy
Utilization rate of AFVs	Higher	Easy

This section on increasing utilization of AFVs and technological improvements in the vehicles provide a significant opportunity. However, external factors, including technological maturity, barriers to implementation and government support and regulation, should be carefully assessed before adoption, especially in the case of AFVs.

At the federal level, Malaysia has introduced incentives in its National Automotive Policy (NAP) to increase the use of hybrid and electric vehicles, such as tax exemptions for AFVs

and development of infrastructure to support a green-fuelled automotive industry. This forms part of the Malaysia Automotive Technology Roadmap (MATR), an action plan to meet the objectives of National Automotive Plan 2014 by supporting industries and businesses with renewable energy technological investment and adoption.

IRDA also plans to support MATR by promoting renewable energy-fuelled transportation within its region. These incentives for Malaysia's hybrid and electric vehicles extend to the IM region and allow better management of the sustainability of transport operations within IM. Businesses and stakeholders should use these action plans as a guideline to reducing carbon emissions from transportation, thus working towards achieving IM's and Malaysia's green transportation goals. IM looks to develop green transport infrastructure as well as energy-efficient and renewable energy transport. Using these alternatives can not only reduce carbon emissions, but can also offer cost savings.

More information on incentives available to businesses can be found at www.irda.com.my. and www.kettha.gov.my.

3.3.2. Modal shift

Companies must focus on utilizing the most fuel-efficient mode of transport or combination of modes to reduce GHG emissions, considering emission intensities of different modes of transport. GHG emissions, when expressed in in terms of emissions per tonne-km (WEF, 2011), shipping is the most efficient transport mode, in the region of 1% to 2% of those of airfreight per tonne-km. Therefore, optimizing mode of transport, especially switching:

- from Intercontinental air to ocean freight;
- from short haul air to road transport;
- from long distance road freight to rail or waterways

can be an option for food processing industry to maximize their efficiency in logistics.

Nestle is reducing their GHG emissions by shifting long distance road transportation to a combination of rail and short sea shipping (Nestle Sustainability Report, 2013). *Nespresso* utilizes mainly rail and rail-road transport for its distribution to regional retailers within Europe, especially, deliveries to Switzerland and Sweden are 100% by rail. At the end of 2013, they have reduced 13% of emissions in

Europe which are related to *Nespresso*. *Nestle Waters* are also distributed primarily by rail, with up to 40% in volume for *San Pellegrino* and 38% for *Vittel*.

Action: Increasing efficiency during modal transfers. Containerization, standardizing sizes and features can reduce intermodal transfer times and increase cost efficiency and fuel efficiency. Also, Automated Transfer Management System (ATMS) can streamline inter modal transfer processes and maximize efficiency in connection platforms. ATMS is "an active parking stall, a mini-crane, that can elevate, lower, store and position the container for the truck carrier or crane to lift, designed to position and transfer a container between or among modes." (NREL, 2013). ATMS applications include: Trackside at rail terminals; Vessel loading / unloading; Chassis flips; Port stack container yards; Chassis storage; Loading bays at distribution centers.

Key Performance Index

Key Performance Index		Objective	Ease of Implementation
Intermodal transfers:	Proportion of Intercontinental air to ocean freight	Lower	Easy
	Proportion of short	Lower	Easy

	haul air to road transport		
	Proportion of long distance road freight to rail or waterways	Lower	Easy
Improving efficiency during intermodal transfers:	Average idle time for stand-by for loading and unloading between inter-modal transfers	Lower	Easy
	Average time taken for loading and unload between inter-modal transfers	Lower	Easy
	Distance over which a container is handled within a terminal.	Lower	Easy
	In-terminal time of trucks delivering and picking up containers.	Lower	Easy
	Time from inbound arrival to outbound departure	Lower	Easy
	Decrease in fuel consumption enabled by reduced idling time	Higher	Moderate
	Reduction in GHG emissions enabled by reduced idling time	Higher	Difficult

To establish itself as a global logistics hub, IM seeks to introduce a comprehensive and effective logistics system by

designing a cost- and energy-efficient transport network to facilitate movement of people, goods and services. By creating a clear system of truck routes, terminals and building logistics centers for easy management and distribution of products, IM encourages competition and trade in its region which is key to economic growth. Stakeholders and partners can add to IM's efforts by improving their strategies for distribution, which can also maximize time and cost.

Switching to less GHG intensive mode of transport and improving efficiency during modal shift outlay opportunities for the food processing industry. A careful analysis of potential switches should be identified internally.

3.4. Water Management

Water availability is increasingly becoming a global issue. The United Nations Environment Program has identified water shortage as one of two major environmental issues that the globe is facing today (Monash University Malaysia, 2014). Water-rich Malaysia, too, is not impervious to this impact of climate change on water security. The *New Straits Times* has reported that the Klang Valley water rationing in June 2014 has affected 3 million consumers. This incident is

not localized either; other areas, such as Gombak, Kuala Lumpur and Petaling, were faced with the same predicament.

As it is, Malaysia registers as one of the high water consuming populations in the region. At an individual level, *Business Insider Malaysia* has estimated that Malaysians use 226 litres per person per day. This is significantly higher than Singaporeans, who register 154 litres per person per day, and Thais, who register 90 litres per person per day. Malaysians need to reduce their water intensity level by 37% to achieve the recommended 165 litres per person per day. One of the reasons to explain this water intensity level is the low to free water tariffs that create a wasteful habit. This habit could translate into increased wastages in work environment as well. Not only do businesses suffer from paying additional costs, the sheer

Businesses should play key role in conserving water because water scarcity directly affects their operations. During Malaysia's water crisis in early 2014, *Bloomberg* has reported that Malaysia's Top Glove Corporation had expected a cost increase as much as 10 times due to water shortages. *Bloomberg* has also found that another electrical products company in Malaysia had lost a RM40 million order due to uncertainty in water supplies.

volume of water consumed by industries exponentially worsen the situation, leading to accelerated water scarcity.

Action: Re-using greywater for flushing and irrigation

Greywater systems recycle water by collecting water that has been used for one purpose, and then using it for another, thus reducing the amount of fresh water required, and therefore reduces the volume of wastewater produced

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Water intensity	Lower	Easy
Utilisation of greywater	Higher	Moderate

3.5. Deforestation

Forests and natural peat lands found in tropical regions are extremely valuable in carbon sequestration, which stores carbon and reduces carbon emissions. However, oil palm production has led to the expansion of oil palm plantations in order to obtain maximum monetary benefit. This is a huge environmental detriment as more carbon is emitted when

peat lands and forests are burnt to make space for oil palm plantations. Since carbon emissions are direct indicator of the environmental impact of an industry, there is a palpable need to green the palm oil industry.

Action: Increasing production without expansion

Expansion of palm oil plantations directly contributes to carbon emissions and habitat destruction. To develop sustainably, palm oil producers should look into intensify yield per unit space. Best Management Practices such as a shorter harvesting interval and allowing for crop recovery can increase yield of palm oil over time. (Donough, Witt, & Fairhurst, 2009) Using physical methods such as pruning strategies, fertilizer and biodegradable pesticides can increase production yields (Gnych).

Action: Certifying Sustainable Palm Oil

Manufacturers of refined palm oil and palm oil derivatives can contribute to a sustainable supply chain by looking for Certified Sustainable Palm Oil (CSPO). Palm oil can be certified sustainably sourced by certification bodies such as the Roundtable on Sustainable Palm Oil (RSPO) or (MSPO). This creates Malaysian Sustainable Palm Oil consumer awareness on sustainable palm oil and increases

transparency of supply chains, hence encouraging sustainable palm oil production.

Key Performance Index

Key Performance Index	Objectives	Ease of Implementation
Increasing production intensity	Higher	Easy
Certifying sustainable palm oil	Higher	Easy

As the world's second largest exporter of palm oil and palm oil products, Malaysia plays an important role in satisfying the growing global need for oil and fats sustainably (MPOC, 2013). Malaysia is an advocate of sustainable palm oil and has limited expansion of palm oil plantations. The Malaysian palm oil industry is also participating in RSPO discussions. Palm oil companies can work with the Malaysian Palm Oil Council to ensure sustainable operations.

3.6. Monitoring & Reporting

Action: Development/Adoption of green technologies

The information and communications technology (ICT)-enabling effect involves the introduction or improvement of ICT to reduce environmental impact and/or greenhouse gas emissions. For instance, the development of video conferencing has reduced the need for corporate air travel as meetings can be done through video conferences. An analysis by Global e-Sustainability Initiative found that ICT is crucial to mitigating climate change and could enable emissions reductions of 7.8Gt CO_2e, or 15% of GHG emissions (GeSI, 2008). Adopting and developing ICT can help with environmental initiatives and cutting costs.

Action: Create a "carbon budget" during monthly/annual strategic meetings

Companies can create a carbon budget to ensure that they meet carbon emissions targets. This sets a goal for their employees as well as discloses the company's interest in reducing emissions. A detailed carbon budget comes with a clear emissions reduction plan for the long-term which can provide direction/guidelines for staff. A carbon budget sets short-term emissions goals and allows for frequent

monitoring and review compared to an emissions target over a period (Gilbert & Reece, 2006).

Action: Measuring and monitoring environmental indicators

BEMS is a computer-controlled automation system which aims to create the safest, most comfortable environment possible at the lowest possible cost. On average, BEMS save about 10% of overall annual building energy consumption, and more than half of all buildings in the U.S. larger than 100,000 square feet have one (Brambley, 2005). This is achieved through:

- Building system automation: This can be done according to time, type of day, or environmental conditions. For example, BEMS can control lighting to avoid unnecessary use of energy outside normal working hours or when ambient daylight levels are adequate (Sustainable Energy Authority of Ireland, 2014).

- Provide energy monitoring and management information. BEMS provides users with easily available data on energy flows, consumption, trends and overall building performance. Companies such as Siemens even have professionals at their

operations center to evaluate the data collected and create comprehensive reports to identify ways to improve energy usage and achieve additional savings.

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Number of records of energy consumption	Higher	Moderate

3.7. Educating and Training Employees

Employees are the drivers of businesses on the ground. A well-intentioned environmental strategy from the management without the support of the employees to implement it correctly would subvert the effectiveness of the strategy. Similarly, eco-friendly equipment in the hands of an untrained employee will be ineffective. Hence, it is essential to have an educated and trained workforce that shares the management's concerns and ambitions to build a green and sustainable business.

Businesses should embark on strategic programs and initiatives to build on their capacity for improving

environmental performance. Activities to educate and train the company's employees on environmental issues, such as climate change, could motivate employees to be more involved and committed to greening the company and thereby contributing to green economy in IM. For example, an understanding of the deleterious health effects of GHG enables employees to support the management's goal to reduce GHG emissions. Employees could become more dedicated and actively participate in sustainable development activities realizing that their welfare is directly affected by such emissions.

It is essential for employees to be made aware that they too have an impact on the environment. Firms could introduce a system that reveals to employees their impact on the environment. For instance, Woh Hup Pte Ltd in Singapore has implemented an environmental management system that monitors on a daily basis the energy, water and generated by the company. These figures are on display in prominently visible areas, such as lift lobbies and pantries, so that employees are reminded of their daily environmental footprint. Individual electric meters were also issued to staff to monitor personal electrical consumption per day. In this manner, employees could relate to their environmental performance, monitoring in real time the impact of their

consumption or savings.

Employees could also participate in seminars and conferences as a way for sharing and learning opportunities. For instance, Universiti Utara Malaysia organized the International Conference on Management and Business Sustainability in 18-19 August 2014 that aimed to facilitate exchange of ideas to attain sustainability through business transformation (Universiti Utara Malaysia, 2014). Alternatively, business owners could conduct in-house training with the assistance of IRDA's environment team or other experts such as the Malaysian Green Technology Corporation to customize training specifically to business operations.

Ultimately, businesses should aim to have a workforce educated and trained in sustainability topics as a matter of business strategy. With adequate awareness and training, employees would be better equipped to contribute to developing successful solutions. Finally, businesses are the beneficiaries of the cost-savings and subsequent profits generated by such an environmentally-conscious workforce.

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Number of hours of sustainability training per employee	Higher	Easy
Number of training sessions organized by company	Higher	Easy

3.8. Compliance to Local Regulations

As a commercial entity present in Malaysia, businesses should as a first and essential requirement abide by the rules and regulations of the country. Compliance to regulations is a non-negotiable requirement before businesses can fully benefit from this guideline to further improve on the sustainability and green initiatives of business operations.

Malaysia has numerous prevailing national standards and also international standards that businesses are encouraged to adopt. Compliance to authorized standards acknowledged by the Malaysian government is complementary to the recommended actions proposed in this manual. Some

examples of recommended standards that businesses are encouraged to comply with are the MS1525, ISO14001, ISO18001 and ISO50001. In addition, businesses can also look to have their products certified MyHijau and disclose their GHG emissions performance through MYCarbon reporting.

The MS1525 is a code of practice pertaining to energy efficiency and use of renewable energy for non-residential buildings. Developed by the Department of Standards, Malaysia, this code primarily focuses on energy efficiency in buildings. In general, the code distinguishes between passive measures and active measures that building owners could adopt. Passive measures consist of recommendations relating to architectural and passive design strategies and the building envelope. Active measures correspond with lighting, power and distribution, air conditioning and mechanical ventilation and energy management systems. The adoption of the recommendations in MS1525 would help businesses to eventually reduce energy consumption and minimize use of non-renewable energy sources while maintaining a safe, healthy and comfortable environment for building occupants.

Businesses may also adopt the international standards from

the International Standard Organization (ISO) as an alternative to the Malaysian Standards. The ISO is not only an independent non-governmental membership organization; it is also the world's largest voluntary developer of international standards, covering more than 19,500 standards across all industries. Common ISO standards that businesses adopt are the ISO 14000 (environmental management), ISO 18000 (occupational health and safety) and ISO 50001 (energy management system). This manual encourages business to consult and consider the ISO standards in addition to the Malaysian Standards.

Moreover, businesses with green features built into their products can look to be certified under MyHijau for enhanced consumer confidence and to demonstrate their commitment to sustainable development. The MyHijau Mark is an internationally-recognized environmental and ecological label. Products labelled MyHijau can be featured in the MyHijau directory which helps businesses to promote their environmentally-friendly goods (Malaysia Green Technology Corporation, 2013).

Businesses could also seek disclose their GHG emissions performance through MYCarbon. The Ministry of Natural Resources and Environment (NRE) Malaysia has instituted

the MYCarbon Programme, which acts as the National Corporate GHG Reporting Programme for Malaysia. The advantage of engaging in a reporting exercise includes creating the awareness in business owners of the importance of measuring and reporting on emissions. This could also eventually lead to efforts put into management of the measureables, such as GHG emissions or energy use, creating better products, services and operations.

3.9. Case Study

3.8.1. Nestle (Nestle Sustainability Report, 2013)

Nestle is a Swiss food and agroprocessing company headquartered in Switzerland with offices worldwide. As the largest food company in the world, Nestle recognizes the importance of creating shared value amongst their consumers, stakeholders and the society as a whole. In terms of environmental impacts, this is done by focusing on a few key areas:

- Product life cycle
- Resource efficiency
- Environmental impact of products
- Climate change leadership
- Water
- Responsible procurement

Nestle analyzes its products with life cycle analysis, assessing their products' from raw material extraction, manufacturing, packaging, transport, information and dialogue, consumption to waste and recovery. At each stage of production, Nestle investigates and evaluates more sustainable practices, such as working with sustainable

farming and agricultural initiatives to obtain environmentally and socially responsible raw food products and optimizing transport networks and route planning.

Nestle also plans to improve resource efficiency by using less to produce more. Nestle has disclosed its objectives to achieve zero waste disposal in 10% of their factories as well as 25% reduction in energy consumption in all factories by 2015. It has also implemented the Nestle *Environmental Management System* to continually improve the management cycle.

Environmental impacts of all products from Nestle's 12 product categories are also analyzed. Nestle has extended its *EcoDEX* ecodesign tool to all research and development locations to develop and improve products that can be more energy- and resource-efficient. Environmental performance of a product starts with good ecodesign, thus Nestle emphasizes a clear analysis of environmental life-cycle impacts.

Nestle being a global leader in the food industry acknowledges its influence and its commitment to climate change leadership that not only focuses on GHG emissions but on other environmental aspects such as water and waste. For instance, Nestle strives to reduce its water consumption

Image 2: Agrivair employee visiting farmers near Vittel, France to discuss farming methods that avoids polluting ground water (Nestle Sustainability Report, 2013)

by reducing direct water withdrawals from the manufacture of products as well as engage suppliers to farm using less water-intensive methods and using drought-resistant crops.

In this way, Nestle is committed to developing its business such that natural resources are not depleted. Currently, 30% of all Nestle products have been assessed by the Responsible Sourcing Guidelines and are compliant, while non-compliant products have plans for improvement in place.

For its efforts, Nestle has been recognized by Dow Jones Sustainability Index 2013 as the Best Performer in the food sector group and the Best Performer in all sectors combined in the CDP Climate Disclosure Leadership Index and Climate Performance Leadership Index in 2013.

3.8.2. Felda Global Ventures (Felda Global Ventures, 2014)

Felda Global Ventures (FGV) and agri-business based in Malaysia with operations across 4 continents in North America, Europe, Asia and Australia. FGV is the third largest oil palm plantation operator in the world and focuses on the whole supply chain of palm oil and rubber, as well as sugar manufacturing and downstream activities in the oleo-chemicals sector.

As a global agribusiness, FGV recognizes its influence and has become a world leader in agricultural sustainability. FGV has a framework in place to ensure environmental sustainability, which includes:

- Laying Sustainable Groundwork
- RSPO
- Advancing agriculture through R&D
- Utilizing innovative biocontrols
- Generating power from waste
- Harnessing the benefits of livestocks

FGV ensures that the entire agricultural process is sustainable, by placing measures to ensure soil health and productivity. Decomposed plants are used as natural fertilizers, to preserve the organic content of the soil environment. This also recycles waste material from the process of palm oil manufacture. Nutritional content of the soil is also fixed by the introduction of leguminous cover crops, reducing the need for inorganic nitrogen fertilizer as well as preventing the use of weed killer in FGV's products.

Image 3: Deforestation is a major contribution to climate change (Source: Creative Commons)

Deforestation for palm oil plantation expansion is a big issue in the palm oil industry, and FGV has restricted plantation expansion by deforestation. FGV has not cleared any rainforest in Malaysia since 1996, and has addressed concerns of soil degradation and erosion by terracing sloped terrains.

Currently, FGV produces 10% of the world's palm oil, and is focused to maintain complete RSPO certification in every palm oil estate and oil mill. It targets to achieve this by 2017.

FGV's biodiesel facility in Pahang, Malaysia, is also the first facility outside Europe to meet the International Sustainability and Carbon Certification standards, the world's most comprehensive certification for bioliquids.

Due to its commitment to increase productivity without expansion, FGV has an extensive research centre to develop breeds of oil palm with higher yield and higher resistance to diseases and extreme weather conditions. It has also developed biocontrols for significant oil palm pests such as rats and beetles. To reduce the use of pesticides, FGV employs biologically available methods such as introduction of the bat owl to reduce population of rats and pheromone traps for beetles.

To ensure that raw materials are efficiently used, FGV generates power through palm waste materials.POME is treated and methane is captured, and the POME is subsequently used for electricity generation. This offsets the mill's electricity consumption. In the long-term, excess electricity generated will be supplied to the national grid.

Lastly, FGV rears about 30,000 free grazing cattle in its peninsular plantations to increase local livestock production and maximize land use, as well as manure the plantation, control weed and increase biodiversity. FGV also uses

livestock to aid in the fruit picking process, and this reduces dependence and intensity of automated fruit picking methods.

4. Social Responsibility

The promotion of sustainable business practices, respect for labour and human rights and transparency through disclosure are increasingly expected from responsible businesses. Democratic freedoms, ethical behaviour and good governance, the rule of law, property rights and a thriving civil society create fertile conditions for private sector led growth. The absence of such safeguards takes individuals out of markets, reduces innovation, restricts access to opportunity and drives political instability and conflict.

Forbes has reported that human capital is an increasingly scarce resource in a global economy. It is deemed by many experts as the most important segment of a business' value chain. In the war for talent, companies with excellent human rights track record are consistently ranked high on Employer Branding surveys. This helps in attracting and retaining this key resource, contributing to lower rates of staff turnover and higher productivity, and increasing employee motivation.

Businesses should also note that institutional investors, pension funds and equity firms are increasingly taking ethical factors such as human rights into account in their

investment decisions. More than 1,260 signatories with USD 45 trillion Assets under Management have adopted the UN Principles for Responsible Investment (www.unpri.org), including the Harvard University Endowment. This represents an opportunity for businesses to highlight their human rights credentials in an increasingly enlightened and cautious market.

4.1 Human rights, labour standards and ethical behaviour

Respect for human rights is no longer a good to have but a prerogative of every aspiring country. Businesses that neglect human rights are also liable to boycotts, litigations and backlash by increasingly vocal and militant stakeholders. As reported by *Business Insider,* multinational corporations like Nike have been accused of exploiting low cost labour and have faced public pressure to introduce better working conditions and a minimum wage (Nisen, 2013). Businesses cannot ignore the impact that non-governmental organizations, civil society and social media can effect. Instead of being reactive, businesses should anticipate any aspects of their operations that may infringe on human rights and proactively work towards avoidance of such violations.

In line with the principles outlined by the United Nations Global Compact (www.unglobalcompact.org) and the International Labour Organization (www.ilo.org), IRDA fully supports international standards for human rights, enshrined in the charter of Ministry of Human Resources (www.mohr.gov.my).

International labour standards are aimed at promoting opportunities for women and men to obtain decent and productive work, in conditions of freedom, equity, security and dignity. In today's globalized economy, international labour standards are essential components in the international framework for ensuring that the growth of the global economy provides benefits to all.

Malaysia too believes that everyone is entitled to their inalienable rights to invest, live, work, worship and play with dignity and respect. This is in accordance with IRDA's vision of building a "Strong and Sustainable Metropolis of International Standing".

Outlined below are the UN Global Compact principles for businesses to support and enact within their sphere of influence, applying the following 10 core values in areas of human rights, labour standards, the environment and anti-corruption.

Human Rights

- Principle 1: Businesses should support and respect the protection of human rights (enshrined in the Malaysian constitution, please refer to http://www1.umn.edu/humanrts/research/malaysia-constitution.pdf);
- Principle 2: ensure that they are not complicit in human rights abuses across their supply chain.

Labour

- Principle 3: Businesses should uphold the freedom of association and recognise the right of employees to collective bargaining;
- Principle 4: remove all forms of forced and compulsory labour;
- Principle 5: abolish the use of child labour; and
- Principle 6: eliminate all forms of discrimination in hiring and employment practices

Environment

- Principle 7: Businesses should adopt a precautionary approach to environmental issues;
- Principle 8: undertake initiatives to incorporate greater environmental stewardship in its operations; and
- Principle 9: encourage the development and diffusion of environmentally friendly

Anti-Corruption

Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery.

IRDA strongly encourages businesses to consider this important aspect and take an enlightened approach to adopt the framework in everyday business decisions and practices.

Key office holders should come together to formulate a human rights policy for the business to comply with and make it publicly accessible on mediums such as websites or on the annual report. Top management and HR professionals

should take a proactive approach in educating every employee to abide by the values defined in the human rights policy.

4.2 Disclosure Requirements

Sustainability disclosure is the act of communicating organizational performance on financial, environmental, social and governance (ESG) activities. It is practiced by many leading businesses to communicate their ESG progress to stakeholders and lend credibility to their commitments to sustainable development.

Across the globe, more enlightened stakeholders are raising concerns over businesses' non-financial performance and are demanding them to disclose their ESG performance with greater transparency and detail. In certain regions, such sustainability disclosure is a legal requirement. With effect from 31 December 2007, companies listed in Bursa Malaysia are required to include a description of the corporate social responsibility activities or a statement to that effect in their annual reporting (Listing Requirements of Bursa Malaysia Appendix 9C, Part A, Paragraph 29). Bursa Malaysia supports businesses by providing training for companies and offers guidance for sustainability reporting (Sustainable

Stock Exchange Initiative, 2013).

Many businesses are accustomed to file mandatory sustainability disclosures such as annual reports and quarterly 10-Qs or in the form of non-financial reports such as pollutant and emissions reports for those in heavy industries. There are also established voluntary disclosure frameworks such as GRI and the Carbon Disclosure Project which businesses adopt in their corporate social responsibility or sustainability reports. There is also a trend of companies aligning financial and non-financial information in a single integrated report.

For businesses that are in their nascent stage of reporting their ESG impacts, they can get in touch with IRDA to learn more on disclosure requirements and report information on the basic triple bottom line performance. This ensures that the disclosed information is complete, consistent, useful and reliable.

The business expression, "If you can measure it, you can manage it" holds true. The process of developing a sustainability disclosure unlocks opportunities for a business to gain insights into its operations and supply chain, identify and mitigate risks and uncover potential cost savings and

growth. Businesses that regular publish sustainability disclosures are recognised on established indices such as the Dow Jones Sustainability Index and FTSE4Good. Businesses that disclose ESG performance not only receive tangible and intangible benefits as mentioned, but also pave the way for a greener economy in Iskandar.

To achieve a more sustainable food & agro processing sector, we have identified the following indices that businesses should monitor:

- Initiatives and targets for environmental performance;
- Direct and indirect energy consumption
- Energy saved due to conservation and efficiency improvements;
- Initiatives to reduce indirect energy consumption and reductions achieved;
- Total direct and indirect GHG emissions;
- Initiatives to reduce GHG emissions and reductions achieved;
- Initiatives to mitigate environmental impacts of products and services, and extent of impact mitigation;

- Initiatives to improve public awareness on climate change issues

Requirements outlined above are based on the Key Performance Indices indicated in the above sections and aligned with the GRI Indicators.

4.3 Responsible Procurement

Responsible Procurement ensures that business commitment to good corporate responsibility is reflected in how they select and work with suppliers. Responsible businesses encourage other companies that they do business with to meet the standards of ethics, business integrity and environmental practice expected of them. This would include adherence to high standards on Health & Safety, Fair Business Practices, Environmental Protection, Human Rights, and Local Community Development.

Businesses need to develop a model to bring about meaningful change within the supply chain by way of identifying gaps in the suppliers' ethical business practices, and collaborating with them to develop tangible improvements.

Internationally, leading countries have also embarked on sustainable procurement guidelines across their ministries to

ensure that labour rights and environmental concerns are respected. Recognizing the importance of Government Green Procurement (GGP), the Malaysian government has taken initial steps to boost demand for green products and services.

As the long-term action plan laid out for Malaysia intends for GGP to be implemented at all levels of government by 2020, this sets an exemplary model for private sector companies to follow suit and enjoy potential business opportunities.

Common products which companies and organizations have adopted green procurement policies for include recycled paper, renewable energy sources, VOC-free paints and adhesives, etc. Businesses can also cascade their procurement policy to suppliers/contractors to achieve a widespread effect of green procurement.

Leading firms are conducting life cycle assessments to identify materials in their products that may pose significant environmental, health and safety risks. With this information, firms can re-design their products to prevent or mitigate such risks, which forms a logical part of effective supply chain management practices. Companies operating in Iskandar Malaysia could strive to have at least 10% of their

purchases in the initial years, and move towards 100% green procurement in the years to come.

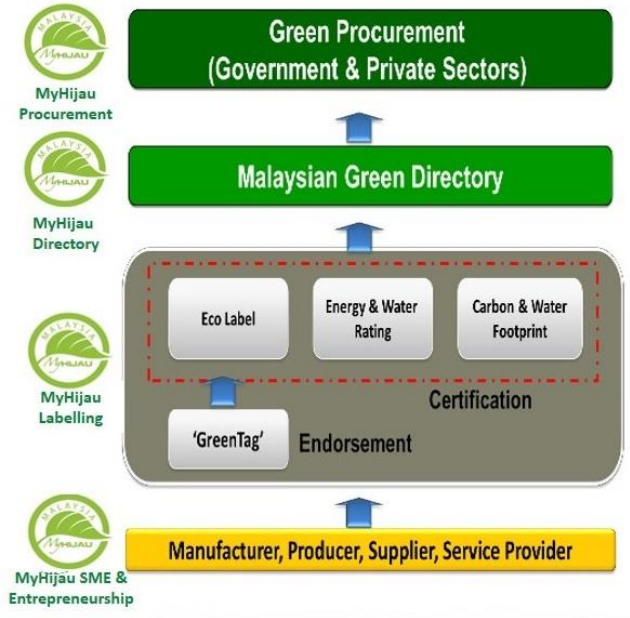

Figure 7: Malaysia Government Green Procurement (Greentech Malaysia, 2013)

A series of case studies that describe how organizations from different countries have approached the verification of social criteria at various stages of the tender process is available at this link: http://www.sustainable-procurement.org/resources/tools-and-guidance/. Each study

looks into how the compliance of direct suppliers is monitored and how this applies to the rest of the supply chain. Procurement professionals and other key stakeholders could learn from the experiences of their counterparts to develop or improve their systems.

Another similar report that provides an overview of responsible procurement in the private sector globally is the *Green Purchasing: The New Growth Frontier* by the International Green Purchasing Network (http://www.igpn.org/DL/Green_Purchasing_The_New_Growth_Frontier.pdf).

The ideas generated and lessons learnt from these cases can provide additional incentives, goals, and tools for other companies to further advance their environmental purchasing policies.

5. Conclusion

This guideline has identified opportunities for food processing industries to reduce waste, energy consumption and GHG emissions. Prioritized actions outlined in Chapter 3 are essential in meeting these identified opportunities and the key performance indicators can guide industries to monitor its progress. With expected growth in the sector, these actions will play an even greater role.

Useful Links

Bursa Malaysia regulations on sustainability disclosures
http://www.bursamalaysia.com/misc/system/assets/5949/regulation_rules_main_market_bm_mainchapter9.pdf

EY Publication on Budget 2014 Malaysia
http://www.ey.com/Publication/vwLUAssets/EY_Take_5_-_3rd_edition/$FILE/EY-take-5-msia-edition-3.pdf

Green Building Index
www.greenbuildingindex.org

Iskandar Regional Development Authority
www.irda.com.my

Low Carbon Cities Framework and Assessment
http://esci-ksp.org/wp/wp-content/uploads/2012/04/Low-Carbon-Cities-Framework-and-Assessment-System.pdf

Low Carbon Society Blueprint
http://2050.nies.go.jp/cop/cop18/SPM_LCS%20Blueprint_Iskandar%20Malaysia.pdf

Ministry of Energy, Green Technology and Water
www.kettha.gov.my

The 2015 Budget Speech
http://www.thestar.com.my/News/Nation/2014/10/10/Budget-2015-full-speech-text/

Key Industry Contacts

Department of Agriculture (DoA)

www.doa.gov.my

Department of Environment (DoE)

www.doe.gov.my

Ministry of Energy, Green Technology and Water (KeTTHA)

www.kettha.gov.my

Land Public Transport Commission (LPTC)

www.lptc.gov.my

Malaysian Industrial Development Authority (MIDA)

www.mida.gov.my

Ministry of Transport (MOT)

www.mot.gov.my

Ministry of International Trade and Industry (MITI)

www.miti.gov.my

Green Economy Guideline Manual

Ministry or Transport (MOT)

www.mot.gov.my

Ministry of Natural Resources and Environment (NRE)

www.nre.gov.my

Malaysian Palm Oil Council

www.mpoc.org.my

Ministry of Plantation Industries & Commodities (KPPK)

www.kppk.gov.my

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www.sirim.my

Bibliography

Ali, M., Saidur, R., Hasanuzzaman, M., & Ward, T. (2012). Energy and emission analysis in the malaysian food industries. *Environmental Progress & Sustainable Energy*.

Audsley. (2009). An assessment of greenhouse gas emissions from the UK food system and the scope for reduction by 2050. How low can we go? WWF UK and the Food Climate Research Network.

Barkan. (2009). Railroad Transportation Energy Efficiency. University of Illinois .

BBC. (2011). Low Energy Lighting Guide for TV Production. BBC, ARUP.

Bersin, J. (2013, December 19). *Forbes*. Retrieved August 28, 2014, from http://www.forbes.com/sites/joshbersin/2013/12/19/ten-predictions-for-talent-leadership-and-hr-technology-in-2014/

BMI. (2014). *Electronics Sector Growth Rate* . Business Monitor International.

BMI. (2014). Global Food Retail Sales data. Business Monitor International.

Boye and Arcand. (2012). Green Technologies in Food Production and Processing. Food Engineering Series, Springer Science and Business Media.

Brambley, M. (2005). Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways. prepared for the U.S. Department of Energy by Pacific Northwest National Laboratory.

BSEEP. (2013). *Building Energy Efficiency Technical Guideline for Passive Design* (1st ed.). Kuala Lumpur: Building Sector Energy Efficiency Project (BSEEP).

Carbon Trust. (2007). Energy Efficiency – Best Practice Programme (EEBPP) – Technology Overview – Lighting – Bright Ideas for . Carbon Trust.

Carbon Trust. (2012). Food and drink processing. Carbon Trust.

CarbonTrust. (2002). Good Practice Guide 319: Managing energy in warehouses. HMSO.

Donough, C., Witt, C., & Fairhurst, T. (2009). Yield Intensification in Oil Palm Plantations through Best Management Practice. *Better Crops, 93*.

EEA. (2010). Final energy consumption by transport modes between 1990-2010 in EU27 (Mega tonnes of oil equivalent). Europe Environmental Agency.

FAO. (2011). *Appropriate Food Packaging Solutions for Developing Countries.* Retrieved from Food and Agriculture Organization of the United Nations: http://www.fao.org/docrep/015/mb061e/mb061e00.pdf

FAO. (2011). *Global Food Losses and Food Waste.* Retrieved from www.fao.org.

FDA. (2013). Recycled Organic Waste as Animal Feed. FDA.

FedEx. (2013). Sustainability Report. FedEx.

Felda Global Ventures. (2014). *Sustainability - Planet*. Retrieved from http://feldaglobal.com/sustainability_planet.php

Food and Agriculture Organization. (2011). *"Energy-Smart" Food for People and Climate*. Retrieved July 21, 2014, from Food and Agriculture Organization of the United Nations: http://www.fao.org/docrep/014/i2454e/i2454e00.pdf

Food Export Association of the Midwest USA. (2011). *Malaysia Country Profile*. Retrieved July 15, 2014, from Food Export Association of the Midwest USA: https://www.foodexport.org/Resources/CountryProfileDetail.cfm?ItemNumber=1029

Food Processing. (2013). *Food Processing's Top 100*. Retrieved 06 15, 2014, from http://www.foodprocessing.com/top100/top-100-2013/

General Mills . (2013). Global Responsibility. General Mills .

GeSI. (2008). *Smart 2020*.

Gilbert, A., & Reece, G. (2006). Developing a carbon budget in the UK with opportunities for EU action. *EcoFYS UK*.

Gnych, S. (n.d.). *Intensification & Land Use Change*. Retrieved from Sustainable Palm Oil Platform: www.sustainablepalmoil.org/growers-millers/growers/increasing-production-and-land-use-change/

Green Building Index. (2009). *Benefits of Going GBI Green*. Retrieved July 13, 2014, from http://www.greenbuildingindex.org/Resources/20091116%20-%20GBI%20Update%20On%20Incentives/20091116%20-%20Benefits%20of%20Going%20GBI%20Green%20Presentation.pdf

Greentech Malaysia. (2013). *Government Green Procurement in Malaysia*. Retrieved September 1, 2014, from http://www.greentechmalaysia.my/content.asp?cmscategoryid=397&zoneid=2#.VARHbPmSwYo

IEA. (2010). Energy Technology Perspectives . IEA.

IEA. (2011). Biofuels for Transport Roadmap. IEA.

IEA. (2012). Fuel Economy of Road Vehicles. IEA.

IFC. (2012). EHS Guidelines, Food and Beverage Processing. IFC.

ILO. (2011). Environmental Protection and Public Health Issues. International Labor Organization.

Inbound Logistics. (2008). *Getting leand and going green* . Retrieved 06 10, 2014, from http://www.inboundlogistics.com/cms/article/getting-lean-and-going-green-innovations-in-warehouse-operations/

Intelligent Energy Europe. (2010). Strategies for the introduction of alternative fuels and automotive technologies. Energy research Centre of the Netherlands (ECN), the Netherlands.

Iskandar Regional Development Authority. (2014, February 28). *5th High Level Seminar on Environmentally Sustainable Cities*. Retrieved July 8, 2014, from http://www.hls-esc.org/documents/5hlsesc/Iskandar.pdf

Kraft Foods. (2013). Sustainability Report. Kraft Foods.

Kraft Foods. (2014). *YES Pack Sustainability*. Retrieved 06 15, 2014, from http://www.kraftyespack.com/full/sustainability.aspx#

Lafarge. (2014). *Environment* . Retrieved from Lafarge-Building better cities: http://www.lafarge.com/wps/portal/2_4_4_1-EnDet?WCM_GLOBAL_CONTEXT=/wps/wcm/connect/Lafarge.com/AllCS/Env/NR/CP1610621385/CSENc

Low, M. L., & Kasmuri, A. (2014, November 30). *IM Biz Watch*. Retrieved August 22, 2014, from Iskandar Malaysia: http://www.iskandarmalaysia.com.my/sites/default/files/IM%20BizWatch%20July%202014.pdf

Malaysia Green Technology Corporation. (2013). *MyHIJAU Mark*. Retrieved August 26, 2014, from http://www.greentechmalaysia.my/content.asp?zoneid=28&articleid=220#.U_xhGfmSwYo

Market Research. (2010). *Malaysia Food & Beverage Industry*. Retrieved from www.marketresearch.com.

MIDA. (2014). *Food Technology and Sustainable Resources*. Retrieved from www.mida.gov.my: http://www.mida.gov.my/home/food-technology-and-sustainable-resources/posts/

Monash University Malaysia. (2014). *Quest to Solve Water Scarcity*. Retrieved August 15, 2014, from http://www.monash.edu.my/news/researchers-say/quest-to-solve-water-scarce

Moriarty, K. (2013, January). *Feasibility Study of Anaerobic Digestion of Food Waste in St. Bernard, Louisiana*. Retrieved August 19, 2014, from National Renewable Energy Laboratory: http://www.nrel.gov/docs/fy13osti/57082.pdf

MPOC. (2013). *Palm Oil and the Environment*. Retrieved from Malaysian Palm Oil Council : www.mpoc.com.my/palm_oil_and_the_environment.aspx

Murray. (2014). *Packaging In The Warehouse*. Retrieved 06 10, 2014, from http://logistics.about.com/od/operationalsupplychain/a/Packaging-In-The-Warehouse.htm

Neelis. (2008). Energy Efficiency Improvement and Cost saving Opportunities for the Petrochemical Industry. Berkeley National Laboratory, USEPA.

Nestle Sustainability Report. (2013). Creating Shared Value. Nestle.

Nisen, M. (2013, May 9). *Business Insider*. Retrieved August 28, 2014, from http://www.businessinsider.com/how-nike-solved-its-sweatshop-problem-2013-5?IR=T&

NREL. (2013). Potential for Energy Efficiency Improvement Beyond the Light-Duty-Vehicle Sector. NREL.

Packaging Federation. (2005). Packaging – a Very Productive Resource. Packaging Federation.

Pepsico. (2012). *Pepsico Sustainability Report 2012*. Retrieved July 21, 2014, from Pepsico: http://www.pepsico.com/Purpose/Performance-with-Purpose/Sustainability-Reporting

Rabindra. (2004). Use of Earth Air Tunnel HVAC system in minimizing indoor air pollution; Air Quality Monitoring and Management. proceedings of Better Air Quality 2004.

Rodrigue. (2012). *The Geography of Transport Systems*. Retrieved 05 12, 2014, from https://people.hofstra.edu/geotrans/eng/ch3en/conc3en/intermodal_transmodal.html

Sustainable Energy Authority of Ireland. (2014, July 13). *Building Energy Management Systems (BEMS)*. Retrieved from http://www.seai.ie/Your_Business/Technology/Buildings/Building_Energy_Management_Systems_BEMS_.html

Sustainable Stock Exchange Initiative. (2013). *Bursa Malaysia (Malaysian Exchange)*. Retrieved August 26, 2014, from http://www.sseinitiative.org/fact-sheet/bursa/

Swedish Gas Center. (2012). *Basic Data on Biogas*. Retrieved August 19, 2014, from Energikontor Sydost: http://eks.standout.se/userfiles/file/BiogasSydost/BioMethaneRegions/BasicDataonBiogas2012-komprimerad.pdf

T5 Lighting USA. (2014). *Benefits*. Retrieved 06 10, 2014, from http://t5lightingusa.com/t5-lighting-benefits/

Tan, C. (2013, December 13). *Johor government plans go big on agriculture and food production over the next five years*. Retrieved July 15, 2014, from The Star Online:

http://www.thestar.com.my/News/Community/2013/12/13/Moving-towards-a-great-industry-Johor-government-plans-go-big-on-agriculture-and-food-production-ove/

Tufts University. (2014). *Bulb Exchange*.

UNIDO. (2011). Green Industry Initiative for Sustainable Development. UNIDO.

UNIDO. (2012). Industrial Solutions for a Sustainable Future. UNIDO.

Universiti Utara Malaysia. (2014). *Universiti Utara Malaysia*. Retrieved August 27, 2014, from http://www.hiccob.uum.edu.my/

University of Twente, Unilever. (2013). Sustainable Warehousing. University of Twente, Unilever.

UPS. (2012). UPS Sustainability Report . UPS.

US Department of Energy. (2014). *LED Lighting*. Retrieved July 13, 2014, from http://energy.gov/energysaver/articles/led-lighting

US EPA. (2007). Energy Trends in Selected Manufacturing Sectors : Opportunities and Challenges for Environmentally Preferable Energy Outcomes. U.S. Environmental Protection Agency.

US EPA. (2009, August). *A Guide to Energy-Efficient Heating and Cooling*. Retrieved July 13, 2014, from http://www.energystar.gov/ia/partners/publications/pubdocs/HeatingCoolingGuide%20FINAL_9-4-09.pdf?7abc-7028

USEPA. (2011). *Alternative Fuel Data Centre*. Retrieved 05 12, 2013, from http://www.afdc.energy.gov/data/

WEF. (2009). Supply Chain Decarbonization. World Economic Forum.

WEF. (2011). *Green is the Future for the Logistics Industry*. Retrieved 05 29, 2014, from www.eulogisticshub.com/blog/2011/03/green-is-the-future-for-the-logistics-industry/

Wilmar. (2014). *Environmental Stewardship - Water Management*. Retrieved from Wilmar International: http://www.wilmar-international.com/sustainability/environmental-stewardship/water-management/

World Bank. (2014). *CO2 emissions from transport (million metric tons)*. Retrieved 06 10, 2014, from http://data.worldbank.org/indicator/EN.CO2.TRAN.MT

World Bank. (2014). *GDP (current US$) | Data | Table - The World Bank*. Retrieved 06 10, 2014, from http://data.worldbank.org/indicator/NY.GDP.MKTP.CD

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About IRDA
The Iskandar Regional Development Authority (IRDA) is a Malaysian Federal Government statutory body tasked with the objective of regulating and driving various stakeholders in both public and private sector towards realizing the vision of developing Iskandar Malaysia into a strong and sustainable metropolis of international standing

The Division provides strategic advice on environmental planning, development and management, carries out research and works in partnership with external agencies to promote a green growth economy for Iskandar Malaysia. In addition, the Division builds capacity, collaborates to integrate Climate Change programmes, statutory requirements related to the environment and supports green growth aligned to national commitments.

For further details, please contact the Head of Environment Division, IRDA.

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